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The mission of the Ventura River Watershed Council is to facilitate and support efforts by individuals, agencies, and organizations to maintain and improve the health and sustainability of the Ventura River watershed for the benefit of the people and ecosystems that depend upon it.
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This is your plan. Thank you!

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Lorraine Walter, Ventura River watershed coordinator, managed the project, facilitated the planning process, and was the principal researcher, author, and photographer.

Lisa Brennies, consultant, provided essential support throughout the plan’s development. Lisa brought her “information architect” skills to the project, along with development editing, graphic design, photography, and layout skills. To the extent that the plan is interesting, clear, and comprehensible by lay readers, Lisa deserves the credit.
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Lake Casitas Intake Structure Under Construction, 1958
Photo courtesy of Casitas Municipal Water District
Executive Summary

The Watershed’s Story

The Ventura River watershed is a rare and remarkable coastal southern California treasure; it is water-self-reliant, providing clean water to many farms and residents both within and outside its boundaries. Stream networks in surrounding watersheds are often channelized and hard to recognize as streams; in the Ventura River watershed river and streams are largely unchannelized. Urban development dominates much of the landscape of southern California; yet cities comprise only three percent of the Ventura River watershed, and developed land only 13%. A unique set of circumstances has left this small watershed with a relatively healthy ecosystem, containing over 100 special status plant and animal species.

At 226 square miles (144,833 acres), the Ventura River watershed is the smallest of Ventura County’s three major watersheds. The watershed extends from its Matilija Creek headwaters in the steep Transverse Ranges of the Matilija Wilderness to the Pacific Ocean, 33.5-miles downstream. The beginning of the Ventura River itself is marked by the confluence of Matilija Creek with North Fork Matilija Creek, 16.2 miles from the Pacific Ocean.

The river flows south along the western edge of the Ojai Valley; past the City of Ojai and the communities of Meiners Oaks, Mira Monte, Oak View, Casitas Springs, and through the edge of the City of Ventura. In its final stretch, the river flows through the Ventura River estuary, and if the sandbar is breached, proceeds to the ocean. Along the river’s route it picks up water from tributaries, the most significant being San Antonio Creek.

What is a watershed?

A watershed is a basin that catches rain and snow and drains into a central waterbody—in this case, the Ventura River. Every area of land is part of a watershed. Watersheds come in all shapes and sizes and often contain smaller “subwatersheds.” There are complex interrelationships among the streams, aquifers, lakes, habitats, people and economies that make up a watershed system, such that changes or impacts to one part of a watershed can ripple through and affect other parts.
Cycles of drought and flood are the norm. Since 1906, 67% of the years have had less than average rainfall.

Major or moderate floods have occurred once every five years on average since 1933.

Agriculture is the dominant land use: including grazing, it comprises 18.5% of the land area.

Cities comprise only 3.17% of the watershed.

The watershed is comprised of five subwatersheds: Matilija Creek, North Fork Matilija Creek, San Antonio Creek, Cañada Larga Creek, and Coyote Creek.

Steep mountains and foothills comprise most of the land area, with altitudes ranging from 6,010 feet to sea level. Valley floors are home to communities and farms.

Rainfall varies geographically, seasonally, and from year to year. Cycles of drought and flood are the norm. Since 1906, 67% of the years have had less than average rainfall. Many parts of the streams network are typically dry during much of the year. Surface water readily disappears underground in some stream reaches (segments); in others, groundwater regularly feeds streamflow.

Rainfall in the Matilija Wilderness, the river’s headwaters, is the highest in Ventura County, averaging 35.17 inches a year, which is over twice that of rainfall at the coast where the yearly average is 15.46 inches. This rain sometimes comes in large storms, which, when combined with the steep topography, can produce fast-moving floodwaters. Major or moderate floods have occurred once every five years on average since 1933.

Agriculture is the dominant land use: including grazing, it comprises 18.5% of the watershed’s land area. About half of the water supply goes to agricultural users. The agricultural economy and the watershed’s water supply system grew up together, and have a long history of interdependence. Fifty-four percent of the watershed is federally managed.

Limited land development and large areas of protected habitat help support water that is relatively clean; however, surface waters are still considered “impaired” for a number of factors, including trash, algae, water diversion/pumping, eutrophic conditions, low dissolved oxygen, nitrogen, fish barriers, coliform, bacteria, mercury, and total dissolved solids.

Cities comprise only 3.17% of the watershed. Residential land uses occupy 4% of the land area. 44,140 people live in the watershed. The population is 58% white, 37% Hispanic or Latino, 2% Asian, and 3% other races. Income varies widely, and several areas qualify as disadvantaged or severely disadvantaged communities. The strength of the community’s existing stewardship is one the watershed’s greatest assets.

Part 3 of this plan, the “Watershed Characterization,” offers a much more detailed story of the watershed. In mostly non-technical language, and with many photos and illustrations, the various factors influencing the watershed—from geology and climate to local policies and infrastructure—are described. The Watershed Characterization provides a reference for anyone wanting to know more about the watershed.
Chapter 2.3, “Campaigns,” also tells the watershed’s story—in this case the story of the work already underway to improve conditions in the watershed, the people doing it, the ways they are working together, and some of the key proposed projects and programs that would further advance this work.

Quick Facts

<table>
<thead>
<tr>
<th><strong>Main Tributaries &amp; Subwatersheds</strong></th>
<th>Matilija Creek, North Fork Matilija Creek, San Antonio Creek, Cañada Larga Creek, Coyote Creek</th>
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<tr>
<td><strong>Jurisdictions</strong></td>
<td>Of the watershed area in Ventura County: County of Ventura (49.1%), US Forest Service (47.7%), City of Ojai (1.9%), City of Ventura (1.2%). A small corner of the watershed is in Santa Barbara County (3.9% of the entire watershed).</td>
</tr>
<tr>
<td><strong>Population</strong></td>
<td>44,140</td>
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<tr>
<td><strong>Headwaters</strong></td>
<td>Transverse Ranges</td>
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<tr>
<td><strong>Mouth</strong></td>
<td>Pacific Ocean (Santa Barbara Channel)</td>
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<tr>
<td><strong>Length</strong></td>
<td>33.5 miles (16.2 miles of main stem, plus 17.3 miles of Matilija Creek headwaters)</td>
</tr>
<tr>
<td><strong>Area</strong></td>
<td>226 sq. mi., 144,833 acres</td>
</tr>
<tr>
<td><strong>Average Annual Precipitation</strong></td>
<td>15.46&quot; (lower watershed)</td>
</tr>
<tr>
<td></td>
<td>21.31&quot; (middle watershed)</td>
</tr>
<tr>
<td></td>
<td>35.17&quot; (upper watershed)</td>
</tr>
<tr>
<td><strong>Median Annual Precipitation</strong></td>
<td>14.12&quot; (lower watershed)</td>
</tr>
<tr>
<td></td>
<td>19.20&quot; (middle watershed)</td>
</tr>
<tr>
<td></td>
<td>28.74&quot; (upper watershed)</td>
</tr>
<tr>
<td><strong>Discharge</strong></td>
<td>Average – 65 cubic feet per second (cfs), Maximum – 63,600 cfs (1978)</td>
</tr>
<tr>
<td><strong>Elevation</strong></td>
<td>Highest: 6,010 ft.</td>
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<td>Lowest: sea level</td>
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Ventura River Estuary Looking out to the Santa Barbara Channel

Photo courtesy of Santa Barbara Channelkeeper
A Collective Management Strategy

Chapter 2.3, "Campaigns," outlines a strategy to collectively solve shared watershed problems and manage shared resources. As an alternative to focusing on separate individual priority projects or programs, the Council chose to widen the perspective and focus on a short list of six priority regional "campaigns." The campaigns build upon work already underway, and illustrate specific watershed interrelationships and why collaboration is so important at the watershed scale.

Advancing these priority campaigns depends upon implementation of a variety of different types of projects and programs, involving many different stakeholders at many different levels of effort. By presenting the Council's priority projects and programs in this broader perspective, the campaigns offer a realistic framework for collectively achieving improvements.

The Council's six implementation campaigns are:

- **River Connections Campaign.** Seeks to increase understanding, appreciation, and stewardship of the Ventura River and its watershed by connecting people with the river, with information about its history and issues, and with the community working to keep it vital.

- **Resiliency through Infrastructure Campaign.** Seeks to strengthen both infrastructure and local policy in order to reduce the vulnerability of the watershed and its residents to extended droughts, major floods, seismic hazards, and water supply contamination.

- **Extreme Efficiency Campaign.** Seeks to maximize the conservation of water by all water users by continually realizing greater water use efficiency from equipment, technology, and peoples pursuing more opportunities to reuse water; and rewarding conservation.

- **Water Smart Landscapes and Farms Campaign.** Seeks to improve and innovate residential and commercial landscape and farm management practices in order to protect, supplement, and extend water supplies, and protect the long-term viability of farms.

- **Arundo-Free Watershed Campaign.** Seeks to remove, and keep at bay, the invasive non-native plant Arundo donax, which consumes excessive amounts of water, poses a major fire hazard, clogs flood control channels, and destroys native habitat.

- **Healthy San Antonio Creek Campaign.** Seeks to increase the flow of clean water in San Antonio Creek, increase recharge of the interconnected Ojai Valley Groundwater Basin, and improve the creek's riparian and instream habitats.
Going Forward

Implementation of this plan through the six campaigns will be achieved by individuals and organizations working both independently and collectively. The extent of implementation will depend upon the availability of grant funds and the priorities and budget conditions of dozens of different organizations, as well as landowners and businesses.

The Council is committed to continuing its work on integrated watershed planning, and building upon the momentum and assets it has established thus far.

Goals and Core Findings

The Council developed and approved seven goals for the watershed management plan. All the goals put together form the Council’s “vision” and big-picture priorities for the watershed. Each goal is supported by key findings, which describe the key factors that underlie that goal.

These goals are:

**Sufficient Local Water Supplies.** Sufficient local water supplies to allow continued independence from imported water and reliably support ecosystem and human (including urban and agricultural) needs in the watershed now and in the future, through wise water management.

**Clean Water.** Water of sufficient quality to meet regulatory requirements and safeguard public and ecosystem health.

**Integrated Flood Management.** An integrated approach to flood management that improves flood protection, restores natural river processes, enhances floodplain ecosystems, increases water infiltration and storage, and balances sediment input and transport.

**Healthy Ecosystems.** Healthy aquatic and terrestrial ecosystem structures, functions, and processes that support a diversity of native habitats.

**Access to Nature.** Ample and appropriate opportunities for the public to enjoy the watershed's natural areas and open spaces associated with aquatic habitats, to provide educational opportunities, and to gain appreciation of the need to protect the watershed and its ecosystems.

**Responsible Land and Resource Management.** Land and resources managed in a manner that supports social and economic goals and is compatible with healthy ecosystem goals.
**Coordinated Watershed Planning.** A Watershed Council that fairly represents stakeholders; collaborates on developing an integrated watershed management plan to guide watershed priorities; facilitates communication between public, private, and nonprofit stakeholders; educates and engages stakeholders; provides a forum for collecting, sharing, and analyzing information about, and creatively and proactively responding to, watershed issues; and maximizes grant funding opportunities.

Each of the seven goals has a set of objectives that identify the assumptions about what needs to be accomplished in order to achieve the goal. Section “2.1.2 Goals, Objectives, and Findings” lists each set of objectives.

**Core Findings**

A set of findings was developed for each goal. These findings are the backstory of each goal; they describe the current watershed characteristics, strengths, challenges, and other factors that give rise to the goal and its objectives. Section 2.1.2 contains the detailed list of findings; the core findings, a subset of the full list, are provided below.

**Sufficient Local Water Supplies**

- The Ventura River watershed is 100% dependent upon local water sources. Groundwater comprises almost half of the total water produced. The Lake Casitas reservoir is the watershed's main source of surface water and was designed to maintain supplies during a multi-year dry period.

- Surface water and groundwater are closely connected. Subsurface conditions influence instream surface water levels and flows. Groundwater basins can be quickly recharged.

- There are currently 182 active wells in the Ojai Valley Groundwater basin, 64 of which have been drilled since 2000; in the Upper Ventura River Groundwater Basin, there are currently 149 active wells, 44 of which have been drilled since 2000.

- Wastewater is being beneficially reused. There is potential for and stakeholder interest in pursuing opportunities to expand its use.

- There are opportunities and widespread stakeholder support for supplementing water supplies by capturing additional rainwater and surface flows.

- Many large and small water suppliers serve the watershed, most of whom have some dependency on Lake Casitas.
- Because water supplies are 100% local and the amount of rainfall received annually is highly variable, supplies must be managed with caution.

- Water originating in the Ventura River watershed is used both inside and outside of the watershed, and use is divided roughly equally between the agricultural and urban sectors. Data on groundwater use are incomplete.

- State and federal requirements regulating the amount of surface water that must be available for endangered species affect management of the watershed’s water resources. Potential requirements to provide increased instream flows could further reduce water available for municipal, agricultural, and other uses.

- Groundwater is estimated to provide almost half of the local water supply; however, the locations and volumes of groundwater extracted and the effects on streamflow are not accurately known. This data gap inhibits analysis and planning. The Sustainable Groundwater Management Act, signed into law in September, 2014, should result in more groundwater management plans with additional data gathering that will help fill this gap.

- The invasive exotic riparian plant Arundo donax, which can be found throughout the watershed, removes scarce water from stream channels at a rate three times that of native riparian plants.

- Increased demand for water has been relatively low; changes in this trend would present management challenges.

- While considerable improvements in conservation and efficiency have been made, significant potential for reducing water demand remains.

**Clean Water**

- Surface water quality is good compared with more developed watersheds in the region and has improved notably in recent decades.

- Despite relatively good water quality, all of the watershed’s major waterbodies are on the Clean Water Act Section 303(d) list of impaired waterbodies. Between these waterbodies there are 14 different types of impairments.

- Further efforts are required in order to improve instream water quality conditions and meet water quality regulations.

- The effort and resources devoted to compliance with water quality regulations are considerable and could benefit from better efficiencies, integration, and new funding sources.
Groundwater quality is generally good enough for drinking and irrigating, though a few parameters exceed standards with some regularity and are monitored and managed accordingly.

- Casitas Municipal Water District and the Bureau of Reclamation maintain proactive programs to maintain good water quality in Lake Casitas.

**Integrated Flood Management**

- Major or moderate floods have occurred once every five years on average since 1933.
- The steep terrain of the Ventura River watershed, coupled with intense downpours that can occur in the upper watershed, result in flash flood conditions where floodwaters rise and fall in a matter of hours.
- Besides riverine flooding, the watershed also experiences alluvial fan, coastal, and urban drainage flooding, and related hazards.
- Flood protection infrastructure, including all three levees, is in need of improvement. Important water and sewer facilities are vulnerable to flood damage because of their location.
- High sediment loads carried and deposited by local streams are a very significant factor in local riverine flood risk and present major challenges to flood management.
- Alterations in natural sediment transport regimes have exacerbated coastal erosion and increased coastal flooding risk.
- Restoring natural floodplain functions where feasible is favored by stakeholders as a least cost/greatest gain strategy for long-term flood management.

**Healthy Ecosystems**

- The Ventura River watershed supports a remarkable array of healthy and biodiverse southern California natural habitats.
- The watershed's river and stream network remains largely unchannelized and is supportive of considerable wetland and riparian habitats. These riparian habitats are especially critical in dry southern California.
- The Ventura River estuary, a place where river water and ocean water converge, is an exceptionally valuable wetland habitat and ecological resource.
- Streamflow and pools support aquatic systems in some reaches; other reaches are typically too dry to sustain aquatic habitats.
• The watershed is home to numerous protected species and habitats, including 137 plants and animals protected at either the federal, state, or local level. The watershed is also challenged by invasive, non-native species.

• The federally endangered southern California steelhead is of particular significance. The streamflow and pools, and associated food chain, required for its survival are indicators of healthy aquatic ecosystems. Allocating that “environmental water,” given the watershed’s often dry and always variable climate, is challenging and a continuing source of stakeholder controversy.

• Controlling *Arundo donax* (giant reed) is a priority for habitat restoration, as well as fire prevention, flood protection, and water supply enhancement.

• Removing Matilija Dam is a priority restoration project with widespread stakeholder support. A coalition of stakeholders has been working to remove Matilija Dam since 1999.

• Local land conservancies have proven to be very effective at acquiring, protecting, and restoring strategic habitats for the benefit of the watershed.

• Facilitating the recovery of the steelhead is important to many stakeholders.

• Lack of funding is preventing the US Forest Service from effectively addressing important management issues of concern, including fish passage barriers, illegal and destructive marijuana farms, and the spread of invasive species.

• A changing climate could modify the biological diversity and viability of the watershed’s ecosystems.

**Access to Nature**

• Residents and visitors are more likely to gain appreciation of the need to protect the watershed when given the opportunity to visit and learn about the diverse ecosystem processes and services provided by its aquatic habitats. Access to nature is available, though educational opportunities could be substantially improved.

• The watershed is fortunate to have many organizations committed to providing the public with safe access to nature and nature-based recreation opportunities.

• The availability and ease of public access to nature-based activities varies in different parts of the watershed and for different user types.
• The vision of a “Ventura River Parkway”—a network of trails, vista points, and natural areas along the river—is being actively pursued by a coalition of stakeholders.

**Responsible Land and Resource Management**
• Developed land comprises only about 13% of the total land area in the watershed.
• Local policies and physical constraints have effectively limited development on the watershed’s privately owned land.
• Agriculture is the dominant land use and is a critical factor in the management and stewardship of the land and water.
• Agriculture plays a critical role in maintaining many services supportive of a healthy watershed.
• The viability of agriculture is seriously threatened by water supply issues, high land costs, continued threats from exotic pests, and the challenges of competing in the modern industrial-scale farming business.
• Residential land use makes up about 4% of the area of watershed, and much of this is rural and low density.
• Oil extraction is a significant commercial land use, making up about 3.5% of the area of the watershed.
• Wildfires can threaten local water quality and supply. Moderate wildfires occur once every 10 years on average, and extreme wildfires once every 20 years.
• The population of the watershed is relatively small and the rate of growth low.
• Employment opportunities are diverse. Leisure and hospitality jobs, which rely on the natural beauty and recreational assets of the watershed to attract visitors, dominate the employment landscape.

**Coordinated Watershed Planning**
• Coordinated watershed planning offers a wide range of fiscal and management benefits.
• Through their participation, Watershed Council members have demonstrated a commitment to the value of a collective approach.
• While participants clearly value the Watershed Council and understand the benefits of integrated watershed planning, process problems challenge the implementation of such planning.
The Plan and the Process

The Ventura River Watershed Management Plan was developed over the course of three years, from 2012 to 2015.

The Ventura River Watershed Council, a large and diverse group of stakeholders, put considerable effort into developing the plan: they met regularly as a group and in subcommittees; conversed in emails and on phone calls; faced disagreements; worked out compromises; edited and re-edited draft language.

This management plan is not mandatory and it has no regulatory teeth. It crosses multiple jurisdictions and authorities. Its implementation success depends upon the priorities and budget conditions of dozens of different organizations, as well as landowners and businesses.

Even so, watershed-level planning has taken hold across the globe as understanding grows that water is not bound by arbitrary jurisdictional authorities; water is bound by the watershed. The interconnected biological, chemical, and physical parts and processes that comprise watersheds do not correspond to the fragmented patchwork of land and water regulatory jurisdictions.
In California, watershed-level planning is not yet mandatory, but is "highly encouraged," (for example with preferential access to grant funding) and there is a growing move to institutionalize the watershed-level view. Some water quality regulations are now issued by watershed.

This plan was developed to serve as a guiding document for the Council and to inform the public about the watershed and the factors that influence its conditions. The plan outlines the Council’s priorities for maintaining and improving the watershed’s health and sustainability for the benefit of the people and ecosystems that depend upon it. The plan initiates the integration of the many parts and processes of the watershed through recommendations for projects and programs developed with the complexity of the Ventura River watershed in mind.

The Ventura River Watershed Council was formed in 2006 to work on watershed planning. Twenty-one different organizations now serve on the Council’s Leadership Committee (voting members), representing a balance of perspectives and interests, including government, water and sanitary districts, land management and recreation organizations, environmental nonprofits, agricultural organizations, and businesses.
The Ventura River Watershed Council

Between 2011 and 2014, the Council established its Leadership Committee; developed a mission statement, a logo, and a governance charter; tripled stakeholder involvement and grew member diversity; developed a useful, content-rich website; compiled and inventoried over 500 documents, plans, and policies relevant to the watershed; professionally mapped 36 different aspects of the watershed and posted a Map Atlas online; and developed this plan. Over $400,000 in local support and grant funding has been invested in building the Council’s capacity as an organization—and it shows. The Council has built capability; it has built confidence; and it has a plan.

The strengthening of the Watershed Council for the purposes of producing this plan is in itself an important achievement. The Council now provides a structure for continued input from and dialogue between stakeholders. The Council’s meetings, website resources, e-newsletters, and other services offer opportunities for improved community understanding, interest, and leadership in watershed issues. Compiled data and information help reduce duplicative work efforts and efficiently advance new research and analysis. The Council cultivates relationships and facilitates partnerships and collaboration.

The Council identified four primary purposes of the plan:
1. To tell the story of the watershed and its many interdependencies.
2. To identify and prioritize water-related concerns in the watershed.
3. To outline a strategy to collectively solve our shared watershed problems and collectively manage our shared resources.
4. To better position ourselves for funding.

The Council cultivates relationships and facilitates partnerships and collaboration.
PART 1

About this Plan

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1.1 Introduction

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Aerial View of Lower Ventura River
Watershed and Estuary
Photo courtesy of Rick Willborn
1.1 Introduction

1.1.1 Watersheds and Watershed Management

Watersheds are basins that catch rain and snow and drain into a central waterbody. Every area of land is part of a watershed; each one separated from the next by ridges between elevation peaks. Watersheds come in all shapes and sizes and usually contain smaller "subwatersheds."

Mountain ridges in the Topatopa and Santa Ynez Mountains and the Transverse Ranges form the boundaries of the Ventura River watershed; and all of the watershed's tributaries ultimately drain to the Ventura River.

Ventura River Watershed 3D Map
Boundaries of watersheds are defined by ridges connecting elevation peaks.
Each watershed has a unique mix of topography, climate, geology, habitats, and land development, which affects the amount of water available, the nature of flooding, the quality of water, and ecosystem health in that watershed.

Ventura County has three major watersheds—Santa Clara River, Calleguas Creek, and Ventura River, all of which drain to the ocean. At 226 square miles, the Ventura River watershed is the smallest of the three.

There are complex interrelationships among the streams, aquifers, lakes, habitats, people and economies that make up a watershed system, such that changes or impacts to one part of a watershed can ripple through and affect other parts. Pollutants that enter the stream network in Ojai can affect the estuary in Ventura, for example. Modifications to stream channels upstream can cause streambank erosion downstream. The water available to each groundwater pumper can depend upon activity at neighboring wells. Arundo infestations can decrease streamflow and aquatic habitat and increase flooding hazards. A dam erected to address a water supply concern can deprive the downstream riverbed and local beaches of sand. The interrelationships go on and on.

The web of interconnected processes that permeate watersheds do not correspond to the fragmented patchwork of land and water regulatory jurisdictions. The recognition of these interrelationships is the essence of watershed-level planning. Collaborating across jurisdictional boundaries, sharing the wider watershed perspective, can increase the effectiveness and efficiency of managing water supplies, keeping water clean, managing flood flows, and maintaining habitat for sensitive species.

There is no one agency responsible for watershed management planning. The plans are sometimes initiated, lead and funded by citizens, sometimes by local governments, resource conservation districts, or watershed councils.

When the plan development process is inclusive of the broad base of stakeholders, watershed plans are a rare example of a planning effort that places considerable emphasis on what the stakeholders actually care about. Each watershed management plan offers a unique vision for a specific watershed that is rooted in the local community.
Aerial View

Ventura River Watershed

Aerial View Map
1.1.2 Plan Organization

The plan starts with an Executive Summary—a quick overview of the entire plan.

Part 1. About this Plan

Part 1 starts with this introductory plan overview chapter, followed by a chapter which chronicles the history and structure of the Ventura River Watershed Council, and a chapter detailing the development process for this management plan.

Part 2. Watershed Plan, Projects, and Programs

Part 2 contains the product of the Council’s consensus:

2.1 Plan Guiding Framework describes the purpose and values that guided the development of the plan, and outlines the plan’s goals and associated objectives and key findings.

2.2 Existing Projects, Programs, and Recent Accomplishments summarizes existing projects and programs and stakeholder accomplishments over a three-year period between 2011 and 2013.

2.3 Campaigns presents the Watershed Council’s proposed projects and programs organized into six focused “campaigns,” which present desired new projects and programs framed in the context of watershed management work already underway.

Each section includes a list of the key documents on that topic where readers can find more detailed and technical information.

Part 3. Watershed Characterization

Part 3—the Watershed Characterization—starts with an Overview and Quick Facts summary of the watershed’s physical features, followed by six more detailed characterization sections which describe and illustrate the watershed’s physical features, geology and climate, surface water and groundwater hydrology, flooding, water supplies and demands, water quality, habitat and species and related issues, opportunities for access to nature, and demographics and local regulations. Characterization sections contain topic history, relevant statistical data, and assessment of current conditions. Each section includes a list of the key documents on that topic where readers can find more detailed and technical information.
Part 4. References and Supporting Material

Part 4 provides a key to the acronyms that appear in the plan, a glossary of technical and local terms, a listing of the source documents used to develop this plan, and a number of appendices that provide data and information that expand on information provided in the body of the plan.
1.2 Ventura River Watershed Council

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Paul Jenkin, Surfrider Foundation, 
Leads Tour of Surfers’ Point Managed Shoreline Retreat Project
1.2 Ventura River Watershed Council

1.2.1 Participants

The Ventura River Watershed Council is a stakeholder group for watershed planning in the Ventura River watershed. It is an open group with active participation by local, state, and federal government agencies, water and sanitation districts, environmental and educational nonprofits, agricultural organizations, community volunteer groups, as well as engineers, biologists, businesses, students, and other private citizens.

In addition to citizens, landowners, and consultants, the following organizations and businesses regularly participate on the Council:

- Aera Energy
- California Coastal Conservancy
- California Conservation Corps
- California Regional Water Quality Control Board
- Casitas Municipal Water District
- City of Ojai
- City of Ventura (Ventura Water)
- Farm Bureau of Ventura County
- Friends of the Ventura River
- Friends Ranch
- Meiners Oaks Water District
- Ojai Basin Groundwater Management Agency
- Ojai Valley Green Coalition
- Ojai Valley Land Conservancy
- Ojai Valley Sanitary District
- Santa Barbara Channelkeeper
- Surfrider Foundation
- University of California Santa Barbara
- Ventura Citizens for Hillside Preservation
- Ventura County Agricultural Irrigated Lands Group
- Ventura County Cattlemen's Association
- Ventura County Coalition of Labor, Agriculture, and Business
1.2.2 Council History, Structure, and Governance

The Council was formed to provide a framework for enhancing communication and collaboration among diverse stakeholders in order to better address the Ventura River watershed's many complex and cross-jurisdictional issues.

The Council is also one of three watershed planning subcommittees that comprise the Watersheds Coalition of Ventura County (WCVC). The others are the Santa Clara River Watershed Committee and the Calleguas Creek Watershed Steering Committee.

1.2.2.1 History

The Ventura River Watershed Council has been in existence since May 2006. The Wetlands Recovery Task Force of Ventura County, a program of the California Coastal Conservancy, had the original idea to form the Council. At the same time, the WCVC was working on developing the countywide Integrated Regional Water Management Plan and needed a stakeholders group from each of the County's three major watersheds.
for that process. And so it happened that WCVC’s program manager was able to serve as the Council’s coordinator during its first five years.

In 2011, the Council was successful in securing grant funding, for three years, for a watershed coordinator. The Ojai Valley Land Conservancy agreed to host the position. The Council’s watershed coordinator began in the fall of 2011.

1.2.2.2 Mission Statement

The mission of the Ventura River Watershed Council is to facilitate and support efforts by individuals, agencies, and organizations to maintain and improve the health and sustainability of the Ventura River watershed for the benefit of the people and ecosystems that depend upon it.

1.2.2.3 Strategies

The Council seeks to use the following strategies to accomplish its mission:

1. Collaborate on the development of a comprehensive, integrated watershed management plan to guide priorities and implementation strategies.
2. Facilitate communication between public, private, and nonprofit stakeholders.
3. Provide a forum for collecting, sharing, and analyzing information about, and creatively responding to, watershed issues.
4. Refine understanding—among Council members, decision-makers, and the general public—of the watershed’s conditions, processes, interrelationships, and challenges from a variety of perspectives, including scientific, cultural, economic, and regulatory.
5. Identify opportunities for Council members to leverage resources and work together toward common goals.
6. Serve as a subcommittee of the Watersheds Coalition of Ventura County and a contributor to the County’s Integrated Regional Water Management Plan.
7. Promote the priorities and projects of the watershed management plan to local, state, and federal officials.
8. Seek funding and other support to implement priority watershed management projects.
9. Monitor the effectiveness of, and regularly update, the watershed management plan.
10. Facilitate coordination of watershed education activities.
1.2.2.4 Governance

In May 2012, before launching work on development of a watershed management plan, the Watershed Council adopted its first governance charter. The charter is intended to ensure that the Council fairly represents the different stakeholders in the watershed, and that a balance of perspectives and interests are represented in its decisions.

As stated in the charter, the Council is a voluntary organization and has no powers or authorities other than those already possessed by its member agencies. The agencies, organizations, and interests represented on the Council are not obligated to adopt or carry out the recommendations of the Council, but have agreed to give due consideration to the recommendations and take actions they consider appropriate.

The charter outlines two categories of members: general members and Leadership Committee members, with the primary difference being that Leadership Committee members are voting members. The Council strives to make its decisions and recommendations by consensus, but when consensus cannot be reached on a given issue, the charter calls for a vote by the Leadership Committee to resolve the issue.

Leadership Committee

The Leadership Committee of the Ventura River Watershed Council comprises the Council's voting members. The Leadership Committee, which has 21 members, was established to ensure that a balance of perspectives and interests are represented in the Council's decisions. Leadership Committee membership is reviewed annually. There are five categories of members: government, water and sanitary, land management/recreation, environmental, and business/landowner.

Profiles of the current members of the Leadership Committee are provided below, organized by category.

(Some of the background information below on the water agency members was taken directly from the Draft Ventura River Habitat Conservation Plan produced by Entrix, Inc. and URS Corp. in 2004.)

Government

Ventura County Board of Supervisors District 1,
Supervisor Steve Bennett
805/654-2703
www.ventura.org/board-of-supervisors

Ventura County is one of the three local governments in the watershed. About half of the Ventura River watershed is under the jurisdiction of Ventura County. The Ventura County Board of Supervisors is the
five-member governing body that governs Ventura County. Members of the board are elected by members of their respective districts. Supervisor Steve Bennett represents the First Supervisorial District, which includes the entirety of the Ventura River watershed (except for the small piece in Santa Barbara County).

In addition to being the governing body of Ventura County government, the Board of Supervisors also governs the Ventura County Watershed Protection District. Supervisor Bennett is a member of the Board of Directors of the Fox Canyon Groundwater Management Agency.

**Ventura County Watershed Protection District**

805/654-2001

http://portal.countyofventura.org/portal/page/portal/PUBLIC_WORKS/Watershed_Protection_District

The Ventura County Watershed Protection District (VCWPD), originally named the Ventura County Flood Control District, was formed by state approval of the Ventura County Flood Control Act of 1944.

The primary purposes of the VCWPD as indicated in the Act (as amended) are to: 1) provide for the control and conservation of flood and storm waters; 2) protect watercourses, watersheds, public highways, life, and property from floods; 3) prevent waste or loss of water supply; 4) import water into the district, retain and recycle storm and flood flows, and conserve all such water for beneficial uses; and 5) provide for recreational use and beautification as part of the flood control and water conservation objectives by acquiring or constructing recreational facilities or landscaping as part of any VCWPD project.

The district is organized into five divisions to administer these broad purposes: Water and Environmental Resources; Design and Construction; Planning and Regulatory; Operations and Maintenance; and Administration. Although VCWPD is a separate legal entity from the County of Ventura, the Ventura County Board of Supervisors also serves as VCWPD's board.

The district is funded through property taxes, benefit assessments, and land development fees paid by property owners within Ventura County. The district is divided into four zones, roughly corresponding to the major watersheds within the County (including Cuyama watershed), and monies raised within a zone support district studies and projects in that zone. Benefit assessment monies collected from each zone are dedicated to support operations and maintenance and NPDES (National Pollutant Discharge Elimination System) permit activities within that zone. Property tax monies raised within a zone are spent on construction projects and to support district planning studies within that zone. The boundaries
of the district's Zone 1 roughly follow the boundaries of the Ventura River watershed.

The list of watershed-related programs and services that the district administers/supports is far too long to enumerate here; below are just some highlights:

- Lead role in the Ventura Countywide Stormwater Quality Management Program, a group of partners that work together to improve stormwater quality, monitor watershed health, and comply with water quality requirements;
- Design, construction, and maintenance of levees, debris basins, channels, and other drainage and flood control structures;
- Lead role in monitoring and collection of precipitation, weather, and streamflows data;
- Management, permitting, and planning of floodplain activities;
- Flood emergency planning and response;
- Hydrologic modeling and forecasting;
- Environmental restoration efforts, including removal of Matilija Dam and invasive species;
- Lead grant applicant/administrator in support of watershed partner projects;
- Groundwater well permitting, groundwater data, and basin condition assessments; and
- Public education on watershed issues.

**City of Ventura (Ventura Water)**

805/667-6500  
www.cityofventura.net/water

The City of Ventura is one of the three local governments in the watershed. The western part of the City (1,798 acres) lies within the watershed, including the Ventura River estuary and adjacent beaches, the Ventura Avenue area, and downtown Ventura to Oak Street.

Ventura Water is the name of the City of Ventura's department that treats and supplies water, collects and treats wastewater, supplies recycled water, and collaborates with the Public Works Department to manage stormwater. This department has historically been most engaged with the Council. Ventura Water's service area encompasses the incorporated land of the City, with a population of over 109,000 people.
Water Supplies

The City of Ventura obtains water supplies from five sources: Casitas MWD, Ventura River Foster Park facilities, Mound Groundwater Basin, Oxnard Plain Groundwater Basin, and Santa Paula Groundwater Basin. Ventura also produces recycled water from the Ventura Wastewater Reclamation Facility.

The City of Ventura has been using water from the Ventura River watershed since its founding in 1782. The Foster Park Subsurface Diversion, built on the Ventura River in 1906, was acquired by Ventura in 1923. When Casitas Municipal Water District was originally formed, its service area included the entire City of Ventura boundary, as it existed at that time. The City also operates shallow groundwater wells in the Foster Park area. The Ventura Avenue Treatment Plant is owned and operated by the City to treat water from the Foster Park facilities. The City has approximately 31,000 service connections; about 3,500 of these connections are within the Ventura River watershed; however, water from the watershed is served to City residents outside of the watershed.

Wastewater Treatment

Ventura Water provides wastewater treatment services to approximately 98% of the City's residences. In the Ventura River watershed, the City's sewer lines begin at the City limits on upper Ventura Avenue, and deliver wastewater to the Ventura Water Reclamation Facility located in the Ventura Harbor area near the mouth of the Santa Clara River. The facility uses a tertiary, or advanced, treatment method. In the past, most of the treated wastewater was discharged into the Santa Clara River estuary after flowing through a series of wildlife ponds for about four days; however, a legal settlement will change how the City uses its reclaimed water in the future.

Stormwater Management

The City of Ventura is a member of the Ventura Countywide Stormwater Quality Management Program, a group of partners that work together to improve stormwater quality, monitor watershed health, and comply with water quality requirements. The City responds to illicit discharges to storm drains, inspects construction sites and commercial and industrial facilities to ensure implementation of stormwater pollution prevention controls, reviews development plans for stormwater mitigation control, conducts outreach to residents and school-age children, and maintains the City's storm drains and flood control conduits.
City of Ojai
805/646-5581
www.ci.ojai.ca.us

The City of Ojai is one of the three local governments in the watershed. The entire City, comprising 2,795 acres, is within the watershed.

The City’s Public Works department, which addresses stormwater management and water quality issues, is engaged with the Council. The City of Ojai is a member of the Ventura Countywide Stormwater Quality Management Program, a group of partners that work together to improve stormwater quality, monitor watershed health, and comply with water quality requirements. The City responds to illicit discharges to storm drains, inspects construction sites and commercial and industrial facilities to insure implementation of stormwater pollution prevention controls, reviews development plans for stormwater mitigation controls, conducts public outreach, and maintains the City's storm drains and flood control conduits.

California Coastal Conservancy
510/286-4092
http://scc.ca.gov

The California Coastal Conservancy, established in 1976, is a state agency that uses entrepreneurial techniques to purchase, protect, restore, and enhance coastal resources, and provide access to the shore.

The Legislature created the Conservancy as a unique entity with flexible powers to serve as an intermediary among government, citizens, and the private sector in recognition that creative approaches would be needed to preserve California’s coast for future generations. A seven-member board of directors, appointed by the Governor and Legislature, governs the Conservancy.

The Conservancy:
- Protects and improves the quality of coastal wetlands, streams, watersheds, and near-shore ocean waters;
- Helps people get to coast and bay shores by building trails and stairways and acquiring land and easements. The Conservancy also assists in the creation of low-cost accommodations along the coast, including campgrounds and hostels;
- Revitalizes urban waterfronts;
- Helps to solve complex land-use problems;
- Purchases and holds environmentally valuable coastal and bay lands;
- Protects agricultural lands and supports coastal agriculture;
- Accepts donations and dedications of land and easements for public access, wildlife habitat, agriculture, and open space.

The Conservancy also administers state park and water bond funds (e.g., Propositions 50 and 84) and awards these funds in the form of grants. Millions of dollars in grant funding have been awarded by the Conservancy for projects in the watershed. For example, the Conservancy has played a key role in funding projects related to the removal of Matilija Dam and has funded a number of land acquisitions in support of a Ventura River Parkway.

**Water and Sanitary**

**Casitas Municipal Water District**
805/649-2251
www.casitaswater.org

Casitas Municipal Water District is a special district formed in 1952 to develop and supply water for agricultural and urban uses in the Ojai Valley and Ventura areas. Casitas is the largest water supplier in the watershed, serving close to 70,000 people and hundreds of farms. Their service area encompasses 150 square miles and includes the City of Ojai, Upper Ojai, the Ventura River Valley area, the City of Ventura south to about Mills Road, and the coastal Rincon area to the Santa Barbara County line. Casitas has approximately 3,200 service connections, including 300 agricultural connections; for a number of these connections Casitas is the “backup” supply, used only when groundwater supplies become depleted. A five-member elected board of directors governs the district.

The primary source of Casitas’s water is Lake Casitas, built by the U.S. Bureau of Reclamation in 1959 along with Robles Diversion and Robles Canal.

Nine public and private water agencies use Casitas water, including the City of Ventura, Golden State Water Company, Ventura River Water District, and Meiners Oaks Water District. All of these water agencies rely on water from Casitas when their groundwater supplies are depleted.

In addition to operating and maintaining the reservoir and associated facilities, Casitas also operates and maintains a fish passage facility at the Robles Diversion and the Lake Casitas Recreation Area. Lake Casitas Recreation Area is a popular destination site with over 750,000 visitors each year. Recreational facilities at the lake include a lazy river water park, camping, picnicking, motor boating, sailing, canoeing, and fishing. Swimming or other body-contact recreational activities are not
permitted in the lake. In the past Casitas also managed releases of water from Matilija Dam, but this practice was discontinued in 2011.

**Ventura River Water District**  
805/646-3403  
www.venturariverwd.com

The Ventura River Water District (VRWD) is a special district formed in 1956 to provide water in the neighborhoods from Casitas Springs to the City of Ojai at the Vons shopping center. The district is governed by an elected five-member board of directors. VRWD's service encompasses about 2,220 acres, and includes residential and commercial customers. VRWD has approximately 2,100 service connections and serves a population of about 5,700 people.

VRWD obtains water from four wells adjacent to the Ventura River within the Upper Ventura River Groundwater Basin. Casitas Springs customers are always supplied from Lake Casitas. VRWD also has an agreement to purchase water from Casitas during emergencies and drought conditions.

**Meiners Oaks Water District**  
805/646-2114  
http://meinersoakwater.com

Meiners Oaks Water District (MOWD) is a special district formed in 1949 to provide water in the Meiners Oaks community on the east side of the Ventura River. The district is governed by an elected five-member board of directors. MOWD's service area encompasses approximately 1,300 acres, and includes residential, commercial, and agricultural customers. MOWD has approximately 1,200 service connections, serving about 4,200 people.

MOWD obtains water from five wells located adjacent to the Ventura River and within the Upper Ventura River Groundwater Basin. The district has an arrangement to purchase water from Casitas during emergencies and drought conditions.

**Ojai Valley Sanitary District**  
805/646-5548  
www.ojaisan.org

The Ojai Valley Sanitary District (OVSD) was formed in 1985 to provide sewer-related services to much of the urban areas of the watershed—from the City of Ojai and the Ojai Valley down to Ventura city limits. The district was created as a consolidation of the Ventura Avenue, Oak View, and Meiners Oaks Sanitary Districts, and the Sanitation
Department of the City of Ojai. They are governed by an elected seven-member board of directors.

The service area of the OVSD is approximately 5,660 acres and includes about 20,000 residents. The district maintains 120 miles of sewer mainlines, five pump stations, and the treatment plant. Wastewater is collected and delivered to the OVSD Treatment Plant located five miles from the ocean, and one mile downstream from Foster Park on the east bank of the Ventura River. The treatment plant has the capacity to treat three million gallons a day.

The facility uses a tertiary, or advanced, treatment method, typically using no chemicals—just microbes, oxygen, and ultraviolet light. Treated effluent is discharged into the Ventura River and provides water to the lower Ventura River and the river ecosystem. Biosolids, the byproduct of the treatment process, are composted onsite by OVSD and the compost is made available free to the public.

Ojai Basin Groundwater Management Agency
805/646-1207
www.obgma.com

The Ojai Basin Groundwater Management Agency (OBGMA) was created to manage the groundwater within the Ojai Groundwater Basin for the protection and common benefit of agricultural, municipal, and industrial water users.

Creation of the Ojai Basin Groundwater Management Agency required a special act of the state legislature. The act became law in 1991 in the fifth year of a drought, amidst concerns of local water agencies, water users, and well owners about potential overdraft of the basin. The OBGMA is one of only 13 special act districts with legislative authority to manage groundwater in California (CDWR 2003).

There are five seats on the OBGMA board, which are filled by representatives from the City of Ojai, Casitas Municipal Water District, Golden State Water Company, Ojai Water Conservation District and mutual water companies (one director is elected to represent three mutual water companies).

The OBGMA oversees the management of the Ojai Basin, and is required by law to have a groundwater management plan to guide its operations. Elements of OBGMA's Groundwater Management Plan are implemented in the form of policies, rules, regulations, and ordinances. Water drawn from the basin is divided roughly equally between urban and agricultural users.
Land Management/Recreation

Ojai Valley Land Conservancy
805/649-6852
www.ovlc.org

The Ojai Valley Land Conservancy (OVLC) is a nonprofit organization formed in 1987 to protect the Ojai Valley’s views, trails, water, wildlife, and working agricultural lands. The OVLC also provides educational enrichment for the community on its open space preserves. OVLC has roughly 1,200 members and is governed by an 11-member board of directors.

OVLC receives funding from member dues and donations, as well as grants and mitigation fees. Working only with willing landowners on a voluntary basis, OVLC protects land in perpetuity through purchase or by donation of either land or conservation easements (which convey only the development rights to the OVLC, not the title). OVLC has permanently protected 13 properties totaling over 2,300 acres, including roughly 1,900 acres of publically accessible open space preserves, and several conservation easements totaling over 200 acres. The Ventura River Preserve, OVLC’s largest property, protects nearly 1,600 acres in and adjacent to the Ventura River, including three miles of the river. Over 25 miles of trails are maintained for the public’s enjoyment on the six preserves that are open for public access.

Habitat restoration and enhancement is ongoing on many of OVLC’s properties, including *Arundo* removal; and native grassland, oak woodlands, and wetland habitat restorations.

OVLC offers a number of ongoing education programs, leads hikes and hosts docents on its preserves, provides hands-on volunteer opportunities for students and interested community members of all ages, and is actively engaged with local partners for watershed protection. OVLC hosts, on behalf of the Ventura River Watershed Council, the Ventura River watershed coordinator—a grant-funded staff position serving the Watershed Council.

Ventura Hillsides Conservancy
805/643-8044
www.venturahillsides.org

Formed in 2003, the Ventura Hillsides Conservancy (VHC) is a land trust operating in the Ventura region to protect and conserve open space resources through acquisition of land and easements, stewardship of protected lands, and public education about local natural resources. VHC has over 700 members and is governed by a 10-member board of trustees.
VHC receives funding from member dues and donations, grants, and events. VHC owns seven properties totaling nearly 30 acres; 25 of these acres are located in or adjacent to the Ventura River.

VHC’s most recent land acquisition, the Willoughby Preserve, located near downtown Ventura, had been known for decades as “hobo jungle.” With lots of help from volunteers, social service organizations, local government, and businesses, VHC has reclaimed the property to make it a clean and safe place where the community can enjoy rare access to the lower Ventura River.

VHC enjoys a strong volunteer base, organizes many community events, and is especially dedicated to creating opportunities for youth to experience and connect with nature.

**Ventura County Resource Conservation District**
805/764-5130
www.vercd.org

The Ventura County Resource Conservation District (RCD) is a special district that provides assistance to help rural and urban communities in Ventura County conserve, protect, and restore natural resources. A seven-member board of directors governs the RCD; directors must be landowners or agents of landowners residing within the district. The RCD is one of 99 resource conservation districts in California, and is primarily funded by grants.

The RCD’s function is to make available technical, financial, and educational resources, whatever their source, and focus or coordinate them so that they meet the needs of the local land managers for the conservation of soil, water, and related natural resources.

Priority issues for the RCD include preservation of agriculture, open space advocacy, outreach and education on water resources, watershed protection, watershed restoration, control and/or eradication of invasive species, evaluating the potential impacts of loss of wildlife habitat, and maintaining air quality.

Some of the RCD’s programs in the Ventura River watershed include the Mobile Lab Irrigation Efficiency Evaluation Program and the Stormwater Quality Best Management Practices Program, which includes staff support for the Horse and Livestock Watershed Alliance, and horse and livestock property best management practice education.
Environmental

Surfrider Foundation, Ventura County Chapter
http://ventura.surfrider.org
www.venturariver.org

The Surfrider Foundation, formed in 1984, works for the protection and enjoyment of oceans, waves, and beaches through an activist network. The Ventura County chapter was formed in 1991 by local ocean enthusiasts who were concerned by the threat of beach armoring at Surfers' Point, which would have destroyed the surf break and the beach. The local chapter is governed by a five-member board of directors.

With over 800 members, many volunteers, and dedicated and persistent leadership, the local chapter is known for effectively working on integrated solutions to a number of local issues threatening the ocean, waves, and beaches.

Current programs and campaigns include Ocean Friendly Gardens, an education program that uses conservation, permeability, and retention to protect the environment and reduce polluted runoff; Rise Above Plastics, an education program aimed at reducing the impact of plastics in the marine environment by raising community awareness about the dangers of plastic pollution and presenting alternatives; Matilija Dam Ecosystem Restoration, an effort to remove the dam that is blocking sediment flow to local beaches and preventing migration of anadromous steelhead to their historic spawning grounds; Ventura River Parkway, an effort to restore the Ventura River ecosystem and recreate the human connection to the river that once existed; and Surfers' Point Managed Retreat, an ecosystem-based approach to managing the erosion at Surfers' Point as an alternative to building a seawall.

Santa Barbara Channelkeeper
805/563-3377
www.sbck.org

Santa Barbara Channelkeeper is a grassroots nonprofit organization, founded in 1999, whose mission is to protect and restore the Santa Barbara Channel and its watersheds through science-based advocacy, education, field work, and enforcement. Channelkeeper is advised by a 13-member board of directors.

Channelkeeper works on the water and in the communities along the Santa Barbara Channel to monitor water quality, restore aquatic ecosystems, advocate for clean water, enforce environmental laws, and educate and engage citizens in implementing solutions to water pollution and aquatic habitat degradation.
A member of both the international Waterkeeper Alliance and the California Coastkeeper Alliance, Channelkeeper is part of a large network of groups working to patrol and protect watersheds and defend their communities’ right to clean water.

In the Ventura River watershed, Channelkeeper collects and analyzes surface water samples from the Ventura River on a monthly basis with their Ventura River Stream Team. Over a decade’s worth of data have been collected and studied thus far, representing one of the best long-term datasets that exists on the river’s water quality. These data are used by regulators to inform regulations (such as TMDLs) for the watershed. Channelkeeper also acts as a watchdog for environmental impacts in the watershed, engages many volunteers through their water sampling program, and educates hundreds of local students about the Ventura River watershed and water quality testing techniques.

Ojai Valley Green Coalition, Watershed Council
805/669-8445
http://ojaivalleygreencoalition.com

The Ojai Valley Green Coalition (OVGC) is a nonprofit organization established in 2007 to advance a green, sustainable and resilient Ojai Valley. OVGC has over 800 members and is governed by a nine-member board of directors.

OVGC works on a variety of fronts, with three separate issue-focused councils: renewables, energy efficiency, and appropriate lighting; local food; and watershed literacy and water security.

Education about ecological issues and sustainable practices is central to the work of OVGC. The group organizes an annual Green Home and Building Tour; hosts numerous educational meetings, films, and events; and maintains a green resources lending library.

OVGC advocates for changes in local policy, including initiatives to ban plastic bags and reduce excessive nighttime lighting. OVGC facilitates environmental responsibility by making it easier: it organizes waste collection and recycling events, secures discounts on solar systems, and provides bicycle valet parking at events. OVGC also works on restoring creekside habitats.
Friends of the Ventura River

805/620-7001
http://friendsofventurariver.org

Friends of Ventura River has a long history of advocating for the Ventura River. The group was established in 1974 to provide an independent organized means of addressing the multitude of threats to the Ventura River and to actively promote the preservation and restoration of its natural resources, including its unique fish and wildlife resources, for the benefit of present and future generations.

Since its inception, the Friends have actively participated in a wide variety of planning and regulatory processes affecting the Ventura River watershed at the local, state, regional, and federal levels. They have also pursued and supported research of the botanical and fishery resources of the Ventura River, producing important studies of the estuary and steelhead habitats of the Ventura River watershed. These reports have stimulated further scientific investigations, which have contributed to the management of the river’s biological resources.

Through active participation in land-use and water management programs, the Friends, in collaboration with other local groups, have helped shape local, state, and federal plans, including the Ventura County General Plan, Ojai General Plan, city and county Local Coastal Plans, Ventura County Water Management Plan, and the Ventura River Trail Plan. Over the years, the Friends have reviewed countless land use decisions affecting the Ventura River.

The Friends contributed to the establishment of the U.S. Bureau of Reclamation’s Teague Memorial Watershed to protect the Lake Casitas water supply, and to both the Ventura River Preserve and the Confluence Preserve, which are now owned and managed by the Ojai Valley Land Conservancy.

In 1999, with support from Patagonia and the Environmental Defense Center, the Friends organized the first multi-agency symposium to consider the removal of Matilija Dam.

The Friends were also instrumental in getting the Tidewater goby and the southern California steelhead listed as endangered under the U.S. Endangered Species Act in 1994 and 1997.

Recent work includes advocating for a Ventura River Parkway to advance protection and public enjoyment of the Ventura River, developing a watershed resources document library, and ongoing advocacy and education about the river and its watershed.
Business/Landowner

Farm Bureau of Ventura County
805/289-0155
www.farmbureauvc.com

Founded in 1914, the Farm Bureau of Ventura County is an independent, nonpartisan organization that is not affiliated with any government entity. It acts as an advocate for Ventura County’s agricultural industry, promoting policies and fostering community action intended to preserve that industry’s sustainability and vitality.

For decades, the Farm Bureau has played an important role in the effort to ensure an adequate, reliable, and affordable supply of water for Ventura County. It has worked with local water agencies to manage rivers, reservoirs, and aquifers equitably and efficiently, and to defend local water supplies against degradation and depletion.

In recent years, the Farm Bureau has taken a leadership role in helping farmers and ranchers comply with water-quality regulations aimed at agriculture. The most prominent of these efforts has been the creation and administration of the Ventura County Agricultural Irrigated Lands Group, or VCAILG. VCAILG is a program that allows participating growers to achieve compliance with state and federal water quality requirements by working collectively as a “discharger group” at a much more cost-effective approach than individual farm compliance. The Farm Bureau administers the VCAILG program, with input and assistance from a VCAILG Steering Committee. It also partners with numerous public agencies, including municipalities, water purveyors, and state and county entities to coordinate watershed-wide initiatives to address water-quality issues.

Friends Ranch, Emily Ayala
808/646-2871
http://friendsranches.com

The Friends Ranch family has been growing citrus in the Ojai Valley for over 100 years. Five generations of the Friends family have lived and farmed in the valley.

Friends Ranch owns the roadside packinghouse familiar to travelers up Highway 33 near the mouth of the Ventura River. They pack citrus for wholesale markets and pack fruit and juices for farmers’ markets.
Friends Ranch is a member of the Ojai Pixie Growers Association, a group of almost 40 family-scale tangerine growers in the Ojai Valley who get together to share information about growing and selling the specialty Pixie tangerine—a exceptionally sweet, off-season tangerine particularly well suited to the Ojai Valley’s climate.

In addition to serving on the Ventura River Watershed Council, Emily Ayala of Friends Ranch sits on the Ojai Valley Water Conservation District and is active with other growers in the valley in educating about protection of the agricultural industry in the Ojai Valley.

**Oil Extraction – Aera Energy**

661/665-5000

www.aeraenergy.com/ventura.asp

Aera Energy LLC is one of California’s largest oil and gas producers, accounting for over 25% of the state's production. Formed in June 1997 and jointly owned by affiliates of Shell and ExxonMobil, it is operated as a stand-alone company through its own board of managers.

The Ventura County oil and gas operations of Aera cover approximately 4,300 acres located largely in the Ventura River watershed just to the northwest of the City of Ventura. Production averages 13,900 barrels per day of crude oil and 7.8 million cubic feet per day of natural gas. Oil is transported to refineries in the Los Angeles basin. Natural gas is shipped to Southern California Gas Co.

Aera and its forerunner companies have been actively producing crude oil in Ventura County since the 1920s. Much of the operation is now in secondary recovery water injection. Aera is the largest onshore oil producer in Ventura County.

Aera and its employees are actively involved in the local community, providing support to programs that benefit local students, charities, police programs, and economic development.

Over 110 employees work directly for Aera in Ventura, and over 600 contractors are employed at Aera’s sites for daily operations and development. In addition, the company directly supports many local businesses, such as service providers on Ventura Avenue.
Ventura County Coalition of Labor, Agriculture, and Business
805/633-2291
www.colabvcs.org

Ventura County Coalition of Labor, Agriculture, and Business, or VC COLAB, is a 501(c)(6) nonprofit formed in 2010 to work with public agencies and decision makers in Ventura County to provide regulatory solutions that support business and private property owners. VC COLAB is governed by a 14-member board of directors. The local group cooperates with the COLAB groups in Santa Barbara and San Luis Obispo counties.

VC COLAB seeks to provide a balance between environmental, regulatory, and economic concerns. Its goal is to facilitate a coalition of agricultural and other businesses to identify and research issues that impact business, work with regulatory agencies, and propose solutions.

Through active participation in land-use management policy development, VC COLAB has helped shape local policy and regulations, including the Ventura County Initial Study Assessment Guidelines for assessing biological impacts from development projects under the California Environmental Quality Act, the County’s grading ordinance, and the Algae TMDL (Total Maximum Daily Load) state-promulgated water quality regulation.

VC COLAB is also working with the Ventura County Resource Conservation District, Horse and Livestock Watershed Alliance, and the Ventura County Cattlemen’s Association to draft “Waivers” with the Regional Water Board that will help horse, cattle, and other livestock owners preserve their lifestyles and livelihoods.

1.2.3 Council Milestones

The following list includes milestones in the Council’s development as an organization, as well as projects and grant awards that depended on the Council’s involvement or support.

May 2006

Ventura River Watershed Council formed. The California Coastal Conservancy's Wetland Recovery Project launched the Watershed Council. Shortly thereafter leadership transferred to the Watersheds Coalition of Ventura County. A big part of the Council’s early work was helping to develop a regional, integrated water management plan for Ventura County. These plans are a prerequisite for receiving water bond funding under Proposition 50 (2002) and Proposition 84 (2006).
January 2008

$3,791,000 in Proposition 50 funding awarded for three projects:
1) a Ventura River Watershed Protection Project (largely surface water hydrology modeling to inform flood control), 2) San Antonio Creek Spreading Grounds Rehabilitation (groundwater recharge), and 3) Senior Canyon Mutual Water Company Equipment Upgrades (to reduce water demand) on Lake Casitas.

April 2010

“Watershed U – Ventura River” was held, a comprehensive educational series for the community that was coordinated by the University of California’s Cooperative Extension office and supported by Watershed Council participants. This popular program provided 18 hours of educational presentations by local experts on a wide variety of watershed topics.

January 2011

$500,000 in Proposition 84 funding awarded for the Ojai Meadows Ecosystem Restoration Project.

February 2011

$75,000 in Proposition 84 funding awarded for a Biodigester Feasibility Study as a potential manure management option.

September 2011

Watershed coordinator hired. The watershed coordinator position was funded by a grant ($277,906) from the California Department of Conservation, with additional support provided by several Watershed Council partners. Development of a Ventura River watershed management plan was a key objective of the watershed coordinator position. The Ojai Valley Land Conservancy generously offered to host the staff position.

January 2012

Organizational identity strengthened. Developed a mission statement, logo, and website for the Council. (www.venturawatershed.org)

April 2012

Evening meetings. The first evening meeting of the Council was held to accommodate the schedules of those who cannot attend daytime meetings. Evening meetings are typically held twice a year, in April and October.
May 2012

Governance Charter adopted. A governance charter was adopted, which outlines the organization’s purpose, objectives, membership, and decision-making structure. The charter makes explicit the stakeholders’ commitment to the work of the Watershed Council and helps give credibility to the Council’s work.

An additional $500,000 in Proposition 84 grant funding received for completion of the San Antonio Creek Spreading Grounds Rehabilitation project.

October 2012

$48,833 grant awarded from the Bureau of Reclamation to expand the Watershed Council and help with the development of a watershed management plan.

October 2012 – July 2013

Built watershed management plan foundations; expanded information availability. Expanded stakeholder involvement; developed a Council brochure; held a Public Scoping Meeting about the plan; developed the plan’s goals and objectives; added an interactive map viewer, map atlas, and video page to the Council’s website; added Spanish-language materials to the website; compiled a comprehensive Document Inventory of watershed-related documents, reports, plans, and policies; and developed a master list of project and program ideas.

July 2013

$49,687 grant awarded from the Bureau of Reclamation, a second year of the grant to expand the Watershed Council and help with the development of a watershed management plan.

October 2013

$1,500,000 in Prop 84 funding awarded for Arundo removal and public recreation and access improvements along Ventura River.

April 2014

Watershed coordinator grant extended. In response to the drought, the California Department of Conservation allowed a six-month extension for the watershed coordinator position (extending the grant to December of 2014). A small amount of additional funding was provided, with the rest coming from unspent grant balances.
December 2014

$2.0 million in Proposition 84 drought grant funding awarded:
$890,000 for an aeration system in Lake Casitas, and $1.1 million for Arundo removal in San Antonio Creek.

March 2015

Watershed management plan completed. After two and half years in development, the Ventura River Watershed Management Plan was completed.

1.2.4 Council Funding

Since the fall of 2011, the primary support for the Watershed Council has been from the following two grants:

- California Department of Conservation (DOC), Watershed Coordinator Grant: $280,844
- Bureau of Reclamation, WaterSMART Cooperative Watershed Mgmt. Program Grant: $98,520

The required 25% matching funds for the DOC grant were provided by seven local organizations:

- Ventura County Watershed Protection District
- Casitas Municipal Water District
- City of Ventura
- Ojai Valley Sanitary District
- Ojai Valley Land Conservancy
- Ventura Hillsides Conservancy
- Surfrider Foundation

These grants and matching funds supported a full-time watershed coordinator, office equipment/supplies, plus contractor support with map development, webpage development, administration, writing, editing, and graphics.

In addition to grant funding, the Watershed Council has been assisted since its inception with staff support by the Watersheds Coalition of Ventura County.
1.3 The Planning Process

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1.3 The Planning Process

The Watershed Council’s process for developing the management plan was, by design, very broad, inclusive, and transparent. The Council started with a rough idea of what a watershed management plan was and could do. This idea evolved as stakeholder input was received, as the Council grew in understanding, and as the plan took shape. With the guidance of a full-time watershed coordinator, the Council worked together for two and a half years to develop a plan that fits the watershed’s and the Council’s specific circumstances and constraints, and clearly reflects the voices of its many and diverse stakeholders.

The watershed management plan is intended to serve as a guiding document for the Council and also to inform and guide local decision makers, resource managers, public and private organizations, landowners, community members, students, and others about the watershed, the factors that influence its conditions, and the priorities for maintaining and improving its health and sustainability for the benefit of the people and ecosystems that depend upon it.

The plan is just one element of this process, however. The relationships established along the way, together with the ongoing communication and exchange of information that comes with those relationships, are the most valuable legacy of this Watershed Council’s first Ventura River Watershed Management Plan. The Council’s new strength has already had an impact on watershed management. The following sections describe the steps taken to successfully complete the plan.

1.3.1 Strengthen Organizational Capacity/Ensure Committed Leaders

Once the Council had committed to the development of a watershed management plan, they moved to strengthen the organizational capacity of the Council and to ensure the Council had committed leaders. Key aspects of these steps are briefly described below.

Funding for the Watershed Coordinator. Funding for watershed planning is not easy to come by, but the Council succeeded in securing grant funding from the California Department of Conservation in order to hire a full-time watershed coordinator for a three-year term. The Ojai Valley Land Conservancy agreed to host the position, and six local agencies provided matching grant funds. The watershed coordinator began
the fall of 2011. In October of 2012, the coordinator was able to secure additional funding from the US Bureau of Reclamation to further support the watershed management plan's development. One year of funding was awarded, with the potential for a second year based on performance. In July 2013 the Council was awarded a second year of funding.

Mission Statement, Logo, and Website. As part of building organizational identity, the Council defined its mission statement and approved a logo design that reflected the specific nature and characteristics of the watershed—dry, rocky and mountainous. The Council’s website, http://www.venturawatershed.org, was launched in 2012.
Governance Charter. During the first half of 2012, the Council and an ad hoc committee worked on the language of a governance charter. While many in the group liked the informal nature of the group, people understood that development of a watershed management plan was a new undertaking and that there would likely be issues of substance that would benefit from having an established decision-making structure. The governance charter identifies the Leadership Committee—the voting members of the Council; by having participants agree to serve on the Leadership Committee, the Council was assured of the active and ongoing participation of members. The charter, which makes explicit the requirement for fair and balanced representation, lends an important authority and respect to the group. The Council's first charter was approved in May 2012, and is reviewed annually.

1.3.2 Expand Stakeholder Involvement/Gather Stakeholder Ideas

In its beginnings, Watershed Council meetings were attended primarily by representatives of public agencies—cities, counties, and water and sanitary districts, along with several long-standing environmental and nonprofit groups. A big focus of the group early on was helping the Watersheds Coalition of Ventura County write the Ventura County Integrated Water Management Plan and related grant proposals in order to secure some of the state's water bond funding.

Before beginning the development of the watershed management plan, considerable effort went into reaching out to a broader range of stakeholders and inviting them to the table. As a result of the outreach efforts summarized below, Council meeting participation increased from an average of 15 to 20 people per meeting to an average closer to 30 to 40 people per meeting. Watershed Council meetings are held about nine times a year. The Council's email distribution list, which stood at 120 contacts in late 2011, has 370 contacts in late 2014.

One-on-One Outreach. Stakeholders from a much broader range of interests were invited to participate in the Council. Large landholders were approached, including growers, ranchers, and representatives from the oil industry. Personal contact was made with a wide range of agencies, organizations, and interests, including resource agencies, chambers of commerce, local government departments (fire, land use planning, environmental health, parks, public works, flood management, stormwater management), agricultural organizations, environmental groups, universities, consultants, water districts, water organizations, and land managers.
Evening Meetings. In 2012, the Council started holding one or two evening meetings per year for the benefit of stakeholders unable to attend daytime meetings. These meetings have been very well received and well attended, and succeeded in getting more participation by interested citizens, landowners, and businesses.

Stakeholder-Targeted Meetings. The Council publicized and held several topic-focused Council meetings in order to attract a wider variety of potential stakeholders: a public scoping meeting (to identify issues and concerns) for the watershed management plan, a meeting focused on agriculture, and a bilingual meeting to reach out to the watershed's Spanish speakers. At each of these targeted meetings, as well as at regular meetings of the Council, watershed-related concerns and ideas were gathered for integration into the watershed management plan.

Public Scoping Meeting. A public scoping meeting for the watershed management plan was held in October, 2012. Meeting outreach included direct mail invitations to streamside property owners; press releases; newspaper, radio and cable TV announcements; announcements by other groups including Association of Water Agencies of Ventura County, Ojai Valley Land Conservancy, Friends of Ventura River, and Ojai Valley Green Coalition. Sixty people attended, including 28 new participants. At the meeting, participants had the opportunity to provide written input on their five “biggest concerns” and “best ideas” with regard to the watershed. These concerns and ideas were recorded and distributed after the meeting, and were used in the development of the watershed management plan.
Agriculture-Focused Council Meeting. An agriculture-focused meeting was held in October 2013; 69 people participated.

Spanish-Speakers Outreach Meeting. A special meeting was held in January of 2014 to bring information about watershed planning and improvements to Spanish speakers on Ventura’s Westside, and to gather their ideas and input. The event was called “Exploring Your Backyard: Healthy Water, Healthy Communities.”

The meeting was presented in both English and Spanish. Childcare and children’s activities were provided. Topics included an overview of the watershed, where local water comes from, the watershed planning process, the drought, and access to the Ventura River near Ventura’s Westside.

A representative from the California Coastal Conservancy described the importance of river parkways to surrounding communities. Representatives from Friends of Ventura River and Ventura Hillsides Conservancy talked about local opportunities to enjoy nature. The new Spanish language version of the Ventura River Parkway map was unveiled, and special guests from the community spoke about their connections with the Ventura River and how they are helping to build a healthy watershed.
1.3.3 Define Plan Purpose, Goals and Objectives, and Values

The writing of the watershed management plan began with clarifying its purpose, goals and objectives, and the overall values that would guide the development and implementation of the plan. This was done in a series of Council, Technical Advisory Committees (TACs), and ad hoc meetings between May and December of 2012. The process steps included:

- Based on input from the Public Scoping Meeting and research of other watershed management plans, the watershed coordinator prepared draft language for the plan's purpose, goals, objectives, and values as a starting point.
- After a general discussion of the draft language, the Council decided to form a TAC for each goal to refine the language.
- A special Agriculture/Economics Subcommittee meeting was held to work out whether supporting local agriculture should be included as a separate plan goal. The group recommended the addition of language specific to supporting agriculture in the other watershed management plan goals and objectives.
- The six TACs met and developed recommended goal and objective language for the Council's consideration.
- The Council approved the purpose, goals, objectives, and values language. See "2.1 Plan Guiding Framework" for this final language.
1.3.4 Educate Participants/Compile Reference Information

The Ventura River watershed might be one of the most studied small watersheds in the nation. At just 226 square miles, the number of reports and studies that analyze watershed-related issues is remarkably large. Much has been done already to understand and manage the watershed; and one of the most important outcomes of the watershed management planning effort was the sharing of that information with and among stakeholders. Making that information readily accessible, translating technical data with visuals and slideshows, providing engaging videos—these efforts, described below, helped elevate the understanding of stakeholders so that discussions about issues could be clearer and more productive. These benefits continue with ongoing Council meetings.

Meeting Presentations. At most Watershed Council meetings, at least one presentation is provided by a watershed stakeholder. This is a means of keeping the meetings relevant and interesting while also increasing understanding and appreciation among Council members of the issues and subtleties involved in different areas of focus. These presentations are a rich source of current information about the watershed that becomes available to the public when they are posted on the Council’s website after meetings. Forty-nine stakeholder presentations can now be found on the website.

Document Inventory. As part of research for the watershed management plan, and in order to make watershed data and information more accessible, a comprehensive document inventory was compiled. The inventory spreadsheet includes primarily watershed-specific documents, although some countywide documents are also included where appropriate. Reports, studies, plans, policy documents, and relevant educational materials are included in the inventory. Subjects include agriculture, climate change, coast and ocean, demographics, emergencies/hazards, flood management, geology, groundwater, hydrology, land use, Matilija Dam, recreation, resource conservation, restoration, habitat, San Antonio Creek, sediment, steelhead, water quality, water supply, and watershed-wide concerns.

The inventory spreadsheet includes many fields for convenient sorting, such as subject, date developed, who prepared the document and for whom it was prepared, and spatial area covered. The website URL is also provided when the document is available on the internet. The document inventory contains over 500 entries, and the file is available for download on the Watershed Council’s website.
Map Atlas and Interactive Map Viewer. It was important to the Council that the watershed management plan be interesting and user-friendly, so graphics, such as maps, photos and charts, were developed to help tell the story whenever possible. With this in mind, a comprehensive watershed Map Atlas was developed. The atlas is comprised of 36 high-quality maps covering a wide range of topics, all of which are posted on the Council's website and available for download. In addition, an online interactive map viewer was added to the website, which allows users to scroll and zoom in on the watershed map to get finer-scale information on several types of watershed data.

Video Library. Many Council stakeholders have produced valuable videos on a variety of topics related to the Ventura River watershed. To ensure that visual and oral information about the watershed is readily available, the Council's website was expanded to include a page devoted to videos about the watershed. Forty-five different videos with a wide variety of topics, from Arundo to water conservation, are featured on the page, along with a few videos produced by and for the Council itself.

E-Newsletters. The watershed coordinator assembles and distributes e-newsletters to the Council's distribution list several times each month. E-newsletter content includes Council meeting reminders, along with articles and announcements about other events, news, reports or happenings relevant to the watershed. These e-newsletters are posted to the Council's website as announcements and available for public view.
The newsletters were an important communication tool in development of the plan; they provided updates on the plan’s progress and announced the availability of draft sections for review to a wide audience.

**Website.** In addition to the document archive, map atlas, and map viewer mentioned above, the Council’s website contains a variety of other helpful information, such as the “Save More Water” page, a comprehensive reference for water conservation focused on Ventura County, background information about the Council and links to other organizations and data sources. The website was also an important communication tool in the development of the plan; meeting announcements, draft sections for review, and copies of the e-newsletters were posted there.

### 1.3.5 Characterize the Watershed

An important component of this watershed management plan process is the assembly of the watershed characterization. The characterization describes and illustrates the watershed’s features such as geology, climate, surface water and groundwater hydrology, flooding, water supplies and demands, water quality, habitat and species and related issues, opportunities for access to nature, and demographics and local regulations.

The process for developing these sections varied based on the nature of the topic, but typically involved the watershed coordinator developing a first-pass draft of a section, using all of the existing documents available, and often in collaboration with local experts on the given topic. The first-pass draft was then circulated to the appropriate TAC for comments.
Once comments were integrated, a second-pass draft was sometimes issued to the TAC, or to a larger general list of stakeholders who had registered interest in reviewing drafts. Some topics, such as water quality, were not only technical but also raised sensitive policy issues and required several meetings of the TAC to work out acceptable language. In some cases ad hoc TACs were called for focused work on topic, such as developing a map of priority fish passage barriers.

A password-protected page on the Council’s website was established and first-and second-pass drafts were posted there and made available to reviewers. This was especially important for draft files that were too large for emailing.

Work on characterizing the watershed went on simultaneously with work on other parts of the plan.

### 1.3.6 Develop List of Projects and Programs

The next step in writing the watershed management plan was developing a preliminary list of the projects and programs that stakeholders would like to see implemented to help achieve the goals and objectives.

As with the development of the goals and objectives, this process began with the watershed coordinating compiling a draft, which the Council’s six TACs—one for each of the first six goals—then revised. The TACs met twice during this process. Work on the list started in February of 2013, and a working draft list of projects and programs was approved in June of 2013. The list contains almost 200 potential project and program ideas.

This process is further detailed in “2.4.1 Priority Project and Program List Development.”

### 1.3.7 Develop Implementation Strategy

Perhaps the most challenging part of developing the watershed management plan was crafting an approach for a loose group of separate organizations—which all report to their own boards/members and are governed by their own budgets/priorities—to agree to some level of collective action and implementation.

Initially, the Council tried to develop a “Short-Term Action Plan” strategy that would prioritize projects and programs that might realistically be completed or worked on within a three-year time frame. In trying to craft
such an approach, the limitations became clear. Specific commitments by individual organizations could not be secured as this would require approval by each organization’s governing board on projects/programs would need to be in line with that board’s current priorities, etc.

What could be secured, however, was the commitment of each organization to work towards improving the health and sustainability of the watershed—individually, and where feasible, together. This work was in fact already occurring.

In November of 2013, a revised strategy, focused around six “campaigns,” was crafted that offered a more realistic approach to the plan’s implementation. Instead of focusing on separate individual priority projects or programs, the campaigns widened the perspective and focused on a short list of priority regional issues. Addressing those priority issues would depend upon implementation of a variety of different types of projects and programs, involving many different stakeholders at many different levels of effort. The campaigns were also structured to build upon work already underway.

By presenting the Council’s priority projects and programs in this broader perspective, and by starting from work already underway, the campaigns offer a realistic framework for collectively achieving measurable improvements.

The Council’s six implementation campaigns are:

- River Connections Campaign
- Resiliency through Infrastructure Campaign
- Extreme Efficiency Campaign
- Water Smart Landscapes and Farms Campaign
- Arundo-Free Watershed Campaign
- Healthy San Antonio Creek Campaign

See “2.3.1 The Campaign Approach” for more background on the campaign idea.

### 1.3.8 Approve the Plan

The Watershed Council approved Parts 1 and 2 of the plan—essentially “the plan” part of the plan—at their November 2014 meeting. Approval of Parts 3 and 4—the watershed characterization and supporting information—was approved in March 2015.
1.3.9 Implement the Plan

Implementation of this plan through the six campaigns will be achieved by individuals and organizations working both independently and collectively. The extent of implementation will depend upon the availability of grant funds and the priorities and budget conditions of dozens of different organizations, as well as landowners and businesses.

An important factor in implementation success will be the continuation of the Watershed Council as a group. Council meetings cultivate the collaboration, information sharing, and partnerships that will advance the Council’s goals for the watershed. The Council has secured modest programmatic support from 16 different local organizations that will fund part-time staff to keep meetings going through 2015. This will allow the group to maintain its momentum, build on the assets it has established, and continue to demonstrate its value.
PART 2

Watershed Plan, Projects, and Programs

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2.1 Plan Guiding Framework

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2.1 Plan Guiding Framework

The Ventura River Watershed Management Plan's guiding framework serves as the plan's foundation and was constituted by the Watershed Council to guide its current and future watershed planning and management efforts. This guiding framework includes:

- A description of the purpose of the plan and a set of guiding values.
- Seven goals and 44 associated objectives that are supported by key findings.

2.1.1 Purpose and Values

Because watershed boundaries are inherently geophysical and not political, watershed management plans typically range over multiple political jurisdictions, water and sanitary districts, and many other boundaries and jurisdictions of organizations involved in the watershed's management. In California, local watershed management plans do not currently have any regulatory teeth. They are not mandated and they grant no special powers. Even so, the planning process itself—gathering diverse stakeholders in a watershed to come together and write a plan—has demonstrated widespread benefit in watersheds across the world. The purpose of the Ventura River Watershed Management Plan, as approved by the Watershed Council, is:

1. To tell the story of the watershed and its many interdependencies.
2. To identify and prioritize water-related concerns in the watershed.
3. To outline a strategy to collectively solve our shared watershed problems and collectively manage our shared resources.
4. To better position ourselves for funding.

The Watershed Council established eight values to guide the development and implementation of the watershed management plan. These guiding values answer the question, "What kind of management plan do we want?"

1. Our watershed management plan will be pragmatic and actionable.

While striving toward the larger watershed goals, our watershed management plan shall nonetheless have a highly pragmatic and financially realistic orientation. Our work will build upon and leverage work already done. Our recommendations shall be feasible so that we can celebrate success. We will use common sense, creatively
leverage existing resources and data, look for low-hanging fruit, and consider how to get the most "bang for the buck."

2. **Our watershed management plan will be accessible to the general public.**
   We will strive to produce a watershed management plan, and other associated written materials, in a manner that conveys technical information in an interesting and easy to understand format so that it is readily accessible to members of the general public.

3. **Our watershed management plan will be unique.**
   Our watershed management strategies shall acknowledge the unique circumstances of our particular watershed. We will not mimic language or strategies that do not make sense here. We will encourage innovative ideas and solutions.

4. **Our watershed management plan will acknowledge the triple bottom line.**
   A healthy and sustainable watershed requires not only vibrant and well-functioning ecological systems, but also vibrant and well-functioning social and economic systems. Our watershed plan will include humans and their social and economic needs as part of an integrated and balanced approach to watershed management.

5. **Our watershed management plan will address prevention.**
   Damaged habitats need restoration, but equally important is prevention of further damage. This applies not only to habitats, but also to water supply, water quality, and flood management. We will give due attention to long-term, proactive strategies, such as land use planning policies, that may be more difficult to implement in the short-term but have the potential for significantly greater and longer-lasting benefit.

6. **Our watershed management plan will address policy.**
   While the watershed management plan in itself is not a regulatory document, it is our intention to nonetheless outline, for the benefit of regulators, the specific manner in which regulations are hindering or could benefit the watershed.

7. **Our watershed management plan will be technically strong.**
   We hold high expectations for the technical understanding that underlies our watershed management plan. Whether in the area of science, policy, civic engagement, economics, infrastructure management, or education, we expect to rely upon analyses that are sophisticated, thorough, and endure scrutiny.
8. Our watershed management plan will be a living document.
   It is our intention to regularly update our watershed management plan as new information becomes available and priorities change so that it continues to be relevant and useful.

2.1.2 Goals, Objectives, and Findings

The Watershed Council approved seven major goals for the watershed management plan. These goals are brief, visionary statements about the big-picture results the Council is working to achieve. The goals answer the question, “What do we want for our watershed?” All the goals put together form the Council’s “vision” for the watershed. These goals:

- serve as a reference or touchstone to guide future projects and programs,
- imply a wide perspective and a long view, and
- address a primary watershed threat or need.

Because the goals address water and the many issues with which water intersects, the goals naturally overlap and are interdependent.

The objectives identify the assumptions about what needs to be accomplished in order to achieve each goal. Objectives, with their greater specificity, are also the measuring sticks against which progress can be gauged.

Each goal and its objectives are supported by key findings. These findings summarize those Ventura River watershed characteristics, strengths, and challenges that Watershed Council stakeholders find to be most significant. The findings provide a rich, condensed story about the watershed and its current conditions.

Together, the findings, goals, and objectives form the foundation and justification for the implementation campaigns, as well as the project and program list found later in this section.
2.1.2.1 **Sufficient Local Water Supplies**

**Goal**

*Sufficient local water supplies to allow continued independence from imported water and reliably support ecosystem and human (including urban and agricultural) needs in the watershed now and in the future, through wise water management.*

**Objectives**

a. Improve water supply reliability for human needs through increased water use efficiency and capture, water system resiliency and efficiency, knowledge, conservation practices, reuse, and recycling.

b. Protect existing water supplies from harm and losses.

c. Continue to look for new and innovative water sources and storage areas in the watershed.

d. Improve coordinated management of surface water and groundwater supplies to protect aquatic ecosystems while meeting water demands.

e. Manage water supply costs to sustain our watershed’s mixed land uses.

f. Track the potential impacts of climate change on local water supplies so that adaptation strategies can be developed.
Findings

Sources

- The Ventura River watershed is 100% dependent upon local water sources. Groundwater comprises almost half of the total water produced. The Lake Casitas reservoir is the watershed's main source of surface water and was designed to maintain supplies during a multi-year dry period.
  
  - On average, surface water comprises about 54% of the water recovered from the watershed and groundwater comprises about 46%.
  
  - Lake Casitas reservoir is the watershed's main source of surface water supplies and serves as backup for many groundwater users, including other water districts.
  
  - Lake Casitas stores runoff collected from the lake's surrounding watershed and diverted from the Ventura River.
  
  - The reservoir is carefully managed to maintain supplies during a repeat of the 21-year dry period from 1945 to 1965 (the longest dry period on record). The most severe test of the reservoir's function since its construction was the dry period from 1984 to 1991, when water storage dropped to nearly 50% capacity. The last time the reservoir was at near full capacity was in 2006.
  
  - The City of Ventura and Casitas Municipal Water District own and pay for allocations of water from the State Water Project (10,000 AF and 5,000 AF respectively); however no connecting distribution system is in place.

- Surface water and groundwater are closely connected. Subsurface conditions influence instream surface water levels and flows.

Groundwater basins can be quickly recharged.

- Groundwater basins are primarily "unconfined," and can be quickly recharged by rain, stream and river flows, and water applied to overlying lands (e.g., through irrigation).

- Groundwater rises and becomes surface water in places, often in association with underground faults and other geologic constrictions and in-river springs; just as surface water seeps into the ground in certain reaches, leaving sections of the riverbed dry during all but very wet years.

- Ojai Valley Groundwater Basin subsurface underflow is an important contributor of streamflow to San Antonio Creek.

- Surface water or groundwater withdrawals in one area can potentially have significant impacts on water users in other areas.
• There are currently 182 active wells in the Ojai Valley Groundwater basin, 64 of which have been drilled since 2000; in the Upper Ventura River Groundwater Basin, there are currently 149 active wells, 44 of which have been drilled since 2000.

• Wastewater is being beneficially reused. There is potential for and stakeholder interest in pursuing opportunities to expand its use.
  - Some wastewater from the watershed is reused to offset potable water demands. Wastewater that enters the sewer within the City of Ventura is treated by the City's Ventura Water Reclamation Facility; 700 AF of that treated wastewater is reused for landscape irrigation within the City and the rest is discharged to the Santa Clara River estuary.
  - Treated wastewater from Ojai Valley Sanitary District (OVSD) is discharged into the Ventura River. This effluent provides downstream habitat for the endangered southern California steelhead trout, and also recharges the Lower Ventura River Groundwater Basin.
  - If OVSD's effluent were to be repurposed, the City of Ventura, as property owner of the OVSD wastewater treatment plant site, holds first rights to that water. A feasibility study was completed in 2007 analyzing the potential to reuse OVSD's effluent.
  - Current regulations and local agreements on water reuse are complex and must be addressed in order to expand reuse projects.
  - Exploring the feasibility of reusing wastewater for irrigation higher in the watershed is of interest to some stakeholders.
  - Reuse of residential graywater offers an opportunity to extend local water supplies and is being actively promoted.

• There are opportunities and widespread stakeholder support for supplementing water supplies by capturing additional rainwater and surface flows.
  - Rainwater capture, infiltration, and groundwater recharge—through large projects such as recharge basins, and small projects such as bioswales and berms—are of interest to stakeholders as a means to increase water supplies.
  - The restored San Antonio Creek spreading grounds will divert surface water for recharge of the Ojai Valley Groundwater Basin: an estimated average of 126 acre-feet up to a maximum of 914 acre-feet per year.
- Many large and small water suppliers serve the watershed, most of whom have some dependency on Lake Casitas.
  - Casitas Municipal Water District is the main water supplier, and acts primarily as a wholesale and agricultural water supply agency. Casitas serves a small number (2,715) of residential customers directly; about 40% of their water is sold directly to agricultural customers (~250 customers), and the district serves the critical role of backup water supply for dozens of customers whose primary water source is groundwater.
  - The City of Ventura and Golden State Water Company are the largest retail water suppliers. The City of Ventura obtains wholesale water from Casitas, pumps directly from City-owned wells, and utilizes surface and subsurface water diversions from the Ventura River in the Foster Park area when available. Golden State relies primarily on groundwater and secondarily on Casitas.
  - Two other urban water suppliers, 11 small to medium mutual water companies, and several small private water companies also supply water. Most of these suppliers provide groundwater while it is available and have the ability to switch to Casitas water if necessary.
  - Many agricultural users have their own wells, and are also connected to Casitas for backup water.

- Because water supplies are 100% local and the amount of rainfall received annually is highly variable, supplies must be managed with caution.
  - Cycles of drought and flooding occur regularly. Annual rainfall in downtown Ojai has ranged from a low of 7 inches to a high of 49 inches—a sevenfold variation.
  - Lake Casitas is managed conservatively to ensure adequate supplies during extended dry periods.
  - The variability in rainfall could likely be magnified by climate change.
  - Increased wildfire risk due to climate change could also negatively impact water supply reliability.
Water Uses & Conservation

- Water originating in the Ventura River watershed is used both inside and outside of the watershed, and use is divided roughly equally between the agricultural and urban sectors. Data on groundwater use is incomplete.
  - Lake Casitas and the Ventura River also supply water to adjacent coastal watersheds: the Rincon area to the west and portions of the City of Ventura to the east.
  - Dry years see increased agricultural demand relative to urban demand.
  - Because there are so many groundwater wells with unreported extractions, data on the amount of water used and the relative amounts used by each sector are incomplete.

- State and federal requirements regulating the amount of surface water that must be available for endangered species affect management of the watershed's water resources. Potential requirements to provide increased instream flows could further reduce water available for municipal, agricultural, and other uses.
  - The amount of water that Casitas must allow to bypass their water diversion in the Ventura River increases during the fish passage season.
  - Modifications of existing conditions that could affect the steelhead, such as improvements to or repairs of the City of Ventura's wells in the Foster Park area, or a reduction in the amount of treated wastewater that is now discharged into the Ventura River, would likely be subject to approval by the federal agencies that enforce the federal endangered species act.

- Groundwater is estimated to provide almost half of the local water supply; however, the locations and volumes of groundwater extracted and the effects on streamflow are not accurately known. This data gap inhibits analysis and planning. The Sustainable Groundwater Management Act, signed into law in September, 2014, should result in more groundwater management plans with additional data gathering that will help fill this gap.
  - Of the watershed's four groundwater basins, only one—the Ojai Valley Groundwater Basin—has a management plan and governing body.
  - State funding for groundwater projects is generally restricted to those basins with groundwater management plans.
Outside of the Ojai Valley Groundwater Basin, data from groundwater extraction reporting is incomplete. This data gap inhibits development of precise groundwater hydrology models and water budgets for the watershed.

The links between groundwater pumping and reduced streamflow are not well understood.

- **The invasive exotic riparian plant *Arundo donax*, which can be found throughout the watershed, removes scarce water from stream channels at a rate three times that of native riparian plants.**

  - *Arundo* is estimated to consume up to 4.8 million gallons per acre a year. This is 3.2 million gallons more water than native riparian plants, enough water to support 16 households or four acres of citrus—all year.

  - Significant and successful efforts to control *Arundo* infestations are ongoing in some portions of the watershed, but require continual maintenance to be effective. Large areas of *Arundo* remain untouched.

- **Increased demand for water has been relatively low; changes in this trend would present management challenges.**

  - The rate of population growth and development has been low in recent decades.

  - Even with the addition of a couple of large groundwater-dependent agricultural operations, the acreage of irrigated agriculture is trending downward. Irrigated agricultural acreage using Casitas water (either in full or supplemental) has gradually dropped from 6,276 acres in 2000 to 5,264 acres in 2013—a reduction of 1,012 acres, or 16%.

  - Significant changes in the watershed’s economic, environmental, or regulatory conditions could significantly shift water demand.

- **While considerable improvements in conservation and efficiency have been made, significant potential for reducing water demand remains.**

  - Because of water scarcity and cost, most growers in the watershed irrigate efficiently and stay current with improvements in technology. The volume of agricultural water use suggests, however, that ongoing support of agricultural efficiency can continue to reduce water demand.

  - Improving the irrigation efficiency of large landscapes, and retrofitting existing landscapes to be lower-water using, offers great potential water savings.
- Established rebate and incentive programs for high efficiency fixtures and equipment continue; they have been effective and could be expanded to realize additional savings.

- Leaks from pipes and plumbing fixtures waste a considerable amount of water. Ongoing education and monitoring for leaks is very worthwhile and could be improved.

- Important savings could be realized through improvements to older water distribution infrastructure and use of more sophisticated leak detection technology.

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2.1.2.2 Clean Water

Goal

*Water of sufficient quality to meet regulatory requirements and safeguard public and ecosystem health.*

Objectives

a. Protect all beneficial uses of surface water and groundwater in the watershed by preventing and reducing pathogens, nutrients, salinity, trash, fine sediment, and other water quality impairments.

b. Protect in-stream beneficial uses of surface water in the Ventura River and tributaries, within weather and geologic constraints.

c. Improve and protect near-shore ocean water quality by preventing and reducing pathogens, trash, and other water quality impairments.
d. Increase the amount of developed property that retains and treats runoff onsite.

e. Improve understanding of the sources and causes of water quality impairments.

f. Reduce the burden and cost of compliance with water quality regulations through collaboration and innovation.

g. Improve the usefulness of water quality monitoring data collected through data availability and statistical analysis.

Findings

- Surface water quality is good compared with more developed watersheds in the region and has improved notably in recent decades.
  - Trash pollution, a long-standing problem, has improved significantly in recent years. Keeping ahead of this issue will require ongoing vigilance and resources.
  - Efforts to reduce nutrient pollution have been underway 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.

- Despite relatively good water quality, all of the watershed's major waterbodies are on the Clean Water Act Section 303(d) list of impaired waterbodies. Between these waterbodies there are 14 different types of impairments.
  - Two TMDL (Total Maximum Daily Load) regulations, which require considerable ongoing compliance effort, have been approved for the watershed to date: the “Ventura River Trash TMDL,” and the “Algae, Eutrophic Conditions, and Nutrients TMDL for Ventura River and its Tributaries.”
  - Water quality data show that San Antonio Creek has some of the most compromised surface water quality in the watershed, with especially high levels of nutrient pollution. The creek is on the Section 303(d) list for bacteria, nitrogen, dissolved oxygen, and total dissolved solids.
  - Indicator bacteria concentrations in urban runoff and in streamflow typically exceed standards for human contact following a rainstorm large enough to produce runoff. Cañada Larga, the Ventura River estuary, San Antonio Creek, and a stretch of the Ventura River are on the Section 303(d) list for bacteria or coliform.
- Low levels of streamflow exacerbate water quality problems, and lack of instream water is itself considered to be an impairment to the “beneficial use” of the river by the endangered southern California steelhead. Much of the Ventura River, from just below Foster Park on up, is on the Section 303(d) list for water diversion and pumping for this reason. The extent to which water diversions and groundwater pumping contribute to low flows needs further study.

- The water quality impairments for algae and related effects, and trash are being addressed through TMDL regulations. The water quality aspects of the diversion and pumping impairment have been considered addressed through the Algae TMDL.

- **Further efforts are required in order to improve instream water quality conditions and meet water quality regulations.**

  - Water pollutants in the watershed come primarily from diverse sources (non-point sources) rather than from large single sources (point sources).

  - Nutrient pollution needs to be reduced in order to improve instream water quality and meet regulatory requirements. Excess instream nutrient levels are associated with problems of algae growth, excessive aquatic plant growth, and low dissolved oxygen. Fertilizers used on landscapes and farms, septic systems (many homes are still on septic), waste from horse/livestock operations, and urban runoff have been identified as human-generated sources of nutrients. Additional research is needed to identify the sources of greatest concern.

  - Discharge from the Ojai Valley Sanitary District wastewater treatment plant, below Foster Park, is the primary “point source” of nutrients to the Ventura River. Although the plant discharges relatively high quality water, the latest regulatory clean water targets are more stringent and will require significant treatment plant upgrades.

  - Stormwater runoff from natural and urban areas contributes to instream water pollution. Runoff from urban areas is covered under a stormwater NPDES permit, and continuous improvements to reduce stormwater pollution are being made.

  - There is a high level of interest among stakeholders in retrofitting existing urban stormwater systems to capture and treat runoff before it enters the stream drainage network, thereby reducing instream pollutants. Several new private and public bioswale systems have appeared in the past five years.
- Runoff from the watershed causes near-shore oceanic pollution, especially from unsafe levels of fecal bacteria after storms.
- Sewer mainlines are located in or immediately adjacent to the Ventura River and San Antonio Creek, and remain at risk from breaks and spills.

- **The effort and resources devoted to compliance with water quality regulations are considerable and could benefit from better efficiencies, integration, and new funding sources.**
  - Many stakeholders report that the staff time and the money spent annually on required water quality monitoring and reporting strain their budgets and impact their ability to manage effectively.
  - The watershed would benefit by additional analysis of the considerable amount of water quality data already collected, and by making the findings of these analyses more readily available to the general public.

- **Groundwater quality is generally good enough for drinking and irrigating, though a few parameters exceed standards with some regularity and are monitored and managed accordingly.**
  - Levels of nitrate exceed standards in some wells, so this water must be blended with lower nitrate water to be suitable for drinking.
  - Total dissolved solids—a constituent of concern primarily to agricultural water users—is typically elevated in the Lower Ventura River Groundwater Basin due to the easily dissolved mineral content of the underlying rocks within these basins.
  - Groundwater in the Lower Ventura River Groundwater Basin is minimally used, likely because of high total dissolved solids and other quality issues.
  - Because most of the watershed’s aquifers are unconfined, groundwater is vulnerable to contamination from surface pollution.
  - The risk of groundwater contamination from hydraulic fracting is a growing concern among some stakeholders.

- **Casitas Municipal Water District and the Bureau of Reclamation maintain proactive programs to maintain good water quality in Lake Casitas.**
  - The 6,641 acres immediately surrounding the lake are federally protected to prevent land uses that could threaten lake water quality.
  - Strict controls are in place to prevent Lake Casitas from being invaded by exotic quagga and zebra mussels, which can have a significant adverse effect on water quality. These filter-feeding
mussels exacerbate problems with algal blooms and would have major cost implications for water treatment and delivery.

East Ojai Flooding
Photo courtesy of David Magney

2.1.2.3 Integrated Flood Management

Goal
An integrated approach to flood management that improves flood protection, restores natural river processes, enhances floodplain ecosystems, increases water infiltration and storage, and balances sediment input and transport.

Objectives
a. Minimize risks to human life and property due to flooding adjacent to Ventura River, its tributaries, and the ocean, and on alluvial fans, through traditional and nontraditional means.

b. Maximize low-cost nonstructural flood protection through natural floodplain restoration.

c. Integrate ecologic value into channel designs that accommodate natural geomorphic processes.

d. Address the lack of funding for flood management in the watershed.

e. Improve integration among the various regulatory agencies to advance streamlined permitting.

f. Track the potential impacts of climate change on local flood risk so that adaptation strategies can be developed.
Findings

- Major or moderate floods have occurred once every five years on average since 1933.
  - Since 1962, there have been eight Presidential.declared major flood disasters in Ventura County.
  - Of the 49 “repetitive loss” structures (insurable buildings for which a flood insurance claim was made within a 10-year period) in Ventura County as of 2004, 19 (39%) are located in the Ventura River watershed.
  - Flood maps identify multiple areas where homes are located in floodplains.

- **The steep terrain of the Ventura River watershed, coupled with intense downpours that can occur in the upper watershed, result in flash flood conditions where floodwaters rise and fall in a matter of hours.**
  - During the flood of 1992, the rate of flow in the Ventura River increased nearly 500-fold within about three hours.

- **Besides riverine flooding, the watershed also experiences alluvial fan, coastal, and urban drainage flooding, and related hazards.**
  - The watershed is subject to alluvial fan flooding in Ojai’s East End and coastal flooding near the shore.
  - With two significant dams (Casitas and Matilija), there is also a risk, though small, of dam failure and inundation flooding.
  - Other hazards associated with flooding include mudslides, landslides, and liquefaction.

- **Flood protection infrastructure, including all three levees, is in need of improvement. Important water and sewer facilities are vulnerable to flood damage because of their location.**
  - Flood protection is provided by three major levees along the Ventura River: Ventura River Levee, Casitas Springs Levee, and Live Oak Levee.
  - All three levees need improvements to fully meet current FEMA standards. The required upgrades are being pursued by the Ventura County Watershed Protection District; however, additional sources of funding are needed to complete the necessary engineering and structural improvements.
  - Matilija Reservoir is full of sediment and no longer serves a significant flood control function.
- Critical water-related infrastructure, including sewer mainlines and water supply wells, are located in river channels and are thereby exposed to damage from floodwaters and erosion.
- *Arundo donax* has invaded many drainage channels and increases flooding hazards by clogging infrastructure and reducing flow capacity.

- **High sediment loads carried and deposited by local streams are a very significant factor in local riverine flood risk and present major challenges to flood management.**
  - The watershed's mountains are composed of erodible rocks lying on very steep slopes with exceedingly high rates of erosion.
  - The river system is characterized by years of riparian vegetation and sediment buildup followed by scouring during floods.
  - Property owners have found it unreasonably expensive and time consuming to secure permits for preventative channel maintenance.
  - At four to five year intervals, a scouring flood typically occurs on the Ventura River that transports an average of 42 times more sand to the coast than in the drier years between floods. These pulses of sand augment local beaches and help buffer coastal areas from coastal flooding.

- **Alterations in natural sediment transport regimes have exacerbated coastal erosion and increased coastal flooding risk.**
  - Significant armoring of the coastline west of the Ventura River has further reduced the amount of sand delivered to beaches via the longshore littoral current.
  - The need for costly "arming" and repair of coastal structures is reduced when such natural processes are allowed to exist. The Surfers' Point Managed Retreat Project is a model project that has given beach sand more room to behave like a natural seasonally growing and shrinking beach.
  - The watershed's dams, Robles Diversion structure, and debris basins intercept some of the natural downstream flow of sediment from the mountains to the coast.

- **Restoring natural floodplain functions where feasible is favored by stakeholders as a least cost/greatest gain strategy for long-term flood management.**
  - The watershed's primary stream network remains largely unchannelized, with stream shape and hydrologic patterns relatively natural in many reaches. In a few areas, however, development
has been allowed in or very close to the floodway and requires costly ongoing protection.

- Little flood control funding is available; limited land development in the watershed restricts the source of revenues that typically fund flood protection projects (property taxes, land development fees, and benefit assessment fees).
- Restoring *Arundo*-invaded habitats will support restoration of natural floodplains.
- A changing climate could increase flooding risk; new data on atmospheric rivers and superstorms indicate that the watershed could be at risk from more frequent extreme flood events—and events exceeding the magnitude of past floods. Sea level rise also poses an increased flooding risk on the coast.

\[\text{Red-Legged Frog}\]
Photo courtesy of Chris Brown

2.1.2.4 Healthy Ecosystems

Goal

*Healthy aquatic and terrestrial ecosystem structures, functions, and processes that support a diversity of native habitats.*

Objectives

a. Protect and enhance the ecosystem services, functions, and values of riparian, wetland, and aquatic habitats in the watershed.

b. Increase southern California steelhead populations in the watershed through improvements to both the habitat available for spawning, rearing, and over-summering, and fish passage.
c. Protect native species' mobility and survival by improving and protecting habitat connectivity.

d. Protect and restore habitat for species with special status at the local, state, or federal level.

e. Improve the natural transport of sediment in the Ventura River and the associated replenishment of coastal beach sands.

f. Improve understanding of the Ventura River estuary system and feasible options to restore this ecosystem's functions and habitat values.

g. Improve the overall biodiversity and ecosystem resiliency of the watershed.

Findings

Habitat

- The Ventura River watershed supports a remarkable array of healthy and biodiverse southern California natural habitats.
  - Most of the land in the north half of the watershed is in a national forest and boasts habitats that are relatively undisturbed. A significant amount of the remaining unprotected land comprises steep hillsides and undeveloped floodplains, which also support native habitats.
  - The watershed's diverse geography—from steep mountains to coastal delta—supports a diverse array of natural habitats, including 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.
  - The watershed is located within the California Floristic Province, one of the world's biodiversity hotspots, where species diversity and numbers of endemic species, as well as threats to diversity are all particularly high.
  - The Ventura River and its associated drainages provide important wildlife connections between wilderness areas of the Santa Ynez foothills, the Los Padres National Forest, Sulphur Mountain, and the Pacific Ocean.
  - Lake Casitas provides high-quality habitat for migrating waterfowl and other birds and wildlife.
- The watershed's river and stream network remains largely unchannelized and is supportive of considerable wetland and riparian habitats. These riparian habitats are especially critical in dry southern California.
  - Stream shape and hydrologic patterns are relatively natural in many reaches.
  - The river and its many tributaries support hundreds of miles, and approximately 5,100 acres, of riverine and river-associated wetlands, and riparian habitats.
  - These wetlands and their associated riparian habitats are among the region's most biologically diverse and sensitive ecosystems; and given the dry nature of the climate, they provide critical wildlife habitat.

- The Ventura River estuary, a place where river water and ocean water converge, is an exceptionally valuable wetland habitat and ecological resource.
  - The diversity of habitats within the estuary supports an abundance and diversity of species, including endangered species.
  - The estuary serves as important feeding, spawning, and nursery habitat for many aquatic animals, and is the entry point for the anadromous (sea-going) steelhead.

- Streamflow and pools support aquatic systems in some reaches, other reaches are typically too dry to sustain aquatic habitats.
  - The reach of the Ventura River from the Robles Diversion down to below the Santa Ana Boulevard Bridge, and the alluvial wash area of the San Antonio Creek and its tributaries on Ojai's East End, are commonly only flowing during and shortly after storms.
  - Groundwater extraction can affect flow in streams; the extent to which this is the case needs further study.
  - Drainages that maintain flowing water in most years include some higher elevation tributaries, lower San Antonio Creek, the Ventura River above Robles Diversion, and the Ventura River from its confluence with San Antonio Creek down to the coast.
  - The discharge of highly treated wastewater effluent into the lower Ventura River below Foster Park contributes instream flows to the river that provide important support of riverine and estuarine habitats and species. In dry years, these discharges comprise most of the lower river's flow.
Plants & Animals

- The watershed is home to numerous protected species and habitats, including 137 plants and animals protected at either the federal, state, or local level. The watershed is also challenged by invasive, non-native species.
  - 25,397 acres and 48 miles of river and tributaries are designated as "critical habitat" (areas of habitat believed to be essential to the species' conservation) for five federally endangered and threatened species: southern California steelhead, California red-legged frog, California condor, tidewater goby, and southwestern willow flycatcher.
  - 137 special status plant and animal species can be found in the watershed: species protected at either the federal, state, or local level. This includes 15 species listed as endangered, threatened, or fully protected at the state or federal level.
  - Problems posed by invasive species include outcompeting native species for habitat, increasing fire hazard, flooding, high water demands, and potentially increasing the management costs of Lake Casitas.
- The federally endangered southern California steelhead is of particular significance. The streamflow and pools, and associated food chain, required for its survival are indicators of healthy aquatic ecosystems. Allocating that “environmental water,” given the watershed's often dry and always variable climate, is challenging and a continuing source of stakeholder controversy.
  - Historically, steelhead spawned in the Ventura River and its tributaries.
  - Dams, diversions, and road crossings have blocked steelhead from reaching some of their historic spawning habitat.
  - Less groundwater and surface water reaching the river system is a steelhead recovery factor of unknown magnitude.
  - Today, steelhead access remaining spawning habitat up Matilija Creek (below the Matilija dam), North Fork Matilija Creek, and San Antonio Creek.
  - Considerable effort goes into monitoring and studying steelhead and its habitat each year.
Restoration & Protection

- Controlling Arundo donax (giant reed) is a priority for habitat restoration, as well as fire prevention, flood protection, and water supply enhancement.
  - There have been significant efforts to control Arundo donax. Public agencies, land conservancies, nonprofits, and private landowners have all taken a leadership role in this important restoration task.
  - The regulatory burden and cost involved in undertaking these projects is considered a significant obstacle. Grant funding and a cooperative management effort among stakeholders has helped with local program success.

- Removing Matilija Dam is a priority restoration project with widespread stakeholder support. A coalition of stakeholders has been working to remove Matilija Dam since 1999.
  - The dam blocks migration of endangered steelhead to prime historical spawning habitat.
  - The dam prevents sand originating upstream from entering the Ventura River and potentially becoming beach sand. Removing Matilija Dam will increase sediment delivery from the watershed by about 50%.
  - Altered sediment transport has increased channel erosion.
  - While a project scope has been approved by Congress, the US Army Corps of Engineers, and the Ventura County Watershed Protection District, and an EIR/EIS and Biological Opinion completed, work continues on refining elements of the dam removal project design.
  - The most challenging remaining dam removal issue is management of the seven million cubic yards of sediment behind the dam, including the potential for natural sediment transport.
  - Once a feasible approach to remove the dam and manage the sediment that meets with stakeholder acceptance is found, the challenge will be securing funding for the dam's removal and other project components.
  - In the meantime, bridge improvements and other downstream mitigation that will be required if the dam is removed are being proactively pursued.
- Local land conservancies have proven to be very effective at acquiring, protecting, and restoring strategic habitats for the benefit of the watershed.
  - Over 2,300 acres of land is being protected in perpetuity by local land conservancies and their supporters.
  - Much of the protected lands are in the floodplain of the Ventura River and therefore support natural floodplain functions.
  - Conservancies continue their efforts to acquire high-value habitat, watershed, and recreation lands.

- **Facilitating the recovery of the steelhead is important to many stakeholders.**
  - Regulators consider Ventura River watershed steelhead to be at the highest level of priority ("Core 1") for recovery actions.
  - Improving oversummering pool habitats and removing fish passage barriers and impediments are recovery priorities. Barriers can block adult access to spawning areas and the migration of young fish back to the ocean.
  - San Antonio Creek offers the most important spawning and rearing habitat in the watershed now accessible to steelhead. The creek generally flows for longer periods of time than other accessible streams, contains a significant amount of gravel needed for spawning, and steelhead are known to grow faster in the San Antonio Creek than elsewhere in the watershed.
  - Several impediments to steelhead migration have been removed in recent years.
  - The Robles Fish Passage Facility, which became operational in 2006, provides for the passage of steelhead up and down the Ventura River past the Robles Diversion.
  - The Matilija Dam and road crossings on the North Fork Matilija Creek and Bear Creek in the Wheeler Gorge campground are some of the priority barriers that need to be removed.

- **Lack of funding is preventing the US Forest Service from effectively addressing important management issues of concern, including fish passage barriers, illegal and destructive marijuana farms, and the spread of invasive species.**

- **A changing climate could modify the biological diversity and viability of the watershed's ecosystems.**
  - Longer extended droughts, more intense rainfall, higher temperatures, rising sea levels, and more severe wildfires are some of the threats facing local ecosystems from climate change.
2.1.2.5 Access to Nature

Goal

Ample and appropriate opportunities for the public to enjoy the watershed’s natural areas and open spaces associated with aquatic habitats, to provide educational opportunities, and to gain appreciation of the need to protect the watershed and its ecosystems.

Objectives

a. Increase the amount of permanently protected, accessible, high quality, safe, public, open, natural areas (particularly near the river, creeks, and wetlands) available for enjoyment by all community members.

b. Provide a multimodal trail network between and within open, natural areas that is connected to population centers, and that is proportional in size and scope to the open natural areas available while not harming sensitive habitat.

c. Increase the number of permanently protected, vehicle-accessible, natural or semi-natural parks and picnic areas for the enjoyment of all community members.

d. Provide interpretive opportunities, including signs, docent-led tours, visitor centers, and/or other educational opportunities, to enhance visitor understanding of the watershed and its resources.

e. Protect and maintain existing public access amenities, including trails, open space, parks, picnic areas, and interpretive features.
Findings

- Residents and visitors are more likely to gain appreciation of the need to protect the watershed when given the opportunity to visit and learn about the diverse ecosystem processes and services provided by its aquatic habitats. Access to nature is available, though educational opportunities could be substantially improved.
  - Over 100 miles of trails are accessible and maintained on tens of thousands of acres of protected natural habitats.
  - The variety of natural landscapes in the watershed offer a wide range of nature-based activities including walking, hiking, wildlife viewing, picnicking, camping, cycling, horseback riding, fishing, boating, canoeing, kayaking, swimming, and surfing.
  - In locations where the public has direct access to the aquatic habitats, there are too few interpretive signs.
  - The watershed has been thoroughly characterized, in non-technical language, as part of development of this management plan. Descriptions of its features—such as geology, hydrology, ecosystems, and water quality—illustrated with a comprehensive atlas of maps, are now available for use in interpretive materials (www.venturawatershed.org/map-atlas).

- The watershed is fortunate to have many organizations committed to providing the public with safe access to nature and nature-based recreation opportunities.
  - Land conservancies are actively acquiring land, providing interpretive signs and opportunities, and establishing new trails and access points.
  - Increased access to nature brings increased impacts and maintenance, which must be monitored for and mitigated.
  - Federal, state, and local agencies maintain and interpret for the public significant natural land resources.
  - In response to clean water regulations, local agencies have committed to keeping the lower Ventura River clean of trash and illegal camps, making this important aquatic habitat safer and more accessible.
- The availability and ease of public access to nature-based activities varies in different parts of the watershed and for different user types.
  - Abundant access opportunities are available in the northern half of the watershed in the Los Padres National Forest; in the Ojai Valley and the Ventura River corridor above Foster Park; around the Ventura River estuary and associated coastal habitats; and at the beach.
  - The river corridor below Foster Park offers fewer access opportunities. The Highway 33 freeway and the Ventura Levee block access to the river in an area of the watershed that has the highest population density and lowest median household income—the City of Ventura's Westside.
  - To better serve all sectors of the community, more opportunities to enjoy the watershed's natural aquatic habitats are needed to serve families and those traveling by bicycle or bus.
  - Information about the watershed's access opportunities needs to be better communicated to the public through a variety of different media in English and Spanish.

- The vision of a "Ventura River Parkway"—a network of trails, vista points, and natural areas along the river—is being actively pursued by a coalition of stakeholders.
  - The river parkway would create a continuous network of publicly accessible trails, vista points, and natural areas along the river, from the coast to Matilija Canyon. Existing trails form the beginnings of the parkway.
  - By working with willing landowners on a voluntary basis over time, supporters hope that a parkway will take shape that will yield the many health, quality of life, and economic benefits seen in other communities that have established river parkways.
2.1.2.6 Responsible Land and Resource Management

Goal

*Land and resources managed in a manner that supports social and economic goals and is compatible with healthy ecosystem goals.*

Objectives

a. Improve the economic strength, viability, and resiliency of the community through consistent integration of economic and social perspectives in watershed management discussions and decisions.

b. Support a viable agricultural industry that is compatible with watershed management goals.

c. Advance watershed management goals in local land use and resource management decisions through active engagement with policy makers and land managers.

d. Develop and distribute information on land use sustainability and resource stewardship to improve land and resource management practices.

e. Track the potential impacts of climate change on local land uses and resources so that adaptation strategies can be developed.
Findings

Land Use

- Developed land comprises only about 13% of the total land area in the watershed.
  - The northern half (48%) of the watershed lies within the Los Padres National Forest.
  - The Bureau of Reclamation owns 9,401 acres (6.5%) of the watershed surrounding Lake Casitas.
  - Another 3,655 acres (2.5%) is protected as natural habitat, open space, or parkland.
  - Cities comprise 3.17% of the watershed (1.24% City of Ventura; 1.93% City of Ojai). The City of Ojai lies entirely within the watershed and 13% of the City of Ventura lies within the watershed. The rest of the watershed is in unincorporated Ventura County.
  - Developed land uses comprise about 13% of the watershed. Of this 13%, agriculture (excluding grazing lands) makes up about 5%, residential land 4%, oil and mineral extraction 1.5%, and commercial, industrial, and miscellaneous land uses the remaining 2.5%.

- Local policies and physical constraints have effectively limited development on the watershed's privately owned land.
  - Steep terrain restricts widespread development. Only 35 out of the total 226 square miles in the watershed have a slope of 10% or less.
  - Ventura County land use policies—the Guidelines for Orderly Development (1969), Ojai Valley Area Plan (1979), large-lot zoning, and the more recent SOAR ordinances (Ventura County, 1998; City of Ventura 1995)—have served to ensure that the rate of growth is kept within resource constraints and that development preserves agriculture and the rural character of the area.
  - The City of Ojai's residential and commercial growth control policies (1979, 1991) have preserved the City's small town size and character.
  - The Ojai Valley Clean Air Ordinance, adopted in 1982 to limit emissions of pollutants by limiting the increase in the number of dwelling units, and the Ojai Valley Area Plan (an element of the Ventura County General Plan) have significantly restricted development.
- Casitas Municipal Water District’s Water Efficiency and Allocation Program has effectively kept water demand within the lake’s safe yield since its adoption in 1992.

- **Agriculture is the dominant land use and is a critical factor in the management and stewardship of the land and water.**
  - Including cattle grazing, 18.5% of the watershed’s land area is used for agriculture.
  - Water from the watershed irrigates over 6,000 acres of agricultural land, including some land outside and adjacent to the watershed (in the Rincon area).
  - Citrus and avocado are the primary crops grown; citrus comprises about 43% of the acreage, and avocados 25%.
  - Approximately 21,000 acres of land is used for cattle grazing. The majority of this land is privately held.

- **Agriculture plays a critical role in maintaining many services supportive of a healthy watershed.**
  - Open agricultural and grazing lands provide expanses of permeable land that infiltrates rainwater and slows flood flows; serve as wildlife corridors and habitat; and provide attractive views and local food.
  - The Ojai Valley is a growth-restricted area due to water limitations and land use policies. There are few economic options that would be as watershed-friendly as the agriculture now in place.

- **The viability of agriculture is seriously threatened by water supply issues, high land costs, continued threats from exotic pests, and the challenges of competing in the modern industrial-scale farming business.**
  - The Ojai Valley is remote from the centers of Ventura County’s agricultural infrastructure. Packing houses, agricultural supplies, and support services are miles away. Farm labor crews are also based closer to the center of agricultural production, which makes it more expensive to farm in the watershed.
  - The Asian citrus psyllid (ACP), an exotic insect that is a host to the Huanglongbing (HLB) bacteria, poses a very significant threat to agriculture. HLB is lethal to citrus and has decimated citrus production in areas where it has become established. There have been three ACP detections so far in the Ojai Valley.
  - The soil in the Ojai Valley’s East End, where the bulk of the farming occurs, is extremely rocky. Tilling the soil is not an option, which significantly limits the type of crops that can be grown in that area should current crops become untenable.
- Some growers have no backup water when their wells run dry, such as in the 2014 drought. To purchase a new water allocation is prohibitively expensive, and according to Casitas’s Water Efficiency and Allocation Program, less than 1 acre-foot of water remains available to allocate to the agricultural water user category.
- A great majority of the established wells and water distribution systems in place now are old, in some cases inefficient, and in need of costly upgrades.
- Agricultural operators face difficult and time-consuming processes required to secure multiple permits for many regular maintenance or improvement activities, such as clearing debris from channels. New water quality requirements and monitoring have added additional and considerable costs.
- A changing climate threatens to magnify the threats that agricultural operators face: longer droughts, increased pest threats, increased risk of fires, and weather anomalies that interfere with fruit setting and plant growth.

- **Residential land use makes up about 4% of the area of watershed, and much of this is rural and low density.**
  - The watershed’s most densely populated area is in the City of Ventura’s Westside. The next highest population density is in the City of Ojai and the unincorporated community of Meiners Oaks.

- **Oil extraction is a significant commercial land use, making up about 3.6% of the area of the watershed.**
  - The Transverse Ranges, of which the watershed is part, is one of the important oil-producing areas in the United States.
  - There are over 700 active oil wells in the watershed.
  - The major oil field is the Ventura Oil Field, an area that covers approximately 3,400 acres on both sides of Highway 33 in the lower watershed near the coast. The Ojai Oil Field comprises another 1,780 acres of active recovery.

- **Wildfires can threaten local water quality and supply. Moderate wildfires occur once every 10 years on average, and extreme wildfires once every 20 years.**
  - Fifty-four percent of the watershed burned in the 1985 Wheeler Fire.
  - Wildfires threaten water supplies largely by causing damaging sedimentation and siltation of reservoirs. Equipment damage, interrupted power supply, ash deposits, and use of water for fire suppression are other potential impacts.
Demographics

- The population of the watershed is relatively small and the rate of growth low.
  
  - As of the 2010 Census, the estimated population of the watershed was about 44,140, including 22,940 people residing in County of Ventura unincorporated areas, 13,740 people in the City of Ventura, and 7,461 in the City of Ojai.
  
  - Between 2000 and 2014, the population has decreased in the City of Ojai by 3.4%, increased in the City of Ventura by 8.0%, and increased in unincorporated Ventura County by 4.5%. (The last two figures do not necessarily reflect growth within the watershed however.)
  
  - Between 2003 and 2012, the number of new residential customers increased by 23 for Casitas, by 634 for the City of Ventura (citywide), and decreased by 1 for Golden State Water.
  
  - Between 2000 and 2012, total K-12 public school enrollment for schools within the watershed decreased by 1,149, or 28%. The decrease in the City of Ojai was 53.6% percent.
  
  - The population is 58% white, 37% Hispanic or Latino, 2% Asian, and 3% other races.

- Employment opportunities are diverse. Leisure and hospitality jobs, which rely on the natural beauty and recreational assets of the watershed to attract visitors, dominate the employment landscape.
  
  - There is a wide range of incomes, and several areas qualify as disadvantaged or severely disadvantaged communities.
  
  - The watershed supported an estimated 15,681 jobs in 2012.
  
  - The four largest job sectors according to SCAG are leisure and hospitality (art/entertainment) (3,860 jobs in 2012); education and health services (3,750 jobs in 2012); professional and business services jobs (1,493 jobs in 2012); and retail trade jobs (1,323 jobs in 2012). Note: the jobs provided by key watershed industries, such as agriculture and mining, are often provided by support services that come from outside the watershed or that fall into a different job category, so may not be reflected in these numbers.
2.1.2.7 **Coordinated Watershed Planning**

**Goal**

A Watershed Council that fairly represents stakeholders; collaborates on developing an integrated watershed management plan to guide watershed priorities; facilitates communication between public, private, and nonprofit stakeholders; educates and engages stakeholders; provides a forum for collecting, sharing, and analyzing information about, and creatively and proactively responding to, watershed issues; and maximizes grant funding opportunities.

**Objectives**

a. Maintain and administer open and transparent Watershed Council meetings as a forum for information sharing, collaborative planning, networking, and problem solving.

b. Develop and maintain working relationships with partners, stakeholders, and governments in order to improve the Watershed Council’s capacity for innovation, efficiency, and effectiveness.

c. Characterize the watershed and its issues, and prioritize collaborative watershed projects to address those issues, through development of a comprehensive watershed management plan.

d. Secure funding to support the Watershed Council's ongoing meetings, staff, and operations; the implementation of priority watershed management plan projects and programs; and the development, monitoring, and updating of the watershed management plan.
e. Facilitate implementation of collaborative multi-partner watershed projects and programs.

f. Facilitate public education about, engagement with, and stewardship of the watershed.

g. Maintain high standards of data quality and credibility; and improve and maintain the availability of up-to-date, user-friendly data and information about the watershed in a variety of formats, media, and venues, and targeting stakeholders of different ages and backgrounds.

h. Monitor the implementation of collaborative watershed projects and programs in order to track success and improve on strategies and tactics.

Findings

- Coordinated watershed planning offers a wide range of fiscal and management benefits.
  - Coordinated watershed planning and management acknowledges the complexity, interconnectedness, and cross-jurisdictional nature inherent in a water resource environment.
  - Regulators are increasingly using a watershed model, and grant funders are increasingly rewarding integrated watershed planning.
  - Consolidation and sharing of data and information enhances access and usability for watershed partners, and promotes the education of individuals, organizations, and agencies with the most current information.
  - Coordinated watershed planning provides a forum for evaluating and better understanding current and historical watershed conditions.
  - Watershed-level planning provides a way to address the scale and complexity of water issues with a larger group of community partners.
  - Cross-sector coordination and communication provides the opportunity to achieve shared watershed goals more efficiently and effectively, and to minimize disagreements.
  - The outreach component of coordinated watershed management offers opportunities for coordination between watershed groups and for garnering cost-effective support of local efforts. Getting effective information to homeowners, land managers, businesses, and agricultural operators about conservation practices, best management practices that reduce nutrient pollution, invasive species, and other issues is a critical need throughout the
watershed. Visitors to the watershed's natural habitats also need information on what they can do to protect the resources they have come to enjoy.

- Through the Watershed Council, and its partnership with the Watersheds Coalition of Ventura County, over $5,700,000 in grant funding has been brought into the watershed for a variety of projects.

- **Through their participation, Watershed Council members have demonstrated a commitment to the value of a collective approach.**
  - Participation on the Watershed Council has expanded since its start in 2006 and continues to grow in both numbers and diversity.
  - The Watershed Council benefits from a high level of relevant experience and expertise among its participants, as well as a generally high level of civic engagement among community members. For a variety of reasons, many residents in the watershed like it as a place to live and call home, and demonstrate a willingness to actively protect it in their own way.
  - Council participants attend Council meetings to learn and share knowledge, establish relationships, support one another's efforts, and present differing perspectives.
  - Grant funding, and matching support from local organizations, has supported a watershed coordinator staff position to build the Watershed Council's capacity and develop a watershed management plan. The plan tells the story of the watershed and its many interdependencies; identifies and prioritizes water-related concerns; and identifies projects and programs that could improve watershed conditions.

- **While participants clearly value the Watershed Council and understand the benefits of integrated watershed planning, process problems challenge the implementation of such planning.**
  - There are institutional barriers to integration. Without a watershed planning mandate, the separate mandates of the individual organizations involved take precedence.
  - Participants are not neutral: each has preferences and motives; each comes with a different level of authority, funding, and political position. Maintaining an environment of trust and cooperation requires that stakeholders invest significant time for planning and meeting.
2.2 Existing Projects, Programs, and Recent Accomplishments

Brian Stark, Ojai Valley Land Conservancy, Explains the Ojai Meadow Preserve's Flood Management Features
2.2 Existing Projects, Programs, and Recent Accomplishments

Watershed stakeholders are already making great advances individually and in some cases together. Table 2.2.1 summarizes existing projects and programs in the watershed and their accomplishments over a three-year period between 2011 and 2013. The list includes 111 different projects and programs that have either been accomplished or are underway. The length and breadth of the list clearly demonstrates that there is already a remarkable level of effort going towards improving water-related concerns in the watershed.

Accomplishments are listed by goal in this section; and many of these same accomplishments are further described and illustrated with photos in the context of the Council’s implementation campaigns in following section, “2.3 Campaigns.”

Table 2.2.1 List of Accomplishments, 2011 to 2013

<table>
<thead>
<tr>
<th>ID#</th>
<th>Years</th>
<th>Primary Lead (PL)</th>
<th>Other Leads (OL)^1</th>
<th>Project/Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2011–2012</td>
<td>Casitas</td>
<td></td>
<td><strong>Sufficient Local Water Supplies</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>Free Landscape and Indoor Water Use Surveys.</em> Conducted 147 free onsite water-use surveys (indoor and/or landscape) at residences and businesses. The indoor survey includes a test of showerhead and faucet flow rates, an estimate of toilet flush volumes, a review of all water-using appliances, and a test for leaks. The landscape survey includes a review of the irrigation system, irrigation design, and watering schedules. The survey also includes reading the meter to reveal possible system leaks in the customer’s system. Large landscapes were prioritized for outreach.</td>
</tr>
<tr>
<td>2</td>
<td>2011–2012</td>
<td>Casitas</td>
<td></td>
<td><strong>Free Leak Detection Surveys.</strong> Conducted 189 free leak detection surveys for direct customers.</td>
</tr>
<tr>
<td>3</td>
<td>2012–2013</td>
<td>Casitas</td>
<td></td>
<td><strong>Water Infrastructure Improvements – Casitas Municipal Water District.</strong> Made repairs and upgrades to pump electrical equipment to improve safety and operational efficiency. Made repairs and seismic improvements to Casitas’s only water tank in Upper Ojai.</td>
</tr>
<tr>
<td>4</td>
<td>2011</td>
<td>Casitas</td>
<td></td>
<td><strong>Demonstration Landscape.</strong> Installed a demonstration low-water-using landscape at Casitas Municipal Water District headquarters.</td>
</tr>
<tr>
<td>5</td>
<td>2011–2012</td>
<td>PL: Casitas</td>
<td>OL: VRWD, MOWD</td>
<td><strong>Water Efficient Equipment – Distributed for Free and Rebated.</strong> Promoted rebate programs for residential and commercial high-efficiency clothes washers and high-efficiency toilets; provided rebates on SMART irrigation controllers. Provided free equipment to direct and indirect customers, including 1,018 showerheads, 1,993 faucet aerators, 34 toilet flappers, and 14 leak detection kits. Provided rebates on equipment to direct and indirect customers, including rebates on 108 residential high-efficiency washing machines, 170 residential and commercial high-efficiency toilets, 97 residential and commercial weather-based irrigation controllers.</td>
</tr>
<tr>
<td>ID#</td>
<td>Years</td>
<td>Primary Lead (PL)</td>
<td>Other Leads (OL)</td>
<td>Project/Program</td>
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<tr>
<td>6</td>
<td>2011–2013</td>
<td>Casitas</td>
<td></td>
<td><strong>Water Conservation and Efficiency Workshops/Classes and Education.</strong> Hosted eight education workshops on various aspects of water use efficiency and conservation. Provided classroom and field trip water education presentations. Provided informational materials to customers through newsletters, website, and at local events. Continued to sponsor the “Water Wise Gardening in Ventura County” website.</td>
</tr>
<tr>
<td>7</td>
<td>2007–2014</td>
<td>PL: Casitas</td>
<td>OL: Senior Canyon MWC</td>
<td><strong>Water Infrastructure Improvements – Senior Canyon.</strong> Casitas facilitated the installation of new pipes and automation equipment at the Senior Canyon Mutual Water Company in order to “fine-tune” the use of groundwater vs. surface water and thereby increase overall water supply reliability.</td>
</tr>
<tr>
<td>8</td>
<td>2011–2014</td>
<td>MOWD</td>
<td></td>
<td><strong>Water Infrastructure Improvements – MOWD.</strong> Installed variable frequency drive electric motors and new motor controllers on pumps to reduce energy demand and associated costs. Began rehabilitation of an old well.</td>
</tr>
<tr>
<td>9</td>
<td>2012</td>
<td>MOWD</td>
<td></td>
<td><strong>Surface and Groundwater Interaction Preliminary Study, Ventura River Groundwater Basin.</strong> Commissioned a preliminary analysis of the interaction between groundwater pumping in the Ventura River Basin and surface flows in the Ventura River.</td>
</tr>
<tr>
<td>10</td>
<td>2011–2013</td>
<td>MOWD</td>
<td></td>
<td><strong>Water Conservation and Efficiency Education.</strong> Provided informational materials to customers through website and information on bills.</td>
</tr>
<tr>
<td>11</td>
<td>2011</td>
<td>Ojai Basin GMA</td>
<td></td>
<td><strong>Groundwater Model.</strong> Developed a groundwater model for the Ojai Basin to advance understanding of the basin for improved management. The model was developed using the MODFLOW-SURFACT computer code.</td>
</tr>
<tr>
<td>12</td>
<td>2013</td>
<td>OVG Coalition</td>
<td></td>
<td><strong>Water Awareness Month Exhibits.</strong> During Water Awareness Month, installed a greywater exhibit at Ojai City Hall and a water conservation exhibit at Ojai Library.</td>
</tr>
<tr>
<td>13</td>
<td>2013</td>
<td>OVG Coalition</td>
<td></td>
<td><strong>Educational Workshops.</strong> Provided two workshops (Greywater: Rehydration for a Thirsty Land) during Water Awareness Month. Also organized a Rainwater Harvesting presentation.</td>
</tr>
<tr>
<td>14</td>
<td>2007–2012</td>
<td>RCD</td>
<td></td>
<td><strong>Mobile Lab Irrigation Efficiency Evaluations.</strong> Conducted 19 agricultural irrigation evaluations in the watershed. This program assists growers by evaluating the efficiency of their irrigation systems and implementing Best Management Practices (BMP) to improve system efficiency. The burden of BMP expenses is reduced through use of various cost-sharing opportunities.</td>
</tr>
<tr>
<td>15</td>
<td>2013</td>
<td>PL: UCSB OL: Surfrider</td>
<td></td>
<td><strong>Bren School Study “Sustainable Water Use in the Ventura River Watershed.”</strong> This study sought to identify water management strategies that effectively reduce water demand and increase water supply. A water budget model of the watershed was created using the WEAP Model System. This model, combined with economic analysis, was used to assess the impact of water management strategies, land use change, and climate change on local water resources.</td>
</tr>
<tr>
<td>16</td>
<td>2011–2014</td>
<td>PL: VCWPD OL: Ojai Basin GMA</td>
<td></td>
<td><strong>San Antonio Creek Spreading Grounds Rehabilitation Preliminary Work.</strong> Installed a depth-discrete monitoring well; completed the CEQA document for the project; and secured required permits from Calif. Dept. of Fish and Wildlife, Los Angeles Regional Water Quality Control Board, U.S. Army Corps of Engineers, and the State Water Resources Control Board (Water Rights Division). Began construction of project facilities (access road, intake structure, 24-inch recharge pipeline, pond transfer channels, and 4 passive recharge wells) in September 2013. Project was completed in 2014. This project is intended to capture seasonal high-flows from San Antonio Creek to increase groundwater recharge in the Ojai Valley Groundwater Basin.</td>
</tr>
<tr>
<td>ID#</td>
<td>Years</td>
<td>Primary Lead (PL) Other Leads (OL)</td>
<td>Project/Program</td>
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<tr>
<td>17</td>
<td>2011–2013</td>
<td>VRWD</td>
<td><strong>Water Infrastructure Improvements – Ventura River CWD.</strong> Made repairs, improvements, and seismic retrofits to water tanks, valves, fire hydrants, and pumps. The installation of isolation valves helps limit the amount of water and property loss in the case of a mainline leak.</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>2012</td>
<td>PL: VRWD OL: OVG Coalition</td>
<td><strong>Demonstration Landscape.</strong> Installed a demonstration low-water-using and ocean-friendly landscape at Ventura River Water District headquarters.</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>2011–2013</td>
<td>VRWD</td>
<td><strong>Water Conservation and Efficiency Education.</strong> Provided informational materials to customers through newsletters and website.</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>2013</td>
<td>Ventura</td>
<td><strong>Report – “Comprehensive Water Resources.”</strong> This report provided the City Council with a comprehensive evaluation of current and projected water supply needs.</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>2011</td>
<td>Ventura</td>
<td><strong>Plan – Water Efficiency Plan.</strong> Plan developed to address the City’s increased water supply risks, including drought, potential environmental restrictions, groundwater quality concerns, and litigation actions. The plan provides a road map to buffer the City from these potential impacts and improve reduction targets.</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>2011–2013</td>
<td>Ventura</td>
<td><strong>Water Conservation and Efficiency Education.</strong> Provided a free Water Wise Gardening series of classes. Provided informational materials to customers through paid advertising, bill inserts, bills showing water usage in comparison to the previous year’s usage, media events, an active website, and media events. Provided water conservation programs to elementary school students and large group assemblies, field trips, and children’s water events. Continued to sponsor the “Water Wise Gardening in Ventura County” website.</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>2011–2013</td>
<td>VCWPD</td>
<td><strong>Groundwater Elevation Monitoring.</strong> Monitored water levels of all the groundwater basins in Ventura County.</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>2011–2013</td>
<td>Casitas, Ventura, Channelkeeper, OVSD, Farm Bureau, VCEHD, VCWPD, VCSQMP</td>
<td><strong>Clean Water</strong></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>2011–2013</td>
<td>Al Leydecker (biologist studying Ventura River water quality)</td>
<td><strong>Water Quality Monitoring.</strong> Thousands of water quality samples were collected throughout the watershed (some monthly, quarterly, annually, and biannually), analyzed and results provided to regulatory agencies. Includes both surface waters and groundwater.</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>2012</td>
<td>PL: Casitas OL: Watershed Council</td>
<td><strong>Water Quality Reports/Analysis.</strong> Produced over 10 analyses of different water quality constituents and associated patterns and relationships within the watershed.</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>2012</td>
<td>PL: Ojai OL: OVG Coalition</td>
<td><strong>Water Awareness Month Promotion.</strong> Coordinated watershed-wide promotion of various water-related educational activities, ongoing rebate programs, waste collection events, irrigation efficiency evaluations, and related programs during Water Awareness Month.</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>2011–2013</td>
<td>Farm Bureau</td>
<td><strong>Single-Use Bag Ban.</strong> Ojai City Council passed a single-use bag ban, with considerable advocacy and support by the Green Coalition.</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>2011–2013</td>
<td>Ventura</td>
<td><strong>Agricultural Water Quality Classes.</strong> Thirty water quality educational opportunities were offered to growers in Ventura County, amounting to 100 hours of education. Ventura County Agricultural Irrigation Lands Group (VCAILG) members completed 9,540 hours of water quality education.</td>
<td></td>
</tr>
<tr>
<td>ID#</td>
<td>Years</td>
<td>Primary Lead (PL)</td>
<td>Other Leads (OL)</td>
<td>Project/Program</td>
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<tr>
<td>30</td>
<td>2011</td>
<td>OVSD</td>
<td></td>
<td>Study — “(Corrected) Source Assessment Report: Nitrogen and Phosphorus in the Ventura River Watershed.” The purposes of this report were to provide a summary of the sources of nutrients in the Ventura River watershed; compile existing source data from local, regional, or relevant national sources; estimate loadings from the sources using gathered data; and prepare separate dry and wet weather loadings (if feasible) for the sources.</td>
</tr>
<tr>
<td>31</td>
<td>2011–2013</td>
<td>OVSD</td>
<td></td>
<td>Educational Tours. Provided 18 educational tours of the wastewater treatment plant to students from third grade to college level, as well as to Council members and other adults.</td>
</tr>
<tr>
<td>32</td>
<td>2012</td>
<td>OVSD</td>
<td></td>
<td>Water Infrastructure Improvements – Vulnerable Sewer Pipe. Replaced and relocated an 800-foot section of underground sewer pipe that ran along the edge of San Antonio Creek. This pipe was vulnerable to damage during floods, which could lead to sewage spills.</td>
</tr>
<tr>
<td>33</td>
<td>2012</td>
<td>OVSD</td>
<td></td>
<td>Plant of the Year Award. Won Small Plant of the Year award from the California Water Environment Association.</td>
</tr>
<tr>
<td>34</td>
<td>2012</td>
<td>OVSD</td>
<td></td>
<td>Water Infrastructure Improvements – Ventura Avenue Sewer. Completed $6.5 million Ventura Avenue Sewer Improvement Project to update aging infrastructure and reduce energy demand.</td>
</tr>
<tr>
<td>35</td>
<td>2013</td>
<td>PL: RCD</td>
<td>OL: VC CoLAB</td>
<td>Horse and Livestock Watershed Alliance Formed. Through the Stormwater Quality Best Management Program, provided staff support to launch and administer a new group representing horse and livestock owners in the watershed. The group is focused on horse and livestock property best management practice education, and working with regulators for effective compliance with water quality requirements. The group met on a regular basis and responded to the proposed TMDL regulations.</td>
</tr>
<tr>
<td>37</td>
<td>2011–2013</td>
<td>Channelkeeper</td>
<td></td>
<td>Engaged Volunteers in Water Quality Monitoring. Trained and engaged 101 distinct volunteers in the Ventura River watershed. These volunteers contributed over 1,200 hours to monitoring the Ventura River Watershed.</td>
</tr>
<tr>
<td>38</td>
<td>2013</td>
<td>Channelkeeper</td>
<td></td>
<td>Began Water Quality Monitoring in Ventura Estuary. Added the estuary to the list of water quality sampling locations in the watershed. This filled an important data gap, as no other entity regularly monitors the water quality of the estuary.</td>
</tr>
<tr>
<td>39</td>
<td>2011</td>
<td>Channelkeeper</td>
<td></td>
<td>Report – “Ventura River Stream Team Trash Surveys.” This document uses maps and photographs to summarize trash conditions observed during a survey conducted by Stream Team volunteers in March 2011. The survey area was from the Highway 101 bridge to the ocean.</td>
</tr>
<tr>
<td>40</td>
<td>2013</td>
<td>Channelkeeper</td>
<td></td>
<td>Continuous Data Loggers. Upgraded the quality of water quality monitoring data through the deployment of an array of sensors and continuous data loggers.</td>
</tr>
<tr>
<td>41</td>
<td>2012–2013</td>
<td>PL: Surfrider OL: Ventura, OVG Coalition</td>
<td></td>
<td>Ocean Friendly Gardens Program. Ocean Friendly Gardens (OFG) is a national Surfrider program for transforming landscapes and hardscapes to prevent water pollution. This is done through education, hands-on training events, and policy work. The Ventura County Surfrider chapter, the City of Ventura, the Ojai Valley Green Coalition, and others partnered to advance OFG in the watershed. Over 300 people were trained in OFG practices, with two training events for professionals; three private and two public landscapes were retrofitted; and a demonstration parkway curb cut/bioswale was installed. Trainings and retrofits received media attention. OFG garden signs were also installed to help promote OFGs.</td>
</tr>
<tr>
<td>ID#</td>
<td>Years</td>
<td>Primary Lead (PL) Other Leads (OL)</td>
<td>Project/Program</td>
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<tr>
<td>42</td>
<td>2011–2013</td>
<td>Taylor Ranch (farm along lower Ventura River)</td>
<td>Illegal Encampment Removal/Ongoing Enforcement – Taylor Ranch. On 56 acres of property in the lower Ventura River, removed trash and numerous illegal encampments. 58 tons of trash removed since 2008. Regularly patrolled the property to ensure that camps were not rebuilt.</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>2012</td>
<td>VC Public Works</td>
<td>Trash Reduction – Increased Fines for Littering. Amended Ventura Co. Stormwater Quality Management Ordinance (Ord. No. 4450) to prohibit litter and trash discharge or deposition that may enter the county’s storm drain system or receiving waters. The revision increased civil penalties for violations and provisions for issuing administrative fines, recovery of costs and misdemeanor violations.</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>2011–2013</td>
<td>VC Public Works, Ventura, Ojai</td>
<td>Trash Reduction – Stormwater Pollution Prevention Site Inspections. Conducted commercial, industrial, and construction facility site inspections to ensure that proper pollutant prevention BMPs are applied and conduct educational outreach and employee trainings to educate on pollution prevention.</td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>2011–2013</td>
<td>PL: VCVWPD OL: VC Behavioral Health</td>
<td>Trash Reduction – Illegal Encampment Removal. Implemented two Anumdo / homeless encampment / trash removal projects on Watershed Protection District-owned properties. 300 tons of trash was collected in 2012 and over two tons in 2013. County of Ventura Behavioral Health Dept. used $100,000 for a pilot program to provide motel vouchers for homeless individuals living in the Ventura River estuary bottom.</td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>2011–2012</td>
<td>PL: VCSQMP OL: VC Public Works, Ventura, Ojai</td>
<td>Trash Reduction – Single-Use Bag Ban EIR. Endorsed a pro-rata share of funding for a regional Environmental Impact Report (EIR), which is required under the California Environmental Quality Act before a model single-use bag ban can be adopted. With the EIR, other cities and the county can move forward with consideration of adoption of a single-use plastic bag ban.</td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>2011</td>
<td>Ojai</td>
<td>Drains to Ocean Signs. Erected 10 “Do Not Dump, Drains to Ocean” signs near drainages within the city.</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>2013</td>
<td>PL: VCVWPD OL: Waste 2 Energy collaborative</td>
<td>Biodigester Feasibility Study. Produced a feasibility study on the use of a biodigester to convert organic wastes generated in the Ventura River watershed to energy and other useful byproducts. This was pursued in part as a manure management strategy to address nitrogen and algae water quality problem.</td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>2011–2012</td>
<td>Ventura County Fairgrounds</td>
<td>Trash Reduction – New Trash Cans Along Beach. Instituted daily trash pickup for six new trash cans placed along the bike path and installed several recycling bins targeting beverage containers in the same area.</td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>2011–2013</td>
<td>PL: VCSQMP OL: VC Public Works, Ventura, Ojai</td>
<td>Trash Reduction – General Public Education. Provided bilingual outreach and education programs advocating proper trash disposal. This program made over 5,980,000 countywide media impressions (TV, radio, internet, transit shelters) in 2012.</td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>2011–2013</td>
<td>PL: VCSQMP OL: VC Public Works, Ventura, Ojai</td>
<td>Trash Reduction – Cleanups. Sponsored two cleanup events: Earth Day Beach Cleanup and Coastal Cleanup Day; and conducted two cleanup events in the lower Ventura River (under Main Street bridge and near Front Street storm drain).</td>
<td></td>
</tr>
</tbody>
</table>
Table 2.2.1 List of Accomplishments, 2011 to 2013 (continued)

<table>
<thead>
<tr>
<th>ID#</th>
<th>Years</th>
<th>Primary Lead (PL)</th>
<th>Other Leads (OL)</th>
<th>Project/Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>54</td>
<td>2011–2012</td>
<td>Ventura</td>
<td></td>
<td>Trash Reduction – Enforcement of No Camping/Trespassing in River Bottom. Ventura City Council established a plan to eliminate encampments in the Ventura River and to implement an ongoing enforcement program by March 2013. Includes organizing stakeholder partners, conducting civic engagement, developing an action plan and follow-up steps, posting camps, conducting camp removal, and launching post-camp-removal strategies. The project was initiated in Sept. 2012. Since then, over 45 camps and 100 individuals have been relocated and over 250 tons of trash and <em>Arundo</em> have been removed from the river bottom.</td>
</tr>
<tr>
<td>55</td>
<td>2011–2012</td>
<td>Ventura</td>
<td></td>
<td>Trash Reduction – Trash Excluders. Installed 103 full-capture trash devices (excluders) in the watershed. Installed full-capture devices at 100% of city-owned or city-managed conveyances discharging into the estuary.</td>
</tr>
<tr>
<td>57</td>
<td>2011–2013</td>
<td>VC Public Works, Ventura, Ojai</td>
<td></td>
<td>Stormwater Retention and Treatment Requirements for Development Projects. As required by the Municipal Stormwater Permit, new development and redevelopment projects were required to integrate stormwater retention and treatment requirements.</td>
</tr>
<tr>
<td>58</td>
<td>2011–2013</td>
<td>VC Public Works, Ventura, Ojai</td>
<td></td>
<td>Stormwater Construction Best Management Practices (BMPs) and Inspection Program. As required by the Municipal Stormwater Permit, public and private construction, demolition, and other projects causing soil disturbance were required to implement erosion and sediment control BMPs.</td>
</tr>
<tr>
<td>60</td>
<td>2011–2013</td>
<td>VC Public Works, Ventura, Ojai</td>
<td></td>
<td>Storm Drain, Flood Channel and Catch Basin Cleaning. Municipal storm drains, flood control channels, and catch basins were inspected and cleaned (annually, more often in some cases).</td>
</tr>
<tr>
<td>62</td>
<td>2013</td>
<td>Ojai</td>
<td></td>
<td>Pressure Washer Water Pickup Equipment. A boom and vacuum system to collect runoff from pressure washing of sidewalks, trash cans, etc., was purchased and use of equipment initiated.</td>
</tr>
<tr>
<td>63</td>
<td>2013</td>
<td>Ojai</td>
<td></td>
<td>Fulton Street Parkways and Bioswales. As part of new street construction, parkway bioswales using native grasses were installed. Native grass should reduce watering and mowing needs and the bioswales will retain and infiltrate water.</td>
</tr>
</tbody>
</table>

**Integrated Flood Management**

**Watershed Hydrology Model.** Developed a “continuous” simulation (HSPF) model that provides the ability to: 1) Produce real-time estimates of flow during storms and thus identify locations at risk of flooding; 2) Evaluate the effects of development or changes in land use practices on water supply or runoff volumes; and 3) Evaluate the effects of changes in land use or management practices on surface water quality. Made various refinements to the model based on updated information for specific areas/drainages, such as Ojai’s East End and Canadita de San Joaquin.
<table>
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<tr>
<th>ID#</th>
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<th>Primary Lead (PL) Other Leads (OL)³</th>
<th>Project/Program</th>
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<tbody>
<tr>
<td>65</td>
<td>2013</td>
<td>VC Public Works, VCWPD</td>
<td>FEMA Flood Maps for Ojai’s East End Preliminarily Updated. Based on a study by the Ventura County Watershed Protection District, the Federal Emergency Management Agency released updated preliminary maps of Ojai’s East End that would remove 133 properties from the 100-year (1% annual exceedance probability) flood zone. Being in the flood zone makes property owners with federally backed mortgages subject to flood insurance requirements.</td>
</tr>
<tr>
<td>66</td>
<td>2011–2013</td>
<td>VCWPD</td>
<td>Levee Improvements. Began levee evaluation, design engineering, California Environmental Quality Act compliance, and improvements required to certify the existing levees in the watershed.</td>
</tr>
<tr>
<td>67</td>
<td>2011–2012</td>
<td>PL: VC Public Works OL: VCWPD</td>
<td>Implemented Various Projects to Reduce Flood Risk in Unincorporated Areas to Reduce Insurance Policy Premiums. Implemented 32 flood protection and community flood risk awareness projects throughout unincorporated Ventura County as part of the National Flood Insurance Program’s Community Rating System program; as a result floodplain property owners in unincorporated Ventura County receive a reduction (up to 20%) in their annual flood insurance premiums.</td>
</tr>
<tr>
<td>68</td>
<td>2013</td>
<td>VCWPD</td>
<td>Fresno Canyon/ Casitas Springs Flood Mitigation Project Launched. Initiated planning for a new bypass storm drain facility to transport floodwaters, sediment, and debris from Fresno Canyon to Ventura River in order to reduce the risk of flooding in Casitas Springs. Preparation of an Environmental Impact Report is underway.</td>
</tr>
</tbody>
</table>

**Healthy Ecosystems**

<table>
<thead>
<tr>
<th>ID#</th>
<th>Years</th>
<th>Primary Lead (PL) Other Leads (OL)³</th>
<th>Project/Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>2011</td>
<td>California Coastal Conservancy</td>
<td>Report – “Historical Ecology of the lower Santa Clara River, Ventura River, and Oxnard Plain: an analysis of terrestrial, riverine, and coastal habitats.” This study used history—namely, the interpretation and integration of historical documents with environmental sciences—to provide a new perspective on how the Ventura County landscape has changed since the early 19th century. Synthesizing over two centuries of local documents, the report and accompanying maps help to improve understanding of the natural forces that have shaped the local landscape.</td>
</tr>
<tr>
<td>71</td>
<td>2011–2012</td>
<td>PL: VC Parks OL: VCWPD, California Coastal Conservancy</td>
<td>Fish Passage Barrier Removed at San Antonio Creek Confluence. Built a 500-foot bridge over San Antonio Creek near the Ventura River confluence, replacing a 1980s concrete, culvert/dry-weather crossing that lay in the bed of the creek. The bridge provides an all-weather crossing for people using the Ojai Valley Trail, and greatly improves passage for migrating steelhead. As part of the project, planted one acre with native hydrosed mix, 0.38 acres with willow stakes and .05 acres of cottonwood and sycamore seedlings. Restoration included removing 0.5 acre of Arundo.</td>
</tr>
<tr>
<td>72</td>
<td>2011–2012</td>
<td>VC Parks</td>
<td>Riparian Restoration at County Parks. Installed 102 native trees along the Thacher Creek riparian corridor that runs through Soule Park golf course and day use park. Installed 72 native trees in the riparian corridor of Foster Park and 44 in Camp Comfort.</td>
</tr>
<tr>
<td>73</td>
<td>2009–2013</td>
<td>PL: OVG Coalition OL: CREW</td>
<td>Ojai Creek Riparian Habitat Restoration. Restored 1.4 acres of Ojai Creek behind Libbey Park in Ojai. Many volunteers were involved in this project, which removed thick brambles of invasive plants and replanted the riparian corridor with natives.</td>
</tr>
<tr>
<td>ID#</td>
<td>Years</td>
<td>Primary Lead (PL)</td>
<td>Other Leads (OL)</td>
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<tr>
<td>74</td>
<td>2011</td>
<td>OVLC</td>
<td></td>
</tr>
<tr>
<td>75</td>
<td>2013</td>
<td>PL: OVLC OL: CCC, CREW</td>
<td>Fox Canyon Barranca and Stewart Canyon Creek Restoration. Removed over 200 Mexican fan palms from the Fox Canyon Barranca and Stewart Canyon Creek. This project continues the work begun on Ojai Creek in Libbey Park.</td>
</tr>
<tr>
<td>76</td>
<td>2012–13</td>
<td>OVLC</td>
<td>Ecosystem Restoration – Ventura River Preserve. Initiated a riparian habitat restoration project to relocate Rice Creek back to its historical channel, which traversed Ventura River's upper floodplain before gradually meeting the channel of the Ventura River. Orchard trees were removed, thousands of native plants were planted, and earthmoving equipment resculpted the former channel.</td>
</tr>
<tr>
<td>77</td>
<td>2011</td>
<td>PL: Surfrider OL: CDFW</td>
<td>Report – “Steelhead Population Assessment in the Ventura River/Matilija Creek Basin – 2011 Data Summary.” Field sampling was conducted to assess the distribution and abundance of steelhead in the Ventura/Matilija Basin. The primary objectives were to reassess the distribution and abundance of steelhead throughout the Ventura River basin, and compare 2011 results from similar surveys conducted in 2006–2010.</td>
</tr>
<tr>
<td>78</td>
<td>2011–2013</td>
<td>Taylor Ranch</td>
<td>Arundo Removed – Taylor Ranch. Removed <em>Arundo</em>, largely in monoculture stands, on 13.5 acres. Those acres, plus 32 acres where <em>Arundo</em> was previously removed (in 2008), were monitored and re-treated as needed.</td>
</tr>
<tr>
<td>79</td>
<td>2011</td>
<td>VC Public Works</td>
<td>Fish Passage Barrier Removed on Old Creek Road/San Antonio Creek. Built a 210-foot bridge over San Antonio Creek, stretching from Highway 33 to Old Creek Road near Casitas Springs. The bridge replaced a concrete dry-weather crossing that lay in the bed of the creek and became impassable for cars during heavy storms. The bridge also removes a passage barrier for migrating steelhead.</td>
</tr>
<tr>
<td>80</td>
<td>2011–2013</td>
<td>PL: VCWPDO OL: USACE, California Coastal Conservancy</td>
<td>Matilija Dam Removal Project – Pre-Construction Project Elements. Completed pre-construction elements of the project to remove Matilija Dam and restore the ecosystem, including work to prepare detailed design reports for several project elements; work on design of Santa Ana Boulevard and Camino Cielo Bridges; sediment studies; and purchase of Matilija Hot Springs.</td>
</tr>
<tr>
<td>81</td>
<td>2013</td>
<td>VHC</td>
<td>Acquired Willoughby Preserve. Acquired an eight-acre property on the lower Ventura River and created the Willoughby Preserve.</td>
</tr>
<tr>
<td>83</td>
<td>2011–2013</td>
<td>VCWPDO</td>
<td>Arundo Removal and Re-treatment. Removed (in 2009–2011) approximately six acres of <em>Arundo</em> (within a 212-acre area) from upper San Antonio Creek and its tributaries; re-treated some of these areas. Also re-treated parts of the 1,200-acre area on Matilija Creek and the upper Ventura River where approximately 200 acres of <em>Arundo</em> were previously removed.</td>
</tr>
</tbody>
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### Access to Nature

<table>
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<tr>
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<tbody>
<tr>
<td>84</td>
<td>2013</td>
<td>Friends</td>
<td></td>
<td>Ventura River Parkway Trail Guide. Produced and distributed a printed guide and map of the trails and recreational opportunities along the Ventura River corridor from the river mouth to Matilija Dam.</td>
</tr>
</tbody>
</table>
Table 2.2.1 List of Accomplishments, 2011 to 2013 (continued)

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<tr>
<th>ID#</th>
<th>Years</th>
<th>Primary Lead (PL) Other Leads (OL)*</th>
<th>Project/Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>85</td>
<td>2011</td>
<td>PL: Friends OL: Surfrider, VHC</td>
<td>Ventura River Parkway Community Picnic. The Ventura River Parkway concept was launched publicly with a community picnic at the river, which included tours of the river, educational exhibits, children’s education, and hands-on activities. The “Picnic at the River” became an annual event.</td>
</tr>
<tr>
<td>86</td>
<td>2013</td>
<td>OVLC</td>
<td>Acquired Valley View Preserve. Acquired a 195-acre property within the City of Ojai and created the Valley View Preserve. Reclaimed two historic trails on the property that connect with existing trails, expanding the trail network and creating shorter loop options. The new trails are accessible from the City of Ojai.</td>
</tr>
<tr>
<td>87</td>
<td>2011</td>
<td>PL: OVLC OL: California Coastal Conservancy</td>
<td>Acquired Steelhead Preserve. Acquired a 65-acre property (Hollingsworth Ranch) located along one mile of the Ventura River, and created the Steelhead Preserve — so named because it includes some of the best steelhead habitat on the river. This preserve will become open to the public after site improvements have been made.</td>
</tr>
<tr>
<td>88</td>
<td>2011–2013</td>
<td>PL: OVLC OL: Once Upon a Watershed</td>
<td>Organized Hikes and Hosted Field Trips. Led or organized dozens of hikes and topical walks (i.e., birds, wildflowers, herbs), and hosted many school field trips on the OVLC’s various preserves.</td>
</tr>
<tr>
<td>89</td>
<td>2012</td>
<td>PL: OVLC OL: Ojai Valley Lions Club</td>
<td>New Bridge/Accessible Interpretive Loop. Built a wheelchair-accessible bridge on the Ojai Meadows Preserve, allowing people of all mobility levels to complete an interpretive loop.</td>
</tr>
<tr>
<td>90</td>
<td>2011</td>
<td>PL: VCWPD OL: OVLC</td>
<td>New Trailhead/Trails – Old Baldwin Road. Installed a new trailhead at Old Baldwin Road, including horse trailer accessibility, a 1,500-foot-long wheelchair-accessible trail, 2.5 miles of new trails, and an interpretive kiosk.</td>
</tr>
<tr>
<td>91</td>
<td>2013</td>
<td>PL: VHC OL: Friends, CCC, Surfrider</td>
<td>Trash Reduction – Willoughby Preserve Cleanup. Removed the trash, illegal encampments, and much of the Arundo from the newly acquired Willoughby Preserve in order to make the preserve safe for public access, and to restore habitat. Arundo re-treatments ongoing.</td>
</tr>
</tbody>
</table>

**Responsible Land and Resource Management**

- **92 2013 VCEHD** Advanced the Petrochem Site Cleanup. Requested USEPA oversight of some of the cleanup operations at the Petrochem abandoned refinery along the lower Ventura River. Preliminary investigation and cleanup has occurred.

- **93 2011 VC Planning** Ventura County Initial Study Assessment Guidelines (ISAG) for Biological Resources Updated. The County of Ventura’s ISAGs provide “thresholds of significance” for use in assessment of potential environmental impacts from new developments, per the California Environmental Quality Act (CEQA). The biological resources ISAGs specifically address impacts to wetlands and sensitive species. The update helped to standardize and clarify methodologies followed in making CEQA potential impact determinations; to make the ISAG consistent with CEQA and other state, federal, and local regulations. Clear and consistent procedures help to effectively and fairly implement the County’s General Plan policies that call for strong protection of wetlands and other significant biological resources.

- **94 2011 Friends** Watershed Document Online Library. Compiled a watershed document library on the Friends’ website, which contains a historical record of information related to the Ventura River watershed, including newspaper articles, policy statements, minutes, and other data. The library is searchable by keyword or topic. Many historic documents were scanned for inclusion in the library.
<table>
<thead>
<tr>
<th>ID#</th>
<th>Years</th>
<th>Primary Lead (PL)</th>
<th>Other Leads (OL)</th>
<th>Project/Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>95</td>
<td>2012</td>
<td>PL: Friends of VR</td>
<td>OL: California Coastal Conservancy, Surfrider, VHC</td>
<td>Ventura River Parkway Concept Approved by Board of Supervisors, Calif. Coastal Conservancy, Trust for Public Land, Friends of the Ventura River, Surfrider Foundation, and VHC worked with Supervisor Steve Bennett to gain conceptual support from the Ventura County Board of Supervisors for a Ventura River Parkway. The idea of a parkway is to provide more public access, trails, and recreational opportunities along the river to make the river a more visible and valued community asset.</td>
</tr>
<tr>
<td>96</td>
<td>2013</td>
<td>OVG Coalition</td>
<td></td>
<td>Green Resources Lending Library. Opened a Resource Lending Library that makes books and DVDs on sustainability and other environmental issues available for browsing or borrowing.</td>
</tr>
<tr>
<td>97</td>
<td>2011–2013</td>
<td>OVLC</td>
<td></td>
<td>Provided Educational Workshops. Provided 15 educational workshops for the public through the “Wild About Ojai” educational series, many on natural history and watershed-related topics.</td>
</tr>
<tr>
<td>98</td>
<td>2011–2013</td>
<td>Once Upon a</td>
<td></td>
<td>Student Education. Taught over 3,600 4th-, 5th-, and 6th-grade students from public and private schools in the Ventura River watershed to awaken wonder, discovery, and connection with the natural world. Using preserves in the watershed and the estuary, students investigated their environment using watershed curriculum linked to the California Science Standards and participated in hands-on conservation projects.</td>
</tr>
<tr>
<td>99</td>
<td>2011–2013</td>
<td>PL: Channelkeeper</td>
<td>OL: VHC, Ventura, Ventura College</td>
<td>Student Education. Educated over 1,500 students about the Ventura River watershed, often through partnerships with the VHC, City of Ventura, Ventura College, and local Brownie troops.</td>
</tr>
<tr>
<td>100</td>
<td>2012–2013</td>
<td>VC CoLAB</td>
<td></td>
<td>Engaged Businesses in Watershed Issues and Planning. Expanded channels of communication between local businesses and those working on watershed-related planning efforts. Facilitated a proactive response to water quality regulations, specifically the Algae TMDL, by local horse and livestock owners.</td>
</tr>
<tr>
<td>101</td>
<td>2012</td>
<td>VHC</td>
<td></td>
<td>Watershed Mural. Beautified the Ventura River Trail with a watershed mural designed by local students and painted by local artist. The mural says, “The Health of our Watershed is in our Hands.”</td>
</tr>
<tr>
<td>102</td>
<td>2011–2013</td>
<td>PL: Ventura</td>
<td>OL: Surfrider, California Coastal Conservancy</td>
<td>Surfers’ Point Managed Retreat. Implemented a multi-part, ecosystem-based project designed to manage erosion at Surfers’ Point and restore the beach profile to natural conditions, as an alternative to building a seawall. The project included beach/dune restoration, beach widening, a new multi-use bike path, and new stormwater filtration system and bioswale. Maintenance of the native plants on the dunes is ongoing.</td>
</tr>
</tbody>
</table>

**Coordinated Watershed Planning**

<table>
<thead>
<tr>
<th>ID#</th>
<th>Years</th>
<th>Organization</th>
<th>Project/Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>105</td>
<td>2013</td>
<td>Watershed Council</td>
<td>Watershed Atlas and Maps. Created an interactive map viewer and 32 maps of the watershed, which are available to the public on the website. The maps include information on physical features, water features, water supply and demand, water quality, ecosystems, and people in the watershed.</td>
</tr>
</tbody>
</table>
Table 2.2.1 List of Accomplishments, 2011 to 2013 (continued)

<table>
<thead>
<tr>
<th>ID#</th>
<th>Years</th>
<th>Primary Lead (PL) Other Leads (OL)</th>
<th>Project/Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>106</td>
<td>2011</td>
<td>Watershed Council</td>
<td>Watershed Coordinator Hired. The new watershed coordinator position is funded by a three-year grant, with additional support provided by several Watershed Council partners. The Ojai Valley Land Conservancy generously hosts the staff position.</td>
</tr>
<tr>
<td>108</td>
<td>2012</td>
<td>Watershed Council</td>
<td>Evening Watershed Council Meetings Launched. The first evening meeting of the Watershed Council was held to accommodate the schedules of those who cannot attend daytime meetings. Evening meetings are held twice a year, in April and October.</td>
</tr>
<tr>
<td>109</td>
<td>2012</td>
<td>Watershed Council</td>
<td>Watershed Council Governance Charter Adopted. A basic governance charter was adopted, which outlines the organization's purpose, objectives, membership, and decision-making structure. The charter makes explicit the stakeholders' commitment to the work of the Watershed Council and helps give credibility to the Council's work.</td>
</tr>
<tr>
<td>110</td>
<td>2012–2013</td>
<td>Watershed Council</td>
<td>Watershed Document Inventory. Compiled a comprehensive inventory of watershed-related documents, reports, presentations, plans and policies; and developed a master list of project and program ideas. The indexed inventory spreadsheet can be filtered by subject, and is posted on the Council's website. Over 300 documents are in the inventory, which continues to grow.</td>
</tr>
<tr>
<td>111</td>
<td>2012</td>
<td>Watershed Council</td>
<td>Watershed Management Plan Goals and Objectives. Approved a set of seven goals and corresponding objectives to serve as the framework for the watershed management plan.</td>
</tr>
</tbody>
</table>

1. The organization listed is the Primary Lead (PL) unless otherwise indicated.

Acronyms and Abbreviations:

CCC—California Conservation Corps  
Casitas—Casitas Municipal Water District  
CDFW—California Department of Fish and Wildlife  
Channelkeeper—Santa Barbara Channelkeeper  
Farm Bureau—Farm Bureau of Ventura County  
NOWD—Meiners Oaks Water District  
Ojai—City of Ojai  
Ojai Basin GMA—Ojai Basin Groundwater Management Agency  
OVA Coalition—Ojai Valley Green Coalition  
OMC—Ojai Valley Land Conservancy  
OVS—Ojai Valley Sanitary District  
RCD—Resource Conservation District, Ventura County  
Senior Canyon MWC—Senior Canyon Mutual Water Company  
Surfrider—Surfrider Foundation  
UCSB—University of California Santa Barbara  
USACE—United States Army Corps of Engineers  
VCWQMP—Ventura Countywide Stormwater Quality Management Program  
VC Behavioral Health—Ventura County Behavioral Health Department  
VC CoLAB—Ventura County Coalition of Labor, Agriculture and Business  
VCEHD—Ventura County Environmental Health Division  
VC Parks—Ventura County Parks Department  
VC Planning—Ventura County Planning Division  
VC Public Works—Ventura County Public Works Department  
VCWPD—Ventura County Watershed Protection District  
Ventura—City of Ventura  
VRWD—Ventura River Water District
2.3 Campaigns

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2.3.4 Extreme Efficiency Campaign ......................................... 130
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2.3.6 Arundo-Free Watershed Campaign .................................... 145
2.3.7 Healthy San Antonio Creek Campaign .............................. 154

Ventura Hillsides Conservancy
Volunteers Removing Arundo by the Main Street Bridge
Photo courtesy of Ventura Hillsides Conservancy
2.3 Campaigns

2.3.1 The Campaign Approach

This section presents the Watershed Council's proposed projects and programs organized into six focused "campaigns." The campaign structure allows the Council to present desired new projects and programs framed in the context of the considerable watershed management work already underway. Council members have been actively pursuing their work for decades and are determined to continue that work.

Each campaign proposal is structured to:

- State the campaign's intent.
- Describe the conditions—the threat, opportunity, or necessity of continued management.
- Identify the campaign's specific targets.
- Highlight some of the projects, programs, and practices underway in this campaign area, including ways in which stakeholders are already working together and complementing one another's work.
- Present the Council's proposed projects and programs that undertake to achieve that campaign's intent.

Watershed management tasks and projects are cyclical by nature: infrastructure must be constantly monitored, repaired and replaced. Stream habitats must be continually protected from trash, pollutants, and invasive plants. Every year, another group of kids take their first trip down to the creek. The campaigns described here acknowledge the ongoing, cyclic work of watershed management.
Finally, the campaign approach was deemed to be the best way to meet the purpose of the watershed management plan. The purpose of the plan, as adopted by the Watershed Council, is to:

- **To tell the story of the watershed and its many interdependencies.** Each campaign tells a story. It puts the projects and programs that can advance integrated watershed management into a context that stakeholders, and policy makers, and grantors can understand and appreciate. These stories amplify the interconnected and interdependent nature of watersheds. What happens upstream affects conditions downstream.

- **To identify and prioritize water-related concerns in the watershed.** The campaigns focus attention in six targeted areas. These areas are not, by any means, the only areas where important work is happening, but these are priority areas that Council members are prepared to take action on.

- **To outline a strategy to collectively solve our shared problems and collectively manage our shared resources.** The campaigns each include a list of proposed projects and programs, many of which require coordinated action.

- **To better position ourselves for funding; some grant programs give preference to projects identified in regional plans.** By demonstrating our existing collaboration and accomplishments, and the desire to build upon those assets, the campaigns convey strength and competency—qualities that instill confidence in funders.
The River Connections Campaign seeks to increase understanding, appreciation, and stewardship of the Ventura River and its watershed by connecting people with the river, with information about its history and issues, and with the community working to keep it vital.

2.3.2 River Connections Campaign

2.3.2.1 The Issue

Getting your feet wet is one of the best ways to get to know the Ventura River, but public access to the river as a source of recreation and learning is limited. This is especially true downstream of Foster Park in the river’s lower section, an area of high population density, low household income, and limited recreational opportunities. A freeway, a levee, and private property have largely cut off access to the river in this area.

More opportunities to visit and learn about the watershed’s natural aquatic habitats are necessary to better serve all sectors of the
community. The needs of families and visitors traveling by bicycle or bus should also be planned for.

The Ventura River watershed is a remarkable place for so many reasons—water self-reliance, biodiversity, geology, watershed protections in place, the number of organizations working to care for it—but information about this watershed and its remarkable attributes is underdeveloped and under-distributed.

In locations where the public has direct access to the river and other aquatic habitats, there are too few interpretive signs that offer the general public an opportunity to learn about the watershed, its hydrology, and the diverse ecosystem processes and services provided by its natural habitats. Web-based information is often not easy to find or too technical for the general public. Significant educational opportunities remain untapped.

2.3.1.2 Targets

More people knowledgeable about and engaged with the river and watershed

People in the community who know about the watershed—how it works, how it is managed, its strengths and challenges—are more likely to see themselves as stewards of this watershed. Residents, business operators, resource managers, policy makers, students, and tourists can all take positive actions in support of a healthy watershed. Readily accessible information makes this more likely.

More well-used trails and river access points, especially in underserved areas

Residents and visitors are more likely to gain appreciation of the need to protect the watershed and its ecosystems when given the opportunity to visit and learn about its natural aquatic habitats. Opportunities to enjoy natural habitats also contribute to health and well-being and quality of life, as well as property values.
Considerable habitat is already protected and waiting to be interpreted. With 57% of the watershed in protected status, and much of that in a natural state, there are many opportunities to tell the watershed’s story on new and enhanced signs and kiosks.
Land conservancies are actively acquiring land and establishing new access opportunities.

Over 2,300 acres of land is now protected in perpetuity by two local land conservancies, the Ojai Valley Land Conservancy and the Ventura Hillsides Conservancy, and the acreage of land protected by conservancies continues to grow.

The California Coastal Conservancy has been a strong supporter of land acquisition and public access projects in the watershed.

Both Ojai Valley Land Conservancy and Ventura Hillsides Conservancy place high importance on educating community members about their protected lands and the values they offer.
Land conservancy held properties support over 25 miles of trails.

The conservancies provide ongoing support to protect and maintain these lands and trails. These photos are from the Ventura River Preserve.
The Ventura River Preserve (above photos) includes 2.6 miles and 655 acres of the upper Ventura River floodplain.
The Ojai Valley Land Conservancy recently built a wheelchair-accessible bridge on their Ojai Meadows Preserve, allowing people of all mobility levels to complete an interpretive loop.

With help from the Ventura County Watershed Protection District and the California Coastal Conservancy, Ojai Valley Land Conservancy installed a new trailhead on the Ventura River Preserve at Old Baldwin Road, including horse trailer accessibility, a 1,500-foot-long wheelchair-accessible trail, 2.5 miles of new trails, and an interpretive kiosk.
California State Parks, Ventura County Parks, City of Ventura Parks, Lake Casitas Municipal Water District, and the US Forest Service protect and maintain almost 80,000 acres of open space and natural habitat. These lands support an additional 80 miles of trails (photos above and on previous page).
A plan for the Ventura River Parkway, led by Friends of the Ventura River, continues to take shape. A visioning document, developed by college students, helped generate ideas about the potential for a parkway along the river. A coalition of local groups and individual has produced a "Ventura River Parkway Map" (detail left) a beautiful guide to the parkway's existing trails and recreation amenities.

The parkway coalition organizes an annual "Picnic on the River" (photo above) to bring attention to the parkway vision and existing access and stewardship opportunities.

In 2012, the Ventura County Board of Supervisors approved the parkway concept, and in 2014 the parkway was awarded National Recreation Trail (NRT) status. State Senator Hannah Beth Jackson recognized the organizations, Friends of the Ventura River and Ventura Hillsides Conservancy, for their role in getting the NRT status.
The Ventura County chapter of the Surfrider Foundation has a long tradition of engaging the community in watershed issues. They played a key role in the implementation of the Surfers' Point Managed Shoreline Retreat Project, and involved many volunteers in the dune restoration (photo above) and other aspects of that project. Photo courtesy of Paul Jenkin.

Santa Barbara Channelkeeper’s Ventura River Stream Team has been getting people’s feet wet in the Ventura River and its tributaries for over a decade. Volunteers participate in Channelkeeper’s monthly water quality monitoring events at sampling locations throughout the watershed. Participants get an intimate introduction to the river system, its hydrology, and water quality concerns. Channelkeeper also provides education on the Ventura River watershed to students, often in partnership with other local organizations.

Photo courtesy of Santa Barbara Channelkeeper.
Established in 1974, the Friends of Ventura River has a long history of citizen advocacy on behalf of the Ventura River. Since its inception the Friends have actively participated in planning and regulatory projects at the local, state, regional, and federal levels and produced important studies of the estuary and the steelhead habitats of the Ventura River watershed. These reports have stimulated further scientific investigations, which have contributed to the management of the river’s biological resources.

The Friends contributed to the establishment of the Ventura River Preserve and Confluence Preserve, which are now owned and managed by the Ojai Valley Land Conservancy. In 1999, with support from Patagonia and the Environmental Defense Center, the Friends organized the first multi-agency symposium to consider the removal of Matilija Dam. Recent work includes advocating for a Ventura River Parkway to advance protection and public enjoyment of the Ventura River, developing a watershed resources document library, and ongoing advocacy and education about the river and its watershed.

Photo courtesy of Mark Capelli.
The watershed has been thoroughly characterized, in non-technical language, as part of development of this management plan. Descriptions of it features—such as geology, hydrology, ecosystems, and water quality—illustrated with a comprehensive atlas of maps, are now available for use in interpretive and other educational materials. The Watershed Council's website (above) makes maps, videos, data, and information available, including a comprehensive inventory of watershed-related documents, reports, plans, and policies.
The Ventura Hillside Conservancy’s Willoughby Preserve includes 8 acres of the lower Ventura River floodplain.

In response to clean water regulations, local agencies have committed to keeping the lower Ventura River clean of trash and illegal camps. This photo (above) shows the Ventura County Watershed Protection District participating in a major, multi-partner coalition cleanup effort. The presence of river bottom encampments has discouraged public use of the lower river for many decades. Tons of trash has been removed in recent years and the area is now regularly patrolled.

Photo courtesy of Ventura County Watershed Protection District.
Once Upon a Watershed, in partnership with local land conservancies, provides hands-on watershed education, restoration, and stewardship experience to 4th, 5th and 6th grade students in the Ventura River Watershed. This includes students in the Ojai (upper watershed) and Ventura (lower watershed) communities. Using preserves in the watershed and the estuary, students investigated their environment using watershed curriculum linked to the California Science Standards and participated in hands-on conservation projects.

Photo courtesy of Once Upon a Watershed.
Signs and murals encourage stewardship. The Ventura County Watershed Protection District erected six "Ventura River Watershed – Keep it Clean" signs near drainages in the watershed. The City of Ojai erected 10 "Do Not Dump, Drains to Ocean" signs near drainages within the City. The Ventura Hillsides Conservancy facilitated the installation of a beautiful mural along the bike path—a reminder that the health of the watershed is in our hands.
2.3.2.3 Highlights from Existing Projects, Programs, and Practices

Here are a few selected highlights from the watershed's ongoing projects, programs, and practices connecting the community with the Ventura River—and with each other.

2.3.2.4 Proposed Projects and Programs

The types of projects and programs below would advance the intent of the River Connections Campaign. Some of these projects are planned and some are already being implemented to some degree. These projects and programs can also be found summarized in table format in "2.4.2 Priority Projects and Programs."

Establish New/Upgrade Existing River Access Opportunities

- **Ventura River Parkway.** The vision of a “Ventura River Parkway” is being pursued by a number of stakeholders. The Parkway would create a continuous network of publicly accessible trails, vista points, and natural areas along the river, from the coast to Matilija Canyon. Much of the land that would be involved is in private ownership. Parkway supporters hope that by working with willing landowners on a voluntary basis over time a parkway will take shape that will yield the many health, quality of life, and economic benefits seen in other communities that have a river parkway.

- **Prevent Illegal River Bottom Camps.** Continue the effort to ensure that river bottom camps in the lower river are not established. Collaborators include the City of Ventura’s Community Development Dept., Public Works Dept., Fire Dept., & Police Dept.; Ventura County Sheriff; Ventura County Watershed Protection District, Taylor Ranch, State Parks, and Ventura Hillsides Conservancy.

- **Cleanup Petrochem.** The blighted and abandoned oil refinery has marred the view and threatened the water quality of the lower Ventura River for decades. Work to have the facility removed and cleaned up by the responsible parties.

- **Land Protection & Public Access.** Acquire land or conservation easements from willing landowners that can provide public access to the river’s habitats. As part of this effort, work with the Ventura County Planning Division to help make the conservation subdivision process as efficient and inexpensive as possible.

- **New Trails.** Install sustainably designed new trails and look for appropriate opportunities to serve different types of trail users (walkers, hikers, ADA, bicycle, equestrian).
- **New Family Picnic Areas.** Look for opportunities to install vehicle-accessible parks and picnic areas that offer family access to aquatic habitats.

- **Maintain and Improve Existing Trails and Access Locations.**
  Make improvements to existing trails and access locations, such as by expanding access by different types of trail users (walkers, hikers, ADA, bicycle, equestrian). Continue to keep trails accessible and safe, and increase efforts to reduce erosion and related sediment inputs into waterways.

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**Engage the Community and Encourage Stewardship**

- **Interpretive Signs.** Install and maintain watershed interpretive signs at special/high profile watershed locations and easily accessible river viewpoints.

- **Trail Guides.** Create and distribute trail guides that describe not only the trails and access points, but also the watershed’s ecosystems and the important services and values they provide.

- **Ventura River Stream Team Citizen Monitoring Program.** Continue this citizen water quality monitoring program that provides important long-term water quality data throughout the watershed, while empowering, educating and engaging residents.

- **Steelhead Preserve Education and Conservation Center.** Develop a comprehensive watershed education center at the 70-acre historic Hollingsworth Ranch along the Ventura River between Ventura and Ojai. At the Center, displays and demonstrations will interpret and animate the natural and cultural history of the watershed, and community and educational events will be hosted. The center will also be a place for students, groups, researchers and agencies to collaborate on and conduct scientific studies.

- **Watershed Literacy.** Continue and expand education programs that improve understanding of watershed issues (e.g., hydrology, source water, regulations, functions and value of healthy ecosystems, value of agriculture).

- **Youth Education.** Continue to engage youth in the watershed, such as the “Once Upon a Watershed” education program and youth camps that take youth out to nature.

- **Watershed Curriculum.** Develop a Ventura River watershed curriculum using the maps and information developed for the watershed management plan. Distribute to local public and private schools.

- **Watershed Stewardship Opportunities.** Continue and expand opportunities for citizens to learn about good stewardship and participate directly in stewardship projects.
Work Together

Facilitate communication and collaboration among those already working on efforts to engage the community with the river and its issues, and to provide more direct experiences with the river. Look for opportunities to support one another's work, learn from each other, leverage resources and craft a smarter, more integrated approach to the task.

2.3.2.5 Organizations

The following organizations and entities are actively supportive of the intent of the River Connections Campaign.

- California Coastal Conservancy
- California State Parks
- Casitas Municipal Water District
- City of Ventura/Ventura Water
- County of Ventura
- Friends of the Ventura River
- Ojai Valley Green Coalition
- Ojai Valley Land Conservancy
- Santa Barbara Channelkeeper
- Surfrider Foundation
- Resource Conservation District
- United States Forest Service
- Ventura County Watershed Protection District
- Ventura Hillsides Conservancy
2.3.3 Resiliency through Infrastructure and Policy Campaign

2.3.3.1 The Issue

Old Infrastructure

Aging infrastructure—water and sewer pipes, water storage tanks, water wells, flood control channels and levees, debris basins, water treatment systems—is a critical problem challenging water, wastewater, and
flood control managers across the state. Old system equipment, often installed 50 to 100 years ago, is reaching the end of its useful life, and managers are encountering new complicating factors surrounding equipment replacement that did not exist when the infrastructure was initially installed.

In the Ventura River watershed for example, a number of key sewer pipelines were originally sited beneath San Antonio Creek when they were installed in the early 1960s. Floods have exposed and damaged these pipelines, but to relocate the pipes today would involve right-of-way issues, changes to slope and associated pumping requirements, and enormous costs related to environmental review, permitting, and mitigation. Some key pipelines remain exposed to flood risk today.

**The Resiliency through Infrastructure and Policy Campaign seeks to strengthen both infrastructure and local policy in order to reduce the vulnerability of the watershed and its residents to extended droughts, major floods, seismic hazards, and water supply contamination.**

The issue of infrastructure repair and upgrading costs is being actively discussed and debated in California, with the realization that the rate schemes put in place long ago did not adequately account for the cost of infrastructure replacement in today’s complicated regulatory environment. This is a major issue. Water, wastewater, and flood control agencies are facing enormous repair and retrofit bills.

New infrastructure also means new approaches, and today there is greater understanding of the value of managing water on small-scales as well as large-scales, and making better use of free “ecosystem services.” That can mean onsite rainwater harvesting or stormwater treatment, or the use of natural or engineered “green” infrastructure—from bioswales to natural floodplains.

Approaches to water management might also need updating. The need to understand exactly how surface water and groundwater interact has grown as water managers are now tasked with considering the needs of fish and aquatic habitats as well as water customers. More information and better analyses are needed to know more precisely what the needs are of the aquatic habitats, and how and where water management adjustments might be beneficial.
Old Policies

As pipes get outdated, sometimes policies do too. There are opportunities to use local policies to more effectively realize the goals and objectives of the watershed management plan. For example, the ban against single-use plastic bags passed by the City of Ojai in 2012 (and being considered by other local jurisdictions), is helping to reduce trash pollution in local waterways. Similarly, the state of California’s easing of regulations regarding “laundry to landscape” graywater systems has made this important water reuse option more available to many residents.

Watershed stakeholders have identified the potential for policies to better address floodplain management, stormwater management, manure management, and other watershed concerns. Besides the need for adopting new or updated policies, significant gains could be realized by streamlining existing regulatory procedures and requirements and, in some cases, by improving the enforcement of existing regulations.

A Vulnerable Watershed

In the Ventura River watershed, dependable infrastructure is especially critical. The watershed is characterized by great variability: cycles of drought and flood are the norm. Infrastructure takes a beating in the major and moderate floods that occur about every 5 years, and cyclic droughts challenge water supply managers to build resiliency and

Golden State Water Company’s water main burst under the Ojai Playhouse theater in downtown Ojai in 2014. The flooded theater had to be evacuated. “The cause of the water main break is unknown, other than the age of the pipe,” stated a press release from Golden State.
Water supply wells for the City of Ventura, located in the river bottom in the Foster Park area, have seen repeated flood-related damage.

redundancy into their systems. With the water supply 100% local, this prudence is all the more important. The location of the watershed in the Transverse Ranges, one of the most folded, faulted, and rapidly rising regions on Earth, presents earthquake and land movement hazards that must be planned for and considered in emergency response planning.

**New Threats from Climate Change**

Weather extremes have always been a part of this watershed, and our systems have been designed to anticipate drought, flood, and fire. Even so, current systems may not withstand the extreme events the watershed may face due to climate change: longer extended droughts, megafloods, massive wildland fires, and sea level rise. New system design needs state-of-the-art thinking on survivability to contend with uncertain future conditions.

### 2.3.3.2 Targets

**Durable, reliable, and efficient water supply system**

Water supply equipment and facilities that are up-to-date, strategically located, built for seismic safety, and adaptable to changing hydrologic conditions will increase the safety of the watershed’s water supply systems. Complementing centralized infrastructure with smaller-scale, decentralized systems—such as for rainwater harvesting or groundwater recharge—will build important resiliency into the water supply system.
More water in storage
System improvements that reduce leaks and inefficiencies, and increase water capture, storage or reuse will improve water supply resiliency, whether the water is captured in Lake Casitas, groundwater basins, new storage tanks or in rain barrels. Improvements may be physical, such as more efficient wells or distribution systems—or technology-driven, i.e., sophisticated water metering and electronic sensing and control systems. Improvements may also be achieved through skilled use of management schemes, such as conjunctive water use or conservation pricing.

Improved safety of people and property from flooding
Reduce flood damage, risk, and vulnerability by improvements to existing flood control channels, levees and other infrastructure, and by restoring floodplains and other lands integral to flood management.

Reliably clean water
Protect water quality by investing in more sophisticated surface water and wastewater treatment equipment. Pursue improvements that capture and treat more urban stormwater runoff before it reaches river/streams; and better protect sewer system mainlines from damaging flood flows.

Reduced beach erosion
The restoration of a more natural sediment transport regime, primarily by removing Matilija Dam, could reduce beach erosion and associated management costs.

Effective, efficient, enforced local policies and regulations
The goals and objectives of the watershed management plan could be productively supported through current policies that reflect current information and challenges, streamlined permitting processes that encourage rather than discourage beneficial actions (such as removing *Arundo*), and enforcement of existing regulations protective of watershed health.

2.3.3.3 Highlights from Existing Projects, Programs, and Practices
Here are a few selected highlights from the watershed's complex and varied infrastructure: from mountain headwaters to dune restoration on Ventura's beaches—a portfolio of reservoirs, levees and habitats, all of which require active management.
Water Supply

Lake Casitas is a remarkable asset. The reservoir was designed to maintain supplies during a repeat of the 21-year dry period from 1945 to 1965 (the longest drought on record at the time of design), and the lake's managers have established careful policy controls to keep water demand within the 21-year safe yield. In multi-year dry periods, Lake Casitas' reserves are typically more robust than local supply reservoirs found in neighboring watersheds.

Photos courtesy of Casitas Municipal Water District.

The watershed benefits from having established water supply backup systems in place. Most users of groundwater are also connected to Casitas, either for regular or emergency backup. In extended dry periods, the majority of these backup connections are activated, replacing groundwater supplies.

Groundwater basins in the watershed recharge quickly. With basins that are alluvial and largely unconfined, and with plenty of open, unpaved landscapes and drainage channels, recharge of the watershed's groundwater supplies occurs relatively quickly in years of high rainfall.

Photo courtesy of Ventura County Watershed Protection District.

Casitas Municipal Water District secured grant funding on behalf of Senior Canyon Mutual Water Company to upgrade old leaking pipes and replace inefficient manually controlled pumping equipment with an efficient automated system. By making better use of local supplies, these improvements reduced the water company's dependence on Lake Casitas.
Clean Water

Ojai Valley Sanitary District replaced and relocated an 800-foot section of underground sewer pipe that ran along the edge of San Antonio Creek. This pipe was vulnerable to damage during floods, which could lead to sewage spills. The district also completed a $6.5 million Ventura Avenue Sewer Improvement Project (photo above) to update aging infrastructure and reduce energy demand.

Photo courtesy of Ojai Valley Sanitary District.

The City and County of Ventura have installed "full capture" trash excluders on storm drains throughout the watershed. The devices prevent trash from entering the storm drain system and are helping to reduce the amount of trash that reaches the estuary and other parts of the river.

Photo courtesy of Ventura County Watershed Protection District.
Flood

The Ventura County Watershed Protection District developed a watershed hydrology model to better identify locations at risk of flooding and understand how development or other changes in land use could affect water supply or runoff volumes.

The Ventura County Watershed Protection District is pursuing improvements to the watershed’s three levees that are required to fully meet current FEMA standards. The district is conducting levee evaluations, design engineering, and CEQA compliance, as well as exploring options for funding the upgrades. Pictured below is the Ventura River Levee, which protects the City of Ventura and lower Highway 33.

Photo courtesy of Rick Wilborn.
Pre-construction elements of the project to remove Matilija Dam and restore the ecosystem are underway, including redesign of Santa Ana Boulevard Bridge (photo above) and Camino Cielo Bridge, sediment studies, and purchase of Matilija Hot Springs.

The City of Ventura, Surfrider Foundation, and California Coastal Conservancy implemented the innovative Surfers’ Point Managed Shoreline Retreat Project as an ecosystem-based approach to coastal erosion. The multi-part project was designed to restore the beach profile to natural conditions as an alternative to building a seawall. It included beach/dune restoration, beach widening, a new multi-use bike path, and new stormwater filtration system and bioswale. The photos above show the area before (2008) and after (2013) the project.

The plan at right shows the parking areas removed in order to allow for the "retreat"
Surfers' Point Managed Shoreline Retreat Project
A combination of county and city land use policies (the Guidelines for Orderly Development, Ojai Valley Area Plan, large-lot zoning, growth control policies, SOAR [Save Open space and Agricultural Resources] ordinances), air quality policies (Ojai Valley Clean Air Ordinance), water management policies (Casitas Municipal Water District’s Water Efficiency and Allocation Program), and citizen activism have served to keep development within the resource constraints of the watershed.

All local jurisdictions in Ventura County now require new development and redevelopment projects to integrate stormwater retention and treatment into their project design. Bioswales help to capture stormwater and filter pollutants. This bioswale is in the parking lot at Oak Street and Santa Clara Avenue in the City of Ventura. (Oak Street marks the boundary of the Ventura River watershed.)
The Casitas Municipal Water District Board of Directors has established and implements various policies, such as their Water Efficiency and Allocation Program, to help ensure that water supplies are safe and available during extended dry periods.

Lake Casitas is one of the relatively few water supply facilities in California that are operated on a "safe yield" basis. Safe yield is the rate at which the water supply can be "safely" depleted. The designers of the lake determined that "safe" in this case meant that the water in the lake should be managed to last during another 21-year dry period, such as occurred from 1945 to 1965, which was the longest drought on record at the time of the reservoir's design. As long as annual demand on Lake Casitas is less than its 21,630 acre-feet per year safe yield, it should not go dry during a repeat of the 21-year dry period.

In contrast, most water supply facilities in California are operated on an "as available" basis. During wet years, a greater amount of water is delivered to customers than would be allowed under a safe-yield scenario. However, during dry spells, deliveries to customers are reduced, and they must seek other supplies. Delivering water on an "as available" basis allows greater deliveries on the average, but reduces reliability during droughts.
2.3.3.4 Proposed Projects and Programs

The types of projects and programs below could advance the intent of the Resiliency Through Infrastructure Campaign. Some of these projects are planned and some are already being implemented to some degree. These projects and programs can also be found summarized in table format in “2.4.2 Priority Projects and Programs.”

Establish new/upgrade existing facilities/functions (conventional and natural)

Water Supply

- **Existing Water Supply Infrastructure Reliability Improvements.** Replace or retrofit aging or threatened water supply tanks, wells, pipes, and other conveyance and storage equipment to reduce water losses, ensure supply reliability, and bring up to earthquake standards.

- **Contingency Water Storage.** Install decentralized contingency water storage.

- **Ventura Water - Casitas Conduit Intertie.** Install a new 5.5 mile pipeline from Lake Casitas to the City of Ventura, and a pump station, to provide Casitas with a backup for potential water service delivery interruption to the Rincon area and to improve the City of Ventura’s water supply reliability and system operational abilities.

- **Ventura Water Foster Park Wellfield Restoration.** Install additional wells in the Foster Park area to allow the City of Ventura to produce more water from the river when flows are high.

- **Ventura Water North-Side Satellite Wastewater Treatment Plant.** Install a small (2 million gallons per day) tertiary wastewater treatment plant near the Fairgrounds to treat wastewater from the Westside of Ventura for agricultural and urban reuse.

- **Reclaimed Water Analysis.** Investigate the opportunities for and feasibility of using reclaimed water from the Ojai Valley Sanitary District, such as during winter flows when the water is not so critical in the river.

- **Surface Water-Groundwater Interaction Analysis.** Increase understanding about the interaction between groundwater extractions and surface flows. Install surface flow monitors at key locations, such as along San Antonio Creek at the Ventura River Basin-Ojai Basin boundary, and within the Ojai Basin. Look for correlations between pumping extractions and changes in surface flow.

- **Continuous Groundwater Level and Quality Monitoring Equipment.** Install in wells in the watershed’s basins instruments that
allow for continuous monitoring of water level and/or water quality parameters.

**Water Quality**

- **Sewer Trunk Relocation.** Relocate a sewer line in the Ventura River threatened by river flow. A sewer line break here would affect water companies, instream uses, and ocean water quality.

- **Septic System TMDL Special Study.** Conduct a study to identify those septic systems, either individually or by geographic area, that are contributing to the impairment of surface waters in the watershed. This will facilitate a focused application of available resources to reduce or eliminate the contribution of these systems to water quality impairments.

- **Stormwater Retrofit Plan (LID and Green Streets).** Develop a plan that inventories, assesses, and prioritizes opportunities to retrofit impervious surfaces with alternative approaches (e.g., low impact development [LID] and green streets) that capture, treat, and infiltrate urban stormwater runoff. (Green streets integrate landscapes or other facilities designed to capture, clean, and store stormwater.)

- **Stormwater Retrofit Demonstrations (LID and Green Streets).** Retrofit impervious surfaces with alternatives (e.g., low impact development and green streets) that capture, treat, and infiltrate urban stormwater runoff in order to demonstrate the use of bio-retention systems, permeable surfaces, and runoff treatment and infiltration in urban areas. Prominent public locations will be prioritized when feasible.

- **Dry Weather and/or First Flush Diversions.** Install devices to capture dry weather and/or first flush contaminated stormwater and send directly to the wastewater treatment plant.

- **Stormwater Parking Lot Retrofits.** Retrofit parking lots to improve stormwater capture and infiltration, where feasible, as they come up for rehabilitation.

- **Trash Excluders.** Retrofit catch basins with trash excluders to filter trash from storm flows.

**Matilija Dam**

- **Matilija Dam Removal – Studies and Mitigation.** Studies will take another look at dam removal and sediment transport options. Various improvements are required to mitigate for the dam’s removal.

- **Matilija Dam Removal.** Remove dam to restore sediment transport and access for migrating steelhead, and eliminate the dam failure hazard.
Flooding
- **Bring Levees up to FEMA Standards.** Complete levee improvements required to meet FEMA certification requirements.
- **Channel, Stormdrain, and Culvert Improvements.** Make various improvements to address channel erosion and flooding problems.
- **Debris Basin Installation/Maintenance - Fresno Canyon Flood Mitigation.** Construct a reinforced concrete pipe diversion from upstream of Highway 33 to Ventura River. The purpose of this project is to protect the community of Casitas Springs from a 100-year (or 1% annual exceedance probability) flood in Fresno Canyon.
- **Flood Modeling - Thacher Creek Flood Mitigation.** Use modeling to plan improvements to Thacher Creek, which is undersized and carries a heavy sediment load.

Natural/Other
- **Riparian Habitat and Wetland Restoration.** Restore riparian habitats and wetlands to promote attenuation of flood flows, capture of sediments, treatment of runoff, infiltration and to deter algae growth.
- **Increase the emergency preparedness of service providers.**
- **Extended Drought/Climate Change Preparation.** Facilitate ambitious, coordinated planning, preparedness, and response for extended droughts.
- **Megastorm (ARkStorm) Scenario Drill.** Develop response plans for a megastorm hitting the watershed and test the plans with a full-scale real-time exercise. Work with emergency services, water and sanitary districts, the media, and local and state government.

Monitor policy changes and implementation, and promote policy updates that advance the watershed's resiliency
- **Single-Use Bag Ban.** Promote adoption of a single-use bag ban by the County of Ventura and City of Ventura (already adopted by City of Ojai).
- **Efficient Conservation Subdivision Permit Process.** Work with the Ventura County Planning Division to help make the conservation subdivision process as efficient and inexpensive as possible. A conservation subdivisions is a special exemption from Ventura County zoning and subdivision regulations for the purposes of donating or selling land to a conservation organization.
- **Mixed Use Zoning.** Amend Ventura County's and the City of Ojai's zoning ordinances to allow appropriate mixed use zoning in urban
communities in order to advance our watershed goals, such as minimizing impervious cover and open space loss.

- **North Ventura Avenue Area Plan.** Update Ventura County's North Ventura Avenue Area Plan (integrate appropriate mixed use, LID, Parkway access, mobility, etc.).

### Work Together

- **Coordinated Water Quality Monitoring.** Investigate opportunities to coordinate the various water quality monitoring programs to reduce redundancy, and improve the cost-effectiveness and utility of the data, such as by sharing monitoring locations, standardizing protocols and formats, and sharing data.

- **Integrated and Accessible Water Quality Monitoring Data.** Maximize the usefulness of the water quality monitoring data collected by different organizations by compiling and interpreting the data, and offering user-friendly access to it.

- **Flood Control Project Design.** Participate in the Watershed Protection District's pre-design stakeholder process for flood control projects.

### 2.3.3.5 Organizations

The following organizations and entities are actively supportive of the intent of the Resiliency Through Infrastructure and Policy Campaign.

- California Coastal Conservancy
- Casitas Municipal Water District
- City of Ojai
- City of Ventura/Ventura Water
- Meiners Oaks Water District
- Ojai Basin Groundwater Management Agency
- Ojai Valley Green Coalition
- Ojai Valley Land Conservancy
- Ojai Valley Sanitary District
- Resource Conservation District
- Surfrider Foundation
- Ventura County Environmental Health Division
- Ventura County Planning Division
- Ventura County Public Works Department
- Ventura County Watershed Protection District
- Ventura Hillside Conservancy
- Ventura River Water District
The Extreme Efficiency Campaign seeks to maximize the conservation of water by all water users by continually realizing greater water use efficiency from equipment, technology, and people; pursuing more opportunities to reuse water; and rewarding conservation.

2.3.4 Extreme Efficiency Campaign

2.3.4.1 The Issue

Cyclical dry periods are a permanent part of the landscape here, so water users in the Ventura River watershed have pursued water conservation and use efficiency for decades. New technologies do appear, however, and existing systems age out and require replacement, so the potential for greater conservation and efficiency remains significant. Water users can do more to conserve, and water suppliers can help them. Some efficiency improvements employ new high efficiency technology that can offer easy water savings. Other changes may take a bit more effort, such as changing landscapes or behavior.

Water users continue to pursue water use efficiency because the benefits of conservation are real and immediate: Reduced demand can help keep water bills low and conserves groundwater supplies. Higher groundwater levels could supply more water to local streams, supporting healthy
aquatic habitats and swimming holes. In multi-year dry periods, conserved water helps extend precious lake supplies.

2.3.4.2 Targets

State-of-the-art water use efficiency by all sectors, indoors and outdoors

Make our water using fixtures, equipment, and practices more efficient with more advanced systems together with better education and incentives that effectively change behavior.

Increased water reuse

Expand and encourage large-scale and small-scale water reuse. Reused water reduces not only water demand but also energy demand. Every gallon of water that doesn't need to be further treated or pumped saves energy.

2.3.4.3 Highlights from Existing Projects, Programs, and Practices

Here are a few selected highlights from the watershed’s ongoing commercial and residential water use efficiency projects, programs, and practices.

The Casitas Municipal Water District offers a variety of water conservation and water use efficiency programs, which are available to all water uses within Casitas's wholesale service area (whether a customer of Casitas's or not). Their programs include free water saving showerheads, toilet flappers, and faucet aerators; residential and commercial water use surveys and leak detection; hobby farm irrigation evaluations (and equipment rebates); and rebates on residential and commercial high-efficiency toilets, washing machines, and weather-based irrigation controllers. Casitas hosts free educational classes on various ways to save water, such as landscaping with natives or installing a graywater system. Classroom and field trip water education is also provided.

Photo courtesy of Casitas Municipal Water District.
Ventura Water (City of Ventura) offers their customers rebates on rain barrels, promotes Ocean-Friendly Gardens, provides school water education, and hosts classes and events.

The City of Ventura produces educational videos on a variety of water saving topics (above), such as how to use rain barrels or how to check your water meter for leaks. They make active use of their website and social media (right) for outreach and education.
The Ojai Valley Green Coalition (OVGC) is an important voice for water conservation in the watershed. OVGC seeks out many opportunities to educate the public, including classes and member meetings, an annual Green Living Home Tour, displays at public venues, newsletter promotions, and distribution of free water saving equipment on behalf of Casitas Municipal Water District. The OVGC has an extensive lending library with books, videos, and literature at its downtown Resource Center. The group is active in advancing policies to protect local resources.

The Ventura River Watershed Council’s SAVE MORE WATER website, hosted on the main Watershed Council site, serves as a clearinghouse of information on saving water throughout the watershed. The site features many videos, lists of upcoming classes and events, and links to water saving resources provided by local water suppliers and organizations—free equipment, rebates, free on-site irrigation surveys, and more. SAVE MORE WATER is aimed at motivating and informing residential, commercial, and agricultural water users to conserve.

The Ventura County Building and Safety Division has been actively promoting graywater systems since the state of California’s easing of regulations regarding “laundry to landscape” graywater systems has made this important water reuse option more available to many residents.
2.3.4.4 Planned Projects and Programs

The Extreme Efficiency Campaign proposes solutions aimed at equipment and technology improvements, together with improved and ongoing education aimed at motivating behavioral changes, and includes all sectors—residential, commercial, and institutional. The projects and programs below could advance the intent of the Extreme Efficiency Campaign. Some of these projects are planned and some are already being implemented to some degree. These projects and programs can also be found summarized in table format in “2.4.2 Priority Projects and Programs.”

Promote and Incentivize the Use of High Efficiency Fixtures and Equipment, and Graywater Systems

- **Water Use Efficiency and Reuse Education Program.** Promote and incentivize water use efficiency and reuse (e.g., low-water-using landscapes; replacement of hobby orchards with lower-water-using landscapes; use of local, woody mulch; use of graywater systems; high-efficiency plumbing retrofits, fixing leaks, efficient use of agricultural water). Install demonstration landscapes.

- **Landscape Irrigation Efficiency Audits/Upgrades.** Continue to promote the availability of Casitas Municipal Water District’s free landscape irrigation efficiency surveys; continue or expand subsidies for equipment upgrades.

- **Native and Climate-Appropriate Plant Education.** Develop and implement an education program that promotes landscaping with natives and other climate-appropriate plants.

- **Agricultural and Hobby Orchard Irrigation Efficiency Evaluations.** Continue to promote the availability of the Resource Conservation District’s free irrigation efficiency evaluation program (Mobile Irrigation Lab) for farms and hobby orchards; continue or expand subsidies for equipment upgrades.

Consider Rate Incentives

- **Water Rate Analysis.** Research creative water rate model options that strongly incentivize conservation while covering district costs. Analyze the relative amount of funding spent by local water suppliers on conservation.
Use Policies

- **Plumbing Fixture Retrofit Policy Enforcement.** Monitor enforcement of the Ojai Area Plan policy that stipulates that new development must not add any net increase demand to existing water supplies. This is achievable through mitigation such as off-site plumbing retrofits.

Work Together

Facilitate communication and collaboration among those working to advance water conservation and water use efficiency. Look for opportunities to support one another's work, learn from each other, leverage resources and craft a smarter, more integrated approach to the task.

2.3.4.5 **Organizations**

The following organizations and entities are actively supportive of the intent of the Extreme Efficiency Campaign.

- Casitas Municipal Water District
- City of Ventura/Ventura Water
- Meiners Oaks Water District
- Ojai Basin Groundwater Management Agency
- Ojai Valley Green Coalition
- Resource Conservation District
- Surfrider Foundation
- Ventura River Water District
The Watershed-Smart Landscapes and Farms Campaign seeks to improve and innovate residential and commercial landscape and farm management practices in order to protect, supplement, and extend water supplies, and protect the long-term viability of farms.

2.3.5 Watershed-Smart Landscapes and Farms Campaign

2.3.5.1 The Issue

Irrigated agriculture is a major land use in the watershed, and local farms are an important and valued part of the economic and cultural history of the watershed. In 1956, Congress authorized the construction of Lake Casitas. The bill's language emphasized that the new water supply was needed for agricultural and economic opportunities. Today, agricultural
water accounts for about 45% of the water use from Lake Casitas, and growers are a major user of groundwater in the watershed.

Agriculture plays a critical role in maintaining many services supportive of a healthy watershed. The citrus and avocado orchards that embody the rural character of the watershed also provide expanses of unpaved land that infiltrates rainwater and slows flood flows; serve as wildlife corridors and habitat; and provide attractive views and local food. Should these orchards become unviable, the character of the watershed would change dramatically.

Landscapes, especially in the Ojai Valley, are also a significant land use. The watershed is home to several golf courses, many public and private schools with ball fields, and large residential properties and estates. Residential landscapes throughout the Ojai Valley are planted with small citrus orchards, which are irrigated, but may never be harvested. Landscape water generally accounts for at least half of residential water demand, but can run much higher when landscapes are on the large side, like in the Ojai Valley.

Efficient irrigation is already widely practiced in the watershed, but there is still considerable room for reducing the water demand of landscapes and farms. Agricultural and landscape irrigation together can account for as much as two-thirds of local water use. With such a large volume of water involved, many small improvements in efficiency can result in significant savings—extending limited water supplies and reducing water costs for irrigators.

Landscapes and farms also serve the important function of infiltrating rainwater for groundwater recharge. Better land contouring, use of mulch, and other practices could capture and infiltrate much more of the watershed's rainfall and stormwater runoff.

Fertilizers used by landscapes and farms are one of the sources of nutrients that can cause water quality impairments in the watershed. Reducing this load of nutrients on water supplies may be required to improve water quality and meet regulatory requirements.

### 2.3.5.2 Targets

**Reduced demand for landscape and farm irrigation water**

With improved irrigation efficiency and less-water-demanding landscapes, the amount of water used for irrigation in the watershed could be significantly reduced.
**Increased groundwater recharge**

Through better land contouring and diversion of stormwater to landscaped swales, landscapes and farms could capture and infiltrate more of the watershed's rainfall and stormwater runoff, thereby improving recharge of groundwater basins.

**Cleaner groundwater and surface water**

With better management of fertilizers and livestock waste, nutrient concentrations in groundwater and surface water could be reduced.

**A viable agricultural industry**

Reducing water costs through improved efficiency, helping growers meet regulatory requirements, and studying options in the face of pest threats would help keep local farms viable.

### 2.3.5.3 Highlights from Existing Projects, Programs, and Practices

Irrigation efficiency in agriculture and landscape has been pursued in the Ventura River watershed ever since the first local farmers faced down a 21-year dry period between 1945 and 1965. Water conservation is a constant priority. Growers and landscape managers keep abreast of the latest

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Mulch is widely used in watershed orchards to save water, but it has other benefits as well. The mulch cover holds moisture in the soil, reduces soil temperature, and suppresses weeds. Mulch cover slows and absorbs rainfall and applied irrigation water, improving infiltration and preventing erosive runoff. By preventing fertilizers and other nutrients from traveling off-site in runoff, mulch cover is a recommended BMP for protecting water quality.

It is very important to use locally sourced mulch in order to prevent the spread of exotic pests from mulch imported from outside the area. Ojai Valley Organics can supply locally-sourced mulch in the Ojai Valley.
Row crop growers in the watershed use drip tape to produce food with the minimum water necessary. Narrowly focusing irrigation reduces weed growth as well.

Ocean Friendly Gardens (OFG) is a national Surfrider Foundation program for transforming landscapes and hardscapes to prevent water pollution. Landscapes that use rainwater as a resource and employ conservation, permeability, and retention practices are promoted. The Ventura County Surfrider chapter, the City of Ventura, the Ojai Valley Green Coalition, and others have partnered to advance OFG in the watershed through training workshops, landscape retrofits, demonstration projects, and educational videos.

The Ojai Community Demonstration Garden, located next to Ojai City Hall, provides a forum for educating residents about landscape management techniques which conserve water and reduce waste. Water conservation is demonstrated through the use of drought-tolerant plantings appropriate to Ojai's microclimate, mulching, and drip irrigation systems. Workshops are offered at the garden, such as the one pictured above on how to landscape with native plants.

Photo courtesy of Les Dublin.
Casitas Municipal Water District (CMWD) offers free onsite landscape surveys throughout their wholesale service area. The surveys include a review of the irrigation system, irrigation design, and watering schedules. CMWD also offers rebates on selected residential and commercial weather-based irrigation controllers.

Photo courtesy of CMWD.

Throughout the year, Casitas Municipal Water District (CMWD) hosts water use efficiency and conservation workshops. In this photo, Dr. Ben Faber of the University of California Cooperative Extension lectures growers on irrigation efficiency.

Photo courtesy of CMWD.

Graywater workshops have been provided by the Ventura County Building and Safety Division, Casitas Municipal Water District, and Ojai Valley Green Coalition (OVGC). This photo is of an OVGC hands-on workshop.

Photo courtesy of OVGC.
Through their “Mobile Irrigation Lab,” the Ventura County Resource Conservation District (RCD) provides free on-site agricultural irrigation system analysis and technical assistance to improve water use efficiency. Included is a cost share program to help fund “best management practice” (BMP) implementation for irrigation systems of orchard, row crop, and nursery operations.

Photos at right courtesy of the RCD.

Ventura County Agricultural Irrigation Lands Group (VCAILG), administered by Farm Bureau of Ventura County, offers a number of educational workshops for growers each year. The classes focus on various aspects of water quality, and attendance by VCAILG participating growers helps meet water quality regulations.

Photo courtesy of UC Cooperative Extension.

The recently formed Horse and Livestock Watershed Alliance represents horse and livestock owners in the Ojai Valley. The group works with horse and livestock owners to improve manure management practices that affect water quality, and works with water quality regulators to help craft fair regulatory schemes that minimize economic impacts.
techniques and equipment to get the most out of the limited supply of local water. Managing fertilizers and animal wastes is also an important part of being watershed-smart, and educational programs are in place to help make further improvements to these management practices. Below are selected highlights from the watershed’s existing landscape and farm projects, programs and practices.

### 2.3.5.4 Proposed Projects and Programs

The Watershed-Smart Landscapes and Farms Campaign proposes a wide range of solutions to this issue, from small-scale backyard improvements to large-scale institutional retrofits. Improvements can be made at residences, businesses, and farms. The projects and programs listed below—some in the planning stage and others already underway—could advance the intent of the Watershed-Smart Landscapes and Farms Campaign. These projects and programs can also be found summarized in table format in “2.4.2 Priority Projects and Programs.”

#### Increase Landscape and Farm Irrigation Efficiency

- **Landscape Irrigation Efficiency Audits/Upgrades.** Continue to promote the availability of Casitas Municipal Water District’s free landscape irrigation efficiency surveys; continue or expand subsidies for equipment upgrades.

- **Agricultural and Hobby Orchard Irrigation Efficiency Evaluations.** Continue to promote the availability of the Resource Conservation District’s free irrigation efficiency evaluation program (Mobile Irrigation Lab) for farms and hobby orchards; continue or expand subsidies for equipment upgrades.

#### Decrease Water Demand through Better Plant Selection, Landscape/Farm Design and Maintenance, and Water Reuse

- **Landscape Water Use Efficiency and Reuse Education Program.** Promote and incentivize replacement of turf and hobby orchards with lower-water-using landscapes; use of local, woody mulch; and use of graywater and rain barrel/cistern water for irrigation. Install demonstration landscapes.

- **Ocean/River-Friendly Gardens Education Program.** Expand the Ocean/River-Friendly Gardens program (which promotes conservation, rain harvesting, and non-polluting methods) watershed-wide; integrate incentives.
- **Native and Climate Appropriate Plant Education.** Educate and motivate people about landscaping with natives and other climate-appropriate plants.

- **Water Efficient Crop Study.** Research the feasibility of alternative crops in the watershed that are economically sustainable and low-water using. This could serve as an Asian Citrus Psyllid contingency plan.

- **Stormwater Parking Lot Retrofits.** Retrofit parking lots and their landscapes to improve stormwater capture and infiltration, where feasible (given clay soils and high groundwater) as they come up for rehabilitation.

### Improve Water Capture and Infiltration

- **Slow It/Spread It/Sink It Campaign.** Coordinate an educational program to advance onsite rain/stormwater harvesting at residences, churches, schools and businesses; integrate incentives, demonstration projects, and showcase individual examples.

- **On-Farm Water Detention/Retention Analysis.** Investigate opportunities for small-scale on-farm stormwater detention and storage options (e.g., swales, contours, wet ponds, rainwater harvesting, underground storage).

### Improve Nutrient Management

- **Farm and Stable Nutrient Management Program.** Promote farm and/or stable nutrient management best management practices (BMP) (e.g., filter strips, rainwater collection, manure management, erosion control, off-stream watering); offer on-farm/stable evaluations, BMP design, and technical assistance; identify priority parcels for livestock BMP implementation. Include Spanish-language component and demonstration projects. Showcase individual examples.

- **Water Pollution Prevention Campaign.** Develop and implement an educational program to prevent water pollution from fertilizers and other nutrients, pesticides, and herbicides.

- **Livestock Nutrient Management Program.** Promote livestock nutrient best management practices (BMP) (e.g., rotational grazing, off-stream water facilities, salt/supplement feeders, the installation of stream/river exclusionary fencing where appropriate, and erosion control); offer water quality assessments, BMP design, and technical assistance.
Work Together

Facilitate communication and collaboration among those already working on efforts that help make landscapes and farms more watershed-smart. Look for opportunities to support one another’s work, learn from each other, leverage resources and craft a smarter, more integrated approach to the task.

2.3.5.5 Organizations

The following organizations and entities are actively supportive of the intent of the Watershed-Smart Landscapes and Farms Campaign.

- Casitas Municipal Water District
- City of Ojai
- City of Ventura/Ventura Water
- Farm Bureau of Ventura County
- Meiners Oaks Water District
- Ojai Basin Groundwater Management Agency
- Ojai Valley Green Coalition
- Resource Conservation District
- Santa Barbara Channelkeeper
- Surfrider Foundation
- UC Cooperative Extension
- Ventura County Coalition of Labor, Agriculture and Business
- Ventura County Watershed Protection District
- Ventura River Water District
2.3.6 Arundo-Free Watershed Campaign

The Arundo-Free Watershed Campaign seeks to remove, and keep at bay, the invasive non-native plant *Arundo donax*, which consumes excessive amounts of water, poses a major fire hazard, clogs flood control channels, and destroys native habitat.

2.3.6.1 The Issue

Every day during the watershed’s warm season, a single acre of the invasive, non-native plant *Arundo donax* can take 39,000 gallons of precious stream and ground water—up to three times as much water as the native streamside plants that it outcompetes. Each acre infested removes 4.8 million gallons of water, or 3.2 million gallons of water more than native streamside plants, every year. That’s an annual water supply for 16 households or four acres of citrus. It is estimated that there are over 180 acres infested with Arundo in the watershed.

*Arundo donax*, or giant reed, is a bamboo-like plant that is among the fastest growing terrestrial plants—growing up to four inches a day during the warm months, and reaching heights of up to 30 feet.
Just like Bermuda grass, *Arundo* grows by sending out underground vegetative shoots, or rhizomes, that take root and send up new stalks. It spreads when pieces of rhizome fragments break off, travel downstream and take root in moist soil. *Arundo* forms massive thickets of vegetation that can cover many acres, virtually eliminating all other plant species, along with the critical wildlife habitat of streamside ecosystems.

Besides consuming so much water and crowding out native habitat, *Arundo* also poses a severe fire risk: the plant contains volatile oils that make it highly flammable, and infestations along streams can act like wicks, quickly spreading fires to new areas. During floods *Arundo* can also create hazards when uprooted plants clog flood control infrastructure.

Hundreds of acres of *Arundo* have already been removed in the watershed. By completing the job of removing remaining major infestations, the watershed can realize the water savings, and the many other benefits of having the plant gone. The need for ongoing monitoring and retreatment will always remain, but relative to the cost of other water supply projects, *Arundo* control is considered a bargain.

### 2.3.6.2 Targets

**Increased groundwater supplies and summertime streamflow**

Less *Arundo* means less water consumed along streams, leaving more water in streams and groundwater basins.

**Improved habitat**

As soon as *Arundo* is removed, native plants and animals begin returning and the watershed’s abundant natural biodiversity begins to reestablish itself.

### 2.3.6.3 Highlights from Existing Projects, Programs, and Practices

Thanks to extraordinary and persistent efforts by agencies, private property owners, and hundreds of volunteers organized by local non-profit organizations, *Arundo* control in the watershed has made great progress—especially in the last 10 years. About 270 acres of *Arundo* have been removed, and much of this acreage is being monitored for regrowth. Once established, *Arundo* can be persistent, but by removing the big stands and controlling regrowth, the massive stands that choke out habitat and consume so much water can be prevented. Here are a few selected highlights from the watershed’s ongoing *Arundo donax* removal projects, programs, and practices.
The Ventura County Watershed Protection District (VCWPD) has played a lead role in Arundo control efforts—starting with a demonstration project in 2004. The project was designed by the Ventura County Arundo Task Force to evaluate the cost-effectiveness of four different methods of eradication and to improve public support for future Arundo removal. The VCWPD administered the demonstration project on a five-acre section on the east bank of the Ventura River near Casitas Springs. Severe flood flows in 2005 scoured much of project area and interfered with the trials, but valuable information was gained nonetheless.

Since the first 2004 project, the VCWPD has launched several ongoing Arundo removal projects on the lower Ventura River, upper San Antonio Creek and its tributaries, and other VCWPD land holdings.

Photo courtesy of VCWPD.
The watershed's largest VCWPD *Arundo* removal project started in 2008 on Matilija Creek and the upper Ventura River. 200 acres of *Arundo* in a 1,200-acre area were removed. The map shows the areas of *Arundo* (giant reed) infestation above and below Matilija Dam prior to removal.

The project to remove *Arundo* above and below Matilija Dam was part of mitigation associated with the project to remove Matilija Dam and restore the ecosystem. Ongoing monitoring and retreatment continues on VCWPD’s projects. Photos show the Arundo infestation above Matilija Reservoir, before, during removal, and after.

Photos courtesy of VCWPD.
Private property owners are actively helping to control Arundo. The owners of Taylor Ranch in the lower watershed removed over 45 acres of Arundo in the riverbed of the lower river area.
On the Taylor Ranch on the lower Ventura River, Arundo had grown into monoculture stands that had choked out most other vegetation and provided makeshift illegal camp shelters. With the Arundo removed, native vegetation is returning, and the property owners continue to monitor and retreat the area as needed.

The Ojai Valley Land Conservancy has facilitated some large Arundo removal projects on its properties, and continues to monitor and control. These photos show removal and revegetation on the Ventura River Preserve in 2006.
Ventura Hillsides Conservancy is removing *Arundo* on their properties, using hand tools and lots of volunteer hours.

The Ventura County Watershed Protection District and the Ventura County Planning Division produced a *Guide to Native and Invasive Streamside Plants* booklet to help educate residents about the problems that invasive plants, including *Arundo*, pose to streamside habitats.
2.3.6.4 Proposed Projects and Programs

The types of projects and programs below could advance the intent of the Arundo-Free Watershed Campaign. Some of these projects are planned and some are already being implemented to some degree. These projects and programs can also be found summarized in table format in “2.4.2 Priority Projects and Programs.”

Remove and Continue to Control Arundo

Continue to remove Arundo infestations and monitor and retreat regrowth as necessary. Key infestations targeted for removal include areas along San Antonio Creek and the Ventura River floodplain from the Highway 150 Bridge south.

Reduce Permitting Time and Costs

Pursue strategies to reduce the cost and burden of securing permits for Arundo removal. Clustering projects into one permit may be one strategy.

Engage the Community and Encourage Stewardship

Develop an education and outreach program that explains the problems that Arundo presents in the watershed and encourages property owners and land managers to proactively prevent its spread.

Work Together

Facilitate communication and collaboration among those already working on efforts to remove and monitor Arundo. Look for opportunities to support one another’s work, learn from each other, leverage resources and craft a smarter, more integrated approach to the task.
2.3.6.5 **Organizations**

The following organizations and entities are actively supportive of the intent of the *Arundo*-Free Watershed Campaign.

- Aera Energy
- California Coastal Conservancy
- City of Ventura
- Ojai Valley Land Conservancy
- Taylor Ranch
- Ventura County Parks Department
- Ventura County Resource Conservation District
- Ventura County Watershed Protection District
- Ventura County Weed Management Area
- Ventura Hillsides Conservancy
2.3.7 Healthy San Antonio Creek Campaign

2.3.7.1 The Issue

San Antonio Creek subwatershed is a key drainage in the Ventura River watershed. One of the two principle drainages in the watershed, it carries 34% of the watershed's median annual runoff.

The Ojai Valley Groundwater Basin drains into San Antonio Creek. For much of the year, flow in the lower half of San Antonio Creek is groundwater from the basin. Demands on or impacts to the groundwater basin directly affect the creek.
The San Antonio Creek subwatershed drains the largest urban area in the Ventura River watershed—the City of Ojai and surrounding unincorporated areas. The population density 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 urban and agricultural areas to San Antonio Creek not only pollute the creek and its aquatic habitats, but also the water in the Ventura River all the way down to the sensitive fisheries in the Ventura River estuary at the coast. Nutrient pollution, which can contribute to algae blooms, is a significant contaminant that local agencies must address. The highest in-stream nutrient concentrations in the watershed are found in San Antonio Creek.

Rhizome fragments from infestations of the invasive, water-thirsty plant *Arundo donax* travel downstream from San Antonio Creek, creating a constant source of new *Arundo* infestations all the way down the Ventura River.

**The Healthy San Antonio Creek Campaign seeks to increase the flow of clean water in San Antonio Creek, increase recharge of the interconnected Ojai Valley Groundwater Basin, and improve the creek's riparian and instream habitats.**

San Antonio Creek also offers some of the watershed's most important spawning and rearing habitat accessible to the endangered southern California steelhead. Migratory steelhead using San Antonio Creek benefit from more reliable flow, and avoid the "dry reach"—the wide, alluvial section of the Ventura River upstream of the San Antonio Creek confluence that is dry most of the year. The creek generally flows longer than other accessible streams and contains gravel needed by steelhead for spawning. Steelhead have been found to grow faster in the San Antonio Creek than elsewhere in the watershed.

### 2.3.7.2 Targets

**Increased groundwater recharge and summertime streamflow**

With improved water conservation, and water capture and infiltration, groundwater levels in the Ojai Valley Groundwater Basin could remain higher for longer, thus improving the amount of summertime streamflow (relative to rainfall) in San Antonio Creek. Additionally, removal of the invasive, non-native plant *Arundo donax* would significantly reduce the amount of water used by streamside plants.
Cleaner groundwater and surface water

With better management of fertilizers, septic systems, and horse and livestock wastes, nutrient concentrations in groundwater and surface water could be reduced.

Thriving steelhead

With structural in-stream improvements, such as the addition of more over-summing pools, together with increased summertime streamflow, steelhead recovery could be dramatically enhanced.

2.3.7.3 Highlights from Existing Projects, Programs, and Practices

Many of the existing projects, programs, and practices described in the other campaigns are also relevant to the Healthy San Antonio Creek Campaign. In addition, here are some highlights specific to the San Antonio Creek subwatershed.

The Ojai Basin Groundwater Management Agency (OGBMA) is a special-act district that manages the water of the Ojai Valley Groundwater Basin. Formed by state legislation in 1991, OBGMA is one of only 13 such districts with groundwater management authority in California. The agency was established in the fifth year of a drought, amidst concerns of local water agencies, water users, and well owners about potential groundwater basin overdraft. The OBGMA is administered collaboratively by key stakeholders: the 5-seat board includes the City of Ojai, Casitas Municipal Water District, Golden State Water Company, Ojai Water Conservation District, and one mutual water company representative.
The Ojai Valley Groundwater Basin underlies the City of Ojai and Ojai Valley’s East End, where the majority of the watershed’s agriculture is located.
Constructed in 2014, the San Antonio Creek Spreading Grounds project was designed to divert surface water from upper San Antonio Creek for recharge of the Ojai Valley Groundwater Basin using passive injection wells. Annual recharge is estimated to average 126 acre-feet of water with a maximum of 914 acre-feet per year. The project was a collaboration between the OBGMA and the Ventura County Watershed Protection District, with state grant funding secured through the Watersheds Coalition of Ventura County. Casitas Municipal Water District is also a project partner helping with facility maintenance. Top photo: spreading grounds intake structure; bottom photo: holding basins. Photos courtesy of Ventura County Watershed Protection District.
Ideal steelhead spawning habitat has cool, oxygen-rich water with clean gravel along the channel bottom and in-stream vegetative cover. Steelhead spawning surveys show that the lower reaches of the San Antonio Creek have these habitat characteristics and that fish are spawning there. There is a potential to expand these habitats and improve the quality of existing habitats with the addition of more rearing habitats, such as deep pools, removal of invasive plants, and revegetation of bare stream banks. Pictured at right is ideal steelhead habitat on lower San Antonio Creek.

A 20-inch adult steelhead in San Antonio Creek, about a half-mile above its confluence with the Ventura River, April 2012.

Photos courtesy of Scott Lewis.
The Ojai Valley Green Coalition and the C.R.E.W. (Concerned Resource and Environmental Workers), along with lots of volunteers, have teamed up to restore the West Barranca, located behind Libbey Park in downtown Ojai. The barranca is a tributary of Ojai Creek, which eventually drains into San Antonio Creek. Team members have removed the invasive plant thickets that had smothered the creek and installed native plants.

The Ojai Valley Land Conservancy collaborated with the California Conservation Corps and The C.R.E.W. to remove over 200 Mexican fan palms from Fox Canyon Barranca and Stewart Canyon Creek. This project continues the work begun on Ojai Creek in Libbey Park.
The Ventura County Parks Department installed 44 native trees along the San Antonio Creek riparian corridor in Camp Comfort; 102 native trees along Thacher Creek, which runs through Soule Park golf course and day use park; and 72 native trees in the riparian corridor of Foster Park.

Between 2009 to 2011, the Ventura County Watershed Protection District (VCWPD) removed approximately six acres of Arundo (within a 212-acre area) from upper San Antonio Creek and its tributaries: McNell, Thacher and Reeves Creeks. Grant funding for this project was secured through the Watersheds Coalition of Ventura County.

Photo courtesy of VCWPD.
The Farm Bureau of Ventura County administers VCAILG (Ventura County Agricultural Irrigated Lands Group) on behalf of farmers in Ventura County. The program is a “Conditional Waiver” program, an approach to complying with required water quality regulations collectively rather than individually. Landowners and growers are asked to provide VCAILG with information on their management practices, participate in educational workshops, and implement best management practices to reduce or eliminate contaminated discharges.

Photo courtesy of University of California Cooperative Extension-Ventura.

VCAILG performs water quality monitoring and reporting. The photo at right is an excerpt from a VCAILG report that describes one of their two monitoring sites in the watershed.

VRT_SANTO
This monitoring site is located on San Antonio Creek just upstream of Grand Avenue in Ojai. San Antonio Creek is a tributary of the Ventura River.

Site Map

View downstream at the Grand Ave. bridge

This site remained dry during the 2013 monitoring events. Table 47 includes the number and types of trash observed at the monitoring site. Citrus and avocados are the predominant crop types associated with this site.
Several impediments to fish passage in the San Antonio Creek watershed have been removed in recent years through the construction of bridges. The bridges allow the natural channel bottom to reestablish and remove low flow impediments to fish migration.

In 2010, this bridge replaced a "fair weather crossing" (a road crossing that allows a waterway to run over a road) on Lion Canyon Creek, a major tributary of San Antonio Creek. The bridge improved steelhead access to over nine miles of upstream habitat.

Photos courtesy of South Coast Habitat Restoration.

A beautiful bridge for pedestrians and bicyclists using the Ojai Valley Bike Trail was installed in 2012 at the very end of San Antonio Creek, just before it merges with the Ventura River. The bridge replaced an old concrete crossing over some box culverts that frequently became plugged with woody debris during storms.

Photos courtesy of Ventura County Star (left) and Santa Barbara ChannelKeeper (right).
A fair weather crossing in lower San Antonio Creek at Old Creek Road was replaced with a multi-span bridge in 2012.

Photo (right) courtesy of Ventura County Public Works Transportation Department.

A clear span bridge was constructed in 2013 on San Antonio Creek near the confluence with Stewart Canyon Creek, just south of the City of Ojai. The bridge replaced a fair weather crossing on private property.

Photo courtesy of Bill O'Brien.
2.3.7.4 Proposed Projects and Programs

The Healthy San Antonio Creek Campaign focuses all the work described in the Council's other campaigns in a targeted subwatershed because efforts focused on San Antonio Creek can yield great benefits throughout the watershed. This campaign is an integrated campaign that works on many fronts. The projects and programs listed below—some in the planning stage and others already underway—could advance the intent of this campaign. These projects and programs can also be found summarized in table format in “2.4.2 Priority Projects and Programs.”

Target Implementation of Projects and Programs from the Council’s Other Campaigns in the San Antonio Subwatershed

The San Antonio Creek campaign takes a holistic and comprehensive approach, drawing ideas from project and program solutions described for the Council's entire slate of campaigns.

- Watershed-Smart Landscapes and Farms Campaign
- Extreme Efficiency Campaign
- Resiliency Through Infrastructure and Policy Campaign
- Arundo-Free Watershed Campaign
- River Connections Campaign

Protect the Groundwater Basin

- Land Subsidence Monitoring. Establish a land subsidence monitoring network using real time kinematic GPS to measure changes in ground elevation due to groundwater pumping-related subsidence.

Restore and Protect Habitats

- Steelhead Restoration Plan. Consolidate existing watershed-specific steelhead data (e.g., habitat, population and monitoring data). Identify priority limiting factors for all life stages of the steelhead (e.g., lack of over-summering pools for smolts and older fish, rearing habitats for younger age classes, spawning habitats.) Describe a suite of project types to address these limiting factors. Prioritize stream reaches for steelhead habitat restoration based upon least cost/greatest gain.

- Steelhead Pool Development/Maintenance on San Antonio Creek. Surveys and monitoring of San Antonio Creek over the years have revealed the need for over-summering pools in the creek as a priority for steelhead recovery. Support steelhead survival by developing
and maintaining over-summering pools in strategic, least cost/greatest gain, perennial flow locations.

- **Fish Passage.** Modify priority fish passage barriers (e.g., Camp Comfort and Fraser Street).

### Engage the Community and Encourage Stewardship

- **Friends of San Antonio Creek.** Coordinate meetings of residents/landowners along San Antonio Creek to foster and facilitate increased knowledge about watershed issues and stewardship. Address topics such as invasive plant removal, habitat restoration, steelhead habitat protection, permeable surfaces, stormwater retention, flooding awareness and preparation, and livestock BMPs.

### 2.3.7.5 Organizations

The following organizations and entities are actively supportive of the intent of the Healthy San Antonio Creek Campaign.

- Casitas Municipal Water District
- City of Ojai
- City of Ventura/Ventura Water
- The Concerned Restoration and Environmental Workers
- Farm Bureau of Ventura County
- Meiners Oaks Water District
- Ojai Basin Groundwater Management Agency
- Ojai Valley Green Coalition
- Ojai Valley Land Conservancy
- Resource Conservation District
- Santa Barbara Channelkeeper
- Surfrider Foundation
- UC Cooperative Extension
- Ventura County Coalition of Labor, Agriculture and Business
- Ventura County Parks Department
- Ventura County Resource Conservation District
- Ventura County Watershed Protection District
- Ventura County Weed Management Area
- Ventura River Water District
2.4 Complete List of Priority Projects and Programs

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2.4.2 Priority Projects and Programs ......................... 171
2.4 Complete List of Priority Projects and Programs

2.4.1 Priority Project and Program List Development

The first step in developing a priority list of projects and programs for achieving the watershed management plan’s goals and objectives was to create a master list of ideas. This master archive of projects and programs (MAPP) represents an unedited, unranked repository of ideas large and small.

The creation of the MAPP began with a draft list of project and program ideas compiled by the watershed coordinator. Ideas were gleaned from a variety of sources: Watershed Council meetings, stakeholder conversations, past reports and plans, and other watershed management plans. Six technical advisory committees (TACs) of the Watershed Council held a series of meetings in March 2013 and again in May 2013 to further develop and refine this list.

<table>
<thead>
<tr>
<th>Project/Program List Development Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1: Create Master Archive of Projects and Programs</td>
</tr>
<tr>
<td>Step 2: Filter Projects and Programs into Tier 1 or Tier 2</td>
</tr>
<tr>
<td>Step 3: Filter Tier 1 Projects and Programs by Those with Leads and Those Without Leads</td>
</tr>
</tbody>
</table>

The MAPP is maintained in a comprehensive spreadsheet that indicates a variety of features about each project or program idea, such as the goals and objectives it could satisfy, the general project type, estimated cost, and the organizations that are willing to lead or support the project. The MAPP is intended to be a living document that the Watershed Council can continue to add to over time.
The second step in developing a priority project and program list was to categorize the projects assembled in the MAPP archive into one of two "tiers":

**Tier 1 projects and programs** are those that
1. Meet one or more of the plan objectives,
2. Are feasible,
3. Have clear benefit,
4. Have general stakeholder support, and
5. Have a project lead or supporter.

The third step in developing a priority project and program list was to categorize the Tier 1 projects and programs by whether they had a committed project lead or not. The Tier 1 projects and programs that have at least one lead represent the priority and "potentially ready" projects and programs. Those Tier 1 projects and programs with only supporters represent priority, but not quite ready, projects and programs.

**Tier 2 projects and programs** are all those that do not meet all Tier 1 criteria, and therefore are not yet ready to move forward with Council support, but remain on the MAPP as concepts.

**Leads and Supporters**

Tier 1 projects and programs must have either a lead (Tier 1L) or a supporter (Tier 1S). A lead is defined as an organization that is willing and able to lead and/or be the grant applicant of the project/program. Being a lead does not represent a commitment to implement the project; lead status simply indicates a big enough interest in seeing the project implemented that the organization would consider leading it or pursuing funding under the right circumstances. A supporter is an organization willing to actively advance a project/program, but that is not in a position to be the lead.

The project and program list is not static. As circumstances and needs change, Council members may wish to elevate a project’s status, such as from a Tier 1S to a Tier 1L, or add a new project or program. The list can be updated at any time with Council approval, and the most current list will be maintained on the Council’s website.
2.4.2 Priority Projects and Programs

Table 2.4.2 represents the Council's Tier 1L list of projects and programs. The Tier 1L list describes those projects and programs that Council members are prepared to act on if funding becomes available. These are the projects/programs that are the most developed conceptually, the most feasible, and that have Council member support. Some of these projects are already occurring and would benefit from expansion or enhancement; and some of the projects are new. The implementation campaigns, discussed previously in this chapter, combine projects and programs from the Tier 1L list into coherent thematic strategies that reflect the on-the-ground integration of these various projects and programs.

The list of Tier 1S and Tier 2 Projects and Programs can be found in "4.4 Appendices."

Table 2.4.2.1 Tier 1L Priority Projects and Programs

<table>
<thead>
<tr>
<th>ID#</th>
<th>Tier 1L Project or Program</th>
<th>Fill Data Gaps / Analyze</th>
<th>Make Physical Improvements</th>
<th>Educate/Engage / Incentivize</th>
<th>Improve Use, Regulations &amp; Policies</th>
<th>Plan/Collaborate Regionally</th>
<th>Leads (L)</th>
<th>Supporters (S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Surface Water-Groundwater Interaction Analysis. Increase understanding about the interaction between groundwater extractions and surface flows. Install surface flow monitors at key locations, such as along San Antonio Creek at the Ventura River Basin-Ojai Basin boundary, and within the Ojai Basin. Look for correlations between pumping extractions and changes in surface flow.</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L: Ventura Water, MOWD</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Water Use Efficiency and Reuse Education. Promote and incentivize water use efficiency and reuse (e.g., low-water-using landscapes; replacement of hobby orchards with lower-water-using landscapes; use of local, woody mulch; use of graywater systems and cisterns/rain barrels; high efficiency plumbing retrofits, fixing leaks, efficient use of agricultural irrigation water). Continue to promote the availability of large landscape irrigation efficiency surveys and ag/hobby orchard irrigation efficiency evaluations. Continue/expand subsidies for equipment upgrades.</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>L: Ventura Water, RCD, OVGC</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Casitas MWD Reservoir Tank Seismic Retrofit. Bring two Casitas MWD reservoir tanks up to earthquake standards to prevent potential seismic damage.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L: Casitas</td>
<td></td>
</tr>
</tbody>
</table>

Goal 1: Sufficient Local Water Supplies
<table>
<thead>
<tr>
<th>ID#</th>
<th>Tier 1L Project or Program</th>
<th>Fill Data Gaps / Analyze</th>
<th>Make Physical Improvements</th>
<th>Educate/Engage/Incentivize</th>
<th>Improve/Use Regulations &amp; Policies</th>
<th>Plan/Collaborate Regionally</th>
<th>Leads (L.)/Supporters (S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Water Supply Infrastructure Reliability Improvements. Replace or retrofit aging or threatened water supply tanks, walls, pipes, and other conveyance and storage equipment to reduce water losses, ensure supply reliability, and bring up to earthquake standards. Install backup equipment to improve the watershed’s resiliency to emergencies.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L: Casitas, MOWD S: Ventura Water</td>
</tr>
<tr>
<td>11</td>
<td>On-Farm Water Detention/Retention Analysis. Investigate opportunities for small-scale on-farm stormwater detention and storage options (e.g., swales, contours, wet ponds, rainwater harvesting, underground storage).</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L: RCD S: RWQCB</td>
</tr>
<tr>
<td>12</td>
<td>Contingency Water Storage. Install decentralized contingency water storage.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L: Ventura Water</td>
</tr>
<tr>
<td>14</td>
<td>Water Supply System Loss Minimization. Reduce water supply losses from leaking pipes or inefficient equipment.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L: Casitas, Ventura Water, RCD</td>
</tr>
<tr>
<td>15</td>
<td>Additional Flow Gauges. Install streamflow gauges in key locations, such as on San Antonio Creek, to improve understanding about surface flow patterns relative to groundwater levels.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L: OBGMA</td>
</tr>
<tr>
<td>16</td>
<td>Water Rate Analysis. Research creative water rate model options that strongly incentivize conservation while covering district costs. Analyze the relative amount of funding spent by local water suppliers on conservation.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L: Casitas</td>
</tr>
<tr>
<td>17</td>
<td>Reclaimed Water Analysis. Investigate the opportunities for and feasibility of using reclaimed water from the Ojai Valley Sanitary District, such as during winter flows when the water is not so critical in the river. (Per state policy, recycled water cannot be used until a Salt and Nutrient Management Plan is completed.)</td>
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<td></td>
<td>L: Ventura Water S: OVSD</td>
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<tr>
<td>18</td>
<td>Conjunctive Use Study. Investigate opportunities for maximizing the efficiency of use and storage between surface and groundwater.</td>
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<td></td>
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<td></td>
<td></td>
<td>L: Casitas, Ventura Water</td>
</tr>
<tr>
<td>19</td>
<td>Ocean/River Friendly Gardens Education Program. Expand the Ocean/River-Friendly Gardens program (conservation, rainwater harvesting, non-polluting) watershed-wide; integrate incentives.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L: OVGC, Surfrider S: Ventura Water</td>
</tr>
<tr>
<td>22</td>
<td>Large Landscape Irrigation Efficiency Surveys/Upgrades. Continue to promote the availability of Casitas’s free landscape irrigation efficiency surveys; continue or expand subsidies for equipment upgrades.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L: Casitas</td>
</tr>
<tr>
<td>23</td>
<td>Ventura Water - Casitas Conduit Intertie. Install a new 5.5 mile pipeline from Lake Casitas to the City of Ventura, and a pump station, to provide Casitas with a backup for potential water service delivery interruption to the Rincon area and to improve the City of Ventura’s water supply reliability and system operational abilities.</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>L: Ventura Water S: RWQCB</td>
</tr>
<tr>
<td>ID#</td>
<td>Tier 1L Project or Program</td>
<td>Fill Data Gaps / Analyze</td>
<td>Make Physical Improvements</td>
<td>Educate / Engage / Incentivize</td>
<td>Improve / Use Regulations &amp; Policies</td>
<td>Plan / Collaborate Regionally</td>
<td>Leads (L)</td>
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<tr>
<td>25</td>
<td>OVSD Sewer Main Lining Study. Prevent infiltration of groundwater into sewer lines by lining existing sewer pipes. Up to 7.5 million gal/day of groundwater infiltrate the sewer pipes during storm events. That’s 23 acre-feet of water a day.</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L: OVSD</td>
</tr>
<tr>
<td>26</td>
<td>Casitas MWD Exposed Main Line (San Antonio Creek) Burial. Bury this important gravity main line for improved protection.</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L: Casitas</td>
</tr>
<tr>
<td>27</td>
<td>Ventura Water Foster Park Wellfield Restoration. Install additional wells in the Foster Park area to allow the City of Ventura to produce more water from the river when flows are high. Ventura faces the challenge of meeting water demands in ways that protect and enhance the steelhead. New wells at Foster Park will allow the City to better assure that adequate surface flow is available at critical times to support steelhead migration, spawning, and rearing.</td>
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<td>L: Ventura Water</td>
</tr>
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<td>29</td>
<td>Ventura Water North-Side Satellite Wastewater Treatment Plant. Install a small, 2 million gallons/day (mgd) tertiary wastewater treatment plant near the Fairgrounds to treat wastewater from the Westside of Ventura for reuse. The recycled water could meet ag demand (1 mgd avg., 1.8 mgd max/mo.) and urban demand (0.23 mgd avg., 0.33 mgd max/mo.). Provides a small water supply benefit by offsetting potable demands for urban irrigation. Ag recycled water use would reduce groundwater extractions. While the supply/demand is relatively small, there are advantages to this alternative: the availability of city-owned property at the Seaside Pump Station for treatment facilities, the low chloride and TDS concentrations in the wastewater, and the similarity between the available supply of recycled water and the demand in the vicinity of the Seaside Pump Station. (Per state policy, recycled water cannot be used until after a Salt and Nutrient Management Plan is completed.)</td>
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<td>L: Ventura Water</td>
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<tr>
<td>31</td>
<td>Native and Climate Appropriate Plant Education. Develop and implement an education program that promotes landscaping with natives and other climate-appropriate plants.</td>
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<td>L: Casitas</td>
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<tr>
<td>34</td>
<td>Plumbing Fixtures Retrofit Policy Enforcement: Monitor enforcement of the Ojai Area Plan policy that stipulates that new development must not add any net increase demand to existing water supplies. This is achievable through mitigation such as off-site plumbing retrofits. “New discretionary development shall be required to retrofit existing plumbing fixtures or provide other means so as not to add any net increased demand on the existing water supply. This policy shall be applicable until such time as a groundwater basin study is completed and it is found that the available groundwater, or other sources of water, could adequately provide for cumulative demand without creating an overdraft situation.”</td>
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<td>L: Council</td>
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<tr>
<td>35</td>
<td>Meiners Oaks WD Replacement Water Well. Replace a potable water well built in the 1950s.</td>
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<td>L: MOWD</td>
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</table>
### Table 2.4.2.1 Tier 1L Priority Projects and Programs (continued)

<table>
<thead>
<tr>
<th>ID#</th>
<th>Tier 1L Project or Program</th>
<th>Fill Data Gaps / Analyze</th>
<th>Make Physical Improvements</th>
<th>Educate/Engage/Incentivize</th>
<th>Improve/Use Regulations &amp; Policies Regionally</th>
<th>Leads (L)</th>
<th>Supporters (S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>Meiners Oaks WD Standby Electric Generator. Install a standby generator to maintain water supply and fire flows in a critical zone during an extended power outage.</td>
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<td>L: MOWD</td>
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<tr>
<td>37</td>
<td>Meiners Oaks WD Water Tank Replacement. Replace an aging bolted steel 500,000-gallon water tank with a welded steel tank with concrete ringwall.</td>
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<td>L: MOWD</td>
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<tr>
<td>39</td>
<td>Agricultural and Hobby Orchard Irrigation Efficiency Evaluations. Continue to promote the availability of the Resource Conservation District's free irrigation efficiency evaluation program (Mobile Irrigation Lab) for farms and hobby orchards; continue or expand subsidies for equipment upgrades.</td>
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<td>L: RCD, Casitas S: Colab</td>
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<tr>
<td>41</td>
<td>Foster Park Infrastructure and Bank Protection and Restoration. Prevent critical infrastructure loss (such as in the 2005 storms) and support the development of steelhead habitat by building groins, revegetating the banks and preventing bank erosion. This reach, which is critical riparian habitat for steelhead, includes the city of Ventura's wellfield, a portion of Ojai Valley Sanitary District's sewer trunk line and a Casitas MWD main water line - all critical infrastructure that needs protection from storms. A bank protection design has been developed, with input from resource agencies, which would allow habitat to re-establish on its own and support steelhead spawning.</td>
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<td>L: Ventura Water S: OVSD</td>
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<tr>
<td>42</td>
<td>Groundwater Data Loggers. Install and maintain data loggers in key wells to continuously track water level and other parameters.</td>
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<td>L: OBGMA</td>
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<tr>
<td>43</td>
<td>Direct Installation of High Efficiency Irrigation Equipment on Large Landscapes. Provide irrigation surveys for large landscapes along with installation of appropriate water-saving technologies (e.g., low-precipitation rate nozzles, rain shut-off sensors, weather-based controllers) by a professional installer.</td>
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<td>L: Casitas</td>
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<tr>
<td>46</td>
<td>Land Subsidence Monitoring. Establish a land subsidence monitoring network using real time kinematic GPS to measure changes in ground elevation due to groundwater pumping-related subsidence.</td>
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<td>L: OBGMA</td>
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### Goal 2: Clean Water

<table>
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<tr>
<th>ID#</th>
<th>Project or Program</th>
<th>Tier 1L Project or Program</th>
<th>Fill Data Gaps / Analyze</th>
<th>Make Physical Improvements</th>
<th>Educate/Engage/Incentivize</th>
<th>Improve/Use Regulations &amp; Policies Regionally</th>
<th>Leads (L)</th>
<th>Supporters (S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>49</td>
<td>OVSD Sewer Trunk Relocation - Ventura River. Relocate a sewer line in the Ventura River threatened by river flow. A sewer line break here would affect water companies, instream uses, and ocean water quality.</td>
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<td>L: OVSD</td>
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<tr>
<td>51</td>
<td>OVSD Sewer Trunk Relocation - Ventura River/Meiners Oaks. Remove an old sewer line that crosses the river that could become a dam and steelhead impediment if the level of the riverbed drops.</td>
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<td>L: OVSD</td>
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<tr>
<td>52</td>
<td>Livestock Nutrient Management Program. Promote livestock nutrient best management practices (BMP) (e.g., rotational grazing, off-stream water facilities and salt/supplement feeders, installation of stream/river exclusionary fencing where appropriate, and erosion control); offer water quality assessments, BMP design, and technical assistance.</td>
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<td>L: RCD, RWQCB, CCC, SBCK</td>
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<tr>
<td>ID#</td>
<td>Tier 1L Project or Program</td>
<td>Fill Data Gaps / Analyze</td>
<td>Make Physical Improvements</td>
<td>Educate/Engage</td>
<td>Incentivize</td>
<td>Improve Use of Regulations &amp; Policies</td>
<td>Plan/Collaborate Regionally</td>
<td>Leads (L) / Supporters (S)</td>
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<td>53</td>
<td><strong>Slow It/Spread It/Sink It Campaign.</strong> Coordinate an educational program to advance onsite rain/stormwater harvesting at residences, churches, schools and businesses: integrate incentives, demonstration projects, and showcase individual examples.</td>
<td>x</td>
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<td>L: OVGC, SBCK, S: Ventura, CCC, RCD</td>
</tr>
<tr>
<td>54</td>
<td><strong>Farm and Stable Nutrient Management Program.</strong> Promote farm and stable nutrient management best management practices (BMP) (e.g., filter strips, rainwater collection, manure management, erosion control, off-stream watering); offer on-farm/stable evaluations, BMP design, and technical assistance; identify priority parcels for livestock BMP implementation. Include Spanish-language component and demonstration projects. Showcase individual examples.</td>
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<td>L: RCD S: RWQCB</td>
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<tr>
<td>55</td>
<td><strong>Coordinated Water Quality Monitoring.</strong> Investigate opportunities to coordinate the various water quality monitoring programs to reduce redundancy, and improve the cost-effectiveness and utility of the data, such as by sharing monitoring locations, standardizing protocols and formats, and sharing data.</td>
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<td>L: OVSD, WPD S: RWQCB, SBCK</td>
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<tr>
<td>56</td>
<td><strong>Adopt-a-River Program.</strong> Coordinate a program that enlists service organizations, youth groups, businesses, and others to commit to river/stream/channel/trail cleanup, such as collection events on Cali. Coastal Cleanup Day, ongoing dog mitt dispenser/maintenance on major trails, and ongoing horse manure collection on major trails.</td>
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<td>L: VHC, SBCK, County of Ventura, Ventura S: OVGC</td>
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<tr>
<td>57</td>
<td><strong>Friends of San Antonio Creek.</strong> Coordinate meetings of residents/landowners along San Antonio Creek to foster and facilitate increased knowledge about watershed issues, and stewardship. Address invasive plant removal, habitat restoration, steelhead habitat protection, permeable surfaces, stormwater retention, flooding awareness and preparation, livestock BMPs, etc.</td>
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<td>L: RCD S: Ojai, SBCK</td>
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<td>58</td>
<td><strong>Stormwater Retrofit Plan (LID and Green Streets).</strong> Develop a plan that inventories, assesses and prioritizes opportunities to retrofit impervious surfaces with alternative approaches (e.g., low impact development [LID] and green streets) that capture, treat, and infiltrate urban stormwater runoff. This may include public properties - such as public rights-of-way, street medians, sidewalks, parking lots and parks - as well as private properties, where public-private partnerships are possible. This planning will include soils investigations and development of preliminary retention calculations and design volumes based on prioritized ranking of parcel size, soil percolation rates and depths to groundwater.</td>
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<td>L: Ventura, County of Ventura, SBCK S: RWQCB, OVGC</td>
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<tr>
<td>59</td>
<td><strong>Water Pollution Prevention Campaign.</strong> Coordinate an educational program to prevent nonpoint source pollution (nutrients, pesticides/herbicides, trash, pharmaceuticals, etc.).</td>
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<td>L: Ventura, WPD, SBCK S: RCD</td>
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<tr>
<td>60</td>
<td><strong>Prevent Illegal River Bottom Camps.</strong> Support the work of the City of Ventura, County of Ventura, law enforcement, and social service organizations to prevent illegal activities in the river.</td>
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<td>L: Ventura, SBCK S: Friends, County of Ventura</td>
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<tr>
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<tr>
<td>61</td>
<td><strong>In-Situ Water Quality Monitoring Equipment.</strong> Install multi-parameter monitoring equipment to continuously monitor water quality in the river system, including dissolved oxygen.</td>
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<td>L: SBCK, OVSD</td>
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<tr>
<td>63</td>
<td><strong>Stormwater Retrofit Demonstrations (LID and Green Streets).</strong> Retrofit impervious surfaces with alternatives (e.g., low impact development and green streets) that capture, treat, and infiltrate urban stormwater runoff in order to demonstrate the use of bioretention systems, permeable surfaces, runoff treatment, infiltration and the restoration of natural hydrological functions in urban areas. May include public properties - such as public rights-of-way, street medians, sidewalks, parking lots and parks - as well as private properties, where public-private partnerships are possible. Prominent public locations will be prioritized when feasible.</td>
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<td>L: Ventura, County of Ventura, SBCK, RWQCB</td>
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<tr>
<td>64</td>
<td><strong>Ventura River Stream Team Citizen Monitoring Program.</strong> Continue this citizen water quality monitoring program that provides important, long-term water quality data throughout the watershed, while empowering, educating, and engaging residents.</td>
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<td>L: SBCK</td>
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<tr>
<td>65</td>
<td><strong>Manure/Composting Storage Demonstration Site.</strong> Install a manure/composting bunker or similar system, as a demonstration site at a horse facility.</td>
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<td>L: RCD</td>
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<tr>
<td>66</td>
<td><strong>Dry Weather and/or First Flush Diversion.</strong> Install devices to capture dry weather and/or first flush contaminated stormwater and send directly to the wastewater treatment plant.</td>
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<td>L: Ventura, Ojai, RWQCB, OVSD</td>
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<tr>
<td>72</td>
<td><strong>Ventura Water San Jon/Prince Barranca Urban Stormwater/Flood Control Retrofit Pilot Project.</strong> Retrofit parking and recreation areas, construct detention basins, and upgrade storm drains in order to enhance infiltration, water conservation, stormwater reuse, and urban flood protection. (In IWPP as channel/drainage improvements. Technically outside of the watershed proper.)</td>
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<td>L: Ventura, WPD, Surfrider</td>
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<tr>
<td>73</td>
<td><strong>Brownfield Project Remediation.</strong> There are 30 brownfield sites in the Westside and North Ventura Avenue areas of the city of Ventura that are potentially contaminated with hazardous substances and that could pose a threat to groundwater. Assist property owners with securing funding to clean up these sites.</td>
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<td>L: Ventura</td>
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<tr>
<td>74</td>
<td><strong>Single-Use Bag Ban.</strong> Promote adoption of a single-use bag ban by the County of Ventura and City of Ventura (already adopted by City of Ojai).</td>
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<td>75</td>
<td><strong>Septic System TMDL Special Study.</strong> Conduct a study to identify those septic systems, either individually or by geographic area, that are contributing to the impairment of surface waters in the watershed. This will facilitate a focused application of available resources to reduce or eliminate the contribution of these systems to water quality impairments, and more effectively meet the requirements of the state's AB 885 policy and TMDL requirements.</td>
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<td>L: EHD</td>
<td>S: Ojai, RWQCB, SBCK, OVSD</td>
</tr>
<tr>
<td>76</td>
<td><strong>Geologic Nitrogen Sources - TMDL Special Study.</strong> Conduct a special study to determine the extent to which the natural Monterey Formation contributes nutrients to water systems.</td>
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<td>L: CoLab</td>
<td>S: RWQCB</td>
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<tr>
<td>77</td>
<td><strong>Stormwater Parking Lot Retrofits.</strong> Retrofit parking lots and their landscapes to improve stormwater capture and infiltration, where feasible (given clay soils and high groundwater) as they come up for rehabilitation.</td>
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<td>L: Ojai</td>
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<tr>
<td>78</td>
<td><strong>Trash Excluders.</strong> Retrofit catch basins with trash excluders to filter trash from storm flows.</td>
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<td>L: Ojai</td>
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<tr>
<td>186</td>
<td><strong>Cleanup Petrochem.</strong> The blighted and abandoned oil refinery has marred the view, threatened the water quality, and impaired recreational values of the lower Ventura River for decades. Work to have the facility removed and cleaned up by the responsible parties.</td>
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<td>L: County</td>
<td>RMA</td>
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**Goal 3: Integrated Flood Management**

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<thead>
<tr>
<th>ID#</th>
<th>Tier 1L Project or Program</th>
<th>Fill Data Gaps / Analyze</th>
<th>Make Physical Improvements</th>
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<th>Leads (L)</th>
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</tr>
</thead>
<tbody>
<tr>
<td>79</td>
<td><strong>Bring Levees up to FEMA Standards - Casitas Springs Levee. (Also Matilija Dam Removal Mitigation)</strong> Complete levee improvements required to meet FEMA certification requirements and as part of the Matilija Dam Ecosystem Restoration Project.</td>
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<td>L: WPD</td>
<td>S: Coastal Cons.</td>
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<tr>
<td>80</td>
<td><strong>Bring Levees up to FEMA Standards - Live Oaks Levee. (Also Matilija Dam Removal Mitigation)</strong> Complete levee improvements required to meet FEMA certification requirements and as part of the Matilija Dam Ecosystem Restoration Project.</td>
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<td></td>
<td>L: WPD</td>
<td>S: Coastal Cons.</td>
</tr>
<tr>
<td>82</td>
<td><strong>Matilija Dam Removal - Mitigation: Meiners Oaks Levee.</strong> Construct new Meiners Oaks Levee/floodwall - part of the Matilija Dam Ecosystem Restoration Project.</td>
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<td>L: WPD</td>
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<td>84</td>
<td><strong>Matilija Dam Removal - Mitigation: Santa Ana Bridge Upgrades.</strong> Widen and upgrade Santa Ana Bridge - part of the Matilija Dam Ecosystem Restoration Project.</td>
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<td>L: WPD</td>
<td>S: OVSD</td>
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<tr>
<td>85</td>
<td><strong>Matilija Dam Removal - Mitigation: Camino Cielo Bridge Replacement.</strong> Replace Camino Cielo Bridge - part of the Matilija Dam Ecosystem Restoration Project.</td>
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<td>L: WPD</td>
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<tr>
<td>86</td>
<td><strong>Bring Levees up to FEMA Standards - Ventura River Levee and Parkway Enhancement.</strong> Complete levee improvements required to meet FEMA certification requirements, and create safe access to the lower river for recreation.</td>
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<td>L: WPD</td>
<td>S: Coastal Cons.</td>
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<td>Leads (L)</td>
<td>Supports (S)</td>
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<td>87</td>
<td>Canada de San Joaquin Bank Stabilization. Fix severe bank erosion and degrading invert. Service road is threatened, followed by homes above bank. Construct grade stabilizers; protect banks from erosion; acquire right-of-way. (IWPP)</td>
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<td>L: WPD</td>
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<tr>
<td>91</td>
<td>Channel Improvements - Canada Larga. Make creek shortcut (from 2005 flood) permanent. Excavate 1,500’ long channel and/or build levees to provide flood protection. (IWPP)</td>
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<td>L: WPD</td>
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<tr>
<td>92</td>
<td>Debris Basin Installation/Maintenance - Coyote Creek. Excessive debris and sediment in channel, implement routine debris clean out; build debris basin at mouth of Red Mountain Canyon. (IWPP)</td>
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<td>L: WPD</td>
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<tr>
<td>93</td>
<td>Right-of-Way Acquisition - Coyote Creek. ROW needed to get access for repairs and maintenance. (IWPP)</td>
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<td>L: WPD</td>
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<tr>
<td>94</td>
<td>Channel Improvements - Dent Drain Outlet. Ventura River bank erosion threatening headwall and flapgate. Construct upstream rock riprap groin. (IWPP)</td>
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<td>L: WPD</td>
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<tr>
<td>95</td>
<td>Debris Basin Installation/Maintenance - Dron Creek. Very high sediment yield; fills channel and causes flooding. Develop design that minimizes downstream erosion. Construct debris basin in canyons north of Gridley Rd. (IWPP)</td>
<td>x</td>
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<td>L: WPD</td>
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<tr>
<td>96</td>
<td>Channel Improvements - Rebuild East Ojai Drain. Undersized drain needs enlarging. (IWPP)</td>
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<td>L: WPD</td>
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<tr>
<td>97</td>
<td>Channel Improvements - Fox Barranca. Replace the existing concrete channel and increase flow capacity. (IWPP)</td>
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<td>L: WPD</td>
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<tr>
<td>98</td>
<td>Right-of-Way Acquisition - Fox Canyon Debris Basin. ROW needed to get access for maintenance. (IWPP)</td>
<td>x</td>
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<td>L: WPD</td>
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<tr>
<td>99</td>
<td>Right-of-Way Acquisition - Fresno Canyon Flood Mitigation. ROW needed to get to levee and end of Fresno Cnyn from Edison Drive. (IWPP)</td>
<td>x</td>
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<td>L: WPD</td>
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<tr>
<td>100</td>
<td>Debris Basin Installation/Maintenance - Fresno Canyon Flood Mitigation. Construct a reinforced concrete pipe diversion from upstream of Highway 33 to Ventura River. The purpose of this project is to protect the community of Casitas Springs from a 100-year flood in Fresno Canyon. (IWPP)</td>
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<td>L: WPD</td>
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<tr>
<td>101</td>
<td>Channel Improvements - Howard Ave. Drain. No access road to maintain earth channel. Extend 35” pipe upstream 1060 feet. (IWPP)</td>
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<td>L: WPD</td>
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<tr>
<td>102</td>
<td>Right-of-Way Acquisition - Manuel Canyon. ROW needed to get access for repairs and maintenance. (IWPP)</td>
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<td>L: WPD</td>
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<tr>
<td>103</td>
<td>Flood Modeling - McNeiI Creek Flood Mitigation. Creek is undersized and carries a heavy sediment load. Use modeling to plan improvements. (IWPP)</td>
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<td>L: WPD</td>
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<td>ID#</td>
<td>Tier 1L Project or Program</td>
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<td>Make Physical Improvements</td>
<td>Educate/Engage/Incentivize</td>
<td>Improve/Use Regulations &amp; Policies Regionally</td>
<td>Plan/Collaborate Regionally</td>
<td>Leads (L)</td>
<td>Supporters (S)</td>
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<tr>
<td>104</td>
<td><strong>Flood Modeling - Thacher Creek Flood Mitigation.</strong> Creek is undersized and carries a heavy sediment load. Use modeling to plan improvements. (IWPP)**</td>
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<td>L: WPD</td>
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<tr>
<td>105</td>
<td><strong>Right-of-Way Acquisition - Parkview Drain.</strong> ROW needed to get access for maintenance. (IWPP)**</td>
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<td>L: WPD</td>
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<tr>
<td>106</td>
<td><strong>Debris Basin Installation/Maintenance - Senior Canyon.</strong> Crossings are undersize and debris deposition a problem. Design and construct a new debris/detention basin at the abandoned basin site. (IWPP)**</td>
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<td>L: WPD</td>
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<tr>
<td>108</td>
<td><strong>Channel Improvements - Skyline Drainage Rock RipRap Stabilizer.</strong> Erosion at outlet threatening adjacent bank and trail/access road. Reconstruct concrete rock outlet. (IWPP)**</td>
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<td>L: WPD</td>
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<tr>
<td>109</td>
<td><strong>Channel Improvements - Thacher Creek - Grand Ave.</strong> Calif crossing (bridgeless stream crossing) interrupts sediment transport; local flooding. Replace crossing with a bridge. (IWPP)**</td>
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<td>L: WPD</td>
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<tr>
<td>110</td>
<td><strong>Channel Improvements - Thacher Creek @ Siete Robles.</strong> Community subject to flooding from inadequate channel. Replace. (IWPP)**</td>
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<td>L: WPD</td>
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<td>111</td>
<td><strong>Ventura River Integrated Watershed Protection Plan Annual Update.</strong> Update the IWPP and include a comprehensive survey and engineering analysis of the watershed's drainage infrastructure and cost/benefit of improvements. Consider infrastructure needs in light of megastorm scenarios. Ensure integration of the watershed management plan's flood management priorities in the IWPP. (IWPP)**</td>
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<td>L: WPD</td>
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<tr>
<td>112</td>
<td><strong>Channel Improvements - Vince Street Drain Outlet to Ventura River.</strong> Make improvements to prevent Ventura River flooding and sedimentation of earth channel and inlet to culvert. (IWPP)**</td>
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<td>L: WPD</td>
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<tr>
<td>113</td>
<td><strong>ARKStorm Scenario Drill.</strong> Develop response plans for a megastorm hitting the watershed and test the plans with a full-scale real-time exercise. Work with emergency services, water and sanitary districts, the media, and local and state government.**</td>
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<td>L: WPD</td>
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<tr>
<td>114</td>
<td><strong>100-Year Flood Event Drill.</strong> Work with Watershed Protection District, Public Works Transportation, water and sanitary districts, and local governments to stage a 100-year flood event exercise in the watershed.**</td>
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<td>L: WPD</td>
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<tr>
<td>115</td>
<td><strong>Flood Control Project Design.</strong> Participate in the Watershed Protection District's pre-design stakeholder process for flood control projects.**</td>
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<td>L: Council</td>
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<td>116</td>
<td><strong>Stormdrain Improvements - Ojai Avenue (Eastside).</strong> Area subject to flooding.**</td>
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<td>L: Ojai</td>
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<td>117</td>
<td><strong>Culvert Improvements - Maricopa Hwy at Besant Meadow.</strong> Area subject to flooding.**</td>
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<td>L: Ojai</td>
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<td>Educate/Engage/Incentivize</td>
<td>Improve/Use</td>
<td>Regulations &amp; Policies</td>
<td>Plan/Collaborate Regionally</td>
<td>Leads (L), Supporters (S)</td>
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<td>118</td>
<td>Matilija Dam Removal - Interim Notch of Matilija Dam. Notch the dam down to the existing sediment level.</td>
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<td>L: WPD, S: Coastal Cons., Matilija</td>
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<tr>
<td>119</td>
<td>Matilija Dam Removal. Remove dam to restore sediment transport and access for migrating steelhead, and eliminate the dam failure hazard.</td>
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<td>L: WPD, Coastal Cons.</td>
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<tr>
<td>120</td>
<td>Matilija Dam Removal - Desilting Basin. Construct a desilting basin for diverted surface water before it enters Casitas Reservoir - part of the Matilija Dam Ecosystem Restoration Project.</td>
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<td>L: WPD, Coastal Cons.</td>
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<tr>
<td>121</td>
<td>Matilija Dam Removal - Mitigation: Robles Diversion High Flow Bypass. Construct three additional gates and appurtenant work to allow expected additional sediment to pass by the Robles Diversion - part of the Matilija Dam Ecosystem Restoration Project.</td>
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<td>L: WPD, Coastal Cons.</td>
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<tr>
<td>124</td>
<td>Matilija Dam Removal - Sediment Removal. Remove and dispose of sediment behind the dam - part of the Matilija Dam Ecosystem Restoration Project.</td>
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<td>L: WPD, Coastal Cons.</td>
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<tr>
<td>125</td>
<td>Matilija Dam Removal - Mitigation: Invasive Plant Removal and Retreatment. Retreat areas where Arundo and other invasive species have been removed, from Matilija down to Hwy 150 - part of the Matilija Dam Ecosystem Restoration Project.</td>
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<td>L: WPD, Coastal Cons., OVSD</td>
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<tr>
<td>126</td>
<td>Confluence Wetland Mitigation. Casitas Springs Levee runs through natural wetland at confluence of Ventura River and San Antonio Creek. Lower and realign levee so wetland can be restored. (IWFP)</td>
<td>x</td>
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<td>L: WPD</td>
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<tr>
<td>127</td>
<td>Invasive Plant Task Force. In collaboration with the County Weed Mgmt. Area, establish an invasive plant task force in the watershed to share knowledge/resources, prioritize areas for removal, ensure state-of-the-art procedures are employed, study innovative alternatives, streamline permitting, establish protocols that ensure pesticide use is minimized and maximally effective, and to develop public information materials on the dangers of Arundo and other invasives.</td>
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<td>L: Council</td>
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<tr>
<td>128</td>
<td>Invasive Plant Removal. Remove and monitor Arundo and other invasive non-native species that threaten aquatic habitats.</td>
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<td>L: OVLC, VHC, S: Coastal Cons., Ojai</td>
</tr>
<tr>
<td>129</td>
<td>Steelhead Habitat Enhancement. Support steelhead recovery by creating and maintaining in-stream habitat that supports all life stages of the steelhead. Examples include large woody debris, spawning gravel, riffles, riparian cover and rock outcroppings. Where feasible start with strategic, perennial flow, least cost/greatest gain locations.</td>
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<td>L: VHC, OVLC, CCC, S: Casitas, Ventura Water</td>
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</table>

Goal 4: Healthy Ecosystems
<table>
<thead>
<tr>
<th>ID#</th>
<th>Tier 1L Project or Program</th>
<th>Fill Data Gaps / Analyze</th>
<th>Make Physical Improvements</th>
<th>Educate / Engage / Incentivize</th>
<th>Improve Use / Policies / Regulations / Collaborate Regionally</th>
<th>Leads (L) / Supporters (S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>130</td>
<td>Fish Passage. Remove fish passage barriers (e.g., Matilija Dam; barriers at Wheeler Campground, Ojai Rock Quarry, Camp Comfort and Fraser Street).</td>
<td>x</td>
<td></td>
<td></td>
<td>L: RCD&lt;br&gt;S: Coastal Cons, CCC, Casitas, Matilija</td>
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<tr>
<td>132</td>
<td>Steelhead Pool Development / Maintenance on San Antonio Creek. Support steelhead survival by developing and maintaining over-summering pools in strategic, least cost / greatest gain, perennial flow locations. San Antonio Creek (SAC) offers some of the best habitat for relatively quick improvements to the recovery of steelhead in the watershed.</td>
<td>x</td>
<td></td>
<td></td>
<td>L: OVLC, CCC&lt;br&gt;S: Coastal Cons, Casitas, Ventura Water</td>
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<tr>
<td>133</td>
<td>Steelhead Restoration Plan. Consolidate existing watershed - specific steelhead data (e.g., habitat, population and monitoring data). Identify priority limiting factors for all life stages of the steelhead (e.g., lack of over-summering pools for smolts and older fish, rearing habitats for younger age classes, spawning habitats.) Describe a suite of project types to address these limiting factors. Prioritize stream reaches for steelhead habitat restoration based upon least cost / greatest gain.</td>
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<td>L: CDFW&lt;br&gt;S: Ventura Water</td>
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<tr>
<td>135</td>
<td>Land Protection Plan. Establish land acquisition priorities that best serve the goals and objectives of the watershed management plan (e.g., integrated flood management, water infiltration, public access to nature, habitat connectivity, healthy ecosystems, natural water treatment).</td>
<td>x</td>
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<td>L: OVLC, VHC&lt;br&gt;S: TPL</td>
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<tr>
<td>138</td>
<td>Land and Public Access Protection. Acquire land or conservation easements from willing landowners that provide important watershed functions and values (e.g., integrated flood management, water infiltration, public access to nature, habitat connectivity, healthy ecosystems, natural water treatment).</td>
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<td></td>
<td>L: OVLC, VHC&lt;br&gt;S: Coastal Cons., TPL</td>
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<td>140</td>
<td>Wildlife Connectivity Study. Identify and map wildlife connectivity hot spots.</td>
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<td>L: VHC</td>
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<td>141</td>
<td>Protected Tree Mitigation Fees. Amend Ventura County procedures to allow tree protection mitigation fees to go directly to local conservation entities for restoration work.</td>
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<td>L: VHC, County Planning&lt;br&gt;S: OVLC</td>
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<td>142</td>
<td>Efficient Conservation Subdivision Permit Process. Work with those seeking a conservation subdivision and the Ventura County Planning Division to help make the conservation subdivision process as efficient and inexpensive as possible.</td>
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<td>L: OVLC, VHC</td>
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<td>143</td>
<td>Riparian Habitat and Wetland Restoration. Restore (conservancy-, publicly-, and privately-owned) riparian habitats and wetlands to promote native vegetation growth to benefit fish and wildlife, promote attenuation of flood flows, capture of sediments, treatment of runoff, infiltration and to deter algae growth.</td>
<td>x</td>
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<td>L: OVLC, VHC, CCC&lt;br&gt;S: RWQCB, Casitas, Coastal Cons., OVGC</td>
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<td>144</td>
<td>Arundo Removal in San Antonio Creek at Camp Comfort. Remove Arundo growing within the 2,500-foot stretch of the San Antonio Creek that runs through Camp Comfort.</td>
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<td>146</td>
<td>San Antonio Creek Restoration at Soule Park Golf Course. Restore this stretch of creek by stabilizing the bank and reestablishing riparian vegetation.</td>
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<tr>
<td>147</td>
<td>Invasive Plant Removal and Retreatment - San Antonio Creek. Retreat, for 10 years, areas where Arundo and other invasive plants were removed on San Antonio Creek.</td>
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<td>148</td>
<td>Mitigation Bank. Develop a local mitigation bank as a means to protect and restore existing or degraded wetlands or other sensitive habitats, while providing a mechanism for effective mitigation of development-related impacts.</td>
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<td>149</td>
<td>Steelhead Preserve Education and Conservation Center. Develop a comprehensive watershed education center at the 70-acre historic Hollingsworth Ranch along the Ventura River between Ventura and Ojai. Include displays and demonstrations that interpret and animate the natural and cultural history of the watershed, and community and educational events will be hosted.</td>
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<td>150</td>
<td>Ventura River Parkway Plan. Develop and implement a phased Ventura River Parkway Plan that will improve public access to the river and trail opportunities along the river by working with willing landowners on a voluntary basis.</td>
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**Goal 5: Access to Nature**

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<tr>
<th>ID#</th>
<th>Project Description</th>
<th>Fill Data Gaps / Analyze</th>
<th>Make Physical Improvements</th>
<th>Educate/Engage/Incentivize</th>
<th>Improve/Use Policies</th>
<th>Plan/Collaborate Regionally</th>
<th>Leads (L)</th>
<th>Supporters (S)</th>
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<tbody>
<tr>
<td>151</td>
<td>Trail Guides. Create and distribute trail guides that describe the trails and access points, as well as information on the watershed's ecosystems and the important services and values they provide.</td>
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<td>L: Friends</td>
<td>S: Coastal Cons.</td>
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<td>156</td>
<td>New Family Picnic Areas/Parks. Install vehicle-accessible parks and picnic areas that offer family access to aquatic habitats.</td>
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<td>L: OVLG</td>
<td>S: Coastal Cons.</td>
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<td>157</td>
<td>New Trails. Install sustainably designed new trails and look for appropriate opportunities to serve different types of trail users (walkers, hikers, ADA, bicycle, equestrian).</td>
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<td>L: OVLG</td>
<td>S: Coastal Cons., VHC</td>
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<td>159</td>
<td>Easements and Acquisitions for Lower Ventura River Public Access. Where appropriate, secure public access to the lower Ventura River, such as access to the levee and the under-freeway culvert (now used illicitly) that connects the levee to Ventura Avenue.</td>
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<td>L: Coastal Cons., VHC, Friends</td>
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<td>163</td>
<td>Interpretive Signs. Install and maintain watershed interpretive signs at special/high profile watershed locations and easily accessible river viewpoints.</td>
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<td>L: OVLG</td>
<td>S: Coastal Cons., CCC, VHC, OVLG, Friends</td>
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<td>Lead (L) Supports (S)</td>
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<td>164</td>
<td>Maintain and Improve Existing Trails and Access Locations. Make improvements to existing trails and access locations, such as by expanding access by different types of trail users (walkers, hikers, ADA, bicycle, equestrian). Continue to keep trails accessible and safe, and increase efforts to reduce erosion and related sediment inputs into waterways.</td>
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<td>L: OVLC S: VHC</td>
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**Goal 6: Responsible Land and Resource Management**

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<th>Educate/Engage/Incentivize</th>
<th>Improve/Use Regulations &amp; Policies Regionally</th>
<th>Lead (L) Supports (S)</th>
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<tbody>
<tr>
<td>165</td>
<td>Development Project and New Policy Monitoring. Review and comment on proposed land use projects and policies - by the three local governments in the watershed - on an ongoing basis.</td>
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<td></td>
<td>L: Council</td>
</tr>
<tr>
<td>167</td>
<td>Extended Drought/Climate Change Preparation. Facilitate ambitious, coordinated emergency planning, preparedness, and response for extended droughts.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L: Casitas S: Ventura</td>
</tr>
<tr>
<td>169</td>
<td>Mixed Use Zoning. Amend Ventura County's and the City of Ojai's zoning ordinances to allow appropriate mixed use zoning in urban communities in order to advance our watershed goals, such as minimizing impervious cover and open space loss.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L: Ojai County Planning</td>
</tr>
<tr>
<td>171</td>
<td>Water Efficient Crop Study. Research the feasibility of alternative crops in the watershed that are economically sustainable and low-water using. (Asian Citrus Psyllid contingency plan.)</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>L: RCD</td>
</tr>
<tr>
<td>172</td>
<td>North Ventura Avenue Area Plan. Update Ventura County's North Ventura Avenue Area Plan (integrate appropriate mixed use, LID, Parkway access, mobility, etc.).</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L: County Planning</td>
</tr>
<tr>
<td>173</td>
<td>Agricultural Best Management Practices. Promote agricultural best management practices (e.g., efficient irrigation and nutrient management, use of mulch or compost, swales and grassed drainages, habitat protection, pollution prevention).</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L: Casitas, RCD S: Coastal Cons., CCC, Colab</td>
</tr>
</tbody>
</table>

**Goal 7: Coordinated Watershed Planning**

<table>
<thead>
<tr>
<th>ID#</th>
<th>Tier 1L Project or Program</th>
<th>Fill Data Gaps/Analyze</th>
<th>Make Physical Improvements</th>
<th>Educate/Engage/Incentivize</th>
<th>Improve/Use Regulations &amp; Policies Regionally</th>
<th>Lead (L) Supports (S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>174</td>
<td>Watershed and River Signs. Install and maintain &quot;Entering Ventura River Watershed&quot; highway signs and watercourse crossing signs along major roads crossing the Ventura River and its tributaries.</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>L: WPD S: OVGC</td>
</tr>
<tr>
<td>175</td>
<td>Watershed Education Center. Support the efforts of the Ojai Valley Land Conservancy to develop a comprehensive watershed education center to serve as a center of learning on all aspects of the watershed and its management. Include education/stewardship for youth and Spanish-speakers; facilitate student and low-income access to the center; integrate Chumash information.</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>L: OVLC</td>
</tr>
<tr>
<td>178</td>
<td>Watershed Council - Council and Coordinator. Develop ongoing funding for the watershed coordinator and Watershed Council, or form a different organizational vehicle to achieve watershed management goals. Maintain Council website and serve as a data and information clearinghouse. Coordinate the implementation campaigns.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L: Council S: RCD</td>
</tr>
</tbody>
</table>
### Table 2.4.2.1 Tier 1L Priority Projects and Programs (continued)

<table>
<thead>
<tr>
<th>ID#</th>
<th>Tier 1L Project or Program</th>
<th>Fill Data Gaps</th>
<th>Analyze Make Improvements</th>
<th>Educate/Engage/Incentivize</th>
<th>Improve/Use Regulations &amp; Policies</th>
<th>Plan/Collaborate Regionally</th>
<th>Leads (L) / Supporters (S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>179</td>
<td>Watershed Council - Watershed Management Plan. Maintain a &quot;living&quot;</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>watershed management plan by updating and redistributing the plan every 3 to 5 years.</td>
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<td>L: Council</td>
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<tr>
<td></td>
<td>annual performance evaluation program to track the performance and effectiveness of</td>
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<td></td>
<td>L: Casitas, OVLC,</td>
</tr>
<tr>
<td></td>
<td>the watershed management plan.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Friends</td>
</tr>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>S: WPD, Ventura</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Water, Ventura</td>
</tr>
<tr>
<td>183</td>
<td>Youth Education. Support programs that engage youth in the watershed, such as the</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>&quot;Once Upon a Watershed&quot; education program and youth camps that take youth out to</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>nature.</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>184</td>
<td>Watershed Stewardship Opportunities. Continue and expand opportunities for citizens</td>
<td></td>
<td></td>
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<td></td>
<td>to learn about good stewardship and participate directly in stewardship projects.</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>L: Council</td>
</tr>
<tr>
<td>185</td>
<td>Watershed Curriculum. Develop a Ventura River watershed curriculum using the maps</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td>and information developed for the watershed management plan. Distribute to local</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>public and private schools.</td>
<td></td>
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</tr>
</tbody>
</table>

Note: "ID#" in the table is only a reference number and does not indicate priority.

1L = A Tier 1 project or program which has a "lead"—an entity or organization willing to lead the project or be the grant applicant.

**Abbreviations:**

- CCC—California Conservation Corps
- Casitas—Casitas Municipal Water District
- Coastal Cons.—California Coastal Conservancy
- Colab—Ventura County Coalition of Labor, Business, and Agriculture
- Council—Ventura River Watershed Council
- County of Ventura—County of Ventura, Public Works
- County Planning—Ventura County Planning Division
- COUNTY RMA—Ventura County Resource Management Agency
- EHD—Ventura County Environmental Health Division
- Friends—Friends of Ventura River
- Matilija C.—Matilija Coalition
- MOWD—Meiners Oaks Water District
- OBGMA—Ojai Basin Groundwater Management Agency
- Ojai—City of Ojai
- OVGC—Ojai Valley Green Coalition
- OVLC—Ojai Valley Land Conservancy
- OVSD—Ojai Valley Sanitary District
- Parks—Ventura County Parks Department
- RCD—Ventura County Resource Conservation District
- RWQCB—California Regional Water Quality Control Board—Los Angeles District
- SBCK—Santa Barbara Channelkeeper
- SCC—State Coastal Conservancy
- Surfrider—Ventura Chapter of the Surfrider Foundation
- TPL—Trust for Public Lands
- WPD—Ventura County Watershed Protection District
- Ventura—City of Ventura
- Ventura Water—City of Ventura’s Water Division
- VHC—Ventura Hillsides Conservancy
PART 3

Watershed Characteristics

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3.5 Water Quality .......................................................... 428
3.6 Ecosystems and Access to Nature ............................... 492
3.7 Land Use and Demographics ...................................... 656
3.1 Overview and Quick Facts

3.1.1 Quick Facts ...................................................... 188

Lake Casitas
Photo courtesy of Michael McFadden
3.1 Overview and Quick Facts

“Watershed Characterization,” Part 3 of this plan, provides an overview of the current physical, biological, hydrological, and social conditions of the Ventura River watershed. Prepared with the latest available technical data and information and input from a multi-stakeholder review, the Watershed Characterization is intended to help all stakeholders, including water managers, policy makers, regulators, residents, businesses, and students, better understand the watershed and its many interdependent relationships.

The characterization is data-rich—featuring photos, maps, graphics and explanatory sidebars—but is intended to be engaging and easily understandable by lay readers. Each section includes a list of the key documents on that topic where readers can find more detailed and technical information.
3.1.1 Quick Facts

**Location:** The Ventura River watershed is located in southern California, in western Ventura County, with a small section in the northwest corner located in eastern Santa Barbara County. At 226 square miles, it is the smallest of the three major watersheds in Ventura County, which are the Ventura River, Santa Clara River, and Calleguas Creek watersheds.

<table>
<thead>
<tr>
<th></th>
<th>Square Miles</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventura River</td>
<td>226</td>
<td>144,833</td>
</tr>
<tr>
<td>Calleguas Creek</td>
<td>343</td>
<td>219,520</td>
</tr>
<tr>
<td>Santa Clara River</td>
<td>1,634</td>
<td>1,045,760</td>
</tr>
</tbody>
</table>

The watershed is fan-shaped: It measures 18 miles north to south, is 17 miles at its widest point and 1.3 miles wide at its narrowest point, the estuary.
The Ventura River runs through the center of the watershed, draining numerous tributaries along a 33.5-mile run from its headwaters in the Transverse Ranges to the Pacific Ocean. The main stem of the Ventura River originates at the junction of Matilija Creek and North Fork Matilija Creek, 16.2 miles from the Pacific Ocean.

**Subwatersheds:** The Ventura River is fed by five significant tributaries that form "subwatersheds" nested within the larger Ventura River watershed. These tributaries, and subwatersheds, include Matilija Creek, North Fork Matilija Creek, San Antonio Creek, Cañada Larga Creek, and Coyote Creek. Ridges form the rims of these subwatersheds. The main stem of the Ventura River forms a sixth subwatershed.

**Subwatershed Relationships**

Subwatersheds exhibit the same intra-relationship dynamics as the larger watersheds of which they are part. For example, groundwater levels in the San Antonio Creek subwatershed affect streamflow in the San Antonio Creek, which can affect the creek's water quality and availability of instream habitat for fish. Subwatersheds also have inter-relationships with the larger watershed. For example, the quality of water in San Antonio Creek ultimately affects the quality of water in the Ventura River watershed's estuary.
Figure 3.1.1.2 Subwatersheds Map
Land Use and Demographics: Conditions in the watershed remain natural and undeveloped, with 57% of its land area in protected status. Most of the watershed’s primary streams and drainages are unchannelized, though two dams—Casitas and Matilija Dams—and three levees—Ventura River, Casitas Springs, and Live Oak—have modified natural hydrologic patterns.

The northern half of the watershed lies within Los Padres National Forest. The watershed’s southern half includes two cities and a number of unincorporated communities. The population is approximately 44,140, which represents just 5.4% of Ventura County’s population of 823,318 residents (as of 2010 Census). The City of Ojai lies entirely within the watershed, 13 miles inland at an elevation of 746 feet. Thirteen percent of the City of Ventura lies within the watershed, adjacent to the coast and the lower stretch of the Ventura River. The population of the watershed is relatively small and the rate of growth low.

Developed land (excluding grazing) comprises only about 13% of the total land area in the watershed. Agriculture is the dominant land use. Citrus and avocados are the primary irrigated crops grown, and a significant area of land is used for cattle grazing.
Lower Ventura River Watershed Land Uses: Urban, Oil Extraction, Agriculture

Photo courtesy of Brian Hall, by way of Santa Barbara Channelkeeper and LightHawk
Water Quality: Surface water quality is good compared with more developed watersheds in the region and has improved notably in recent decades. Despite relatively good water quality, all of the watershed's major waterbodies are on the Clean Water Act Section 303(d) list of impaired waterbodies. Between these waterbodies there are 14 different types of impairments.

Water Supply: Unlike most all of its neighbors in southern California, the Ventura River watershed truly depends upon its watershed to "shed" water. All of the water used in the watershed falls from the sky. Lake Casitas serves as the major surface water supply reservoir in the watershed and groundwater is heavily relied upon. On average, surface water comprises about 55% of the water recovered from the watershed and groundwater comprises about 45%.

Cycles of drought and flooding occur regularly. Annual rainfall in downtown Ojai has ranged from a low of seven inches to a high of 49 inches—a sevenfold variation. Because the annual amount of rainfall received is highly variable, water supplies must be managed with caution.
Two small coastal watersheds—the North Ventura Coastal Streams watershed and the Buenaventura watershed—flank the Ventura River watershed's lower section and are dependent on its water. Water from the Ventura River watershed is used to irrigate avocado orchards in the North Ventura Coastal Streams watershed and serves a significant population in a portion of the Buenaventura watershed that lies within the City of Ventura.

**Flooding:** The steep terrain of the Ventura River watershed, coupled with intense downpours that can occur in its upper portions, result in flash flood conditions where floodwaters rise and fall in a matter of hours. Major or moderate floods have occurred once every five years on average since 1933.

**Habitat and Species:** The watershed's rugged topography, largely undeveloped status, and Mediterranean climate combine to make for an area of exceptional biodiversity. It supports a diverse array of natural habitats, including 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. The Ventura River estuary, at the mouth of the Ventura River, is an exceptionally valuable wetland habitat and ecological resource in the watershed.
The watershed is home to numerous protected species and habitats, including 137 plants and animals protected at either the federal, state, or local level. The federally endangered southern California steelhead is of particular importance, given the watershed’s often dry and always variable climate. Removing Matilija Dam, in part to return access to the steelhead to spawning habitat, is a major project that is underway in the watershed. The watershed is also challenged by invasive, non-native species, such as *Arundo donax*.

The watershed is a recreation destination for hikers, walkers, bikers, surfers, campers, fishermen, boaters, backpackers, equestrians, and birders, as well as artists, spiritual seekers, and students of natural history. Many local organizations are committed to providing the public with access to nature and nature-based recreation opportunities.
3.2 Physical Features

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3.2.2 Geology and Soils .................................................. 209
3.2.3 Geomorphology and Sediment Transport ................. 229

Top of the Ventura River Watershed:
Highway 33 Runs Across the Steep Transverse Ranges
3.2 Physical Features

3.2.1 Climate

The Ventura River watershed has a two-season Mediterranean climate: a cool winter-spring wet season and a long summer-fall dry season without measurable rain.

3.2.1.1 Climate Zones

The watershed has three distinct climate zones: the low-lying coastal area within a few miles of the ocean; the inland, higher elevation valley floor area where most of the inland development and farming is located; and the mountainous area above the valley floor. The coastal area has smaller seasonal and daily variations in air temperature, cooler summer air temperatures, moister air and less rainfall than inland areas. It is subject to an inversion layer that traps cool, moist air at low elevations, producing fog or low clouds during the night and early morning hours. The inland areas have greater rainfall than coastal areas, along with drier air, and a greater range of daily and seasonal air temperature variation, with summer temperatures averaging 10°F to 15°F hotter. The high elevation mountainous area receives the most rain.

3.2.1.2 Air Temperature

July and August are typically the hottest months in the watershed. From late September through March, the watershed can experience “Santa Anas,” which are strong, warm, very dry winds that blow in from the deserts to the east and are associated with the rapid spread of wildfires. These winds are felt mostly in the coastal areas, although their drying effects extend inland.

In winter, the inland areas of the Ojai Valley experience an average of 31 days where the temperature drops below freezing; in the coastal zone, freezing temperatures are only reached an average of two days a year (WRCC 2013).

The highest temperature recorded in Ojai was 119°F, on June 16, 1917, and the lowest recorded temperature was 13°F on January 6, 1913 (WRCC 2013).
Figure 3.2.1.2.1 Historical Average Minimum and Maximum Temperature

* Extreme maximum and minimum temperatures not available for this location.
** Oxnard data is a proxy for Ventura, as the weather is very similar and there is no weather station in Ventura.

Data sources: Matilija Dam - PRISM Climate Group 2013; Ojai and Oxnard - Western Regional Climate Center (WRCC 2013)

Table 3.2.1.2.1 Historical Average Minimum and Maximum Temperature

<table>
<thead>
<tr>
<th></th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matilija Dam 1905–2011</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>avg max temp (°F)</td>
<td>57.2</td>
<td>59.2</td>
<td>62.0</td>
<td>67.2</td>
<td>73.5</td>
<td>81.5</td>
<td>89.3</td>
<td>89.3</td>
<td>85.0</td>
<td>75.9</td>
<td>65.8</td>
<td>58.4</td>
</tr>
<tr>
<td>avg min temp (°F)</td>
<td>35.7</td>
<td>37.3</td>
<td>38.9</td>
<td>41.9</td>
<td>47.4</td>
<td>53.5</td>
<td>60.2</td>
<td>59.6</td>
<td>55.5</td>
<td>48.2</td>
<td>40.3</td>
<td>36.3</td>
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<tr>
<td>Downtown Ojai 1905–2012</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>avg max temp (°F)</td>
<td>66.6</td>
<td>67.9</td>
<td>70.2</td>
<td>74.0</td>
<td>77.4</td>
<td>83.4</td>
<td>90.9</td>
<td>91.5</td>
<td>88.7</td>
<td>82.1</td>
<td>74.7</td>
<td>67.9</td>
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<tr>
<td>avg min temp (°F)</td>
<td>35.9</td>
<td>38.0</td>
<td>39.9</td>
<td>43.1</td>
<td>46.9</td>
<td>50.3</td>
<td>54.5</td>
<td>54.3</td>
<td>52.1</td>
<td>46.7</td>
<td>40.3</td>
<td>36.4</td>
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<tr>
<td>Oxnard (Proxy for Ventura) 1923–2003</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>avg max temp (°F)</td>
<td>65.5</td>
<td>66.0</td>
<td>66.5</td>
<td>68.0</td>
<td>69.2</td>
<td>71.2</td>
<td>74.0</td>
<td>74.7</td>
<td>74.8</td>
<td>73.9</td>
<td>71.1</td>
<td>66.5</td>
</tr>
<tr>
<td>avg min temp (°F)</td>
<td>43.5</td>
<td>44.5</td>
<td>45.7</td>
<td>47.8</td>
<td>50.9</td>
<td>53.8</td>
<td>56.7</td>
<td>57.5</td>
<td>56.0</td>
<td>52.2</td>
<td>47.2</td>
<td>44.2</td>
</tr>
</tbody>
</table>

Data source: Matilija Dam - PRISM Climate Group 2013; Ojai and Oxnard - Western Regional Climate Center (WRCC 2013)

Table 3.2.1.2.2 Average Annual Temperature (°F)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Downtown Ojai (1905–2012)</td>
<td>61.37</td>
</tr>
<tr>
<td>Oxnard (Proxy for Ventura) (1923–2003)</td>
<td>60.11</td>
</tr>
</tbody>
</table>

Note: Average temperature data is not available for Matilija Dam.
Data source: Western Regional Climate Center (WRCC 2013)
Aerial View of Fog in the River Valley. The climate of the watershed is also influenced by fog. From mid-May to mid-July, fog and low clouds commonly hug the coastline, typically retreating offshore by afternoon. Drizzle frequently falls in the morning when the fog is thickest. The fog conditions begin to decrease in intensity and duration from mid-July through mid-September. The fog is much more dominant at the coast, as in the interior valleys it is more readily dissipated by solar heating (VCAPCD 1998).

3.2.1.3 Rainfall

Rainfall is highly variable in the watershed—seasonally, and from year to year. Rainfall typically occurs in just a few significant storms each year, which can come any time between October 15 and April 1, with 90% of the rainfall occurring between November and April (VCWPD 2010). Snowfall is generally minimal and short-lived.

Definition: Water Year

A "water year" or "rain year" is defined as October 1 of the previous year through September 30. For example, water year 2003 is from October 1, 2002, through September 30, 2003.

The Ventura River watershed's rainfall patterns are also variable geographically. The rainfall totals from the watershed's three climate zones shown in Table 3.2.1.3.1 illustrate that, on average, the watershed's upper area (Matilija Canyon) receives over twice as much rainfall, almost 20 inches more, as its lower areas (downtown Ventura). See "4.4 Appendices" for the annual rainfall data for the years 1873 to 2012.
Table 3.2.1.3.1 Rainfall Average and Median (inches/year)

<table>
<thead>
<tr>
<th>Station #</th>
<th>Water Years</th>
<th>Average</th>
<th>Median</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matilija Canyon (upper watershed)</td>
<td>207</td>
<td>1960–2012</td>
<td>35.17</td>
<td>28.74</td>
<td>9.09</td>
</tr>
<tr>
<td>Downtown Ojai (middle watershed)</td>
<td>30</td>
<td>1906–2012</td>
<td>21.31</td>
<td>19.20</td>
<td>6.88</td>
</tr>
<tr>
<td>Downtown Ventura (lower watershed)</td>
<td>66</td>
<td>1873–2012</td>
<td>15.46</td>
<td>14.12</td>
<td>4.62</td>
</tr>
</tbody>
</table>

Data Source: VCWPD Hydrologic Data Server (VCWPD 2013)

Figure 3.2.1.3.1 Average Monthly Rainfall, 1906–2011 (Matilija Dam, Ojai, Ventura)

Data Source: VCWPD Hydrologic Data Server (VCWPD 2013)

Since 1906, 67% of the years have had less than average rainfall in downtown Ojai.
Average annual rainfall does not adequately convey the reality of the rainfall situation, however. Very few years actually have average rainfall; most years are drier than average, and a relatively few very wet years heavily influence the average (Leydecker & Grabowsky 2006).

For example, rainfall data (Table 3.2.1.3.1.) collected since 1906 show that annual rainfall in downtown Ojai has ranged from a low of 6.88 inches in 1924 to a high of 49.20 inches in 1998; average rainfall over this period was 21.31 inches. Since 1906, 67% of the years have had less than average rainfall in downtown Ojai.


<table>
<thead>
<tr>
<th>Mean vs. Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>The use of “averages,” also known as the “mean,” to convey rainfall information can be misleading in a watershed with as much rainfall variability as the Ventura River watershed. The average yearly rainfall in the watershed is not equal to the rainfall that most typically occurs in the watershed, because the average rainfall figure is derived from more years that are dry and many fewer very wet years.</td>
</tr>
<tr>
<td>“Median” values give a truer picture of the actual experience of rainfall in the watershed in a typical year. A median rainfall value indicates that half the measurements (daily, monthly or annually) are above and half the measurements are below the median. An average rainfall value, on the other hand, averages all the measurements; average rainfall numbers end up higher than median numbers because of the really big rain years (called “outliers” in statistics). One extreme rain event will have less of an effect on a median value than an average value.</td>
</tr>
</tbody>
</table>
Precipitation

Ventura River Watershed

Average Annual Precipitation (inches) based on data from 1971 - 2000

Data Source:
Precipitation/PWIP Data
Map Created by Greenfield Network using ArcGIS software
October 2013 www.greenfield.org

Figure 3.2.1.3.2 Precipitation Map
The Ventura River watershed receives more rainfall than other watersheds in Ventura County. The reason: a 5,560-foot elevation gain in just six miles, from downtown Ojai to the top of Chief Peak behind the city. This wall of vertical mountains near the coast causes what is called “orographic lift”: air coming in from the ocean hits the mountains, rises up quickly, cools, condenses, and forms rain. This orographic lift can cause heavy-intensity rainfall events over the mountains of the watershed, most notably in the Matilija Creek subwatershed, the primary headwaters of the watershed. In 2005, 97 inches of rainfall was recorded on the Murrieta divide above Matilija Creek (Holder 2012). The peak historic rainfall intensity was approximately 4.04 inches per hour measured during a 15-minute period at the Wheeler Gorge gauge in the mountains adjacent to Ojai (VCWPD 2010).

**Figure 3.2.1.3.3 Ojai Historical Rainfall: Rain Years 150% or Greater than Average.** Since 1906, there have been 15 years of significantly high rainfall (at least 150% of average—or greater than 32 inches) in downtown Ojai. This is an average of once every seven years. Average rainfall in downtown Ojai during this period was 21.31 inches.

Data Source: VCWPD Hydrologic Data Server (VCWPD 2013)
**El Niño/La Niña Weather Cycle**

The watershed is subject to an El Niño/La Niña weather cycle that can also affect winter precipitation amounts. In our area, the El Niño/La Niña weather pattern is characterized by warming and cooling cycles in the waters of the eastern equatorial Pacific Ocean, which typically have a 1.0- to 1.5-year duration and a 3- to 8-year recurrence interval. Elsewhere in southern California, El Niño years are generally characterized by relatively high rainfall intensities; La Niña years are generally characterized by lower than average rainfall. In the Ventura River watershed, however, the correlation between El Niño/La Niña events and rainfall amounts is somewhat weak, especially relative to the typical variability. As Figure 3.2.1.3.4 illustrates, rainfall amounts have been below average in moderate El Niños and above average in weak La Ninas. The most significant pattern is that strong El Niños bring above normal rainfall, sometimes substantially more than normal (Shaeffer 2013; Leydecker & Grabowsky 2006).

![Effects of El Niño on Rainfall in Ventura](image)

*Figure 3.2.1.3.4 Effects of El Niño on Rainfall in Ventura. Average rainfall (15.23 inches) is represented as zero on this chart. Rainfall numbers below zero indicate less than average rainfall, and numbers above indicate greater than average. Data Source: Golden Gate Weather Service 2013; VCWP's Hydrologic Data Server (VCWP 2013)*
Wet/Dry Cycles

The watershed typically experiences multi-year cycles of wetter years and drier years. Determining approximately when wet and dry groups of years have occurred in the past is helpful to understanding the relationships in the watershed between these wet/dry cycles and floods, fires, sediment transport, and other related factors. For example, major floods generally occur during wet periods, which is when most of the sediment is transported. Major fires tend to occur at the end of wet periods and the beginning of dry periods (Stillwater Sciences 2011).

Most of California’s moisture originates in the Pacific Ocean. During the wet season, the atmospheric high pressure belt that sits off western North America shifts southward, allowing Pacific storms to bring moisture to California. Atmospheric river storms—storms fueled by concentrated streams of water vapor from the Pacific Ocean—are big contributors to annual water supply conditions. A few major storms more or less shift the balance between a wet year and a dry one.

—*Drought in California, Calif. Dept. of Water Resources Brochure* (CIDWR 2012)

![Wet and Dry Periods, 1892-2013](image)

**Figure 3.2.1.3.5 Wet and Dry Periods in the Ventura River Watershed, 1892–2013.** Blue bars indicate wet periods and orange bars indicate dry periods. Hatched bars indicate that the long-term wet or dry trend is not yet clear. These periods were determined by analyzing how the annual rainfall of each year in the past departs from the long-term average annual rainfall—cumulatively, over time. Records from the City of Ojai were used since this location is central in the watershed; however, records from the City of Ventura go back in time a little further and were used for the years 1892 to 1905.

*Data Source: VCPD Hydrologic Data Server (VCPD 2013)*
Figure 3.2.1.3.5 illustrates the watershed’s history of wet and dry periods since 1892. Dry periods include: 1984–1904, 1919–1934, 1945–1965, 1970–1977, 1984–1991, 1999–2004, and 2007–2013. (Note: these data are based on “water years” which run from October 1 of the previous year through September 30 of the year indicated.) While there were years of high rainfall during these dry periods, the predominance of dry years resulted in an overall long-term downward trend in rainfall, which is reflected in the ability of water reserves—groundwater basins and reservoirs—to replenish themselves.

Lake Casitas is managed to maintain water supplies during a repeat of the 21-year dry period from 1945 to 1965 (the longest drought on record at the time of design).

Drought and Floods—a Long History

A drought cycle started in the watershed in 1944, and didn’t let up for 21 years. Throughout the late 1940s and early 1950s, residents and farmers struggled to obtain water. In the growing community of Oak View, wells went dry and residents had to truck in water (CMWD 2013).

Although official rainfall records are not available before 1892, historical records confirm a similar record of regular wet and dry periods. The following references to drought are from The San Francisco Estuary Institute’s Historical Ecology (Beller et al. 2011) analysis of the Ventura River:

**1776:** Did not rain much this year ... watering places gave out and the country was very dry and cracked ...
— Font 1776, in Bolton et al. 1930

**1809:** It has not rained at all thus far this year. You can well imagine the inevitable hardship caused by the resulting lack of fodder and pasture, and the severe damage to our crops.
— Fray José Sefián, April 4, 1809

**1810:** The year when [Ventura] river had its great flood ...
— Harrington 1986b

**1828:** [22-month drought] struck down thousands of the mission’s animals ...
— Smith 1972

**1838–45:** Greatest drought ever known.
— Ventura Free Press 1895

**1839–40:** The winter ... was a severe one in California, an immense quantity of rain falling.
— Davis 1929

**1861–62:** Greatest storm in the written history of California ...
— Engstrom 1996

**1861–62:** During the winter of 1861–62, there was an excessive amount of wet weather ... all the land to a great depth was saturated and reeking; live stock was reduced almost to starvation, the animals dying in great numbers. Landslides were very frequent ...
— Storke 1891

**1864:** Great drought. Thousands of cattle, horses, etc., starved to death.
— Ventura Free Press 1895

**1867:** Even higher water occurred in the Ventura River [than in 1861–62].
— Moore 1936
3.2.1.4 Local Climate Monitoring

**Western Regional Climate Center (WRCC)**
Regional Climate Centers deliver climate services at national, regional and state levels working with National Oceanographic and Atmospheric Administration (NOAA) partners in the National Climatic Data Center, National Weather Service, the American Association of State Climatologists, and NOAA Research Institutes. One station in Ojai provides temperature data to WRCC; Oxnard is the nearest coastal station for temperature data. WRCC also monitors precipitation data (WRCC 2013).

**PRISM Climate Group**
The PRISM Climate Group combines actual monitored temperature data with climate modeling techniques to produce spatial climate datasets to reveal short- and long-term climate patterns. The data covers the period from 1895 to the present. The PRISM Climate Group also monitors precipitation data (PRISM 2013).

**Casitas Municipal Water District**
The Casitas Municipal Water District maintains two weather stations, one in the recreation area and one at Casitas Dam. Evaporation, temperature, and rainfall are monitored.
Ventura County Watershed Protection District [VCWPD]

Historical Rainfall Data. VCWPD maintains 26 active rainfall gauges throughout the watershed, a number of which have been logging data since 1906. These gauges monitor daily observations, and some take hourly and 15-minute readings. Some have pan evaporation measurements as well. The gauges located in the Ventura River watershed are numbered as follows: 4A, 20B, 30D, 59, 64B, 66E, 85, 122, 134B, 140, 153A, 165C, 204, 207C, 218, 254, 264, 300, 301, 302, 303, 304, 305, 306, 307, 308. VCWPD makes the data available on their Hydrologic Data Server website, which provides rain, stream and evaporation data.

See “4.4 Appendices” for the annual rainfall data for the years 1873 to 2012.

www.vcwatershed.net/hydrodata/php/getstations.php?dataset=rain_hour&order=site_id

Current Rainfall Data. VCWPD also provides current (almost real-time) rainfall data at a website that is updated every 10 minutes. The site includes National Weather Service warnings.

www.vcwatershed.net/fws/gmap.html

3.2.1.5 Key Data and Information Sources/ Further Reading

Ventura River Watershed Hydrology Model, Data Summary Report. The Data Summary Report—prepared for the Ventura County Watershed Protection District as part of development of a hydrology model for the watershed—contains a detailed analysis of precipitation, evaporation, and evapotranspiration in the watershed (Tetra Tech 2008).

Gaps in Data/Information

Temperature is monitored at only one inland location (in Ojai) and at no coastal locations in the watershed. The nearest coastal temperature monitoring location is in the City of Oxnard, so this is used as a proxy for the City of Ventura or coastal watershed temperatures.
3.2.2 Geology and Soils

3.2.2.1 Landform Zones

The Ventura River watershed has three distinct landform zones: the mountains and foothills of the Transverse Ranges, the broad valley floors, and the coastal zone. These zones define the watershed and influence its hydrology in many important ways, from how much and where it rains, to how much water it can store, to the biodiversity of its ecosystems.

Aerial View of Watershed Landforms
Photo courtesy of Brian Hall, Santa Barbara Channelkeeper & LightHawk (aerial support)

Mountains and foothills dominate the watershed. Only 35 square miles (15%) of the watershed are flat (with a slope of 10% or less). This includes the broad valley floors where most of the residences and farms are concentrated, and the coastal zone. The coastal zone includes the delta and coastline, the delta being the land at the mouth of the river formed over time by the deposition of sediments carried by the river. The delta surrounds and contains the Ventura River estuary, a dynamic zone of interaction between the fresh and salt waters of river and ocean and their hydrologic and biologic systems.
Mountains

Dramatically steep, folded and faulted, rocky and erodible: these are the notable geologic characteristics of the Ventura River watershed’s mountains.

In just 10 miles (as the crow flies), the land of the watershed rises from sea level to the top of Mount Arido at 6,010-foot elevation—a gain of 601 feet per mile. Even steeper is the elevation gain from downtown Ojai, at 746-foot elevation, to the top of Chief Peak at 5,560-foot elevation in just six miles—a gain of 802 feet per mile. These dramatically steep mountains of the watershed squeeze more water out of the air, but shed that water quite quickly, making for fast-moving, “flasky” storm flows.

Figure 3.2.2.1.1 3D Watershed Map
Source: Vision Plan for the Lower Ventura River Parkway
(CalPoly 2008)

Folded and Erosive Mountains, Matilija Canyon
Photo courtesy of Michael McFadden
Figure 3.2.2.1.2 Elevation Map
Mountains and foothills make up 85% of the watershed, covering most of its north half and framing it on three sides. The watershed's Santa Ynez and Topalopa mountain ranges are part of the Transverse Ranges, which lie along an east-west axis, running from the Santa Barbara coast east to the Mojave and Colorado deserts.

Major peaks in the watershed are Mount Arido (6,010 ft.), Chief Peak (5,560 ft.), Old Man Mountain (5,538 ft.), White Ledge Peak (4,640 ft.) and Nordhoff Peak (4,485 ft.) (USFS 2005).

**California's Transverse Ranges**

The Ventura River watershed is located in the Transverse Ranges province, an east-west trending series of steep mountain ranges and valleys. The Transverse Ranges hold the distinction of being one of the fastest rising anticlines (a type of folded geologic structure) in the United States, with uplift rates as high as 0.2–0.4 inches per year. The Transverse Ranges started being uplifted, folded, and faulted about 1 million years ago (in the middle Pleistocene) and the distortion and rise continues today at the same rapid geologic rate (Ferren et al. 1990).

**Figure 3.2.2.1.3 Transverse Ranges Map**

Image source: California Geological Survey (CGS 2002)

Geologically, the mountains are primarily comprised of 3- to 70-million-year-old (Tertiary) sedimentary rocks—sandstones, siltstones, conglomerates, and shales originally deposited in horizontal layers.
Although these bedrock sequences have been severely deformed by folding and faulting, they remain fairly well consolidated and have low permeability relative to the unconsolidated alluvial deposits of the valley floors (EDAW 1978). They are, however, highly erosive.

**Definition: Alluvial Deposits**

Alluvial deposits are loose, unconsolidated sediments that have been transported by and deposited from running water.

Conglomerate, San Antonio Creek, Camp Comfort

Foothills East of Lower Ventura River
Photo courtesy of Bruce Perry, Department of Geological Sciences, CSU Long Beach
Figure 3.2.2.1.4 The Monterey Formation Map. The “Monterey Formation,” often referred to as “Monterey Shale,” is a geologic formation that is a major petroleum source and host rock in California. There has been some discussion in the watershed, and in nearby Malibu Creek watershed, about whether this rock formation may be contributing nutrients to the water (Orton 2009). This discussion is relevant to the regulatory mandates to reduce nutrient inputs in the watershed. The Monterey Formation forms the ridge top of Sulphur Mountain, contributing sediment to the valleys on each side, and crosses lower San Antonio Creek and the Ventura River.

Figure 3.2.2.1.5 Geology Map. The major groundwater basins of the Ventura River watershed are located in the alluvial fill valleys.

See the Watershed Council's website Map Atlas for more detailed geology maps (7.5' Quadrangle Dibblee Maps).
Valley Floors

The 15% of the watershed that is relatively flat is found largely along the broad valley floors associated with the Ventura River, its stream channels, alluvial fans, and river terraces. This includes the area of the City of Ojai, the orchards of the Ojai Valley’s East End, the valley floor of Upper Ojai, and the broad valley along the main stem of the Ventura River.

These broad, flat valley floors are largely filled with relatively shallow unconsolidated alluvial deposits of silt, sand, gravel, cobbles, and boulders eroded from the surrounding mountains over millions of years (EDAW 1978). The alluvial valley fills constitute the major groundwater aquifers, and the major groundwater basins of the Ventura River watershed are located in these valleys (Entrixt & Woodward Clyde 1997). Numerous terraces, caused by vertical uplift, are present along both the west and east sides of the Ventura River.

The East End, Ojai Valley Floor

Floodplain Terrace, Rancho Matilija
Photo courtesy of Rick Wilborn

The Avenue Area, Lower Ventura River Valley Floor
Photo courtesy of Stephanie Grumbeck, Brooks Institute of Photography
Coast

In the coastal zone, significant landforms include the Ventura River delta and the beach. The delta is the area of land where the Ventura River meets the Pacific Ocean. As fast-moving, sediment-filled floodwaters approach the ocean, they spread out and slow down, depositing boulders, cobble, and sediments. Over time, this deposition has built up a two-mile long, arc-shaped bulge in the coastline that extends from beyond Emma Wood State Beach above the river mouth to just short of the pier below.
Intermixed Beach Cobble Substrate. The cobble substrate of the delta is intermixed with fine sediments derived from both the river and the longshore littoral (sand and rock) current (Capelli 2010). Submerged delta sediments also extend farther offshore.

The Ventura River delta is one of the few actively expanding deltas on the southern California coast. Because of rapid tectonic uplift and high rates of erosion, the Ventura River delta is one of the few actively expanding deltas on the southern California coast (Entrix & Woodward Clyde 1997). Beaches for several miles south of the river depend on this sediment for new sand supply. The delta allows the formation of the river's estuary, the exceptionally valuable wetland habitat where the fresh water riverine and saltwater ocean processes converge. Although relatively small in size, the estuary is a very important ecological resource in the watershed.

Ventura River Estuary, February 2014
Photo courtesy of Rick Willborn
The Ventura River has two major dams (Matilija and Casitas) and a river diversion (Robles Diversion Facility) that inhibit the natural downstream flow of sediment from the mountains to the coast. Significant armoring of the coastline east of the Ventura River has further reduced the amount of sand delivered to the beaches through the longshore littoral current. Beach and delta erosion is an important watershed management concern. See "3.2.3 Geomorphology" for an expanded discussion of this topic.

3.2.2.2 Soils

Soils are classified by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) into one of four hydrologic soil groups—A, B, C, or D—based on the water infiltration rate when the soils are not protected by vegetation, are thoroughly wet, and are receiving precipitation from long-duration storms (Cardno-Entrix 2012). Finer-grained soils (clays) have very low water-infiltration rates but a high water holding capacity compared with larger-grained soils (sands and small gravels) that exhibit the opposite characteristics.

**VCWPD Soil Classification System**

The Ventura County Watershed Protection District (VCWPD) has developed a more detailed soil classification system for the purposes of hydrology studies and project design. That system groups soils into seven hydrologically homogeneous families. See the VCWPD Design Hydrology Manual for more information (VCWPD 2010a).

The map of the watershed's hydrologic soil groups (Figure 3.2.2.2.1) shows that the areas of significant infiltration of water into the soil are the alluvial fan heads—by Senior, McNell, Thacher, and San Antonio creeks, as well as in Upper Ojai—and on land under and adjacent to the Ventura River itself (Schnaar 2013). These areas, indicated as group “B” on the map, are generally composed of coarser sediments.
Soils - Hydrologic Groups

Ventura River Watershed

A - High infiltration rate (low runoff potential) when thoroughly wet
B - Moderate infiltration rate when thoroughly wet
C - Slow infiltration rate when thoroughly wet
D - Very slow infiltration rate (high runoff potential) when thoroughly wet
Terrace Escarpment - No Soil Group Assigned

Figure 3.2.2.1 Soils – Hydrologic Groups Map
3.2.2.3 Petroleum

The petroleum-rich sedimentary rocks of the Transverse Ranges, of which the watershed is a part, make this geologic province an important oil-producing area in the United States (CGS 2002).

The Ventura field is the watershed’s major oil field, covering approximately 3,410 acres on both sides of Highway 33 near the coast. The Ojai Oil Field comprises 1,780 acres of small, active oil fields located primarily in the Upper Ojai areas of Sulphur Mountain and Sisar Creek, with smaller fields in the Lion Mountain area and in Weldon Canyon. Cañada Larga also has a small, 40-acre oil field (DOGGR 1992).

Tar Seep, Sulphur Mountain Road
Natural oil seeps and tar are found throughout the area.

Ventura Oil Field. The Ventura Oil Field is the major oil-producing field in the watershed. The watershed contains several other smaller oil fields, the next most significant being the Ojai Oil Field, located mostly in Upper Ojai.
3.2.2.4 Faults

Intense tectonic forces have uplifted, twisted, and folded the watershed's mountains, creating multiple faults that crisscross the watershed. These faults influence the watershed in several important ways. For example, faults that cross streams can act like underground dams of bedrock that hold back or redirect streamflow, sometimes causing groundwater to surface as springs. Some of the favorite swimming holes in the watershed are upstream of such bedrock-surfacing occurrences.

San Antonio Creek typically runs longer into the year than the upper Ventura River in part because it runs along a fault block and in places the creek bottom is bedrock. Some of the "walls" or boundaries of the watershed's groundwater basins are also formed by faults. The Santa Ana Fault, for example, forms the southern boundary of the Ojai Valley Basin (Kear 2005).
Figure 3.2.2.4.1 Major Faults Map
Significant accumulations of accessible oil and gas deposits in the watershed are also associated with its fault structures. The large area of oil wells along Ventura Avenue and surrounding hills in the lower watershed is directly associated with the Ventura Avenue anticline.

Many of the streams in the Oak View-Ojai area have a complex history that is intimately related to recent tectonics. When the Oak View terrace was being deposited (about 40,000 years ago) the watershed of the Ventura River included the Santa Paula Creek and Sisar Creek drainages, along with the upper Ojai Valley, which was continuous with the lower Ojai Valley. Santa Paula and Sisar Creeks were eventually captured by headward erosion of a tributary of the Santa Clara River. However, in view of activity of the faults in the area, it seems reasonable to speculate that tectonics probably were a significant factor in the drainage history. For example, after uplift along the Santa Ana fault, separating the upper and lower Ojai Valleys, and after capture of Santa Paula and Sisar Creeks by a tributary of the Santa Clara River, the drainage of the lower Ojai Valley was directed along the scarp of the Santa Ana fault.

—Tectonic Geomorphology and Earthquake Hazard, North Flank, Central Ventura Basin, California (Keller et al. 1980)

### 3.2.2.5 Geologic and Seismic Hazards

#### Earthquakes

The Ventura River watershed is a dynamic landscape that is continually experiencing uplift, folding, and faulting, and with these powerful forces often come earthquakes. A number of faults within and near the watershed are capable of producing magnitude 7.0 earthquakes, and the nearby San Andreas Fault—the longest and most significant fault in California—is capable of producing a magnitude 8.3 earthquake along some of its segments (USACE 2004b).

A 2004 study of historical earthquakes, conducted as part of the Matilija Dam removal project, summarized earthquakes with a magnitude of 5.0 and greater that have occurred within a 50-mile radius around Matilija Dam between the years 1800 and 2000 (Table 3.2.2.5.1), and the magnitude seven and greater earthquakes that have occurred within a 100-mile radius of the dam (Table 3.2.2.5.2).

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<th>Number of Times Exceeded</th>
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<td>49</td>
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<td>21</td>
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<td>1</td>
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</table>

Source: USACE 2004b
Table 3.2.2.5.2 Magnitude 7 and Greater Earthquakes within a 100-Mile Radius of Matilija Dam

<table>
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<th>Earthquake Date</th>
<th>Magnitude</th>
<th>Distance (miles)</th>
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</tr>
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<td>12/21/1812</td>
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<td>09/24/1827</td>
<td>7.0</td>
<td>37.8</td>
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<tr>
<td>11/27/1852</td>
<td>7.0</td>
<td>39.7</td>
</tr>
<tr>
<td>01/09/1857</td>
<td>7.9</td>
<td>62.9</td>
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<td>11/04/1927</td>
<td>7.5</td>
<td>84.1</td>
</tr>
<tr>
<td>07/21/1952</td>
<td>7.7</td>
<td>39.3</td>
</tr>
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</table>

Source: USACE 2004b

**Liquefaction**

Liquefaction occurs when ground shaking causes loose, saturated soil to lose cohesive strength and act as a viscous liquid for several moments. Engineered structures including roads, bridges, dams, houses, and utility lines are subject to potential damage from liquefaction (VCPD 2011a).

Given the number of active faults in the area and the alluvial nature of the sediments, damage to the Casitas Dam from liquefaction has been a concern. Between 1999 and 2001, Casitas Dam underwent a major modification to prevent a liquefaction-induced failure from seismic activity. Seismic hazard evaluations conducted in the 1990s indicated that the potential earthquake loading was much higher than evaluations conducted in the 1980s indicated. Additionally, groundwater levels had also risen since the 1980s. To address this hazard, the liquefiable materials at the downstream toe of the dam were excavated and replaced, an overlying stability berm was constructed, and the crest of the dam was widened to provide additional protection (USBR 2001).

Liquefaction has occurred in this area and can be expected to potentially occur again whenever an earthquake of sufficient intensity occurs. Areas with high liquefaction potential have had water table levels within 15 feet of the ground surface sometime in the last 50 years.

—*Matilija Dam Ecosystem Restoration Project EIS/EIR*  
(USACE2004)

Areas where groundwater tables are more than 40 feet below the ground surface are typically not considered potential liquefaction zones (CGS 2003).
Liquefaction Potential

Ventura River Watershed

Liquefaction Zone Area - Areas where historic occurrence of liquefaction, or local geological, geotechnical and groundwater conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2893(c) would be required.

Figure 3.2.2.5.1 Liquefaction Potential Map
Landslides and Debris Flows

Landslides and debris flows are types of “mass wasting.” Mass wasting is the downward movement of soils and rock under gravity, and it requires source materials, a slope and a triggering mechanism. Source materials include fractured and weathered bedrock and loose soils. Triggering mechanisms include earthquake shaking, heavy rainfall and erosion (URS 2010).

The following discussion about landslide hazard is taken from the Ventura County General Plan:

In general, the highest propensity for landsliding is found in weak rock formations along the more prominent fault zones, near anticlinal folds, and in areas of the younger geologic formations. It is apparent that the combination of these three factors has resulted in relatively intense areas of landsliding such as along the Rincon.

Landslides and potentially unstable slopes are especially common in weak rock formations in hillside areas underlain by sedimentary bedrock of the Pico, Santa Barbara, Monterey/Modelo, and Rincon Formations. These formations are generally soft and contain abundant silt and clay strata.

Many landslides are also associated with steep slopes that have been undercut by erosion and downslope inclination of bedding planes (such as in the Ventura Anticline area). The presence of subsurface water is also a contributing factor to slope instability in the great majority of landslide occurrences.

Landslides and slope instability are widespread throughout the hillside areas. They are subject to potential renewal movement if triggered by poorly planned grading, earthquake ground motions, or increases in ground moisture by any one of numerous factors including, sewage disposal, irrigation, rainfall, etc.

—Ventura County General Plan, Hazards Appendix (VCPD 2011a)

Rockslides from steep slopes are the most abundant type of earthquake-induced landslide. Less abundant are shallow debris slides on steep slopes, along with slumps and block slides on moderate to steep slopes (USACE 2004).
3.2.2.6 Key Data and Information Sources/ Further Reading

Below are some key documents that address geology in the watershed. See “4.3 References” for complete reference citations.

- Botanical Resources at Emma Wood State Beach and the Ventura River Estuary, California: Inventory and Management (Ferren et al. 1990)
- California Oil, Gas, and Geothermal Resources: An Introduction (Ritzius 1993)
- Chronology and Rates of Faulting of Ventura River Terraces, California (Rockwell et al. 1984)
- Design Hydrology Manual (VCWPD 2010a)
- Erosion and Sediment Yields in the Transverse Ranges, Southern California (Scott & Williams 1978)
- Hydrology, Hydraulics and Sediment Studies of Alternatives for the Matilija Dam Ecosystem Restoration Project (USBR 2007)
- Quaternary rate of folding of the Ventura Avenue anticline, western Transverse Ranges, Southern California (Rockwell et al. 1988)
- Seismic Hazard Zone Report for the Matilija 7.5-Minute Quadrangle, Ventura County, California (CGS 2003)
- Tectonic Geomorphology and Earthquake Hazard, North Flank, Central Ventura Basin, California (Keller et al. 1980)
- The Monterey/Modelo Formation & Regional Water Quality (Orton 2009)
- Ventura County General Plan, Hazards Appendix (VCWPD 2011a)
- Ventura River Steelhead Restoration and Recovery Plan (Entrix & Woodward Clyde 1997)
- Wetlands of the Central and Southern California Coast and Coastal Watersheds: A Methodology for their Classification and Description (Ferren, Fiedler & Leidy 1995)
3.2.3 Geomorphology and Sediment Transport

3.2.3.1 Sediment Production and Transport

The watershed's mountains are composed largely of geologically young marine sedimentary rock—sediments that were at the bottom of a sea floor not very long ago, geologically speaking. These weak, highly erodible rocks are set at very steep angles, causing the watershed to have exceedingly high rates of erosion. In fact, the Ventura River has the highest suspended load and bed load yield of sediment per unit area of any watershed in southern California (Keller & Capelli 1992).

The Watershed's Steep Mountains
Photo courtesy of Les Dublin
The headwaters and upper tributaries of the watershed—including Matilija Creek, North Fork Matilija Creek, Cozy Dell Creek, and streams on the East End of Ojai (e.g., Thacher and Senior Canyon creeks)—produce large amounts of cobble and sediments that flow downward and are deposited on the valley floors. These sediments form most of the alluvium that underlies the watershed’s streams and comprises its groundwater basins in the flatter portions of the watershed.

As the river flows downstream, boulders become more rounded, coarse sands give way to finer sands, which eventually partially erode into silts and clays as the river nears the Pacific Ocean. Flash floods and heavy storm flows help to move larger material downstream, so cobbles and small boulders continue to be scattered throughout the river’s path.

A number of geomorphic processes contribute sediment to the watershed’s streams including sheet erosion (water flowing over land as a sheet rather than in distinct channels), dry land sliding, earthflows, and debris flows (Hill & McConaughy 1988). Wildfire intensifies all of these processes.
Sediment Transport and Deposition in San Antonio Creek, 1969
Photo by Dan Poush

The vast majority of sediment transport, and the resulting changes to channel shape and location, occurs during relatively infrequent major storms. A 1988 analysis of sediment transport over a 12-year period found that 92% of the sediment transported in the Ventura River occurred during five storms averaging 10 days each (Entrix & URS 2004).

During periods without major storms, stream channels undergo more-or-less continuous fill; eroded sediments that have made their way into stream channels gradually build up. Then, during large storm events, these built-up channel sediments are mobilized and channels undergo substantial scour (Scott & Williams 1978).

The difference between the movement of sediment during a “normal” year and during a winter dominated by very large storms cannot be exaggerated: it can be as large as 30:1. It has been estimated that the sediment transported to the ocean by the Ventura and Santa Clara rivers during the 1969 floods was greater than all the sediment transported during the previous 25 years (Inman & Jenkins 1999).

The high rates of erosion and landslides in the watershed present significant challenges to flood management and to protection of water and wastewater infrastructure.

**Alluvial Fans**

Alluvial fans are a significant geologic feature of the Ojai Valley formed by the transport of sediment by water. Alluvial fans are cone-shaped fans of rock and sediment that have built up at the mouths of mountain
Alluvial fans present a special kind of flood hazard risk because the stream channels associated with alluvial fans are shallow and not well defined, and their movement is unpredictable.

Three distinct alluvial fans in the East End of Ojai have been identified: Dron-Crooked Creek Fan, San Antonio Creek Fan, and Thatcher Creek Fan (see Figure 3.2.3.1.1). As discussed more in “3.3.2 Flooding,” alluvial fans present a special kind of flood hazard risk because the stream channels associated with alluvial fans are shallow and not well defined, and their movement is unpredictable.

Following are excerpts from a 2009 study by the Ventura County Watershed Protection District on the alluvial fans on Ojai’s East End:

Active fans [where fan building is still active or potentially active] exist mostly in the floor of the valley where ground surface slopes become milder and channels lose their ability to carry sediments further downstream. The geological soil type in these parts of the fans is mainly fluvial deposits. Geological conditions indicate that most of the alluvial fans in East Ojai were formed during the last 12,000 years.

Typical of alluvial fan flooding, flood water from relatively high mountain areas where slope is steep and energy is abundant, carries a large amount of sediment. Some of which are deposited in the channels at floors of alluvial fans. As a result, most of the channels at floors of alluvial fans are wide, shallow and unstable. Overbank flooding occurs frequently and can cause a significant amount of property damages. In fact, many parts of the East Ojai floodplain have been designated by FEMA as repetitive flooding areas.

—Alluvial Fan Floodplain Mapping, East Ojai FLO-2D Floodplain Study (VCWPD 2009)
3.2.3.2 Fluvial Geomorphology – Rivers Sculpting Landform

Fluvial geomorphology is the study of the processes that operate in river systems and how they shape stream channels and other landforms over time. Many factors play a role: tectonics, climate, geology, topography, wildfires, land use, and more.

The Ventura River watershed’s fluvial geomorphic story is, in a word, dynamic. Steep, tectonically active mountains, intense storm flows, and erosive sediments all add up to stream channels that are moving and changing.

_Floodplain Terrace, Meiners Oaks._ Graphic examples of fluvial geomorphic processes at work are the series of floodplain terraces along the Ventura River in Meiners Oaks and near the river’s mouth. These terraces were shaped by cycles of relatively rapid vertical uplift followed by downcutting of the river over the last 60,000–80,000 years (Ferren et al. 1990). These terraces also show that the river has migrated to the west over time.
The Braided Ventura River, 2005 Flood. Fluvial geomorphic processes have shaped the main stem of the Ventura River: it is a braided river (meaning numerous channels split off and rejoin each other to give a braided appearance) that flows through riverbed cobble and sometimes crosses bedrock and active geologic structures (Keller 2010).

Photo courtesy of David Magney
In its natural state, the Ventura River had a dynamic equilibrium wherein the river channel shape changed from flood to flood, and the river would yield major supplies of sand to the Ventura coastline (USACE 2004). The river’s elevation rose between floods from sediment deposits, only to be scoured out during large floods. This natural state of the river has been modified, in part due to impediments to sediment transport as described later in this section.

**Flood Scour and Cycles of Vegetation Growth, Ventura River at Main Street Bridge.** The river’s cycle of sediment buildup followed by scour influences many other processes, including the growth of riparian vegetation, aquatic plants, and algae, and the extent and adequacy of fish habitat. The left-hand photos show the river after big, scouring winters (top 2005, bottom 2008); algae is growing and aquatic plants are minimal. Gradually, without scouring winter flows, aquatic plants become dominant. Source: Leydecker 2010b

A notable feature on maps of the Ventura River dating from the late 1800s is the presence of large, well-defined islands in the river—ranging in area from about one to over 35 acres. Contemporary accounts from the early 20th century mention residents camping during the summers on an island located between Coyote Creek and the Ventura River (Beller et al. 2011).

Fluvial geomorphic processes also directly influence the shape and extent of the river’s delta. One characteristic of deltas formed by rivers carrying high loads of sediment is that their channels tend to migrate over time when deposited sediments interfere and redirect water flow (Keller & Capelli 1992).

These dynamic fluvial geomorphic processes significantly influence the land and watershed. They can directly affect flood control, water quality, habitat protection, land use, water supply, and many other aspects of watershed management.
Ventura River Estuary, Second Mouth. Just west of the main channel of the Ventura River is a currently inactive channel called the “Second Mouth” of the Ventura River. The multiple channels of a delta system, called “distributary channels,” may be active for a period of time, become inactive, and then become active again at a later date (Keller & Capelli 1992).

3.2.3.3 Impediments to Sediment Transport

While the general pattern of sediment buildup followed by flood scour persists today and still defines many river processes, in-channel and floodplain developments have constricted flow and reduced the availability of sediment.

The Ventura River watershed has two dams and a river diversion that inhibit the natural downstream flow of water and sediment: Matilija Dam (built in 1947) interferes with sediment flow from the Matilija Creek subwatershed and Casitas Dam (built in 1959) traps almost all of the sediment of the Coyote Creek subwatershed. The associated Robles Diversion Facility in the Ventura River (built in 1959) also interferes with sediment transport from watershed areas above the diversion.
Together these features block the natural drainage of about 37% of the watershed and thereby impede over half of all sediment delivery (Beller et al. 2011).

The Matilija Dam originally provided for 7,018 acre-feet of water storage. Rapid sedimentation, however, reduced this to only 500 acre-feet as of 2003 (Tetra Tech 2009). The vast majority of this sediment was deposited during a few big storm years; the floods of 1969 alone contributed a large proportion of the sediment (USACE 2004b).

From 1947 to 1964, it is estimated that the [Matilija] dam trapped about 95% of the total sediments from the watershed. Today, it is estimated that the trapping efficiency has dropped to approximately 45% of the total sediment load from Matilija Creek, although the trap efficiency for sand sizes and greater is still practically 100%.

— Matilija Dam Ecosystem Restoration Feasibility Study Final Report (USACE 2004b)

The following excerpt describes the impact that the dam has had on the river:

Trapping sediment in the dam substantially reduces the sediment supply to the stream downstream of the dam. As a result, the stream, which still has a similar sediment transport capacity, makes up the difference by obtaining sediment for transport from the channel bank and bed. The removal of this sediment, without replacement by sediment from upstream, causes the bed elevation to drop over the long term, and increases the potential for bank erosion. In-stream structures such as bridges and utility crossings
could be adversely affected, as could structures located adjacent to the stream. As the smaller-sized sediments in the channel bed are more easily transported than larger sediments, the channel bed composition would change to become more dominated by cobbles and boulders rather than sand. The delivery of sand to the beach would be reduced.

—Draft Environmental Impact Report for the Matilija Dam Ecosystem Restoration Project (USACE 2004)

As stated in the excerpt below, the effect of the dam is significant, but no less significant than streamflow.

Matilija Dam does not block all the sand from the Ventura River. San Antonio and North Fort Matilija still contribute large amounts of sand. However, it does block a significant portion of sand and its removal will increase the size of the beaches. How much is hard to tell, but the sand loads input into the Ventura River will be about 50% larger than they are now because Matilija Dam blocks about ½ of the total watershed area. Matilija Dam is still trapping almost all the sand that enters the reservoir. There is still sand being eroded from the bed of the Ventura River that currently replaces some of the sand that is trapped behind Matilija. However, the sand in the bed is of limited quantity and will eventually run out.

It should be remembered that the biggest variable of beach sand is simply the flow in the river. Without river flows, the beaches erode. The beachline in 1947 (prior to Matilija Dam) is essentially identical to the beachline now because the 40s were relatively dry. Beaches will erode in this area with or without Matilija Dam if there is no rain.

—Blair Greimann, Hydraulic Engineer, Matilija Dam Ecosystem Restoration Project (Greimann 2014)

### 3.2.3.4 Beach and Delta Sediments

Sand and other sediments get deposited on the beaches by both longshore drift and direct buildup from the Ventura River. A longshore current, called the Santa Barbara Littoral Cell, transfers sediment along beaches in the Santa Barbara Channel in a west-to-east direction from Ellwood Beach in Santa Barbara County to Point Mugu in Ventura County. This current is supplied with sediment from coastal cliff erosion and the floodwaters of streams and rivers, with steep-gradient creeks and rivers being the primary sources of sediment (BEACON 2009).
Figure 3.2.3.4.1 Santa Barbara Littoral Cell

Source: Coastal Regional Sediment Management Plan (BEACON 2009)

Beach Cobble Delta,
Seaside Wilderness Park
Sediment transport to the ocean from coastal southern California streams is highly episodic and correlated with flood flows, and this variability is reflected in the amount of beach that exists at any given time.

This natural cycle of sediment buildup and erosion has suffered from a lack of replenishment sediment, however, and this has resulted in growing erosion of beaches in the region (USACE 2004b). Another contributor to beach erosion is coastline armoring—the erection of seawalls and rock revetments (structures used to support embankments) to prevent erosion.

The Rincon Parkway, located between Rincon Point and the Ventura River delta, is one of the most fortified sections of coastline within the entire Santa Barbara Littoral Cell (BEACON 2009): 77% of this 17-mile stretch of coastline is armored with seawalls and revetments (CDBW & SCC 2002).

Rincon Parkway Armoring

Table 3.2.3.4.1 Estimated Sediment Supply Delivered to the Coast from Rivers and Streams of the Santa Barbara Littoral Cell

<table>
<thead>
<tr>
<th>Watershed</th>
<th>Fluvial Delivery Volume (cubic yards/year)</th>
<th>Reduction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Santa Maria River</td>
<td>811,000 (Pre-dam) 261,000 (Post-Dam)</td>
<td>68</td>
</tr>
<tr>
<td>San Antonio Creek</td>
<td>60,000 (no dams)</td>
<td>0</td>
</tr>
<tr>
<td>Santa Ynez River</td>
<td>713,000 (no dams)</td>
<td>51</td>
</tr>
<tr>
<td>Santa Ynez Mountains Watershed</td>
<td>195,000 (no dams)</td>
<td>0</td>
</tr>
<tr>
<td>Ventura River</td>
<td>216,000 (no dams)</td>
<td>53</td>
</tr>
<tr>
<td>Santa Clara River</td>
<td>1,634,000 (no dams)</td>
<td>27</td>
</tr>
<tr>
<td>Calleguas Creek</td>
<td>65,000 (no dams)</td>
<td>0</td>
</tr>
</tbody>
</table>

Data Source: Coastal Regional Sediment Management Plan (BEACON 2009)

Such armoring has been documented to ultimately reduce beach widths via several mechanisms. For example, sediment from previously eroding coastal bluffs that would otherwise be available for transport and deposit by the littoral current is impounded by shoreline armoring.

Another mechanism is passive erosion:

Whenever a hard structure is built along an eroding coastline, the shoreline will eventually migrate landward on either side of the structure. The effect will be gradual loss of the beach in front of the seawall or revetment as the water deepens and the shoreface profile migrates landward. This process is designated as passive erosion and has been well documented along many different shorelines. Passive erosion takes place regardless of the type of protective structure emplaced. This process is perhaps the most significant long-term effect of shoreline armoring.

—The Effects of Armoring Shorelines, The California Experience (Griggs 2010)

Beach and delta erosion is a watershed management concern. The Matilija Dam removal project is an effort to return the river to more natural conditions, increasing sediment flow downstream, creating more alluvial floodplain habitat, and replenishing the sand-starved beaches along the coast. In concert with the Matilija Dam removal project, the Surfers’ Point Managed Shoreline Retreat Project is designed to restore the beach profile to more natural and sustainable conditions (City of Ventura & Rincon Consultants 2003).
Surfers’ Point Managed Shoreline Retreat Project

In 1992, winter storms eroded a new beachfront bike path, owned by the California Department of Parks and Recreation, and damaged the adjacent parking lot for the Ventura County Fairgrounds. Fairgrounds officials proposed the construction of a sea wall to stop further erosion. The local chapter of the Surfrider Foundation and the California Coastal Conservancy opposed the sea wall plan, which would have reduced the habitat and recreational value of the site and, by altering wave patterns, likely increased erosion rates on nearby beaches.

In 2001, the many parties with an interest in the site agreed on a managed retreat approach for the site. With leadership from Surfrider, funding assistance from the California Coastal Conservancy, a land contribution from the state of California’s fairgrounds, and management by the City of Ventura, a progressive “managed retreat” project was designed and implemented at Surfers’ Point in order to give the beach sand more room to behave like a natural seasonally growing and shrinking beach. Phase 1 construction, covering a 900-foot reach, was completed in 2011. Phase 2 is awaiting additional funding as of 2014.

(continues on next page)
Surfers’ Point Managed Shoreline Retreat Project (continued)

Features of this project include:

- Removing all existing improvements seaward of Shoreline Drive, including the damaged bike path and eroded public parking lot, and relocating them farther inland;
- Modifying Shoreline Drive to allow for retreat of the existing parking facilities and preserve public access to Surfers’ Point;
- Improving parking by constructing two new “low impact development” parking lots that incorporate runoff treatment controls—including appropriate landscaping, permeable surfaces, and a stormwater treatment system—and installation of an entry kiosk and bicycle parking;
- Improving recreational amenities by constructing a new multi-use trail to replace the existing path, creating a new interpretive area, and expanding an existing picnic area; and
- Restoring the retreat zone and providing protection for the new improvements by recontouring the retreat area with natural beach materials and re-creating sand dunes.

The Surfers’ Point Managed Shoreline Retreat project is one of the first managed retreat projects to be implemented in California. Developed in response to coastal erosion, it serves as a model of sustainable shoreline management for other similar projects up and down the California coast. The project was featured at the California and the World Ocean Conference in 2006 and as a case study for managed retreat by NOAA’s Office of Ocean and Coastal Resource Management. The California Coastal Commission has cited the project as an example for other locations including Goleta Beach and Pacific Beach (Jenkin 2013).
3.2.3.5 Key Data and Information Sources/Further Reading

Acronyms Used in this Section
NOAA—National Oceanic and Atmospheric Administration

Further Reading: Geomorphic Assessment of the Santa Clara River Watershed

In addition to the resources listed here, a comprehensive fluvial geomorphological study was undertaken on the Santa Clara River watershed, which is adjacent to the Ventura River watershed to the southeast. There are enough similarities between these watersheds that this study can be informative for the Ventura River watershed.


Below are some key documents that address geomorphology in the watershed. See “4.3 References” for complete reference citations.

Alluvial Fan Floodplain Mapping, East Ojai FLO-2D Floodplain Study (VCWPID 2009)

Botanical Resources at Emma Wood State Beach and the Ventura River Estuary, California: Inventory and Management (Ferren et al. 1990).

Channel Geomorphology and Stream Processes (Entrix 2001a)

Coastal Regional Sediment Management Plan (BEACON 2009)


Draft Ventura River Habitat Conservation Plan (Entrix & URS 2004)

Erosion and Sediment Yields in the Transverse Ranges, Southern California (Scott & Williams 1978)

Historical Ecology of the lower Santa Clara River, Ventura River and Oxnard Plain: an analysis of terrestrial, riverine, and coastal habitats (Beller et al. 2011)

Hydrology, Hydraulics and Sediment Studies of Alternatives for the Matilija Dam Ecosystem Restoration Project (USBR 2007)

Matilija Dam Ecosystem Restoration Feasibility Study Final Report (USACE 2004b)


Surfer’s Point Managed Shoreline Retreat Environmental Impact Report (City of Ventura and Rincon Consultants 2003)

The Effects of Armoring Shorelines—The California Experience (Griggs 2010)

3.3 Hydrology

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Ventura River Downstream of Santa Ana Bridge
Photo courtesy of Scott Lewis
3.3 Hydrology

Hydrology is the study of water and its properties, distribution, and circulation—in the air, on the ground, and beneath the surface. This chapter addresses primarily the distribution and circulation of surface water and groundwater in the watershed. Water quality is addressed in “3.5 Water Quality.” Other important factors that affect hydrology are described in other sections, including rainfall (“3.2.1 Climate”), vegetation (“3.6.1 Habitats and Species”), and land use (“3.7.3 Land Use”).

3.3.1 Surface Water Hydrology

3.3.1.1 Drainage Network

The Ventura River drainage network includes five significant tributaries that feed into the Ventura River: Matilija Creek, North Fork Matilija Creek, San Antonio Creek, Coyote Creek, and Cañada Larga. A notable feature of the Ventura River watershed is that its primary stream network remains largely unchannelized, with relatively natural stream shape and hydrologic patterns in many reaches (Beller et al. 2011). Two dams, three levees, and high rates of runoff from urban areas have modified stream shape and hydrologic patterns in other reaches.

Table 3.3.1.1.1 Summary of Primary Drainages in the Ventura River Watershed

<table>
<thead>
<tr>
<th>Drainage Area</th>
<th>Drainage Area</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Square Miles)</td>
<td>(Acres)</td>
<td>(Miles)</td>
</tr>
<tr>
<td>Ventura River Mainstem</td>
<td>44.0</td>
<td>28,143</td>
</tr>
<tr>
<td>Matilija Creek</td>
<td>54.6</td>
<td>34,927</td>
</tr>
<tr>
<td>North Fork Matilija Creek</td>
<td>16.1</td>
<td>10,291</td>
</tr>
<tr>
<td>San Antonio Creek</td>
<td>51.2</td>
<td>32,746</td>
</tr>
<tr>
<td>Coyote Creek</td>
<td>41.3</td>
<td>26,414</td>
</tr>
<tr>
<td>Cañada Larga Creek</td>
<td>19.2</td>
<td>12,312</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>226.4</strong></td>
<td><strong>144,833</strong></td>
</tr>
</tbody>
</table>

1. Includes the area under the reservoirs built on these creeks.

Ventura River

The Ventura River mainstem covers a distance of 16.2 miles on its journey from the mountains to the ocean. In that short distance the river can look and behave quite differently. The river’s five distinct reaches are described in the following sections.
Figure 3.3.1.1.1 Drainage Network Map
Above the Robles Diversion

The Ventura River begins at the confluence of Matilija Creek and North Fork Matilija Creek, just south of Matilija Hot Springs Road. The river’s beginning marks the transition from the steep canyons associated with these two creeks to flatter land and the exit of these creeks from the Los Padres National Forest. Still constrained by mountains, the river remains narrow for about a mile as it flows past orchards and the community of Ojala off of Camino Cielo Road.

Aerial View of Ventura River’s Beginnings, Looking Downstream
Photo courtesy of Google Earth.

Ventura River’s Beginnings. Upstream of Camino Cielo Bridge, June 2008
Photo courtesy of Santa Barbara Channelkeeper

Ventura River at Camino Cielo Bridge

Ventura River Exits the Mountains
Below the Robles Diversion – The Dry Reach

About 1.5 miles downstream from the river’s formation, the landscape opens up and becomes much flatter. The river responds by becoming “depositional,” dropping its largest sediments (very large boulders and cobbles) as the force of the flow from the steep canyons dissipates onto the gentler gradients.

The Robles Diversion Facility—the structure that diverts Ventura River flow to Lake Casitas—is located on the west bank of the Ventura River channel, opposite and just below where Cozy Dell Canyon Creek enters.

Past the Robles Diversion, the riverbed widens considerably and splits into multiple braided channels. The river flows past the community of Meiners Oaks and through the Ventura River Preserve, picking up Kennedy, Rice, and Wills Canyon creeks from the west and McDonald Canyon Creek and Happy Valley Drain from the east before flowing under the Highway 150 Bridge.
The stretch of the Ventura River from below the Robles Diversion to just above the river's confluence with San Antonio Creek is the river's "dry reach." Except during very wet rainfall years, surface water in this part of the river quickly disappears underground once storm flows have passed—even when the river is still flowing above and below this reach. About 80% of the time there is no significant surface flow in the Ventura River in this reach (Cardno-Entrix 2012).

Flow duration curves were developed by the BOR [Bureau of Reclamation] for various stream gauges along the river. Over 60 percent of the time, the flow is less than ten cfs in the Ventura River at Foster Park, and approximately 80 percent of the time the flow is less than ten cfs in the Ventura River at Meiners Oaks. The river has no flow at least 30 percent of the time at Meiners Oaks.


The San Francisco Estuary Institute documented numerous historical records going back to the 19th and early 20th century indicating that this reach of river has regularly gone dry, or exhibited intermittent flow (Beller et al. 2011).

Past the community of Mira Monte, the Ventura River picks up two channelized drainages from the east: Mirror Lake Drain and Skyline Drain. It then flows past the Live Oak Acres development on the west, where the Live Oak Levee constricts the river down to a small fraction of its width and guides it under the Santa Ana Bridge on Santa Ana Road.
**Definitions: Perennial, Intermittent, and Ephemeral**

**Ephemeral Stream:** A stream that flows in direct response to and only during and shortly after precipitation events. Ephemeral streams may or may not have a well-defined channel. Their beds are always above the elevation of the water table, and stormwater runoff is their primary source of water. Ephemeral streams include normally dry arid or semi-arid region desert washes.

**Intermittent Stream:** A stream that flows only at certain times of the year when it receives water from springs, groundwater, rainfall, or surface sources such as melting snow. Includes intermittently dry desert washes in arid or semi-arid regions.

**Perennial Stream:** A stream that flows continuously during a year of normal rainfall (Vyverberg 2010).

**Figure 3.3.1.1.2 Ventura River Dry Reach.** Since the 19th and early 20th century, the dry reach of the Ventura River has had intermittent flows, in contrast to the reaches above and below it. In many years, the dry reach could even be called “ephemeral,” because flows disappear so quickly after storms. The transitions between intermittent and perennial reaches are approximate boundaries, which shift from year to year. Image courtesy of San Francisco Estuary Institute (Beller et al. 2011)

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**Live Oak Levee Protects Live Oak Acres Community.** Live Oak Acres, to the left, is protected by the Live Oak Levee. Oak View is to the right.
Past the Santa Ana Bridge, the river widens again and flows by the community of Oak View, receiving the Oak View Drain before reaching the confluence with San Antonio Creek.

**San Antonio Creek Confluence to Foster Park – The Live Reach**

Just above the San Antonio Creek confluence, the Ventura River’s wide depositional channel begins to narrow. The river then picks up water and momentum from San Antonio Creek for the last half of its journey to the ocean. During wetter years or winter rainy periods, rising groundwater springs in the river cause the Ventura River’s flow to begin increasing above the San Antonio Creek confluence.

A large pool forms at the confluence of the Ventura River and San Antonio Creek, providing important habitat for fish and other animals.
In-river groundwater springs are also found in the river as it passes through the aptly named “Casitas Springs” area below the San Antonio Creek confluence (EDAW 1978). The community of Casitas Springs is protected here by the Casitas Springs Levee.

Farther downstream at Foster Park, underground geologic structures also force subsurface flow to the surface (USACE 2004). At Foster Park, Coyote Creek enters from the west; however, this drainage contributes very little water to the river since the construction of Casitas Dam in 1959. Highway 33, which closely parallels the river, turns into a freeway at this point.
Because of the significant contributions of water from San Antonio Creek and naturally rising groundwater, the stretch of the Ventura River between the San Antonio Creek confluence and Foster Park is referred to as “the live reach.” This reach typically flows year round except in multi-year dry periods.

Because of the significant contributions of water from San Antonio Creek and naturally rising groundwater, the stretch of the Ventura River between the San Antonio Creek confluence and Foster Park is referred to as “the live reach.” This reach typically flows year round except in multi-year dry periods.

The City of Ventura draws subsurface water from the river and groundwater in the Foster Park area. The City also has a surface water diversion in the river at Foster Park, but this location has been dry since 2000 because the main channel of the river has meandered.

**Below Foster Park to the Estuary**

In the mile between Foster Park and the Ojai Valley Sanitary District’s wastewater treatment plant, there are several good-sized pools surrounded by the denser vegetation typical of this area.
Downstream from this location, the river receives treated effluent from the wastewater treatment plant. The effluent constitutes a significant input and, in many years, accounts for the perennial flow in the remaining stretch of the Ventura River.

Aerial View of Wastewater Treatment Plant. The Ojai Valley Sanitary District’s wastewater treatment plant contributes treated wastewater to the flow of the river. Located to the east of the wastewater plant is the City of Ventura’s plant for treating water pulled from the river upstream at Foster Park.

Just past the wastewater treatment plant, Cañada Larga Creek enters the Ventura River from the east; the river then flows through an area of active oil production wells. Several minor drainages (Manuel Canyon Creek, Cañada de San Joaquin, and Dent Drain) flow into the river from the east in this reach. The last 2.6 miles of the river are constrained by the Ventura River Levee on the east, which protects the City of Ventura from flooding.
Ventura River Flowing Through Active Oil Fields
Photo courtesy of Brian Hall, Santa Barbara Channelkeeper and LightHawk

Ventura River Levee
Photo courtesy of Rick Wilborn
Ventura River Estuary

In its final stretch, the Ventura River flows through the Ventura River estuary, which extends from around the 101 Freeway bridge to the ocean. The estuary is a shallow body of water that receives both freshwater from the river and salt water from the ocean. A sandbar typically separates the estuary from the ocean during the dry season; when storms breach the sandbar, however, the flow of the river can proceed directly to the ocean. A smaller estuary at the “second mouth” of the Ventura River also exists to the west of the main estuary, but is only open to the ocean during very large floods (RWQCB-LA 2002).
Matilija Creek

Matilija Creek, considered the primary headwaters of the Ventura River, originates in the rugged mountains in the northwest corner of the watershed.

Matilija Falls, Near the Headwaters of the Watershed
Photo courtesy of Michael McFadden

Matilija Creek flows southeast, and is fed along the way by a number of smaller tributaries including Upper North Fork Matilija Creek from the north (not to be confused with North Fork Matilija Creek, described later in this section), and Old Man and Murrieta creeks draining the Santa Ynez Mountains from the south. Matilija Creek and its tributaries originate at elevations between 4,000 and 6,000 feet in the watershed’s tallest and steepest mountains.
Matilija Reservoir
Photo courtesy of Paul Jenkin

Matilija Dam Spilling, March 2014
Photo courtesy of Mike Sullivan
Matilija Creek flows for about 15 miles until it meets Matilija Reservoir behind Matilija Dam, and for an additional half mile after the reservoir until it joins with North Fork Matilija Creek. In the past, water was released from the reservoir a few times during the winter to enhance diversions to Lake Casitas via the Robles Canal; however, this practice was discontinued in 2011 because of regulatory concerns related to instream water quality (Evans 2013). Even during low flow periods, water flowing into Matilija Reservoir commonly flows over the top of Matilija Dam.

Almost all, 93% (32,391 acres), of Matilija Creek’s drainage area is in the Los Padres National Forest, and 67% (23,477 acres) is in a federal wilderness area. Several hot springs and a few cold springs are located along the creek’s course. With the exception of Matilija Dam, Matilija Creek is unchannelized.

**North Fork Matilija Creek**

From its origins at the top of the watershed near the Rose Valley turnoff, North Fork Matilija Creek parallels Highway 33 down about 8 miles to where it joins Matilija Creek below Matilija Dam. The course of North Fork Matilija Creek winds southwest out of the mountains through a steep and rugged canyon, which in places becomes a narrow, confined gorge bordered by vertical walls of bare, folded, and tilted rock. North Fork Matilija Creek is relatively unmodified.
Swimming Hole, North Fork Matilija Creek

Many seeps and springs flow out of the rocks along this canyon. Until 2006, Bellyache Springs, a perennial spring located next to Highway 33, had an easy access spigot that allowed people to fill water bottles with spring water. Wheeler Hot Springs, located along the creek, was a popular tourist destination in the area from 1891 to 1997.

Except for a few properties along the highway, all of North Fork Matilija Creek’s drainage area (94% or 9,673 acres) is in the Los Padres National Forest.

San Antonio Creek

In terms of water volume, San Antonio Creek is the Ventura River’s most significant tributary after Matilija Creek. San Antonio Creek originates in the northeast part of the watershed on the eastern end of the Ojai Valley floor, and serves as the main drainage for the greater Ojai Valley. Lion Canyon Creek, a major tributary to San Antonio Creek, contributes a significant amount of flow from the Upper Ojai Valley at the extreme eastern end of the Ventura River watershed.

A number of East End creeks, all draining the steep Topatopa Mountains, feed into upper San Antonio Creek. The creek’s beginning is marked by the convergence of Gridley and Senior Canyon creeks; it then flows southwest through orchards on the valley floor and picks up Dron Creek and Crooked Creek from the north, then McNell Creek (near Highway 150) from the east. In Soule Park Golf Course, Thacher Creek adds its considerable flow. Reeves Creek, a tributary to Thacher, also adds substantial flow.
San Antonio Creek and Subwatershed

- San Antonio Creek Subwatershed
- San Antonio Creek
- Ojai Valley Groundwater Basin
- U.S. Forest Service
- City of Ojai

Figure 3.3.1.1.3 San Antonio Creek Subwatershed Map
Upper San Antonio Creek at Grand Avenue

Thacher Creek at Highway 150

Reeves Creek at McNell Road, March 2014
The headwater drainages of San Antonio Creek are also responsible for forming the alluvial fans of the East End and the underlying alluvial Ojai Valley groundwater basin.

Continuing southwest along the edge of the City of Ojai, San Antonio Creek receives flow from Stewart Canyon Creek at the beginning of Creek Road. Stewart Canyon Creek is an important drainage that flows south from the Topatopa Mountains through the City of Ojai. Much of it is underground or channelized through the City, but the lower reach, which receives flow from Fox Canyon Barranca, is primarily unchannelized and often has perennial flow (Magney 2005).
Stewart Canyon Creek Flowing into San Antonio Creek Below Ojai. Stewart Canyon Creek converges with San Antonio Creek just below Creek Road.

“Typical” in the Ventura River Watershed

Given the extreme variability of rainfall and other factors in the Ventura River watershed, describing what streamflow conditions are like in a “typical” year is highly suspect. The reader must keep in mind that, by necessity, fairly gross generalizations have been made in the descriptions of “typical” conditions.

Lion Canyon Creek. Lion Canyon Creek drains Upper Ojai and is a significant tributary to San Antonio Creek.

Below its junction with Stewart Canyon Creek, San Antonio Creek winds along Creek Road, picking up Lion Creek—which drains the Upper Ojai Valley—just past Camp Comfort, and finally converges with the Ventura River after passing under Highway 33 above Casitas Springs.

Upstream of the Thacher Creek confluence in Soule Park Golf Course, San Antonio Creek is ephemeral—typically drying quickly after storm flows have passed. After the confluence with Thacher Creek, San Antonio Creek typically exhibits perennial flow downstream to about a half mile past the Lion Canyon Creek confluence. From that point to the Ventura River confluence, San Antonio Creek’s flow characteristics typically alternate between perennial (~65% of this length of creek), intermittent (~10%), and ephemeral (~25%) (Lewis 2014).
Lower San Antonio Creek, Camp Comfort. San Antonio Creek during storm flows, March 2014.

San Antonio Creek is 9.66 miles long and is, except for revetments at bridges, primarily unchannelized.

Coyote Creek

Coyote Creek originates in the Santa Ynez Mountains on the western rim of the watershed. From its origins at an elevation of 4,200 feet, the creek flows southeast. Before Lake Casitas was built, Coyote Creek picked up Santa Ana Creek as a tributary from the north before converging with the Ventura River at Foster Park. The Lake Casitas Dam was built across Coyote Creek and has transformed much of the creek into a reservoir. Now Santa Ana Creek and most of Coyote Creek flow directly into the lake.

Coyote Creek Flowing into Lake Casitas
Coyote Creek is 14.62 miles long (including the stretch now under the reservoir). Because of Casitas Dam, the lower 2.5 miles of the creek below Lake Casitas is now disconnected from its original hydrology and only receives water from surrounding small drainages. With the exception of Casitas Dam, Coyote Creek is unchanneled. Forty-seven percent (12,384 acres) of its drainage area lies within the Los Padres National Forest.

Cañada Larga Creek

Cañada Larga Creek originates on the lower eastern edge of the watershed at 1,400 feet. It is the last major tributary to add water to the Ventura River, and the least steep. It flows southwest through a wide, largely undeveloped valley of low foothills used primarily for cattle grazing.

There is at least one major spring as well as numerous smaller springs and seeps throughout the Cañada Larga Creek drainage area. These are more common during wetter years. Oil is found in some of the springs (Williams 2014). Cañada Larga Creek is joined by Hammond Canyon Creek from the north in its upper reaches and a handful of smaller tributaries farther downstream as it winds along Cañada Larga Road.
To expedite freeway construction, Cañada Larga Creek was diverted so that the streambed now makes a sharp bend where it meets Highway 33 and flows south along the east side of the highway for a stretch. A concrete channel conducts Cañada Larga Creek under Highway 33 and North Ventura Avenue and subsequently through an undeveloped field before converging with the Ventura River just above the abandoned Petrochem gasoline refinery site. Cañada Larga Creek is 7.85 miles long.

3.3.1.2 Streamflow

In the often dry and ever-variable Ventura River watershed, flowing water is a precious resource. Streamflow is vital for habitat and wildlife, both aquatic and terrestrial, on all levels in the food chain. Streamflow determines how much Lake Casitas refills each year, and plays a big role in groundwater recharge. Flow affects pollutant concentrations and water quality. It affects whether or not there will be water in the swimming holes, and whether fish can swim to spawning grounds. Flow can also flood property, damage infrastructure, and scour the riverbed clean of vegetation. Streamflow is also the major contributor to sediment transport, scour, and erosion within the watershed.

Inputs and Outputs

Sources of water for streamflow in the watershed include rainwater, groundwater (baseflow and springs), treated wastewater, and urban runoff. Snowmelt is typically an insignificant contributor to streamflow in the watershed.
Rainwater

A watershed hydrology model, called the HSPF model (Hydrological Simulation Program – Fortran), was developed for the watershed in 2009 based on data from water years 1997 to 2007. The average Ventura River streamflow during these 11 years was 87.69 cubic feet per second (cfs) (at Foster Park), 30% greater than the long-term average of 65.38 cfs. However, the average rainfall during these years (22.41 inches in downtown Ojai), was very similar to the long-term average of 21.31 inches. Based on the data from these 11 years, the model estimated that about 322,008 acre-feet (AF) of rain falls on the watershed in a typical year and that 33% of that rainfall (113,275 AF) makes its way directly into streams and rivers (Tetra Tech 2009a, Table 6-6).

(See "4.4 Appendices" for a table of monthly average and annual average streamflow at Foster Park between 1930 and 2013.)

Surface Water/Groundwater Interaction

Exchanges between surface water and groundwater have an important effect on the total amount of streamflow in the watershed. Changes in either the surface water or groundwater system can affect the other in both positive and negative ways.

Figure 3.3.1.2.1 Where the Rain Went, 1997–2007
Source: Baseline Model Calibration and Validation Report (Tetra Tech 2009a, Table 6-6)
Figure 3.3.1.2.2 Gaining and Losing Streams. These images illustrate the concept of gaining and losing streams. In some places the stream recharges the groundwater below, and in other areas it receives groundwater from the aquifer—depending on the relationship between the water level in the stream and the elevation of the water table in the nearby aquifer.

Source: Streamflow Depletion by Wells (Barlow & Leake 2012). Reprinted with permission.

Because many animals and riparian habitats depend on the availability of surface flow, the condition of the groundwater basins can have important consequences for both terrestrial and aquatic species. The availability of surface water for recreation, aesthetic value, or water supply diversions can also be impacted.

One of the primary concerns related to the development of groundwater resources is the effect of groundwater pumping on streamflow. Groundwater and surface-water systems are connected, and groundwater discharge is often a substantial component of the total flow of a stream. Groundwater pumping reduces the amount of groundwater that flows to streams and, in some cases, can draw streamflow into the underlying groundwater system. Streamflow reductions (or depletions) caused by pumping have become an important water-resource management issue because of the negative impacts that reduced flows can have on aquatic ecosystems, the availability of surface water, and the quality and aesthetic value of streams and rivers.

—Streamflow Depletion by Wells—Understanding and Managing the Effects of Groundwater Pumping on Streamflow (Barlow & Leake 2012)

The surface water/groundwater interconnection is an important water management issue in the Ventura River watershed for a number of reasons, including the need to provide habitat for the endangered southern California steelhead. Ventura River Reaches 3 and 4 (from Camino Cielo
The link between groundwater pumping and streamflow in the Ventura River watershed is poorly understood at this time because neither the collection of sufficient field measurements nor the development of a groundwater model have been undertaken.

Road below Matilija Dam to the confluence with Weldon Canyon, just north of Cañada Larga Creek) are on the Section 303(d) list of impaired waterbodies for diversion and pumping. In adding these reaches to the 303(d) list, the Regional Water Quality Control Board associated groundwater pumping and surface water diversion with impacts to the cold freshwater habitat needed by the steelhead (USEPA 2012).

Changes in surface flows can also affect groundwater recharge. For example, the requirement that the Robles Diversion must allow a minimum of 20 cfs of Ventura River water to flow downstream is in place to prevent unreasonable interference with prior rights to the use of underground water.

The link between groundwater pumping and streamflow in the Ventura River watershed is poorly understood at this time because neither the collection of sufficient field measurements nor the development of a groundwater model have been undertaken. The HSPF model developed in 2009 to understand surface water hydrology in the watershed lacked critical information about these surface water/groundwater relationships, and thus does not constitute a comprehensive model of the watershed’s overall hydrology.

An improved understanding of this surface water/groundwater relationship—how the magnitude, timing, and location of groundwater pumping affects the flow in the river and creeks—is critical for better management of water supplies among multiple competing needs.

Ventura River Dry Reach Going Dry
This photo was taken in December 2011 on the Ventura River Preserve (Meiners Oaks area), just a few hundred feet downstream of "the swimming hole" where children were jumping off rocks into a large pool. This marks the point where the river disappeared underground.
Figure 3.3.1.2.3 Map of Wells in Upper Ventura River Basin. The link between groundwater pumping and streamflow in the Ventura River watershed is not well understood at this time.
Various studies have estimated the amount of water flowing between surface water and groundwater, but without more sophisticated measurements and analyses, the findings of these studies are understood to be preliminary and based on insufficient data. The key studies focused on this interaction and some of their findings are described below:

The Draft Environmental Impact Report for the Ventura River Conjunctive Use Agreement, prepared by EDAW [consultants] in 1978, described a very close correspondence between the groundwater level in a well located on the floodplain adjacent to the Ventura River just above Highway 150 bridge and the surface flow 250 feet below the mouth of the San Antonio Creek (in the live reach). When the water level in the well falls below approximately 495 feet msl (mean sea level), surface flow in much of the live reach stops (though some pools remain). A flow of 1 cfs or more in the live reach corresponds with a water level in this well of greater than 507 feet msl. When the groundwater in the Upper Ventura River Basin is depleted or nearly depleted, flows due to rising groundwater springs in the area of San Antonio Creek will cease (EDAW 1978).

The Surface Water-Groundwater Interaction Report, a comprehensive study prepared by Entrix in 2001 to inform a Habitat Conservation Plan for the Ventura River, estimated that annual groundwater contributions from the Upper Ventura River basin to surface water flow at Foster Park range from approximately 3,000 to 10,000 AF per year (Entrix 2001). To put this into perspective, the annual median flow at Foster Park between 1930 and 2013 was approximately 6,226 AF (USGS 2014b).

The HSPF model of the Ventura River watershed estimated that 7,375 AF of water from streams in the watershed infiltrates into groundwater basins annually, and that 4,252 AF of groundwater is contributed back to surface waterbodies annually (Tetra Tech 2009a, Table 6-6).

A groundwater budget study for the Upper and Lower Ventura River Basins, prepared by Daniel B. Stephens & Associates in 2010, estimated a net of 2,280 AF of surface water from the river infiltrates into the Upper Ventura River Basin; and that in the Lower Ventura River Basin a net of 1,254 AF of groundwater discharges to surface water (DBS&A 2010, Tables 13 & 14).

A surface water/groundwater interaction study focused on the City of Ventura’s groundwater extractions in the Foster Park area concluded that, for this area, “As long as there is surface flow in the river, the alluvial aquifer is completely refilled in less than a week (2 to 4 days) after cessation of city pumping.” (Hopkins 2010)
The Ojai Basin Groundwater Model estimated that an average of 2,282 AF per year is discharged to San Antonio Creek from the Ojai Valley Basin (DBS&A 2011).

A Ventura River Water District analysis of groundwater pumping in the dry reach of the Upper Ventura River Groundwater Basin during the 2010 steelhead migration season found that pumping by the two water districts using that part of the basin was equivalent to a continuous flow of 3.5 cfs and private pumping in the reach was estimated to be equivalent to a flow of 1.1 cfs (VRWD 2014).

Natural springs found throughout the watershed also contribute to streamflow (Entrix & URS 2004).

Ventura River at Casitas Springs, Very Wet and Very Dry. Both of the photos above were taken on August 14, 2013, in the Ventura River at Casitas Springs. The lake-like pool was next to the levee immediately adjacent to the Casitas Springs Mobile Home Park (top); about 400 feet downstream, the main channel of the river disappeared underground (bottom).
Figure 3.3.1.2.4 Effects of Pumping on an Unconfined Aquifer that Discharges to a Stream. Effects of pumping from a hypothetical water table aquifer that discharges to a stream. A. Under natural conditions, recharge at the water table is equal to discharge at the stream. B. Soon after pumping begins, all of the water pumped by the well is derived from water released from groundwater storage. C. As the cone of depression [a depression of the water level that occurs when groundwater is pumped from a well] expands outward from the well, the well begins to capture groundwater that would otherwise have discharged to the stream. D. In some circumstances, the pumping rate of the well may be large enough to cause water to flow from the stream to the aquifer, a process called induced infiltration of streamflow. [Q represents the pumping rate at the well]

Note: this example is a generalization and may not apply to all situations.

Source: Streamflow Depletion by Wells (Barlow & Leake 2012). Reprinted with permission.
The contribution to the Ventura River of treated effluent from the wastewater treatment plant averages 2.1 million gallons per day, which is equivalent to an average year-round streamflow of approximately 3.3 cubic feet per second.

Wastewater

The watershed’s primary wastewater treatment plant is located next to the Ventura River just below Foster Park, about five miles from the ocean. Managed by the Ojai Valley Sanitary District (OVSD), it produces highly treated water, called effluent, which is discharged to the Ventura River. The contribution from the treatment plant averages 2.1 million gallons, or 6.44 AF, per day, which is equivalent to an average year-round streamflow of approximately 3.3 cfs. During the rainy season, this contribution of effluent to streamflow is a relatively small portion of the total volume of water. During the dry season, however, the effluent can constitute more than 50% of the streamflow below the treatment plant (Entrix & Woodward Clyde 1997).

Urban and Agricultural Runoff

Some storm drains in urban areas of the watershed continue to have a minor trickle of flow even in the driest times of summer. This water can come from a variety of urban sources, including irrigation runoff, car washing, other types of cleaning, leaking pipes, etc. This water can make its way to streams.
Urban development—specifically impervious surfaces such as roads, parking lots, and rooftops—prevents natural infiltration of rain water, thus decreasing recharge to groundwater and increasing the amount of water entering the drainage network. Because water runs off pavement and rooftops so quickly, these impervious surfaces also increase peak flows during storms. Increased urban development can thus put a strain on existing channels lacking sufficient width and depth to carry additional storm flows, as well as levees built to protect developed areas.

Excess agricultural irrigation water may also contribute to streamflows.

**Outputs**

Once in the drainage network, streamflow is discharged to the ocean, diverted for use, used by riparian plants, evaporated, or infiltrated into soil and groundwater basins. The HSPF model estimated, based on data from water years 1997 to 2007, that approximately 71% of the water entering the stream network travels fairly quickly to the ocean by way of the Ventura River, 16% is diverted for consumption, 6% recharges groundwater basins, and 7% is lost to stream and reservoir evaporation (Tetra Tech 2009a).

![Where Streamflow Went, 1997-2007](image)

*Evaporation from streams and lakes and losses to groundwater from reservoirs*

**Figure 3.3.1.2.5 Where Streamflow Went, 1997–2007**

Data source: Baseline Model Calibration and Validation Report (Tetra Tech 2009a, Table 6-6)
Table 3.3.1.2.1 Factors Affecting Streamflow

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate</td>
<td>Rainfall is the primary factor affecting streamflow in the watershed. Because groundwater basins are readily recharged by big rain events, and groundwater discharges water to the stream network, rainfall ultimately determines the amount of water contributed to the stream network from groundwater. (See &quot;3.2.1 Climate&quot; for more information.) Temperature, which affects plant water demand as well as evaporation, also affects streamflow.</td>
</tr>
<tr>
<td>Groundwater and Springs</td>
<td>The greatest total volume of water comes from rainwater. However, once the rains and associated runoff have passed, the primary source of water in local streams for the rest of the year is groundwater. Natural springs are also found throughout the watershed, and can contribute to streamflow.</td>
</tr>
<tr>
<td>Geology and Soils</td>
<td>The watershed’s steep mountains cause runoff water to flow very quickly, resulting in “flashy” streamflow after rain events. Steep mountains also increase the amount of rain received because of “orographic lift”—air coming in from the ocean hits the mountains, rises up quickly, cools, condenses, and forms rain. The cobbly, alluvial nature of the watershed’s streambeds and groundwater basins plays a key role in the dynamic relationship between surface water and groundwater. (See &quot;3.2.2 Geology and Soils&quot; for more information.)</td>
</tr>
<tr>
<td>Water Withdrawals</td>
<td>The amount of water withdrawn from streams for consumption affects streamflow. Because groundwater is an important source of streamflow, groundwater withdrawals may also affect streamflow.</td>
</tr>
<tr>
<td>Water Additions</td>
<td>The addition of treated wastewater to the lower Ventura River is a significant contribution to streamflow, especially in the dry season.</td>
</tr>
<tr>
<td>Dams, Channel Modifications, and In-Channel Structures</td>
<td>Streamflow is reduced by the watershed’s two dams, is increased during rain events by cement-lined drainage channels, and is modified by other in-channel structures such as debris basins, levees, and groundwater recharge basins.</td>
</tr>
<tr>
<td>Urban Development</td>
<td>Impervious surfaces reduce infiltration and increase stormflow volumes and rate of flow. Irrigation water can also contribute to streamflow.</td>
</tr>
<tr>
<td>Fires and Vegetative Cover</td>
<td>Recently burned hill slopes in steep, semi-arid lands can respond to winter rains with increased runoff. The removal of natural vegetation, such as floodplain riparian plants, can increase the flashy response of rivers during flood events (Stillwater Sciences 2011).</td>
</tr>
<tr>
<td>Native &amp; Invasive Riparian Plants</td>
<td>The growth of all riparian vegetation follows cycles of flood scour and regrowth. Denser vegetation consumes more water. The nonnative, invasive plant <em>Arundo donax</em>, which occupies many parts of the watershed, is significantly thirstier than native streamside plants.</td>
</tr>
</tbody>
</table>

Besides the obvious contribution from rainfall, there are many other factors that influence the amount and duration of flow in the watershed’s streams.

*Arundo* in Ventura River

Photo courtesy of Santa Barbara Channelkeeper
Streamflow Characteristics

Storms contribute the greatest volume of water to streamflow, so seasonal flows mimic rainfall seasonality. However, the watershed typically experiences only a few major storms a year. Outside of the direct runoff of these infrequent wet periods, it is groundwater that provides base flow, if it exists, to the Ventura River and its tributaries (RWQCB-LA 2012).

Streamflows fall into the “major flood” category on the Ventura River when flows hit 40,000 cfs or more as measured at Foster Park. This has occurred about once every 14 years since 1933. Between 1933 and 2011, the highest peak flow measurement obtained for the Ventura River at Foster Park was 63,600 cfs, measured on February 11, 1978 (VCWPD 2013).

Of the watershed’s major tributaries, Matilija Creek and San Antonio Creek are the biggest contributors of water. Table 3.3.1.2.3 shows the relative amount of peak flow in the watershed’s various drainages.

![Monthly Average Streamflow at Foster Park, 1930-2013](image)

**Figure 3.3.1.2.6 Monthly Average Streamflow at Foster Park, Water Years 1930–2013**

Data Source: USGS National Water Information System Website (USGS 2014b)

<table>
<thead>
<tr>
<th></th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
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<tbody>
<tr>
<td><strong>Average</strong></td>
<td>3.5</td>
<td>9.4</td>
<td>29.2</td>
<td>142.3</td>
<td>250.4</td>
<td>208.8</td>
<td>89.1</td>
<td>32.4</td>
<td>15.2</td>
<td>8.0</td>
<td>4.7</td>
<td>3.6</td>
</tr>
<tr>
<td><strong>Median</strong></td>
<td>0.6</td>
<td>1.4</td>
<td>5.0</td>
<td>12.6</td>
<td>34.1</td>
<td>30.7</td>
<td>18.3</td>
<td>9.2</td>
<td>5.1</td>
<td>2.9</td>
<td>1.5</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>Highest</strong></td>
<td>41</td>
<td>278</td>
<td>234</td>
<td>1,880</td>
<td>2,919</td>
<td>1,954</td>
<td>1,351</td>
<td>408</td>
<td>158</td>
<td>64</td>
<td>36</td>
<td>29</td>
</tr>
<tr>
<td><strong>Lowest</strong></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Table 3.3.1.2.2 Monthly Average Streamflow (cfs) at Foster Park, Water Years 1930–2013**

Monthly average streamflow is the average of all daily streamflows for the month.

Data Source: USGS National Water Information System Website (USGS 2014b)
Figure 3.3.1.2.7 Annual Average Streamflow at Foster Park, Water Years 1930–2013. As this chart indicates, the historical annual average streamflow in the watershed rarely occurs in actuality. This is because occasional extreme flows skew the average. Historical annual median streamflow is much more common. The "median" represents the midpoint of the set of data, such that half of the years had an average rate of flow less than the median and half had an average rate of flow greater than the median.

Annual average streamflow is the average of all daily streamflows for the year.

Data Source: USGS National Water Information System Website (USGS 2014b)

Figure 3.3.1.2.8 Average Streamflow at Foster Park, June–September, Water Years 1960–2012

Data Source: USGS National Water Information System Website (USGS 2014b)
### Table 3.3.1.2.3 Storm Peak Flow Estimates Based on Modeling

<table>
<thead>
<tr>
<th>Stream Name</th>
<th>Peak Flow (cfs)</th>
<th>10-Yr</th>
<th>50-Yr</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ventura River and Smaller Tributaries</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below Matilija Creek/N. Fork Matilija Creek Confluence</td>
<td>15,000</td>
<td>24,000</td>
<td></td>
</tr>
<tr>
<td>Ventura River Baldwin Rd</td>
<td>16,000</td>
<td>24,800</td>
<td></td>
</tr>
<tr>
<td>Ventura River Casitas Springs</td>
<td>35,200</td>
<td>56,600</td>
<td></td>
</tr>
<tr>
<td>Ventura River Gauge at Foster Park</td>
<td>36,400</td>
<td>59,700</td>
<td></td>
</tr>
<tr>
<td>Ventura River at Shell</td>
<td>41,300</td>
<td>67,900</td>
<td></td>
</tr>
<tr>
<td><strong>Matilija Creek</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Matilija Creek below dam and above N. Fork Matilija Creek</td>
<td>12,500</td>
<td>18,800</td>
<td></td>
</tr>
<tr>
<td>North Fork Matilija Creek</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N. Fork Matilija (upper part)</td>
<td>3,830</td>
<td>10,380</td>
<td></td>
</tr>
<tr>
<td>N. Fork Matilija (lower part)</td>
<td>3,960</td>
<td>10,740</td>
<td></td>
</tr>
<tr>
<td><strong>San Antonio Creek and Tributaries</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Senior and Gridley</td>
<td>4,590</td>
<td>12,440</td>
<td></td>
</tr>
<tr>
<td>San Antonio Creek below McNell Creek</td>
<td>5,760</td>
<td>15,630</td>
<td></td>
</tr>
<tr>
<td>Reeves Creek above Thacher Creek</td>
<td>1,530</td>
<td>4,150</td>
<td></td>
</tr>
<tr>
<td>Thacher Creek above San Antonio Creek</td>
<td>2,860</td>
<td>7,750</td>
<td></td>
</tr>
<tr>
<td>San Antonio Creek below Thacher Confluence</td>
<td>7,490</td>
<td>20,330</td>
<td></td>
</tr>
<tr>
<td>San Antonio Creek above Stewart Creek</td>
<td>11,620</td>
<td>20,990</td>
<td></td>
</tr>
<tr>
<td>Stewart Canyon above San Antonio Creek with Fox</td>
<td>1,070</td>
<td>2,920</td>
<td></td>
</tr>
<tr>
<td>San Antonio after Thacher Confluence</td>
<td>8,590</td>
<td>23,320</td>
<td></td>
</tr>
<tr>
<td>San Antonio Creek above Lion Confluence</td>
<td>7,760</td>
<td>21,050</td>
<td></td>
</tr>
<tr>
<td>Big Canyon (Upper Ojai)</td>
<td>690</td>
<td>1,880</td>
<td></td>
</tr>
<tr>
<td>Lower Lion Canyon Creek</td>
<td>3,430</td>
<td>9,310</td>
<td></td>
</tr>
<tr>
<td>San Antonio after Lion Canyon Confluence</td>
<td>10,430</td>
<td>28,300</td>
<td></td>
</tr>
<tr>
<td>San Antonio Creek above Ventura River Confluence</td>
<td>9,960</td>
<td>27,020</td>
<td></td>
</tr>
<tr>
<td><strong>Coyote Creek</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coyote Creek above Ventura River</td>
<td>680</td>
<td>1,980</td>
<td></td>
</tr>
<tr>
<td><strong>Cañada Larga Creek</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cañada Larga Creek above Ventura River</td>
<td>5,370</td>
<td>14,580</td>
<td></td>
</tr>
</tbody>
</table>

This table shows model-generated estimates of peak flows of various streams and stream reaches in the watershed. These 10-year and 50-year peak flows are expected to occur once every 10 or 50 years, respectively. The largest peak flows ever measured in the watershed (63,600 cfs) were at the Foster Park gauge and were the equivalent of a 65-year peak flow.

Source: Ventura River Watershed Design Storm Modeling Final Report (VCWP 2010)
Extremely Variable

As in other watersheds in the region, streamflow patterns in the Ventura River watershed reflect the same extreme variation found in rainfall patterns. As shown in Table 3.3.1.2.4, between 1930 and 2013, the average annual rate of flow of the Ventura River at Foster Park was 65.4 cfs, but this period saw an annual low of 0 cfs and a high of 382.8 cfs. Table 3.3.1.2.4 also indicates the equivalent volume of water from these flow rate amounts. The annual runoff volume of the wettest water year was 227,096 AF—almost five times greater than the annual average and over 18 times greater than the annual median. These numbers help illustrate the extremely variable nature of streamflow in the watershed.

Table 3.3.1.2.4 Annual Average Streamflow at Foster Park, Water Years 1930–2013

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cubic feet/second (cfs)</td>
<td>65.4</td>
<td>17.8</td>
<td>0.0</td>
<td>382.8</td>
</tr>
<tr>
<td>Acre feet/year (AF/yr)</td>
<td>47,329</td>
<td>12,349</td>
<td>0.0</td>
<td>227,096</td>
</tr>
</tbody>
</table>

For comparison purposes, the rate of flow (cfs) was converted into the equivalent acre-feet for the year (AF/yr).

Annual average streamflow is the average of all daily streamflows for the year. 2012–2013 data is provisional.

Data Source: USGS National Water Information System Website (USGS 2014b)

Table 3.3.1.2.5 Annual Peak Flows at Foster Park, Water Years 1933–2013

<table>
<thead>
<tr>
<th></th>
<th>Avg.</th>
<th>Median</th>
<th>Low (1951)</th>
<th>High (1978)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cubic feet/second</td>
<td>10,410</td>
<td>3,330</td>
<td>0.0</td>
<td>63,600</td>
</tr>
<tr>
<td>Acre-feet/minute</td>
<td>14.34</td>
<td>4.59</td>
<td>0.0</td>
<td>87.60</td>
</tr>
</tbody>
</table>

For comparison purposes, the peak rate of flow (cfs) was converted into acre-feet per minute.

Data Source: Ventura County Watershed Protection District Hydrologic Data Server (VCWPD 2013)

The median rate of flow is also provided in Table 3.3.1.2.4. The median represents the midpoint of the set of data, such that half of the years had an average rate of flow less than the median and half had an average rate of flow greater than the median. When data sets have an extreme range of variability, a few extreme numbers, such as a few extreme flood years, can skew the average. In such instances the median represents a much truer picture of “typical”—in this case, what flow is like in a typical year. Median flows, those closer to 17.8 cfs, are experienced much more often than average flows of 65.4 cfs. An average flow that is almost four times the median flow indicates high streamflow variability. Table 3.3.1.2.5 shows similar data for peak flows at Foster Park between the years 1933 and 2013.
Figure 3.3.1.2.9 Cumulative Distribution of Daily Average Flows at Foster Park, Sept. 1926–Oct. 2012.

This chart illustrates that typical flows in the river are relatively low: 88% of the time average daily flows at the Foster Park gauge are less than 50 cfs, 75% of the time flows are less than 24 cfs, and 50% of the time flows are less than 11 cfs.

Source: USGS National Water Information System/Website (USGS 2014b)

Figure 3.3.1.2.10 Total Annual Streamflow Volume and Ojai Rainfall, Water Years 1930–2012

Source: Streamflow: USGS National Water Information System Website (USGS 2013); Rainfall: VCWPD Hydrologic Data Server (VCWPD 2013)
Cubic Feet Per Second and Acre-Feet

Water in motion—streamflow—is usually measured in "cubic feet per second" or "cfs," which is equal to the volume of water one-foot wide and one-foot high, flowing a distance of one foot in one second. A cubic foot equals 7.48 gallons flowing each second, or 449 gallons flowing each minute. One cfs will produce 646,272 gallons per day, or 724 AF of water per year.

Water that is in storage or impounded is typically measured in "acre-feet" or "AF," which is equal to the volume of water that would cover an acre of land (43,560 square feet) to a depth of one foot. An AF equals 325,851 gallons of water. One AF is equal to 0.504 cfs/day, meaning that if water was flowing at 0.504 cfs for the duration of one day, the volume discharged during that day would be one AF (USGS 2014).

Below are photos that illustrate what different streamflows look like on the Ventura River.

35 and 200+ CFS of Streamflow, Ventura River, Below Robles Diversion.
These photos are intended to show what different rates of flow (cubic feet per second, or cfs) look like. The top photo shows a flow of about 35 cfs and the bottom photo, a flow 200+ cfs.

Photo courtesy of Casitas Municipal Water District

Streamflow of 30,000 cfs, Ventura River at Casitas Springs, 1998
Photo courtesy of Ventura County Watershed Protection District
Flashy and Intermittent

Streamflow in the Ventura River watershed responds very quickly to rainfall. During the rainy season, streamflows in the watershed are typically “flashy”—they increase, peak, and subside rapidly in response to storms. The rainy season is between October 15 and April 1, and rainfall tends to occur in just a few significant storms during this time. Streamflows generally peak in January through March and are lowest from August through October. See also “3.3.2 Flooding” for a look at streamflow and flood events.

The amount of streamflow that persists outside the rainy season, called “base flow,” depends upon how much rain fell the previous winter and consequently how much recharge the groundwater basins received and how saturated the soil became. Typically, after the rains have passed, the amount of water flowing in streams in the watershed diminishes fairly rapidly. For the “ephemeral” streams, this marks the end of flow altogether; for the “intermittent” streams or stream reaches, flow will continue on for some time; and for the “perennial” stream reaches, flow will continue all year except in extended drought periods.

Direct Runoff vs. Base Flow

Direct runoff is the surface flow that contributes to a stream during and immediately after a storm. Base flow is the flow of water in streams that remains well after storms have passed. The source of base flow is groundwater that has made its way into the stream channel (Williamson & Klamut 2001). Base flow is a critical factor in the life cycle of some species, such as the endangered southern California steelhead, and is highly impacted by sustained drought or water withdrawals for human use. Because streamflow in the Ventura River watershed comes primarily from rain and not snowmelt, and because a few big storms often bring the bulk of the rain, the majority of total annual flow occurs as storm flow, or direct surface runoff, rather than as base flow.
Of the six major streams in the watershed, only Matilija Creek and North Fork Matilija Creek are typically perennial for their entire lengths, although sections of Matilija Creek occasionally dry up. Some of the tributaries of San Antonio Creek that are spring fed, such as Gridley Canyon and Senior Canyon Creeks, are also known to be perennial in their upper reaches. All other major streams are typically intermittent for either their entire length or parts of it. In rare, very wet years, the Ventura River may have continuous flow to the ocean; however, in most years, flow is intermittent, with the river drying up in the dry reach between the Robles Diversion Facility and the confluence with San Antonio Creek. Many of the watershed's smaller streams are ephemeral, existing only briefly after storms.

Although the increased consumption of water by people in recent times has certainly influenced streamflow in the watershed, an extensive study of historical records by the San Francisco Estuary Institute demonstrated that the intermittent nature of the Ventura River mainstem has been a condition of the river for over one hundred years. As observed today, surface flows commonly became intermittent when the river dropped out of the mountains and entered flatter terrain. At the confluence with San Antonio Creek, and from Foster Park to the mouth of the river, flows were perennial (Beller et al. 2011).

"...we found ourselves at the mouth of...the Matilija Canón...A rapid brook runs down the anon, shrinking into the deserted bed of what must once have been a broad river, and here and there the gravel spreads far over the desolate bottom. But soon after entering the ravine, the eye is relieved by patches of wood and verdure which at short intervals break in upon the sand" (Hassard 1887).

Documentation of flow conditions on the Ventura River consistently depicts three reaches with distinct summer flow regimes within the study area. These reaches are depicted on the historical topographic quad for the river (USGS 1903c; fig. 4.9). The first perennial reach extends from beyond the northern edge of the study area (Matilija Hot Springs) downstream to around the Cozy Dell Canyon (Matilija reach). Below this, the Ventura River valley begins to open up into the head of the Ojai Valley, and the river is intermittent until below Oak View and the river's confluence with San Antonio Creek (Oak View reach). Last, perennial flow is shown from just above the San Antonio Creek confluence downstream to the ocean (Avenue/Casitas reach).

—Historical Ecology of the Lower Santa Clara River, Ventura River, and Oxnard Plain (Beller et al. 2011)
3.3.1.3 Surface Water Diversions, Dams and Reservoirs

The natural flow of water through the stream network has been altered by diversions of water for human use. These include dams and surface water diversions, which are discussed below, but also the extraction of groundwater. See “3.3.3 Groundwater Hydrology” and “3.4 Water Supplies and Demands” for information on groundwater withdrawals.

There are two major dams within the Ventura River watershed: Casitas Dam, which forms Lake Casitas, and Matilija Dam, which forms the Matilija Reservoir. There are two minor dams: Senior Canyon Dam, which forms Senior Canyon Reservoir, and the Stewart Canyon Debris Basin Dam, which exists to slow storm flows and capture storm debris.

There is also one subsurface dam in the Ventura River at Foster Park and two significant surface water diversions, the Robles Diversion and the Foster Park Diversion (although the Foster Park surface diversion has not been used since the mid 1990's because the river has been dry in that location). Many others in the watershed, including individuals, farms and ranches, and small water companies, hold and use rights to divert smaller amounts of surface water (SWRCB 2013). As of March 2014, 21 different entities were registered in the state's eWRIMS (Electronic Water Rights Information Management System) database as having rights to withdraw surface water or water from subterranean streams in the watershed (SWRCB 2014b).

Lake Casitas and Robles Diversion

Lake Casitas is the watershed's principal water supply reservoir, providing water to users throughout the watershed and to the small adjoining coastal watersheds (including the Rincon area and the City of Ventura). Lake Casitas gets its water from Coyote and Santa Ana Creeks (~55%), which flow directly into the lake; and from Ventura River diversions (~45%), transported to the lake via the 5.4-mile Robles Canal from the Robles Diversion and Fish Passage Facility (Robles Diversion) located on the river. The relative amounts from these sources depend upon a variety of factors that change from year to year (Wickstrum 2014). The lake has a maximum storage capacity of 254,000 AF.

The Robles Diversion is located on the western bank of the Ventura River about 1.5 miles downstream of the junction of Matilija and North Fork Matilija Creeks, and it includes a fish ladder to facilitate passage of migrating fish. In low rainfall years, there is typically little or no surface flow in the river at the diversion. When winter rains result in sufficient surface flows at the diversion, the amount of water diverted to the lake versus that required to be released downstream is dictated by a regulatory...
Lake Casitas Dam and Reservoir
Photo courtesy of Rick Wilborn

Santa Ana Creek Entering Lake Casitas Recreation Area

document called the Robles Fish Passage Facility Biological Opinion (NMFS 2003). The Biological Opinion was prepared by the National Marine Fisheries Service as a required part of construction of a fish passage facility (which became operational in 2006) at the Robles Diversion. It outlines complex operational and flow guidelines to provide for the migration and passage of the endangered southern California steelhead up and down the main stem of the Ventura River and through
the diversion during the steelhead migration season, which is between January 1 and June 30. Outside of the migration season, the flow guideline is simpler: a minimum flow of 20 cfs must be released downstream to protect rights of downstream groundwater users.

Robles Diversion Aerial
Photo courtesy of Google Earth

Robles Diversion. The Robles Diversion structure is located 1.5 miles downstream of the confluence of Matilija and North Fork Matilija Creeks, the beginning of the Ventura River. The concrete structure is located on the western bank of the river, and has diversion gates, bypass gates, and a fish ladder. A 350-foot-long by 9.5-foot-high earthen dam is located across the river to divert flows to the diversion structure (Entrix & Woodward Clyde 1997). Both photos were taken during the dry season when no water diversions were occurring.
Matilija Reservoir and Dam

Matilija Reservoir is an older, smaller reservoir built on Matilija Creek. It was originally built to hold 7,000 AF of water, but is now nearly full of sediment and holds less than 500 AF (USACE 2004b). During the 1950s and 1960s, irrigation water from Matilija Reservoir was delivered by gravity flow to the western Ojai Valley via a pipeline system, called the Matilija Conduit, originating at the face of the dam. In the past, reservoir water was also sometimes released in the winter through a gate valve in the dam to enhance diversions to Lake Casitas via the Robles Diversion; however, this practice was discontinued in 2011 because of regulatory concerns over instream water quality (Evans 2013).
A concerted, multi-stakeholder effort to remove Matilija Dam has been underway since 1998 because the reservoir no longer provides a water supply function, blocks the migration of the endangered southern California steelhead and restricts the natural transport of sediment to the Ventura River and coastal beaches. See "3.6.3 Matilija Dam" for a more detailed discussion about the dam.

**Foster Park Subsurface Dam and Diversion**

A small dam also exists in the Ventura River at Foster Park. This is an area of the river that naturally has regular flow, in part because underground geologic structures force subsurface flow to the surface. In 1906, this natural geologic feature was enhanced by construction of a subsurface diversion dam across the river to enhance the amount of water available for diversion to the City of Ventura. The dam crosses the Ventura River as well as the mouth of Coyote Creek (Entrix & Woodward Clyde 1997), and works in combination with subsurface collector pipes.
3.3.1.4 Streamflow Monitoring

Streamflow data are regularly monitored in the watershed by the Ventura County Watershed Protection District (VCWPD), the United States Geological Survey (USGS), Casitas Municipal Water District (CMWD), and Santa Barbara Channelkeeper (SBCK). The City of Ventura has also conducted intermittent streamflow monitoring.

The VCWPD and USGS have websites that make these data available to the public.
Streamflow Data Limitations

Streamflow monitoring is subject to a number of data quality challenges and limitations, as described in this excerpt:

Data quality is an important issue for stream gauge records. Many of the streams in the watershed flow through unstable channels that shift dimensions over time and become choked with debris, causing the relationship between measured stage and discharge to change over time. In addition, flood peaks that exceed the range for which velocities have been measured (or those that disable the stage recorder) are often estimated with considerable uncertainty.

—Data Summary Report, Ventura River Watershed Hydrology Model (Tetra Tech 2008)

<table>
<thead>
<tr>
<th>VCWPD #</th>
<th>USGS #1</th>
<th>Location</th>
<th>Agency²</th>
<th>Monitored</th>
</tr>
</thead>
<tbody>
<tr>
<td>603</td>
<td>11114495</td>
<td>Matilija Creek above Matilija Reservoir</td>
<td>USGS (with $ from VCWPD)</td>
<td>Continuous flow</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Matilija Creek at Matilija Hot Springs</td>
<td>CMWD</td>
<td>Continuous flow</td>
</tr>
<tr>
<td>602</td>
<td>(11115500)</td>
<td>Matilija Creek at Matilija Hot Springs</td>
<td>VCWPD</td>
<td>Continuous flow</td>
</tr>
<tr>
<td>604</td>
<td>(11116000)</td>
<td>North Fork Matilija Creek</td>
<td>VCWPD</td>
<td>Continuous flow</td>
</tr>
<tr>
<td></td>
<td>(11116550)</td>
<td>Ventura River below Robles Diversion (Meiners Oaks)</td>
<td>CMWD</td>
<td>Continuous flow</td>
</tr>
<tr>
<td>605</td>
<td>(11117500)</td>
<td>San Antonio Creek at Hwy 33</td>
<td>VCWPD</td>
<td>Continuous flow</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Santa Ana Creek above lake</td>
<td>CMWD</td>
<td>Continuous flow</td>
</tr>
<tr>
<td></td>
<td>(11117600)</td>
<td>Coyote Creek above lake</td>
<td>CMWD</td>
<td>Continuous flow</td>
</tr>
<tr>
<td>608</td>
<td>11118500</td>
<td>Ventura River at Foster Park</td>
<td>USGS (with $ from VCWPD &amp; CMWD)</td>
<td>Continuous flow</td>
</tr>
<tr>
<td>630</td>
<td></td>
<td>Cañada Larga Creek at Ventura Ave</td>
<td>VCWPD</td>
<td>Storm peak and event data only</td>
</tr>
<tr>
<td>631</td>
<td></td>
<td>Fox Canyon Drain below Hwy 150</td>
<td>VCWPD</td>
<td>Continuous flow</td>
</tr>
<tr>
<td>633</td>
<td></td>
<td>Happy Valley Drain at Rice Rd</td>
<td>VCWPD</td>
<td>Storm peak and event data only</td>
</tr>
<tr>
<td>669</td>
<td></td>
<td>Thacher Creek at Boardman</td>
<td>VCWPD</td>
<td>Event peak and flood warning only</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Robles Diversion Canal, 1 near Diversion; 1 inside park before lake</td>
<td>CMWD</td>
<td>Continuous flow</td>
</tr>
</tbody>
</table>

---

1: Gauge numbers in parentheses indicate gauges that were historically, but are no longer, monitored by USGS.

Data Source: VCWPD (VCWPD 2014)

2: USGS-United States Geological Survey; CMWD-Casitas Municipal Water District; VCWPD-Ventura County Watershed Protection District
VCWPDP Historic Streamflow Data. Data from eight active streamflow monitoring stations (\#s 602, 603, 604, 605, 608, 630, 633, and 669) are collected by VCWPDP and can be found at www.vcwatershed.net/hydrodata/php/getstations.php?dataset=stream\_day. Some VCWPDP stream gauges are operated or co-operated by the USGS.

VCWPDP Current Streamflow Data. VCWPDP also provides current (almost real-time) observed and forecasted streamflow data at a website that is updated every 10 minutes. Website: www.vcwatershed.net/fws/VCAHPS/\#.

USGS Historic and Current Streamflow Data: The USGS currently operates two streamflow gauges (\#s 11114495 and 11118500) in the watershed. They have also operated gauges at other locations in the watershed in the past. Streamflow data are available in real-time (updated every 15 minutes) or as a daily average of streamflow dating back to the beginning of the period of record. The USGS data can be found at: http://waterdata.usgs.gov/ca/nwis/sw.

CMWD Streamflow Data: CMWD operates five streamflow gauges and helps fund a sixth gauge, as indicated in Table 3.3.1.4.1. Data from the gauges are compiled in the district's annual hydrology report.

Santa Barbara Channelkeeper Streamflow Data: Santa Barbara Channelkeeper's Stream Team has collected estimated streamflow measurements since 2001. From 2001 to November 2006, estimated measurements were made utilizing a “float” method. In December 2006, Stream Team began collecting measurements using electronic current velocity meters. In accordance with an adapted USGS streamflow measurement protocol, flow is estimated based on measurements of the cross-sectional width, velocity, and depth of the stream at several equally spaced intervals along the cross section. Streamflow measurements have been irregularly collected at various Stream Team sites throughout the duration of the program. Channelkeeper maintains its streamflow dataset and makes it available by request to educators, agencies, and the public.

City of Ventura Data: Since 2009 the City of Ventura has conducted intermittent monitoring of groundwater levels and streamflow in the vicinity of the City's wellfield at Foster Park. This monitoring is a part of a Surface/Groundwater Interaction Study that looks at the effect of the City's pumping on flows in the Foster Park Area. In addition, the City has monitored the pools and riffles (shallow areas of a stream where water moves fast enough that it ripples) within the Foster Park reach of the river on several occasions in an attempt to compare changes in flow rates with changes in fish habitat using a Habitat Suitability Index based on 18 variables (indicators) including water temperature, flow velocity, substrate, and shading. These studies are intermittent for the purpose of developing data for CEQA documentation for the installation of additional wells.
3.3.1.5 Key Data and Information Sources/Further Reading

Below are some of key documents that address surface water hydrology in the watershed. See “4.3 References” for complete reference citations.

**HSPF Model**

In 2008, under contract from the VCWPD, Tetra Tech completed a hydrologic model for the Ventura River Watershed using the USEPA’s Hydrological Simulation Program-Fortran (HSPF). Data integrated into this model include precipitation, evapotranspiration, land use and land cover, soils, slopes and elevations, watershed segmentation, planning and zoning, fire regime, hydrography, channel characteristics, flood elevation modeling (HEC-RAS), reservoir management for Casitas and Matilija, diversion structures, debris and detention basins, groundwater recharge, discharge, and surface water interactions, irrigation, point sources, and stream gauging. While the HSPF model has the ability to account for some aspects of groundwater, groundwater-surface water interactions are a potential source of uncertainty because limited groundwater information was included in the majority of the model runs, and the model has limited capability for groundwater simulation and dynamic exchanges with surface water features. The HSPF model was validated against data from water years 1997–2007. Following the validation, the model was used to perform a natural conditions simulation to determine what the state of water resources in the Ventura River Watershed would be without human influence. The input data and the results of the model runs are listed in several reports:

- Data Summary Report, Ventura River Watershed Hydrology Model (Tetra Tech 2008),
- Natural Condition Report, Ventura River Watershed Hydrology Model (Tetra Tech 2009),


Channel Geomorphology and Stream Processes (Entrix 2001a)
City of Ojai Urban Watershed Assessment and Restoration Plan (Magney 2005)

Design Hydrology Manual (VCWPD 2010a)

Draft Ventura River Habitat Conservation Plan (Entrix & URS 2004)

Historical Ecology of the lower Santa Clara River, Ventura River, and Oxnard Plain: an analysis of terrestrial, riverine, and coastal habitats. (Beller et al. 2011)


Hydrologic Assessment San Antonio Creek Sub-Watershed, Ventura County, California (DBS&A 2006)

Hydrology, Hydraulics and Sediment Studies of Alternatives for the Matilija Dam Ecosystem Restoration Project (USBR 2007)

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

Report on the Environmental Impacts of the Proposed Agreement Between Casitas Municipal Water District and the City of San Buenaventura for Conjunctive Use of the Ventura River–Casitas Reservoir System (EDAW 1978)

Surface Water-Groundwater Interaction Report for the Ventura River Habitat Conservation Plan (Entrix 2001)

Ventura River Steelhead Restoration and Recovery Plan (Entrix & Woodward Clyde 1997)

Ventura River Watershed Design Storm Modeling Final Report (VCWPD 2010)
3.3.2 Flooding

This section describes the recurring pattern of floods in the Ventura River watershed. The major flood types—riverine, alluvial, coastal, and urban—are defined, and the nature of these floods is described, including the role that the watershed's steep mountains play in the flashy nature of local floods. Coastal floods and erosion, which stem not from fresh water but from saltwater, are also examined. Finally, existing infrastructure and systems that are in place to protect lives and the built environment are reviewed.

**Floodplain Management**

Floods are, of course, natural events; it is only human-created infrastructure—either put in the pathway of flood flows or altering flooding conditions—that presents the need to "manage" them. Fortunately, those charged with managing floods are moving beyond simple "flood control" approaches focused strictly on moving water quickly in order to protect human life and property, to a "floodplain management" approach that acknowledges the functions and values of floodplains, such as water infiltration and groundwater recharge, providing critical riverine and aquatic habitats, and naturally attenuating flood flows.

Some flood-related topics are covered in other sections of this report: precipitation in "3.2.1 Climate," topography and well as the flood-related hazards of landslides, debris flows, and liquefaction in "3.2.2 Geology and Soils," and surface water flows in "3.3.1 Surface Water Hydrology."

San Antonio Creek Ranch, 1969 Flood

Photo courtesy of Ventura County Star
3.3.2.1 Flood Frequency and Intensity

Ventura River watershed residents are no strangers to floods. Damaging floods, like droughts, are an unpredictable yet relatively frequent occurrence. What local officials consider “major” floods—peak flows of 40,000 cubic feet per second (cfs) or more (as measured at Foster Park)—have occurred every 14 years on average since 1933. Some of the watershed's bigger floods are in the “moderate” category, those with peak flows of 20,000 cfs to 39,999 cfs (at Foster Park). Major or moderate flood flows on the Ventura River have occurred once every 5 years on average since 1933. Sometimes multiple peak flow events are seen in the course of one rainy season. Two of the watershed's six major peak flows on record occurred during one wet season: the flood of 1969; of the 18 major and moderate flows on record, three occurred during the winter of 2005.

Major or moderate flood flows on the Ventura River have occurred once every 5 years on average since 1933.

Since 1962, there have been eight Presidential declared major flood disasters in Ventura County (see Table 3.3.2.1.2). “A Presidential major disaster declaration puts into motion long-term federal recovery programs, some of which are matched by state programs and designed to help disaster victims, businesses and public entities.” (FEMA 2014)

Figure 3.3.2.1.1 Annual Peak Flow at Foster Park, 1933–2013. This graph shows the largest peak flow event for each of the years from 1933 to 2013.
Table 3.3.2.1.1 summarizes significant flood flows since streamflow monitoring began in 1933.

### Table 3.3.2.1.1 Ventura River Flood Flows Greater than 15,000 cfs, 1933–2011

<table>
<thead>
<tr>
<th>Date</th>
<th>Water Year</th>
<th>Peak Flow (cfs) (^1)</th>
<th>% Annual Exceedance Probability (^2)</th>
<th>Flood Category (^3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1978, February</td>
<td>1978</td>
<td>63,600</td>
<td>1.5%</td>
<td>Major</td>
</tr>
<tr>
<td>1969, January</td>
<td>1969</td>
<td>58,000</td>
<td>2.2%</td>
<td>Major</td>
</tr>
<tr>
<td>1992, February</td>
<td>1992</td>
<td>45,800</td>
<td>5.2%</td>
<td>Major</td>
</tr>
<tr>
<td>1995, January</td>
<td>1995</td>
<td>43,700</td>
<td>6.0%</td>
<td>Major</td>
</tr>
<tr>
<td>2005, January</td>
<td>2005</td>
<td>41,000</td>
<td>7.3%</td>
<td>Major</td>
</tr>
<tr>
<td>1969, February</td>
<td>1969</td>
<td>40,000</td>
<td>7.8%</td>
<td>Major</td>
</tr>
<tr>
<td>1938, March</td>
<td>1938</td>
<td>39,200</td>
<td>8.2%</td>
<td>Moderate</td>
</tr>
<tr>
<td>1998, February</td>
<td>1998</td>
<td>38,800</td>
<td>8.5%</td>
<td>Moderate</td>
</tr>
<tr>
<td>1980, February</td>
<td>1980</td>
<td>37,900</td>
<td>9.0%</td>
<td>Moderate</td>
</tr>
<tr>
<td>1943, January</td>
<td>1943</td>
<td>35,000</td>
<td>11.0%</td>
<td>Moderate</td>
</tr>
<tr>
<td>1952, January</td>
<td>1952</td>
<td>29,500</td>
<td>16.1%</td>
<td>Moderate</td>
</tr>
<tr>
<td>2005, January</td>
<td>2005</td>
<td>29,400</td>
<td>16.2%</td>
<td>Moderate</td>
</tr>
<tr>
<td>1983, March</td>
<td>1983</td>
<td>27,000</td>
<td>19.1%</td>
<td>Moderate</td>
</tr>
<tr>
<td>1952, March</td>
<td>1952</td>
<td>24,600</td>
<td>22.5%</td>
<td>Moderate</td>
</tr>
<tr>
<td>1934, January</td>
<td>1934</td>
<td>23,000</td>
<td>25.2%</td>
<td>Moderate</td>
</tr>
<tr>
<td>1986, February</td>
<td>1986</td>
<td>22,100</td>
<td>26.8%</td>
<td>Moderate</td>
</tr>
<tr>
<td>2004, December</td>
<td>2005</td>
<td>20,600</td>
<td>29.7%</td>
<td>Moderate</td>
</tr>
<tr>
<td>1944, February</td>
<td>1944</td>
<td>20,000</td>
<td>30.9%</td>
<td>Moderate</td>
</tr>
<tr>
<td>2011, March</td>
<td>2011</td>
<td>19,100</td>
<td>32.9%</td>
<td>Flood</td>
</tr>
<tr>
<td>2001, March</td>
<td>2001</td>
<td>19,100</td>
<td>32.9%</td>
<td>Flood</td>
</tr>
<tr>
<td>2005, February</td>
<td>2005</td>
<td>18,800</td>
<td>33.6%</td>
<td>Flood</td>
</tr>
<tr>
<td>1958, April</td>
<td>1958</td>
<td>18,700</td>
<td>33.8%</td>
<td>Flood</td>
</tr>
<tr>
<td>1945, February</td>
<td>1945</td>
<td>17,000</td>
<td>38.1%</td>
<td>Action</td>
</tr>
<tr>
<td>1969, January</td>
<td>1969</td>
<td>16,600</td>
<td>39.1%</td>
<td>Action</td>
</tr>
<tr>
<td>1973, February</td>
<td>1973</td>
<td>15,700</td>
<td>41.6%</td>
<td>Action</td>
</tr>
<tr>
<td>1941, March</td>
<td>1941</td>
<td>15,200</td>
<td>43.1%</td>
<td>Action</td>
</tr>
</tbody>
</table>

1: Peak flows are as measured, in cubic feet per second (cfs), at the Foster Park gauging station.
2: The Annual Exceedance Probability (AEP) values indicate the chance that specific flood flows will occur in any one year. A 1% AEP means there is a 1 in 100 chance that a flood will occur in any one year. AEP values are most accurate for the highest flows, but estimates are provided for the lower flows to indicate the general trend. See sidebar definition of 100-year flood and AEP.
3: Flood Category thresholds are different in different parts of the watershed, as determined by Ventura County Watershed Protection District.

Data Sources: Hydrologic Data Server [VCWPD 2013]; [VCWPD 2014]
100-Year Flood (also called Base Flood)—A misleading term that does NOT mean a flood that will occur once every 100 years. It is a flood whose flow has a 1% chance of being exceeded in any given year. A 50-year flood (which has smaller peak flows) has a greater chance, 2%, of being exceeded in any given year; and a 500-year flood (which has greater peak flows) has a lesser chance, 0.2%, of being exceeded in any given year.

1% Annual Exceedance Probability Flood—"Annual Exceedance Probability (AEP) Flood" is the current preferred term, because it describes the probability of specific flood flows occurring, rather suggesting the length of time (years) between floods of specific flows. A 100-year flood could occur more than once in a short period of time.

According to the Federal Emergency Management Agency’s (FEMA) statistics, a 100-year flood has a 26% chance of occurring during a 30-year period, which happens to be the length of many mortgages. People living inside of the 100-year or 1% AEP flood hazard zone are subject to flood insurance requirements if their mortgage is backed by the federal government through the National Flood Insurance Program (VCWPD 2014; CRS 2013).

The Ventura River’s greatest recorded peak flood flow, 63,600 cfs (in February 1978), was the equivalent of a 65-year flood or 1.5% AEP flood (VCWPD 2014). Since streamflow measuring began in 1929, the Ventura River has never experienced a 100-year (1% AEP) flood.

As described in more detail in “3.3.1 Surface Water Hydrology,” streamflows in the watershed are closely correlated with rainfall, and thus flood events are almost exclusively associated with rainfall events. As indicated in Table 3.3.2.1.1, most of the watershed’s major and moderate floods have occurred in January or February, well into the rainy season when soils may have already been saturated and “primed” for runoff.

The total amount of rainfall, however, is not the only factor involved; the timing and intensity of the rainfall, the timing and quantity of previous rainfall, soil saturation levels, and the condition of the stream channels, among other factors, also matter. Snowmelt is not a significant contributor to flooding in the Ventura River watershed. The snow that sometimes does fall on the mountains of the watershed generally melts gradually and fairly quickly—not lasting long enough for a warmer storm to cause the fast melting that boosts flood flows.

<table>
<thead>
<tr>
<th>Year</th>
<th>Month</th>
<th>President</th>
</tr>
</thead>
<tbody>
<tr>
<td>1962</td>
<td>February</td>
<td>Kennedy</td>
</tr>
<tr>
<td>1965</td>
<td>November–December</td>
<td>Johnson</td>
</tr>
<tr>
<td>1967</td>
<td>November–December</td>
<td>Johnson</td>
</tr>
<tr>
<td>1969</td>
<td>January</td>
<td>Nixon</td>
</tr>
<tr>
<td>1983</td>
<td>February–March</td>
<td>Reagan</td>
</tr>
<tr>
<td>1992</td>
<td>February</td>
<td>Bush</td>
</tr>
<tr>
<td>1995</td>
<td>January–March</td>
<td>Clinton</td>
</tr>
<tr>
<td>2005</td>
<td>January</td>
<td>Bush</td>
</tr>
</tbody>
</table>

1: The Presidents declaring the disaster are shown in parenthesis.

Data Source: Flood Histories of the Counties in the Alluvial Fan Task Force Study Area (Earp 2007)
Figure 3.3.2.1.2 Select Flow Monitoring Locations Map. This map of select streamflow monitoring locations accompanies Table 3.3.2.1.3.

Table 3.3.2.1.3 Flood Flows (cfs) by Flood Category on Various Drainages

<table>
<thead>
<tr>
<th>Drainage Location</th>
<th>Major</th>
<th>Moderate</th>
<th>Flood</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matilija Creek (above Matilija Dam)</td>
<td>9,000</td>
<td>8,000</td>
<td>7,000</td>
<td>6,000</td>
</tr>
<tr>
<td>Ventura River (at Foster Park)</td>
<td>40,000</td>
<td>20,000</td>
<td>18,000</td>
<td>15,000</td>
</tr>
<tr>
<td>Thacher Creek (at Boardman)</td>
<td>5,500</td>
<td>5,000</td>
<td>4,000</td>
<td>3,000</td>
</tr>
<tr>
<td>Fox Canyon Barranca (at Athletic Club)</td>
<td>2,050</td>
<td>1,950</td>
<td>1,900</td>
<td>1,700</td>
</tr>
<tr>
<td>Happy Valley Drain (at Rice Rd.)</td>
<td>2,000</td>
<td>1,900</td>
<td>1,700</td>
<td>1,500</td>
</tr>
<tr>
<td>San Antonio Creek (near confluence with Ventura River)</td>
<td>10,000</td>
<td>9,000</td>
<td>8,000</td>
<td>6,000</td>
</tr>
</tbody>
</table>

1: See Figure 3.3.2.1.2 for a map of these locations.

The flow, in cubic feet per second (cfs), that is considered "major," "moderate," or "minor" is different for different streams and different sections of the river. On San Antonio Creek, for example, a flow of 10,000 cfs or higher at the creek's confluence with the Ventura River indicates a major flood, whereas on the Ventura River, a flow of 40,000 cfs or higher (at Foster Park) is considered a major flood.

Data Source: VCWPD Google Maps Interface for rainfall, stream, and evaporation stations (www.vcwatershed.net/fws/VCAHPS/#)
San Antonio Creek Flood Flows

Major floods along San Antonio Creek are described as having a peak discharge greater than 10,000 cfs. The most severe flood on record on San Antonio Creek occurred in 2005, with a peak flow of 24,000 cfs recorded at the gauging station on San Antonio Creek at Casitas Springs (VCWPD 2013c).

As discussed later in this section, coastal flooding, caused by ocean water tide and wave inundation, often occurs when riverine flooding occurs, but can also occur independently of inland flooding. Table 3.3.2.1.4 summarizes past coastal floods in the watershed.

Table 3.3.2.1.4 Significant Coastal Floods in the Watershed

<table>
<thead>
<tr>
<th>Year</th>
<th>Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>1907</td>
<td>December</td>
</tr>
<tr>
<td>1939</td>
<td>September</td>
</tr>
<tr>
<td>1969</td>
<td>December</td>
</tr>
<tr>
<td>1977–78</td>
<td>Winter</td>
</tr>
<tr>
<td>1982–83</td>
<td>Winter</td>
</tr>
<tr>
<td>1988</td>
<td>January</td>
</tr>
<tr>
<td>1997–98</td>
<td>Winter</td>
</tr>
<tr>
<td>2010</td>
<td>January</td>
</tr>
</tbody>
</table>

Data Source: Ventura County Open Pacific Coast Study (FEMA 2011)

Of Water and Sediment

Flooding in the Ventura River watershed is as much about sediment and boulders as it is about water. The erosive rocks of the Transverse Ranges supply a steady stream of boulders and sediment, easily eroded in the intense downpours that occur in the watershed’s upper elevations. When a flood is rolling down the river valley, the chocolate brown flow is thick with rocks, sediment, and other debris, and residents report the sound of thunder as boulders crash downstream.

Debris from the river’s flood flows is carried out to sea or gets deposited along the way, typically in wider and flatter areas of the river channel. Piled-up debris can also create islands in the river or change the path of the river altogether. This topic is discussed further in “3.2.3 Geomorphology and Sediment Transport.”
3.3.2.2 **Flood Hazard Zones**

The Federal Emergency Management Agency (FEMA) manages the National Flood Insurance Program. As part of that program, FEMA creates and updates flood hazard maps, called Flood Insurance Rate Maps (or FIRMs), for communities across the country. These maps indicate areas where there is a 1% or greater probability of inundation by flood flows in any year, now called a “1% annual exceedance probability (AEP) flood” (formerly referred to as the 100-year flood).

Homes and buildings in areas mapped as having a 1% AEP are considered at high risk for floods and are required to have flood insurance if they have mortgages from federally regulated or insured lenders. These areas have a 1% or greater chance of flooding in any given year, which is equivalent to a 26% chance of flooding during a 30-year mortgage period (FEMA 2013).

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**Figure 3.3.2.2.1 Repetitive Loss Structures Map.** Repetitive loss structures are buildings identified by FEMA that, since 1978 and regardless of any change(s) of ownership during that period, have experienced one of the following: 1) four or more paid flood losses of more than $1,000 each; 2) two paid flood losses within a 10-year period that, in the aggregate, equal or exceed the current value of the insured property; and 3) three or more paid losses that, in the aggregate, equal or exceed the current value of the insured property (URS 2005). Of the 49 repetitive loss structures in Ventura County (as of 2004), 19 (39%) are located in the Ventura River watershed. Because of the high incidence of repetitive loss claims, FEMA has been working to reduce the losses experienced by repetitively flooded properties.

Source: VCPWPD 2014e
FEMA Flood Zones

- Ventura River Watershed
- 1% Annual Exceedance Probability Flood Zone (formerly 100-Year Flood Zone)
- 2% Annual Exceedance Probability Flood Zone (formerly 500-Year Flood Zone)
- Areas Protected by Levees or Subject to Lesser/Shallow Flooding

FEMA flood hazard zone data
effective date: September 25, 2014

Data Source:
FEMA

The FEMA (Federal Emergency Management Agency) flood hazard map is for informational purposes only. On-site flood risk determinations are provided by the local jurisdiction. For a complete flood risk determination, please contact the Ventura County Flood Control District or the property owner's local building department.

Map Created by Greencity Network using InfoWorks GIS software, December 2014 www.greencity.info

Figure 3.3.2.2.2 Flood Hazard Zone Map
3.3.2.3 Types of Floods and Where They Occur

The Ventura River watershed experiences several distinct types of flooding, including riverine flooding, alluvial fan flooding, coastal flooding, and urban drainage flooding; it also has the potential for dam failure flooding.

**Riverine Floods**

Riverine flooding occurs when a stream or river channel receives so much water that the excess water flows over its banks and onto the adjacent floodplain. The periodic inundation of floodplains is a natural and important ecosystem function that renews nutrients and triggers cycles of successive vegetation. As described in “3.3.1 Surface Water Hydrology,” a long list of factors influence streamflows. Two important factors that strongly influence the nature of riverine flooding in the watershed are the steepness of the terrain and the intensity of rain events.

*In the flood of 1992, the rate of flow of the Ventura River rose from less than 100 to 46,700 cubic feet per second—an increase of 46,600%—within about three hours.*

The steep terrain of the Ventura River watershed is carved by a network of streams that discharge water in a very short distance. The distance from the headwaters to the ocean is only 33.5 miles. Stormflows move fast in such a steep environment which, when coupled with the intense downpours that can occur in the upper watershed, results in streamflows that sometimes cannot be contained by their banks.

Floods in these conditions are called “flashy” because floodwaters tend to rise and fall in a matter of minutes. In the flood of 1992, as an extreme example, the rate of flow of the Ventura River rose from less than 100 to 46,700 cfs—an increase of 46,600%—within about three hours. The Ventura can be a fiercely flashy river.
Ventura River Preserve Swimming Hole, Dry and During 2005 Flood
Flood photo courtesy of David Magney

San Antonio Creek, 2005 Flood
Photo courtesy of Paul Jenkin

Casitas Springs, 2005 Flood
Photo courtesy of Ventura County Watershed Protection District

City of Ventura’s Nye Well 1A, 2005 Flood. The City’s Nye Well 1A replaced Nye Well 1, lost in a previous flood. The February 2005 flood took out the rest of its replacement.
Photo courtesy of Ventura Water, City of Ventura

Overflowing Manhole in San Antonio Creek, 2005 Flood. Stormwater caught in the sewer system flows out the manhole.
Photo courtesy of Ojai Valley Sanitary District
In addition to the risks associated with water overflowing its banks, riverine floods also pose risks related to erosion. Properties adjacent to streams and rivers can be scoured and undercut during floods, threatening homes, roads, and infrastructure. The floods of 1969 and 2005 both washed out a number of sewer mainlines along the edges of San Antonio Creek and the Ventura River. In the 2005 flood, this caused raw sewage mixed with stormwater to spill into the river for several days.
The high sediment load carried and deposited by local streams is a very significant factor in local riverine flood risks.

The high sediment load carried and deposited by local streams is a very significant factor in local riverine flood risks. Deposited rocks and sediment readily fill established channels which, if not cleaned out, can cause channel overflow and exacerbate flooding.

The wildland fires that occur in the forest and chaparral habitats that frame the watershed are also important contributors to flooding. After an intense fire, a waxy substance from the burning of brush and trees can be left on the soil, which makes the soil repel water. These “hydrophobic” soils decrease infiltration and increase runoff. A pattern of floods following fires within watersheds has been closely observed for more than 90 years in southern California (Earp 2007).
The Flood of 1969: The Watershed’s Most Damaging Flood

The most damaging riverine flood recorded in the Ventura River watershed occurred in 1969. The watershed above Ojai received a staggering 43 inches of rain in nine days between January 18 and January 27. The floodwaters and associated debris rolled down out of the mountains, flooding homes in Casitas Springs and Live Oak Acres. Much agricultural land, primarily citrus groves, was seriously damaged or destroyed. All over Ventura County, transportation facilities, including roads, bridges, and railroad tracks, were damaged. The wastewater treatment plant below Foster Park was severely damaged and dumped raw sewage into the Ventura River. In addition, sewer trunk lines were broken along the Ventura River and San Antonio Creek. Untreated sewage polluted the river and beach (VCPD 2011a). The capacity of the Matilija reservoir was significantly reduced by siltation from the flood (USACE 2004). See “4.4 Appendices” for a more detailed description of the 1969 flood.

Highway 33 Destroyed at North Fork
Matilija Creek, 1969
Photo courtesy of Ventura County Star
Figure 3.3.2.3.1 1969 Flood Damages Map
Source: Ventura County Flood Control District
**Alluvial Fan Floods**

Alluvial fans are the fan-shaped deposits of rock and sediment that accumulate on valley floors at the mouths of canyons in steep erosive mountains, typically in dry climates. The stream channels associated with alluvial fans are shallow and poorly defined, and their path is unpredictable. During heavy rains, water runs off the steep mountains above alluvial fans very quickly and with tremendous erosive force. The water picks up sediment, rocks, and boulders that can easily fill the shallow stream channels and cause floodwaters to spill out, spread out, and cut new channels. Alluvial fan floods can cause significant damage due to the high velocity of water flow, the amount of debris carried, and the broad area affected.

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**East Ojai Avenue, 1969 Flood**
The stream channels associated with alluvial fans are shallow and poorly defined, and their path is unpredictable.

*Photo courtesy of Ventura County Star*

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**Soule Park Golf Course, 2005 Flood**

*Photo courtesy of Ventura County Watershed Protection District*
A significant area of the Ojai Valley's East End appears on FEMA floodplain maps because of alluvial fan flood risk. Three alluvial fans occur in this area: Thacher Creek Alluvial Fan, San Antonio Creek Alluvial Fan, and Dron-Crooked Canyon Alluvial Fan (VCWPD 2009).

San Antonio, Thacher, McNeill, Reeves, and Dron Creek-Crooked Creeks are associated with the alluvial fan flooding on the East End of Ojai. These creeks have some of the highest erosion rates in Ventura County (Hawks & Associates 2005). This area of the watershed is dominated by citrus orchards, and flooding of the creeks can cause erosion and damage to the orchards, as well as to homes and roads. Residential neighborhoods built in these areas have a history of repeated flood damage. The Siete Robles neighborhood on Ojai's East End, located directly on the "active" or depositional area of the alluvial fans, has seen severe flooding over the years.

Figure 3.3.2.3.3 East Ojai 100-Year (1% AEP) Floodplain Map. In a Cooperative Technical Partnership with FEMA, Ventura County Watershed Protection District performed a comprehensive floodplain study of the east Ojai area, which culminated in 2011 with a proposal to FEMA to revise the floodplain map of this area. The revised map, which is very different than the old map, became effective in September of 2014.

Coastal Floods

Coastal flooding occurs when water from the ocean is driven onto land by storm surges, storm-generated wind, tides and waves, or tsunamis. Coastal flooding may cause damaging erosion of the coast, beaches, and structures along the coast, and this hazard is exacerbated by the reduction in the natural transport of sand and gravel to replenish local beaches. Rising sea level from climate change also presents a potential coastal flooding hazard. Backwater flooding at the river mouth, where the flow of the river to the ocean is "backed up" by exceptionally high ocean water or sand berms, is a type of flooding that is possible under conditions of higher sea level. Backwater flooding regularly occurs at the drainage to the coast on San Jon Road in Ventura, just outside of the watershed.

A tsunami is a series of sea waves generated by an earthquake, landslide, volcanic eruption, or other large disruption to the ocean. These sea waves can move more than 500 miles per hour and their destructive power can be enormous when they hit land. Damaging tsunamis have occurred infrequently in California, but they are a possibility that must be considered in coastal regions (CGS 2013).

The tsunami from an earthquake in Alaska in 1964 caused approximately $35,000 of damage to the marinas in Ventura County. A major earthquake off the coast of Chile in 2010 generated a tsunami that caused over $200,000 in damages to structures and vessels in Ventura Harbor. The worst recorded tsunami to hit California was in 1812, when an earthquake occurred in the Santa Barbara Channel; the resulting waves were probably 15 feet or higher above sea level at Ventura (VCPD 2011a).
Coastal flooding often occurs at the same time that riverine flooding occurs because both are associated with major storms, but this is not always the case. Sometimes powerful storms can flood or significantly erode the coast but not drop enough water to cause significant riverine flooding.

The boundaries of the watershed at the coast extend from the upper end of the City of Ventura's Seaside Wilderness Park adjacent to Emma Wood State Beach to just west of the tall Crowne Plaza Hotel at California Street. Coastal development in this area consists primarily of the 62-acre Ventura County Fairgrounds, several apartment complexes, and the Ventura Promenade.

Relative to other parts of the coastline, this area is sheltered from ocean storm swells by both Point Conception and the Channel Islands (BEACON 2009). Nonetheless, Emma Wood State Beach and the Ventura Promenade in front of the Ventura County Fairgrounds—both located on the river’s delta—have experienced repeated coastal flooding and erosion damage over the years. Emma Wood State Beach is eroding at a rate of about 0.6 feet annually, and past storms have caused extensive damage and led to its temporary closure (VCPD 2011a).
A reduction in the natural flow of sediment and sand to the beach is one of the reasons the ocean has been able to cause so much erosion here. The natural supply of sediment to the beaches in this region of the coast is principally from the steep gradient mountain creeks of the Santa Ynez and Topatopa Mountains. Over half of this natural sand and gravel supply is now blocked from reaching the beach, largely by Matilija Dam, but also by other dams, diversions, and debris basins (Beller et al. 2011).

Erosion of the coastal bluffs northwest of the Ventura River delta has historically contributed sediment to local beaches, but this natural process has also been modified. The Rincon Parkway, the 17-mile stretch of coastline above the mouth of the Ventura River, is almost entirely protected with either seawalls or revetments installed to protect the railroad, freeway, and development from erosion and the impact of waves (BEACON 2009).

### Sea Level Rise

California’s Cal-Adapt website states that “Global models indicate that California may see up to a 55 inch (140 cm) rise in sea level within this century given expected rise in temperatures around the world.” The map below from the website shows the latest projections for sea level rise at the watershed’s coastline. These data were developed by scientists from the USGS and Pacific Institute (Cal-Adapt 2014).

![Projected Sea Level Rise Map](image)

**Projected Sea Level Rise Map**

Source: Cal-Adapt 2014
The City of Ventura is a beach town; its inviting and accessible beaches are a central part of its cultural identity, and the health and maintenance of these beaches and coastal habitats are strongly supported by watershed stakeholders. A well-used promenade and bike path runs along the coast, east of the river mouth in front of the fairgrounds, and connects to paths up and down the coast, as well as up the river. This area of the coast is a highly regarded surfing spot, a point break known as “Surfers’ Point.” Erosion of the beach in this area is a significant issue of concern in the watershed. The bike path and parking area eroded more than 60 feet back in some places since originally installed. See “3.2.3 Geomorphology and Sediment Transport” for a discussion on the innovative “managed retreat” project being implemented in this location to address the loss of beach sand.
Urban Drainage Floods

Storm drain infrastructure (systems of ditches, culverts, pipes, and lined channels designed to quickly move storm flows out of urban areas) can be overwhelmed by storm flows and cause urban flooding. These systems may be undersized or poorly designed, become damaged, or get clogged by debris, resulting in flooding in areas outside the expected flood zone. Urban drainage problems can also result in areas protected by levees because the natural flow towards the river is blocked by the levee itself. Urban drainage flooding is primarily nuisance flooding since significant flows are not usually involved. This type of flooding does not generally pose a serious threat to life and property.

Development in natural wetlands is another reason for urban drainage flooding in the watershed. Springs, vernal ponds, and other types of wetlands are commonly associated with geological faults. The highly folded and faulted Ventura River watershed, one of the most tectonically active uplifting regions of the world, comprises several fault-associated wetlands scattered throughout the area (Ferren 2004). Some areas in the watershed have a very high water table, which can also present urban drainage flooding problems.
Stormwater Infiltration Infrastructure

Impervious surfaces—rooftops, roadways, and parking lots—in urban areas exacerbate flood flows because water flowing over these surfaces cannot infiltrate or evaporate; it simply flows off—fast. The result is that both peak streamflow rates and runoff volumes can be increased by impervious surfaces. Groundwater recharge is also diminished. Impervious surfaces also accumulate pollution and sediment, which increases nutrients, bacteria, and other pollutant concentrations in local channels, rivers, and the ocean.

As a result of these impacts to water quality, state and local regulators have developed stormwater "best management practice" (BMP) programs and requirements to increase the retention and infiltration of stormwater onsite, so that the amount and quality of water leaving the site during storms more closely matches that of predevelopment conditions. These BMPs include bioswales, rain gardens, vegetated filter strips, small neighborhood retention basins, and other types of infiltration systems (and curb cuts that direct runoff into these infiltration systems), as well as pervious pavements, green roofs and other systems. The photos below illustrate some of these systems installed in the watershed.

Bioswale, Oak Street Parking Lot, Ventura

Bioswale, Surfers' Point, Ventura

Bioswale, Hwy 33, Mira Monte

Bioswale, Downtown Ventura

Pervious Parking Lot, Ojai

Photo courtesy of Lisa Brenneis

Pervious Pavers, Oak Street Parking Lot, Ventura
Dam Failure Floods

Flooding as a result of dam failure is another type of flooding that could potentially occur in the watershed. Dam failure can result in severe flooding because the flows that would result would be much larger than the capacity of the downstream channels. Four dams are of sufficient size to be regulated for safety in the watershed: Casitas Dam, Matilija Dam, Senior Canyon Dam, and the dam associated with Stewart Canyon Debris Basin. Because of the size of Lake Casitas, the Casitas Dam poses the greatest flooding potential. Depending on whether a dam is federally or locally owned, dams are under the regulatory jurisdiction of either an agency of the Federal government, as is the case for Casitas Dam, or under the California Division of the Safety of Dams (DSOD), as is the case for Matilija Dam, Senior Canyon Dam, and Stewart Canyon Debris Basin (USACE 2004b). Table 3.3.2.3.1 summarizes the four dams in the watershed.

<table>
<thead>
<tr>
<th>Dam</th>
<th>Owner</th>
<th>Regulatory Jurisdiction</th>
<th>Capacity (acre-feet)</th>
<th>Flood Route</th>
</tr>
</thead>
<tbody>
<tr>
<td>Casitas Dam</td>
<td>U.S. Bureau of Reclamation</td>
<td>U.S. Bureau of Reclamation</td>
<td>254,000</td>
<td>Coyote Creek, Ventura River</td>
</tr>
<tr>
<td>Matilija Dam</td>
<td>Ventura County Watershed Protection District</td>
<td>California DSOD&lt;sup&gt;1&lt;/sup&gt;</td>
<td>500</td>
<td>Matilija Creek, Ventura River</td>
</tr>
<tr>
<td>Senior Canyon Dam</td>
<td>Senior Canyon Mutual Water Company</td>
<td>California DSOD</td>
<td>78</td>
<td>Senior Canyon, San Antonio Creek</td>
</tr>
<tr>
<td>Stewart Canyon Debris Basin</td>
<td>Ventura County Watershed Protection District</td>
<td>California DSOD&lt;sup&gt;1&lt;/sup&gt;</td>
<td>64.6</td>
<td>Stewart Canyon Creek Channel, Stewart Canyon Creek, San Antonio Creek</td>
</tr>
</tbody>
</table>

<sup>1</sup>: California Division of the Safety of Dams

Data Sources: URS 2005; Cardno-Entrench 2012; USACE 2004 and 2004b, Magney 2005

The Casitas Dam is located in an area of high seismicity, which presents a potential hazard to the dam’s integrity, as described in the following excerpt:

Casitas Dam is located in an area where the earth’s crust is being compressed rapidly (on a geologic time scale). As a result, the area surrounding the dam contains numerous active faults, including the Red Mountain thrust fault less than 2 miles from the dam. A peer-reviewed study shows this fault to be capable of producing an earthquake of approximate magnitude M<sub>s</sub> 7. The resulting accelerations could exceed 0.7 times the earth’s gravity (0.7 g). A seismic hazard assessment was performed considering the Red Mountain Fault as well as other nearby faults. This evaluation
concluded that there is from 1 chance in 100 to 1 chance in 300 in any given year of accelerations exceeding 0.6 g. This probability is unusually high, even for California.

—Design Summary, Casitas Dam Modification (USBR 2001)

Much of the embankment of the dam bears upon stream-channel alluvial substrate (USBR 2001), a material that is susceptible to liquefaction during earthquakes (URS 2005a). Liquefaction occurs when ground shaking causes loose, saturated soil to lose cohesive strength and act as a viscous liquid for several moments (VCPD 2011a).

Modifications to Casitas Dam were designed to alleviate concerns about the potential liquefaction of the alluvium substrate under the dam in a severe earthquake. These upgrades to the facility, including stabilization of the downstream slope and modification of the crest to accommodate instability of the upstream slope, were implemented in 2001 (USBR 2007). At the crest, the earth filled Casitas Dam originally measured 40 feet from lakeside to the face of the dam. The foot of the dam was 1,750 feet thick. This seismic retrofit increased the thickness of the dam by 110 feet (CMWD 2013).
Dam Failure Response

In Ventura County, disaster coordination and planning is the responsibility of the Sheriff’s Office of Emergency Services (OES). The OES serves as the depository for Ventura County’s Dam Inundation Maps and is charged with ongoing maintenance of the County’s Dam Failure Response Plan (VCPD 2011a).

Figure 3.3.2.3.4 Casitas Dam Evacuation Map. For the complete map, with legend and instructions, go to http://readyventuracounty.org/pdf/CasitasDamEvacuationMap.pdf

Source: Casitas Dam Evacuation Route (VCOES 2013)
3.3.2.4 Flood Protection Infrastructure

The primary flood control infrastructure in the watershed consists of levees, debris basins, stormwater channels, pipes and culverts, and bank revetments such as riprap. Dams and reservoirs can also provide some potential flood control functions. Most of the flood management infrastructure in the watershed is designed, managed, and maintained by the Ventura County Watershed Protection District.

Levees

There are three major levees along the Ventura River, all owned and operated by the Ventura County Watershed Protection District. Of the 16.23 miles of the mainstem of the Ventura River, 4.93 miles (30%) of the length of the river have a levee on one side.

Channel Meandering vs. Channel Hardening

Levees are embankments built to prevent the overflow of a body of water, such as a river. Levees are a conventional "bricks and mortar" approach to flood control. While such structures have become essential in some areas to protect urban developments, they are inconsistent with and counteract the natural tendency of rivers to erode and deposit sediments. Channel meandering is a natural process by which a river dissipates its energy during floods. Channel straightening and hardening of banks tend to increase the energy of the river during floods and potentially create accelerated erosion at other locations. Flood control agencies have come to understand this, and are now attempting to integrate more nonstructural approaches to flood management that combine natural and man-made alternatives.

Federal regulations administered by FEMA, the federal agency that offers flood insurance, require levee owners and operators to certify that their levees will continue to provide a barrier to the base flood (generally the 1% AEP flood) in order for FEMA to accredit such flood protection levels on Digital Flood Insurance Rate Maps (DFIRMs). In November of 2009, the Ventura County Watershed Protection District completed the mandated engineering evaluations for the levees in the watershed. The three levees in the watershed were found to have deficiencies such that they could not be certified as fully meeting federal standards by the November 2009 compliance deadline.

Consequently, property owners behind the non-certified levees would be in a flood hazard zone, when new FEMA flood hazard maps are created. At that time, property owners with federally backed mortgages would be subject to mandatory federal flood insurance requirements. FEMA’s DFIRMs do not get updated often, and a number of studies and
Figure 3.3.2.4.1 Levees in the Ventura River Watershed Map
Table 3.3.2.4.1 Levees in the Ventura River Watershed

<table>
<thead>
<tr>
<th>Levee</th>
<th>Year Built</th>
<th>Location</th>
<th>Length (miles)</th>
<th>Built to Protect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventura River Levee</td>
<td>1948</td>
<td>From Pacific Ocean to Canada de San Joaquin, City of Ventura</td>
<td>2.65</td>
<td>City of Ventura</td>
</tr>
<tr>
<td>Live Oak Levee</td>
<td>1978</td>
<td>From Santa Ana Blvd. Bridge to the Live Oak Diversion (near the junction of Riverside and Burnham Roads), Oak View</td>
<td>1.28</td>
<td>Live Oak Acres</td>
</tr>
<tr>
<td>Casitas Springs Levee</td>
<td>1979</td>
<td>From Santa Ana Blvd north to Riverside Rd., Casitas Springs</td>
<td>1</td>
<td>Casitas Springs</td>
</tr>
</tbody>
</table>

1: See Levees Map, Figure 3.3.2.4.1

Data Source: Cardno Entranx 2012; USACE 2004b

Steps are required before they are updated for the Ventura River watershed. FEMA has not yet released an official date to issue new DFIRMs for the watershed. The projected earliest release date for new DFIRMs for the areas protected behind the three levees would be sometime during 2016 (VCWPD 2013d).

The Matilija Dam removal project, called the Matilija Dam Ecosystem Restoration Project, involves installing and upgrading a number of flood control structures in the river, including enhancing the Casitas Springs and Live Oak levees, as well as constructing a new levee at Meiners Oaks. Design work is already in process, and if sufficient construction funding can be secured for these levee rehabilitation projects, federal levee certification requirements should be met for these two levees.

For the Ventura River levee, the Ventura County Watershed Protection District is engaged in preliminary reconnaissance and feasibility work in support of levee retrofit and/or enhancement projects required to certify the levee, and is researching possible sources of funding.

Limited Flood Management Funding

It is the mission of the Ventura County Watershed Protection District to protect life, property, watercourses, watersheds, and public infrastructure from the dangers and damages associated with floods and stormwaters in Ventura County. The District has four service areas that roughly correspond to the major river systems in the County; the district’s Zone 1 comprises the Ventura River watershed and adjacent coastal drainages.

Ongoing funding for the District’s activities comes from property taxes, benefit assessments, and land development fees. In addition, supplemental funding from grants, cost-share programs, and other funding sources has become increasingly important to the District’s ability to complete large, capital-intensive flood protection projects.

The relative amount of funding available for flood management in each of the District’s zones differs because of how the District is funded. Benefit assessment monies collected from each zone are dedicated to support operations and maintenance and NPDES (National Pollutant Discharge Elimination System) permit activities within that zone. Property tax monies raised within a zone are spent on construction projects and to support District planning studies within that zone (VCWPD 2005).

Due to the limited development in the Ventura River watershed, revenues from property taxes, land development fees, and benefit assessment fees in Zone 1 are significantly lacking, and are much less than in zones comprising the County’s other two major watersheds. Annual revenues available for flood management projects in Zone 1 have averaged less than $2 million a year.
Debris and Detention Basins

Debris basins are a very important component of flood control systems in areas where streams carry high sediment loads. Typically placed at canyon mouths, debris basins capture the sediment, gravel, boulders, and vegetation that are washed out of canyons during storms. The basins capture the material and allow the water to flow into downstream drainage channels. Removing sediment and debris helps prevent blockage of channels and associated flooding. One of the drawbacks of debris basins is that by removing the sediment from the water, the flowing water becomes “hungry” for sediment and as a result increased erosion and scour downstream of debris basins has been observed (VCWPD 2013a).

There are four functioning debris basins that collect sediment from drainages before they enter the mainstem of the Ventura River: Dent, Live Oak, McDonald Canyon, and Stewart Canyon. All of these basins are owned and operated by the Ventura County Watershed Protection District.

An earth and rock debris basin was built on San Antonio Creek in 1986 as an emergency structure in response to the Wheeler Fire that had burned the watershed in 1985. It served its purpose, accumulating 26,600 cubic yards of debris during the first year of operation. The basin has been damaged and filled over the years and is no longer functioning as a debris basin (Hawks & Associates 2005).

Some basins have been designed specifically as “detention basins,” which detain large volumes of water during the early phases or peak of a storm event, then slowly release the water over time. Detention basins reduce the peak downstream flows, which reduces flooding, but they also act to retain debris. Similarly, basins designed primarily as debris basins also help to attenuate peak flow, depending on their storage capacity.

Table 3.3.2.4.2 Debris Basins in the Ventura River Watershed

<table>
<thead>
<tr>
<th>Basin</th>
<th>Year Built</th>
<th>Location</th>
<th>Watershed Area (acres)</th>
<th>Maximum Debris Storage Capacity (cubic yards)</th>
<th>Expected Debris Production for 1% AEP? Flood (cubic yards)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dent Debris Basin</td>
<td>1981</td>
<td>Ventura, behind De Anza Middle School</td>
<td>19</td>
<td>4,100</td>
<td>1,624</td>
</tr>
<tr>
<td>Live Oak Diversion Dam</td>
<td>2002</td>
<td>Oak View, west of Burnham Rd. between Santa Ana Rd. and Hwy 150</td>
<td>794</td>
<td>28,700</td>
<td>20,932</td>
</tr>
<tr>
<td>McDonald Canyon</td>
<td>1998</td>
<td>Meiners Oaks, east of Hwy 33/ Fairview Rd junction</td>
<td>573</td>
<td>23,400</td>
<td>20,179</td>
</tr>
<tr>
<td>Stewart Canyon Debris Basin</td>
<td>1963</td>
<td>Ojai, at north end of Canada St.</td>
<td>1,266</td>
<td>328,300</td>
<td>209,000</td>
</tr>
</tbody>
</table>

1: See Dams and Debris Basins Map, Figure 3.3.2.4.2
2: Annual Exceedance Probability
Data Sources: VCWPD 2005a; Cardno-Entrix 2012

Typically placed at canyon mouths, debris basins capture the sediment, gravel, boulders, and vegetation that are washed out of canyons during storms.
Dams and Debris Basins

Ventura River Watershed

- Debris Basin
- Dam

Figure 3.3.2.4.2 Dams and Debris Basins Map
Stewart Canyon Debris Basin

The Stewart Canyon Debris Basin is worth special mention. It is so massive that it stands out in aerial photos of the City of Ojai. The basin sits at the base of Stewart Canyon, one of the primary drainages off of Nordhoff Peak. Stewart Canyon naturally drains through the center of the City of Ojai, and in the flood of 1938 this became a big problem. A 1938 newspaper stated, “The Arcade was awash from a cascade down Montgomery Street and Signal Street. Lion and Aliso were also completely flooded as water raced down Stewart Canyon.” (OVN 1969)

This flood provided motivation for the construction of the Stewart Canyon Debris Basin, which is credited with saving the City of Ojai from major property damages and loss of lives. It is estimated that over 200,000 cubic yards of material were deposited in the basin during the storms in January and February of 1969 (City of Ojai 1991).
Dams and Reservoirs

The Matilija Reservoir no longer serves a significant flood control function because it is largely full of sediment. The capacity at Lake Casitas (if available) provides attenuation of flood flows downstream of the dam, as the stormwater from upper Coyote Creek and Santa Ana Creek flows into the lake. The exception to this is if the lake is full. Additionally, up to 500 cfs can be diverted from Ventura River to Lake Casitas; however, this diversion has little effect on large Ventura River peak flows (Entrix & URS 2004). See “3.3.1 Surface Water Hydrology” for more information on the watershed’s dams and reservoirs.

3.3.2.5 Flood Monitoring

The Ventura County Watershed Protection District maintains a Google Maps interface that provides current (almost real-time) streamflow observations. The monitoring location icons are color-coded to indicate the current flooding status. Clicking on a specific monitoring location icon opens a window with last observed flow data and forecast information. The monitoring location link within this window provides access to more detailed information on flood flow categories and potential flood impacts for that location. Website: www.vcwatershed.net/fws/VCAHPS/".

Figure 3.3.2.5.1 VCWP D’s Advanced Hydrologic Prediction System Website. See “3.3.1 Surface Water Hydrology” for a summary of the other streamflow monitoring programs in the watershed.
3.3.2.6 Key Data and Information Sources/ Further Reading

“4.1 Appendices” contains additional information on flooding in the watershed, including the following documents:

Ventura River Mainstem Flood Risk Areas

1969 – Our Most Damaging Flood

Past Floods in Brief

Table of Storm Event Peak Flows, Foster Park (Station 608), 1933–2013

Below are some of key documents that address flooding in the watershed. See “4.3 References” for complete reference citations:

The Ventura County Watershed Protection District’s websites (http://portal.countyofventura.org/portal/page/portal/PUBLIC_WORKS/Watershed_Protection_District and www.vcfloodinfo.com) have considerably more information on the topic of flooding.

Alluvial Fan Floodplain Mapping: East Ojai FLO-2D Floodplain Study (VCWPD 2009)

Coastal Regional Sediment Management Plan (BEACON 2009)

Design Summary, Casitas Dam Modification (USBR 2001)


Final Environmental Impact Statement/Environmental Impact Report for the Matilija Dam Ecosystem Restoration Project (USACE 2004a)

Flood Histories of the Counties in the Alluvial Fan Task Force Study Area (Earp 2007)

Flood Mitigation Plan for Ventura County, California (URS 2005)

Hydrologic Data Server, Foster Park Gauge. Includes info on flood flow categories, potential flood impacts by flow, and flooding hot spots. (VCWPD 2013b) www.vcwatershed.net/fws/VCAHPS/php/ahps.php?gage=608

Hydrologic Data Server, San Antonio Creek Gauge. Includes info on flood flow categories and potential flood impacts by flow (VCWPD 2013c) www.vcwatershed.net/fws/VCAHPS/php/ahps.php?gage=608

Hydrology, Hydraulics and Sediment Studies of Alternatives for the Matilija Dam Ecosystem Restoration Project (USBR 2007)

Matilija Dam Ecosystem Restoration Feasibility Study Final Report (USACE 2004b)

San Antonio Creek Debris Basin Feasibility and Upper San Antonio Creek Deficiency Study (Hawks & Associates 2005)


Ventura County General Plan, Hazards Appendix (VCPD 2011a)

Ventura County Open Pacific Coast Study (FEMA 2011)

Ventura River Watershed Protection Plan Report (Cardno-Entirix 2012)

Ventura River Watershed Design Storm Modeling Final Report (VCWPD 2010)

3.3.3 Groundwater Hydrology

This section summarizes the physical location, capacity, and dynamics of the Ventura River watershed's major groundwater systems. These groundwater systems form essential water storage and transport functions in the watershed. For the water quality aspects of groundwater in the watershed, see "3.5.2 Groundwater Quality," and for the water supply aspects of groundwater in the watershed, see "3.4 Water Supplies and Demands."

Water that falls on the earth is disposed of in three ways. It evaporates into the air, it sinks into the ground, or it runs off the surface of the earth... Water on the land surface is visible in lakes, ponds, rivers, and creeks or surface water. What is not seen is the important water that is out of sight—called groundwater. It is convenient to refer to surface and groundwater separately in describing the location of the water, even though they are not different kinds of water. Both come from precipitation.

—Luna B. Leopold, Water, Rivers and Creeks

The watershed's groundwater basins generally lie within geologic depressions that have filled with alluvium, layered sediments primarily deposited by streams over long periods of time. The deposited material includes coarse deposits, such as sand and gravel that form the aquifers where water is stored and can flow, and finer-grained deposits, such as clay and silt that form the aquicludes, barriers to groundwater movement.

The boundaries of the groundwater basins are essentially defined by the alluvium that fills the basins and overlies low-permeability rock or, in a few cases, large geologic fault blocks (VCFCD 1971). When groundwater basins are full, the water table often occurs at relatively shallow
There are four groundwater basins of significance in the Ventura River watershed: Ojai Valley Basin, Upper Ventura River Basin, Lower Ventura River Basin, and Upper Ojai Basin.

Groundwater: Water in the Saturated Zone

The pores, fractures, and other voids that are present in the sediments and rocks that lie close to the earth's surface are partially to completely filled with water. In most locations, an unsaturated zone in which both water and air fill the voids exists immediately beneath the land surface. At greater depths, the voids become fully saturated with water. The top of the saturated zone is referred to as the water table, and the water within the saturated zone is groundwater.

Figure 3.3.3.1 Groundwater Illustrated
Image courtesy of The Groundwater Foundation

Although voids beneath the water table are filled with water, the ability of subsurface materials to store and transmit water varies substantially. The term aquifer refers to subsurface deposits and geologic formations that are capable of yielding usable quantities of water to a well or spring, whereas a confining layer (or confining bed) refers to a low-permeability deposit or geologic formation that restricts the movement of groundwater. An aquifer can refer to a single geologic layer (or unit), a complete geologic formation, or groups of geologic formations.

—Streamflow Depletion by Wells: Understanding and Managing the Effects of Groundwater Pumping on Streamflow (Barlow & Leake 2012)
Figure 3.3.3.2 Groundwater Basins Map

Data sources: See Table 3.4.2.1.3 Groundwater Basins Map. Data sources in "3.4.2 Water Supplies" for an explanation of the various data in the table.
The Ojai Valley Basin, which lies under the City of Ojai and the Ojai Valley’s East End, has the largest capacity of the four groundwater basins. It is a relatively deep, bowl-shaped basin and is heavily relied upon for serving municipal and agricultural water users. It is the only basin in the watershed that has a formal management oversight entity—the Ojai Basin Groundwater Management Agency (OBGMA)—with specific authority to manage the supply and demand of the groundwater resource (Senate 1991).

The Upper Ventura River Basin, which lies under and adjacent to the Ventura River from the upper end at the Matilija Creek–North Fork Matilija Creek junction down to Foster Park, supplies the greatest volume of groundwater in the watershed, even though its water holding capacity at any one time is not the largest. This basin is tilted at a slight southward gradient, unconfined (see “Unconfined and Confined Aquifers” later in this section), and much shallower than the Ojai Valley Basin (SWRCB 1956; Entrixt 2001).

The Lower Ventura River Basin is similar to the Upper Ventura Basin in that it primarily underlies the river. The basin begins at Foster Park and extends to the coast (deep layers of this basin extend offshore as submerged alluvial delta deposits). This basin has water quality limitations (VCIFCD 1971) and is used minimally for industrial or agricultural needs.

The Upper Ojai Valley Basin is a fairly deep, bowl-shaped basin. It is an important source of water for residential users in Upper Ojai, as well as some agricultural users. Less hydrologic information is known about this basin than the others.

Each of these basins is described in more detail in “Groundwater Basins” later in this section.

### 3.3.3.1 Unconfined and Confined Aquifers

Aquifers can be confined, unconfined, or semi-confined. A confined aquifer lies between two confining layers, such as impermeable or low-permeable clay or rock. An unconfined aquifer has no upper confining layer—its upper boundary is the water table (i.e., the boundary between water-saturated ground and unsaturated ground) (Barlow & Leake 2012). Unconfined aquifers are sometimes called “leaky aquifers,” aquifers that lose or gain water through adjacent less permeable layers (USGS 2014a).

A semi-confined aquifer has some characteristics of both a confined and an unconfined aquifer.

Unconfined aquifers are typically located closer to the ground surface and are permeable, so they can be directly recharged by rain, irrigation
water, septic tank effluent, or infiltration from lakes and streams. Confined aquifers tend to be located deeper beneath the ground surface; they can be recharged by rain or surface water infiltrating the ground at considerable distance away from the aquifer (Barlow & Leake 2012). Often aquifers are unconfined along their highest elevation reaches where they “crop out” (intersect with the ground), and may become confined at lower elevations (Schnaar 2013).

![Diagram of groundwater systems](image)

**Figure 3.3.3.1.1 Unconfined and Confined Groundwater Aquifers.** The image shows how groundwater systems can be composed of a vertical sequence of aquifers, with an upper, unconfined aquifer underlain by one or more confined aquifers. Groundwater systems can also be composed of a single, unconfined aquifer underlain by largely impermeable bedrock.

Image Source: Streamflow Depletion by Wells (Barlow & Leake 2012)

Unconfined aquifers are usually recharged by rain or irrigation water infiltrating directly through the overlying soil, and by infiltration from lakes and streams. The water table of unconfined aquifers is free to fluctuate up and down in response to recharge and discharge rates. Groundwater in these aquifers tends to be young (Barlow & Leake 2012), so surface conditions can directly affect water quality.

Except for the Ojai Valley Basin, current understanding is that the watershed's usable aquifers are unconfined. The Ojai Valley Basin has areas of confined, semi-confined, and unconfined groundwater (Kear 2005).

### 3.3.3.2 Recharge and Discharge

The concepts of groundwater recharge and discharge are introduced in this section. See also the surface water/groundwater interaction discussion in "3.3.1 Surface Water Hydrology."
Recharge

Groundwater recharge occurs when surface water percolates to groundwater and adds to the total volume in storage.

Surface water makes its way into groundwater basins by percolation of:

1. Streamflow in established drainages (such as the Ventura River, San Antonio Creek, and other streams). Stream reaches that lose water to the underlying aquifer are called “losing reaches.”
2. Rain falling directly on wetlands and valley floors.
3. Reservoir leakage.
4. Irrigation water (in excess of plant use).
5. Septic system effluent seepage.
6. Enhanced recharge systems designed to increase the amount of water stored in aquifers.

In addition, water finds its way into groundwater basins by inflow from bedrock and neighboring groundwater basins (DBS&A 2010; CDWR 2003). Table 3.3.3.2.1 shows the relative amount of recharge from different sources in the Ojai Valley Basin.

Table 3.3.3.2.1 Ojai Valley Basin Groundwater Model - Annual Inflows and Outflows by Source

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AF/Year</td>
<td>%</td>
</tr>
<tr>
<td><strong>Groundwater Inflows</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Precipitation Recharge (Basin Floor)</td>
<td>4,743</td>
<td>65%</td>
</tr>
<tr>
<td>Precipitation Recharge (Upgradient Alluvial Channels)</td>
<td>2,032</td>
<td>28%</td>
</tr>
<tr>
<td>Irrigation Recharge</td>
<td>364</td>
<td>5%</td>
</tr>
<tr>
<td>Recharge from Septic Systems, Wastewater, &amp; Former San Antonio Creek</td>
<td>173</td>
<td>2%</td>
</tr>
<tr>
<td>Spreading Grounds</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Inflows</strong></td>
<td>7,312</td>
<td></td>
</tr>
<tr>
<td><strong>Groundwater Outflows</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pumping from Private Wells</td>
<td>2,606</td>
<td>35%</td>
</tr>
<tr>
<td>Pumping for Ojai City Use (Golden State Water Co.)</td>
<td>1,673</td>
<td>23%</td>
</tr>
<tr>
<td>Discharge to San Antonio Creek</td>
<td>7,744</td>
<td>37%</td>
</tr>
<tr>
<td>Riparian Evapotranspiration</td>
<td>265</td>
<td>4%</td>
</tr>
<tr>
<td>Groundwater Flow Exiting Basin</td>
<td>135</td>
<td>2%</td>
</tr>
<tr>
<td><strong>Total Outflows</strong></td>
<td>7,423</td>
<td></td>
</tr>
<tr>
<td><strong>Net Change in Storage</strong></td>
<td>-111</td>
<td></td>
</tr>
</tbody>
</table>

1: AF – acre-feet

Data Source: Update to the 2010 Ojai Basin Groundwater Model (DBS&A 2014)
Enhanced Recharge

Enhanced, or artificial, recharge refers to systems specifically designed to introduce and store water in aquifers. Enhanced recharge is used to stabilize or raise groundwater levels, smooth out supply/demand fluctuations, reduce losses from evaporation and runoff, and store water in aquifers for future use. Common methods include surface infiltration, percolation of recharge water at some depth below the ground surface, and direct injection of recharge water into the aquifer (Reddy 2008). The San Antonio Creek Spreading Grounds (see “3.4.2 Water Supplies”) on Ojai’s East End is an example of enhanced recharge using passive percolation recharge wells.

Recharge from Irrigation

Irrigation—primarily for crops, but also for watering large residential landscapes, golf courses, schools, and parks—comprises a significant use of water in the watershed. Agriculture alone comprises about 40% of water demand (see “3.4.3 Water Demands”). Irrigation water applied in excess of plant needs is recharged to groundwater. A 2010 study estimated that crop and landscape irrigation water contributes an average of 2,891 acre-feet (AF) per year to the Upper Ventura River Basin and 655 AF per year to the Lower Ventura River Basin (DBSSA 2010). A 2014 study estimated that crop and landscape irrigation water contributes 364 AF per year (5% of total recharge) to the Ojai Valley Basin (see Table 3.3.3.2.1) (DBSSA 2014).

The source of irrigation water is both groundwater and Lake Casitas water. During extended dry periods when groundwater is less available, much more Casitas water is used for irrigation. The water from Lake Casitas then becomes an input into the system, indirectly recharging groundwater basins.

Recharge from Septic Systems

Large areas of the watershed rely on septic systems for wastewater treatment; one of the largest populated areas is Ojai’s East End (see Figure 3.5.1.1 Sewer Lines and Septic Systems Map in “3.5.3 Wastewater Quality”). This area sits over the Ojai Valley Basin. Some of the consumed water from households using septic systems is eventually recharged to groundwater. Like irrigation water, water used by households with septic systems can come from groundwater or Lake Casitas water.

Since unconfined aquifers are permeable and open to infiltration from the surface, they can recharge quite rapidly during wet periods. This is especially the case in the Ventura River watershed, where groundwater basins are for the most part surrounded by mountains of impermeable bedrock that essentially funnel water into the alluvial basins. The sediments in the watershed’s stream channels tend to be loose and unconsolidated deposits of gravel and sand—very permeable materials that water readily infiltrates. Underlying faults and folds are also found in these streambeds and may facilitate downward flow into aquifers. By inhibiting subsurface underground flows, these faults and folds can also delay or retain available water, enhance percolation time, and cause springs (Entriks 2001).

The following study excerpt describes the importance of the inflow of San Antonio Creek to the recharge of the Upper Ventura River Basin where the City of Ventura has their well field, and how quickly the basin can recharge:

We conclude that the inflow from San Antonio Creek is a direct and significant influence on flow in this reach of the River system during the low-flow conditions observed by the study. We also conclude that high streambed infiltration rates and high
aquifer hydraulic conductivity values result in a very rapid rate of groundwater recharge. These conditions result in a quick groundwater level response to changes in City production. Based on data provided from the controlled shutdown period when the wells were turned off, we conclude that when the surface flow entering the Foster Park reach from the live reach of the River is 5 cfs or greater, the alluvial aquifer affected by City wellfield diversions is completely refilled within a week (or sooner) after cessation of City pumping.

- Preliminary Hydrogeological Study, Surface Water/Groundwater Interaction Study, Foster Park (Hopkins 2013)

An example of rapid groundwater recharge occurred in 1952, when the heavy winter rainfall was sufficient to return the groundwater in the Ojai Valley Basin to near maximum levels, even though the basin was at historic low levels following five years of deficient rainfall (Kear 2005). More recently, the groundwater level in one of Ventura River Water District’s (non-pumping) wells in the Ventura River floodplain (located just above the Highway 150 Bridge) was raised 15 feet within 20 days and 22 feet within 40 days following a four-day, 7.3-inch storm in the spring of 2014 (Rapp 2014).

**Figure 3.3.3.2.1 Aquifer Recovery, March–April 2014, Ventura River Water District Well #2.** Following a four-day, 7.3-inch storm in the spring of 2014, the groundwater levels in one of Ventura River Water District’s (static/non-pumping) wells in the Ventura River floodplain (located just above the Highway 150 Bridge) was raised 15 feet within 20 days and 22 feet within 40 days. 
Source: Ventura River Water District

**Discharge**

Discharge of water from groundwater basins in the watershed occurs via groundwater pumping for municipal, industrial, domestic, and agricultural purposes; consumption by riparian and other natural vegetation; outflow to the ocean or neighboring groundwater basins; and discharge into open channels or drainages (DBS&A 2010). During wet periods, artesian conditions or springs can occur when the elevation to which groundwater will naturally rise exceeds the ground surface elevation.
This is not uncommon in the southwestern part of Ojai Valley Basin (Kear 2005; DBS&A 2011).

Groundwater rising above the level of a stream bottom results in what is called a “gaining stream,” where groundwater seeps out of the surface and flows downstream. For much of the year—and almost all of the dry-season—nearly all of the water in the Ventura River and its tributaries is from groundwater and springs (excluding the lower stretch of the river that is partially fed by treated wastewater).

It is not unusual for streams in Southern California that are rain fed and lack groundwater support to dry up in summer months, in both average and below average precipitation years. In the Ventura River watershed, however, several of the small tributaries and even the mainstem have short perennial reaches that are fed by springs and/or the perched groundwater over shallow bedrock.

—Surface Water–Groundwater Interaction Report for the Ventura River Habitat Conservation Plan (Entrix 2001)

Only during storms, and for a relatively short period of time afterwards, do surface runoff and flows from soil water (water diffused in the soil) add to the base flow.

Figure 3.3.3.2.2  Groundwater Level and Streamflow, Water Years 2001–2014. The graph shows the depth-to-water measurements for two wells (indicated by green circles and blue squares) in the upper San Antonio Creek subwatershed—one to the east and the other to the west of San Antonio Creek about two miles above the San Antonio/Stewart Canyon Creek confluence. Also shown are average monthly Ventura River flows measured at Foster Park (monthly flows were used to remove the multiple spikes in the hydrograph caused by individual storms). The graph indicates that the elevation of the water table in the Ojai Valley Basin and flow of the Ventura River at Foster Park are extremely well correlated.

Data Source: Nitrate in the Ventura River Watershed (Leydecker 2013a)
The Upper Ventura River Basin, has been referred to by locals as a series of “tea cups” rather than a “basin,” because of its relatively small capacity and the tendency for groundwater to collect more in some areas than others.

Because the watershed and its basins follow the topography and slope toward the coast (SWRCB 1956; Entrix 2001), some groundwater also drains downward into other basins or is lost to the ocean. The Upper Ventura River Basin drains into the Lower Ventura River Basin, and the Lower Ventura River Basin loses water to the ocean; the Ojai Valley Basin drains indirectly into the Upper Ventura River Basin by way of its discharge to San Antonio Creek. Coastal basins in the region are prone to seawater intrusion (CDWR 2003) because of the hydraulic connection between groundwater and seawater.

The basins along the Ventura River can be drawn down relatively quickly during dry periods by well extractions, evapotranspiration, and other discharge mechanisms. This may be especially true for the Upper Ventura River Basin, which has been referred to by locals as a series of “tea cups” rather than a “basin,” because of its relatively small capacity and the tendency for groundwater to collect more in some areas than others.

Because of the relatively rapid discharge and recharge that occurs in the watershed’s groundwater basins, groundwater levels and storage volumes can fluctuate dramatically from one year to the next. For example, in just seven months, between March 2012 and October 2012, water levels in the Ojai Valley Basin dropped 84 feet (VCWPD 2014). However, historical analysis (on the Ojai Valley Basin) and the experience of pumpers indicate that the long-term average amount of groundwater in storage has been fairly stable (DBS&A 2011; CDWR 2003).

**Figure 3.3.3.2.3 Ojai Valley Basin Monitoring Well Hydrograph, 1949 to 2013**

*Source: Ventura County Watershed Protection District*

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**Seasonal Groundwater Levels**

The following excerpt describes typical variations in seasonal groundwater levels in the two most developed basins in the watershed:

Groundwater levels in the Upper Ventura River Basin, the Ojai Basin, and the Lower San Antonio Creek Basin [now considered part of the Upper Ventura River Basin] fluctuate seasonally with the highest water levels occurring in the winter and early spring and the lowest levels occurring in the late summer and early fall.
In general, groundwater levels in these basins recover rapidly following periods of precipitation and decline slowly under natural conditions, which is characteristic of unconfined groundwater basins. In the Upper Ventura River basin, groundwater levels in the vicinity of Meiners Oaks appear to fluctuate less than groundwater levels in the vicinity of Casitas Springs, which may be related to differences in groundwater extraction and/or potentially related to a threshold-response relationship for groundwater flow across the Santa Ana/Arroyo Parida fault.

- *Surface Water-Groundwater Interaction Report for the Ventura River Habitat Conservation Plan* (Entrix 2001)

### 3.3.3.3 Groundwater Basins

#### Ojai Valley Basin

The Ojai Valley Basin is one of the most important basins in the watershed in terms of serving a large number of people and agricultural acres. It also contributes regular annual flow volumes to San Antonio Creek (DBS&A 2011), providing critical base flow and supporting its riparian habitat, which serves many important ecological functions, including supporting endangered steelhead.

Below is an excerpt from a 2011 report on the development of a groundwater model for this basin.

In the lower elevations of the Basin, below the confluence of Thacher Creek and San Antonio Creek, it has generally been understood that gaining reaches are present in San Antonio Creek, with nearly perennial flow as the creek exits the Basin. This observation is supported by data collected from the nearest streamflow gage on San Antonio Creek, which is located 4 miles downstream of the Basin at the confluence of San Antonio Creek and the Ventura River. Flow was present in that location of San Antonio Creek 88 percent of the time during the model calibration period.

The model-simulated results are consistent with these observations. Groundwater discharge rates to the streamflow channels (represented by Drain boundary conditions) vary based on model-wide recharge rates; however, discharge is maintained at minor levels during dry periods (Figure 19). Additionally, groundwater discharge zones simulated by the model are limited to the lower-elevation areas of the domain, consistent with the general understanding of the Basin hydrogeology.

—*Groundwater Model Development – Ojai Basin* (DBS&A 2011)
The Ojai Valley Basin is bounded on the west and east by non-water-bearing Tertiary age rocks, on the south by the Santa Ana Fault and Black Mountain, and on the north by the Topatopa Mountains (CDWR 2003).

Major surface drainages that contribute influx or recharge to this basin include San Antonio Creek and the various tributary streams that drain the East End of the Ojai Valley and flow into San Antonio Creek. Steep slopes in these creeks—especially those flowing out of Senior Canyon, Horn Canyon/Thacher Creek, and Horn Canyon (VCWPD 2009)—are responsible for forming extensive alluvial fan deposits as the fast-moving, debris-laden water coming out of the mountains slows, spreads out, and deposits suspended sediment. These deposits of sand and gravel, thickest closest to the mountains in the northeastern portion of the basin, are largely responsible for filling the Ojai Valley Basin over time and forming the water-bearing aquifers of the basin (VCFCD 1971; Kear 2005).

Unconfined conditions exist in the northern and eastern portions of the basin, in the areas of the alluvial fan heads. Groundwater in the rest of the aquifer system is, depending on the amount of water in storage and groundwater level position, mostly confined to semi-confined in the central, southern, and western portions of the basin (Kear 2005).

With respect to aquifer confinement conditions, it appears that water levels are imperative to the status of confined versus unconfined conditions observed in the basin...

—*Hydrogeology of the Ojai Groundwater Basin: Storativity and Confinement, Ventura County, CA* (Kear 2005)

Groundwater generally flows in a southwesterly direction; however, it also flows towards the municipal wells in the central portion of the basin (DBS&A 2011).

Bowl-like in shape, the basin is deepest in the center and southern areas where sediments have built up against the boundary defined by the Santa Ana Fault. The thickness of the water-bearing alluvium is as much as 715 feet (DBS&A 2011). The primary storage areas are approximately four sand and gravel units that are each on the order of up to 100 feet thick (Kear 2005).
Depth to water can be on the order of 300 feet in the eastern and northern alluvial fan-head portions of the basin (with seasonal variations between 50 and 90 feet). In the southern and western portions of the basin, depth to water is typically less than 50 feet (with seasonal variations on the order of 15 feet). The southwestern wells sometimes exhibit flowing artesian conditions when the basin reaches its storage limit during periods of high water levels (Kear 2005).

The maximum water-holding capacity of the basin is about 85,000 AF (CDWR 2003), the largest capacity of the watershed's four basins.

**Upper Ventura River Basin**

The Upper Ventura River Basin plays a major role in providing municipal and agricultural water. Of the four watershed basins, it has the largest surface area extent—9,360 acres. With less depth than the Ojai Valley Basin, the Upper Ventura River Basin has the second largest water storage capacity at 35,118 AF (CDWR 2003). This storage capacity is small relative to annual surface water runoff (Entrix 2001).

The basin is bounded on the south by the Lower Ventura River Basin, on the east by the Ojai Valley Basin, and on the north and west by impermeable rocks of the Santa Ynez Mountains. The boundary between the Ojai Valley Basin and the Upper Ventura River Basin is roughly Camp Comfort to the south and the Arbolada to the north (Entrix 2001). Shallow bedrock and near surface faults in some places cause water levels to remain or rise near the surface (Entrix & Woodward Clyde 1997).

The east-west trending Santa Ana Fault crosses the basin just below the Highway 150 Bridge.

Major surface drainages that contribute water to this basin include San Antonio and Matilija creeks and the Ventura River (CDWR 2003). Another indirect contributor of surface water is Lake Casitas. Drainage around and under Lake Casitas flows towards the bottom of Upper Ventura River Basin. It is estimated that about 2,003 AF of water a year are contributed from the lake to recharge of this basin (DBS & A 2010).

The basin is unconfined, with generally thin water-bearing alluvial deposits. In some areas (e.g., near San Antonio and Coyote creeks), alluvium thickness is only 5 to 30 feet (CDWR 2003); below the point where the Santa Ana Fault crosses the Ventura River, alluvium attains a thickness of about 65 feet, whereas alluvium thickness is greater than 200 feet just north of the fault (VCFC 1971). This location is a good example of how faults can create enhanced groundwater deposits on the upstream side of a natural barrier to underflow.
The unconfined Upper Ventura River Basin has an open and direct relationship with the surface water of the Ventura River.

This unconfined groundwater basin has an open and direct relationship with the surface water of the Ventura River (EDAW 1978; VFCFPD 1971; Entrex 2001; DBS&A 2006; Tetra Tech 2009a; Hopkins 2010; DBS&A 2010). Much of the river bottom overlying the Upper Ventura River Basin is known locally as "the dry reach," where, in low to moderate rainfall years, the surface water quickly disappears underground once storm flows have passed—even when the river is still flowing above and below this reach.

The boundaries of the dry reach depend on the magnitude of the previous rainy season and the state of groundwater storage, but they generally extend from somewhere below the Robles Diversion to just above the river’s confluence with San Antonio Creek (just below Oak View). See “3.3.1 Surface Water Hydrology” for a more in-depth discussion on the dry reach.
Ventura River Dry Reach above Highway 150 Bridge
Photo courtesy of Rick Willborn

Groundwater is known to upwell via in-river springs in the area just above Foster Park. The community in this area is aptly named “Casitas Springs.”

Geographically, this dry reach is where boulders, cobbles, and sediments that have been eroded from the tallest mountains in the watershed are deposited as the gradient flattens and storm flows spread out. Water rapidly filters down through this coarse material to the groundwater basin below.

Groundwater flows through the alluvium from north to south, following the surface drainage and the slight but relatively consistent gradient of the basin (SWRCB 1956). Well logs and historic accounts of rising water above the Highway 150 bridge and above where the Santa Ana Fault crosses the river suggest that the fault slows the flow of groundwater (VCFCID 1971); however, this phenomena remains to be studied. The Ventura River Water District’s wells are located in this area to take advantage of this potential effect.

Upstream of the San Antonio Creek confluence, a groundwater constriction forces water in the Upper Ventura River Basin to the surface (USBR 2007).

Groundwater is known to upwell via in-river springs in the area just above Foster Park (EDAW 1978). The community in this area is aptly named “Casitas Springs.” Farther downstream at Foster Park, groundwater becomes indistinguishable from surface water where the shallow, 33-foot-deep (DBS&LA 2010), water-holding alluvium runs into a natural bedrock barrier that forces subsurface flow to the surface (USACE 2004). Faults often block groundwater flow and cause springs to emerge upstream. The bedrock in this area could be associated with the Red Mountain fault, which is inclined (dips) to the north, so at depth is closer to Foster Park (Keller 2014). This natural bedrock barrier was enhanced by the Ventura County Power Company in 1906 through the construction of a subsurface diversion structure to increase water retention in that area for extraction purposes (CDWR 2003).
City of Ventura's Subsurface Diversion Structure at Foster Park. The diversion dam slows the flow of subsurface water downstream. The City of Ventura extracts water at the structure and also has a number of wells just upstream.

The subsurface diversion structure at Foster Park marks the border between the Upper and Lower Ventura River Basins. A 1956 assessment of groundwater resources in Ventura County considered the Upper and Lower Ventura River Basins one groundwater basin until the subsurface diversion was installed:

Under natural conditions, this basin was undifferentiated from the Upper Ventura River Basin, but it has been treated separately herein because of the impedance to ground water movement effected by the artificial subsurface barrier at Foster Park.

—Bulletin 12, Ventura County Investigation (SWRCB 1956)

A 2010 groundwater budget study estimated that the groundwater flux into the Lower Ventura River Basin from the Upper Ventura River Basin is 535 AF per year (DBS&A 2010).

The largely unconfined [Upper Ventura River] aquifer is aligned along a moderately sloping valley profile and has a persistent downvalley flow direction. However, the rate of downvalley flow is not uniform through the various river reaches and groundwater nodes. Differential depths to bedrock and bedrock controls on valley width along the river reaches create varied aquifer storage
and transmission rates that affect groundwater and surface water interactions. The Santa Ana fault configuration has a fundamental influence on downvalley movement of groundwater. North of the fault, on the down-dropped side, the thicker aquifer has a relatively large storage capacity while the south side of the fault has a much thinner alluvial veneer over bedrock. When groundwater levels on the upvalley (north) side of the fault fall below certain elevations, downvalley movement of groundwater can be reduced or eliminated. This situation is likely to have a fundamental effect on groundwater support to surface water flows downstream of the fault.

—Surface Water-Groundwater Interaction Report (Entrix 2001)

The Ventura River Water District, one of two water districts that have water wells in the river in the upper part of the Upper Ventura River Basin, has found that the section of the basin where it pumps tends to hold about an 18 month supply of water (estimated from pumping during an extended dry spell following a good rainfall winter). Conversely, the basin can go from empty to full with just three months of average winder (Rapp 2013).

Figure 3.3.3.2 Ventura River, Robles Diversion to Foster Park, Summer Conditions. "There is usually no continuous surface flow in the Ventura River during the summer. However, two important local areas of surface flow do occur as a result of rising groundwater springs in the river. These are shown above as the 'live stretch' that occurs at and below the mouth of San Antonio Creek and the stretch below the Foster Park area. Flow in these stretches is stimulated by the presence of groundwater in the river alluvium, which depends on recharge from releases and spills at Robles Dam and flow from San Antonio Creek."

Note: Illustration not to scale. Source: EDAY 1978
Figure 3.3.3.3.3 Comparison of Upper Ventura River Groundwater Conditions 1957–1958 (upper) and 1968–1970 (lower). "The consistency of the two fall groundwater profiles (1957 and 1968), despite different antecedent water year conditions, suggests that when high groundwater levels occur, they do not have long duration."

"The seasonal profiles presented in Figures 3 and 4 (1957–1958 and 1968–1970 figures respectfully) demonstrate the impacts of the Santa Ana/Arroyo Parida fault zone on the groundwater profile for the Upper Ventura River groundwater basin. Groundwater levels downstream of the Highway 150 crossing may be impacted when the groundwater elevations north of the fault fall below the base of the downstream aquifer (approximately 495 feet msl [above mean sea level]) which results in a disconnection in groundwater flow across the fault."

Source: Surface Water–Groundwater Interaction Report (Entrix 2001)
Lower Ventura River Basin

The Lower Ventura River Valley Basin has the lowest water supply withdrawals in the watershed. Its storage capacity is estimated at 8,743 AF—assuming a basin area of 3,192 acres and an estimated average saturated thickness of 33 feet (DBS&A 2010). The California Department of Water Resources’ Bulletin 118 lists its capacity as 243,000 AF (CDWR 2003); this very large figure may be due to inclusion of storage in very deep geologic formations underlying the basin as well as offshore components of those formations. The 8,743 AF estimate is based on the onshore, unconsolidated alluvium layer of the basin and not any deep or offshore layers.

The basin is bounded on the north by the Upper Ventura River Basin, on the south by the Pacific Ocean, to the southeast by the Mound Basin, and to the west and northwest by near-surface impermeable rocks of the Santa Ynez Mountains (CDWR 2003).

Major surface drainages that contribute water to this basin include the Ventura River, Coyote Creek, and Canada Larga. The flow of the Ventura River in this area is consistently enhanced by the addition of treated wastewater from the Ojai Valley Sanitary District. Unlike some other parts of the river, the stretch from the wastewater treatment plant to the coast rarely goes dry.

The basin is unconfined; the depth to groundwater is about 3 to 13 feet below ground surface in the floodplain and deeper as elevation increases towards the edge of the basin (VCWPD 2012). The alluvium continues offshore and may be in hydraulic continuity with the ocean (CDWR 1975).

As in the Upper Ventura River Basin, water flows through the alluvium from north to south, following the surface drainage and the slight gradient of the basin. A significant amount of groundwater, up to an estimated 2,412 AF a year, is discharged to the Pacific Ocean from the basin (DBS&A 2010).

Upper Ojai Basin

The Upper Ojai Basin, the third most important basin from a water supply perspective, serves residential and agricultural users in the Upper Ojai Valley. It is the smallest of the watershed’s groundwater basins in aerial extent (2,840 acres) and storage capacity (5,681 AF) (CDWR 2003).

The Upper Ojai Valley Basin is narrowly elongated in an east-west direction, and is bounded by non-water-bearing Tertiary age rocks (Tan & Irvine 2005), including the Topatopa Mountains to the north, Black Mountain to the west, Sulphur Mountain to the south, and the convergence of the Topatopa Mountains and Sulphur Mountain to the east.
A surface and groundwater structural arch or divide is found in the eastern part of the basin (near Sisar Road); the divide separates groundwater flow westward toward Lion Canyon Creek and eastward toward Santa Paula Creek and into the Santa Clara River watershed (CDWR 2003).

**Upper Ojai Basin: Historical Changes to Overlying Drainages**

The strata in the underground Saugus formation (between San Cayetano and Lion Canyon faults) tilts toward Santa Paula in the ancient Sisar Creek from the surface through at least 100 feet, which I have dowsed and seen dowsed. Most of the water follows ancient well-sorted stream channels, which gently curve toward the east in those levels. In the late 1800's, I was told by old residents (Hofmeister, Romp, Thompson) that during El Nino-type rainfall Sisar Creek occasionally flooded to the west until the mid-1890's. At those times, it ran down Sycamore Creek into Arnaiz Creek, bypassing the Ojai Valley geologic structure.

I was told by the above-listed people that Tom McGuire's father was an early settler in the late 1800's and owned the property east of the current Black Mountain Ranch. He dryland farmed as my ancestors did. When the occasional flood happened, it littered his fields with rocks and flotsam that took a great amount of effort to remove for growing hay. Tom told my uncle that in the mid 1890's his father had hired local laborers to wall up and divert Sisar Creek water to the east. My uncle said that a few years later, a large slide slid down from the San Cayetano escarpment at the mouth of the creek, which built it up so that the flow now always continues to the east (although it almost came over in 1969 and again in 2004/05).

—Rod Thompson, Historian, 4th generation Upper Ojai resident, and Sisar Mutual Water Company board president

Lion Canyon Creek drains the Upper Ojai Valley to the west. Major tributaries to this creek include Sycamore Creek, draining the Topatopa Mountains, and Big Canyon Creek, draining Sulphur Mountain.

The Upper Ojai Valley Basin is a fairly deep, bowl-shaped unconfined basin filled primarily with alluvial fan deposits derived from erosion of the surrounding mountains. The average thickness of water-bearing deposits is approximately 60 feet, reaching a maximum of about 300 feet near Sisar Creek. Depth to groundwater is about 45 to 60 feet below ground surface (VCWPD 2012; CDWR 2003).
3.3.3.4 Key Data and Information Sources/Further Reading

The most comprehensive evaluation of groundwater in the watershed was done by the California State Water Resources Control Board in the Ventura County Investigation included in Bulletin 12, 1956. The California Department of Water Resources’ Bulletin 118 is the state’s current, comprehensive evaluation of groundwater basins in California; the bulletin is actually a series of bulletins that have been updated over the years.

In 1971, John Turner of the Ventura County Flood Control District (now the Ventura County Watershed Protection District) produced a detailed analysis of groundwater basins in the watershed, estimating their storage capacity and actual storage. This report, Geohydrology of the Ventura River System: Groundwater Hydrology (VCFCD 1971), is one of the most often cited analyses of the basins in the watershed (excluding the Lower Ventura River Basin).

Subsequent to the Turner report, a number of detailed studies have been prepared for the Ojai Valley Basin, which is now the watershed’s most well-studied groundwater basin. A graduate thesis published in 2005 documented the geology, degree of confinement, and hydraulic characteristics of the Ojai Valley Basin (Kear 2005). A comprehensive groundwater model prepared in 2010 estimated the basin’s safe yield and provided additional information about the basin’s subsurface structure (DBS&A 2011). An update to this model prepared in 2014 calibrated the original model using data through the end of 2013 and improved estimates of recharge from turf and crop irrigation (DBS&A 2014). The updated model is being used to evaluate how basin groundwater levels are expected to respond to various drought scenarios.

An important study conducted in 2010, Groundwater Budget and Approach to a Groundwater Management Plan Upper and Lower Ventura River Basin, provides estimates of water inputs and outputs for these basins, as well as a final groundwater budget (DBS&A 2010).

The Ventura County Watershed Protection District also produces an annual report summarizing well-monitoring data, well levels, and water quality (VCWPD 2012).

The OBGMA collects continuous groundwater level and temperature data in the Ojai Valley Basin via data loggers in five production wells and the San Antonio Creek Spreading Grounds depth discrete monitoring well.
Below is a list of some of the key documents that address groundwater hydrology in the watershed. See “4.3 References” for complete reference citations.

Bulletin 46: Ventura County Investigation (CDWR 1933)
Bulletin 12: Ventura County Investigation (SWRCB 1956)
Groundwater Model Development – Ojai Basin (DBS&A 2011)
Update to Ojai Basin Groundwater Model Memo (DBS&A 2014)
Groundwater Section Annual Report, 2013 (VCWPD 2013g)
Hydrogeologic Investigation, Ojai Groundwater Basin, Section 602 and 603 Study Tasks (SGD 1992)
Hydrogeology of the Ojai Groundwater Basin: Storativity and Confinement (Kear 2005)
Hydrologic Assessment San Antonio Creek Sub-Watershed (DBS&A 2006)
Hydrology, Hydraulics and Sediment Studies of Alternatives for the Matilija Dam Ecosystem Restoration Project (USBR 2007)
Surface Water–Groundwater Interaction Report for the Ventura River Habitat Conservation Plan (Entrix 2001)
Ventura County Water Resources Management Study, Geohydrology of the Ventura River System: Ground Water Hydrology (VCPCD1971)

Gaps in Data/Information

A better understanding of groundwater, specifically its relationship with surface water, is considered one of the critical information gaps in the watershed. The extent to which groundwater pumping affects surface flows of water needs further investigation. With a better understanding of this relationship—including when pumping has the greatest effects and the location and extent of these effects—surface and groundwater supplies could be better managed to provide for both the instream water needs of the endangered steelhead at critical times of the year and the ongoing water supply needs of homes and businesses.
California's Sustainable Groundwater Management Act

The Sustainable Groundwater Management Act, signed into law in September, 2014, created a framework for sustainable, local groundwater management for the first time in California history.

The Act established a definition of sustainable groundwater management and requires local agencies to adopt management plans for the state's most important groundwater basins. The legislation prioritizes groundwater basins and sets a timeline for implementation:

- By 2017, local groundwater management agencies must be identified;
- By 2020, overdrafted groundwater basins must have sustainability plans;
- By 2022, other high and medium priority basins not currently in overdraft must have sustainability plans; and
- By 2040, all high and medium priority groundwater basins must achieve sustainability.

For the purposes of this act, the Upper Ventura River and Ojai Valley Groundwater Basins are considered medium priority basins, and the Lower Ventura River Basin and the Upper Ojai Basin are low priority basins.

Implementation of the requirements in the Act will result in more groundwater management plans with additional data collection that should help address groundwater data gaps in the watershed.

Further investigation is warranted for many groundwater hydrology parameters throughout the Ventura River system including:

- groundwater extraction
- groundwater elevation
- accurate storage and safe-yield capacity
- groundwater flow within and between the basins
- definition of aquifer depth, barriers, and boundaries
- enhanced groundwater recharge alternatives
- groundwater–surface water interactions
- detailed location and nature of faults, and how they affect groundwater hydrology
- cross sections of subterranean geology
- quantity of agricultural irrigation infiltration
- recharge and discharge areas

1. At this time, groundwater extractions are only comprehensively reported and monitored in the Ojai Valley Basin; however, anyone with wells having aggregate extractions of more than 25 AF (or extractions of 10 AF or more from a single source) must file a report with the State Water Resources Control Board if there is no delegated local agency such as the OBGMA (Water Code §4999-5009). This has been a requirement in Ventura County since the 1950s. However, this requirement is not enforced, and the record of extractions in the State's electronic Water Rights Information Management System (eWRIMS) database is incomplete.
3.4 Water Supplies and Demands

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3.4 Water Supplies and Demands

3.4.1 Water Suppliers and Managers

3.4.1.1 Types of Suppliers

The watershed has several different types of water suppliers; the differences are mostly in the type of ownership, methods of payment or reimbursement for water, and the governing bodies. Different regulations and procedures may apply to different types of water suppliers. The following descriptions are taken from the Ventura County Watershed Protection District’s Inventory of Public & Private Water Purveyors in Ventura County (VCWPD 2006).

Cities—Any charter or general law city is a public agency that can provide water service as a city function.

Special Districts—Special districts are public agencies formed pursuant to general or special laws, generally for the local performance of government or proprietary functions within limited boundaries.

Public or Special-Use Public Water Suppliers—These are public water suppliers other than cities or special districts. In the Ventura River watershed these are parks, campgrounds, and County facilities.

PUC-Regulated Private Water Companies—In a limited number of cases, the California Public Utilities Commission (PUC) licenses and regulates water companies. These private companies have rates and service areas established by the State PUC. They are not owned by any public agencies or by the affected customers, but usually by shareholders who purchase stock or ownership rights via bond issues, etc.

Mutual Water Districts or Companies—Similar to PUC-regulated water companies but with fewer restrictions, mutual water districts or companies are owned in common by the various shareholders or customers served by the company.

Privately Owned Water Companies—A popular and easily established form of water service is the private company. These include limited partnerships, private landowners, mobile home parks, and irrigation-only companies. Customers may or may not own shares in the company, depending on the size of the purveyor.

Private Well Owners—Many individuals and businesses in the watershed, especially farmers, have private wells and therefore serve as their own “supplier.”
3.4.1.2 Major Urban Water Suppliers

There are five major urban water suppliers in the Ventura River watershed: Casitas Municipal Water District, Ventura Water, Golden State Water Company, Ventura River Water District, and Meiners Oaks Water District. These major urban water suppliers are described briefly below; more information on the suppliers is provided in “3.4.2 Water Supplies” (including a map of water supply key infrastructure) and “3.4.3 Water Demands.”

Casitas Municipal Water District

Casitas Municipal Water District (CMWD) is the primary water supplier in the watershed, providing water to both water resale agencies and retail customers. The City of Ventura is Casitas’ largest customer, and Lake Casitas water serves as one of the main sources of water for the City of Ventura. One of CMWD’s important functions is to serve as the “backup” water supply for a number of their customers, including nine water suppliers, as well as farmers, when groundwater supplies become depleted.

<table>
<thead>
<tr>
<th>Major Urban Water Supplier</th>
<th>Purveyor Type</th>
<th>Year Formed</th>
<th>Area Served</th>
<th>Est. Pop. Served</th>
<th># of Connections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Casitas Municipal Water District</td>
<td>Special District</td>
<td>1952</td>
<td>Boundary include the City of Ojai, Upper Ojai, Ventura River Valley area, the City of Ventura to Mills Road, and the coastal Rincon area to the Santa Barbara County line. 137 sq. mi.</td>
<td>9,379 R 68,557 R+W</td>
<td>3,200</td>
</tr>
<tr>
<td>Ventura Water</td>
<td>City</td>
<td>1923</td>
<td>City of Ventura1 In watershed: 1,798 acres within City + 944 acres within City’s sphere of influence In CMWD service area: 4,112 acres Overall: 22 sq. mi. of City + 944 acres within City’s sphere of influence</td>
<td>106,433 (entire city) 31,604 (Casitas service area within city)</td>
<td>About 32,000 service connections; approximately 30% of those accounts (~9,600) are located within the CMWD service area.</td>
</tr>
<tr>
<td>Golden State Water Company</td>
<td>Investor-Owned Utility</td>
<td>1928</td>
<td>City of Ojai proper and some fringe County areas outside the City. 3,300 acres.</td>
<td>8,202</td>
<td>2,899</td>
</tr>
<tr>
<td>Ventura River Water District</td>
<td>Special District</td>
<td>1957</td>
<td>Part of Casitas Springs, Burnham Road area west of the Ventura River, and north half of Oak View up to Meiners Oaks and to the City of Ojai at the Vons shopping center. 2,220 acres.</td>
<td>5,988</td>
<td>2,150</td>
</tr>
<tr>
<td>Meiners Oaks Water District</td>
<td>Special District</td>
<td>1948</td>
<td>Meiners Oaks community on the east side of the Ventura River. 1,300 acres.</td>
<td>4,000</td>
<td>1,260</td>
</tr>
</tbody>
</table>

R = Retail, W = Wholesale. Because they are a wholesale provider, Casitas’ service area encompasses that of the other districts; it also extends beyond the watershed’s boundaries.

1. Ventura Water may use Casitas water within Casitas’s service area, which extends to about Mills Road, but this restriction does not apply to use of Ventura River water from the City’s Foster Park facilities.

2. Estimated with a GIS tool using Census Block Groups.

Figure 3.4.1.2.1 Major Urban Water Suppliers Map
CMWD's service area encompasses 137 square miles and includes the City of Ojai, Upper Ojai, the Ventura River Valley area, the City of Ventura south to about Mills Road, and the coastal Rincon area to the Santa Barbara County line.

CMWD gets its water from Lake Casitas, which is fed by both the reservoir's surrounding drainages and water diverted from the Ventura River. The district also operates one well in the Mira Monte area.

CMWD operates and maintains Lake Casitas and Casitas Dam, the Robles Diversion and Fish Passage Facility on the Ventura River, the Robles Canal, and the Marion Walker Pressure Filtration Plant. CMWD also maintains and operates one well in Mira Monte, which pulls from the Upper Ventura River Basin.

**Ventura Water**

Ventura Water is the name of the City of Ventura's department that supplies water and treats wastewater. Ventura Water's service area is within their city limits (22 sq. mi.), which comprises several watersheds, including the lower part of the Ventura River watershed east of the Ventura River (primarily the City's Westside). They also supply water to an area in the watershed of about 944 acres that is outside their city limits but within their sphere of influence.

Lake Casitas is one of Ventura Water's primary supply sources. The water received from CMWD may only be used in the part of the City within CMWD's service area (4,112 acres), which extends to about Mills Road. There is an exception to this in Casitas's 1995 contract with the City allowing them to “rent” water from Casitas (and return it later) for use outside of Casitas's service area (CMWD 1995); this contract is being reconsidered for relevance to current water supplies and demands.

Water from wells and diversions in the Foster Park area is another primary water source of Ventura Water. Water from this source may be used anywhere within Ventura Water's service area. Ventura Water also depends upon groundwater from sources in the Santa Clara River watershed.

In the Ventura River watershed, Ventura Water operates four groundwater wells at Foster Park (one of which is not currently operational because of damages sustained in the 2005 flood). These wells pull water from the downstream end of the Upper Ventura River Basin. Ventura Water also has both a surface and subsurface intake on the Ventura River at Foster Park (though the surface diversion has not been operational since 2000).

Ventura Water operates the Avenue Water Treatment Plant, which treats water from the Foster Park wells and diversions.
Golden State Water Company

Of the five major urban water suppliers in the watershed, Golden State Water Company is the only PUC-regulated private water company. Golden State also owns and operates several other water systems in California. In the Ventura River watershed their service area includes the City of Ojai proper, part of the unincorporated County east of the City of Ventura and part of the Meiners Oaks community to the west of Ojai. Golden State’s main source of water is groundwater, which they supplement with water from CMWD.

Because of high water cost rates relative to other rates in the area, as well as complaints related to service, customers of Golden State in the City of Ojai initiated an effort in 2010 to have CMWD acquire the Ojai service area of Golden State and become the area’s service provider. In 2013, voters approved a bond to fund the cost of acquiring the water system and making needed improvements. As of this writing, this issue is being litigated.

Golden State operates five wells in the Ojai Valley Groundwater Basin. They have two connections to CMWD (City of Ojai 2012).

Figure 3.4.1.2.2  Golden State Water Company Annual Water Use by Source
Source: GSWC 2013
**Ventura River Water District**

Ventura River Water District (VRWD) is a small water district that supplies water to the area stretching from the southwestern edge of the City of Ojai down to the northern half of Oak View, and in the eastern half of Casitas Springs. Groundwater is VRWD's primary water supply source. CMWD water is also used, both as a backup source and as a regular source for customers in some locations.

> When full, our aquifer holds about a two year supply of water.
> If we do not receive sufficient rain after that we must rely upon water from Lake Casitas.
> —Ventura River Water District website (VRWD 2014)

VRWD operates four wells in the Upper Ventura River Groundwater Basin, and has five water system connections to receive water from Lake Casitas.

**Meiners Oaks Water District**

Meiners Oaks Water District (MOWD) is a small water district that supplies water to the community of Meiners Oaks on the east side of the Ventura River. Groundwater is MOWD's primary water supply source. Water from CMWD is infrequently used as backup, such as during extended drought periods.

MOWD operates five wells in the Upper Ventura River Groundwater Basin.

<table>
<thead>
<tr>
<th>Major Urban Water Supplier</th>
<th>Water Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Casitas Municipal Water District</td>
<td>Lake Casitas, which is fed by both its surrounding drainages and water diverted from the Ventura River. The district also operates 1 well in the Mira Monte area, in the Upper Ventura River Basin.</td>
</tr>
<tr>
<td>Ventura Water</td>
<td>Sources from the Ventura River watershed include CMWD and Foster Park wells and diversions. Ventura Water operates 4 groundwater wells at Foster Park (one of which is not currently operational because of damaged sustained in the 2005 flood), and both a surface and subsurface intake on the Ventura River at Foster Park (though the surface diversion has not been operational since 2000). Groundwater is extracted from the Upper Ventura River Groundwater Basin. Ventura Water also has rights to reclaim water from the Ojai Valley Sanitary District treatment plant. Reclamation of this water source is currently under study.</td>
</tr>
<tr>
<td>Golden State Water Company</td>
<td>5 wells in the Ojai Valley Groundwater Basin, plus water from CMWD.</td>
</tr>
<tr>
<td>Ventura River Water District</td>
<td>4 wells in the Upper Ventura River Groundwater Basin, plus CMWD water as backup.</td>
</tr>
<tr>
<td>Meiners Oaks Water District</td>
<td>5 wells in the Upper Ventura River Groundwater Basin, plus CMWD water as backup.</td>
</tr>
</tbody>
</table>
3.4.1.3 Mutual Water Companies

There are 11 mutual water companies in the watershed as summarized in Table 3.4.1.3.1. They range from small companies serving 10 to 12 customers, to companies serving hundreds of customers. The majority of these mutual water companies were formed in the 1930s and 40s, before the construction of Lake Casitas. Antiquated infrastructure presents management challenges for some of these older water companies.

There are also eight private water companies that deliver water in the watershed along with three public water suppliers that supply water to locations, such as County parks and facilities.

Table 3.4.1.3.1 Small Water Suppliers, Overview

<table>
<thead>
<tr>
<th>Water Supplier</th>
<th>Year Formed</th>
<th>Service Area</th>
<th>Est. Pop. Served</th>
<th># of Connections</th>
<th>Water Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Casitas Mutual Water Company</td>
<td>1932</td>
<td>Serves residents in Casitas Springs, west of Highway 33.</td>
<td>250</td>
<td>81</td>
<td>Groundwater (Upper Ventura River Basin)</td>
</tr>
<tr>
<td>Gridley Road Water Group</td>
<td>1930</td>
<td>Serves primarily agriculture in the area of the Gridley Road and Grand Avenue intersection in the East End of the Ojai Valley.</td>
<td>44</td>
<td>20</td>
<td>Groundwater (Ojai Valley Basin), Golden State</td>
</tr>
<tr>
<td>Hermitage Mutual Water Company</td>
<td>1975</td>
<td>Serves primarily agriculture and several large residential estates located in the foothills between Gridley and Senior canyons north of the Ojai Valley.</td>
<td>35</td>
<td>22</td>
<td>Gridley Canyon Creek, Groundwater (Ojai Valley Basin), CMWD</td>
</tr>
<tr>
<td>North Fork Springs Mutual Water Company</td>
<td>1948</td>
<td>Serves residential users located up Highway 33, north of the City of Ojai, E. of the Matilija Reservoir, in the Los Padres National Forest.</td>
<td>10</td>
<td>11</td>
<td>Groundwater (Upper Ventura River Basin)</td>
</tr>
<tr>
<td>Old Creek Road Mutual Water Company</td>
<td>1975</td>
<td>Serves residential users along East Old Creek Road.</td>
<td>12</td>
<td>5</td>
<td>CMWD</td>
</tr>
<tr>
<td>Rancho Matilija Mutual Water Company</td>
<td>Pre-1960</td>
<td>Serves agricultural parcels in the Rancho Matilija subdivision, north of Baldwin Road and west of Meiners Oaks.</td>
<td>0</td>
<td>8</td>
<td>Groundwater (Upper Ventura River Basin), Ventura River surface water</td>
</tr>
<tr>
<td>Rancho del Cielo Mutual Water Company</td>
<td>1977</td>
<td>Serves residential and agricultural users along Creek Road (along San Antonio Creek).</td>
<td>18</td>
<td>7</td>
<td>CMWD</td>
</tr>
<tr>
<td>Senior Canyon Mutual Water Company</td>
<td>1929</td>
<td>Serves the northeast end of the Ojai Valley (north of Reeves Creek, east of Carne Road). Serves a mix of residential, large residential, and agricultural users.</td>
<td>800</td>
<td>247 domestic metered; 48 irrigation</td>
<td>Groundwater (Ojai Valley Basin), 2 spring/creek diversions, CMWD</td>
</tr>
<tr>
<td>Siete Robles Mutual Water Company</td>
<td>1940</td>
<td>Serves a housing tract located east of the City of Ojai.</td>
<td>245</td>
<td>98</td>
<td>Groundwater (Ojai Valley Basin), CMWD (minimal)</td>
</tr>
<tr>
<td>Sisar Mutual Water Company</td>
<td>1949</td>
<td>Serves the Summit area of the Upper Ojai Valley (partially within CMWD’s service area boundary).</td>
<td>325</td>
<td>103</td>
<td>Groundwater (Upper Ojai Basin), CMWD</td>
</tr>
<tr>
<td>Tico Mutual Water Company</td>
<td>1949</td>
<td>Serves a small residential area in Mira Monte, west of Highway 33.</td>
<td>77</td>
<td>38</td>
<td>Groundwater (Upper Ventura River Basin), CMWD</td>
</tr>
</tbody>
</table>

3.4.1.4 **Private Wells and Diversions**

Water is also supplied to many agricultural and domestic water users in the watershed by way of private wells and surface water diversions.

As of March 2014, 21 different entities were registered in the state’s eWRIMS (Electronic Water Rights Information Management System) database as having rights to withdraw surface water or water from subterranean streams in the watershed (SWRCB 2014b).

As of May 2014, there were 442 active wells in the watershed, 203 of which were drilled prior to local permit requirements.

<table>
<thead>
<tr>
<th>Groundwater Basin</th>
<th>Active Wells (approx.)</th>
<th>Drilled Before Permits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Ventura River Basin</td>
<td>149</td>
<td>76</td>
</tr>
<tr>
<td>Lower Ventura River Basin</td>
<td>15</td>
<td>3</td>
</tr>
<tr>
<td>Ojai Valley Basin</td>
<td>182</td>
<td>98</td>
</tr>
<tr>
<td>Upper Ojai Basin</td>
<td>96</td>
<td>26</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>442</strong></td>
<td><strong>203</strong></td>
</tr>
</tbody>
</table>

Well records are approximate.
1. Drilling permits became required in 1999.
Source: VCWPD 2014a

3.4.1.5 **Water Management Organizations**

**Ojai Basin Groundwater Management Agency**

Ojai Basin Groundwater Management Agency (OBGMA) is a special-act district that manages the water of the Ojai Valley Groundwater Basin. Formed by state legislation in 1991, OBGMA is one of only 13 such districts with groundwater management authority in the State of California (CDWR 2003). The watershed’s other three important water supply groundwater basins do not have similar management oversight. The OBGMA was established in the fifth year of a drought, amidst concerns of local water agencies, water users, and well owners about potential groundwater basin overdraft (OGMA 2010).

OBGMA’s mission is “To preserve the quantity and quality of groundwater in the Ojai Basin in order to protect and maintain the long-term water supply for the common benefit of the water users in the Basin.”

There are five seats on the OBGMA board, which are filled by representatives from the City of Ojai, Casitas Municipal Water District, Golden State Water Company, Ojai Water Conservation District, and mutual water companies (one director is elected to represent three mutual water companies).
The OBGMA oversees the management of the Ojai Basin, and is required by law to have a groundwater management plan to guide its operations. Elements of OBGMA's Groundwater Management Plan are implemented in the form of policies, rules, regulations, and ordinances. Water drawn from the basin is used roughly equally between urban and agricultural users.

**Ventura County Watershed Protection District**

The Ventura County Watershed Protection District (VCWPD), originally named the Ventura County Flood Control District, was formed by state approval of the Ventura County Flood Control Act of 1944. This Act (as amended) includes five primary purposes of the VCWPD, including several related to water supplies:

- Provide for the control and conservation of flood and stormwaters
- Prevent waste or loss of water supply
- Import water into the district, retain and recycle storm and flood flows, and conserve all such water for beneficial uses.

Key programs and services that the district administers that support water supply management include:

- Lead role in monitoring and collection of precipitation, weather, and streamflows data
- Hydrologic modeling and forecasting
- Lead grant applicant/administrator in support of watershed partner projects, such as the San Antonio Creek Spreadings Grounds project
- Groundwater well permitting, groundwater data, and basin condition assessments
- Stormwater management programs that advance stormwater capture and infiltration.

VCWPD implements Ventura County Well Ordinance No. 4184, which includes issuing permits for modification, construction, and destruction of all types of wells; inspecting well sealing and perforation work; and conducting an annual well usage survey. VCWPD hydrographers regularly perform water level measurements and water quality sampling of approximately 200 wells located throughout Ventura County and produce an annual report summarizing those findings. VCWPD maintains records on all known wells within the County, including a database of wells that helps track well status (active/inactive/destroyed).
Ojai Water Conservation District

The Ojai Water Conservation District (OWCD) is a special district formed in 1949. The district's focus is on reclaiming water in the San Antonio Creek area of the East End of the Ojai Valley for agricultural purposes. The district was formerly called the San Antonio Water Conservation District (VCWPD 2006). OWCD is authorized to monitor the use of groundwater, acquire water rights, store and spread water, and construct dams or other water facilities (VLAFCO 2004). The OWCD is within OBGMA's service area, and is represented on OBGMA's board.

3.4.1.6 Key Data and Information Sources/ Further Reading

Below are some of key documents that address water suppliers in the watershed. See “4.3 References” for complete reference citations.

2010 Urban Water Management Plan (CMWD 2011)

2013 Comprehensive Water Resources Report, Ventura Water (RBF 2013)

2014 Comprehensive Water Resources Report, Ventura Water (RBF 2014)

Inventory of Public & Private Water Purveyors in Ventura County (VCWPD 2006)

Public Water System Statistics (CDWR 2013)


3.4.2 Water Supplies

This section discusses the watershed's water supply sources. Other aspects of these water sources are discussed elsewhere in this document, including "3.3 Hydrology" and "3.5 Water Quality."

3.4.2.1 Current Supply Sources

The Ventura River watershed relies entirely on local water. No imported water is used in the watershed—truly remarkable given its location in coastal southern California. Local surface water and groundwater sources supply water demands within the watershed, and help meet demand in adjacent coastal watersheds. Reclaimed water, i.e., treated wastewater, is not currently used directly as a water supply source. Casitas Municipal Water District (CMWD) and the City of Ventura both hold entitlements to State Water Project water, however no pipeline, tunnel, or conveyance of any kind exists to deliver that water to the watershed.

Surface water is extracted for use directly from the Ventura River and some of the tributaries, but the primary source of surface water comes from Lake Casitas. Groundwater is extracted from the watershed's four groundwater basins by urban water suppliers, growers, and other private businesses and landowners.

Table 3.4.2.1.1 Average Annual Water Production, by Major Supply Source

<table>
<thead>
<tr>
<th>Water Supply Source</th>
<th>Approx. Annual Average Use (acre-feet)</th>
<th>Total by Category</th>
<th>% by Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake Casitas</td>
<td>17,493\textsuperscript{1}</td>
<td>17,493</td>
<td>54%</td>
</tr>
<tr>
<td>Foster Park surface diversion</td>
<td>0\textsuperscript{2}</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Surface Water Total:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ojai Valley Basin</td>
<td>5,113\textsuperscript{3}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Ventura River Basin</td>
<td>9,300\textsuperscript{4,5}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower Ventura River Basin</td>
<td>523</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Ojai Basin</td>
<td>68.2\textsuperscript{6}</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Groundwater Basins Total:</strong></td>
<td></td>
<td>15,004</td>
<td>46%</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td></td>
<td><strong>32,497</strong></td>
<td></td>
</tr>
</tbody>
</table>

1. Average deliveries to the main conveyance system between 1975 and 2013 water years (CMWD 2009a).
2. City of Ventura’s surface water diversion at Foster Park has been inactive since 2000 due to the natural channeling of the active river channel bypassing the structure. The City’s subsurface diversion totals are included with groundwater.
3. Average groundwater production rate between 1985 and 2012 (ORBMA 2014).
4. Average municipal groundwater production rate between 2000 and 2007, plus estimated average annual domestic and agricultural extraction. These numbers are rough estimates due to data limitations and because extractions have changed over time (DBRSA 2010, Table 13). For example, the City of Ventura’s 50-year average extraction rate between 1960 and 2009 was 6,000 AF (RBFB 2013), whereas the 7-year average used in the report cited in the table above was 4,603 AF.
5. The City of Ventura’s subsurface diversions are included in the groundwater category.
6. 10-year average provided by Sisar Mutual Water Co. Roughly half of Sisar’s water is used in the Santa Clara River watershed. No other groundwater pumping data are available.
Surface Water Key Infrastructure

Figure 3.4.2.1.2 Surface Water Key Infrastructure Map
Lake Casitas

Lake Casitas is the cornerstone of the water supply infrastructure in the watershed, and its value cannot be overstated. This man-made lake was designed to hold 254,000 acre-feet (AF) of water, and it is carefully managed to maintain supplies during a repeat of the 21-year dry period from 1945 to 1965, the longest dry period on record. (See the “Safe Yield” section later in this section for more information on this concept.)

Although the lake has not yet been put to a 21-year dry period test, it has been a reliable source of water in many multi-year dry periods when numerous wells were dry and the river barely flowed.

Between 1975 and 2013, total annual deliveries from the reservoir averaged 17,493 AF. During this period, the highest annual delivery was 24,416 AF (1989) and the lowest was 11,694 AF (1993) (CMWD 2014).

Table 3.4.2.1.2 Lake Casitas Quick Facts

<table>
<thead>
<tr>
<th>Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Storage Capacity</td>
<td>254,000 acre-feet</td>
</tr>
<tr>
<td>Safe Annual Yield</td>
<td>20,840 acre-feet per year (includes a small amount of water from one well)</td>
</tr>
<tr>
<td>Water Course Built On</td>
<td>Coyote Creek</td>
</tr>
<tr>
<td>Original Construction</td>
<td>1956 to 1959</td>
</tr>
<tr>
<td>Water Sources</td>
<td>Coyote Creek, Santa Ana Creek, Ventura River via Robles Diversion Canal</td>
</tr>
<tr>
<td>Surface Area (when full)</td>
<td>2,760 acres</td>
</tr>
<tr>
<td>Miles of Shoreline</td>
<td>32</td>
</tr>
<tr>
<td>Deepest Depth</td>
<td>200 feet</td>
</tr>
<tr>
<td>Maximum Diversion Rate at Robles Diversion</td>
<td>500 cubic feet per second</td>
</tr>
</tbody>
</table>

Source: Ventura River Project website (USBR 2014; Merckling 2014)
Water from the Lake Casitas reservoir is the primary water source for many users, and it is also a critical “backup” source for most groundwater users. Casitas’s high-quality water is also blended with poorer quality groundwater by some water purveyors to improve water quality and extend supplies. The Casitas Municipal Water District (CMWD), originally called the Ventura River Municipal Water District, manages

**The Ventura River Project**

The Ventura River Project is the name given to the effort to build Lake Casitas and its associated infrastructure by its builder, the U.S. Bureau of Reclamation. The project included Casitas Dam, Robles Diversion, Robles Canal, and the main conveyance system, which includes 34 miles of pipeline, five pumping stations, and six balancing reservoirs located throughout the project area. A fish passage facility was added to the Robles Diversion in 2006 for the endangered southern California steelhead.

Construction of the Ventura River Project was notably fast—three years of construction, six years including planning:

When the planned $27.5 million Ventura River project was officially authorized on March 1, 1956, construction began immediately. The entire process, from the formation of the VRMWD [Ventura River Municipal Water District] to initial water deliveries to project beneficiaries in 1959, took six years, causing The Reclamation Era to report, “It is believed that this is a record with respect to elapsed time for conception, design, and construction of a Federal reclamation project.”

*—The Ventura River Project (USBR 1995)*

*The Ventura River Project Under Construction*

Photos courtesy of United States Bureau of Reclamation
the lake and is a wholesale and retail water supplier (see “3.4.1 Water Suppliers and Managers” for more information on CMWD).

Lake Casitas was built in 1959 by the U.S. Bureau of Reclamation (USBR) under the title “The Ventura Project.” The project was the last of three “seacoast” projects built by the USBR in southern California to capture floodwaters that would otherwise “waste to the sea” (USBR 1995). The USBR’s other two seacoast projects were the Cachuma (Cachuma Lake) and Santa Maria (Twitchell Reservoir) projects.

The reservoir is filled by runoff from Coyote Creek and Santa Ana Creek, which drain directly into the lake, and by water diverted from the Ventura River by way of the 5.4-mile Robles Canal. The relative contributions from these sources vary depending on runoff conditions, but about 55% of inflow now comes from the surrounding drainages and 45% comes from the Ventura River.

Lake Casitas was built “offstream,” meaning it is not built across the main river that supplies its water, as most water storage projects in the west were designed. One of the fortunate results of this design is that it minimizes the rate at which sediment enters the lake from the Ventura River.

Sedimentation and seismicity have not caused the headaches for district officials at Ventura that they have caused other water project managers in Southern California. Sedimentation, an infamous villain at most regional reclamation developments, has robbed some reservoirs of over ten percent of their capacity (as is the case at Cachuma and Twitchell), but has not been particularly problematic at Casitas because of the project’s make-up. Matilija Reservoir and Robles Diversion Dam, both upstream of Casitas, perennially hold most of the dropped silt in the river basin, leaving little to settle in and present problems at Casitas.

—The Ventura River Project (USBR 1995)

Foster Park Surface/Subsurface Diversions

The Foster Park/Casitas Springs area is critical for both surface water and groundwater production in the Ventura River watershed. Figure 3.4.2.1.3 (Groundwater Basins Map) shows that a constriction of landforms in this area narrows both the riverbed and underlying groundwater basin. The basin alluvium is shallow here and groundwater upwells via in-river springs. In this part of the river, groundwater is near the surface, and rising groundwater contributes to surface flows. San Antonio Creek, which joins the Ventura River from the east just above Foster Park, contributes significant surface flow and groundwater recharge in this area (DBS&A 2010). These various factors cause the river environs just above and below Foster Park to be one of the most consistently wet parts of the river, which has earned it the name “live reach.”
Residents of the City of Ventura have relied upon Foster Park area water since the late 1700s:

When the City was founded in 1782, it used the Ventura River as its primary source of water. Streamflow was diverted near the present-day Foster Park and conveyed in an aqueduct built by the Chumash Indians, under the supervision of the Mission fathers, to a reservoir near the Mission. From 1869 to 1923, water facilities were developed and operated for the City by several companies. In 1923, the City acquired the water system from Southern California Edison and assumed responsibility for providing water to the City’s residents.

—Draft Ventura River Habitat Conservation Plan (Entrix & URS 2004)

In 1906, a subsurface diversion structure was constructed across the river to increase water retention for extraction purposes (CDWR 2003). The dam is 975 feet long and crosses the Ventura River, as well as the mouth of Coyote Creek (Entrix & Woodward Clyde 1997), and works in combination with subsurface collector pipes.

The City of Ventura also has a surface diversion in the Ventura River in the Foster Park area; however, because the river course tends to meander within the riverbed, the diversion intake is now located in a part of the river that has been dry since the year 2000, so no direct surface water diversions have occurred since then. In addition, the City has four wells located upstream of the subsurface dam. Water drawn from the City’s diversions and wells is conducted downstream to the City’s water treatment plant for processing prior to delivery to end-users.

City of Ventura's Subsurface Dam and Diversion at Foster Park. Originally built in 1906 as a subsurface diversion dam, the top of the diversion is now exposed in places due to scour, instream erosion, and the trapping of sediment behind Matilija Dam. An intake pipe runs along the back side of the dam, only partially buried by sediment when this photo was taken on June 17, 2014. This dam blocks migration of shallow subsurface underflow and thus raises groundwater levels in the area to produce enhanced surface flows (Entrix & URS 2004). The City of Ventura extracts water at the structure and also has a number of wells just upstream.
Between 2000 and 2012, the City produced an average of 1,556 AF a year from its subsurface diversion. The highest annual production was 2,025 AF (2006) and the lowest was 1,144 AF (2005). Diversions are generally lower in the winter when flows in the river are high, more turbid, and full of debris (Entrix & URS 2004). The last time the City's surface diversion produced water was in 2000, after which the active river channel migrated and bypassed the diversion structure (City of Ventura 2014). According to the City's 2013 Comprehensive Water Resources Report, the City's current reliable water supply from the Ventura River at Foster Park is 4,200 AF a year, but the report states: “This number may further be drastically reduced by proposed regulatory and environmental constraints” (RBF 2013).

In 1981, the City submitted a pre-1914 water right claim (Statement of Diversion and Use) with the State Water Resources Control Board Division of Water Rights for 7,245 AF per year of surface water from the Ventura River in the Foster Park area; in 2011, the City submitted a water right claim for 72,397 AF per year of surface water from the river (SWRCB 2011).

**Groundwater**

The Ventura River watershed has four groundwater basins that are used as water supply sources: Ojai Valley Basin, Upper Ventura River Basin, Lower Ventura River Basin, and Upper Ojai Basin. The nature and hydrology of these basins are described in more detail in “3.3.3 Groundwater Hydrology.”

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*Well Adjacent to Ventura River, Meiners Oaks*

*Photo courtesy of Smitty West*
**Groundwater Basins**

![Map of Ventura River Watershed showing groundwater basins](image)

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
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<tr>
<td>Upper Ojai</td>
<td>2,840</td>
<td>4.4</td>
<td>0-40</td>
<td>5,881 AF</td>
<td>50 gpm</td>
<td>95</td>
<td>Unavail.</td>
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<tr>
<td>Ojai Valley</td>
<td>6,471</td>
<td>10.1</td>
<td>0-80</td>
<td>85,000 AF</td>
<td>383 gpm</td>
<td>149</td>
<td>5,026 AF</td>
</tr>
<tr>
<td>Upper Ventura River</td>
<td>9,360</td>
<td>14.6</td>
<td>0-5</td>
<td>35,118 AF</td>
<td>600 gpm</td>
<td>160</td>
<td>9,482 AF</td>
</tr>
<tr>
<td>Lower Ventura River</td>
<td>6,090</td>
<td>9.5</td>
<td>3-13</td>
<td>8,743 AF</td>
<td>20 gpm</td>
<td>16</td>
<td>2,130 AF</td>
</tr>
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</table>

**Figure 3.4.2.1.3 Groundwater Basins Map**

Data source: See Table 3.4.2.1.3 (Groundwater Basins Map Data Sources) on the next page.
Precise data on the quantity of groundwater produced in the watershed are not available because private well withdrawals are generally not reported. Production data are the most detailed in the Ojai Valley Basin, because the Ojai Basin Groundwater Management Agency collects data as part of its mandate to manage that basin. Preliminary estimates of pumping have been developed for the Upper and Lower Ventura River Basins in the report *Groundwater Budget and Approach to a Groundwater Management Plan, Upper and Lower Ventura River Basin* (DBS&A 2010). Least is known about extractions from the Upper Ojai Basin.

### Table 3.4.2.1.3 Groundwater Basins Map Data Sources

<table>
<thead>
<tr>
<th>Map Table Column</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres &amp; Sq. Mi.</td>
<td>Ventura County Watershed Protection District (VCWPD) map (GIS shapefiles).</td>
</tr>
<tr>
<td></td>
<td>Other basins—Estimates provided by local groundwater consultants Jordan Kear (Kear Groundwater) &amp; Greg Schnaar (DBS&amp;A).</td>
</tr>
<tr>
<td></td>
<td>Lower Ventura River Basin—The capacity provided in <em>Bulletin 118</em> is exceedingly high, possibly because the number accounts for very deep aquifer layers, or parts of aquifers that historically extended offshore (SWRCB 1956). Greg Schnaar (DBS&amp;A) prepared a calculation that estimated the capacity for only the unconsolidated, onshore alluvium basin.</td>
</tr>
<tr>
<td>Active Wells Yield</td>
<td>Watershed Protection District well database</td>
</tr>
<tr>
<td>Approx. Safe Yield</td>
<td>Upper &amp; Lower Ventura River Basin—Estimate by Greg Schnaar (DBS&amp;A) based on the report <em>Groundwater Budget and Approach to a Groundwater Management Plan Upper and Lower Ventura River Basin</em> (DBS&amp;A 2010). Note: this report estimated the safe yield of the Upper Ventura River Basin as 12,732 AF, however this included the Coyote Creek drainage/Lake Casitas area as part of the basin. These areas are no longer considered by VCWPD to be part of the Upper Ventura River Basin, so Schnaar provided a revised estimate of 9,482 AF.</td>
</tr>
</tbody>
</table>

### Table 3.4.2.1.4 Water Suppliers by Groundwater Basin Use

<table>
<thead>
<tr>
<th>Public or Mutual Water Company¹</th>
<th>Ojai Valley Basin:</th>
<th>Upper Ojai Basin:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Casitas Municipal Water District</td>
<td>Gridley Road Water Group</td>
<td>Sisar Mutual Water Company²</td>
</tr>
<tr>
<td>Casitas Mutual Water Company</td>
<td>Golden State Water Company</td>
<td></td>
</tr>
<tr>
<td>Meiners Oaks Water District</td>
<td>Hermitage Mutual Water Company</td>
<td></td>
</tr>
<tr>
<td>North Fork Springs Mutual Water Company</td>
<td>Senior Canyon Mutual Water Company</td>
<td></td>
</tr>
<tr>
<td>Rancho Matilija Mutual Water Company</td>
<td>Siete Robles Mutual Water Company</td>
<td></td>
</tr>
<tr>
<td>Tico Mutual Water Company</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ventura River Water District</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ventura Water (City of Ventura)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹ - Excluded from this table are private water pumpers.

² - Sisar Mutual Water Company’s wells pump from the Upper Ojai Basin, although they are located just over the border between the Ventura River and Santa Clara River watersheds, on the Santa Clara River watershed side.

Data Source: Ventura County Watershed Protection District Inventory of Public & Private Water Purveyors in Ventura County (VCWPD 2006)
Groundwater Basin Capacity

A groundwater basin reported to have a "maximum capacity" of 85,000 acre-feet (AF) in no way indicates that there is 85,000 AF of usable or recoverable fresh water, only that the basin has the capacity to hold a gross volume of 85,000 AF. Not all of the storage capacity contains economically recoverable water or water that is of acceptable quality for use.

Upper Ventura River Basin

The Upper Ventura River Basin supplies the greatest quantity of groundwater in the watershed. The most significant withdrawals occur in the Foster Park area (at the basin's downstream border) by the City of Ventura. Here, the City has the ability to withdraw both groundwater and subsurface water (discussed earlier in this section).

Because the City of Ventura's wells are in the river bottom, they have been subject to damage over the years:

The Foster Park facilities produce groundwater throughout the year. However, due to storm flows, the wells are subject to inundation and erosion. The early 2005 winter storms destroyed Nye Well 1A and damaged Nye Wells 2, 7 and 8. The pipeline between Nye Wells 7 and 8 along the west bank of the river and the pipeline that crosses the river from Nye Well 8 to the intake pipeline for the Avenue Treatment Plant were also damaged during the storms. Nye Wells 7 and 8 were repaired in late 2006, the pipeline across the river was repaired in late 2007 and the pipeline repair between Nye Wells 7 & 8 was completed in early 2009. To date, Nye Well 2 has not been repaired.

—2013 Comprehensive Water Resources Report, Ventura Water (RBF 2013)

Between 2000 and 2012, groundwater production (excluding subsurface production) from the City's Nye well field in Foster Park averaged 2,481 AF a year. This average reflects disruptions in production from flood-related well damage: very little groundwater was produced between 2005 and 2007. The City's highest annual groundwater production during this period was 5,080 AF (2000) and the lowest was 149 AF (2005). Since 2009, the City's groundwater production has been from two of their Nye wells.
Figure 3.4.2.1.4 Wells in the Upper Ventura River Groundwater Basin Map
Source: Ventura County Watershed Protection District
Ventura River Water District (VRWD) and Meiners Oaks Water District (MOWD) are the next most significant (known) pumphers of groundwater in the Upper Ventura River Basin, with wells in the upper part of the basin between the Highway 150 Bridge and the Robles Diversion. This stretch of river is known as the “dry reach” because water percolates rapidly into the highly permeable riverbed and commonly disappears soon after storms. Both water districts have wells in the floodplain of the Ventura River; MOWD operates five wells and VRWD operates four wells. These water districts serve the communities of Meiners Oaks, Mira Monte, Oak View, and Casitas Springs.

Between 2005 and 2013, groundwater production from the MOWD’s wells averaged 1,016 AF a year. During this period the highest annual production was 1,166 AF (2006) and the lowest was 821 AF (2011) (Hollebrands 2014).

Between 1995 and 2013, groundwater production from the VRWD’s wells averaged 1,324 AF a year. During this period the highest annual production was 1,565 AF (2000) and the lowest was 1,068 AF (2013) (Rapp 2014).

Mutual water companies producing groundwater from the Upper Ventura River Basin include Casitas Mutual Water Company, North Fork Springs Mutual Water Company, Rancho Matilija Mutual Water Company, and Tico Mutual Water Company. Casitas Municipal Water District also operates one well in this basin.

As of 2014, there are 149 active wells in the Upper Ventura River Groundwater Basin, 44 of which have been drilled since 2000 (VCWPD 2014a).

**Ojai Valley Basin**

The Ojai Valley Basin supplies the second largest quantity of groundwater in the watershed. Golden State Water Company (GSWC) depends upon wells in this basin, as do many of the agricultural growers in Ojai’s East End.

Between 1985 and 2012, annual groundwater production from the Ojai Valley Basin averaged 5,113 AF a year (approximately equal to its estimated safe yield of 5,026 AF), with an average of 1,858 AF produced by GSWC and 3,255 AF produced from private wells. During this period the highest production was 7,697 AF (1992: GSWC – 1,645 AF; private wells – 6,052 AF) and the lowest was 3,690 AF (1989: GSWC – 1,766 AF; private wells – 1,924 AF) (OBGMA 2014).
Mutual water companies that produce groundwater from the Ojai Valley Basin include Gridley Road Water Group, Hermitage Mutual Water Company, Senior Canyon Mutual Water Company, and Siete Robles Mutual Water Company.

As of 2014, there are 182 active wells in the Ojai Valley Groundwater basin, 64 of which have been drilled since 2000 (VCWPD 2014a).

**Upper Ojai Basin**

The divide between the Ventura River watershed and the Santa Clara River watershed runs through the Upper Ojai Basin near Sisar Road. Underground strata in this location separate groundwater flow either westward toward Lion Canyon Creek or eastward toward Santa Paula Creek and into the Santa Clara River watershed (CDWR 2003).

Residents and farmers in Upper Ojai rely upon the Upper Ojai Basin. There are limited data on the amount of withdrawals from that basin. The Sisar Mutual Water Company (SMWC) produces groundwater from the Upper Ojai Basin, although their wells sit just over the Ventura River watershed border, in the Santa Clara River watershed. Produced water is distributed to customers in both watersheds, in roughly equal amounts.
Between 2004 and 2013, SMWC's annual groundwater production from the Upper Ojai Basin averaged 67 AF a year. During this period the highest annual production was 74 AF (2013) and the lowest was 63 AF (2011) (Thompson 2014).

As of 2014, there are 96 active wells in the Upper Ojai Basin, 25 of which have been drilled since 2000 (VCWPD 2014a).

**Figure 3.4.2.1.6 Wells in the Upper Ojai Groundwater Basin Map**

*Source: Ventura County Watershed Protection District*

**Lower Ventura River Basin**

The Lower Ventura River Basin is minimally used and data are limited on the amount of water produced from the basin. Most of the wells are agricultural; no public water suppliers use the basin.

As of 2014, there are 18 active wells in the Lower Ventura River Groundwater Basin, 11 of which have been drilled since 2000 (VCWPD 2014a).
Figure 3.4.2.1.7 Wells in the Lower Ventura River Groundwater Basin Map

Source: Ventura County Watershed Protection District
Safe Yield

In the context of water reservoirs, safe yield, or "firm yield" is defined as "...a quantity of water from a project or program that is projected to be available on a reliable basis, given a specified level of risk, during a critically dry period." (Public Law 108-361)

In the context of groundwater basins, safe yield has commonly been defined as "the maximum quantity of water that can be continuously withdrawn from a groundwater basin without adverse effect" (CDWR 2003).

Some definitions of groundwater safe yield explicitly acknowledge the potential streamflow or environmental impacts of groundwater extraction:

Safe yield is the amount of naturally occurring groundwater that can be withdrawn from an aquifer on a sustained basis, economically and legally, without impairing the native groundwater quality or creating an undesirable effect such as environmental damage.

—*Applied Hydrogeology* (Fetter 2001)

As human activities change the system, the components of the water budget (inflows, outflows, and changes in storage) also will change and must be accounted for in any management decision. Understanding water budgets and how they change in response to human activities is an important aspect of groundwater hydrology... a predevelopment water budget by itself is of limited value in determining the amount of ground water that can be withdrawn on a sustained basis.

—*USGS Website: Ground-Water Development, Sustainability, and Water Budgets* (USGS 2014c)

In all cases, the concept of safe yield is complicated, and the factors that determine a water supply's safe yield are often changing, so the safe yield of a particular water supply often changes over time.

Safe Yield: Lake Casitas

The calculation of safe yield for Casitas is based on the storage volume of Lake Casitas, the surface water and groundwater supply managed by Casitas, and the length of time that water supply needs to last (i.e., longest drought on record). The safe yield value is an interpolated value that is held constant over the period of the critical drought, bringing the level of storage to the desired minimum volume.

—*Water Supply and Use Status Report, Casitas Municipal Water District* (CMWD 2004)
In 1954, the United States Bureau of Reclamation established 27,800 AF as the safe annual yield of Lake Casitas. This was based on the most critical dry period on record at that time (1918 to 1936), the ability to integrate operation of the Matilija Reservoir to maximize diversions through the Robles Canal, and other factors.

Safe Yield vs. As Available Supply Management

Lake Casitas reservoir has the capacity to hold almost 12 times its annual yield in storage, and operates on a "safe yield" basis. In contrast, many other water supply facilities are operated on an "as available" or "rule curve" basis. During wet years, customers can draw more water than would be allowed under a safe yield scenario. During dry spells however, deliveries to these customers are reduced, and they are left to seek other supplies. Delivering water on an "as available" basis allows greater deliveries on the average, but reduces reliability during droughts.

California’s State Water Project (SWP) is an example of a water system operated beyond its safe yield. The SWP has 1.4 times its annual yield in storage (CDWR 2014). During very dry years, such as 2014, water deliveries were reduced to less than 5% of normal. If this system were operated within safe yield, annual deliveries would have to be substantially reduced to hold back water for dry spells. In August of 2014, when many state reservoirs were between 30 to 40% of capacity, Lake Casitas remained above 50%. The last time the lake was nearly full was in 2006, so it took nine years for the lake to drop to its August 2014 level.

See “3.4.3 Water Demands” for a discussion of the policies and management practices that have helped CMWD operate within the reservoir’s safe yield.

Figure 3.4.2.1.8 Model of Lake Casitas During Repeat of Critical Dry Period. The period of 1945 through 1965 is the longest dry period on record in the area. This dry period is used by CMWD to estimate how long supplies could last if a similar drought should occur in the future; this then is used to determine safe annual yield. Note that if the lake had existed in this long-term dry period (Lake Casitas was completed in 1959 and did not fill until 1978), there would have been some years when stored supplies increased.

Sources: CMWD 2010; CMWD 2004; Wickstrum 2014
As conditions changed and available data have become more refined, the operating annual safe yield has seen several adjustments. The current safe yield estimate for Lake Casitas is 20,840 AF. The current estimate factors in a new and longer critical drought period (1945 to 1965), greater levels of evaporation from the lake, the application of the Biological Opinion related to mandated flow requirements through the Robles Diversion to support fish passage, the discontinuation of releases of water from Matilija Reservoir, the use of water from a well in Mira Monte, and other factors (CMWD 1989; CMWD 2004; Merckling 2014).

**Safe Yield: Foster Park Surface/Subsurface Diversions**

A primary concern with regard to the amount of surface water or subsurface diversions that can be safely extracted in the Foster Park area is the effect this has on the endangered steelhead. Changes in the timing and magnitude of Ventura River flows and associated downstream hydrologic processes could negatively impact the spawning and migration of the steelhead, as well as the summer rearing of juveniles (NMFS 2007).

A draft Biological Opinion (BO) prepared in 2007 in response to the City of Ventura's request to repair its wells in Foster Park provided a comprehensive analysis of the correlation between the Foster Park facilities and the effect on streamflow. Because the City withdrew its application, this BO never became effective.

Since 2009, the City has been monitoring the effect of their Foster Park extractions on downstream flow and habitat suitability for steelhead. Their studies indicate that a flow threshold exists below which the steelhead habitat suitability declines significantly.

A 2013 report on the City's monitoring program concluded the following:

- Water balance calculations using upstream surface water flow rates, City groundwater diversions, and downstream flow rates indicate that groundwater production at Foster Park during the low-flow season is substantially supported by underflow through the alluvial sediments. Approximately 3 to 4 cubic feet per second can be produced by the City at Foster Park while the flow rate downstream at the Casitas Vista Road Bridge (flowing out of Foster Park) is virtually the same as the upstream flow rate at Casitas Springs where surface water enters the Foster Park reach of the River.

The findings of this study indicate a flow threshold exists whereby when flows decrease below the threshold, the steelhead habitat
suitability declines significantly. During the 2012 low flow conditions when the City diversion was approximately 6.5 cubic feet per second (cfs) and there was 4 cfs or greater upstream (at Casitas Springs) and 2 cfs or greater downstream (at Casitas Vista Road Bridge), the HSI scores for adult steelhead remained fairly constant and the River pools maintained substantial depths. Study data indicate the upstream flow threshold was approximately 4 cfs (at the Casitas Springs live reach), while the downstream flow threshold was approximately 2 cfs (at the USGS gage [at Casitas Vista Road Bridge – ed.]). After surface flows declined below these rates, the HSI scores for steelhead and the habitat volume estimates declined rapidly.

—Preliminary Hydrogeological Study, Surface Water/
Groundwater Interaction Study, Foster Park (Hopkins 2013)

Safe Yield: Groundwater

There are no existing legal constraints that limit groundwater pumping and none of the watershed’s groundwater basins are adjudicated (where the courts determine water rights). The only basin where legal authority exists to enforce safe yield extractions is the Ojai Valley Basin, through the Ojai Valley Groundwater Management Agency (OBGMA). (See “3.4.1 Water Suppliers and Managers” for information on OBGMA.)

A groundwater model developed for the Ojai Basin in 2011 determined that the safe yield of that basin is 5,026 AF per year, which is the median rate of natural basin recharge over the model calibration period (1970 to 2009). This is very close to average rate of groundwater production from the basin, which is 5,113 AF per year (between 1985 and 2012).

Estimated groundwater inputs and outputs for the Upper and Lower Ventura River Basins were analyzed in the 2010 report Groundwater Budget and Approach to a Groundwater Management Plan Upper and Lower Ventura River Basin (DBS&A 2010). Using the inputs from this analysis, the safe yield in the Upper Ventura River Basin is estimated at 9,482 AF per year. This is very close to the estimated average groundwater production from the basin, which is 9,300 AF per year (see Table 3.4.2.1.1). The safe yield in the Lower Ventura River Basin is estimated at 2,130 AF per year.

Not enough information is available to estimate the safe yield of the Upper Ojai Valley Basin.

1 Note: the DBS&A report estimated inputs to the Upper Ventura River Basin as 12,732 AF per year; however this included the Coyote Creek drainage/Lake Casitas area as part of the basin. These areas are no longer considered to be part of the Upper Ventura River Basin, so the report’s author provided the revised estimate of 9,482 AF. The estimate for the Lower Ventura River Basin is preliminary, and based on groundwater balance for water years 1997 to 2007.
Conjunctive Water Management

Conjunctive water use, or conjunctive water management, generally involves the coordinated use of ground and surface water supplies to use the overall water supply more efficiently. Conjunctive water management is a common recommendation for improved water use and protection.

The purposes of conjunctive management are to coordinate water resource use in ways that reduce exposure to drought, to maximize water availability, to protect water quality, and to sustain ecological needs and aesthetic and recreational values. Other potential benefits are improved security of water supplies, reduced reliance on costly and environmentally disruptive surface water impoundment and distribution systems, and enhanced protection of aquatic life and habitat.

Conjunctive management achieves these purposes by capturing surplus precipitation and streamflow, controlling releases from surface water storage facilities, and storing surface supplies underground in aquifers. The stored groundwater serves as a non-evaporating “bank” that can be tapped during subsequent dry periods to sustain consumptive uses or supplement stream flows. The aquifer thus provides a regulatory storage medium that helps to smooth out the greater variability of water demands and surface water supplies. Overall, surface water and groundwater storage facilities are operated together with groundwater supplies and underground storage as components of a single system (i.e., operated “conjunctively”). Multiple water needs are met by shifting mixes of surface and groundwater supplies determined by their relative availability.

—Institutions and Conjunctive Water Management among Three Western States (Blomquist et al. 2001)

In a recent example of conjunctive water management, Senior Canyon Mutual Water Company’s water supply and distribution system was upgraded using grant funds secured by Casitas Municipal Water District to help Senior Canyon make better use of their groundwater supplies and reduce their demands on Lake Casitas. Another example, the San Antonio Creek Spreading Grounds refurbishing project, is described below.

The City of Ventura also practices conjunctive water management of its supplies from the Ventura River and Santa Clara watersheds. A portion of the City's allocation in the Oxnard Plain Groundwater Basin is not used during normal wet years when supply from the Ventura River is plentiful. During these years, the unused groundwater allocation is banked for future use. The City reserves the right to extract the banked water during droughts or emergencies (Entrix & URS 2004).
The Ventura River Conjunctive Use Agreement of 1983

The City of Ventura also practices conjunctive water management of its supplies from the Ventura River and Santa Clara watersheds. A portion of the City's allocation in the Oxnard Plain Groundwater Basin is not used during normal wet years when supply from the Ventura River is plentiful. During these years, the unused groundwater allocation is banked for future use. The City reserves the right to extract the banked water during droughts or emergencies (Entrix & URS 2004).

In 1978, Casitas Municipal Water District and the City of Ventura proposed a large-scale conjunctive water management project for the Ventura River watershed that would change how each agency diverted water from the Ventura River. The following description is from the Draft Environmental Impact Report (EIR) for the proposed conjunctive use agreement. Note that the southern California steelhead was not listed as an endangered species until 1997.

The downstream bypass of the first 20 cfs of flow at Robles Diversion Dam would be discontinued, and all flows up to the 500-cfs capacity of the diversion canal would be diverted. The loss of water available to users downstream from the Robles dam (including the City, irrigators, and other public water purveyors) would be made up by CMWD with water from Casitas Reservoir.

The conjunctive use operation would increase the average yield to the City and to the system as a whole and would significantly increase the reliability of the City's supply. In addition, the consummation of the agreement would settle the dispute between the City and CMWD over water rights in the river. The proposed project will make better use of the storage capacity of the Reservoir and will make more water available for use during periods of below normal rainfall. Casitas Reservoir will receive increased inflow but will have to meet increased demands, with little net effect on reservoir levels. The City and other water diverters will benefit from increased water supply reliability, as dry-year deficiencies will be made up by deliveries from Casitas Reservoir.

—Ventura River Conjunctive Use Agreement, Draft Environmental Impact Report (EDA W 1978)

The draft proposal was strongly opposed by Friends of Ventura River and other stakeholders. The Final EIR, approved by Casitas and the City of Ventura in 1983, included an EIR Addendum requiring a five-year trial period to assess potential significant environment impacts. For various reasons, this conjunctive use effort did not progress. However, the initial implementation efforts of the project, beginning in 1983, marked the beginning of intense monitoring and reporting of well and river system hydrology on the river—a positive result of the effort.

San Antonio Creek Spreading Grounds

In 1949, growers in the east end of Ojai formed a water reclamation district called the San Antonio Water Conservation District, which has since been renamed the Ojai Water Conservation District. The district was formed primarily to divert water into settling ponds along San Antonio Creek for groundwater recharge of the Ojai Valley Groundwater Basin, although the district is also authorized to monitor the use of groundwater, acquire water rights, and construct dams or other water facilities. The district established a series of stair-stepped settling basins on private property adjacent to upper San Antonio Creek, designed so that one would overspill into the next. It is estimated that there were dozens of these basins, each 20 to 30 feet long, 50 to 60 feet wide, and 6 to 10 feet deep (Hawks & Associates 2005).
Between 1951 and 1963, groundwater recharge was conducted using an estimated 10,000 acre-feet of surface water imported from Matilija Lake via pipeline. The pipeline was eventually abandoned and groundwater recharge was conducted by diverting surface water from San Antonio Creek from 1963 to 1985. Surface flow was diverted through a 24-inch-diameter pipe equipped with an iron gate to control flow rates, and was reportedly available on a seasonal basis.

—San Antonio Creek Spreading Grounds Rehabilitation Project: Project Description (VCWPD 2010b)

Following the major “Wheeler Fire” of 1985, the Ventura County Flood Control District, now the Ventura County Watershed Protection District (VCWPD), was concerned that heavy rains could trigger a debris flow downstream and damage properties adjacent to San Antonio Creek. The VCWPD procured the 11.4-acre spreading grounds property and constructed a debris basin in the channel adjacent to the recharge basins. During basin construction, excavated material filled most of the spreading basins. In the early 1990’s, VCWPD and the Ojai Water Conservation District collaborated in an effort to reconstruct the basins, but the reconstruction was only partially successful, and the project was eventually abandoned.

Rehabilitated San Antonio Creek Spreading Grounds, 2014
Photo courtesy of Ventura County Watershed Protection District
In 2006, VCWPD secured funding to rehabilitate the San Antonio Creek Spreading Grounds, and construction was completed in the summer of 2014. The new facility is designed to divert surface water from upper San Antonio Creek into holding basins where the water then recharges groundwater through passive injection wells. Annual groundwater recharge is projected to average 126 AF per year with a maximum of 914 AF per year. The project was a collaboration between the OBGMA and the VCWPD. Casitas Municipal Water District is also a project partner that will help with facility maintenance. (VCWPD 2010b; VCWPD 2014c)

### 3.4.2.2 Potential Future Supply Sources

#### Reclaimed Water

The watershed’s sewer system wastewater is treated at one of two wastewater treatment facilities. Most of the wastewater is treated at the Ojai Valley Sanitary District’s (OVSD) treatment plant located below Foster Park next to the Ventura River. Treated effluent from this facility is not reclaimed for reuse. The effluent is discharged into the Ventura River where it supports valuable habitat for the endangered southern California steelhead, and also recharges the shallow Lower Ventura River Groundwater Basin. The plant discharges an average of 2.1 million gallons per day (mgd), or 3.3 cubic feet per second, to the river. A discharge of 2.1 mgd is equivalent to approximately 2,354 AF per year.

Exploring the feasibility of reusing treated wastewater for irrigation or groundwater recharge within the watershed is of interest to some stakeholders. Locating decentralized “scalping plants” in the upper watershed, such as near the City of Ojai, has been considered in this regard (Entrix & URS 2004). These facilities, sometimes called satellite plants, are small plants that withdraw wastewater from a sewer mainline to produce reclaimed water and return biosolids and non-reclaimable wastewater, such as brine, to the sewer mainline for treatment at the central treatment facility downstream (Byrne). Keeping treated wastewater higher in the watershed for reuse could be especially helpful during extended dry periods.
A number of studies have been conducted to investigate the potential to reclaim OVSD wastewater. ("Key Data and Information Sources/Further Reading" at the end of this section lists these reports.) Over the years, water quality regulations have mandated the treatment plant to produce water of increasingly higher quality, requiring very expensive plant upgrades in some cases. In the past, these high costs have motivated OVSD to reassess effluent discharge options that could come at a lower cost.

Any efforts to reclaim wastewater for reuse in the watershed must address the environmental drawbacks of removing this flow from the river and estuary. Since 1963, OVSD’s effluent has been discharged to the Ventura River. The health of the lower river and the estuary, a very important ecosystem for many species, could be significantly impacted by the reduction in water from the treatment plant. The release of the effluent into the river is now integrated into the water quality permits that govern OVSD’s operation.

The City of Ventura owns the land where OVSD’s treatment plant is located, and holds first rights to any reclaimed water from that facility.

In 2007, the City of Ventura conducted an engineering and market analysis of using OVSD recycled water, which found:

The engineering and market analysis identified a cost-effective combination of localized users that minimized the additional infrastructure necessary to supply the recycled water. The primary users identified were Aera Energy, and local growers, with Aera accounting for the bulk of the demand. These users, which are currently supplied with a combination of raw and potable water, could utilize approximately half of the current effluent discharge.


Much of the sewer system wastewater generated below OVSD’s facility is treated by the Ventura Water Reclamation Facility located within Ventura city limits adjacent to the Santa Clara River estuary in the Santa Clara River watershed. Of the wastewater that enters the Ventura Water Reclamation Facility, 700 AF a year is reused for landscape irrigation within the City and the rest is discharged to the Santa Clara River estuary (RBF 2013).

**Imported Water**

The City of Ventura and CMWD both pay for an entitlement to water imported from the California State Water Project (SWP), but there are no pipelines or facilities in place to deliver SWP water into local distribution systems.
In 1963, the Ventura County Flood Control District contracted with the State of California (State) for 20,000 acre-feet per year of water from the State Water Project (SWP). The SWP conveys water from Northern California to Southern California through a system of reservoirs, canals, pump stations and power generation facilities. In 1971, the administration of the State Water Contract with the State was assigned to the District. Of the 20,000 acre-feet per year contracted, the District [CMWD] is assigned 5,000 acre-feet per year, United Water Conservation District is assigned 5,000 acre-feet per year, and the City of Ventura is assigned 10,000 acre-feet per year. Currently, only United Water Conservation District is receiving water from the SWP.


CMWD’s service area, while holding 5,000 acre-feet of annual State Water entitlement, is not able to receive those annual entitlements due to the lack of any physical connection (pipeline or canal) to the State Water Project to bring State Water into the service area. Due to the cost of the physical connection, estimated in 1990 at over $100 million, and cost of State Water, the service area has not proceeded with the physical connection to the State Water System.

—Casitas Municipal Water District, Urban Water Management Plan, 2010 (CMWD 2011)

In the drought of 1990, water agencies in the watershed participated in plans for an emergency transfer of SWP water to the City of Carpinteria in Santa Barbara County via “water wheeling”—the practice of using facilities owned by others to deliver transferred water. The plan involved transferring SWP to the City of Ventura from the City of Oxnard by way of a temporary, on-the-ground pipeline adjacent to various highways and lesser roads, then the City of Ventura would reduce its use of water from Lake Casitas by an equal amount, and that Casitas water would then be transferred to the City of Carpinteria via an emergency pipeline. Although the Oxnard-to-Ventura temporary pipeline connection was completed, and some water was conveyed, the big rains of 1991 came before the entire plan could be fully carried out.

Such wheeling arrangements are very expensive.

Recent information provided to the City estimates the wheeling costs that would be required to pay Metropolitan Water District in order for the City to wheel water through their facilities would be over $1,300/AF, not including the wheeling charges assessed by local agencies.

—2013 Comprehensive Water Resources Report, Ventura Water (RBF 2013)

The City of Ventura and CMWD both pay for an entitlement to water imported from the California State Water Project (SWP), but there are no pipelines or facilities in place to deliver SWP water into local distribution systems.
Desalinated Water

In 1992, voters in the City of Ventura approved “Measure O,” an advisory ballot measure seeking direction on whether the City should pursue seawater desalination or the State Water Project for additional water supply.

VENTURA — City Council members decided Monday to abide by the voters’ wishes and move forward with building a seawater desalination plant. Residents voted last week 55% to 45% in favor of constructing a plant to desalt 7,000 acre-feet of water a year. An acre-foot is enough water to serve two families of four for a year.

A city-ordered engineering study has estimated that it would cost $30.4 million a year for 30 years to build and maintain the facility.

There are only five desalination plants in California, and two are temporarily shut down, said Shelley Jones, the city’s director of public works. The active plants are at Gaviota, Diablo Canyon and Santa Catalina Island. The others are in Santa Barbara and Morro Bay.

—LA Times, November 11, 1992

Constructing the desalination facilities did not go forward at the time, but remains an option. The per acre-foot cost of desalting ocean water is significantly higher than traditional local sources.

…the citizens of Ventura voted November 3, 1993 [correction: 1992 - ed] in favor of desalinating seawater over importing water through the SWP, as the preferred supplemental water supply option. Current information on desalination of seawater presented by The Pacific Institute recently completed a report entitled, "Desalination, With a Grain of Salt – A California Perspective". The report indicates that the potential benefits of ocean desalination are great, but the economic, cultural and environmental costs of wide commercialization remain high. Alternatives such as treating low-quality local water sources, regional water transfers, improving conservation and efficiency and accelerating wastewater recycling and reuse can provide the same freshwater benefits of ocean desalination at far lower economic and environmental costs. The Pacific Institute analysis found that the cost to produce water from a desalination plant is high but subject to significant variability with recent estimates for plants proposed in the state ranging from $1,900 to more than $3,000 an acre-foot. City staff has been engaged in discussions with other local water agencies in regard to potential regional desalination projects and will continue to do so.

—2013 Comprehensive Water Resources Report, Ventura Water (RBF 2013)
Supply Variability

Seasonal Variability

The majority of the watershed's rainfall occurs during a few winter months. Rainfall typically occurs in just a few significant storms each year, which can come any time between October 15 and April 1, with 90% of the rainfall occurring between November and April (VCWPD 2010). Figure 3.4.2.3.1 shows the fluctuation in rainfall over a typical year in downtown Ojai.

Although most of the rainfall occurs in winter and early spring, most water is used in the summer and fall. This highlights the need for significant water storage.

![Downtown Ojai](image)

**Figure 3.4.2.3.1 Average Monthly Rainfall, Ojai**

Data source: VCWPD Hydrologic Data Server (VCWPD 2013)

Annual Variability

Rainfall and runoff in the Ventura River watershed vary greatly from year to year, and this variability affects annual water supplies. Typically, conditions in the watershed cycle between very wet years that bring more water than drainage networks can hold, and multi-year dry periods that strain available water supplies. This variability in supply poses significant challenges to long-term water supply management.

Since 1930, total annual runoff in the watershed (as measured at Foster Park) has ranged from a low of 0.18 AF in water year (WY) 1951 to a high of 277,096 AF in WY 1995. The median annual total runoff during this period, 12,867 AF, is much lower than the average, 47,329 AF, because of a small number of extremely large runoff years. In the year of greatest runoff (1995), rainfall in Ojai was over 220% of the median (1995: 42.36 inches/median: 19.17 inches).
Figure 3.4.2.3.2 illustrates average annual runoff by water year types since 1930. As the chart shows, runoff conditions can range from very dry to very wet over just a few years. See “4.4 Appendices” for the “Table of Water Year Types Based on Annual Average Runoff,” which lists runoff totals by water year and water year types.

**Figure 3.4.2.3.2 Variation in Average Annual Runoff (by Water Year Types).** Average annual runoff from each water year between 1930–2013 (as measured at Foster Park) was used to assign one of five water year categories—very wet, wet, normal, dry, and very dry—to each year. Half of the years are above the median and half below. See “4.4 Appendices” for the “Table of Water Year Types Based on Annual Average Runoff,” for the list of years by water year type, and an explanation of the category divisions.

Data Source: USGS National Water Information System Website (USGS 2014b)
Rainfall and runoff variability affect not only the water supply in the year it occurs, but also in subsequent years. For example, consecutive dry years reduce the amount of "backup" water in storage in Lake Casitas and groundwater basins. Water managers depend upon the cumulative "carryover storage" from wet and especially very wet years to meet demands during the multi-year dry cycles in the watershed.

Figure 3.4.2.3.3 illustrates the annual volume of water diverted from the Ventura River for storage since Lake Casitas was constructed in 1959. Water from Ventura River comprises about 45% of inflow into the reservoir; drainage from the reservoir's surrounding watersheds comprises the rest. The chart makes clear how important wet and very wet runoff years are in terms of their contribution of water to storage.

![Volume of Water Diverted via Robles Diversion (1960-2013)](image)

**Figure 3.4.2.3.3 Volume of Water Diverted via Robles Diversion, Water Years 1960–2013.** Bar chart colors indicate water year runoff types. Water from Ventura River comprises about 45% of inflow into Lake Casitas. Average annual water use from Lake Casitas is 17,500 AF.

Source: Casitas Municipal Water District, 2014

Figure 3.4.2.3.4 illustrates each year's minimum and maximum storage volumes in Lake Casitas since the reservoir's construction in 1959.

Figures 3.4.2.3.5 to 3.4.2.3.7 illustrate annual groundwater levels in three of watershed's four groundwater basins. (No graph of the Lower Ventura River Basin is available because of limited data availability.)

Figure 3.4.2.3.9 shows the findings of an update to the Ojai Basin Groundwater Model developed in 2014, three years into a drought. The model was used to project groundwater levels to the end of 2015 under three scenarios: 1) continued drought, assuming that precipitation in 2014 and 2015 is similar to that in 2012 and 2013, which is approximately 50% of median precipitation; 2) precipitation similar to the median conditions; and 3) precipitation 150% of median conditions.
Figure 3.4.2.3.4 Minimum and Maximum Lake Casitas Storage Volume. When the reservoir reaches 50% capacity, a "Stage 2 Water Shortage" per CMWD's Water Efficiency and Allocation Program is indicated, which can be the trigger for stricter water conservation requirements.

Data source: Casitas Municipal Water District

Figure 3.4.2.3.5 Upper Ventura River Basin Monitoring Well Hydrograph, 1949–2013. See Figure 3.4.2.3.8 (Monitoring Well Locations Map) below for location.

Source: Ventura County Watershed Protection District (VCWPO 2014b)
Figure 3.4.2.3.6 Ojai Valley Basin Monitoring Well Hydrograph, 1949–2013. See Figure 3.4.2.3.8 (Monitoring Well Locations Map) below for location.
Source: Ventura County Watershed Protection District (VCWPD 2014b)

Figure 3.4.2.3.7 Upper Ojai Basin Monitoring Well Hydrograph, 1972–2013. See Figure 3.4.2.3.8 (Monitoring Well Locations Map) below for location.
Source: Ventura County Watershed Protection District (VCWPD 2014b)
Figure 3.4.2.3.9 Ojai Basin Groundwater Model, 2014 Predictive Simulations. An update to the Ojai Basin Groundwater Model in 2014 found: "groundwater levels are projected to continue to decline significantly under ongoing drought, remain at current-day levels given median precipitation conditions, and increase, albeit to still relatively low levels, assuming a relatively wet upcoming water year." Shown are data from well # 04N22W05L08S.

Source: Update to Ojai Basin Groundwater Model Memo (DBS&A 2014)
Key Data and Information Sources/Further Reading

Below is a summary of some of key documents that address the watershed’s water supplies. See “4.3 References” for complete reference citations. Water suppliers and managers also maintain databases of water supplies, use, levels, etc.

2013 Comprehensive Water Resources Report, Ventura Water (RBF 2013)

2014 Comprehensive Water Resources Report, Ventura Water (RBF 2014)

Biological Opinion for US Army Corps of Engineers Permitting of the City of Ventura’s Foster Park Well Facility Repairs on the Ventura River, Draft (NMFS 2007)


Groundwater Model Development – Ojai Basin, Ventura County, California (DBS&A 2011)

Inventory of Public & Private Water Purveyors in Ventura County (VCWPDD 2006)


Reclaimed Water Feasibility/Marketing Study (Boyle 1992)


The Ventura River Project History (USBR 1995)

Update to Ojai Basin Groundwater Model Memo (DBS&A 2014)

Urban Water Management Plan, Casitas Municipal Water District, 2010 (CMWD 2011)

Urban Water Management Plan, City of Ventura, 2010 (Kennedy/Jenks 2011b)
Ventura River Habitat Conservation Plan, Draft (Entrixt & URS 2004)
Water Supply and Demand Status Report (CMWD 1989)

Gaps in Data/Information

Lack of data on groundwater pumping is considered a significant data gap in the watershed. Data on how much water is pumped by private well owners and the smaller water companies will help with understanding the hydrological connections between groundwater and surface water, and will provide water managers and others dependent upon groundwater as a supply source with important information for planning purposes.

Additional data and information that could help with water supply management include:

- A review of current practices and the potential for water savings through conjunctive use of surface water and groundwater supplies.
- An assessment of the potential for enhanced recharge projects.
- A comprehensive groundwater-surface water interaction analysis (described in “3.3.3 Groundwater Hydrology”), including gathering more data on surface flows, such as on San Antonio Creek, and groundwater levels.
- A comprehensive water supply and demand budget, including current uses and future demands.
- An estimate of the potential impacts of climate change on water supply safe yields.
- An assessment of the potential to use local farmland for on-farm stormwater detention and storage.
- An analysis of water rate models and options to better incentivize conservation while covering fixed costs.
- An analysis of the opportunities to use reclaimed water from the Ojai Valley Sanitary District, such as during winter flows when the water is not as critical to the river.

In addition, a groundwater management plan is needed for the Upper Ventura River Groundwater Basin.
3.4.3 Water Demands

3.4.3.1 Current Water Demands

The total average annual water demand for the watershed is estimated at 32,500 acre-feet (AF), with 54% (17,500 AF) from surface water sources and 46% (15,000 AF) from groundwater sources (See “3.4.2 Water Supplies” for details).

**Water Demand as Defined Here**

In this section, water demand is defined as all demands on this watershed’s water supplies from the areas it serves, including some areas outside the watershed’s boundaries. Water demands in the adjacent coastal watersheds—in the Rincon area and the City of Ventura—are included if the source of the water is the Ventura River watershed.

**Annual and Seasonal Demand Variability**

The annual variability of rainfall in the watershed affects both the total amount of water used each year as well as the relative amounts of surface water versus groundwater used. In very wet years, groundwater use goes up and demand on Lake Casitas goes down; in very dry years the reverse happens. The long-term average demand on Lake Casitas is 17,530 AF, but demand was 24,420 AF, or 139% of average, in water year 1989—a major drought year; and 11,690 AF, or 67% of average, in water year 1993—a very wet year.

**Table 3.4.3.1.1 CMWD Water Deliveries in Wet and Dry Years**

<table>
<thead>
<tr>
<th>Total Deliveries (AF)</th>
<th>1989 (Very Dry Year)</th>
<th>1993 (Very Wet Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average (1976–2013)</td>
<td>17,530</td>
<td>24,420</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11,690</td>
</tr>
</tbody>
</table>

In very dry years, demand on Lake Casitas goes up; in very wet years the reverse happens. Data Sources: CWMD Use Patterns Database and Casitas Consumption Reports.

Water demand in the watershed also varies seasonally. Demand is greater in the drier months of summer and fall, and lesser in the wetter months of winter and spring. A greater seasonal variability is seen in the inland areas, where it is hotter and irrigation needs are greater, than on the coast. Figure 3.4.3.1.1 shows the fluctuation in Lake Casitas water deliveries in 2010, a normal year in terms of rainfall and runoff.
Evaporation

A significant amount of water is lost to evaporation from the 2,760-acre (when full) surface area of Lake Casitas. CMWD takes daily evaporation pan measurements at Casitas Dam and at the Recreation Area. Between 1959 and 2010, an average of 7,986 AF per year evaporated from the lake (Wickstrum 2011).

Urban Water Use

Urban (non-agricultural) water use comprises about 55% of total water demand, with residential use making up the majority of urban water demand. (As stated above, water demand is defined here to include all demands on the watershed’s water supplies from the areas it serves—which include some areas outside the watershed’s boundaries.) (See “Water Use By Sector” later in this section.)

Urban water demands have not increased significantly in recent decades. The greatest growth in demand for urban water has been in the City of Ventura outside of the watershed. Since 2005, 271 single-family units, 1,369 multi-family units, and 1,398,798 square feet of non-residential development have been constructed in the City of Ventura (RBF 2014). Although this growth has not necessarily been within the watershed boundaries, water from the Ventura River watershed currently supplies almost half of the City of Ventura’s water needs (RBF 2013).
Per Capita Water Use

Per capita water use is calculated by dividing the total volume of public water produced daily by the number of people being served. The per capita use figure represents an individual's share of a community's average daily water needs and includes not only water used at home, but also water used at businesses such as restaurants, hotels, and offices; at community facilities like schools, parks, and hospitals; and for other uses like fighting fires (CDWR 2013a). CMWD's agricultural water use is excluded from their per capita calculation; the City of Ventura included their small amount of agricultural water use in their calculation.

Per capita water use varies from place to place, depending on each community's unique mix of land uses, weather, and other variables. Regions near the coast typically have smaller irrigated landscapes and cooler climates compared with the warmer climates and larger irrigated landscapes of inland regions. The statewide average per capita water use is 198 gallons per day (CDWR 2013a).

Table 3.4.3.1.2 provides the average annual per capita water use of the watershed's three largest water suppliers, and Figure 3.4.3.1.3 charts
their historical annual per capita water use. As these data show, inland per capita water use (Casitas, Golden State) is significantly higher than coastal (Ventura Water). Warmer weather and many large landscapes (i.e., golf courses, schools, parks and private estates) contribute to these higher numbers. Per capita water use is further discussed in “Urban Water Management Plan Projections” later in this section.

Figure 3.4.3.1.2 Statewide Per Capita Water Demand
Source: California Water Plan (CDWR 2013a)
Table 3.4.3.1.2 Average Annual Per Capita Water Use, 1999 to 2008

<table>
<thead>
<tr>
<th>Casitas Municipal Water District</th>
<th>Ventura Water</th>
<th>Golden State Water Co.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gallons/Capita/Day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>319.2</td>
<td>165.1</td>
<td>298.5</td>
</tr>
</tbody>
</table>


Figure 3.4.3.1.3 Per Capita Water Use, 1999–2009. The data show inland per capita water use (Casitas Municipal Water District, Golden State Water Company) as significantly higher than coastal (Ventura Water). Warmer weather and many large landscapes (i.e., golf courses, schools, parks and private estates) contribute to these higher numbers. Because so much water is used for irrigation in the non-coastal watershed, per capita water use can change considerably depending upon the type of rain year. (Agricultural water use is excluded from Casitas's per capita calculation.)

Per capita use for Ventura Water and Golden State show a statistically meaningful decreasing trendline. (Note: Casitas calculated their per capita use based on water year, Ventura Water and Golden State used a calendar year.)


Oil Industry Water Use

Oil recovery is a major industry in the watershed. The amount of groundwater used by the industry in the watershed is not known; their use of potable water supplies is relatively minor and has been decreasing in recent years.

All of the water used by Aera Energy for their waterflood injection in the Ventura Field in the lower watershed is brackish groundwater that comes up with the produced oil. This groundwater is filtered, cleaned, and reinjected into the same aquifer from which it was removed (Lampara...
2014). (Note: water suppliers do not use aquifers in this area of the lower watershed).

CMWD serves water to oil and gas production facilities in the Rincon area for high-pressure water injection oil recovery. The district reported in their 2010 Urban Water Management Plan that one of their oil customers recently switched to an alternative groundwater source, reducing demand on CMWD. The average demand from all of CMWD’s industrial customers between 2008 and 2012 was only 38 AF per year.

The City of Ventura reported in their 2010 UWMP that water usage for oil recovery between 1995 and 2000 averaged 1,500 AF per year. Between 2001 and 2005 it was approximately 900 AF per year, and between 2006 and 2010 it was approximately 500 AF per year. Purchased potable water is used primarily in offices, and purchased raw water is used for dust control and equipment cooling (Lampara 2014).

**Agricultural Water Use**

Agricultural water use comprises about 45% of water demand in the Ventura River watershed, which provides irrigation for over 6,000 acres of agricultural land, including some land outside and adjacent to the watershed (in the Rincon area).

Supplying water to agriculture was a primary impetus for the development of the watershed’s reservoirs:

Many agricultural wells in the productive Ojai Valley began going dry in the 1930’s and 40’s, forcing Ventura County to build 7,000 ac-ft Matilija Dam in 1949. The purpose of the dam was to replenish groundwater basins used for farming in Ojai and by the City of Ventura for its municipal supply.

—Ventura River Project (USBR 1995)

Upon conception of the Ventura River Project in 1953–54, it was hoped that a total of 13,200 acres of agricultural lands could ultimately be irrigated within project boundaries. Due to urban expansion, much of the potential farm lands were developed for other uses. As a result, the project has never supplied water to more than 7,000 acres of agricultural lands, with even that number being frozen as of 1995 by CMWD for conservation purposes. The Rincon area of the project, located near the coast to Ventura’s west, has increased its agricultural acreage over the years, growing mostly avocados.

—Ventura River Project (USBR 1995)
Young Avocados Adjacent to Robles Diversion Facility

Citrus and avocado are the primary crops grown within the watershed; citrus comprises about 44% of the acreage, and avocados 25%. Other crops include grains, row crops, berries, flowers, and other tree crops.

Groundwater is less expensive than Casitas water, so if growers have access to it, via their own wells or those of small water companies, most will depend first on groundwater and use Casitas water for supplemental or backup water. Some growers using groundwater have no Casitas connection for backup; some growers use Casitas (or other small water companies) as their only water source.

Even with the recent addition of a couple of large groundwater-dependent agricultural operations, the acreage of irrigated agriculture in the watershed appears to be decreasing. CMWD requires that all growers using their water, including supplemental/backup users, report annually on crop type and irrigated acres. CMWD's 2013 crop data indicates that Casitas provides agricultural water—either as a primary source or as supplemental/backup—to a total of 5,264 acres. This is down from 6,276 acres in 2000; a decrease of 1,012 acres or 16%.
Because so many growers use groundwater directly, and reporting on
this water use is not required, data on water demand by agricultural
users are incomplete. The exception to this is in the Ojai Valley Ground-
water Basin, where the Ojai Basin Groundwater Management Agency
requires irrigators to report their extractions.

Many factors affect agricultural water demand. Demand is greater inland
than on the coast. In dry years, when growers receive less water from
rainfall, agricultural demand increases. Late rains or excessively heavy
rains are less beneficial than moderate rains spaced evenly over the
rainy season. Mature tree crops require more water than young trees,
but young trees need to be watered more frequently. If frosts threaten
orchards in the winter, a grower’s first line of defense is often to turn
the water on, as wet ground holds heat from the day better. Wind has a
drying effect on vegetation, so water demand will increase in winters and
falls with more wind—this is especially true for avocados, which dry eas-
ily in wind events. Some Ojai soils, especially on the East End, are very
rocky and don’t hold water well; this necessitates more water than crops
grown in soils with more clay and organic matter (Ayala 2012).

The cost of water also affects agricultural water demand, and the source
of water that growers choose. Over the years, increases in potable
water rates have caused some growers to switch to groundwater sources.
In the early 1990s, a number of growers shifted to using groundwater instead
of Casitas water as their primary source of water (Entrix & URS 2004);
this occurred again in the late 2000s when CMWD raised agricultural
rates 53%.

CMWD has found that tree crops in the watershed use an average 2.5
AF per acre per year inland, and 2.0 AF near the coast, but crop demand
can vary significantly year to year (see Table 3.4.3.1.3). This irrigation
demand variability has a significant effect on total water demand—some-
thing that is not seen in more urban areas where a smaller percentage of
water is used for irrigation.

<table>
<thead>
<tr>
<th>Table 3.4.3.1.3 Agricultural Water Demand from CMWD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average AF</strong></td>
</tr>
<tr>
<td>7,172</td>
</tr>
</tbody>
</table>

Between 1976 and 2012, CMWD’s total agricultural demand averaged 7,172 AF per year;
however annual demand ranged from 1989’s high of 10,449 AF—50% more than the
average, to 1983’s low annual demand of 4,094 AF—43% of the average.

Data Source: CWMD Use Patterns Database and Casitas Consumption Reports
Environmental Water Use

The Ventura River watershed has more natural habitat than it does developed land. Over half of the watershed’s acreage is in protected status. Over 2,300 acres of land is now protected in perpetuity by two local land conservancies, with much of this land centered around riverine and stream habitats. The river and stream network is largely unchannelized and provides a considerable amount of natural riparian habitat. These existing natural habitats are also important users of local water, and requirements to provide this water are increasingly integrated into the permits of water supply projects.

The Ventura River and key tributaries have been designated by the National Marine Fisheries Service (NMFS) as critical habitat for endangered southern California steelhead. The overall environmental water needs of steelhead have not been quantified for these critical habitat drainages. On a case-by-case basis however, water projects in the watershed have been required to reduce the amount of water withdrawn in order to provide for steelhead.

22–24" Steelhead in Ventura River Above Shell Road Bridge, 2007

Photo courtesy of Mark Capelli
The Robles Diversion is the facility that diverts Ventura River water via a canal to Lake Casitas. A "Biological Opinion," (BO) written by the National Marine Fisheries Service, outlines operational rules for the Robles Diversion and Fish Passage Facility on the Ventura River. The BO includes complex operational and flow guidelines to provide for the migration and passage of the steelhead up and down the main stem of the river and through the diversion during the steelhead migration season (January 1 to June 30). Outside of migration season, if there is any flow, a minimum flow of 20 cubic feet per second (cfs) must be allowed to flow downstream to protect rights of downstream groundwater users. Implementation of the flow release requirements of the BO started in 2005.

The BO also includes a number of drought protection measures. These include: 1) tying the operation of the fishway to naturally occurring river flows, rather than stored water; 2) providing a mechanism for further limiting operation of the fishway when Casitas Reservoir reaches 100,000 acre-feet of storage (approximately half of the reservoir's maximum storage); and 3) temporarily suspending operation of the fishway when the Casitas Reservoir reaches 17,000 acre-feet, and not resuming fishway operations until the level of Casitas Reservoir reaches 65,000 acre-feet (NMFS 2003a).

The rehabilitated San Antonio Creek Spreading Grounds, a project completed in 2014 to enhance groundwater recharge, was required to provide a minimum of one foot of bypass water, water allowed to flow past the intake structure, (as measured at the Grand Avenue gauge) before diversion can begin. This translates into approximately 21 cfs left in the creek for the needs of steelhead.

The City of Ventura has adopted a policy to maintain steelhead habitat by voluntarily reducing groundwater extraction and subsurface collections at their Foster Park facilities when flows decline below 15 cfs at the Casitas Vista Road stream gauge (VCWPD 2014c).

The Ojai Valley wastewater treatment plant below Foster Park has released its treated effluent into the Ventura River for decades. This water has long been responsible for helping maintain aquatic habitats and supporting the fragile and highly biodiverse Ventura River estuary.

The Ojai Valley wastewater treatment plant below Foster Park has released its treated effluent into the Ventura River for decades. The average discharge is 2.1 million gallons per day, or an average of 3.3 cfs. In dry and very dry water years, this water can make up most if not all of the flow in the lower river. This water has long been responsible for helping maintain aquatic habitats and supporting the fragile and highly biodiverse Ventura River estuary. Although discharging effluent to the river did not begin because of a mandate to provide environmental water, the water has essentially become environmental, and discontinuing the discharge could be considered a significant environmental impact by regulators. In addition, the practice is now integrated into the water quality and land use permits under which the district operates (Palmer 2014).
Voluntary Water Transactions

One mechanism to increase water in streams is voluntary water transactions. These are real property transactions where surface water rights from willing sellers are acquired, donated, or leased for instream fish and wildlife beneficial uses. “Increasingly, California land trusts and specialized nonprofits such as the Scott River Water Trust are directly compensating landowners at fair market values—through acquisition, lease, or tax deductible donations—to reduce all or a portion of their surface water diversions to increase instream flows in rivers with salmon and steelhead.” (Hicks 2014)

Water Use by Sector

Water originating in the Ventura River watershed is used both within and outside the watershed, and use is divided roughly equally between the agricultural and urban sectors. Urban water use is estimated at 55%, and agricultural water use at 45%.

Figure 3.4.3.1.4 Water Demand by Sector

See ‘4.4 Appendices’ for water demand by sector data calculations and sources.

Water Sector Data Challenges

A number of factors make precise estimates of water use by sector difficult. There are 21 small water companies that do not report their water use by sector. There are hundreds of private wells. Requirements to report groundwater withdrawals are only enforced in the Ojai Valley Groundwater Basin, and no one is collecting groundwater use by sector data. The watershed’s largest water supplier, Casitas Municipal Water District (CMWD), acts as a wholesale distributor for 40% of its water sales, and does not track the use by sector of that water. The majority of CMWD’s wholesale water is purchased by the City of Ventura. While the City of Ventura does report its use by sector, their data apply to the entire city and their combined water supply sources, not only to the Ventura River watershed or those areas where the watershed’s water is used. The estimates of water use by sector in this section must be understood in the context of these data challenges.
3.4.3.2 Future Water Demands

Trends

Future water demand can be gauged by analyzing historical trends. Within the watershed, there has been very little growth in recent decades. Local policies, described below in “Water Demand Management” have played a big role in this regard.

Based on trends over the last several decades, overall water use is not expected to change significantly, with the greatest potential for increasing demands likely related to growth in the City of Ventura. Tables 3.4.3.2.1 and 3.4.3.2.2 show that the number of customers served by the watershed’s largest water suppliers has not increased significantly over the last decade, and, in fact, has decreased in some cases. The greatest increase in the number of customers is in the City of Ventura’s service area. See also “City of Ventura Growth” later in this section.

<table>
<thead>
<tr>
<th>Water Supplier</th>
<th>Number of Residential Customers</th>
<th>Number of Commercial/Institutional/Industrial Customers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2003</td>
<td>2012</td>
</tr>
<tr>
<td>Casitas Municipal Water District Retail</td>
<td>2,675</td>
<td>2,698</td>
</tr>
<tr>
<td>Ventura Water(^1)</td>
<td>24,899</td>
<td>25,533</td>
</tr>
<tr>
<td>Golden State Water Company</td>
<td>2,542</td>
<td>2,541</td>
</tr>
<tr>
<td>Ventura River Water District</td>
<td>2,498</td>
<td>2,516</td>
</tr>
<tr>
<td>Meiners Oaks Water District</td>
<td>1191</td>
<td>1192</td>
</tr>
</tbody>
</table>

1. City data is for the entire city, not just the part in the Ventura River watershed.

Data Source: Public Water System Statistics Reports

<table>
<thead>
<tr>
<th>Water Supplier</th>
<th>Number of Customers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2003</td>
</tr>
<tr>
<td>Casitas Municipal Water District Retail</td>
<td>258</td>
</tr>
<tr>
<td>Ventura Water(^1)</td>
<td>10</td>
</tr>
<tr>
<td>Meiners Oaks Water District</td>
<td>32</td>
</tr>
</tbody>
</table>

1. City data is for the entire city, not just the part in the Ventura River watershed.

Data Source: Public Water System Statistics Reports
Water demand fluctuates from year to year in response to rainfall and runoff conditions. Figure 3.4.3.2.1 shows that CMWD's total annual water deliveries have been quite variable for the record available, and Figure 3.4.3.2.2 shows that there is a strong statistical correlation between these water deliveries and local rainfall. Water deliveries are generally lower in wet and very wet runoff water years, and higher in dry and very dry years. Extractions from the Upper Ventura River Groundwater Basin over time, illustrated in Figure 3.4.3.2.3, have been similarly variable.

Figure 3.4.3.2.1 CMWD Annual Water Deliveries, Water Years 1976–2013

Data Source: CWMD Use Patterns Database and Casitas Consumption Reports
Figure 3.4.3.2.2 CMWD Annual Water Deliveries and Rainfall, Water Years 1976–2013
Data Source: CMWD Use Patterns Database and Casitas Consumption Reports

Figure 3.4.3.2.3 VRWD Annual Groundwater Pumping, Fiscal Years 1989–2013. VRWD pumps from the Upper Ventura River Groundwater Basin.
Data Source: VRWD
City of Ventura Growth

As stated previously, the greatest growth in demand for urban water has been in the City of Ventura. In recent years, the City has increased efforts to ensure that projected increases in water demands can be met by available supplies. In 2013, the City produced a Comprehensive Water Resources Report to address discrepancies between water supply and demand estimates in various City reports to better refine estimates of supply and demand. An update of this report was prepared in 2014.

The report tallied the estimated water demands of all development projects that were either under construction or that had received all planning approvals as of December 31, 2013. (Projects still pending approvals from the City were not considered in the projections.) The estimated water demands that the City is committed to supply as of 2013 total 18,428 AF per year, and these projects will likely be completed by the year 2020. The City’s total demand for 2013 was 17,723 AF per year. The City’s average annual demand over the last 5 years was 17,343 AF per year, and the average annual demand over the last 10 years (2004 to 2013) was 18,373 AF (RBF 2014).

The report stated that the City’s current reliable water supply is 19,600 AF per year (citywide), although this could drop to an estimated 16,246 AF per year in 2015 due to drought conditions (RBF 2014). The report characterized the City’s current reliable water supply from the Ventura River watershed as 4,200 AF per year from the City’s Foster Park facilities and 5,000 AF per year from Lake Casitas (RBF 2013).

The report emphasized how close the City’s supplies are to its demands:

The results of this Report indicate that the spread between the current water demand and the current water supply is very tight, and if the drought continues the supply could be less than the demand. This presents significant challenges for the City moving forward in the ability to allocate water supply to development projects that will generate additional water demands.

—2014 Comprehensive Water Resources Report (RBF 2014)

The report provided a series of recommendations, including more rigorous accounting of supplies, demands and projections, as well as developing new water supply sources.

The City of Ventura is currently constrained by their 1995 contract with CMWD for a maximum of 8,000 AF per year from the reservoir for use within CMWD’s service area (“in-district”), with that amount decreasing if lake levels drop below 90,000 AF. The City’s in-district use in recent years has averaged about 5,000 AF (RBF 2013). The 1995 contract does allow the City to “rent” water, and later return it, for use outside of
CMWD's service area (CMWD 1995). This contract is being reconsidered for relevance to today's water supplies and demands (Wickstrum 2014). The City is further constrained by the vagaries of yield from their Foster Park groundwater wells and surface/subsurface diversions. The City estimates that with restoration of their Foster Park wellfield and expansion of their Avenue Treatment Plant to its maximum capacity, the City could restore its historical production capabilities from Foster Park to 6,700 AF per year (RBF 2013).

### Population Projections

Population forecasts are generally developed by city or county—not by watershed, which makes deriving watershed estimates challenging. The only population forecast entirely applicable to the watershed is for the City of Ojai; forecasts for the City of Ventura or unincorporated Ventura County may or may not reflect the portion of the watershed within those jurisdictions.

In addition, the forecasts of different sources can vary considerably. Table 3.4.3.2.4 shows the population forecasts of three sources: Ventura Local Agency Formation Commission (VLAFCO), city or county general plans, and Southern California Association of Governments (SCAG). It should be noted that SCAG projections in recent years have significantly overestimated actual population.

<table>
<thead>
<tr>
<th>Area</th>
<th>2000</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ojai</strong></td>
<td>7,862</td>
<td>7,461</td>
<td>7,511</td>
<td>7,500</td>
<td>7,581</td>
<td>7,594</td>
<td>-3.41%</td>
</tr>
<tr>
<td><strong>Ventura</strong>¹</td>
<td>100,916</td>
<td>106,433</td>
<td>107,124</td>
<td>106,667</td>
<td>108,387</td>
<td>108,961</td>
<td>7.97%</td>
</tr>
<tr>
<td><strong>Unincorporated Ventura County</strong>¹</td>
<td>93,127</td>
<td>94,937</td>
<td>94,775</td>
<td>96,147</td>
<td>96,635</td>
<td>97,313</td>
<td>4.49%</td>
</tr>
</tbody>
</table>

1. These population data represent the entirety of the City of Ventura and the Unincorporated County, not just the part within the Ventura River watershed.

Table 3.4.3.2.4 Population Projections

<table>
<thead>
<tr>
<th>Area</th>
<th>Data Source</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ojai</td>
<td>VLAFCO</td>
<td>7,315</td>
<td>7,181</td>
<td>7,049</td>
<td>—</td>
</tr>
<tr>
<td>City General Plan</td>
<td></td>
<td>7,751</td>
<td>7,886</td>
<td>8,021</td>
<td>8,156</td>
</tr>
<tr>
<td>SCAG</td>
<td></td>
<td>8,400</td>
<td>—</td>
<td>—</td>
<td>9,400</td>
</tr>
<tr>
<td>Ventura</td>
<td>VLAFCO</td>
<td>111,706</td>
<td>114,641</td>
<td>117,653</td>
<td>—</td>
</tr>
<tr>
<td>City General Plan - 0.88% growth rate</td>
<td></td>
<td>—</td>
<td>126,153</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>City General Plan - 1.14% growth rate</td>
<td></td>
<td>—</td>
<td>133,160</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>SCAG</td>
<td></td>
<td>116,000</td>
<td>—</td>
<td>—</td>
<td>128,800</td>
</tr>
<tr>
<td>Unincorporated</td>
<td>County General Plan</td>
<td>100,500</td>
<td>—</td>
<td>107,200</td>
<td>—</td>
</tr>
<tr>
<td>Ventura County</td>
<td>SCAG</td>
<td>100,500</td>
<td>—</td>
<td>107,200</td>
<td>—</td>
</tr>
</tbody>
</table>

These data indicate that population projections are quite varied, depending on source.

Data Sources: Ventura Local Agency Formation Commission (VLAFCO 2012), city or county general plans: (City of Ventura 2005a), (City of Ojai 1991), (VCPD 2013), and 2012–2035 Regional Transportation Plan/Sustainable Communities Strategy Growth Forecast Southern California Association of Governments (SCAG 2012).

**Urban Water Management Plan Projections**

The California Urban Water Management Planning Act of 1983 requires all publicly or privately owned entities that serve water for municipal purposes to more than 3,000 service connections or serve more than 3,000 acre-feet of water per year to prepare an urban water management plan (UWMP). These plans must be updated once every five years, at the beginning or mid-point of each decade, to support long-term resource planning.

The primary goals of the UWMP are to: 1) plan the water supply over a 20-year period; 2) identify and quantify water supply for future demands in normal, single-dry, and multiple-dry year conditions; and 3) implement conservation and efficient water use practices in urban settings.

The submission of an UWMP also qualifies the water supplier for state funding opportunities.

Three water supplier UWMPs are applicable to the Ventura River watershed: CMWD, Ventura Water, and Golden State Water Company (GSWC). GSWC prepared an UWMP even though they are not required to do so given their small size. UWMPs address urban water uses, which include residential, commercial, governmental, and industrial uses. Agricultural water use is not addressed by UWMPs. Only about 30% of CMWD's water deliveries are for (non-resale) urban uses.

Per capita water use is reported in these UWMPs; projected water demands are based on this per capita rate plus projections of population growth.
Table 3.4.3.2.5 provides a summary of past and projected urban water demands for CMWD, Ventura Water, and GSWC. Table 3.4.3.2.6 provides the baseline per capita water use for these suppliers, which is calculated per state guidelines, along with their 20 x 2020 targets.

### Table 3.4.3.2.5 UWMP Water Demand Projections

<table>
<thead>
<tr>
<th>Year (calendar)</th>
<th>CMWD³</th>
<th>City of Ventura²</th>
<th>Golden State WC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Actual Demand¹ (AF/yr)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>23,060</td>
<td>20,808</td>
<td>1,955</td>
</tr>
<tr>
<td>2010</td>
<td>16,358</td>
<td>17,351</td>
<td>1,780</td>
</tr>
<tr>
<td><strong>Projected Deliveries⁴ (AF/yr)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>19,347</td>
<td>22,286</td>
<td>2,248</td>
</tr>
<tr>
<td>2020</td>
<td>20,102</td>
<td>23,256</td>
<td>2,384</td>
</tr>
<tr>
<td>2025</td>
<td>20,855</td>
<td>24,270</td>
<td>2,483</td>
</tr>
<tr>
<td>2030</td>
<td>21,809</td>
<td>25,330</td>
<td>2,569</td>
</tr>
<tr>
<td>2035</td>
<td>21,247</td>
<td>26,436</td>
<td>2,625</td>
</tr>
<tr>
<td><strong>Projected Demand w/ Conservation⁴ (AF/yr)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>17,354</td>
<td>20,163</td>
<td>2,494</td>
</tr>
<tr>
<td>2020</td>
<td>17,354</td>
<td>19,657</td>
<td>2,331</td>
</tr>
<tr>
<td>2025</td>
<td>17,354</td>
<td>20,514</td>
<td>2,428</td>
</tr>
<tr>
<td>2030</td>
<td>17,354</td>
<td>21,410</td>
<td>2,513</td>
</tr>
<tr>
<td>2035</td>
<td>17,354</td>
<td>22,345</td>
<td>2,567</td>
</tr>
<tr>
<td><strong>% Change from 2010 Demand</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>5.8%</td>
<td>16.2%</td>
<td>40.1%</td>
</tr>
<tr>
<td>2020</td>
<td>5.8%</td>
<td>13.3%</td>
<td>31.0%</td>
</tr>
<tr>
<td>2025</td>
<td>5.8%</td>
<td>18.2%</td>
<td>36.4%</td>
</tr>
<tr>
<td>2030</td>
<td>5.8%</td>
<td>23.4%</td>
<td>41.2%</td>
</tr>
<tr>
<td>2035</td>
<td>5.8%</td>
<td>28.8%</td>
<td>44.2%</td>
</tr>
</tbody>
</table>

1. 45% of CMWD’s demand is agricultural, and another 45% is resale. Only 10% of their total demand is subject to the state’s 20% by 2020 requirement.
2. Includes the entire city, not just the portion in the Ventura River watershed.
3. Actual demand includes water sold/delivered, water lost during conveyance, and any recycled water.
4. The projected deliveries category does not include water lost during conveyance. Note: each water supplier used different sources for projecting population growth.
5. Projected demand includes water sold/delivered plus water lost during conveyance, minus anticipated conservation and recycled water use.

Table 3.4.3.2.6  20 x 2020 Per Capita Water Use

<table>
<thead>
<tr>
<th>Water Supplier</th>
<th>Gallons/Capita/Day</th>
<th>Baseline</th>
<th>2015 Target</th>
<th>2020 Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Casitas Municipal Water District</td>
<td></td>
<td>319</td>
<td>287</td>
<td>255</td>
</tr>
<tr>
<td>Ventura Water</td>
<td></td>
<td>162</td>
<td>152</td>
<td>142</td>
</tr>
<tr>
<td>Golden State Water Company</td>
<td></td>
<td>299</td>
<td>269</td>
<td>239</td>
</tr>
<tr>
<td>Ventura River Water District$^{1}$</td>
<td></td>
<td>196</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

The Water Conservation Act of 2009 required water suppliers to establish a baseline daily per capita water use in order to derive their 20% reduction target for the year 2020, as well as a 2015 interim target.

The water demand projections are based on estimates of per capita water demand multiplied by projected population growth.

1. Ventura River Water District is not subject to the Act, but their per capita use was included for comparison purposes.


California Water Conservation Act of 2009: 20% by 2020

In 2008, amid a statewide drought, California’s governor directed state agencies to develop a plan to reduce statewide per capita potable water use by 20% by the year 2020. This “20x2020” goal was ultimately enacted into state law, the Water Conservation Act of 2009 (SBx7-7). The legislation is applicable to urban water retail agencies that deliver more than 3,000 AF of water annually or have more than 3,000 customer connections—the same category of water retailers that must produce and update an urban water management plan (UWMP) every five years.

The legislation does not require a reduction in the total volume of water used in the urban sector, because factors such as changes in economics or population will affect water use. Rather, the legislation requires a reduction in per-capita water consumption. Water consumption is calculated in gallons per capita per day.

The Water Conservation Act required water suppliers to report, in their 2010 UWMPs, a 2020 daily per capita water use target that is 20% less than the supplier’s baseline daily per capita water use, which could be derived using a few different methods per the legislation. Establishing an interim 2015 daily per capita water use target was also required.

The consequence for non-compliance with the Water Conservation Act is that the urban water supplier is not eligible for water grants or loans administered by the state.
Future Agricultural Water Use

CMWD reported in their 2010 UWMP that they had not had any additional agricultural accounts in the last five years, and did not anticipate any additional agricultural accounts over the next 25 years (CMWD 2011).

Agricultural is not expected to increase over the next twenty years. Agricultural expansion requires approval and purchase of additional allocation, which is cost prohibitive for most agricultural interests. CMWD has not had any new agricultural allocations purchased in the last several years.

—2010 Urban Water Management Plan, Casitas Municipal Water District (CMWD 2011)

Groundwater supplies approximately half of agricultural water demand. The extent to which agricultural water demands may increase or decrease is unknown. Factors that could cause a significant change in agricultural water demand include extended drought, tree deaths from the lethal Asian Citrus Psyllid (ACP), changes to higher- or lower-water-using crop types, and changes to groundwater regulations.

An important consideration is the potential for orchard land conversions. If existing orchards are destroyed because of ACP infestations or because extended drought makes water too expensive, converting to other income-making land uses will likely be considered by landowners. Potential alternative land uses, such as different crop types, livestock operations, horse boarding, and housing, could significantly affect water demand in the watershed.

Future Environmental Water Use Projections

The extent to which environmental water demands may increase is unknown. Factors that could cause an increase in environmental water demands include new information becoming available that causes regulators to increase existing bypass flow requirements, future laws and regulations, and new water supply or infrastructure projects with a “federal nexus.” Any project that requires a federal permit or involves federal funding has a federal nexus, and because water supply projects in the watershed could affect steelhead, this nexus triggers the requirement under Section 7 of the federal Endangered Species Act to consult the NMFS. NMFS would then outline the conditions under which the project could move forward, including operational measures such as bypass flows that must be implemented.
Factors that could cause an increase in environmental water demands include new information becoming available that causes regulators to increase existing bypass flow requirements, future laws and regulations, and new water supply or infrastructure projects with a “federal nexus.”

Water quality regulations also have the potential to require the provision of environmental water. The Regional Water Quality Control Board’s (RWQCB) water quality control plan, called the Basin Plan, is geared towards protecting the “beneficial uses” of waterbodies. Beneficial uses include not only the use of a water supply for people, but also the use of water for aquatic organisms and recreation. Reaches 3 and 4 of the Ventura River are on the Section 303(d) list of impaired waterbodies for pumping and water diversion because the lack of water in these reaches interferes with the migration of the endangered southern California steelhead. In other words, the lack of water in the river has been identified as a water quality impairment for steelhead. However, the RWQCB does not have the authority to regulate surface flow volumes (water diversions). Authority lies with the State Water Resources Control Board, where the issue may be addressed at some point in the future. Pumping of the Upper and Lower Ventura River Basins, which underlie Reaches 3 and 4, has not historically been regulated at either the state or local level. (However, in September of 2014, Governor Jerry Brown signed three groundwater bills that will create a groundwater management framework for the first time in California.) Still, the pumping and diversion impairments remain on the 303(d) list.

In addition, water rights regulators have the authority to require the provision of environmental water. Water rights regulations in California include a requirement to protect certain resources—such as fisheries and wildlife—that are held in trust for the public. The State Water Resources Control Board is charged with protecting these resources as part of their regulation of water rights.

One of the State Water Board’s charges is to ensure that the State’s waters are put to the best possible use, and that the public interest is served. In making decisions, the State Water Board must keep three major goals in mind, to: develop water resources in an orderly manner; prevent the waste and unreasonable use of water; and protect the environment. This is consistent with the California Constitution Article X Section 2.

—Water Rights: Public Trust Resources website (SWRCB 2014c)

**Climate Change**

Climate change adds uncertainty to future water demand estimates. Climate change could influence where rain falls, produce altered runoff patterns, bring more extreme or extended floods and droughts, change water supply reliability, cause more fires, and result in increased water demands. Water supply and delivery infrastructure may have to be updated to address these issues.
3.4.3.3 Water Demand Management

A combination of policies, water rates, and conservation education and incentives are used to manage water demand in the watershed.

Policy

Local land use and air quality policies and the policies of CMWD have served to ensure that the rate of growth and associated new water demands are kept within resource constraints.

Land Use and Air Quality Policies that Limit Growth

The most significant local land use and air quality policies that have served to limit water demand are listed below, and are described in more detail in "3.7.3 Land Use and Demographics."

- Ventura County Guidelines for Orderly Development (1969)
- Ventura County General Plan, Ojai Valley Area Plan (1979)
- Ventura County large-lot zoning
- Ventura County SOAR ordinance (1998)
- Ventura County's Ojai Valley Clean Air Ordinance (1982)
- City of Ventura SOAR ordinance (1995)
- City of Ojai's residential and commercial growth control policies (1979, 1991)

Casitas Municipal Water District Policies

CMWD is committed to limiting water deliveries to maintain the safe annual yield of Lake Casitas. ("3.4.2 Water Supplies" discusses the safe yield of the reservoir in more detail.) Described below are district policies that serve to implement the commitment to safe yield management.

Water Efficiency and Allocation Program

In 1989, in the middle of a drought, with lake levels at nearly 50%, and following years of development in the watershed, CMWD analyzed the reservoir's water reserves relative to demand and acknowledged that demand was approaching the safe annual yield of the lake. In response, the CMWD board instituted a temporary moratorium on providing new water service connections while staff worked to develop an equitable plan for distribution and management of supplies under the new conditions (CMWD 2004).

The board ultimately adopted a "Water Efficiency and Allocation Program" in 1992. Since then, this powerful policy, along with the pricing mechanisms described in the following section, have played an important role in limiting growth in the watershed, and have been the tools
used by Casitas to manage the reservoir—unlike most other reservoirs in California—on a safe yield basis.

The Water Efficiency and Allocation Program (WEAP) is a comprehensive policy, but key features include:

- All service connections were assigned an allocation of water, which was 80% of 1989 usage. The year 1989 was the year of greatest water demand at that time. Together, these allocations are within the annual safe yield of the lake. Residential, business, industrial, resale, and interdepartmental service connections were assigned individual allocations; agricultural service connections were combined into a single allocation for the entire group (CMWD 2004). The number of new customers between 2005 and 2010 averaged five per year, most being residential customers and some agricultural-residential customers (CMWD 2011).

- The allocation program prohibits new connections unless a new supply can be demonstrated or supply/demand trends indicate that the new connections do not compromise safe yield management. For example, CMWD activated a groundwater well in Mira Monte in 1992, with an average annual yield of 300 AF. With this new water source, Casitas was able to issue a limited number of new service connections between 1992 and 2003. Between 2004 and 2015, the number of Casitas customers in all categories dropped by 49 customers (CMWD 2013a).

- The allocation program outlines the district’s response, in a five-stage process, to reduced water supplies. The different stages can be triggered by the reservoir’s water levels, and each stage employs different pricing mechanisms and/or rationing levels to reduce demand. The first stage calls for a voluntary 20% reduction in water use, and CMWD has remained in this stage since the policy’s adoption. The district has not yet needed to enact the rationing stages of the program.

In response to the drought of 2012–2014 (in effect as of this writing), and reservoir levels approaching their lowest levels since 1991, CMWD is considering changes to the WEAP to limit future demand (CMWD 2011).

**Fees for New Allocations**

New connections to CMWD are very expensive, and this has played a big role in limiting new water demand.

For every 1 AF per year of new water demand or allocation, a one-time fee of $18,644 is charged (plus the cost of the meter). The smallest allocation allowed is 0.32 AF, so the minimum charge for a new allocation is $5,966.08 (0.32 x $18,644). If a grower of citrus wanted a new allocation, the rate would be 2.0 (reflecting the per acre water demand) times $18,644 times the number of acres. So a new connection for a five-acre farm would be charged a one-time allocation fee of $186,440 (2.0 x $18,644 x 5). (This assumes Casitas has the water to allocate to agriculture, which at the time of this writing is limited.)
Water District Water Shortage Contingency Plans

CMWD, Ventura Water, and GSWC all have water shortage contingency plans. These plans establish the steps each supplier will take during the various stages of a water shortage. The action stages begin with education and requests for voluntary conservation, and as water supplies diminish further the successive stages move into mandatory cutbacks and progressively more stringent requirements and penalties. These plans are documented in the UWMPs of these water suppliers.

Water Rates

The watershed’s five major water suppliers (CMWD, Ventura Water, Golden State Water Company, Ventura River Water District, Meiners Oaks Water District) use tiered rate structures, at least for their residential customers. Tiered rate structures use price signals to discourage the waste of water and encourage conservation. Customers pay a flat fee for a basic use allocation; rates increase as the customer’s water use increases.

Proposition 218, passed by voters in 1996, changed the way public agencies (including special districts such as water districts) can finance operations and collect revenue. Proposition 218 contains “proportionality requirements” that prohibit public agencies from imposing any fee or charge “upon a parcel or upon a person as an incident of property ownership” that is more than “the proportional cost of the service attributable to the parcel.” Proposition 218 requires a “significant nexus” between the cost of service and the price of water. Meanwhile, the California Water Code (Sections 370 to 374) encourage a tiered rate structure “as a means of increasing efficient uses of water, and further discouraging wasteful or unreasonable use of water.” In an effort to resolve these conflicting stipulations, water districts subject to these requirements have become more deliberate with their water rate-setting process. Using rates to encourage behavior or support certain water users can only be taken so far; higher rates for one class of user cannot be used to subsidize other users. Proposition 218 has called into question water districts’ ability to provide “lifeline” discounts to low-income households, or to provide lower rates for agricultural water users.

Proposition 218 also requires that any changes to property-related fees (such as water rates) go through a notification procedure that allows customers to submit protests. Proposed water rate changes can be rejected if a majority of affected customers submit formal protests (Donnelly & Christian-Smith 2013).

In the Ventura River watershed, agricultural customers buy considerably more water than urban customers; however, the residential sector has considerably more customers who are thus in the majority. In the late 2000s when water districts adjusted rates in an effort to comply with
Proposition 218, agricultural customers were at a disadvantage to protest water rate changes that affected them.

**Conservation and Efficiency Programs**

One of the most cost-effective options water suppliers have to improve water supply reliability is increasing water use efficiency. Every AF reduction in water demand has the same benefit as increasing supply by an AF, and efficiency measures are usually less costly to implement (CDWR 2013a).

**Water District Programs**

The watershed’s three largest water suppliers, CMWD, Ventura Water, and GSWC, are all members of the California Urban Water Conservation Council (CUWCC) and signatory to a CUWCC Memorandum of Understanding (MOU). The CUWCC is a consensus-based partnership of agencies and organizations concerned with water supply and conservation of natural resources in California, which oversees standards for urban water efficiency. These standards, known as “Best Management Practices” (BMPs), have been developed to provide proven, reliable, and often quantifiable water savings when rigorously implemented.

By becoming a signatory to CUWCC’s MOU, water districts commit to implement a specific set of locally cost-effective conservation practices in their service areas. Assembly Bill 1420, which became effective in January of 2009, requires that issuance of state loans or grant funding be conditioned on implementation of the Demand Management Measures (DMMs) described in Water Code Section 10631. The California Department of Water Resources equates the DMMs with the CUWCC BMPs.

The UWMPs of CMWD, Ventura Water, and GSWC describe their current BMPs/DMMs.

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**Ventura River Watershed Council’s SAVE MORE WATER website.** The Watershed Council’s SAVE MORE WATER website serves as a clearinghouse of information on saving water throughout the watershed. The site features many videos, lists of upcoming classes and events, and links to water-saving resources provided by local water suppliers and organizations—free equipment, rebates, free on-site irrigation surveys, and more. SAVE MORE WATER is aimed at motivating and informing residential, commercial, and agricultural water users to conserve.
Described below are some of the BMPs of these agencies that may be more visible to the public. These conservation programs are further described and illustrated in "2.3.4 Extreme Efficiency Campaign" and in "2.2 Existing Projects, Programs, and Recent Accomplishments."

The conservation and efficiency programs offered by CMWD are available to all water users within the Casitas wholesale service area (whether a direct customer of Casitas’s or not). CMWD’s current programs include:

- Distribution of free water saving devices, including showerheads, toilet flappers, kitchen and bathroom faucet aerators, and dye tables for testing toilets for leaks.
- Free, on-site, residential and commercial, indoor and outdoor water use surveys and leak detection.
- Hobby farm (1 to 2 acres) irrigation evaluations and equipment rebates, in partnership with the Resource Conservation District of Ventura County. As part of the program, a 50% cost share for water use efficiency equipment is offered.
- Rebates on residential and commercial high-efficiency toilets, washing machines, and weather-based irrigation controllers.
- Free educational classes on various ways to save water, such as landscaping with native plants or installing a graywater system.
- Classroom and field trip water education.
- Customer education through newsletters.
- Participation in local community events and speaks to local community groups.

Ventura Water’s current programs include:
- Rebates on rain barrels.
- Promotion of Ocean-Friendly Gardens.
- School water education.
- Free educational classes and events.
- Educational videos on a variety of water saving topics, such as how to use rain barrels or how to check your water meter for leaks.
- Active use of their website and social media for outreach and education.
- Customer education through newsletters.
- Participation in local community events and speaks to local community groups.

In 2014, in response to the three-year drought, the City of Ventura established a Water Shortage Task Force to evaluate the City’s existing Water Shortage Contingency Plan, identify conservation measures and incentives, and investigate drought water rates.

**Other Programs**

The Ojai Valley Green Coalition (OVGC) is an important voice for water conservation in the watershed. OVGC seeks out many opportunities to educate the public, including classes and member meetings, an annual Green Living Home Tour, displays at public venues, newsletter promotions, and distribution of free water saving equipment on behalf of CMWD. The OVGC has an extensive lending library with books, videos, and literature at its downtown Resource Center. The group is active in advancing policies to protect local resources.

The Ventura County Building and Safety Division actively promotes graywater systems since the state of California eased regulations regarding “laundry to landscape” graywater systems, making this important water reuse option more available to many residents.
Agricultural Irrigation Evaluation, Ventura County Resource Conservation District

Photo courtesy of Ventura County Resource Conservation District

Surfrider Foundation of Ventura County actively promotes Ocean Friendly Gardens through education, hands-on activities, and policy change.

Free agricultural irrigation evaluations are provided by the Ventura County Resource Conservation District’s (RCD) Mobile Irrigation Lab. This program provides on-site irrigation system analysis and technical assistance to improve water use efficiency. The RCD Mobile Irrigation Lab also includes a cost share program to help fund BMP implementation for irrigation systems of orchard, row crop, and nursery operations.
3.4.3.4 Key Data and Information Sources/Further Reading

Below is a summary of some of key documents that address water demand and use in the watershed. See “4.3 References” for complete reference citations. Water suppliers and managers also maintain records of water use.

Biological Opinion for US Army Corps of Engineers Permitting of the City of Ventura's Foster Park Well Facility Repairs on the Ventura River, Draft (NMFS 2007)

2013 Comprehensive Water Resources Report, Ventura Water (RBF 2013)

2014 Comprehensive Water Resources Report, Ventura Water (RBF 2014)


San Antonio Creek Spreading Grounds Rehabilitation Project (Component 10) Component Report (VCWPD 2014c)

The Ventura River Project History (USBR 1995)

Urban Water Management Plan, Casitas Municipal Water District, 2010 (CMWD 2011)

Urban Water Management Plan, City of Ventura, 2010 (Kennedy/Jenks 2011b)

Urban Water Management Plan, Ojai, 2010 (Kennedy/Jenks 2011a)

Ventura River Habitat Conservation Plan, Draft (Entrix & URS 2004)


Gaps in Data/Information

As mentioned in “3.4.2 Water Supplies,” lack of data on groundwater pumping is considered a significant data gap in the watershed, and a comprehensive water supply and demand budget is needed.
3.5 Water Quality

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Water Quality Sampling, Ventura River
Just Above San Antonio Creek Confluence
Photo courtesy of Santa Barbara Channelkeeper
3.5 Water Quality

Water quality in the Ventura River watershed is relatively good. The developed area of the watershed is very limited compared to the open-space areas. Residential, commercial, agricultural, and industrial land uses comprise only 13% of the land area (SCAG 2008); and approximately half of the watershed lies within the Los Padres National Forest. However, like most other watersheds where people live and work, the Ventura River watershed has water quality impairments that need to be addressed.

The description of water quality has been organized into four sections: surface water, groundwater, wastewater, and drinking water. While the regulations for water quality differ for each of these water types, the water quality issues are often highly interrelated.

These sections provide a review of water quality impairments, existing water quality studies, the regulatory framework, and ongoing monitoring programs. Many stakeholders, including public agencies, nonprofits, companies, and people who live, work, and recreate within the watershed, have been working on solutions to the watershed’s water quality issues for many years. With sufficient funding of projects (see “2.4.2 Priority Projects and Programs”), many of the water quality objectives of the stakeholder group can be achieved.

3.5.1 Surface Water Quality

The surface water quality concerns that have been identified in the watershed are nutrient pollution (along with its associated problems of algal growth and low dissolved oxygen), risk of pathogens, trash, and excessive total dissolved solids. Lack of streamflow and barriers to fish migration are also considered water quality impairments in the watershed; these topics are briefly discussed in this section and are more thoroughly described in other sections (see “3.3 Hydrology” and “3.6 Ecosystems and Access to Nature”).

3.5.1.1 Surface Water Quality Impairments

Algae, Nitrogen, Dissolved Oxygen, and Eutrophication

Ventura River Reaches 1 and 2 and the Ventura River estuary are on the Clean Water Act’s Section 303(d) list of impaired waterbodies for algae.
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).” (Laydecker 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

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

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).

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 Alstett, 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](image)

*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.
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.

(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.

**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>
<thead>
<tr>
<th>Constituent</th>
<th>Fox Canyon Barranca</th>
<th>Happy Valley Drain</th>
<th>Ventura River</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wet Weather</td>
<td>Dry Weather</td>
<td>Wet Weather</td>
</tr>
<tr>
<td>E. coli</td>
<td>100%</td>
<td>88%</td>
<td>100%</td>
</tr>
<tr>
<td>Fecal coliform</td>
<td>100%</td>
<td>75%</td>
<td>100%</td>
</tr>
<tr>
<td>Aluminum (total)</td>
<td>100%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Copper (dissolved)</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Dissolved Oxygen</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>pH</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Nitrate¹</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Chloride</td>
<td>33%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>Total Dissolved Solids</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>MBAS</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Chlorpyrifos²</td>
<td>17%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Malathion²</td>
<td>17%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>DEHP</td>
<td>8%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

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 in-stream 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 have been measured of 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 mg/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 mg/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 mg/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.

**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>
<thead>
<tr>
<th>Waterbody</th>
<th>Water Quality Impairment</th>
<th>Regulatory Status¹⁻³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matilija Reservoir</td>
<td>Fish barriers (fish passage)</td>
<td>Scheduled to be addressed by 2019</td>
</tr>
<tr>
<td>Matilija Creek Reach 1: Matilija Reservoir to confluence with North Fork Matilija Creek. Reach 2: Above Matilija Reservoir</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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</td>
<td>Nitrogen</td>
<td>Addressed by the Algae TMDL*(became effective 6/28/2013)</td>
</tr>
<tr>
<td></td>
<td>Bacteria</td>
<td>TMDL scheduled for 2021</td>
</tr>
<tr>
<td></td>
<td>Total Dissolved Solids</td>
<td>TMDL scheduled for 2023</td>
</tr>
<tr>
<td>Lake Casitas</td>
<td>Mercury</td>
<td>TMDL scheduled for 2021</td>
</tr>
<tr>
<td>Ventura River Reach 4: Camino Cielo Rd. below Matilija Dam to confluence with Coyote Creek, just south of Foster Park</td>
<td>Pumping, Water Diversion</td>
<td>Addressed by USEPA on 6/28/2013⁵</td>
</tr>
<tr>
<td>Ventura River Reach 3: Confluence with Coyote Creek, just south of Foster Park, to confluence with Weldon Canyon, just north of Cañada Larga</td>
<td>Indicator Bacteria</td>
<td>TMDL scheduled for 2021</td>
</tr>
<tr>
<td></td>
<td>Pumping, Water Diversion</td>
<td>Addressed by USEPA on 6/28/2013⁵</td>
</tr>
<tr>
<td>Ventura River Reach 2: Weldon Canyon to Main St.</td>
<td>Algae</td>
<td>Addressed by the Algae TMDL*(effective 6/28/2013)</td>
</tr>
<tr>
<td>Ventura River Reach 1: Main St. to Estuary</td>
<td>Low Dissolved Oxygen</td>
<td>Addressed by the Algae TMDL*(became effective 6/28/2013)</td>
</tr>
<tr>
<td>Cañada Larga Creek: Tributary to Ventura River. Runs along Cañada Larga Rd. to confluence with Ventura River, south of wastewater treatment plant</td>
<td>Fecal Coliform</td>
<td>TMDL scheduled for 2019</td>
</tr>
<tr>
<td></td>
<td>Total Dissolved Solids</td>
<td>TMDL scheduled for 2021</td>
</tr>
<tr>
<td>Ventura River Estuary: Main St. to Estuary</td>
<td>Trash</td>
<td>Addressed by the Ventura River Trash TMDL (effective on 3/6/2008)</td>
</tr>
<tr>
<td></td>
<td>Algae, Eutrophic Conditions</td>
<td>Addressed by the Algae TMDL*(effective 6/28/2013)</td>
</tr>
<tr>
<td></td>
<td>Total Coliform</td>
<td>TMDL scheduled for 2019</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>TMDL</th>
<th>Responsible Parties</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventura River Estuary Trash TMDL</td>
<td>City of Ventura, Ventura County, Ventura County Watershed Protection District, California Department of Food and Agriculture, Caltrans</td>
<td>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.</td>
</tr>
<tr>
<td>Algae, Eutrophic Conditions, and Nutrients TMDL for Ventura River and its Tributaries (Algae TMDL)</td>
<td>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).</td>
<td>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.</td>
</tr>
</tbody>
</table>

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 2013c)

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.
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 RWQCB is 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 (PBVC 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

<table>
<thead>
<tr>
<th># of permits</th>
<th>Entity</th>
<th>Permit/Waiver¹</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stormwater</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Ventura County Watershed Protection District, County of Ventura, the 10 cities in Ventura County (1 permit issued to all 12 &quot;co-permitters&quot;)</td>
<td>NPDES (MS4) Permit</td>
</tr>
<tr>
<td>16</td>
<td>Operators of construction activities causing 1 acre or more of soil disturbance</td>
<td>General Construction Stormwater NPDES Permit</td>
</tr>
<tr>
<td>31</td>
<td>Industrial facilities meeting the statewide industrial stormwater permit's Attachment 1 Eligibility Criteria</td>
<td>General Industrial Stormwater NPDES Permit</td>
</tr>
<tr>
<td><strong>Non-Stormwater</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Ojai Valley Sanitary District</td>
<td>NPDES Permit</td>
</tr>
<tr>
<td>1</td>
<td>Casitas Municipal Water District</td>
<td>NPDES Permit</td>
</tr>
<tr>
<td>1</td>
<td>City of Ventura</td>
<td>NPDES Permit</td>
</tr>
<tr>
<td>1</td>
<td>Golden State Water Company</td>
<td>NPDES Permit</td>
</tr>
<tr>
<td>1</td>
<td>County of Ventura</td>
<td>NPDES Permit</td>
</tr>
<tr>
<td>1</td>
<td>Ventura River County Water District</td>
<td>NPDES Permit</td>
</tr>
<tr>
<td>18</td>
<td>Various individuals and businesses</td>
<td>Individual or General Waste Discharge Requirements (Non-NPDES)</td>
</tr>
<tr>
<td><strong>Waivers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Ventura County Agricultural Irrigated Lands Group (owners and operators of agricultural lands working together as a &quot;discharger group&quot;)</td>
<td>Conditional Agricultural Waiver</td>
</tr>
</tbody>
</table>

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

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

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

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)
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)


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)

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. CAS804002, 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)

Reports (unpublished) by Al Leydecker, 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)
- 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 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
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.
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.

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.)
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; gpm - 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

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

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 underlying 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

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Upper Ojai Basin</th>
<th>Ojai Valley Basin</th>
<th>Upper Ventura River Basin</th>
<th>Lower Ventura River Basin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrate as NO₃</td>
<td>5/67 (8%)</td>
<td>14/399 (4%)</td>
<td>27/307 (9%)</td>
<td>0/13 (0%)</td>
</tr>
<tr>
<td>Chloride</td>
<td>0/64 (0%)</td>
<td>7/335 (2%)</td>
<td>2/261 (1%)</td>
<td>1/23 (4%)</td>
</tr>
<tr>
<td>TDS</td>
<td>10/97 (10%)</td>
<td>36/450 (8%)</td>
<td>23/342 (7%)</td>
<td>21/23 (91%)</td>
</tr>
<tr>
<td>Manganese</td>
<td>16/32 (50%)</td>
<td>79/191 (41%)</td>
<td>17/210 (8%)</td>
<td>16/22 (73%)</td>
</tr>
<tr>
<td>Iron</td>
<td>13/31 (42%)</td>
<td>63/184 (34%)</td>
<td>33/145 (23%)</td>
<td>14/22 (64%)</td>
</tr>
<tr>
<td>Sulfate</td>
<td>0/61 (0%)</td>
<td>0/328 (0%)</td>
<td>11/255 (4%)</td>
<td>4/23 (17%)</td>
</tr>
<tr>
<td>Boron</td>
<td>0/36 (0%)</td>
<td>1/204 (1%)</td>
<td>4/203 (2%)</td>
<td>4/20 (20%)</td>
</tr>
</tbody>
</table>

Number of exceedances / number of samples in the dataset (% exceedances)

Drinking Water Quality Maximum Contaminant Levels

<table>
<thead>
<tr>
<th>Standard</th>
<th>MCL¹ Standard</th>
<th>SMCL² Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>45 mg/L</td>
<td>250–500 mg/L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>500–1,000 mg/L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.05 mg/L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.30 mg/L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>250–500 mg/L</td>
</tr>
</tbody>
</table>

Notification Level³ | 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 aesthetic 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 NO₃ - 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 (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 water bodies 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 NO₃ - 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 NO₃ (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; VCFCID 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 NO3).
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.


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


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

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


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)

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

<table>
<thead>
<tr>
<th></th>
<th>Ojai Valley Sanitary District</th>
<th>Ventura Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population Served</td>
<td>23,000</td>
<td>10,500</td>
</tr>
<tr>
<td>Miles of Sewer Pipeline (excluding private lateral lines)</td>
<td>120</td>
<td>22</td>
</tr>
<tr>
<td>Average Influent (inflow) (mgd)</td>
<td>2.3</td>
<td>1.3 (min)²</td>
</tr>
<tr>
<td>Average Effluent (outflow) (mgd)</td>
<td>2.1</td>
<td>0</td>
</tr>
<tr>
<td>Plant Capacity (mgd)</td>
<td>3.0</td>
<td>n/a</td>
</tr>
<tr>
<td>Total</td>
<td>109,000</td>
<td>14</td>
</tr>
</tbody>
</table>

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).
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.

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**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).

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**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 in stream 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), estrogens (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 properly 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 - 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 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

**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)
- New Onsite Wastewater Treatment Systems, AB885 Standards (VCEHD 2014)
- Onsite Wastewater Treatment System Technical Manual (VCEHD 2012)
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)


**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](image)

*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 algal 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](image)

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.
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.


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)

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


3.6 Ecosystems and Access to Nature

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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 plummed 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 kinds 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 rattlesnakes 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, coffeetree, sugarbush, toyon, hollyleaf redblue, 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
Figure 3.6.1.1.1 Vegetation Communities Map
Coastal Sage Scrub

Coastal sage scrub covers 13% of the watershed's land area. It is found at lower elevations (below 3,000 feet) and closer to the coast than chaparral. It may occur on a variety of slopes and aspects from nearly level hilltops to steep dry slopes.

Coastal sage scrub is dominated by low- to moderate-sized woody shrubs and sub-shrubs (1.6 to 6.6 feet tall). Plants are generally aromatic and drought-deciduous—dropping all their leaves during summer heat to help reduce moisture loss—with a sparse herbaceous layer below.

Coastal Sage Scrub Plant Species

Common coastal sage scrub plants in the watershed include purple sage, California sagebrush, coyote brush, prickly-pear, California buckwheat, black sage, white sage, coastal goldenbush, deerweed, sticky monkeyflower, chamise, Mexican elderberry, lemonadeberry, giant wild rye, and laurel sumac.

Coast Horned Lizard, State Species of Special Concern
Photo courtesy of Mary Meyer

Oak Woodland and Oak Savanna

Oak woodlands cover 13% of the watershed's land area. They are dominated by coast live oaks—large, tall (up to 90 feet) evergreen, wide-topped trees with spine-toothed, convex, dark green leaves. Oak woodlands form when these oaks are spaced closely enough to form an intermittent to continuous canopy. Oak savannas occur where coast live oak, along with valley oak, are more widely spaced, commonly with a grassland understory.
Oak woodlands are both upland and riparian habitat. They tend to be found at lower elevations (below 4,000 feet) in valleys, and on steep, north-facing slopes, raised stream banks, and terraces. See “Riparian Woodlands” later in this section for a discussion of coast live oak riparian woodlands.

Oak woodlands are most common across the middle section of the Ventura River watershed, especially along Sulphur Mountain and Lion Canyon Creek, and on terraces and canyons along the Ventura River such as in the Foster Park area, and in Wills and Rice Canyons in the Ventura River Preserve.

Oak savannas are landscapes dominated by grasses and herbaceous plants with a scattering of oak trees. Oak savannas are found on lower elevation rolling foothills and open valleys and terraces, often in areas where grazing impedes regeneration of shrubs or other trees.

Coast live oak is considered to be the most fire-resistant California oak tree because of its evergreen leaves, thick bark and ability to sprout from the trunk and roots using food reserves stored in an extensive root system.

**Oak Woodland and Oak Savanna Plant Species**

Understory vegetation in oak woodlands can vary significantly depending on conditions such as soil type, elevation, and aspect. Common understory and co-dominant species include poison oak, snowberry, hummingbird sage, gooseberry, virgin’s bower, monkeyflower, purple sanicle, California figwort, heart-leaved penstemon, California wild cucumber, southern California black walnut, toyon, California bay, California buckwheat, laurel sumac, basketbush, coyote brush, greenbark ceanothus, hollyleaf cherry, blue elderberry, and California blackberry. Many typical grassland species (described in the following section) are also common in the understory of oak woodlands. Grassland species commonly dominant the understory in oak savannas.
Annual Grassland

Grasslands cover about 6% of the watershed. This habitat is commonly found at elevations below 4,000 feet, especially on gradual slopes, flats, and coastal terraces, and as an understory in scrubland, woodland, and savanna habitats. Grasslands typically grow in well-developed, deeper, fine textured soils. Areas dominated by grasses are often in early successional stages, and over time tend to give way to scrublands or woodlands.

Grasslands are dominated by low-growing annual grasses and herbs. Perennial wildflowers, as well as naturalized annual forbs (broad-leaved herbs other than grasses), are important contributors to grasslands. Most of the watershed's grasslands are dominated by non-native species, especially where physical disturbance, such as mowing, grazing, repetitive fire, agriculture, or other disruptive means have altered soils and removed native seed sources.

Annual Grassland Plant Species

Native grassland species include needlegrasses, native fescues, native bluegrass, threeawn, melic grass, wild-rye, June grass, deer grass, California poppy, lupines, owls clover, blue dicks, and farewell-to-spring. Common non-native species include slender wild oats, ripgut brome, soft chess, red brome, hare barley, slender fescue, smilo grass, foxtail fescue, black mustard, shortpod mustard, Italian ryegrass, filaree, clovers, and Russian thistle.

Grasslands with Native Blue Dicks, Ojai
Photo Courtesy of Mary Meyer
Grasslands with Non-Native Mustard, Cañada Larga. Many grasslands have been invaded by non-native mustard, as seen on these hills.

Photo courtesy of Santa Barbara Channelkeeper

Montane Hardwood and Coniferous Forests

Montane hardwood and coniferous forests are found at the highest elevations of the watershed (above 4,000 feet), and cover less than 2% of the land.

Montane Hardwood and Coniferous Forest Plant Species

Montane hardwood and coniferous forests can be dominated by varying combinations of Douglas fir, ponderosa pine, Jeffrey pine, white fir, canyon live oak, incense cedar, and western juniper.
3.6.1.2 Wetland and Riparian Habitats

Overview
While all native habitats have intrinsic value, wetland and riparian habitats are centrally important to watershed management because of the variety of critical functions they perform and the ecosystem niches they provide, and because of their sensitivity to impacts and the associated need for protection. This overview is followed by sections that describe the important wetland and riparian habitats located in the Ventura River watershed.

Wetland Habitats
Wetlands are lands where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface (Cowardin et al. 1979).

The official definition of “wetland” differs among regulatory agencies, but all variations involve these three elements:

**Wetland Hydrology:** The presence of water at or above the soil surface for a period of the year sufficient to significantly influence the plant types and soil chemistry.

**Hydric Soil:** Soil that is wet long enough during the growing season to develop low-oxygen conditions.

**Hydrophytic Plants:** Plants adapted to saturated soil conditions (VCPD 2006a).

Wetlands perform many useful functions and provide valuable assets:

**Water Storage.** Wetlands function like natural tubs or sponges, storing water and slowly releasing it. This process slows the water’s momentum and erosive potential, reduces flood heights, and allows for ground water recharge, which contributes to base flow to surface water systems during dry periods. Although a small wetland might not store much water, a network of many small wetlands can store an enormous amount of water. The ability of wetlands to store floodwaters reduces the risk of costly property damage and loss of life.

**Water Filtration.** After being slowed by a wetland, water moves around plants, allowing the suspended sediment to drop out and settle to the wetland floor. Nutrients from fertilizer application, manure, leaking septic tanks, and municipal sewage that are dissolved in the water are often absorbed by plant roots and
microorganisms in the soil. Other pollutants stick to soil particles. In many cases, this filtration process removes much of the water's nutrient and pollutant load by the time it leaves a wetland. Some types of wetlands are so good at this filtration function that environmental managers construct similar artificial wetlands to treat storm water and wastewater.

**Biological Productivity.** Wetlands are some of the most biologically productive natural ecosystems in the world, comparable to tropical rain forests and coral reefs in their productivity and the diversity of species they support. Abundant vegetation and shallow water provide diverse habitats for fish and wildlife. Aquatic plant life flourishes in the nutrient-rich environment, and energy converted by the plants is passed up the food chain to fish, waterfowl, and other wildlife and to us as well.

—*Functions and Values of Wetlands* (USEPA 2001)

California currently uses the U.S. Fish and Wildlife Service (USFWS) "Cowardin system" to classify wetlands into five basic types. These are the five categories used by the USFWS National Wetlands Inventory (NWI) program to map wetlands:

- **Palustrine** — Vernal wetlands, marshes, ponds, dune swales, seeps, springs, wet meadows, and riparian wetlands
- **Lacustrine** — Deepwater lakes and reservoirs
- **Riverine** — Streams, rivers, canals, etc.
- **Estuarine** — Saline and brackish estuaries
- **Marine** — Intertidal beaches and rocky habitats

The Ventura River watershed has wetlands in all five of these categories, as shown on the Wetlands & Riparian Habitats map (Figure 3.6.1.2.1). This map also includes riparian areas mapped by NWI. See "Riverine Wetlands and Riparian Habitats" later in this section for more information on the mapping of riparian areas.

Man-made reservoirs provide most of the wetland habitat in the watershed. The majority of the watershed's natural wetlands are associated with streams and rivers. The watershed also has coastal wetlands associated with its estuary and beaches. Other wetlands include ponds, freshwater marshes, seeps and springs, vernal wetlands, riparian scrub, and wet meadows.

Many of the watershed's wetlands can be hard to recognize because they are dry during part of the year. The type of plants growing in these wetlands is often the biggest indicator of the underlying soils and wetland conditions. As with all water resources in dry climates, these habitats are vitally important to wildlife.
Scalebroom: A flood storyteller and key insect feeder. Native scalebroom (not to be confused with the non-native Spanish broom) is an indicator of active alluvial systems in the Ventura River watershed. It germinates and establishes after flood events (or bulldozing). Therefore the size and distribution of scalebroom along a stream channel can be used to understand its flooding history.

Scalebroom also plays an essential ecosystem role. It produces abundant aromatic flowers in the fall, which attract and feed a wide variety of insects. This food source is especially important in supporting the food chain during the dry months of fall and extended droughts.

Photos and information courtesy of Mary Meyer

Every California landscape has wetlands. They form where rainfall or runoff accumulates, or where groundwater saturates the topsoil. There are wetlands associated with desert playas, washes, and oases. Mountains and valleys have wet meadows, bogs, fens, sag ponds, vernal pools, and other kinds of wetlands along the shores of lakes, reservoirs, and ponds and on floodplains. The coastal landscapes have tidal flats and tidal marshes.

—Southern California Wetlands Recovery Project website
(SCWRP 2014)

Riparian Habitats

Riparian habitats (scrub and woodlands) are the water-dependent habitats adjacent to streams or other water bodies. These habitats serve as the transition between aquatic habitats and upland, or dry, habitats. Riparian habitats lack the amount or persistence of water usually present in wetlands, yet their connection to surface or subsurface water distinguishes them from adjacent uplands (USEWS 2009). Plants are
Figure 3.6.1.2.1 Wetlands & Riparian Habitats Map
often more abundant and diverse in riparian habitats than in uplands, especially in dry climates such as that of the Ventura River watershed. The majority of the watershed's wildlife species—including invertebrates (aquatic and terrestrial), fish, amphibians, reptiles, birds, and mammals—depend upon these areas for their survival. Riparian areas provide foraging, nesting, and cover habitat, and are used as migration corridors by various species of wildlife including small and large mammals, birds, and reptiles.

Riparian habitats perform many of the same useful functions as wetlands (described in "Wetland Habitats" above). Local regulators have found that protecting and expanding these natural habitats can sometimes be more economical than building and maintaining engineered facilities such as flood-control structures.

**Riverine Wetlands and Riparian Habitats**

The Ventura River and its many tributaries and drainages support hundreds of miles of riverine wetlands and riparian habitats—the watershed's most abundant natural wetlands.

In the following sections, the categories "riverine wetlands," "riparian scrub," and "riparian woodlands" are used to describe the ever-changing zone of riverine wetlands and riparian habitats.

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### The Riverine Wetland-Riparian Habitat Continuum

The Wetlands & Riparian Habitats map (Figure 3.6.1.2.1) indicates that the watershed has 898 acres of riverine wetlands, 1,290 acres of riverine-associated palustrine wetlands, and 2,939 acres of riparian habitats—a total of 5,127 acres.

In the NWI classification system used to create the map, "riverine wetlands" are wetlands within a stream or river channel; "riverine-associated palustrine wetlands" are typically bounded on one side by riverine wetlands and on the other by uplands; and "riparian habitats" are adjacent to stream channels but do not meet the definition of wetland.

The actual line between these categories is imprecise, especially since many of the watershed's stream channels are subject to flooding scour, erosion, drought, and other influences that can change the distribution of vegetation and the relative amount of wetland soils over time.

For example, the most recent mapping of Ventura County's wetlands by NWI was performed in 2004, a year before the big flood of 2005. The boundaries between these various riverine/riparian categories undoubtedly changed after that flood.
Riverine Wetlands

Riverine wetlands generally include the “active channel” of a river or stream system that contains the flow of water under non-flood conditions.

Because storm flows typically rip out vegetation in the active channel every year or every few years, riverine wetlands are characterized by non-persistent vegetation that reflects this unstable environment (Ferren et al. 1995). Perennial reaches support a greater variety of plants than intermittent or ephemeral reaches. While the active channels of most intermittent and ephemeral reaches are devoid of vegetation, perennial reaches support a variety of herbs, and floating and submerged vegetation.

Riverine wetlands provide essential habitat for many animals including fish, reptiles, and amphibians.

Ventura River’s Dry Reach, Intermittent Riverine Wetland. The watershed’s riverine wetlands are quite variable, ranging from intermittent stream/river reaches (sections) that usually flow only in the winter and spring, such as the “dry reach” (pictured above in its wet state), to perennial reaches that flow year-round.

Photo courtesy of South Coast Habitat Restoration
Upper Matilija Creek, Riverine Wetland, Bedrock and Boulders
Photo courtesy of Michael McFadden

Ventura River below Highway 150 Bridge, Riverine Wetland, Mixed Cobbles.
Riverine wetlands vary from upstream to downstream. Substrate in the channel centers changes from bedrock and large boulders in the upper reaches, to mixed cobbles and gravel in the middle reaches, to patchy boulders, cobbles, gravel, mud, and sand in the downstream reaches (Ferren et al. 1995).

Riverine Wetland Plant Species
Common herbaceous plants in riverine wetlands include: dotted water smartweed, willow-herb, water parsnip, water primrose, iris-leaved rush, water speedwell, and California bulrush. Submerged and floating aquatic plants, including leafy pondweed, fennel pondweed, horned pondweed, duckweed, duckweed fern, water cress, and green algae, grow in slow flowing channels.
Red-Legged Frog Egg Mass in Riverine Wetland, Casitas Springs Levee Pool, 2014. Federally Threatened, State Species of Special Concern
Photo courtesy of Chris Lima

Southwestern Pond Turtle Hatchlings in Riverine Wetland, Lion Creek, 2010. State Species of Special Concern
Photo courtesy of South Coast Habitat Restoration

Two-Striped Garter Snake in Riverine Wetland, 2013.
State Species of Special Concern
Photo courtesy of South Coast Habitat Restoration

Coast Range Newt in Riverine Wetland, 2013.
State Species of Special Concern
Photo courtesy of South Coast Habitat Restoration

Great Blue Heron in Riverine Wetland.
State Special Animal
Photo courtesy of Don DesJardin
Riparian Scrub

Riparian scrub is found immediately adjacent to intermittent and perennial streams and rivers, where there is periodic inundation, but scouring flows occur infrequently. This plant community is dominated by shrub-sized plants and fast-growing mid-sized trees; full-sized trees generally do not become established due to the frequency of disturbance by floodwaters. Plant density and height vary depending upon the amount of moisture and sunlight in the channel. This community provides habitat for a variety of small birds.

Several types of scrub habitats (sometimes found together) are common along the watershed’s streams and river: alluvial scrub, mulefat scrub, and southern willow scrub.

Alluvial Scrub, Ventura River Bottom. This habitat type occurs primarily on variously elevated alluvial benches that are protected from regular flooding by topography, but may be subject to some infrequent flooding or inundation. Upland plant species may also be found growing periodically on alluvial scrub terraces. Ground cover between shrubs is open with variable cover of native and non-native annuals and herbaceous perennials. It is likely that these areas were washed over by high flows sometime in the past several decades.

Alluvial Scrub Plant Species
Alluvial scrub vegetation is dominated by scalebroom, California buckwheat, yerba santa, chaparral yucca, California sagebrush, white sage, prickly pear, redberry, lemonadeberry, mountain mahogany, sugarbush, and hollyleaf cherry.

Photo courtesy of Mary Meyer
Mulefat Scrub, Ventura River

Mulefat Scrub Plant Species

Mulefat, the dominant plant species in mulefat scrub, often occurs in pure stands or with a sparse ground layer of vegetation that may include mugwort. Typical secondary species include scalebroom and narrow-leaf willow.

Southern Willow Scrub, Ventura River above Main Street Bridge.
The southern willow scrub plant community consists of dense stands of broad-leaved deciduous shrubs and small trees growing immediately adjacent to streams and rivers.

Photo courtesy of Santa Barbara Channelkeeper

Southern Willow Scrub Plant Species

Dominant plants in southern willow scrub include arroyo willow, narrowleaf willow, and shining willow. Other common native species include mulefat, Douglas’ nightshade, and mugwort. Mulefat and arroyo willow are both examples of plants that can resprout from underground stems after disturbance.
Riparian Woodlands

Riparian woodlands occur along perennial and intermittent streams in areas that are less frequently and less intensely disturbed by flood events than areas with riparian scrub habitat. With less scouring, trees in riparian woodlands have a chance to mature. Riparian woodlands can tolerate some flooding and are reliant on the relatively shallow groundwater associated with streams and rivers. In areas where non-seasonal streams flow out of the mountains and onto flat grasslands, the riparian woodland community may be relatively broad. In higher elevations, where water flows down a narrow passageway confined by geographical features, this community may be only a few meters in width. Riparian woodlands may also occupy the margins of man-made lakes and reservoirs.

Riparian corridors in the watershed support two general riparian woodland types: cottonwood-willow-sycamore and coast live oak.

Cottonwood-Willow-Sycamore Riparian Woodland

The cottonwood-willow-sycamore riparian woodland comprises a mix of mature broad-leaved, deciduous trees that are tolerant of flooding. Each tree species grows best under slightly different conditions, as illustrated below. Broad-leaved shrubs grow in openings and under tree canopies in riparian woodlands.

<table>
<thead>
<tr>
<th>Cottonwood-Willow-Sycamore Riparian Woodland Plant Species</th>
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<tr>
<td>Common plant species in cottonwood-willow-sycamore riparian woodlands include Fremont and black cottonwood, red willow, yellow willow, arroyo willow, shining willow, California sycamore, white alder, scalebroom, mulefat, toyon, arroyo willow, elderberry, nightshade, and coyote brush. Numerous vines, including poison oak, virgin's bower, California blackberry, and wild cucumber, may grow in these areas.</td>
</tr>
</tbody>
</table>
Cottonwood-Willow-Sycamore Riparian Woodland, Matilija Creek.
Wet: Fremont and black cottonwood, both broad-leaved deciduous trees, typically grow on floodplains that are temporarily flooded and on low terraces. California sycamore is one of the watershed's tallest trees and grows on terraces that are infrequently flooded. These large trees depend on occasional flooding for seedling and sapling establishment, but since flooding is infrequent, the trees can grow very large. This photo from Matilija Canyon shows black cottonwoods in fall color intermixed with California sycamores; the trees are located on a terrace away from the active channel.
Photo courtesy of Mary Meyer

Cottonwood-Willow-Sycamore Riparian Woodland, Ventura River.
Wetter: Red, yellow, arroyo, and shining willow are fast growing trees that are good indicators of riparian habitat. They are the watershed's most common riparian forest species, found on the edge of active channels as well as on floodplain terraces where they can reach the shallow groundwater. Arroyo willow has the widest range of occurrence as it can withstand drier conditions than the other willows.
Photo courtesy of Santa Barbara Channelkeeper

Cottonwood-Willow-Sycamore Riparian Woodland, Murrieta Creek.
Wettest: White alder grows along permanent watercourses where their roots remain in saturated soil year-round. White alder is an excellent indicator of a perennial stream.
Photo courtesy of Santa Barbara Channelkeepers
Coast Live Oak Riparian Woodland

Coast live oaks dominate this type of riparian woodland, which is found on the banks of small streams, on high terraces away from active channels, on erosional deposits along the margins of canyon bottoms, and on the lower slopes of canyon sides.

![Coast Live Oak Riparian Woodland, Wills Creek, Ventura River Preserve](image)

Photo courtesy of Ojai Valley Land Conservancy

Coast Live Oak Riparian Woodland Plant Species

Coast live oak is an evergreen species that is not tolerant of extended flooding. Other common trees, shrubs, and vines found in this plant community include arroyo willow, Fremont cottonwood, valley oak, California sycamore, bigleaf maple, California bay, Mexican elderberry, mulefat, Pacific blackberry, gooseberry, snowberry, poison oak, California sagebrush, coyote brush, horsetails, and mugwort.

Lakes and their Marshes

Lakes occur in well-defined basins that are usually permanently flooded. Like most lakes in coastal southern California, the two lakes in the watershed, Lake Casitas and Matilija Reservoir, are artificial. Together, these lakes support 2,472 acres of lacustrine wetlands. The shores of these lakes also support roughly 50 acres of freshwater marsh wetlands (palustrine wetlands). Stock ponds, usually created behind small dams on streams, are another form of lacustrine wetland found in the watershed.
Lake Casitas

Lake Casitas is the largest inland body of water in Ventura County. Surrounded by wilderness, the lake has become a very important aquatic resource for a wide variety of wildlife, but most notably for birds. The California Audubon Society recognizes Lake Casitas as one of 147 “Important Bird Areas” in the state—areas that provide essential habitat for breeding, wintering, and migrating birds (Audubon 2014). Many birds have come to depend on the lake’s open water, protected bays, vegetated shallows, and freshwater marsh habitats. The lake supports some species that occur nowhere else in inland Ventura County. Past bird counts have identified over 160 different species at Lake Casitas (CMWD 2014a).

Freshwater marshes occur along the shore of the lake, especially in coves and channels where the bottom slopes gradually into deeper water. The largest freshwater marsh consists primarily of California bulrush and is located along the edge of the lake near Coyote Creek. The lake’s reedy marsh areas dry up when the lake level is low, but can provide important habitat for wildlife when the water from the lake reaches the bulrushes.

Virginia rails and soras inhabit some of the larger patches of cattails and bulrushes in the winter. The shoreline marshes also provide important habitat for grebes, least bitterns, red-winged blackbirds, and smaller passerines (such as common yellowthroat, song sparrow, and marsh wren). Some of the diving, dabbling, and wading birds found at the lake include western and Clark’s grebes, double-crested cormorants, herons, egrets, lesser scaups, ruddy ducks, and wood ducks. The mudflats and patches of wetland vegetation around the lake provide habitat for green herons, pied-billed grebes, American coots, plovers, avocets, stilts, phalaropes, killdeers, and spotted sandpipers.
Some of the raptors known to breed at the lake include white-tailed kites, red-shouldered hawks, red-tailed hawks, Cooper's hawks, American kestrels, and bald eagles. Visiting species include ospreys, northern harriers, sharp-shinned hawks, golden eagles, peregrine falcons, prairie falcons, zone-tailed hawks, ferruginous hawks, and merlins. Barn owls, great horned owls, northern pygmy owls, short-eared owls, and burrowing owls have been observed at the lake.

**White-Faced Ibis, Lake Casitas. State Species of Special Concern**

Photo courtesy of Allen Berlke

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**Wood Duck, Lake Casitas**

Photo courtesy of Allen Berlke
Osprey, Lake Casitas. State Watch List
Photo courtesy of Allen Bertke

In addition to the many bird species at the lake, it is not uncommon for visitors to see deer, raccoons, rabbits, opossums, coyotes, skunks, and squirrels.

Lake Casitas is also known as a premier fishing lake in the region. Lake Casitas contains a warmwater fishery that includes bass (primarily largemouth), catfish, sunfish, and crappie. These species are non-native and were introduced when the lake was formed, but now have largely self-sustaining populations (Cardno-Entrix 2012).

The lake has historically been stocked with rainbow trout and other species of fish. Stocking was discontinued in 2013 because of concerns that non-native fish could escape and impact protected species if the Casitas dam spilled into downstream waters potentially used by protected aquatic species such as steelhead. The California Department of Fish and Wildlife, together with federal regulators, are currently evaluating each stocking situation to determine if stocking can be resumed in the future.

Steelhead (anadromous rainbow trout) are no longer present in Lake Casitas and its upstream tributaries, because Casitas dam precludes seaward and spawning migration. It is possible that residualized stocks of steelhead remain in Coyote and Santa Ana creeks in non-anadromous, resident form (URS 2010).
Matilija Reservoir

Matilija Reservoir, located on Matilija Creek, provides both lake and freshwater marsh wetland habitat. The reservoir is now largely full of sediment, and though there is still considerable surface area, water depth is very shallow.

Freshwater marsh wetlands surround part of the lake. Emergent wetland plants around the lake include bulrush, smartweed, nuttckedge, and rush species (USACE 2004).

Like Lake Casitas, Matilija Reservoir’s lake and marsh wetland habitats are used by a wide variety of migrating and resident birds. Southwestern pond turtles, a California species of special concern, have been found at Matilija Lake. The lake is also home to large numbers of non-native aquatic predators such as largemouth bass (USACE 2004), bullfrogs, and crayfish, which prey on juvenile turtles.
Coastal Wetlands

The watershed’s coastal wetlands include intertidal habitats (marine wetlands), an estuary, and dune swales. As indicated on the Wetlands & Riparian Habitats map (Figure 3.6.1.2.1), coastal wetlands include 31 acres of marine wetlands and 16 acres of estuarine wetlands. Dune swales, a type of palustrine wetland, comprise about two acres (Ferren et al. 1990). Ferren et al. (1990) mapped estuarine habitats at a finer scale and estimated that the estuary contained 28 acres of estuarine wetlands surrounded by over 50 acres of palustrine wetlands. As with riverine and riparian wetlands, the boundaries of estuarine wetlands are in a regular state of flux.

Intertidal Wetlands

Intertidal (or marine) wetlands in the watershed include sandy and rocky intertidal habitats.

Intertidal Wetland Plant Species

The sand along exposed beaches is continually reworked and moved around by waves, making establishment by attached plants impossible at lower levels. However, plants such as beach saltbush and red sand verbena may become established higher on the beach.

Plants in the rocky intertidal zone attach themselves to rocks but must withstand intense wave action and the stress of drying out during low tides. A variety of algal species live in these habitats, possessing different levels of tolerance to flooding and desiccation. The lower intertidal area exhibits the greatest algal species diversity (Capelli 2010). Rockweed and feather boa kelp can be seen within the intertidal zone, and surfgrass grows at elevations only exposed on the lowest tides.
Marbled Godwits, Sanderlings, and Egrets Feeding in Sandy Intertidal Wetland. In sandy intertidal areas, waves bring food and oxygenated water to the organisms living within the sand. Additionally, freshwater aquifers along the coast drain to the ocean through beach sand, carrying nutrients and sometimes contaminants, to the shore.

Photo courtesy of Dave Hubbard

Invertebrate animals are extremely abundant on sandy beaches, but are not usually visible because they live under the sand. Sand crabs and bean clams live low on the beach. At night, beach-hoppers emerge from their burrows higher on the beach to eat kelp that has washed up at high tide. The abundance of invertebrate life provides important food for shorebirds. Sandy beaches provide nesting habitat for endangered California least terns and western snowy plovers. Some of the animals supported by rocky intertidal habitats include invertebrates, barnacles, striped shore crabs, shorebirds (especially black turnstones and ruddy turnstones), egrets, herons, and gulls.

Black Turnstone, Rocky Intertidal Wetland

Photo courtesy of Don DesJardin
Animals associated with the intertidal habitats include mole crabs, clams, and bristle worms, which bury themselves in the sand between cobbles and feed on particles brought in by the waves. These animals, in turn, are fed upon by shorebirds during low tides and by fish during high tides (USACE 2004).

**Ventura River Estuary**

The watershed is home to the Ventura River estuary. Estuaries occur along the coast where fresh water from rivers meets the salt water from the sea. Estuaries are complex ecosystems. Water can enter the system from river flows, tides, waves, groundwater, seeps, and springs; the amount and movement of this water can be quite variable. Estuaries trap nutrients from freshwater and saltwater sources and disperse them through tidal movement and currents. This brackish water environment and regular influx of nutrients supports a high diversity of life. Many species of birds, fish, and other wildlife depend upon estuarine habitats to live, feed, and reproduce.

*Ventura River Estuary, February 2014.* The estuary extends from the ocean to the area between the Highway 101 bridge and the Main Street bridge upstream (Ferren et al. 1990). It is a lagoon type of estuary, separated from the ocean by a sandbar that generally remains closed off from the ocean. Water periodically breaches the sandbar. The second mouth of the estuary, not shown in this photo, is further west.

*Photo courtesy of Rick Wilborn*
The following excerpt provides an overview of the Ventura River estuary wetland:

The Ventura River Estuary is characterized by (1) short periods of tidal flushing when the mouth is open and longer periods of pending and lagoon formation when the mouth is closed by a sandbar; and, (2) a year-round inflow of fresh water that is the result of upstream surface flows, rising groundwater, and the discharge of effluent from the Ojai Valley Sanitary District. Because there is perennial freshwater runoff into the estuary, hypersaline conditions apparently are not reached at the surface of the estuary. The estuary is tidally flooded by brackish water when the mouth is open, and is flooded by slightly brackish or fresh surface water when the mouth is closed. Freshwater inflow also determines the depth of the estuary, the extent of areas flooded during ponding, and pattern of salinity and temperature stratification (J.J. Smith 1987).

In addition to the main estuary, the Ventura River has [a] second mouth to the west which is flushed by runoff typically only during large flood events. This second mouth can also receive marine water when storm waves top the cobble and sand berm that blocks the mouth. Under these conditions, the second mouth is not a typical estuary. The hydrology of the second mouth estuary and associated lagoons and isolated pools appears to be closely linked to the rise and fall of the water table in the delta. The primary influence on this rise and fall is whether mouth of the main estuary is closed and the system is experiencing lagoonal conditions. The higher the lagoon, the more hydrologically connected the entire system becomes.

—Wetlands of the Central and Southern California Coast and Coastal Watersheds: A Methodology for their Classification and Description (Ferren et al. 1995)

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**Estuary Plant Species**

The open water habitats of the Ventura River estuary contain a mixture of river and seawater and support algae and aquatic plants such as duckweed and pondweed. Near the river mouth, brackish marsh supports pickleweed, alkali heath, and California bulrush. Moving inland, this habitat transitions to freshwater marsh with cattails and bulrushes. Farther inland the habitat transitions to riparian scrub dominated by native willows.
Breached Sandbar, Ventura River Estuary, September 2014. The sandbar that impounds water at the mouth of the Ventura River opens and closes depending on the interactions between river flow and wave action. Winter storm flows often scour out the sandbar, allowing regular tidal flows into the estuary for a period of time. Occasionally the mouth opens during the summer (Ferren et al. 1995).


Estuaries teem with an array of life including invertebrates (clams, shrimp, crabs, snails, and worms) and the vertebrates that prey on them (fish, birds, and mammals).
The Ventura River estuary supports many resident and migratory birds: waterbirds, including ducks, waders, and shorebirds, as well as songbirds and raptors. Bird surveys conducted in 1991/1992 identified 233 native bird species using the estuary and surrounding wetland habitats, six of which were special status species and 37 of which were water-associated species (Hunt & Lehman 1992). Belding’s savannah sparrow, a state-listed endangered species, has been observed in Seaside Wilderness Park adjacent to the estuary (Ferren et al. 1990). This sparrow nests only in estuary salt marsh habitat.

The estuary is used by a large number of waterbirds, whose densities vary seasonally and daily with fluctuating water levels. The largest numbers of birds are typically found when water levels in the estuary are relatively low, exposing mudflats and adjacent aquatic habitats. Moderate numbers of waterfowl are found on-site from mid-fall through early spring, gulls and terns use the area year-round for resting and bathing (as do a small number of Brown Pelicans (Pelecanus occidentalis), and large numbers of shorebirds are present when water levels are low, exposing mudflats utilized for feeding. Regionally declining and/or endangered species that frequent this site include the Osprey (Pandion haliaetus) and Peregrine Falcon (Falco peregrinus) (rare visitors), Snowy Plover (Charadrius alexandrinus) (small numbers are found on
the sandy shores and mudflats, primarily in late summer), and Least Tern (*Sternula antillarum*) (which utilize the estuary area for feeding, resting and bathing, often occurring for extended periods in late summer accompanied by fledged young).

—Vertebrate Resources at Emma Wood State Beach and the Ventura River Estuary, Ventura County, California: Inventory and Management (Hunt & Lehman 1992)

Cormorants and Coots, Ventura River Estuary

Photo courtesy of Stephanie Grunbeck, Books Institute of Photography

Ventura River Estuary History

The Ventura River estuary was once much larger than it is today. The following excerpts from a historical study of the watershed’s habitats demonstrate the dynamic nature of the estuary before it was constrained by development:

Historically, the estuary consisted of a large willow-cottonwood riparian forest with numerous distributary channels, a tidal lagoon and tidal flat, salt marsh, high marsh transition zone, and a number of small seasonal ponds within the marsh.

The Ventura River mouth has shifted location numerous times over the past several hundred years, from the hills west of the river mouth to Figueroa Street in Ventura. Many of these former river mouth areas are still susceptible to flooding. A brackish lagoon, formerly at the site of what is now the Derby Club across from Seaside Park, marked the route of one of these former river mouths.

One notable feature in the Ventura River delta was a brackish lake to the west of the end of Figueroa Street. The lake marked a former outlet of the river, and covered about 2.5 acres of open water and 9 acres of marsh. This lake and former river mouth were also the site of a Chumash village, Mitsqanaqan.

At least three types of coastal estuarine systems are represented on the Ventura shoreline: seasonally or intermittently closing freshwater-brackish estuaries associated with the Santa Clara and Ventura river mouths, dune-dammed non-tidal lagoons associated with now-abandoned Santa Clara River mouths, and the large, more open wetland system at Mugu. These features formed a near-continuous sequence of coastal wetlands from Mugu Lagoon all the way to the Ventura River mouth: the eastern edge of the Ventura River floodplain was separated from the northwestern edge of the Santa Clara River floodplain (today’s Ventura Marina area) by less than one mile.

—Historical Ecology of the lower Santa Clara River, Ventura River and Oxnard Plain: an analysis of terrestrial, riverine, and coastal habitats (Beller et al. 2011)
The Ventura River estuary provides important primary and nursery habitat for several visiting and resident fish species, including topsmelt, prickly sculpin, and California killifish, as well as for sensitive species such as the southern California steelhead and tidewater goby.

The sandbar at the mouth of the estuary is periodically breached by heavy outflows and high tides associated with storm events. Once opened, the river can receive adults of anadromous species attempting to spawn in the estuary (e.g., Topsmelt) as well as species that breed in fresh water upstream (e.g., Pacific Lamprey, Steelhead, California Killifish). Continuous freshwater inflows to the estuary are critical to maintaining the low salinity levels in the upper portions of the estuary favored by the Tidewater Goby. Preservation of these features and maintenance of good water quality are crucial to the continued survival of these resident anadromous and catadromous species in the Ventura River.

—Vertebrate Resources at Emma Wood State Beach and the Ventura River Estuary, Ventura County, California: Inventory and Management (Hunt & Lehman 1992)

Dune Swales

Dune swales are low areas that occur between the crests of coastal dunes. Dune swales typically do not hold ponded water but are areas where the sand surface intersects the shallow groundwater table and the soil remains saturated with fresh water for most or all of the year. Wetland plants colonize these moist areas.

Dune swales can be found at Seaside Wilderness Park, located south of Emma Wood State Beach Group Camp and the railroad tracks.

**Dune Swale Plant Species**

Vegetation species characteristic of dune swales include beach-bur, whiteleaf saltbush, and evening primrose. Dune swales are threatened by non-native species such as iceplant, sea rocket, and European beach grass, which can alter the natural movement of sand.

Special status species present or once present in the area, such as least tern, western snowy plover, and the California legless lizard, commonly utilize coastal dune native vegetation. The dune swale wetlands provide habitat for numerous small mammals that rely on a relatively continuous cover of vegetation for protection from predators.
Vernal Ponds and Lakes

Vernal wetlands occur in small depressions underlain by impenetrable soils. Vernal means “spring,” and these wetlands generally hold standing water, usually rainwater, for only part of the year. This seasonality is a defining feature of vernal wetlands, which usually go through four phases each year: 1) a dry phase during the summer and fall, 2) a wetting phase after rains begin, 3) a flooded phase in the winter, and 4) a drying phase. Vernal wetlands may remain without surface water for several years during droughts. They are mostly found in areas with a Mediterranean climate (wet winter/dry summer).

Today, only a small percentage of vernal wetlands remain in southern California. In the Ventura River watershed, vernal wetlands are closely related to geological features such as faults. These wetlands are often found in the depressions formed by synclines, the down-folded limbs of faults, and at geologic structural knots (the intersection of several faults). These wetlands occur where the subsurface is impermeable, typically in relatively level landscapes such as the floors of wide valleys, plains, or coastal mesas that are not connected to drainages, such that the water slowly evaporates after rainfall ends.

Vernal wetlands types are classified based on depth, duration of the flooding phase, and the types of plants and animals present. From wettest to driest, the types are known as vernal lakes, vernal ponds, and vernal pools.

Remains of Mirror Lake (Vernal Lake), Mira Monte. Mirror Lake, the only example of a vernal lake in Ventura County, had an incredibly rich plant community, supporting several rare and endemic species of plants. Cumulative development impacts have altered the natural processes of the wetland to such a degree that it no longer functions as a vernal lake. Mirror Lake is associated with the Oak View Fault Zone (Ferren et al. 1995).

Photo courtesy of Dave Hubbard
Vernal Pond and Lake Plant Species

Wide variation in the length of possible wet periods and isolation from similar habitats generates a highly variable plant community. Vernal wetlands may contain common species such as spike-rushes and toad rush, as well as vernal wetland specialists such as woolly marbles and California orcutt grass. The unique hydrology and geographic isolation of vernal wetlands tend to support rare and endemic species, making protection of these areas especially important for the preservation of local and regional biodiversity.

Vernal wetlands provide important breeding grounds for frogs, toads, and salamanders and act as stopover points for migratory waterfowl and shorebirds. Aquatic invertebrates tend to be plentiful and may include several types of small crustaceans (e.g., fairy shrimp and clam shrimp), as well as aquatic insects.

Because the plants and animals of vernal wetlands are very sensitive to even minor alterations in hydrology, the functioning of these wetlands can be drastically altered by minor changes in the surrounding landscape.
Freshwater Marshes

Freshwater marshes are wetlands that occur in areas with still or slow-moving shallow water and nutrient-rich mineral soils. Some freshwater marshes may be permanently flooded while others may have standing water for only part of the year. Freshwater marshes receive their water from rain, adjacent lakes, or rivers. Due to the rich mineral soil, these wetlands drain slowly. Freshwater marsh soils remain anaerobic (without oxygen) essentially year-round.

In the Ventura River watershed, freshwater marshes are usually small and scattered. They can be found on the margins of ponds and lakes, in the floodplains of slow moving streams and the Ventura River, in geologic depressions and drainage, along the margins of the estuary, and in artificial impoundments such as stock ponds.

Freshwater Marsh Plant Species

Freshwater marshes tend to have non-woody vegetation. They are dominated by perennial grass-like plants such as common cattail and California bulrush. Other rushes, sedges, spike-rushes, and horsetails may also be common. Freshwater marshes also support plants such as willow-herbs, watercress, yerba mansa, pond lily, biennial sageswort, mosquito fern, and species of duckweed, and pondweed, and smartweed. The vegetation can grow very dense and quite tall.

The luxuriant, bright green growth of freshwater marshes in summer can show a strong contrast with neighboring, non-wetland, plant communities that may drop their leaves or turn brown during summer drought. The contrast reverses during the rainy season when other plants grow.
new leaves while freshwater marsh plants die back for the winter. In the spring, marsh plants re-sprout from their roots and produce large amounts of above-ground shoots and leaves. In addition to its important roles in nutrient recycling and soil conditioning, freshwater vegetation is an important source of nesting material for birds and small mammals.

**Common Yellowthroat**
Photo courtesy of Allen Bertke

**Great Egret. State Special Animal**
Photo courtesy of Allen Bertke

**California Tree Frog**
Photo courtesy of Chris Brown

Freshwater marshes support a wide diversity of wildlife. Birds associated with this habitat include red-winged blackbirds, song sparrows, common yellowthroats, and great egrets. Less common birds include least bitterns and sora rails. Amphibians such as tree frogs depend on the still water for breeding. The extended presence of surface water into the dry season is important for nesting birds and for mammals.
Ojai Meadows Preserve, Restored
Freshwater Marsh
Photo courtesy of Rick Wilborn

Ojai Meadows Preserve

The Ojai Meadows Preserve, located at the northwest edge of the City of Ojai just west of Nordhoff High School, is the site of a significant wetlands restoration project. Historically, water naturally drained to the property, which once contained approximately five acres of freshwater marsh wetlands (Condor Environmental 2004). While surrounding developments altered drainage patterns, the site and the adjacent highway were still subject to flooding during big rain events.

The Ojai Valley Land Conservancy acquired the property in 2000 and, with considerable help from the community, began restoring the wetland. A central focus of the restoration was restoring the historical flood management function of the wetland thereby reducing flooding of adjacent properties and roads. A variety of other native habitat types are also being restored on the 57-acre preserve.

Seeps and Springs

Seeps and springs are wetlands found where groundwater is forced to the surface, typically by faults or bedrock layers. These widely scattered wetlands support diverse and often lush vegetation.

Springs are recognized by the presence of flowing surface water while seeps are areas of saturated soil with very little or no flowing water. While the amount of flowing water or area of saturated soil may vary during the year, these wetlands are typically wet year-round due to the subterranean nature of the water sources. Water from springs and seeps may support other types of wetlands; it is not uncommon to see ponds, freshwater marshes, wet meadows, or riparian wetlands downstream of these perennial water sources.
Springs and seeps may be found anywhere from high slopes in the interior mountains right down to sea level. Springs typically occur in steep rocky terrain where emerging water does not immediately percolate into the surrounding impermeable substrate. Seeps may be found on a variety of slopes, including rock faces. Soils associated with seeps tend to hold a great deal of water and be permanently saturated.

An excellent example of a forested seep may also be seen at Wheeler Gorge along Highway 33.

**Seep and Spring Plant Species**

Vegetation found in springs is limited by the steep rocky terrain characteristic of this wetland type. Rocks covered with flowing water support algae, mosses, liverworts, and lichens. When there is sufficient soil structure to support rooted plants, herbaceous species such as southern maidenhair fern, scarlet monkeyflower, Indian paintbrush, and rothrock lobelia, may be present.

Seeps vary widely in the vegetation they support. Some are meadow-like and dominated by low sedges (common spike-rush and Carex species) and rushes (Mexican rush, brown-headed rush and common rush). Others seeps may support California bay, willow, and bigleaf maple forests with an understory of species such as coastal wood fern, dense-flowered spike-primrose, California rose, creeping wild ryegrass, stream orchid, columbines, and woolly hedge nettle.

**Bellyache Falls, Freshwater Spring, Highway 33, Ojai.** Bellyache Falls is a freshwater spring located below Dry Lakes Ridge along Highway 33 in the upper watershed. A spigot used to fill water containers previously existed at the site.
Seep, Matilija Canyon

Photo courtesy of Michael McFadden
3.6.1.3 Sensitive/Special Status Habitat

Federal Critical Habitat

The federal Endangered Species Act requires designation of critical habitat when a species is listed as endangered or threatened. Critical habitat is a specific area that has the physical or biological features essential to conservation of the species. This may include areas not currently occupied by the species but that will be needed for its recovery. Critical habitat has been designated for five animal species in the Ventura River watershed: southern California steelhead, California red-legged frog, tidewater goby, southwestern willow flycatcher, and California condor. In total, these habitats comprise 25,397 acres and 48 miles of river and tributaries (see Figure 3.6.1.3.1 Critical Habitat map).

When activities that involve a federal permit, license, or funding are likely to adversely modify the area of critical habitat, the US Fish and Wildlife Service or the US National Marine Fisheries Service (depending which agency has jurisdiction over the species) can require amendments to those activities for the protection of the listed species.

State Sensitive Vegetation Communities

In addition to individual plant species (discussed later in this section), plant communities are also recognized as being sensitive and threatened. These vegetation communities, or “alliances,” are ranked in California according to their degree of imperilment (as measured by rarity, trends, and threats), based on NatureServe’s global (G) and state (S) status categories. (NatureServe, an international nonprofit conservation organization, is an authority on rare, endangered, and threatened ecosystems.) Vegetation alliances with state ranks of S1, S2, and S3 are considered to be highly imperiled in California. Though not associated directly with legal protections, vegetation communities with these rankings are recognized as important by local, state, and federal agencies (VCPD 2014a).
Figure 3.6.1.3.1 Critical Habitat Map
The state’s mapping and ranking of alliances is still incomplete, however the following special status habitats are known to occur in the watershed (Meyer 2014):

<table>
<thead>
<tr>
<th>Vegetation Community</th>
<th>Status ³</th>
<th>Vegetation Community</th>
<th>Status ³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alluvial fan chaparral</td>
<td>G2 S2.1</td>
<td>Purple needle grass grassland</td>
<td>G3 S3?</td>
</tr>
<tr>
<td>Ashy buckwheat scrub</td>
<td>G3 S3</td>
<td>Red willow thickets</td>
<td>G3 S3</td>
</tr>
<tr>
<td>California bay forest</td>
<td>G4 S3</td>
<td>Scale broom scrub</td>
<td>G3 S3</td>
</tr>
<tr>
<td>California brittle bush scrub</td>
<td>G4 S3</td>
<td>Southern arroyo willow riparian forest</td>
<td>G2 S2.1</td>
</tr>
<tr>
<td>California sycamore woodlands</td>
<td>G3 S3</td>
<td>Southern coastal salt marsh</td>
<td>G2 S2.1</td>
</tr>
<tr>
<td>California walnut groves</td>
<td>G3 S3</td>
<td>Southern cottonwood willow riparian forest</td>
<td>G3 S2.2</td>
</tr>
<tr>
<td>California walnut woodland</td>
<td>G2 S2.1</td>
<td>Southern mixed riparian forest</td>
<td>G2 S2.1</td>
</tr>
<tr>
<td>Big pod ceanothus chaparral</td>
<td>G3 S3.2</td>
<td>Southern riparian scrub</td>
<td>G3 S3.2</td>
</tr>
<tr>
<td>Chamise - white sage chaparral</td>
<td>G3 S3</td>
<td>Southern willow scrub</td>
<td>G3 S2.1</td>
</tr>
<tr>
<td>Coastal and valley freshwater marsh</td>
<td>G3 S2.1</td>
<td>Sycamore alluvial woodland</td>
<td>G1 S1.1</td>
</tr>
<tr>
<td>Coastal brackish marsh</td>
<td>G2 S2.1</td>
<td>Thick leaf yerba santa scrub</td>
<td>G3 S3</td>
</tr>
<tr>
<td>Freshwater seep</td>
<td>G4 S3.2</td>
<td>Toyon chaparral</td>
<td>G5 S3</td>
</tr>
<tr>
<td>Giant wild rye grassland</td>
<td>G3 S3</td>
<td>Transmontane freshwater marsh</td>
<td>G3 S2.2</td>
</tr>
<tr>
<td>Hairy leaf ceanothus chaparral</td>
<td>G3 S3</td>
<td>Venturan coastal sage scrub</td>
<td>G3 S3.1</td>
</tr>
<tr>
<td>Hoary leaf ceanothus chaparral</td>
<td>G3 S3.2</td>
<td>Vernal marsh</td>
<td>G2 S2.1</td>
</tr>
<tr>
<td>Lemonade berry scrub</td>
<td>G3 S3</td>
<td>White sage scrub</td>
<td>G4 S3</td>
</tr>
<tr>
<td>Native grassland</td>
<td>G3 S3.1</td>
<td>Yellow willow thickets</td>
<td>G4 S3?</td>
</tr>
</tbody>
</table>

1. NatureServe Conservation Status Ranks:
G1 or S1 - Critically Imperiled
G2 or S2 - Imperiled
G3 or S3 - Vulnerable to extirpation or extinction
A question mark (?) denotes an inexact numeric rank due to insufficient samples over the full expected range of the type, but existing information points to this rank.

Locally Important Plant Communities

The Ventura County General Plan calls for protection of “significant biological resources” in Goal 1.1.5, which states: “Preserve and protect significant biological resources in Ventura County from incompatible land uses and development. Significant biological resources include endangered, threatened or rare species and their habitats, wetland habitats, coastal habitats, wildlife migration corridors, and locally important species/communities.” Whether or not a plant community qualifies as “locally important” is determined on a case-by-case basis as part of environmental review associated with a development, with the exception of oak woodlands. The Ventura County Board of Supervisors, as part of their adoption of an Oak Woodland Management Plan, explicitly deemed oak woodlands to be a locally important plant community (VCIPD 2014a).
3.6.1.4 **Habitat Connectivity/Wildlife Movement**

Rivers and streams serve as an interconnected road and highway network for the natural world. In urban areas where habitats become fragmented by roads and development, the network of rivers and streams is critical for the movement of aquatic and terrestrial species. The connectivity of these vital habitats is important to animals not only for food availability, but also for reproduction and genetic vigor. These connections are especially important for species, such as mountain lions, that require extensive areas to survive.

Many species in the watershed are dependent upon the stream network to travel between habitats during part or all of the year. When streams and rivers flow during the rainy season, fish, frogs, turtles, and other aquatic species are able to travel through the water (unless impeded by a barrier). Terrestrial species such as bobcats, deer, coyotes, and fox are able to use the riparian habitat adjacent to streams and rivers to migrate throughout the year.

The following excerpt from an environmental assessment of a project in the Ventura River floodplain provides a thorough overview of the role of the river in habitat connectivity:

The Ventura River and its associated drainages provide important connections between wilderness areas of the Santa Ynez foothills, the Los Padres National Forest, Sulphur Mountain, and the Pacific Ocean. The broad diversity of vegetation and physical topography in this area provides a mechanism for dispersal, supports wildlife travel routes, and allows habitat connectivity for a range of species from steelhead to neo-tropical song birds. Carnivores and ungulates (i.e., coyote, bobcat, bear, and deer), in addition to small less mobile species, also utilize the river and adjacent uplands for movement and dispersal.
Wildlife movements can be classified into three basic categories: dispersal (e.g., juvenile animals moving from natal areas or individuals expanding ranges); seasonal migration; and movements related to home range activities (e.g., foraging for food or water, defending territories, or searching for mates, breeding areas, or cover).

Habitat fragmentation, whether natural or human-induced, can create a mosaic of habitat patches separated by barriers that may be permeable or impermeable to wildlife movement. How a species responds to a fragmented landscape largely depends on its body size. For example, large ground dwelling (i.e., flightless) animals, such as mountain lions, coyotes, grey fox, and badgers, routinely move large distances across extensive home ranges that encompass multiple habitat patches, compared to small ground-dwelling wildlife, such as brush rabbits, ornate shrews, pocket gophers, meadow voles, and Pacific tree frogs, whose relatively small home ranges may include only a portion of a single habitat patch.

Movement corridors are physical connections that allow wildlife to move between patches of suitable habitat. Simberloff et al. (1992) and Beier and Loe (1992) correctly state that, for most species, we do not know what corridor traits (length, width, adjacent land use, etc.) are required for a corridor to be useful. But, as Beier and Loe (1992) also note, the critical features of a movement corridor may not be its physical traits but rather how well a particular piece of land fulfills several functions, including allowing dispersal, plant propagation, genetic interchange, and recolonization following local extirpation.

The following terms are frequently used in discussing wildlife movement corridors:

- **Dispersal Corridors** - Corridors which are relatively narrow, linear landscape features embedded in a dissimilar matrix that links two or more areas of suitable habitat;

- **Habitat Linkages** - Linkages which are broader connections between two or more habitat areas;

- **Travel Routes** - Routes which are landscape features, such as ridgelines, drainages, canyons, or riparian corridors that are used frequently by animals because they provide the least topographic resistance to movement and provide access to water, food, cover, or other necessary resources;

- **Wildlife Crossings** - Crossings which are small, narrow, typically man-made features, such as tunnels, culverts,
underpasses, etc., that allow wildlife to bypass a barrier. The latter represent “choke points” along a movement corridor (Meffe and Carroll, 1997).

Undisturbed landscapes contain a variety of movement corridors, habitat linkages, travel routes, wildlife crossings and other habitat features that facilitate wildlife movement through the landscape and contribute to population stability. The relative size and characteristics of these features differ for species that use them. Wildlife use will depend on the ability of these features to provide adequate space, cover, food, and water, in the absence of obstacles or distractions (e.g., man-made noise, lighting) that could interfere with wildlife movements. Human-induced habitat fragmentation increases the number of wildlife crossings or choke points in a landscape.

Riparian corridors, streams, rivers, and other such linear landscape elements are generally assumed to function as wildlife movement “corridors” between habitat patches, however, as the movements of wildlife species are more intensively studied using radio-tracking devices, there is mounting evidence that many wildlife species do not necessarily restrict their movements to some obvious landscape element, such as a riparian corridor. For example, recent radio-tracking and tagging studies of Coast Range newts (Trenham, 2002), California red-legged frogs (Bulger et al., 2002), southwestern pond turtles (Hunt et al., 1993), and two-striped garter snakes (Rathbun et al., 1992) found that long-distance dispersal in these species involved radial or perpendicular movements away from a water source with little regard to the orientation of the actual riparian corridor. Similarly, carnivores do not necessarily use riparian corridors as movement corridors (Newmark, 1995; Beier, 1993, 1995; Noss, et al., 1996).

However, in the proposed project region many of the east-west linkages are limited and the north-south linkages between the coastal hills and the Santa Ynez mountains area and other open space areas are increasingly tenuous because of urban and agricultural development adjacent to the floodplain. One of the only unconstrained habitat linkages is the Ventura River floodplain which provides the critical feature of wildlife corridors in the region. Therefore, the Ventura River and floodplain provide both passage and dispersal corridors for a variety of both common and sensitive species.

—California River Parkways Trailhead Project, Initial Study
(Aspen Environmental 2010)
Figure 3.6.1.4.1 Regional Wildlife Corridors Map
Mountain Lion Killed on Highway 33 near Foster Park, Dec. 2014.
Animals killed by cars are regularly seen on Highway 33 near Foster Park.
Photo courtesy of Kim Stroud

Collected data on roadkill reveal locations in the watershed where highly travelled roads intersect with well-travelled wildlife movement corridors. One such location is on Highway 33, just south of Foster Park. Roadkill in this area is unfortunately fairly common. Roadkill is also common on Highway 150 east of Lake Casitas (Anderson 2014).

Impediments to wildlife movement include not only roads and development, but also instream barriers that prevent the migration of fish and other aquatic organisms. See “3.6.2 Steelhead” for a discussion on barriers to fish passage in the watershed.

3.6.1.5 Species

Species richness is a hallmark of the Ventura River watershed. The watershed is located within the California Floristic Province (CFP), an area designated by Conservation International as one of the world’s top 35 biodiversity hotspots—areas where species diversity, numbers of endemic species, and threats to diversity are all particularly high (CEPF 2014). Los Padres National Forest, which comprises half the land area in the watershed, is one of the more diverse national forests in California, supporting over 468 species of fish and wildlife (URS 2010).

One indicator of the health and productivity of the watershed’s ecosystems is the number of large carnivores and other large mammals that it supports. It generally takes large areas of connected natural habitat
to support the foraging and breeding needs of top predators and large mammals. These large animals, or their sign, are observed regularly in the watershed. Black bears, for example, are fairly regular visitors in local orchards, especially during drier years, and it is not unusual to see bear tracks on some local trails. Coyotes are commonly observed around some Ojai neighborhoods. Mountain lions, bobcats, and foxes are also occasionally seen in the area.

Mountain Lion Visits Sulphur Mountain Road Home, 2014
Photo courtesy of Fred Rottenberg
Black Bear Visits Ojai Orchard, 2013
Photo courtesy of Emily Ayala

Grey Fox on Fox Canyon Trail, Ojai, 2013
Photo courtesy of Bardley Smith

Coyote in Mira Monte, 2013
Photo courtesy of Tania Parker
Special Status Species

The Ventura River watershed is home to numerous special status plant and animal species. Over 130 species are protected at either the federal, state, or local level, including 16 species listed as endangered, threatened, or fully protected at the state or federal level.

Table 3.6.1.5.1 lists the special status plants and animals known to occur in the watershed, along with their federal, state, or local protection status. The federally endangered southern California steelhead is of particular significance, and is discussed at length in “3.6.2 Steelhead.”

Locally Important Species

The Ventura County General Plan defines a Locally Important Species as a plant or animal species that is not an endangered, threatened, or rare species, but is considered by qualified biologists to be a quality example or unique species within the County and region. The following criteria further define what local qualified biologists have determined to be Locally Important Species (VCPD 2011b):

Locally Important Plants

Taxa that are declining throughout the extent of their range AND have five or fewer element occurrences in Ventura County.

Locally Important Animals

- Taxa for which habitat in Ventura County is crucial for their existence either globally or in Ventura County. This includes:
- Taxa for which the population(s) in Ventura County represents 10 percent or more of the known extant global distribution; or
- Taxa for which there are five or fewer element occurrences, or less than 1,000 individuals, or less than 2,000 acres of habitat that sustains populations in Ventura County; or
- Native taxa that are generally declining throughout their range or are in danger of extirpation in Ventura County.
### Table 3.6.1.5.1 Special Status Species

<table>
<thead>
<tr>
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<tbody>
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<td><em>Alisma plantago-aquaticum</em></td>
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<tr>
<td><em>Allium praecox</em></td>
<td>early onion</td>
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<tr>
<td><em>Allophyllum divaricatum</em> (Nuttall) A.D. Grant &amp; V. Grant</td>
<td>divaricate allophyllum</td>
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<td><em>Amaranthus californicus</em></td>
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<td><em>Astragalus didymocarpus</em> var. milesianus</td>
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<td><em>Astragalus pycnostachyus</em> var. laevisissimus</td>
<td>Ventura marsh milk-vetch[^1]</td>
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<td><em>Atriplex serana</em> var. davidsonii</td>
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<td><em>Crassula aquatica</em></td>
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<td>Torrey forget-me-not</td>
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<td><em>Delphinium papyri</em> ssp. purpureum* (F. Lewis &amp; Eppling) M.J. Warnock</td>
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<tr>
<td>Passerellus sandwichus beldingi</td>
<td>Belding's Savannah Sparrow</td>
<td>SE</td>
<td>x</td>
</tr>
<tr>
<td>Pelecanus occidentalis californicus</td>
<td>California brown pelican</td>
<td>FE, SE</td>
<td>x</td>
</tr>
<tr>
<td>Phalacrocorax auritis</td>
<td>double-crested cormorant</td>
<td>SSC</td>
<td></td>
</tr>
<tr>
<td>Picoides nuttallii</td>
<td>Nuttall's woodpecker</td>
<td>FBCC</td>
<td></td>
</tr>
<tr>
<td>Plegadis chihi</td>
<td>white-faced ibis</td>
<td>SSC</td>
<td></td>
</tr>
<tr>
<td>Selasphorus rufus</td>
<td>rufous hummingbird</td>
<td>FBCC</td>
<td></td>
</tr>
<tr>
<td>Selasphorus sasin</td>
<td>Allen's hummingbird</td>
<td>FBCC</td>
<td></td>
</tr>
<tr>
<td>Sterna antillarum browni</td>
<td>California least tern</td>
<td>FE, SE, SFP</td>
<td>x</td>
</tr>
<tr>
<td>Vireo bellii pusillus</td>
<td>least Bell’s vireo</td>
<td>FE, SE</td>
<td>x</td>
</tr>
<tr>
<td>Xeocoryphus exilis</td>
<td>least bittern</td>
<td>SSC</td>
<td></td>
</tr>
<tr>
<td>Xanthocephalus xanthocephalus</td>
<td>yellow-headed blackbird</td>
<td>SSC</td>
<td></td>
</tr>
</tbody>
</table>

**Mammals**

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Status</th>
<th>FE, FT, SE, ST, SFP²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antrozous pallidus</td>
<td>pallid bat</td>
<td>SSC</td>
<td></td>
</tr>
<tr>
<td>Bassariscus astutus</td>
<td>ringtail</td>
<td>SFP</td>
<td>x</td>
</tr>
</tbody>
</table>
Table 3.6.1.5.1 Special Status Species (continued)

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Status²</th>
<th>FE, FT, SE, ST, SFP³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chorionectes mexicana</td>
<td>Mexican long-tongued bat</td>
<td>SSC</td>
<td></td>
</tr>
<tr>
<td>Eumops perotis californicus</td>
<td>western mastiff bat</td>
<td>SSC</td>
<td></td>
</tr>
<tr>
<td>Lasius cinereus</td>
<td>hoary Bat</td>
<td>SSC</td>
<td></td>
</tr>
<tr>
<td>Lepus californicus bennetti</td>
<td>San Diego Black-tailed jackrabbit</td>
<td>SSC</td>
<td></td>
</tr>
<tr>
<td>Neotoma lepida intermedia</td>
<td>San Diego desert woodrat</td>
<td>SSC</td>
<td></td>
</tr>
<tr>
<td>Taxidea taxus</td>
<td>American badger</td>
<td>SSC</td>
<td></td>
</tr>
</tbody>
</table>

1. indicates species known to be or possibly extirpated (locally extinct)

2. Federal Rankings:
   - FE = Federally listed as Endangered
   - FT = Federal listed as Threatened
   - FBCC = Federal Birds of Conservation Concern

State Rankings:
   - SE = State-listed as Endangered
   - ST = State-listed as Threatened
   - SFP = State Fully Protected Species
   - SR = State Rare
   - SSA = State Special Animal
   - SSC = State Species of Special Concern
   - SWL = State Watch List Species
   - G1 or S1 = NatureServe Global or State Status Critically Imperiled Species
   - G2 or S2 = NatureServe Global or State Status Imperiled Species
   - G3 or S3 = NatureServe Global or State Status Vulnerable Species
   - G4 or S4 = NatureServe Global or State Status Apparently Secure Species
   - G5 or S5 = NatureServe Global or State Status Secure Species

Local Rankings:
   - LIS = Locally Important Species

CNPS Rankings:
   - CNPS-1B = Plants Rare, Threatened, or Endangered in California and Elsewhere
   - .1 = Seriously endangered in California (over 80% of occurrences threatened)
   - .2 = Falsely endangered in California (20–80% occurrences threatened)
   - .3 = Not very endangered in California (<20% of occurrences threatened or no current threats known)
   - CNPS-2 = Rare or endangered in California, more common elsewhere

Data source: List compiled by local biologists based upon experience, knowledge, and data sources including Cal Flora, eBird, U.C. California Fish Website, California Natural Diversity Database, CNPS inventory of Rare and Endangered Plants.

California Red-Legged Frog.
Federally Threatened, State Species of Special Concern

Photo courtesy of Chris Brown
Invasive Species

The watershed is also home to or at risk from a number of non-native species that are problematic because of their invasiveness. The term “invasive” is used for those non-native species that invade natural landscapes and establish self-sustaining populations that significantly degrade the value of native ecosystems.

Invasive plants share certain characteristics that contribute to their destructive spread across riparian habitats:

- They reproduce quickly—by producing large quantities of seed, resprouting from roots, or spreading by stem fragments.
- They often lack local competitors and predators, and may be susceptible to local diseases. Without these limitations, invasive plants can spread unchecked across a landscape, often resulting in an area dominated by a single weedy species. Some invasive plants produce chemicals that inhibit the growth of other plants. Certain species are also poisonous to humans and animals.
- They establish quickly, dominating disturbed sites before native plants have a chance to re-establish.
- They reduce biodiversity by overtaking the native plants that provide superior shelter, nest sites, and food for native animals. This disrupts and degrades the ecosystem and decreases the species richness of an area.
- They often consume considerably more water than native plants, which reduces water availability for native plants, wildlife, and people.
- They are hard to eradicate, requiring regular monitoring and treatment.

Invasive animal species also pose problems from a watershed management perspective. Potential invasion of exotic quagga and zebra mussels in Lake Casitas, for example, is a major concern because these invasive mussels would threaten the ecosystem and increase the management costs of Lake Casitas dramatically. See “3.5.4 Drinking Water Quality” for more information about this issue.

Table 3.6.1.5.2 lists some of the common invasive non-native plants and animals found in riparian and aquatic habitats in the watershed.
<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Plants</strong></td>
<td></td>
</tr>
<tr>
<td>Trees:</td>
<td></td>
</tr>
<tr>
<td>Mexican fan palm</td>
<td>Washingtonia robusta</td>
</tr>
<tr>
<td>Peruvian pepper tree</td>
<td>Schinus molle</td>
</tr>
<tr>
<td>tamarisk</td>
<td>Tamarix ramosissima</td>
</tr>
<tr>
<td>Tasmanian blue gum</td>
<td>Eucalyptus globulus var. globulus</td>
</tr>
<tr>
<td>tree of heaven</td>
<td>Ailanthus altissima</td>
</tr>
<tr>
<td>Shrubs:</td>
<td></td>
</tr>
<tr>
<td>castor bean</td>
<td>Ricinus communis</td>
</tr>
<tr>
<td>giant reed</td>
<td>Arundo donax</td>
</tr>
<tr>
<td>myoporum</td>
<td>Myoporum laetum</td>
</tr>
<tr>
<td>pampas grass</td>
<td>Cortaderia jubata</td>
</tr>
<tr>
<td>poison hemlock</td>
<td>Conium maculatum</td>
</tr>
<tr>
<td>Spanish broom</td>
<td>Spartium junceum</td>
</tr>
<tr>
<td>sweet fennel</td>
<td>Foeniculum vulgare</td>
</tr>
<tr>
<td>tree tobacco</td>
<td>Nicotiana glauca</td>
</tr>
<tr>
<td><strong>Groundcovers and Low Shrubs:</strong></td>
<td></td>
</tr>
<tr>
<td>Bermuda grass</td>
<td>Cynodon dactylon</td>
</tr>
<tr>
<td>black mustard</td>
<td>Brassica nigra</td>
</tr>
<tr>
<td>Cape ivy</td>
<td>Delairea odorata and Senecio mikanoides</td>
</tr>
<tr>
<td>common iceplant</td>
<td>Mesembryanthemum crystallinum</td>
</tr>
<tr>
<td>field mustard</td>
<td>Brassica rapa</td>
</tr>
<tr>
<td>fountain grass</td>
<td>Pennisetum setaceum</td>
</tr>
<tr>
<td>German ivy</td>
<td>Senecio mikanoides</td>
</tr>
<tr>
<td>greater periwinkle</td>
<td>Vinca major</td>
</tr>
<tr>
<td>Himalayan blackberry</td>
<td>Rubus discolor</td>
</tr>
<tr>
<td>Hottentot fig</td>
<td>Carpobrotus edulis</td>
</tr>
<tr>
<td>Italian Thistle</td>
<td>Carduus pycnocephalus</td>
</tr>
<tr>
<td>Kikuyu grass</td>
<td>Pennisetum clandestinum</td>
</tr>
<tr>
<td>perennial pepperweed</td>
<td>Lepidium latifolium</td>
</tr>
<tr>
<td>summer mustard</td>
<td>Hirschiella incana [Erucastrum incanum]</td>
</tr>
<tr>
<td>tocalote</td>
<td>Centaurea melitensis</td>
</tr>
<tr>
<td>wild radish</td>
<td>Raphanus raphanistrum</td>
</tr>
<tr>
<td><strong>Aquatic Plants:</strong></td>
<td></td>
</tr>
<tr>
<td>water primrose</td>
<td>Ludwigia spp.</td>
</tr>
</tbody>
</table>
Table 3.6.1.5.2 Riparian and Aquatic Non-Native Invasive Species (continued)

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animals</td>
<td></td>
</tr>
<tr>
<td>African clawed frog</td>
<td>Xenopus laevis</td>
</tr>
<tr>
<td>black bullhead</td>
<td>Amelurus melas</td>
</tr>
<tr>
<td>brown-headed cowbird</td>
<td>Molothrus ater</td>
</tr>
<tr>
<td>bullfrog</td>
<td>Rana catesbeiana</td>
</tr>
<tr>
<td>carp</td>
<td>Cyprinus carpio</td>
</tr>
<tr>
<td>channel catfish</td>
<td>Icterus punctatus</td>
</tr>
<tr>
<td>green sunfish</td>
<td>Lepomis cyanellus</td>
</tr>
<tr>
<td>red swamp crayfish</td>
<td>Procambarus clarkii</td>
</tr>
<tr>
<td>green sunfish</td>
<td>Lepomis cyanellus</td>
</tr>
<tr>
<td>largemouth bass</td>
<td>Micropterus salmoides</td>
</tr>
</tbody>
</table>


Bullfrog on Lion Creek. Invasive non-native predator of other frogs and wildlife.
Photo courtesy of Santa Barbara Channelkeeper

Pied-billed Grebe Eating Crayfish
Photo courtesy of Allen Bierke
**Arundo**

*Arundo donax*, or giant reed, is by far the most problematic non-native invasive plant species problem in the watershed. It is a large bamboo-like grass that can reach heights of up to 30 feet and is among the fastest growing terrestrial plants in the world—it can grow up to four inches a day in its early growth stages (CIPC 2011). *Arundo* has become established in and is spreading throughout riparian ecosystems in California.

*Arundo* can grow into massive thicketes of vegetation that cover many acres, forming monocultures that virtually eliminate all other plant species, along with the rich biodiversity, structural diversity, and wildlife habitat of riparian ecosystems. Avian and fish species are the most impacted by *Arundo* infestations, and amphibians are also highly impacted (CIPC 2011).

*Arundo donax* Below Foster Park, 2012
Photo courtesy of Santa Barbara Channelkeeper
Arundo has a thick, persistent underground stem system that looks like giant pieces of ginger. Like Bermuda grass, it grows by sending out underground vegetative shoots, called rhizomes, which readily take root and send up new stalks. Arundo spreads when pieces of cane or rhizome fragments break off, travel downstream, and take root in moist soil. The durability of these rhizomes is what makes eradication of Arundo so difficult. Arundo seeds appear to be almost always sterile in California (VCPD 2006).

Arundo consumes exceptionally large quantities of water: during the warm months, one acre of Arundo can use up to 39,000 gallons per day, three times the quantity of water used by the native streamside plants that it outcompetes. In one year, each acre infested with Arundo can consume 4.8 million gallons of water, or 3.2 million gallons more than native streamside plants (Dudley & Cole 2013). Hundreds of acres of Arundo have already been removed in the watershed, and (as of 2014) it is estimated that there are over 180 acres still infested.

Arundo is highly flammable, even when green, creating a significant fire threat to the environment and landowners. Fires also increase the dominance of Arundo in riparian ecosystems because it recovers more quickly than most native plant species after a burn (VCPD 2006).

Arundo stands have two main effects on wildfires: 1) when a wildfire burns riparian habitat containing Arundo, it burns hotter than the habitat would have without the presence of Arundo and 2) Arundo-infested riparian habitat can act as a fire conveyor across the landscape. This can increase the size of riparian fires and may spread fires to upland areas that would normally have been separated by less flammable native riparian vegetation.

—Arundo donax Distribution and Impact Report (CIPC 2011)

Arundo infestations can alter geomorphic and fluvial processes, by redirecting water against streambanks, undercutting them, and accelerating erosion that causes property damage. Large stands of Arundo have been found to functionally increase bed elevations and significantly reduce the flow capacity of streams (CIPC 2011). During floods, Arundo can also create hazards when uprooted plants clog flood control infrastructure.

Removing and managing the spread of Arundo is a watershed management priority. See "2.3.6 Arundo-Free Watershed Campaign" for more information on efforts to control Arundo.
3.6.1.6 Key Data and Information Sources/Further Reading

Below is a summary of some of key documents that address habitats and species in the watershed. See “4.3 References” for complete reference citations.

_Arundo donax_ Distribution and Impact Report (CIPC 2011)

Botanical Resources at Emma Wood State Beach and the Ventura River Estuary, California (Ferren et al. 1990)

California River Parkways Trailhead Project, Initial Study (Aspen Environmental 2010)

City of Ojai Urban Watershed Assessment and Restoration Plan (Magney 2005)

Designing Road Crossings for Safe Wildlife Passage: Ventura County Guidelines (Cavallaro et al. 2005)

Draft Ventura River Habitat Conservation Plan (Entrix & URS 2004)


Functions and Values of Wetlands (USEPA 2001)

Guide to Native and Invasive Streamside Plants: Restoring Riparian Habitats in Ventura County & along the Santa Clara River in Los Angeles County (VCPD 2006)

Habitat Restoration Options for the Lower Ventura River (Pitterle 2010)

Historical Ecology of the lower Santa Clara River, Ventura River and Oxnard Plain: an analysis of terrestrial, riverine, and coastal habitats (Beller et al. 2011)


Land Management Plan: Part 2 Los Padres National Forest Strategy (USFS 2005a)

Locally Important Animals (VCPD 2014)

Locally Important Plant List (VCPD 2014b)


Ojai Meadow Preserve Habitat Restoration and Flood Control Plan (Condor Environmental 2004)

Oak Woodlands Management Plan (VCPD 2007)
Post-treatment Vegetation Monitoring for the Matilija Dam Ecosystem Restoration Project, Giant Reed Removal Element (Hunt & Associates Biological Consulting 2009)

Preliminary Comparison of Transpirational Water Use by Arundo donax and Replacement Riparian Vegetation Types in California (Dudley & Cole 2013)

San Antonio Creek Watershed Vegetation Mapping Project (Wildscape Restoration 2008)

South Coast Missing Linkages: A Wildland Network for the South Coast Ecoregion (South Coast Wildlands 2008)

Surfers’ Point Managed Shoreline Retreat Environmental Impact Report (City of Ventura and Rincon Consultants 2003)

The Ecology of Riparian Habitats of the Southern California Coastal Region: A Community Profile (Faber et al. 1989)

Upper San Antonio Creek Watershed Giant Reed Removal Water Quality Monitoring Plan (VCWPD 2010c)

Ventura County General Plan, Resources Appendix (VCPD 2011)

Ventura County Initial Study Assessment Guidelines (VCPD 2011b)

Ventura River Delta Marine Algae Collection (Capelli 2010)

Ventura River Estuary Enhancement and Management Final Plan (Wetlands Research Associates & Philip Williams and Associates 1994)

Ventura River Multiple Species Habitat Conservation Plan, Draft, Technical Appendices (Entrix 2007)

Vertebrate Resources at Emma Wood State Beach and the Ventura River Estuary, Ventura County, California: Inventory and Management (Hunt & Lehman 1992)

Wetlands of the Central and Southern California Coast and Coastal Watersheds: A Methodology for their Classification and Description (Ferren et al. 1995)
3.6.2 Steelhead

In the Ventura River watershed, 48 miles of river and tributaries are designated as critical habitat for southern California steelhead trout (*Oncorhynchus mykiss* or *O. mykiss*), a federally listed endangered species. The presence of the endangered steelhead is a very significant concern for some stakeholders with regard to watershed management. The streamflow, pools, and associated food chain required for its survival are indicators of healthy aquatic ecosystems. Given the watershed's often dry and always variable climate, the availability of water to support that healthy aquatic ecosystem is a constant challenge and a continuing source of stakeholder controversy.

This section discusses the characteristics of the steelhead, its history, habitat needs, existing habitat conditions, and efforts to manage and recover the local population. A number of other sections of the plan address issues of importance to steelhead survival, including “3.3.1 Surface Water Hydrology,” “3.3.3 Groundwater Hydrology,” “3.5.1 Surface Water Quality,” and “3.4.3 Water Demands.”

Steelhead and Rainbow Trout. Steelhead and rainbow trout are the same species, *Oncorhynchus mykiss* (*O. mykiss*), from the salmon family. All *O. mykiss* hatch in gravel-bottomed rivers and streams. *O. mykiss* that stay in freshwater all their lives are called “resident rainbow trout,” and those that spend part of their lives in the sea are called “steelhead.” Steelhead develop a slimmer profile, become more silvery in color, and typically grow much larger than resident rainbow trout (NMFS 2014).

Drawings by Joseph Tomelleri
Southern California steelhead were listed as endangered under the federal Endangered Species Act in 1997. The Endangered Species Act (ESA) allows listing of full taxonomic species, but also named subspecies and distinct population segments (DPSs) of vertebrates. The southern California steelhead DPS or Evolutionary Significant Unit (ESU) is a subset of *O. mykiss* classified based on location and life form—in this case anadromy, or the strategy of living in the sea and migrating to fresh water to spawn.

Because of presumed evolutionary, ecological, genetic, and physiological differences from steelhead stocks in other parts of the range, the National Marine Fisheries Service (NMFS) has designated steelhead in California from the Santa Maria River south to the Mexican border as a DPS. Individuals within this DPS are referred to as southern California steelhead.

—*The History of Steelhead and Rainbow Trout (Oncorhynchus mykiss) in the Santa Ynez River Watershed, Santa Barbara County, California* (Alagona 2012)

The southern California steelhead DPS encompasses all naturally-spawned anadromous *O. mykiss* populations in watersheds from Santa Maria to Mexico. These steelhead are believed to have adapted to the southern weather patterns and inconsistent streamflow conditions of these coastal watersheds. Steelhead in southern California migrate in and out of rivers during years with sufficient river flow. Extended freshwater sequestration (or isolation) of *O. mykiss* populations in streams and rivers during dry and extended drought years is a natural phenomenon.

The Endangered Species Act requires designation of critical habitat when a species is listed as endangered or threatened. Critical habitat is a specific area that has the physical or biological features essential to conservation and recovery of the species. In 2005, NMFS designated critical habitat for steelhead in many areas, including the Ventura River watershed (NMFS 2005). Forty-eight miles of river and tributaries in the watershed are included in the designation (see Figure 3.6.1.3 Critical Habitat Map, in "3.6.1 Habitats and Species").

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**Indicators of Watershed Health**

Steelhead are often cited as an "indicator species," and this perspective is held by many watershed stakeholders. Because they are particularly sensitive to environmental degradation, steelhead are indicators of the watershed's overall ecological health. The conditions that support steelhead, such as sufficient clean streamflow, riparian vegetation, and a lack of fine sediment, also support life in other levels of the food chain and potentially other endangered species.
3.6.2.1 Life History Highlights

Steelhead have varied life histories that depend upon both freshwater and saltwater habitats. Highlights of their life history are provided below. This information was compiled from three sources: *Southern California Steelhead Recovery Plan Summary* (NMFS 2012a), *Draft Ventura River Habitat Conservation Plan* (Entrix & URS 2004), and *San Luis Obispo Creek Watershed Enhancement Plan* (Stark 2002).

Juveniles born and reared in freshwater undergo a physiological change (smoltification) that allows them to migrate to saltwater.

After maturing in the marine environment for typically one to four years, steelhead leave the marine environment to reproduce in the relatively sheltered and predator-free freshwater environment. Returning adults may migrate from several to hundreds of miles upstream to reach spawning grounds in their natal rivers or streams (streams where they were spawned). They can also spawn in non-natal streams and thus re-colonize watersheds whose populations have been extirpated (or gone extinct locally).

Steelhead typically migrate upstream when streamflows are receding after a storm and after the sandbar, present across the mouth of most southern California streams during the dry season, is breached.

Depending on rainfall, upstream migration and spawning typically occur from January to March in most southern California streams.

Once in spawning habitat, a female will excavate a nest, termed a "redd", in streambed gravels where she deposits her eggs, which a male then fertilizes. Steelhead produce more eggs per individual than typical resident rainbow trout.

*O. mykiss* Eggs, North Fork Matilija Creek, 2012

Photo courtesy of Paul Jenkins

The period between fertilization by the male and hatching varies, lasting from about three weeks to two months. Young fish emerge from the gravel two to six weeks after hatching.

During incubation, sufficient water must circulate through the interstitial space between gravels in the redd to supply embryos with oxygen and remove waste products.
Steelhead do not necessarily die after spawning and may return to the ocean, sometimes repeating their spawning migration one or more times.

In the mainstem Ventura River, steelhead can have very high growth rates, growing to smolt size during their first year, especially when higher-than-normal flow conditions are present.

Within this basic life-history pattern, there can be great variation in the timing or age at which migration to and from the ocean occurs for individual *O. mykiss*. Some may never go to the sea; some may only go as far as the estuary where conditions are similar to the sea in that productivity and growth rates are higher. This plasticity allows *O. mykiss* to take advantage of different habitats and to persist in the highly variable and challenging southern California environment.

### 3.6.2.2 Current Populations and Conditions

Steelhead habitat requirements vary and are dictated by their life stage and seasonal behavior patterns—migration, spawning, and rearing. These habitat needs and conditions in the watershed are discussed in the following sections. Since steelhead spend a portion of their lives in the ocean, oceanic factors, such as ocean water conditions, food availability/productivity (which is higher when cold water upwelling occurs), fishery harvest rates, and predation, also play a significant role in steelhead survival.

Regular fish surveys, conducted fairly consistently since 2003, are helping to create a more detailed picture of current populations of *O. mykiss* and associated habitat conditions in much of the watershed. The data show that there is considerable variation in populations from year to year depending in part on rainfall and streamflow. The survey excerpts below describe some of these findings.

The Lower North Fork of the Matilija [Creek] appeared to contain some of the best habitat for steelhead spawning and rearing within the upper basin. The majority of the channel was type B and was enclosed by riparian forest or, in Wheeler Gorge, by canyon walls. Spawning gravels were very abundant and in good condition, although there was some mineral cementation in areas. Rainbow trout were frequently observed, and several reds and spawning adults were also seen during the March survey. Potential access for steelhead was good throughout most of this reach, despite some steep cascades and falls in the lower end that were expected to be passable at higher flows.

Based on recent surveys, good quality rearing and/or spawning habitat currently occurs in Matilija Creek headwaters, North Fork Matilija and Murietta creeks, a portion of Matilija Creek downstream of Matilija Dam, Coyote and Santa Ana creeks above Casitas Dam, and portions of San Antonio Creek. Much of the mainstream Ventura River steelhead rearing habitat was of generally poor quality except in the Casitas Springs/Foster Park Reach. However, different reaches of the river offer diverse habitat conditions, and even within a given reach, habitat conditions can vary among years depending on flow conditions. The Ventura River Lagoon may also provide rearing habitat.

—Ventura River Habitat Conservation Plan - Draft (Entrix & URS 2004)

### Estimating Historical Steelhead Populations

The extent to which native steelhead were found in the watershed historically is an important question for some stakeholders, in part because it is assumed that expectations for the species' recovery are based upon natural, historical population numbers. A related question is the role that the extensive stocking of steelhead in the past has played in the genetic makeup of the fish: Are the fish that are protected today actually the native fish historically adapted to this region? All of these issues—historical populations, expectations for recovery, and the role and impact of historic stocking—are complicated and controversial topics.

The first "hard" data on historical steelhead populations in the watershed that involved an actual count of observed adult steelhead occurred in 1947 (Evans 1947).

Prior sources of information consist largely of newspaper references, estimates, and extrapolations. These often incomplete and anecdotal accounts are the sources that have been pieced together to describe the history of a species whose population is known to have large fluctuations over time and space in response to the highly variable climatic conditions.

The difficulty of estimating steelhead populations given the lack of objective data was summarized in the technical document that characterized the population of the southern California steelhead for the Southern California Steelhead Recovery Plan:

> The authors of this report are members of a Technical Recovery Team (TRT), convened to advise NMFS on technical aspects of recovery in the study area. This report has two goals: to describe the normal (reference) condition of each ESU; and to identify existing and potential populations of steelhead that could form the basis for recovery.

It should be noted at the outset, however, that these two goals are burdened with numerous uncertainties and judgment calls on the part of the authors. The uncertainty stems from several interacting factors:

1) The extremely large and heterogeneous planning area, comprising the south-west range limit for the species. Environmental heterogeneity appears to constrain the distribution of the species at a number of spatial scales, making the task of describing this distribution somewhat complex.

2) Most of the information about the species in the study area comes from anecdotal reports (descriptive in nature) or from studies conducted at restricted spatial scales (individual reaches, or at best, large sections of individual watersheds).

3) The task of delineating populations and characterizing recovery potential is largely reliant on quantitative data samples from across the planning domain. Since such information is unavailable, we are confined to the less satisfactory exercise of A) applying simplistic yet uniform methods over large spatial extents, and B) describing existing small-extent studies, and making uncertain inferences of their implications for the larger ESU. For the most part, these two approaches lack the level of quantitative description that is necessary for making concrete recommendations.

—Steelhead of the South-Central/Southern California Coast: Population Characterization for Recovery Planning (Boughton et al. 2006)
The Ven 3 [Casitas Springs "live reach"] data illustrates the high variability of *O. mykiss* distribution and abundance in this southern California basin; it reveals the potential significance of this mainstem reach in rearing juvenile steelhead (consistent with some historical data, such as Moore 1980); and it also shows the important role of San Antonio Creek for providing spawning and rearing habitat for steelhead.


In most previous years and in 2011, overall abundance was highest in the upper basin segment above Matilija Dam, intermediate in the middle basin segment between Robles Diversion Dam and Matilija Dam, and lowest in the lower basin segment. The upper basin was estimated to contain 77% of *O. mykiss* fry [under one year of age], with only 1% in the lower basin. However, several important tributaries were not included in the basin-wide estimates, namely Murieta Creek in the upper basin and San Antonio Creek in the lower basin.

—Steelhead Population Assessment in the Ventura River/Matilija Creek Basin, 2010 Data Summary (Normandeau 2011)

**Limiting Factors**

The following summary of limiting factors for steelhead was compiled from the 1997 Ventura River Steelhead Restoration and Recovery Plan (Entrix & Woodward Clyde 1997) and the 2005 City of Ojai Urban Watershed Assessment and Restoration Plan (Magney 2005). Additional descriptions of southern California steelhead habitat requirements were taken from the San Luis Obispo Creek Watershed Enhancement Plan (Stark 2002). The 2004 Draft Ventura River Habitat Conservation Plan (Entrix & URS 2004) contains a more specific description of limiting factors for each creek in the watershed and the Ventura River.

**Streamflow Variability**

Steelhead in the Ventura River watershed are dependent upon a pattern of water flows in the mainstem of the river and significant tributaries, sufficient in time and place to provide for migration, spawning, rearing, and holding habitats. Peak storm flows typically break the estuary sand bar and entice adult steelhead into the river network. Once in the river network, insufficient streamflow is a critical limiting factor to the spawning and rearing activities of steelhead. Steelhead prefer to spawn in perennial streams since one to three years is generally required for offspring to mature and reach the ocean. Intermittent reaches in the watershed often lack riparian vegetation,
A Drying Ventura River
Photo courtesy of Ojai Valley Land Conservancy

have very high temperatures (when wetted), and are generally not very productive spawning habitat.

Deficient streamflow is often a limiting factor for steelhead survival in upper San Antonio Creek and parts of its tributaries (Thacher, Reeves, and Senior Canyon Creeks), parts of Matilija Creek upstream of Matilija Dam, Coyote Creek downstream of Casitas Reservoir, Cañada Larga and Cañada del Diablo Creeks, and the upper mainstem Ventura River downstream of Robles Diversion Dam. Figure 3.6.2.2.1 illustrates the extreme variability in streamflow in the watershed.

![Annual Peak Flow Graph](image)

**Figure 3.6.2.2.1 Annual Peak Flow at Foster Park, 1933–2013 (Water Years).** Charting the highest peak flow in each water year (some years had many peaks) illustrates the variability of annual peak flows. The median annual peak flow year in the dataset (or the midpoint of the dataset) is 1936, with an annual peak flow of only 3,300 cubic feet per second (cfs). 1936 received 20.35 inches of rain in downtown Ojai (the median rainfall in Ojai is 19.20 inches). The largest annual peak flows are many orders of magnitude greater than the median.

Data Source: Ventura County Watershed Protection District's website (VCWPD 2013)
Low flow barriers have a greater effect during the dry years, not only for limiting upstream spawning steelhead, but also for limiting movements of steelhead juveniles and wild resident trout into late summer refugia habitats.


**Poor Water Quality/Elevated Water Temperature**

Steelhead require cool, clear, well-oxygenated fresh water flows for optimum growth and survival. Water temperature is a function of air temperature, stream depth, stream width, flow magnitude, overhead canopy density, and shading from surrounding terrain. Excessively warm water temperatures can retard steelhead growth, reduce rearing densities, increase susceptibility to disease, and impair the ability of young steelhead to compete with other species for food and avoid predation. Warmer water also retains less dissolved oxygen, which can stress steelhead trout and increase their vulnerability to disease.

Water quality problems that affect fish, such as high temperatures and low dissolved oxygen, are seen in many areas of the watershed when flows are low. Areas that tend to have perennial flow are the exception to this. Water quality is also adversely impacted by urban runoff.

In all of the reaches surveyed, water temperatures are likely to be higher than optimal during the summer months. Even during these May surveys, water temperatures in the afternoon ranged from 23 to 25°C.

In all of the reaches surveyed, water temperatures are likely to be higher than optimal during the summer months. Even during these May surveys, water temperatures in the afternoon ranged from 23 to 25°C. These temperatures are stressful to steelhead, and it would be difficult for steelhead to maintain growth unless substantial amounts of food were available. Fortunately, the cobble gravel substrate and predominantly run habitat in the mainstem make excellent food producing areas. Moore (1980) found that steelhead in the Ventura River near Casitas Springs had growth rates similar to or higher than those observed in other populations. This indicates that there was sufficient food production during that study to offset the high water temperatures, even during the drought years of 1976 and 1977.

—Draft Ventura River Habitat Conservation Plan (Entrix & URS 2004)

**Fish Passage Barriers**

Steelhead require unobstructed streams for migration to upper stream reaches where potential spawning and rearing habitat exists. Dams, road crossings, culverts, and other types of modifications to streams present barriers or impediments that can threaten steelhead survival by blocking
their access to inland spawning habitat. In addition to presenting physical obstructions, channel modifications can concentrate flow such that velocities are too high for fish to negotiate.

Matilija Dam completely blocks access to most of Matilija Creek and its tributaries. Casitas Dam is a complete barrier, which blocks access to Coyote and Santa Ana Creeks. Other passage barriers and impediments, both natural and manmade, exist throughout the watershed, including on Matilija Creek and its tributaries, North Fork Matilija Creek, and upper San Antonio Creek and its tributaries.
Fish passage barriers can be total barriers, partial barriers, or temporary barriers (e.g., from construction), and some barriers are only problematic at low flows. Barriers can also change over time, as storms blow out pipes or other obstructions that had acted as barriers. An on-the-ground assessment of current barriers and their priority for removal is needed in the watershed. Based on existing information, the barriers listed in Table 3.6.2.2.1 were identified by a Ventura River Watershed Council technical advisory committee as priorities for removal or mitigation in the watershed.

Table 3.6.2.2.1 Priority Barriers to Fish Passage

<table>
<thead>
<tr>
<th>Subwatershed</th>
<th>Barrier Location</th>
<th>Barrier Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matilija Creek</td>
<td>Matilija Dam</td>
<td>Total</td>
</tr>
<tr>
<td>Matilija Creek</td>
<td>USGS Gauge Weir</td>
<td>Partial</td>
</tr>
<tr>
<td>North Fork Matilija Creek</td>
<td>Lower Wheeler Campground crossing</td>
<td>Total</td>
</tr>
<tr>
<td>North Fork Matilija Creek</td>
<td>Upper Wheeler Campground crossing</td>
<td>Partial</td>
</tr>
<tr>
<td>North Fork Matilija Creek</td>
<td>Bear Creek, Lower Wheeler Campground crossing</td>
<td>Partial</td>
</tr>
<tr>
<td>North Fork Matilija Creek</td>
<td>Bear Creek, Upper Wheeler Campground crossing</td>
<td>Partial</td>
</tr>
<tr>
<td>North Fork Matilija Creek</td>
<td>Ojai Quarry</td>
<td>Partial</td>
</tr>
<tr>
<td>San Antonio Creek</td>
<td>Camp Comfort bridge apron</td>
<td>Partial</td>
</tr>
<tr>
<td>San Antonio Creek</td>
<td>Fraser St. crossing</td>
<td>Partial</td>
</tr>
<tr>
<td>Coyote Creek</td>
<td>Casitas Dam2</td>
<td>Total</td>
</tr>
</tbody>
</table>

1. This is only a partial list intended to highlight known barriers that are a priority for removal. Many other partial barriers exist. A formal on-the-ground assessment of current barriers in the watershed is needed.

2. It is not expected that Casitas Dam will be removed, however NMFS would like this barrier mitigated to allow for fish passage.
**Figure 3.6.2.2.2 Priority Barriers to Fish Passage Map**

<table>
<thead>
<tr>
<th>ID#</th>
<th>Stream &amp; Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Coyote Creek, Casitas Dam*</td>
</tr>
<tr>
<td>2</td>
<td>San Antonio Creek, Fraser Street</td>
</tr>
<tr>
<td>3</td>
<td>San Antonio Creek, Camp Comfort</td>
</tr>
<tr>
<td>4</td>
<td>Matilla Creek, USGS Gauge Weir</td>
</tr>
<tr>
<td>5</td>
<td>Matilla Creek, Matilla Dam</td>
</tr>
<tr>
<td>6</td>
<td>North Fork Matilla Creek, Oljai Quarry</td>
</tr>
<tr>
<td>7</td>
<td>North Fork Matilla Creek, Lower Wheeler Campground Crossing</td>
</tr>
<tr>
<td>8</td>
<td>Bear Creek, Upper Wheeler Campground Crossing</td>
</tr>
<tr>
<td>9</td>
<td>Bear Creek, Lower Wheeler Campground Crossing</td>
</tr>
<tr>
<td>10</td>
<td>North Fork Matilla Creek, Upper Wheeler Campground Crossing</td>
</tr>
</tbody>
</table>

*Points indicate partial fish passage barriers, based on the preliminary estimate of local experts. Many other partial barriers exist. A formal on-the-ground assessment of barriers is needed.

Points indicate full fish passage barriers.

Data Source:
California Fish Passage Association
Database (PAD), Spring 2014
Map Created by Hyperion Network
Using ESRI ArcGIS, 2001
www.hyperion.org
Matilija Dam

Matilija Dam is the watershed’s most significant fish passage barrier because it blocks access to a large area of primary spawning and rearing habitat in the upper reaches of Matilija Creek and its tributaries (USACE 2004). The dam is located one-half mile above the Matilija Creek/North Fork Matilija Creek confluence, which is also the beginning of the Ventura River. Dam removal efforts started in the 1990s and continue today. Removing the dam is considered the highest priority issue for steelhead recovery in the watershed in the long term. The major effort to remove the dam, which also addresses sediment transport issues, is addressed in a separate section, “3.6.3 Matilija Dam.”
Since its construction in 1947, Matilija Dam has blocked Ventura River adult steelhead access to roughly 13 miles of this watershed’s most valuable steelhead spawning and rearing habitat (NMFS 2003). Dam removal would restore access to this vital habitat.

**Robles Diversion**

The Robles Diversion was built on the Ventura River in 1958 to divert water to the Lake Casitas reservoir. The diversion was initially constructed without provisions for passage of fish migrating upstream or downstream. Without fish passage, the Robles Diversion cut off approximately eight miles of prime steelhead spawning and rearing habitat, and reduced flows in the lower 14 miles of the Ventura River (NMFS 2003a).

The Robles Fish Passage Facility was completed in 2006 to reestablish access to upstream steelhead spawning and rearing habitat. The project was designed to provide an accessible route over the Robles Diversion and restore a portion of the flows necessary for fish to reach the Robles Fish Passage Facility. The Fish Passage Facility also allows passage of juvenile steelhead migrating downstream to pass to the ocean.

Additionally, requirements to allow a minimum amount of water to bypass the facility during steelhead spawning and migration season (January through June) may improve spawning and rearing habitat in the lower mainstem of the Ventura River (NMFS 2003a).

The cost to build the Fish Passage Facility was $8.1 million (Lewis 2014).
Robles Fish Passage Facility Ladder. The Robles fish ladder (vertical slot design) works well in systems with variable flows and high levels of debris. Principal components include: 1) boulders arranged to create a series of pools to improve passage over the road crossing/flow measurement gauge; 2) a vertical slot fish ladder to provide fish passage over a 15-foot elevation change; 3) an auxiliary water supply pipeline to provide additional fish ladder “attraction water” and to supplement downstream release flow; 4) a fish counting device to determine number of fish migrating through the fish ladder; 5) a fish screen to prevent upstream and downstream migrants from entering the diversion canal; 6) a guidance device and high flow fish channel exiting upstream of the facility to prevent upstream migrant fallback through the spillway gates (NMFS 2003a; Lewis 2014).

Photo courtesy of Casitas Municipal Water District

The Robles Fish Passage Facility operates when there is sufficient natural streamflow to allow migration of fish upriver from the ocean past the Robles Diversion Dam, and downstream to the Ventura River estuary. The number of days each year that the facility operates depends upon the timing and duration of winter storms (NMFS 2003a).
Lack of Deep Pools

Steelhead rely on a diverse assemblage of instream habitats: pools, runs, riffles, and flatwater. The distribution of these habitats, their quality, ease of access, and degree of shelter determine the health of instream habitat. Deep pools are important because they provide cover for fish to avoid predation.

Juvenile steelhead generally prefer to inhabit riffles and pools, and as stated above, pool size is also important to steelhead for jumping over barriers. Large woody debris, large cobble or boulders, and geomorphic features help support instream pools.

Deep water (greater than half of the vertical jump) is necessary to gain the leaping momentum. Resting pools are necessary in long sections of high velocity flows. During low flows, boulder cascades, bedrock slides, and low gradient riffles may become barriers to upstream fish movement. Steelhead may become stranded on their upstream migration if flows rapidly decline. The presence of good deep pools is essential during this period, as fish may need to wait out the period between storms.


Lack of pool habitat limits steelhead rearing potential in parts of the watershed, such as portions of San Antonio Creek.

Lack of Spawning Substrate

Adult steelhead have been reported to spawn in substrates from 0.2 to 4.0 inches in diameter. Steelhead utilize mostly gravel-sized material for spawning; however, they will also use mixtures of sand-gravel and gravel-cobble. The gravel must be highly permeable to keep incubating eggs well oxygenated, and should contain < 5% sand and silt. Creek reaches that contain no gravel or cobbles, or that contain gravels or cobbles embedded with silt or sand, are a limiting factor for steelhead spawning.

A factor that limits spawning substrate in the watershed is the tendency of substrate materials in some areas to become cemented together, at least temporarily, by mineral deposits (calcification).

The surfaces of gravel, cobbles, and boulders were physically gritty due to the deposits, which effectively "cemented" the particles together. These deposits appeared to significantly reduce substrate quality for spawning, and benthic invertebrate production appeared to be very low. However, it is unknown to what degree
these depositions are removed or if gravels are significantly loosened during winter and spring high-flow events. Several gravel deposits were revisited in April following the March 15th storm event, but such deposits showed little evidence of becoming significantly loosened following that event.


Cemented Gravels, North Fork Matilija Creek. Calcification cements gravels together and limits the availability of gravels needed for fish spawning.

Photo courtesy of California Department of Fish and Wildlife
Steelhead Vocabulary

**Anadromous** – Anadromous fish are born in fresh water, migrate to the ocean to grow into adults, and then return to fresh water to spawn.

**DPS or Distinct Population Segment** – An ecologically discrete subset of *O. mykiss*. A population segment is considered distinct if it is discrete from and significant to the remainder of its species based on factors such as physical, behavioral, or genetic characteristics; or if it occupies an unusual or unique ecological setting; or if its loss would represent a significant gap in the species’ range. A DPS is the smallest division of a taxonomic species that can be protected under the U.S. Endangered Species Act.

**ESU or Evolutionary Significant Unit** – A population (or group of populations) which exhibits two biological characteristics: 1) it is substantially reproductively isolated from other conspecific (of the same taxonomic species) population units; and 2) it represents an important component of the evolutionary legacy of the species.

**Fry** – Refers to fish in their first year of life (e.g., from spring emergence until the following spring).

**Migration Season** – January through June. Most smolts will emigrate between February and June.

**Redd** – The nest constructed by steelhead. Fertilized eggs are deposited in an excavated depression and covered by gravel.

**Resident Rainbow Trout** – *O. mykiss* that remain in freshwater throughout their life.

**Smolt** – Juvenile *O. mykiss* that is physiologically adapted to seawater and emigrates to the ocean.

**Steelhead** – *O. mykiss* that rears to maturity in the ocean before entering freshwater to spawn.

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**Lack of Riparian Vegetation and Shade**

Riparian vegetation is a vital factor for steelhead habitat. Riparian buffers reduce flood water velocity, sort sediment loads for creation of spawning habitats, and mitigate contaminants associated with nearby roads and agricultural, industrial, and residential activities. Riparian vegetation also stabilizes channel banks, thereby reducing erosion and preventing excessive sedimentation into the creeks. The overhead canopy provided by mature riparian trees maintains cooler water temperatures and serves as a source of woody debris that contributes to pool and instream cover habitat formation. In addition, leaf litter from trees is an important input into the stream that supports the aquatic food chain. The roots of these trees can also contribute to other instream shelter types such as undercut banks. Robust canopy may also reduce algal blooms that can cause dissolved oxygen depletion in creek waters by reducing solar exposure.
Shade reduces heating of water. As temperatures rise, fish experience increasing difficulty extracting oxygen from water, while at the same time the amount of oxygen in the water decreases.

Lack of riparian vegetation adjacent to low flow channel limits steelhead rearing potential in parts of the watershed, especially along intermittent reaches.

**Excessive Sediment**

Over the long term, sediment settles and fills the spaces between streambed gravels and rocks, spoiling fish spawning habitat by reducing oxygen-rich water flow to trout eggs that are buried in the gravel beds. Accumulated sediment also reduces the habitat required by smaller organisms (aquatic insects), which are a vital source of food for fish.

Streambank stability is very important for minimizing excess sedimentation. Excess sediment from eroding streambanks accumulates in the stream channel downstream of erosion sources and increases the instability of the channel system. The accumulated sediment can divert water into adjacent banks and create new areas of erosion.

Excess fine sediments severely limit steelhead spawning and juvenile rearing in Coyote Creek downstream of Casitas Reservoir, Cañada Larga Creek, and Cañada del Diablo Creek. Fine sediments are also a problem in upper Matilija Canyon, in the Ventura River just below North Fork Matilija Creek, and in parts of the Ventura River mainstem. Ground disturbing activities and dirt roads can be sources of fine sediment during rain events. Fine sediments are also attributable to natural causes.

**Lack of Instream Cover**

Instream cover is composed of elements within a stream channel that provide fish with protection from predation, reduce water velocities so as to provide resting and feeding areas, and reduce competition through increased living space and visual isolation within the stream. Instream cover includes objects under water that provide shade and resting areas, such as over-hanging vegetation, submerged cobbles and boulders, logs, root wads, submerged vegetation, and undercut banks. Lack of riparian vegetation is the primary factor contributing to a lack of instream cover.

**Current Populations**

Determining how many steelhead are spawning under existing conditions in the Ventura River watershed is fraught with challenges. Until a steelhead reaches a large adult size, it is not easy to distinguish it from a resident rainbow trout just by sight. The flexibility that the species exhibits in terms of which life form it takes on (residency or anadromy)
presents another challenge. For example, fish that have clearly started to smolt (undergo changes necessary to go to sea) can reverse that physiological process if conditions warrant it—they can revert to being a resident. Fish also move around, making definitive counts challenging. Fish radio-tagged by Casitas Municipal Water District (CMWD) staff have been tracked moving downstream and back upstream through the Robles Fish Passage Facility. This has occurred with other radio-tagged smolts in lower portions of the Ventura River.

25-Inch Steelhead at Shell Road Bridge, 2007
Photo courtesy of Mark Capelli

The present number of adult steelhead returning annually to spawn is difficult to determine, in part because there are so few fish, but the present run of steelhead is probably less than 100 fish annually.

—Robles Fish Passage Facilities Biological Opinion, Q & A (NMFS 2003a)

Annual Watershed-Wide Survey Data

Annual *O. mykiss* distribution and abundance surveys have been conducted in the watershed by Normandeau Associates since 2006. “3.6.2.5 Current Steelhead Surveys and Monitoring” describes this program in more detail. The combined data from these surveys over time (Tables 3.6.2.2.2 and 3.6.2.2.3) provide a good description of fry, juvenile, and adult *O. mykiss* abundance in the Ventura River watershed, including the dramatic range of population abundance, reflective of the highly variable flow characteristics in the watershed.
Table 3.6.2.2.2  *O. mykiss* Abundance Data by Study Site, 2006 to 2012

<table>
<thead>
<tr>
<th>Zone</th>
<th>Study Segment</th>
<th>Study Site</th>
<th>Years of Data</th>
<th>Flow (Avg.)</th>
<th># <em>O. mykiss</em> &lt;10 cm</th>
<th># <em>O. mykiss</em> ≥10 cm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mile</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>Lower Anadromous</td>
<td></td>
<td>Ventura River (101 Bridge)</td>
<td>6</td>
<td>0.96</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ventura River (Shell Rd.)</td>
<td>6</td>
<td>1.00</td>
<td>0</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Below Robles</td>
<td>Ventura River (Casitas Springs)</td>
<td>7</td>
<td>0.90</td>
<td>0</td>
<td>843</td>
</tr>
<tr>
<td></td>
<td>Diverion Dam</td>
<td>San Antonio Creek (mid)</td>
<td>5</td>
<td>0.40</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>San Antonio Creek (up)</td>
<td>3</td>
<td>0.48</td>
<td>6</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ventura River (Preserve)</td>
<td>3</td>
<td>0.55</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Middle Anadromous</td>
<td>Between dams</td>
<td>Ventura River (Camino Cielo Rd.)</td>
<td>7</td>
<td>0.51</td>
<td>119</td>
<td>207</td>
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<tr>
<td></td>
<td></td>
<td>North Fork Matilija Creek (low)</td>
<td>7</td>
<td>0.41</td>
<td>70</td>
<td>410</td>
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<tr>
<td></td>
<td></td>
<td>North Fork Matilija Creek (mid)</td>
<td>7</td>
<td>0.41</td>
<td>133</td>
<td>847</td>
</tr>
<tr>
<td>Upper Resident</td>
<td>Above Matilija Dam</td>
<td>Matilija Creek (low)</td>
<td>6</td>
<td>0.50</td>
<td>7.3</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Matilija Creek (mid)</td>
<td>6</td>
<td>0.44</td>
<td>4.9</td>
<td>92</td>
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<td>Matilija Creek (up)</td>
<td>5</td>
<td>0.44</td>
<td>3.4</td>
<td>118</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Upper North Fork Matilija Creek</td>
<td>6</td>
<td>0.50</td>
<td>1.3</td>
<td>186</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Murrieta Creek</td>
<td>1</td>
<td>0.45</td>
<td>0.5</td>
<td>340</td>
</tr>
</tbody>
</table>

1. Zones are distinct areas that support either the anadromous or resident life form of *O. mykiss*.

Data for each study site include both minimum and maximum estimates of fish abundance over the number of years studied. The number of observed/captured fish within each study site is extrapolated to produce an estimate for the entire length of the study site.

Source: Normandeau 2014

Table 3.6.2.2.3  *O. mykiss* Abundance Data by Study Segment and Year, 2006 to 2012

<table>
<thead>
<tr>
<th>Abundance Estimates</th>
<th>Year</th>
<th>Lower Fry &lt;10 cm</th>
<th>Middle Fry &lt;10 cm</th>
<th>Upper Fry &lt;10 cm</th>
<th>Lower Upper Fry</th>
<th>Middle Upper Fry</th>
<th>Upper Upper Fry</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td># Fry &lt;10 cm</td>
<td># Fry &lt;10 cm</td>
<td># Fry &lt;10 cm</td>
<td># Fry Upper</td>
<td># Fry Middle</td>
<td># Fry Upper</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>5</td>
<td>1,759</td>
<td>3,878</td>
<td>22</td>
<td>2,269</td>
<td>4,703</td>
<td>12,636</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>0</td>
<td>4,250</td>
<td>6,294</td>
<td>11</td>
<td>524</td>
<td>1,192</td>
<td>12,271</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>326</td>
<td>2,413</td>
<td>5,003</td>
<td>3,739</td>
<td>3,555</td>
<td>2,641</td>
<td>17,677</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>0</td>
<td>3,867</td>
<td>n/a</td>
<td>494</td>
<td>1,415</td>
<td>n/a</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>709</td>
<td>3,357</td>
<td>4,428</td>
<td>1,328</td>
<td>2,240</td>
<td>2,785</td>
<td>14,847</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>16</td>
<td>1,522</td>
<td>5,263</td>
<td>1,639</td>
<td>1,942</td>
<td>3,435</td>
<td>13,817</td>
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<tr>
<td>2012</td>
<td>2,348</td>
<td>6,637</td>
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<td>967</td>
<td>1,149</td>
<td>3,000</td>
<td>24,134</td>
<td></td>
</tr>
</tbody>
</table>

Data represent annual abundance estimates extrapolated for each entire study segment (upper, lower, or middle), not just the representative study sites shown in Table 3.6.2.2.2. San Antonio and Murrieta creeks were not included because they had fewer years of data.

Source: Normandeau 2014
Robles Fish Passage Facility Data

The Robles Fish Passage Facility includes equipment to count the fish passing through the facility. Since 2006, when the facility first became operational, this equipment has been modified to improve its effectiveness at detecting fish. Counting fish with automated equipment will always have limitations; however, so snorkeling or bank surveys are conducted in the area above and below the Robles Fish Passage Facility every week during the migration season. The snorkel count data are as important as count data from the facility in providing indices of relative abundance of *O. mykiss* upstream and downstream of the facility. Tables 3.6.2.2.4 and 3.6.2.2.5 summarize CMWD’s fish count data since 2006, as well as the important limitations of these data.

**Table 3.6.2.2.4 O. mykiss Observations at Robles Fish Passage Facility**

<table>
<thead>
<tr>
<th>Year</th>
<th>Adults Counted in Fish Detector¹</th>
<th>Fish Counted via Snorkeling and Bank Surveys²</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2007</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>2008</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>2009</td>
<td>0</td>
<td>131</td>
</tr>
<tr>
<td>2010</td>
<td>1</td>
<td>30</td>
</tr>
<tr>
<td>2011</td>
<td>0</td>
<td>94</td>
</tr>
<tr>
<td>2012</td>
<td>0</td>
<td>36</td>
</tr>
<tr>
<td>2013</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>2014</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
<td>326</td>
</tr>
</tbody>
</table>

1. Numbers represent only the fish that swam through the detector pictured on page 80.
2. Fish (adult and juvenile) counted above and below the Robles Fish Passage Facility via snorkeling or streambank surveys conducted weekly during the fish migration season. The peak data represent the weekly count that was highest during the period. These one-day counts avoid double counting fish that may meander back and forth.

Data Source: Lewis 2014

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**Fish Detection Equipment Limitations**

The fish detecting equipment at the Robles Fish Passage Facility has limitations that are important to understand.

- Fish detection equipment is generally designed for larger fish and larger flows. The operators of the Robles facility have had to make modifications over the years as they have learned about these limitations. The equipment now has much better detection efficiencies.
- It appears that the equipment still underestimates the number of smaller fish. The larger the fish the better the detection efficiency.
- Two pieces of information collected by the detector, a silhouette captured by a scanner plate and a video clip, are used to confirm that an object passing through is an *O. mykiss*. If conditions are turbid, the video is often unusable and the object cannot be confirmed.
- Once a data validation and calibration analysis that takes into account the above limitations has been done on the existing data, the operators of the Robles Facility may be able to adjust earlier data such that year-to-year comparisons can be made. Until then, year-to-year comparisons of the data in Table 3.6.2.2.5 provide only relative abundance information.
Table 3.6.2.2.5 Total Annual O. mykiss Detections in Robles Fish Ladder

<table>
<thead>
<tr>
<th>Year</th>
<th>Upstream</th>
<th>Downstream</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006¹</td>
<td>14</td>
<td>19</td>
<td>33</td>
</tr>
<tr>
<td>2007¹</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2008²</td>
<td>112</td>
<td>94</td>
<td>206</td>
</tr>
<tr>
<td>2009²</td>
<td>84</td>
<td>84</td>
<td>168</td>
</tr>
<tr>
<td>2010³</td>
<td>54</td>
<td>40</td>
<td>94</td>
</tr>
<tr>
<td>2011³</td>
<td>101</td>
<td>49</td>
<td>150</td>
</tr>
<tr>
<td>2012³</td>
<td>366</td>
<td>263</td>
<td>659</td>
</tr>
<tr>
<td>2013³</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2014³</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

1. Detections by the original crowder (fish detector) operational at flows >35 cfs with no downstream camera, including probable but unconfirmed O. mykiss. 
2. Detections by new crowder operational at all flows with limited downstream camera, including probable but unconfirmed O. mykiss. 
3. Detections by crowder operational at all flow with functional downstream camera, including only confirmed O. mykiss.

Data Source: Lewis 2014. All data are provisional.

3.6.2.3 Recovery and Management

Federal and state agencies and local nonprofits are actively involved in efforts to recover a viable population of steelhead in the watershed. These efforts include monitoring and studying fish abundance and distribution (described above), prioritizing efforts in recovery plans, improving the condition of existing fish habitat, expanding habitat through stream restoration and barrier removal, protecting land through acquisition, and educating the public about the importance of protecting this endangered species.

Recovery Plans

The Southern Steelhead Recovery Plan, released in 2012, is the current operating recovery plan for steelhead in the watershed. This section provides details on this plan and briefly describes several prior efforts to develop recovery plans, as well as a recovery plan focused on the stream reaches that drain through the City of Ojai.

2012 Southern Steelhead Recovery Plan

The federal Endangered Species Act directs the NMFS to develop and implement recovery plans for threatened and endangered species. Recovery plans identify actions necessary for the protection and recovery of listed species based upon the best scientific and commercial data available. NMFS's recovery plans are considered guidance documents, not regulatory documents.
Southern California Steelhead Recovery Planning Area

“The Southern California Steelhead (SCS) Recovery Planning Area extends from the Santa Maria River to the Tijuana River at the U.S.-Mexico border. It includes both those portions of coastal watersheds that are at least seasonally accessible to steelhead entering from the ocean, and the upstream portions of watersheds that are currently inaccessible to steelhead due to man-made barriers but were historically used by steelhead. Major steelhead watersheds in the northern portion of the SCS Recovery Planning Area include the Santa Maria, Santa Ynez, Ventura, and Santa Clara Rivers, and Malibu and Topanga Creeks. Major steelhead watersheds in the southern portion of the SCS Recovery Planning Area include the San Gabriel, Santa Margarita, San Luis Rey, San Dieguito, and Sweetwater Rivers, and San Juan and San Mateo Creeks.

“The Southern California Steelhead DPS encompasses all naturally-spawned anadromous O. mykiss between the Santa Maria River (inclusive) and the U.S.-Mexico border, whose freshwater habitat occurs below artificial or natural impassible upstream barriers, as well as O. mykiss residing above impassible barriers that are able to emigrate into waters below barriers and exhibit an anadromous life-history.

“The SCS Recovery Planning Area is divided into five biogeographic population groups (BPGs): Monte Arido Highlands, Conception Coast, Santa Monica Mountains, Mojave Rim and Santa Catalina Gulf Coast. Each BPG is characterized by a unique combination of physical and ecological characteristics that present differing natural selective regimes for steelhead populations utilizing the individual watersheds.

“The separate watersheds comprising each BPG are generally considered to support individual O. mykiss populations (i.e., one watershed = one steelhead population). Thus, single BPGs encompass multiple watersheds and multiple O. mykiss populations.”

—Southern California Steelhead Recovery Plan Summary (NMFS 2012a)

Figure 3.6.2.3.1 Steelhead Recovery Planning Area Map, Southern California Coast. The Ventura River watershed is in the Recovery Plan’s Monte Arido Highlands biogeographic population group.
The Ventura River watershed is one of the major steelhead watersheds in the SCS Recovery Planning Area, and Ventura River steelhead are considered a "Core I" population—the highest priority for recovery actions.

Recovery is defined by NMFS as "the process by which listed species and their ecosystems are restored and their future is safeguarded to the point that protections under the Endangered Species Act are no longer needed" (NMFS 2012). Such restoration first requires a description of the normal condition to which the species is to be restored (Boughton et al. 2006). Attempts to quantify historical or existing populations of steelhead are fraught with uncertainties and lack of reliable, quantitative data. Thus, the recovery goals in recovery plans are based not on historic steelhead run sizes, but upon conceptual models that develop viability criteria applicable across the region. As the technical advisors to the SCS Recovery Plan stated: "The task of delineating populations and characterizing recovery potential is largely reliant on quantitative data samples from across the planning domain. Since such information is unavailable, we are confined to the less satisfactory exercise of A) applying simplistic yet uniform methods over large spatial extents, and B) describing existing small-extent studies, and making uncertain inferences of their implications for the larger ESU" (Boughton et al. 2006).

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**Definition: Viable Population**

A viable population is defined as a population having a negligible risk (< 5%) of extinction due to threats from demographic variation, natural environmental variation, and genetic diversity changes over a 100-year time frame. A viable DPS is comprised of a sufficient number of viable populations spatially dispersed, but proximate enough to maintain long-term (1,000-year) persistence and evolutionary potential (McElhany et al. 2000). The viability criteria are intended to describe characteristics of the species, within its natural environment, necessary for both individual populations and the DPS as a whole to be viable, i.e., persist over a specific period of time, regardless of other ongoing effects caused by human actions (NMFS 2012).

The difference in the time-frames considered for individual populations vs. the DPS as a whole reflects the recognition that individual populations may periodically, but temporarily, go extinct within the longer, 1,000-year time-frame; however, the populations are re-established through natural processes (re-colonization through dispersal from other watersheds, or from native, non-anadromous _O. mykiss_ producing progeny that assume an anadromous life-history in sufficient numbers) to re-initiate an anadromous run in the extirpated watershed (Capelli 2014).
Priority Recovery Actions

Priority recovery actions identified in the SCS Recovery Plan for the Monte Arido Highlands Biogeographic Population Group, and applicable to the Ventura River watershed, are summarized below (NMFS 2012a).

- Develop and implement operating criteria to ensure the pattern and magnitude of water releases from dams, including Casitas, Matilija, and Robles Diversion dams, provide the essential habitat functions to support the life-history and habitat requirements of adult and juvenile *O. mykiss*.

- Develop and implement plans to physically modify Casitas, Matilija, and Robles Diversion dams to allow natural rates of adult and juvenile *O. mykiss* migration between the estuary and upstream spawning and rearing habitats, and passage of smolts and kelts downstream to the estuary and ocean.

- Develop and implement a groundwater monitoring program to guide management of groundwater extractions within steelhead-bearing watersheds to ensure surface flows provide essential support for all *O. mykiss* life-history stages, including adult and juvenile *O. mykiss* migration, spawning, incubation, and rearing.

- Develop and implement restoration and management plans for the estuaries associated with steelhead-bearing watersheds. To the maximum extent feasible, planned actions should restore the physical configuration, size, and diversity of the wetland habitats, eliminate exotic species, control artificial breaching of the sand bar, and establish effective buffers to restore estuarine functions and promote *O. mykiss* use (including rearing and acclimation) of the estuaries.

Other Recovery Plans

1997 Ventura River Steelhead Restoration and Recovery Plan

In 1997, a Ventura River Steelhead Restoration and Recovery Plan (Entrix & Woodward Clyde 1997) was prepared on behalf of 10 different agencies with water supply, flood control, or public works responsibilities in the watershed. These agencies included Casitas Municipal Water District, City of San Buenaventura, Ventura County Flood Control District, Ventura County Transportation Department, Ventura County Solid Waste Management Department, Ojai Valley Sanitary District, Ventura River County Water District, Ojai Basin Ground Water Management Agency, Meiners Oaks County Water Districts, and Southern California Water Company. The plan was intended to assist the agencies in addressing steelhead issues and possible permitting requirements.

Several of the restoration and enhancement measures identified in the plan are now being implemented by the agencies. Much of the
information developed for this plan was incorporated into the 2004 Draft Habitat Conservation Plan discussed next.

**2004 Draft Habitat Conservation Plan**

Habitat Conservation Plans (HCPs) are planning documents required as part of an application for an “incidental take” permit under section 10 of the federal Endangered Species Act. HCPs describe the anticipated effects of the proposed taking and how those impacts will be minimized or mitigated.

**Definition: Take**

“Take” is defined in the Endangered Species Act as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect any threatened or endangered species. Incidental take permits authorize the incidental take (i.e., take that occurs incidentally during an otherwise lawful activity) of a listed species, such as steelhead.

In 2004, a draft HCP (Entrix & URS 2004) was prepared on behalf of 11 different cooperating agencies that operate or maintain facilities that could affect listed species or their habitats in the Ventura River watershed. These 11 agencies included: Casitas Municipal Water District, City of San Buenaventura, Meiners Oaks Water District, Ojai Basin Ground Water Management Agency, Ojai Valley Sanitary District, Southern California Water Company, Ventura County Environmental and Energy Resources Department, Ventura County Parks Department, Ventura County Transportation Department, Ventura County Watershed Protection District, and Ventura River County Water District.

The preparation of the HCP was to serve as the basis for an incidental take permit. The agencies anticipated that together the HCP and take permit would outline the limits within which they could continue to provide their services to the community in the watershed (Entrix & URS 2004). The 2004 draft HCP provides an extensive assessment of many different aspects of the Ventura River watershed. However, the HCP process was never completed. A series of factors caused the project to stall: key staff moved on, CMWD received and needed to respond to a separate Biological Opinion related to steelhead, and there were challenges working out the plan details with regulators (Karen Waln, 2014).

Eleven different agencies within the Ventura River watershed were previously involved in a HCP planning process to address adverse environmental impacts to native species listed within the Federal Endangered Species Act (FESA). The HCP was to include individual environmental impact analyses for each of the eleven member agencies that would determine what mitigation efforts
and associated funding (as required per future Federal and State legislature), would be required by each entity.

The HCP has not progressed further than a 2004 Draft Report and was never released to the public.

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

2005 City of Ojai Urban Watershed Assessment and Restoration Plan

In 2005, the City of Ojai prepared a comprehensive assessment and restoration plan focused on steelhead habitat for the subwatersheds that drain through the city limits. The document provides a detailed characterization of streams, habitat conditions, and limiting factors, and identifies actions that can be taken to restore and enhance steelhead habitat conditions.

Provision of Water

Because steelhead are an endangered species, regulators have certain authorities to require that their needs be provided for, including the provision of water.

Any project in the watershed that requires a federal permit or involves federal funding has a “federal nexus,” which grants NMFS the authority to place conditions on the project on behalf of steelhead. The Robles Diversion Facility is an example of a facility that has been so conditioned.

The need to provide water for steelhead has also been addressed in water quality regulations, which are structured to protect “beneficial uses” of state waters—the use of water by fish is considered a protected beneficial use.

Two reaches of the Ventura River—stretching from Camino Cielo Road below Matilija Dam to the river’s confluence with Weldon Canyon, just north of Cañada Larga Creek—are on the Clean Water Act’s 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 steelhead.

Regulators administering water rights in the state are also charged with protecting water as a “public trust” resource, and protecting the environment is included in this mandate.

On a case-by-case basis, water projects in the watershed have been required to reduce the amount of water withdrawn in order to provide for steelhead. See the discussion of “environmental water” in “3.4.3 Water Demands” for more details.
Removal of Barriers

A number of partial fish passage barriers have been removed in recent years.

- In 2006, the Robles Fish Passage Facility (described previously in this section) was completed to reestablish access to upstream steelhead habitat by providing access over the Robles Diversion Facility and restoring a portion of the flows necessary for fish to reach the Robles Fish Passage Facility.

- In 2010, a “fair weather crossing” (a road crossing that allows a waterway to run over a road) on Lion Canyon Creek, a major tributary of San Antonio Creek, was replaced with a bridge. This improved steelhead access to over nine miles of upstream habitat.

- In 2012, a bridge for pedestrians and bicyclists using the Ojai Valley Bike Trail was installed at the very end of San Antonio Creek, just before it merges with the Ventura River. The bridge replaced an old concrete crossing over some box culverts that frequently became plugged with woody debris during storms.

- In 2012, a fair weather crossing in lower San Antonio Creek at Old Creek Road was replaced with a multi-span bridge.

- In 2013, a clear span bridge was constructed on San Antonio Creek near the confluence with Stewart Canyon Creek, just south of the City of Ojai. The bridge replaced a fair weather crossing on private property.

The last four barrier removals are illustrated in “2.3.7 Healthy San Antonio Creek Campaign.”

A major effort to remove Matilija Dam, which also addresses sediment transport issues, has been underway since the 1990s and is addressed in a separate section, “3.6.3 Matilija Dam.”

Protection of Land

In addition to the considerable lands already protected by government agencies, the watershed is fortunate to have two land conservancies that continue to actively purchase and accept donations of land for protection in and adjacent to the Ventura River. Lands owned by these conservancies are held for conservation in perpetuity.

The Ojai Valley Land Conservancy (OVLC) owns four preserves on the Ventura River that together comprise 737 acres in the river or its floodplain and span a total of four miles of the river. Three of their preserves—the Steelhead Preserve, the Confluence Preserve, and the Rio Vista Preserve—are located around the river’s confluence with San Antonio Creek, one of the most consistently wet locations on the river and very important habitat for steelhead. OVLC also owns a preserve near Camp Comfort on San Antonio Creek, another key location for steelhead.
Two preserves owned by the Ventura Hillsides Conservancy—the Willoughby Preserve and Big Rock Preserve—are located in the lower Ventura River or its floodplain. These preserves together comprise 25 acres.

**Habitat Restoration**

Removal of the invasive plant *Arundo donax*, revegetation of streambanks, and removal of passage barriers (discussed previously in this section) are the primary steelhead habitat restoration efforts that have been implemented in the watershed. *Arundo*, or giant reed, limits steelhead habitat potential by reducing available surface water and thereby displacing beneficial native streamside vegetation and wildlife (VCWPD 2009a). About 270 acres of *Arundo* have been removed thus far. With the *Arundo* removed, native plants are able to return and provide shade and other ecosystem benefits. See “2.3.6 Arundo-Free Watershed Campaign” for more details on these projects.

**A Special Opportunity in San Antonio Creek**

San Antonio Creek provides some of the most important habitat currently accessible to steelhead, and steelhead surveys show that the lower reaches of the creek are being used. There is potential to expand and improve the quality of existing habitats with the addition of more rearing habitats, such as deep pools, removal of invasive plants, and revegetation of bare stream banks.

Scott Lewis, a CMWD fisheries biologist, made the following assessment (in an email correspondence) after studying steelhead throughout the watershed for over six years (Lewis 2013).

Based on our data collection over numerous years, San Antonio Creek appears to be the key spawning and rearing tributary for the steelhead population of the Ventura River basin. This is likely due to several reasons that I have discussed below.

**Spawning Habitat:** We conducted a stream habitat survey and documented that San Antonio Creek had significant amounts of spawning gravel. This is obvious even with a quick walk of the stream. The percentage of spawning gravel in San Antonio Creek is much greater than other parts of the basin. The percentage of total habitat with spawning gravel in San Antonio Creek was 33%, North Fork Matilija was 13%, and the mainstem Ventura River was 16%. It seems clear that no additional spawning gravel would be needed in San Antonio Creek. Additional data that we have collected supports this conclusion as well. The number of redds that we have counted over the last 5 years has shown that (continues on next page)
A Special Opportunity in San Antonio Creek (continued)

San Antonio Creek is the primary spawning area in the basin; as high as 90% and a mean of about 70% during the two peak years of total reds.

**Good Juvenile Growth Rates:** Based on our snorkeling surveys over several years, the growth rate of steelhead in San Antonio Creek is better than elsewhere in the basin. The warmer water and better primary production of San Antonio Creek provide abundant food resources that enables steelhead to grow faster and smolt primarily as 1+ [one year or older] fish. In North Fork Matilija for example, I think the majority of smolts are 2+ [two years or older] due to the lower water temperatures and primary production, and therefore lower growth rates. This faster growth rate in San Antonio Creek allows large numbers of smolts to migrate to the ocean following a wet year when adults (anadromous and resident) have successfully spawned.

**Location of San Antonio Creek in Ventura Basin:** The location of San Antonio Creek in the Ventura River basin has given steelhead a suitable spawning tributary for a large portion of each migration year. This is due to the confluence of San Antonio Creek being located at the downstream end of the Robles Reach. The Robles Reach is a wide alluvial section of the Ventura River that is composed of active wash deposits of unconsolidated silt, sand, gravel, and boulders (Tan and Jones 2006). Due to this type of channel morphology and geology, alluvial channels like the Robles Reach have high infiltration rates that cause channel surface flow to rapidly recede and cease shortly after storm events (Cooke et al. 1992). During a “wetter” year when steelhead adults have access to the upper basin and choose to migrate upstream to North Fork Matilija Creek, their passage window may be limited because of upstream channel characteristics. Probably most important though, during a “drier” year, the passage window can be nonexistent and San Antonio Creek or the mainstem Ventura River downstream of San Antonio Creek are the only spawning options. Smolts the following year many times will still have downstream passage, even in a dry year. The aforementioned faster growth rates then allows 1+ juveniles to smolt and leave for the ocean.

**Hydrologic Characteristics:** The San Antonio Creek drainage is one of the largest subbasins of the Ventura River, and given that the headwaters of San Antonio Creek has some of the higher elevations in the basin, it produces a significant amount of the total runoff (24% of total basin runoff at Foster Park). Much of this runoff infiltrates into the Ojai Valley groundwater basin that then sustains the lower 10 km of San Antonio Creek through dryer periods. The combination of San Antonio Creek’s confluence location with more sustained stream flow gives steelhead adults and juveniles greater opportunity for success.

**The Bottleneck:** The limiting factor in San Antonio Creek is dry season rearing habitat. During a wet year, and especially after two back-to-back wet years, the rearing habitat can sustain good numbers of O. mykiss. However, during a dry year, and especially after back-to-back dry years, rearing habitat is diminished dramatically. From our recent electrofishing surveys over the last three months, most of the remaining fish have been found in pool habitat. The problem is that San Antonio Creek does not have very many pools relative to other tributaries like North Fork Matilija Creek. Based on our habitat surveys, the number of pools in San Antonio Creek was only 8/km and North Fork Matilija Creek had 29/km. Of those pools, the number that were deeper than 1 m was only 1/km for San Antonio Creek and 6/km in North Fork Matilija Creek. Our snorkel and electrofishing surveys have yielded proportionally higher numbers of O. mykiss in North Fork Matilija Creek after longer dry periods and supports the conclusion for the lack of pools in San Antonio Creek. During dry years, significant mortality occurs that diminishes the population of resident and juvenile O. mykiss that are producing, or will become, smolts to maintain the anadromous life history of adult steelhead.
3.6.2.4 Steelhead Surveys and Monitoring

This section summarizes some of the most significant recent or ongoing steelhead surveys and monitoring programs in the Ventura River watershed. There have been many other limited-term, or focused, monitoring efforts in the past. Some of these are referenced in “3.6.2.6 Key Data and Information Sources/Further Reading.” Given the wide variation in streamflow and associated conditions from year to year, a considerable, long-term data set is needed to evaluate how those variations affect steelhead.

Casitas Municipal Water District

Casitas Municipal Water District (CMWD) conducts comprehensive annual steelhead monitoring and evaluation in conjunction with their operation of the Robles Fish Passage Facility. The facility became operational in 2006, and CMWD monitoring began in 2005. The specific monitoring and evaluation requirements are outlined in the Biological Opinion (BO) prepared by NMFS. The monitoring and evaluation are intended to achieve the objectives outlined in the BO. Some aspects of the annual monitoring could be discontinued in the future if it is determined that these objectives have been addressed.

CMWD’s annual steelhead monitoring and evaluation include the following:

Robles Biological Opinion Monitoring and Evaluations

- **Upstream Fish Migration Impediment Evaluation.** Physical instream measurements are collected at selected channel features to evaluate flow releases from the Robles Fish Passage Facility.

- **Downstream Fish Passage Evaluation.** During smolt migration, when flows are sufficient, *O. mykiss* are trapped to collect biological and physical information to determine the success of migration through the Facility.

- **Downstream Fish Migration through the Robles Reach.** *O. mykiss* smolts with radio transmitters are monitored through the Robles Reach to determine rate and the success of migration.

- **Fish Attraction Evaluation.** Bank and snorkel surveys are conducted near the Robles Fish Passage Facility to evaluate the effectiveness of the facility in attracting steelhead to the fish ladder.

- **Fish Passage Monitoring.** The fish detector passively detects *O. mykiss* migrating through the Robles Fish Facility to monitor long-term migration trends.
Other *O. mykiss* and Environmental Studies

- **O. mykiss Presence/Absence Surveys.** Watershed-wide snorkel surveys are conducted year-round to provide relative abundance index counts of *O. mykiss* and long-term population trends.

- **Adult Index Spawning Surveys.** During the spawning season, bi-weekly surveys are conducted watershed-wide to identify redds and collect physical data to help understand spawning habitat selection characteristics and monitor long-term population trends.

- **Habitat Survey.** Stream habitat surveys have been completed within the watershed to provide baseline statistical data on the quantity and quality of habitat vital for monitoring and evaluation. Future repeated surveys will provide data on the environmental effects of the morphological changes to the stream channels.

- **Ventura River Estuary Monitoring.** Water quality, surface area, and sandbar status are monitored throughout the year to provide environmental and physical data to understand the function of the estuary for various life-history stages of steelhead.

- **Sub-surface Flow Monitoring.** Year-round monitoring of surface flow and groundwater interactions in key reaches of the watershed, including anadromous and resident locations, provides information on seasonal and long-term trends of perennial and ephemeral stream habitat.

- **Photographic Index Sites.** Stream channels throughout the watershed are photographed twice per year to document general changes in stream channel morphology, streamflow, and riparian zones.

- **Ambient Water Quality Monitoring.** Water quality data are collected watershed-wide by monthly grab samples and continuous water temperature and turbidity probes. These environmental data are integrated into the analysis of other aspects of the monitoring program. Parameters monitored on a monthly basis are temperature, pH, oxidation-reduction potential, dissolved oxygen, conductivity, total dissolved solids, salinity, and turbidity.

### O. mykiss Research

- **Population Structure.** Genetic information from rainbow trout and steelhead of the entire watershed is being analyzed to understand physical, environmental, and biological effects on the genetic structure of *O. mykiss* in the watershed.

- **Smoltification Patterns.** Juvenile *O. mykiss* of varying life-history stages are being analyzed to determine the physical and physiological changes associated with smolting.
- **Juvenile Migration.** RFID (radio frequency identification) technology (or “tagging”) is being utilized to determine smolt migration patterns of juvenile rainbow trout and steelhead.


### Annual *O. mykiss* Distribution and Abundance Surveys

As part of the effort to remove Matilija Dam, steelhead habitat assessments were conducted in 2003 and 2004 on the Ventura River and Matilija Creek and its tributaries. These assessments were intended to assess the quantity and quality of habitat that could be made available to steelhead if the dam were removed.

To build on this dataset, and to assess the relationship between habitat quality and actual abundance of *O. mykiss*, annual *O. mykiss* distribution and abundance surveys were conducted from 2006 to 2012. These surveys were originally initiated and administered by the Ventura County Flood Control District (now the Ventura County Watershed Protection District), and have been initiated/administered by the Matilija Coalition and Surfrider Foundation in recent years.

The surveys focused primarily on the Ventura River mainstem, Matilija Creek and its tributaries, and North Fork Matilija Creek. Sites below the dam are in the “anadromous zone” and sites above are in the “resident zone.” Sampling in 2012 consisted of snorkel surveys and electrofishing at 14 study sites, as well as the Ventura River estuary. By sampling at
the same locations over time these surveys helped to assess the natural variation in *O. mykiss* population characteristics (Tables 3.6.2.2.2 and 3.6.2.2.3), and to establish a more robust assessment of baseline population conditions prior to the anticipated removal of Matilija Dam.

The surveys, conducted by Normandeau Associates (formerly Thomas R. Payne & Associates) utilized a randomized survey design for assessing uncertainty in abundance estimates.

Fish were counted, measured (captured fish only), and categorized by size. Trends in fish size over time and space were analyzed and fish densities were correlated with habitat type (e.g., pools, riffles, flats) and habitat characteristics (e.g., depth, velocity, cover). Habitat conditions such as streamflow and temperature were also recorded.

The habitat data collected in 2006, 2007, 2011, and 2012 were used to evaluate how well Habitat Suitability Index (HSI) scores produced by an existing Fish and Wildlife Service model (Raleigh et al. 1984) correlated with observed densities of *O. mykiss*. This led to the development of a revised model that better fit the observed fish densities and was more representative of conditions in the watershed, called the Southern Steelhead HSI model.

Abundance estimates over the years have displayed significant spatial and temporal variation in *O. mykiss* populations, with the highest abundance and densities consistently observed in the upper segment above Matilija Dam (resident rainbow trout only) and in the middle segment between Robles Diversion Dam and Matilija Dam (mixture of resident and anadromous *O. mykiss*). High densities of *O. mykiss* have been routinely observed in the upper North Fork and lower North Fork Matilija Creek study sites each summer (between 2006 and 2012), while *O. mykiss* have been absent or at very low densities in the lowermost Ventura River study sites and in regularly intermittent reaches (e.g., the Ventura River Preserve pools below the Robles Diversion and portions of San Antonio Creek).

These surveys have begun to reveal the dynamic nature of this fish population, which is constantly adapting to the extreme variability in rainfall from year to year.

The surveys are available at the [www.matilijadam.org](http://www.matilijadam.org) website.

**California Department of Fish and Wildlife Surveys**

The California Department of Fish and Wildlife began steelhead survey work in the watershed in 2013. This work involves counting steelhead adults and smolts and conducting spring spawning, rearing, and habitat surveys.
National Marine Fisheries Service Spawning Surveys

To better understand the ecology of spawning southern California steelhead, NMFS initiated the use of a standard spawning ground survey protocol in 2009/2010 to conduct redd counts in southern California coastal drainages where endangered steelhead populations exist. Surveys were conducted in the Ventura River watersheds after the first measurable precipitation on Dec 19, 2009, through May 28, 2010. Index reaches in the Ventura River watershed below Matilija Dam were surveyed twice a month. The findings from these early studies indicate that spawning is patchily distributed throughout the watershed and that the timing of redd construction is related to periods of elevated streamflow. The spawning surveys continued in 2011 and 2012. The data have not yet been published.

3.6.2.5 History of Steelhead and Fish Stocking

A comprehensive technical report on the history of steelhead and rainbow trout (going back to the Chumash era) in Santa Ynez River watershed in Santa Barbara County summarized the difficulties in describing the steelhead's past distribution and abundance in the area:

Although historical observations can provide important information on the historical geographic distributions of a species, they can suffer from limitations due to the resolution of the data (Hamilton et al. 2005; Adams et al. 2007). Some sources give precise locations, but these are relatively few in number and distributed unevenly throughout the historical record. Many sources offer only general impressions of areas where steelhead or rainbow trout were found, and are based on second-hand or inexpert observations.

The dynamic nature of southern California aquatic ecosystems poses another challenge to reconstructions of past steelhead distributions and abundance. Habitat conditions in southern California's coastal streams may vary widely due to multiple factors, such as severe winter storms, droughts, the seasonal formation and breaching of river mouth sandbars, sediment inputs from post-wildfire erosion or debris flows, variable oceanographic conditions, climatic oscillations, and long-term climate changes (Davis et al. 1988; Florsheim et al. 1991; Keller et al. 1997; Spina and Tormey 2000). All of these perturbations and processes affect steelhead populations, which may have varied by two orders of magnitude annually owing to natural changes alone (Titus 1995a; Titus 2010).

—The History of Steelhead and Rainbow Trout (Oncorhynchus mykiss) in the Santa Ynez River Watershed, Santa Barbara County, California (Alagona 2012)
Fish Stocking History
Records indicate that stocking of trout or steelhead took place in the watershed starting around 1882, reaching a peak around the 1920s, and continued into the 1970s (Bowers 2008; Entrix & URS 2004).

Another thorough source of information is History of Steelhead and Rainbow Trout in Ventura County, Newsprint Accounts from 1870 to 1955 (Bowers 2008), compiled by a historian on behalf of United Water Conservation District, a water supplier in the neighboring Santa Clara River watershed. These newspaper accounts include many reports of fine trout fishing in the Ventura River going back to the 1870s. Below are several such reports.

May 10, 1873 – Ventura Signal
PERSONAL – On Saturday last our fellow townsmen, J.A. Corey and C.C. Wing, bade adieu to mackerel and molasses, harness leather and saddles, and in company with two or three others, took a trip to Wilcox’s hot springs, in the Matilija [sic] canon, returning Monday. They report Mr. Robert Lyon comfortably quartered in his new house, from which he expects to reach the springs as soon as his men get the road cleared—only a two or three day job. Kenneth Grant, of the firm of Grant & Bickford, has swung his hammock under the boughs of a live-oak, and idly swings all day in utter forgetfulness of furnace and wagon tires, gathering health and strength in the balmy air of that delightful place. The party caught some sixty fine trout in the Ventura River, in an hour’s fishing.

November 27, 1875 – Ventura Free Press
Mountain trout are so plentiful in the San Buenaventura River that the water ditches leading from that stream are full of them. The reservoir on the hill back of town is full of these beautiful fish.

According to these newspaper accounts, the stocking of streams in California with hatchery fish started around 1878.

February 23, 1878 – Ventura Free Press
The Fish Commissioner of this State will in a week or two have some young trout from New Hampshire and fresh-water salmon from Maine, for distribution. ...The fish are to be devoted to stocking public waters only. ...This fish (salmon) is probably too large to thrive in our small streams, but some one ought to secure some of the trout.
The newspaper accounts also document early stocking of fish in the watershed in 1882:

December 31, 1881 – Ventura Free Press
FISH FOR ALL – A letter from Fish Commissioner Redding was sent to the San Jose Sportsman’s Club and reprinted in the newspaper. The Fish Commissioner has ordered “a large quantity of Eastern trout eggs, land-locked salmon and white fish from the East…and will be ready for distribution the last of February or the first of March. …The Fish Commissioners are always very glad to assist in filling the streams in any county where there are sportsmen’s clubs, who are giving some attention to the enforcement of the game laws, and who are doing what is equally important, creating public opinion in favor of preserving fish and game in the State.” The editor of the Press inserted the comment, “Now, cannot the Ventura Sportsman’s Club take steps to secure some of these fish for our two streams? What do you say, Mr. Secretary Granger? The price of transportation is the only expense in the matter.”

January 4, 1882 – Ventura Free Press
The Ventura Rod and Gun Club bit at our suggestion like a hungry trout at a fly. Secretary Granger talked the matter up among the members, and the Club will secure from the Fish Commissioners enough young trout and white fish to thoroughly stock the head waters of our streams. It might be well to try a few land-locked salmon, though the rivers are probably too small for them. After procuring the fish, the next duty of the Club will be to see that they are protected during the close[d] season.

July 1, 1910 – Ventura Free Press
STREAMS TO BE WELL-STOCKED – Three-Quarter Million Trout for Southland. Allotment of Young Fish for Southland Waters Doubled by Fish Commission—Special Car to Be Sent Here in September to Supply Forty-seven Creeks.

About 775,000 rainbow, Loch Leven and eastern brook trout are to be distributed in the streams of Southern California in September. M.J. Connell, Fish and Game Commissioner for the Southern District, has been notified that the fish will be shipped from the Sisson hatchery in the special fish car the latter part of August.

The allotment made to the south this year is nearly twice as large as that of last year. Three years ago 250,000 small fish were sent south and last season the number was slightly over 400,000.
R.W. Requa is in charge of the fish car. The fish allotted to Southern California are to be distributed in forty-seven streams, as follows:

...Ventura county: Ventura River, Coyote Creek, San Antonio, Matilija and north fork, See-Saw [Sisar], Santa Paula, Santa Clara and Sespe.

Since stocking first began in the 1880s, more than one million *O. mykiss* have been stocked in the Ventura River watershed (Lewis 2014). Similar stocking took place in the Santa Clara River, Santa Ynez River, and other southern California coastal streams. Table 3.6.2.5.1 provides a perspective on the number of steelhead fry produced by state fisheries in the early years of stocking.

_Since stocking first began in the 1880s, more than one million_ *O. mykiss* _have been stocked in the Ventura River watershed_ (Lewis 2014). _Similar stocking took place in the Santa Clara River, Santa Ynez River, and other southern California coastal streams._

October 15, 1915 – _Ventura Free Press_

_ANOTHER BIG TROUT SHIPMENT COMING_ — The second big shipment of young trout for the Ventura county streams will arrive on October 21st and 22nd at which time Game Warden Barnet will receive [receive] from the state hatcheries 100,000 steelhead, 75,000 of which he will place in the Ventura river and the remaining 25,000 will be planted in the Sespe.
Table 3.6.2.5.1 Output of State Hatcheries before 1911

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Steelhead Trout Fry Produced by State Hatcheries</th>
</tr>
</thead>
<tbody>
<tr>
<td>1902</td>
<td>301,000</td>
</tr>
<tr>
<td>1903</td>
<td>120,000</td>
</tr>
<tr>
<td>1904</td>
<td>90,00</td>
</tr>
<tr>
<td>1905</td>
<td>108,000</td>
</tr>
<tr>
<td>1906</td>
<td>243,000</td>
</tr>
<tr>
<td>1907</td>
<td>352,000</td>
</tr>
<tr>
<td>1908</td>
<td>170,000</td>
</tr>
<tr>
<td>1909</td>
<td>517,000</td>
</tr>
<tr>
<td>1910</td>
<td>667,880</td>
</tr>
</tbody>
</table>

1. Prior to 1902 eggs and fry were produced by the U.S. Fish Commission. This table includes only steelhead and does not include rainbow trout produced in hatcheries. Source: Kentosh, 2008.

The Draft Ventura River Habitat Conservation Plan (Entinx & URS 2004) provides a summary of stocking in the watershed and known numbers of fish; this summary is replicated in "4.4 Appendices." Based on this summary, the peak stocking occurred in the 1930s and 1940s, with most of the fish coming from hatcheries in northern California, and some coming from neighboring watersheds. Stocking of fish in the watershed, except for in Lake Casitas, was discontinued in the 1990s.

Native Steelhead—From the Hatchery?

The extent to which fish stocking influenced the number of fish returning to spawn in the watershed in the past is a point of controversy, which cannot now be definitively settled.

On the one side, it is argued that estimates of the historical numbers of spawning fish were significantly exaggerated because fish stocking resulted in unnaturally high populations. One of the most often cited "population estimates" was based on a one-day field trip report where no adult steelhead were even observed or counted. If the reported populations never existed naturally, however, would recovery have been initiated?

On the other side, it is argued that the rate of survival of a naturally spawned and reared O. mykiss to an adult returning mature steelhead is quite low (about 2-3%). Even if the survival rate of hatchery steelhead was comparable—which would not be the case because of the trauma of capture, transport, and stocking, not to mention the competition from native fish—the number of fish surviving to adulthood would not likely increase the natural run-size appreciably. Furthermore, recent genetic research seems to indicate that hatchery fish genes have not appreciably influenced the native fish stock; present day populations are dominated by ancestry of indigenous southern coastal steelhead (Capelli 2014; Girman & Garza 2006).
Ventura River Steelhead, Tico Crossing, 1920
Photo courtesy of Mark Capelli

Sport fishing was an important local industry in the Ventura River watershed until the late 1940s:

Welch, writing in *California Fish and Game* (1929) reports that prior to the establishment of a daily limit, it was not unusual for a fisherman to take from 100 to 300 trout from a California coastal stream. The *Ventura Signal* (1878) reported three fishermen taking 463 trout in the lower reaches of the Ventura River in a single day.

A number of hotels on Santa Clara Street in San Buenaventura catered to out-of-town fishermen, while the elaborate Anacapa Hotel, formerly situated on the corner of Main and Palm Streets, reserved the ground floor during the trout season for fishing guests. Post cards depicting local fishermen with their steelhead catches were printed in the hopes of attracting tourists. Several sporting goods stores (*Star-Free Press*, 1948; Marcus, 1973) sponsored annual steelhead fishing contests as late as 1948. Census checks have shown 259 fishermen on the opening day of the winter steelhead fishing season along the five mile stretch open to steelhead fishing between Foster Park and the ocean.

— *The Ventura River Recreational Area and Fishery: A Preliminary Report and Proposal* (VCFGC 1973)

On May 8, 1946, staff from the California Division of Fish and Game made a field inspection to the watershed to assess steelhead spawning areas and sport trout fishing in association with the proposed construction of Matilija Dam. The field inspection report does not document actual observations of adult steelhead, but does offer a population estimate based on personal observations and interviews with long-time residents. The report states that "at least 50 percent of the fish entering
the Ventura River eventually enter the main Matilija to spawn. In normal years this represents a minimum of 2000 and 2500 adult spawning steelhead in the 12 mile area.” (Clanton & Jarvis 1946) From this report comes the commonly cited statistic that the watershed historically supported 4,000 to 5,000 adult steelhead.

A year later, in March of 1947, a fisheries biologist with the California Department of Fish and Game, Bureau of Fish Conservation, walked the Ventura River and counted adult steelhead. “The river was checked from the mouth to the Foster Park bridge, which seems to be the upper limit of steelhead movement this season, due to low water conditions.” (Evans 1947) The biologist counted 250 to 300 adult steelhead in this reach. He noted, “In a dry year, such as this, there is an estimated maximum of 2 miles of fairly suitable spawning area below Foster Park bridge. This might support a maximum total of 1000 spawning adult steelhead.”

An extended dry period began in the watershed in 1945. Although intermixed with some wet years, the 20-year period from 1945 to 1965 is considered the longest dry period on record. These dry conditions spurred development of water supply projects. Matilija Dam was completed in 1947 and the Casitas Dam was completed in 1959. Similar dams and diversions were constructed during this period throughout the region. The dry conditions, together with the construction of water supply projects that altered natural flow regimes and restricted access to upstream spawning and rearing habitats, are credited with causing a dramatic decline in steelhead numbers in the area.

Young Fisherman with String of Trout, Foster Park, 1979. When steelhead became endangered in 1997, it became illegal to fish for or otherwise harm any O. mykiss below impassible upstream barriers, such as Matilija Dam.
Photo courtesy of Mark Capelli
3.6.2.6 Key Data and Information Sources/Further Reading

Below is a summary of some of key documents that address steelhead in the watershed. See “4.3 References” for complete reference citations.

Assessment of Steelhead Habitat in Upper Matilija Creek Basin. Stage One: Qualitative Stream Survey (Thomas R. Payne 2003)

Assessment of Steelhead Habitat in the Ventura River/Matilija Creek Basin. Stage Two: Quantitative Stream Survey (Thomas R. Payne 2004)

City of Ojai Urban Watershed Assessment and Restoration Plan (Magney 2005)

Draft Biological Opinion for US Army Corps of Engineers Permitting of the City of Ventura’s Foster Park Well Facility Repairs on the Ventura River (NMFS 2007)


Field Inspection Trip to the Matilija-Ventura Watershed In Relation to the Construction of the Proposed Matilija Dam (Clanton & Jarvis 1946)

History and Status of Steelhead in California Coastal Drainages South of San Francisco Bay (Titus et al. 2010)

History of Steelhead and Rainbow Trout in Ventura County: Newsprint from 1872 to 1954, Volume I (Bowers 2008)

History of Steelhead and Rainbow Trout in Ventura County, Volume II (Kentosh 2008)

Matilija Dam Ecosystem Restoration Feasibility Study Final Report (USACE 2004b)

Population Structure and Ancestry of O. mykiss Populations in South-Central California Based on Genetic Analysis of Microsatellite Data (Girman and Garza 2006)

Preliminary Hydrogeological Study, Surface Water/Groundwater Interaction Study, Foster Park (Includes steelhead habitat assessment) (Hopkins 2010)

Preliminary Hydrogeological Study, Surface Water/Groundwater Interaction Study, Foster Park (Includes steelhead habitat assessment) (Hopkins 2013)

Removing Matilija Dam: Opportunities and Challenges for Ventura River Restoration (Capelli 2004)

Report on the Environmental Impacts of the Proposed Agreement Between Casitas Municipal Water District and the City of San Buenaventura for Conjunctive Use of the Ventura River – Casitas Reservoir System (Includes steelhead habitat assessment) (EDAW 1978)

Robles Fish Passage Facility Biological Opinion (NMFS 2003)

Robles Fish Passage Facilities Biological Opinion, Q & A (NMFS 2003a)

Senior and Gridley Canyons Steelhead Habitat Assessment -2007 Reconnaissance Level Survey (CMWD 2007)

Southern California Steelhead Recovery Plan (NMFS 2012)

Southern Steelhead Resources Evaluation: Identifying Promising Locations for Steelhead Restoration in Watersheds South of the Golden Gate (Becker et al. 2010)

Steelhead (*Oncorhynchus mykiss*) Habitat Characterization of Portions of Upper San Antonio Creek, Senior Creek, Gridley Creek and Ladera Creek, Ventura County, California (Padre 2010)

Steelhead of the South-Central/Southern California Coast: Population Characterization for Recovery Planning (Boughton et al. 2006)

Steelhead Population and Habitat Assessment in the Ventura River/ Matilija Creek Basin, 2006 (Thomas R. Payne 2007)

Steelhead Population and Habitat Assessment in the Ventura River/ Matilija Creek Basin, 2007 (Thomas R. Payne 2008)


Steelhead Population Assessment in the Ventura River/Matilija Creek Basin, 2009 Data Summary (Thomas R. Payne 2010)

Steelhead Population Assessment in the Ventura River/Matilija Creek Basin, 2010 Data Summary (Normandeau 2011)

Steelhead Population Assessment in the Ventura River/Matilija Creek Basin, 2011 Data Summary (Normandeau 2012)

Steelhead/Rainbow Trout Resources of Ventura County (CEMAR 2014)

The History of Steelhead and Rainbow Trout (*Oncorhynchus mykiss*) in the Santa Ynez River Watershed, Santa Barbara County, California (Alagona 2012)

The San Antonio Creek Watershed: An Agricultural and Rural Residential Land Protection Study (NRCS 2010)
The Ventura River Recreational Area and Fishery: A Preliminary Report and Proposal (VCFG 1973)

Ventura County, Ventura River, Steelhead Situation (Evans 1947)

Ventura River Habitat Conservation Plan - Draft (Entrix & URS 2004)

Ventura River Steelhead Restoration and Recovery Plan (Entrix & Woodward Clyde 1997)

Ventura River Steelhead Survey (Capelli 1997)

Ventura Watershed Analysis (Chubb 1997)

**Gaps in Data/Information**

A formal on-the-ground assessment of current barriers in the watershed is needed.
3.6.3 Matilija Dam Ecosystem Restoration Project

“Is the Matilija Dam ever going to come down?” may be the most common question raised in public discussions about the Ventura River watershed. The short answer is: We’re working on it.

Taking down a dam is no small undertaking. The effort to remove Matilija Dam—now called the Matilija Dam Ecosystem Restoration Project (MDERP)—is a complex, multi-stakeholder undertaking that started in the 1990s and continues today.

This section provides a brief overview of the MDERP effort. The MDERP’s website, www.matilijadam.org, contains current information, along with comprehensive background and historical information, meeting presentations, photos, and more. See also “3.2.3 Geomorphology and Sediment Transport” and “3.6.2 Steelhead” for discussions on topics relevant to the Matilija Dam.

Aerial View of Matilija Dam and Reservoir
Photo courtesy of Ventura County Watershed Protection District
In 1947, Matilija Dam was constructed at the lower end of Matilija Creek to provide water storage and flood control. The reservoir was originally built to hold 7,000 acre-feet of water; but sediment from the highly erosive mountains along Matilija Creek rapidly accumulated behind the dam. The reservoir’s capacity, as of 2004, was estimated at less than 500 acre-feet—7% of its original capacity. The reservoir’s capacity was displaced by almost seven million cubic yards of sediment. If the dam still stands in 2040, the reservoir will likely be completely full of sediment (USACE 2004a).

Matilija Dam no longer provides significant water storage or flood control functions, and blocks the passage of endangered southern California steelhead to prime spawning habitat above the dam. The dam has altered the flow of sediment downstream, diminishing the amount of sand replenishing local beaches.

The dam, which has been plagued with structural integrity issues since construction began, also poses a safety risk. The dam height has been lowered twice to address safety concerns.

Matilija Dam Notches. The top of the dam was notched in 1965 and again in 1978 to address safety concerns, including strain on the dam from water stored behind the dam and deteriorating concrete. The original dam height was 198 feet and is now 168 feet (USACE 2004). In 2011, someone painted a huge pair of scissors and a long dotted line on the face of the dam.
The following excerpt from a 2014 report summarizes the overall project and its current status:

Since its construction in 1947, the 168-foot high, arched concrete Matilija Dam has blocked the transport of an estimated 6,800,000 cubic yards (cy) of fine and coarse sediment from naturally moving downstream to the ocean. This has resulted in loss of the reservoir’s original function of water storage for agricultural needs, and limited flood control, loss of downstream sand and gravel sized materials necessary to promoting habitat for a variety of wildlife species, loss of sediment needed to maintain beaches at Surfer’s Point, and increased erosion of the Ventura River streambed. The dam, with its non-functioning fish ladder, also prevents southern steelhead from reaching upper Matilija Creek, which prior to dam construction, was the most productive spawning and rearing habitat in the Ventura River system. Without dam removal, an estimated total of 9,000,000 cubic yards of sediment will be trapped behind the dam before the natural full annual sediment load of Matilija Creek begins to be carried over the dam in approximately 2040. While such a scenario would eventually begin to address sediment deprivation of the downstream reaches, leaving the dam in place would not address fish passage beyond the dam and impacts to upstream habitat.

In the early 2000's, Ventura County Watershed Protection District (VCWPD) and the US Army Corps of Engineers (USACE), evaluated several alternatives for dam removal and published a Final Environmental Impact Statement/Environmental Impact Report (EIS/R, USACE 2014 [2004]). They arrived at a preferred alternative (Alternative 4b) that involved slurrying an estimated 2,100,000 cy of fine sediment from the reservoir area just upstream of the dam to a downstream disposal location, removing the dam in one season, excavating a channel through the remaining coarse sediment, and protecting the lower seven feet of the channel banks with soil cement to allow 10-year and greater storm events to remove the accumulated sediments above the seven-foot level. At some future date, the soil cement would be removed, allowing the remaining accumulated sediment to be flushed through the river system.

Subsequently, in 2009 and 2010, the Matilija Dam Fine Sediment Study Group (FSSG) was convened and temporary upstream disposal of the fine sediment was considered to address concerns over cost and constructability of the downstream disposal options for the fine sediment.
VCWPD has since contracted with URS and Stillwater Sciences (the Consultant Team) to evaluate a range of concepts including those documented in previous documents, concepts developed by the FSSG, and new concepts. A short list of six initial options was identified and is screened (in this report) based on selected key criteria. Following the screening process, up to four alternatives will move forward into the evaluation phase, which would use a wide range of criteria to compare the selected alternatives.


Surfrider Foundation Bumpersticker Advocating for Matilija Dam Removal, 1995. In the 1990s, Surfrider Foundation’s Ventura chapter began urging the County of Ventura to remove the dam.

3.6.3.1 Matilija Dam Ecosystem Restoration Project Highlights

When the Matilija Dam Ecosystem Restoration Feasibility Study was completed in 2004, it was one of the largest dam removal studies in the country. The study presented a number of alternative approaches to removing the dam and restoring the habitat, and selected a recommended approach.

The ecosystem restoration objectives of the study were to:

- Improve aquatic and terrestrial habitat along Matilija Creek and Ventura River and restore fish passage.
- Restore natural processes to support beach sand replenishment.
- Enhance recreational opportunities.

The study identified several key constraints that later influenced the formulation and evaluation of various alternatives, including:

- Maintaining the current level of flood protection along the Ventura River downstream of Matilija Dam.
- Limiting adverse impacts to normal water supply quantity, quality, and timing of delivery to Casitas Reservoir via Robles Diversion Dam.
- Limiting impacts to water quality in Lake Casitas resulting from the release of the fine sediments trapped behind Matilija Dam (USACE 2004b).
The most challenging dam removal issue is management of the 6.8 million cubic yards of sediment behind the dam. The preferred alternative in the MDERP feasibility study outlined a two-part strategy for managing the sediments: four million cubic yards of mixed fine and coarse sediments would be contoured within the dam basin area to allow for natural transport to the ocean and beaches in flood events; and the two million cubic yards of fine silts and clay closest to the dam would be slurried in a pipe to various locations downstream of the Robles Diversion to avoid impacting water diversions to Lake Casitas.

After years of effort and lobbying by the County of Ventura, the MDERP was officially authorized by Congress in 2007, with a budget of $144.5 million. In addition to the federal government’s contribution, the project was expected to require about $55 million from state and local sources, primarily from bonds issued by the state.

The Players

The Matilija Dam Ecosystem Restoration Project (MDERP) is a joint effort between the Ventura County Watershed Protection District (VCWPD), which is the owner of the dam, and the U.S. Army Corps of Engineers (USACE). The MDERP is a federal project under the authority of the USACE, and VCWPD is the local sponsor. The California Coastal Conservancy and the U.S. Bureau of Reclamation are also key players on the management team. The Bureau of Reclamation has technical responsibility for project hydrology, hydraulics, and sediment modeling; the California Coastal Conservancy has been the primary local funding agency. The MDERP has a large stakeholder group—including many federal, state, and local agencies and organizations—that has guided the project from the beginning. The main stakeholder group is now called the Design Oversight Group (DOG).

Matilija Dam Design Oversight Group
Photo courtesy of Paul Jenkins
<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1946</td>
<td>June 18 – Dam construction began. The original reservoir was designed to hold 7,000 acre-feet of water.</td>
</tr>
<tr>
<td>1947</td>
<td>Mr. Harold E. Burkett, architect, warned County Supervisors of alkali-reactive aggregate.</td>
</tr>
<tr>
<td>1947</td>
<td>Dam construction was completed at a cost of $682,000. A report estimated that it would be 39 years before siltation would eliminate capacity. The County sued the engineers for cost overruns and lost.</td>
</tr>
<tr>
<td>1949</td>
<td>A major fish kill occurred behind dam due to stagnant, hot water conditions in the reservoir.</td>
</tr>
<tr>
<td>1952</td>
<td>The reservoir filled.</td>
</tr>
<tr>
<td>1959</td>
<td>Casitas Municipal Water District assumed responsibility of dam operations.</td>
</tr>
<tr>
<td>1964</td>
<td>Dam removal was proposed. Bechtel Corp. Safety study condemned dam and presented removal as an option.</td>
</tr>
<tr>
<td>1965</td>
<td>Bechtel Corp. estimated dam removal cost at $300,000. To address safety concerns, the County elected instead to notch dam (remove a section 30 feet deep and 285 feet wide) to reduce reservoir capacity to 65%, relieving strain while allowing the dam to remain in place.</td>
</tr>
<tr>
<td>1973</td>
<td>A study on littoral processes highlighted the impact of the dam to beaches. The United States Forest Service estimated the sediment contribution of Matilija’s dammed watershed to be 116,000 cubic yards per year—sediment that should be contributed to beaches, but is not.</td>
</tr>
<tr>
<td>1970s</td>
<td>Ed Henke, who’d grown up along the Ventura River, began to lobby for the dam’s demolition.</td>
</tr>
<tr>
<td>1978</td>
<td>The dam was notched a second time (358 feet wide).</td>
</tr>
<tr>
<td>1995</td>
<td>The local chapter of the Surfrider Foundation began campaign promoting dam’s removal.</td>
</tr>
<tr>
<td>1997</td>
<td>The southern California steelhead was designated as an endangered species in California.</td>
</tr>
<tr>
<td>1998</td>
<td>The County resolved to remove the dam. A study on dam removal began.</td>
</tr>
<tr>
<td>2000</td>
<td>A Bureau of Reclamation Appraisal Study was completed. Secretary of the Interior Bruce Babbitt visited a demonstration project at the dam.</td>
</tr>
<tr>
<td>2000</td>
<td>Matilija Coalition was formed to bring together the interests of local non-government organizations.</td>
</tr>
<tr>
<td>2001</td>
<td>The Matilija Dam Ecosystem Restoration Study was initiated by the Ventura County Watershed Protection District (owner of the dam) and the US Army Corps of Engineers.</td>
</tr>
<tr>
<td>2004</td>
<td>Consensus was reached by all stakeholders on preferred project points.</td>
</tr>
<tr>
<td>2004</td>
<td>The Matilija Dam Ecosystem Restoration Feasibility Study was completed. At the time, it was one of the largest dam removal studies in the country. The reservoir’s capacity was estimated at 500 acre-feet, 7% of its original capacity. The study presented a number of alternative approaches to removing the dam and restoring the habitat, and selected a recommended approach.</td>
</tr>
<tr>
<td>2004</td>
<td>Ventura County Board of Supervisors approved the Final EIR/EIS.</td>
</tr>
<tr>
<td>2004</td>
<td>US Army Corps of Engineers Chief’s Report sent to Assistant Secretary of the Army.</td>
</tr>
<tr>
<td>2005</td>
<td>The Design Phase of the Matilija Dam Ecosystem Restoration Project was initiated by the Ventura County Watershed Protection District and the US Army Corps of Engineers.</td>
</tr>
<tr>
<td>2007</td>
<td>After years of effort and lobbying by the County of Ventura, the MDERP was officially authorized by Congress, with a budget of $144.5 million. In addition to the federal government’s contribution, the project was expected to require about $55 million from state and local sources, primarily from bonds issued by the state.</td>
</tr>
<tr>
<td>2007</td>
<td>MDERP Project Component: <em>Arundo donax</em> removal was initiated on 1,200 acres above and below dam. Removals are scheduled through 2025.</td>
</tr>
<tr>
<td>2010</td>
<td>The Design Oversight Group formed a Fine Sediment Study Group.</td>
</tr>
</tbody>
</table>
Table 3.6.3.1.1 Matilija Dam History (continued)

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>MDERP Project Component: Ventura River Parkway Trailhead was installed on the Ventura River Preserve at Old Baldwin Rd. Included new trailhead parking areas, trail enhancement, and public outreach. Fulfilled MDERP recreation goals.</td>
</tr>
<tr>
<td>2011</td>
<td>The Fine Sediment Study Group Final Report was completed. (August)</td>
</tr>
<tr>
<td>2011</td>
<td>A Technical Advisory Committee (TAC) was formed to address the data and research needs related to the sediment management issue. (October)</td>
</tr>
<tr>
<td>2013</td>
<td>A consultant team was selected to complete several studies the TAC deemed necessary to resolve the sediment management issue and reduce the cost of the project. (June)</td>
</tr>
<tr>
<td>2014</td>
<td>The consultant contract started. (February)</td>
</tr>
<tr>
<td>2015</td>
<td>The consultant studies are due early in 2015.</td>
</tr>
</tbody>
</table>

Source: Matiljadam.org; VCPD 2014f; Jenkin 2013

Problems: Costs and Stakeholder Acceptability

After project design was underway, the USACE calculated that slurrying the 2 million cubic yards of sediment would cost about twice as much as the estimate from the feasibility study. Local residents adjacent to certain proposed storage areas expressed concern about the impacts from the downstream storage areas.

These issues led to the concept of the upstream storage area (USA) alternative, wherein the fine sediment would be permanently sequestered within Matilija Canyon. However, a number of stakeholders found the USA alternative unacceptable due to the permanent impacts to the canyon.

Stakeholder support of the approach to managing fine sediments was essential, so the project team orchestrated a facilitated group called the Fine Sediment Study Group, which met several times in 2010 and 2011. From this effort, a Technical Advisory Committee (TAC) formed to address the data and research needs related to the sediment management issue.

The TAC began work in 2011. In February 2014, a consultant team began work on several studies the TAC deemed necessary to move forward. These studies will focus on methods to remove the dam that will allow for the natural transport of all sediment from behind the dam, while minimizing impacts to Robles Diversion. The studies will develop methods to offset any residual impacts to Robles Diversion.
Mitigation

Before Matilija Dam can be removed, several projects must be implemented to accommodate changes downstream expected to result from the dam's removal. Much of this mitigation is related to flooding. Projects include the redesign and improvement of two bridges to increase hydraulic capacity, improvements to the Robles Diversion and Fish Passage Facility, installation of two contingency water wells in the City of Ventura's Foster Park well field, and the redesign of two existing levees as well as a new levee. Figure 3.6.3.1.1 shows the location of key MDERP design features, most of which are mitigation measures. Table 3.6.3.1.2 summarizes the project's flood-related mitigation measures.

![Recommended Plan Design Features](image)

Figure 3.6.3.1.1 Matilija Dam Ecosystem Restoration Project Design Features Map
Source: USACE 2004b
<table>
<thead>
<tr>
<th>Location</th>
<th>Mitigation</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matilija Hot Springs</td>
<td>Buy-out</td>
<td>Proximity of Hot Springs site to dam and channel, narrowness of Matilija Canyon, and limited flood conveyance area create high risk from sediment-laden flows in event of a very large storm event and limit the effectiveness of any structural protection.</td>
</tr>
<tr>
<td>Camino Cielo</td>
<td>Properties buy-out</td>
<td>Proximity of six residential tracts to dam and channel, and narrowness of canyon create high risk from sediment-laden flows in event of a very large storm event and limit the effectiveness of any structural protection.</td>
</tr>
<tr>
<td>Camino Cielo Bridge</td>
<td>Improve conveyance Remove and replace at new location; restore channel width at original location</td>
<td>Existing low flow crossing (concrete box culvert) exacerbates constricted channel. Removal of bridge and restoration to original channel width will improve conveyance and prevent backwater effects. New bridge with higher deck at a wider channel section is justified because bridge is sole ingress/egress for remaining Camino Cielo residential tracts not impacted by potential flooding.</td>
</tr>
<tr>
<td>Meiners Oaks</td>
<td>Construct new (east) levee/floodwall</td>
<td>Flood protection less costly than real estate acquisition. Number of structures already prone to flooding under existing conditions would increase. Dam removal would result in a water depth increase of at least 2 ft. Confine by levee at lower end necessitates continuation of protection upstream.</td>
</tr>
<tr>
<td>Live Oak</td>
<td>Raise existing (west) levee</td>
<td>Flood protection less costly than real estate acquisition. Constricted nature of channel and expected rise in water surface in high flow events upstream of Santa Ana bridge necessitates levee raising. Confine by levee at lower end necessitates continuation of protection upstream.</td>
</tr>
<tr>
<td>Santa Ana Bridge</td>
<td>Improve conveyance by widening channel and extending bridge length</td>
<td>Existing bridge creates severe constriction and channel is incapable of passing a 100-yr discharge with additional sediment-laden flows. Due to constricted channel upstream of bridge, current sediment removal maintenance efforts will need to continue in addition to channel widening for a limited distance (500 ft) upstream of bridge.</td>
</tr>
<tr>
<td>Casitas Springs</td>
<td>Raise existing (east) levee</td>
<td>Flood protection less costly than real estate acquisition. Number of structures already prone to flooding under existing conditions would increase. After dam removal, water depth would increase by at least 2 ft.</td>
</tr>
</tbody>
</table>

Source: Matilija Dam Ecosystem Restoration Feasibility Study, Section 4 (USACE 2004b)

*Arundo donax* control in Matilija Creek and the Ventura River was identified as a key component of ecosystem restoration in the MDERP. *Arundo*, also called giant reed, is a highly invasive non-native riparian plant. As part of the MDERP, the watershed’s largest *Arundo* removal project started in 2008 on Matilija Creek and the upper Ventura River. The VCWPD removed 200 acres of *Arundo* in a 1,200-acre area. Other invasive plants were also removed as part of this project, including Peruvian pepper tree, tamarisk, Spanish broom and castor bean.

Figure 3.6.3.1.2 shows the areas of *Arundo* infestation above and below Matilija Dam prior to removal. This project has been very successfully implemented, as witnessed by the numbers and variety of native animals returning to the treated areas. Ongoing treatment and monitoring is planned for many years to come.
Figure 3.6.3.1.2 Map of *Arundo donax* Infested Areas Prior to Removal Efforts

Source: VCWPO and Ecosystems Restoration 2007
3.6.3.2 Key Data and Information Sources/ Further Reading

Below is a summary of some of key documents that address the Matilija Dam Ecosystem Restoration Project. See “4.3 References” for complete reference citations. See also www.matilijadam.org.


Hydrology, Hydraulics and Sediment Studies of Alternatives for the Matilija Dam Ecosystem Restoration Project (USBR 2007)

Matilija Dam Ecosystem Restoration Feasibility Study Final Report (USACE 2004b)

Matilija Dam Ecosystem Restoration Project brochure (VCWPD 2014f)

Matilija Dam Ecosystem Restoration Project: Fine Sediment Study Group Final Report (Selkirk 2011)


Matilija Dam Giant Reed Removal Plan (VCWPD and Ecosystems Restoration 2007)

California River Parkways Trailhead Project, Initial Study (Aspen 2010)
3.6.4 Access to Nature

Healthy natural landscapes provide important ecosystem services, but these landscapes also provide equally important social and cultural benefits. The opportunity to spend time in nature adds value to life in ways that may be difficult to quantify—aesthetic, recreational, therapeutic, and spiritual—but are no less real. The Ventura River watershed's natural landscapes have long been valued by residents and visitors for such reasons.

*Everybody needs beauty as well as bread, places to play in and pray in, where nature may heal and give strength to body and soul.* —John Muir

The opportunity for people to enjoy natural landscapes firsthand can also serve to help protect those landscapes. People tend to protect what they enjoy, care about, and feel a connection with. Understanding the natural environment, and its important ecosystem services (e.g., cleaning water, cycling nutrients, controlling floods), provides further motivation to support and protect natural landscapes.

There are numerous opportunities for people to come into contact with natural landscapes in the watershed, as over half of the land is in protected status—much of it in a relatively natural state. It is a recreation destination for hikers, walkers, bikers, surfers, campers, fishermen, boaters, backpackers, equestrians, and birders, as well as artists, spiritual seekers, and students of natural history.

The Ventura River watershed has three distinct landform zones: the mountains and foothills of the Transverse Ranges, the broad valley floors, and the coastal zone. The natural habitats and terrain, and the ways that people interact with them, are different in each zone.

The watershed's steep mountains are largely contained within Los Padres National Forest, where the trails are often steep, the views always spectacular, and most of the camping opportunities are backcountry. Aquatic habitats here are riparian corridors of young tributaries of the Ventura River—a number of which flow year round in many years.

The flatter foothills and valley floors have more easily accessible, family-oriented recreation opportunities. Trails are generally flatter, camping opportunities are car-accessible, and parks and preserves are available in some areas for convenient daily use. Aquatic habitats here are larger and include key drainages like San Antonio Creek and the Ventura River, man-made Lake Casitas, and natural and restored wetland habitats. Many of these habitats offer excellent birding and wildlife viewing.
The coastal zone also has readily accessible recreation opportunities. Trails are paved along the beachfront and estuary and unpaved on the sandy and cobble-strewn delta, camping is car-accessible, parks and preserves provide access and amenities, and the vast Pacific Ocean offers spectacular views and a playground for a host of sports. In addition to habitats in coastal waters, aquatic habitats here include the Ventura River estuary—an exceptional biological resource and a great location for birding and wildlife viewing.

The watershed provides many opportunities for people of all ages to enjoy the outdoor environment; however, one area in particular is underserved: the City of Ventura’s Westside. This community, located near the bottom of the Ventura River, has the highest population density and lowest median household income in the watershed. In this area, Highway 33 freeway and Ventura Levee block both access to and views of the river. Much of the river bottom, floodplain, and adjacent lands in the stretch of river below Foster Park is privately owned, and few people have the opportunity to experience it. The lower end of this stretch, near the estuary, has had a long history of heavy use by transient individuals for camping. This has further dissuaded community members in this area from utilizing the river for recreation (though this situation is now getting better). Improving the limited access to the river in this area is a priority for many stakeholders.

In providing access to nature, another consideration is the means by which people are able to get access. Is a car required? Is parking available? Is there a bus stop nearby? Bike racks? Are there access options for those using wheelchairs or who are otherwise less mobile? Are the needs of young and old considered? Is there a staging area for horse trailers? Access opportunities that serve all sectors of the community and all means of mobility are desired. In this regard, access opportunities for those traveling by bus or bicycle have been identified as deficient.

This section catalogs and describes the watershed’s nature-based recreation facilities and activities in two sections:

- “3.6.4.1 Inventory of Nature-Based Recreation Facilities and Activities,” organizes and describes facilities and activities by type; key data are summarized in tables.
- “3.6.4.2 Nature Access by Area,” organizes and describes facilities and activities by location; the watershed is divided into seven different detail maps for a closer look at opportunities by area.

It should be noted that the information presented in this section is limited to those opportunities provided by public agencies and nonprofit organizations. There are also many nature-based recreation opportunities provided by privately owned facilities.
3.6.4.1 Inventory of Nature-Based Recreation Facilities and Activities

The watershed benefits from the many organizations committed to providing the public with access to nature and nature-based recreation opportunities. Federal, state, and local agencies, along with land conservancies, maintain and make available to the public significant natural land resources. Public recreational facilities are provided by six public agencies and two nonprofit organizations: the United States Forest Service, California State Parks, County of Ventura, City of Ojai, City of Ventura, Casitas Municipal Water District, Ojai Valley Land Conservancy, and Ventura Hillsides Conservancy.

Increased public access to natural landscapes provides many benefits, but also brings increased trash, erosion, animal waste, vandalism, fires, and other impacts to natural resources. The costs to monitor and correct these impacts are an ongoing consideration for organizations providing nature-based public access.

Nature Appreciation

Although not explicitly described in this section as an “activity,” nature appreciation—connecting with the beauty and wonder of the natural world—may be at the heart of the instinct to spend time in nature for many people. The approach to nature appreciation is personal—some do it with silence, some paint or write poetry, some observe birds. Nature appreciation is also intangible—its value cannot be quantified in a table in this plan. Nonetheless, few question the deep value of the opportunity to appreciate nature.

Most of the public access opportunities in the watershed are free, so data quantifying public use of trails and recreation areas are limited. This makes it hard to track recreation use patterns such as use of recreational facilities by residents versus tourists. Facilities with fees include Lake Casitas, campgrounds, and county parks.
Los Padres National Forest

Los Padres National Forest (LPNF) covers 69,062 acres within the watershed—most of the northern half. The Matilija Wilderness, a federally designated wilderness area, covers 23,477 acres of this land. Sixteen miles of Matilija Creek have been nominated for Wild and Scenic River designation (USACE 2004). The National Forest System lands within the watershed are located in the Ojai Ranger District.

Much of the LPNF land in the watershed comprises relatively undisturbed natural habitat. Recreation opportunities include hiking, car camping, backpacking, fishing, hunting, bicycling, horseback riding, paragliding, hang-gliding, and wildlife viewing.

The LPNF has many access points that allow visitors to explore its different landscapes. There are nine different trailheads within or leading to the LPNF. Fire breaks and other “unofficial” trails are also commonly used for recreation. Many of these trails provide relatively easy access to a wilderness experience close to urban areas. Highway 33 travels through the LPNF providing for scenic automobile, motorcycle, and bicycle touring.

The LPNF has two car-accessible campgrounds, Wheeler Gorge and Holiday Group Campgrounds are operated by a concessionaire and fees are collected by a campground host. (See “Campgrounds and Recreation Areas” below.) The Wheeler Gorge Visitor Center is located across the highway from Wheeler Gorge Campground. A number of backcountry campgrounds are also located in the LPNF within the watershed.

![Figure 3.6.4.1.1 Los Padres National Forest Area Map](image-url)
Except for Wheeler and Holiday Gorge Campgrounds, admission to the LPNF within the watershed is free. Purchase of a United States Forest Service (USFS) Adventure Pass is not required, except for car access to Nordhoff Ridge Road. Management of the LPNF is directed by the Los Padres Land Management Plan, which was revised in 2005 (USFS 2005a).

**Lake Casitas Recreation Area**

Aside from the LPNF, Lake Casitas Recreation Area (LCRA) is the largest outdoor recreational facility in the watershed. The LCRA includes Lake Casitas (2,700 acres) and the surrounding parkland (almost 400 acres). It is surrounded by thousands of acres of protected open space. All of the recreation area land lies along the north shore of the lake. No body contact with lake water is allowed as a water quality protection measure.

The LCRA provides a variety of recreation opportunities. Facilities include over 400 campsites including RV sites, showers, restrooms, 10 picnic areas, 11 playgrounds, special event areas, a water park, two boat ramps, boat rentals plus boat and trailer storage, a hiking/biking trail, a store, a café, and a radio-controlled airplane landing strip (CMWD 2005; URS 2010).

Rowing is popular on the lake. The Lake Casitas Rowing Association provides recreational and competitive rowing training to youth and adults in the community.

The lake provides excellent opportunities for viewing wildlife, especially birds, which have come to depend on the lake’s open water, protected bays, vegetated shallows, and freshwater marsh habitats. Lake Casitas is
used by many resident and migratory birds, and is a very popular birding destination. The California Audubon Society recognizes Lake Casitas as one of 147 “Important Bird Areas” in the state—areas that provide essential habitat for breeding, wintering, and migrating birds (Audubon 2014). The lake hosts some species that occur nowhere else inland in Ventura County.

The lake is also well-known for its fishing, which takes place from docks, boats, and the shore. Lake Casitas is a warm water fishery that includes bass (primarily largemouth), catfish, sunfish, and crappie. These non-native species, introduced when the lake was formed, now have self-sustaining populations (Cardno-Entrix 2012).


**Preserves**

The Ojai Valley Land Conservancy (OVLC) and Ventura Hillsides Conservancy (VHC) are both actively acquiring and managing land, providing educational information and interpretive opportunities, and establishing new trails and access points in the watershed. Together, these conservancies own and manage 1,953 acres of publicly accessible natural open space lands, with the Ventura River Preserve comprising 1,583 of these acres. These lands are located close to urban population centers, providing convenient access to natural landscapes.
Recreation opportunities on these lands include hiking, bicycling, horseback riding, wildlife viewing, swimming, and wading.

OVLC’s properties have over 22 miles of marked trails. Establishment of marked trails on VHC’s properties is under development. Both conservancies’ properties are well-used as field trip locations for local schools and youth groups.

Table 3.6.4.1.1 provides an overview of the seven publicly-accessible land preserves in the watershed.

<table>
<thead>
<tr>
<th>Preserve</th>
<th>Managed By</th>
<th>Acres</th>
<th>Aquatic/Watershed Amenities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventura River Preserve</td>
<td>OVLC</td>
<td>1,583</td>
<td>Trail access to Ventura River, Wills Creek, Rice Creek</td>
</tr>
<tr>
<td>Ojai Meadow Preserve</td>
<td>OVLC</td>
<td>57</td>
<td>Trail access to freshwater marsh habitat</td>
</tr>
<tr>
<td>Valley View Preserve</td>
<td>OVLC</td>
<td>195</td>
<td>Trail access to watershed views</td>
</tr>
<tr>
<td>Ilvento Preserve</td>
<td>OVLC</td>
<td>80</td>
<td>Trail access to watershed views</td>
</tr>
<tr>
<td>Confluence Preserve</td>
<td>OVLC</td>
<td>13</td>
<td>Protects riparian habitat at the Ventura River/San Antonio Creek confluence; access is provided only by the adjacent Ojai Valley Trail</td>
</tr>
<tr>
<td>Big Rock Preserve (Upper and Lower)</td>
<td>VHC</td>
<td>17</td>
<td>Access to Ventura River, though trails unmarked</td>
</tr>
<tr>
<td>Willoughby Preserve</td>
<td>VHC</td>
<td>8</td>
<td>Access to Ventura River, though trails unmarked</td>
</tr>
</tbody>
</table>

Total: 1,963

1. OVLC – Ojai Valley Land Conservancy; VHC – Ventura Hillsides Conservancy
Campgrounds

There are seven public, car-accessible campgrounds in the watershed, several of which also serve as day use parks. There are eight established backcountry camps in the LPNF. Fees are charged only for the car-accessible campgrounds. Backcountry campsites are on a first-come first-served basis. A free California Campfire Permit is required to build a campfire in a backcountry camp. No fires are allowed during fire restrictions. The Los Padres National Forest website has information of fire restrictions. Table 3.6.4.1.2 lists the campgrounds in the watershed.

<table>
<thead>
<tr>
<th>Detail Map #1</th>
<th>Facility</th>
<th>Type2</th>
<th># of Camp Sites</th>
<th>Managed By3</th>
<th>Aquatic/Watershed Amenities</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Camp Comfort</td>
<td>CC</td>
<td>15</td>
<td>County of Ventura</td>
<td>Next to San Antonio Creek</td>
</tr>
<tr>
<td>4</td>
<td>Dennison Park</td>
<td>CC</td>
<td>32</td>
<td>County of Ventura</td>
<td>Views of Ojai Valley</td>
</tr>
<tr>
<td>5</td>
<td>Emma Wood State Beach Group Campground</td>
<td>CC</td>
<td>4 group sites; 30 people per</td>
<td>State of California</td>
<td>Next to coast and Ventura River estuary</td>
</tr>
<tr>
<td>4</td>
<td>Foster Park Campground</td>
<td>CC</td>
<td>16</td>
<td>County of Ventura</td>
<td>Next to Ventura River</td>
</tr>
<tr>
<td>-</td>
<td>Gridley Springs Camp</td>
<td>BC</td>
<td>1</td>
<td>USFS</td>
<td>Off of Gridley Trail; follows Gridley Creek</td>
</tr>
<tr>
<td>1</td>
<td>Holiday Group Campground</td>
<td>CC</td>
<td>group site</td>
<td>USFS (via concessionnaire)</td>
<td>Next to Cannon Creek</td>
</tr>
<tr>
<td>4</td>
<td>Lake Casitas Recreation Area</td>
<td>CC</td>
<td>400+</td>
<td>Casitas Municipal Water District</td>
<td>Access to Lake Casitas (though no body contact)</td>
</tr>
<tr>
<td>-</td>
<td>Maple Camp</td>
<td>BC</td>
<td>group camp</td>
<td>USFS</td>
<td>Off of North Fork Matilija Trail; next to Upper North Fork Matilija Creek</td>
</tr>
<tr>
<td>-</td>
<td>Matilija Camp</td>
<td>BC</td>
<td>several</td>
<td>USFS</td>
<td>Off of North Fork Matilija Trail; next to Upper North Fork Matilija Creek</td>
</tr>
<tr>
<td>-</td>
<td>Middle Matilija Camp</td>
<td>BC</td>
<td>several</td>
<td>USFS</td>
<td>Off of North Fork Matilija Trail; next to Upper North Fork Matilija Creek</td>
</tr>
<tr>
<td>-</td>
<td>Murietta Camp</td>
<td>BC</td>
<td>several</td>
<td>USFS</td>
<td>Off of Murietta Trail; next to Murietta Creek</td>
</tr>
<tr>
<td>-</td>
<td>Ortega Camp</td>
<td>BC</td>
<td>several</td>
<td>USFS</td>
<td>Off of Ortega Motorcycle Trail</td>
</tr>
<tr>
<td>-</td>
<td>The Pines Camp</td>
<td>BC</td>
<td>several</td>
<td>USFS</td>
<td>Off of Horn Canyon Trail; crosses Thacher Creek</td>
</tr>
<tr>
<td>-</td>
<td>Valley View Camp</td>
<td>BC</td>
<td>several</td>
<td>USFS</td>
<td>Off of Pratt Trail; next to Stewart Canyon Creek</td>
</tr>
<tr>
<td>1</td>
<td>Wheeler Gorge Campground</td>
<td>CC</td>
<td>72</td>
<td>USFS (via concessionnaire)</td>
<td>North Fork Matilija Creek and Bear Creek pass through campground</td>
</tr>
</tbody>
</table>

1: Backcountry campgrounds are not included on the maps. The USFS has information on these campgrounds.
2: BC = Backcountry Campground, CC = Car-Accessible Campground
3: USFS = United States Forest Service
Sources: Ojai Trails (LPFA 2014); Hiking & Backpacking Santa Barbara & Ventura (Carey 2014);
Parks and Recreation Areas

Table 3.6.4.1.3 lists the nine nature-based parks and recreation areas in the watershed.

<table>
<thead>
<tr>
<th>Detail Map #</th>
<th>Facility</th>
<th>Managed By</th>
<th>Aquatic/Watershed Amenities</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Camp Comfort&lt;sup&gt;1&lt;/sup&gt;</td>
<td>County of Ventura</td>
<td>Next to San Antonio Creek</td>
</tr>
<tr>
<td>4</td>
<td>Dennison Park&lt;sup&gt;1&lt;/sup&gt;</td>
<td>County of Ventura</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Emma Wood State Beach Group Campground&lt;sup&gt;1&lt;/sup&gt;</td>
<td>State of California</td>
<td>Access to coast and Ventura River estuary</td>
</tr>
<tr>
<td>4</td>
<td>Foster Park</td>
<td>County of Ventura</td>
<td>Next to Ventura River</td>
</tr>
<tr>
<td>5</td>
<td>Grant Park</td>
<td>City of Ventura</td>
<td>Views of the watershed</td>
</tr>
<tr>
<td>4</td>
<td>Lake Casitas Recreation Area&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Casitas Municipal Water District</td>
<td>Access to Lake Casitas</td>
</tr>
<tr>
<td>5</td>
<td>Seaside Wilderness Park</td>
<td>State of California (west of river)</td>
<td>Access to the Ventura River cobble delta and sand dunes</td>
</tr>
<tr>
<td></td>
<td>City of Ventura (east of river)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Soule Park</td>
<td>County of Ventura</td>
<td>Next to Thacher Creek</td>
</tr>
<tr>
<td>5</td>
<td>Surfers' Point</td>
<td>City of Ventura and Ventura County Fairgrounds/31st District</td>
<td>Ocean and estuary access</td>
</tr>
</tbody>
</table>

<sup>1</sup> Also a campground

Trails

The watershed is home to over 40 trails that are maintained for public access. In addition to pedestrian access for walking, hiking, and backpacking, many of these trails provide access to bicyclists and equestrians. These trails are summarized in Table 3.6.4.1.4.

<table>
<thead>
<tr>
<th>Detail Map #</th>
<th>Trail Name</th>
<th>Trail Uses&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Miles&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Difficulty</th>
<th>Trailhead, Route &amp; Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lake Shore Trail</td>
<td>F, B</td>
<td>2.1</td>
<td>Easy</td>
<td>Unpaved trail begins at the eastern end of the paved road in the Lake Casitas Recreation Area (LCRA). Beginning from the free parking area outside of the LCRA entrance adds 1.4 miles to the walk/ride.</td>
</tr>
<tr>
<td></td>
<td>Omer Rains Trail</td>
<td>F, B, P</td>
<td>2&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Easy</td>
<td>Runs from San Buenaventura State Beach to Emma Wood State Beach</td>
</tr>
<tr>
<td></td>
<td>Ventura River Trail</td>
<td>F, B, P</td>
<td>6.3</td>
<td>Easy</td>
<td>Main St., Ventura to Foster Park</td>
</tr>
<tr>
<td></td>
<td>Ojai Valley Trail</td>
<td>A, F, B, P</td>
<td>9.5</td>
<td>Easy</td>
<td>Foster Park to Fox St., Ojai</td>
</tr>
<tr>
<td></td>
<td>Shelf Road</td>
<td>F, B, H</td>
<td>1.75</td>
<td>Easy</td>
<td>N. Signal St. (trailhead) to Gridley Rd. (trailhead)</td>
</tr>
<tr>
<td></td>
<td>Sulphur Mountain Road</td>
<td>F, B, H</td>
<td>10.5</td>
<td>Mod</td>
<td>From trailhead to trailhead (Sulphur Mountain Rd. at Casitas Springs to Sulphur Mountain Rd. at Upper Ojai)</td>
</tr>
</tbody>
</table>
Table 3.6.4.1.4 Trails in the Watershed (continued)

<table>
<thead>
<tr>
<th>Detail Map #</th>
<th>Trail Name</th>
<th>Trail Uses</th>
<th>Miles</th>
<th>Difficulty</th>
<th>Trailhead, Route &amp; Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ojai Valley Land Conservancy Trails</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Huntington Trail</td>
<td>F, B, H</td>
<td>1</td>
<td>Easy-Mod</td>
<td>Thacher School (trailhead) to Forest N. Cook Trail</td>
</tr>
<tr>
<td>2</td>
<td>Forest N. Cook Trail</td>
<td>F, B, H</td>
<td>1</td>
<td>Easy-Mod</td>
<td>Connects lower to upper Huntington Trail</td>
</tr>
<tr>
<td>Ojai Meadow Preserve</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Interpretive Loop Trail</td>
<td>F, B</td>
<td>1</td>
<td>Easy</td>
<td>Various trail segments in Ojai Meadow Preserve</td>
</tr>
<tr>
<td>Valley View Preserve</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Foothill Trail</td>
<td>F, B</td>
<td>1.1</td>
<td>Easy-Mod</td>
<td>OVLC maintains sections of Foothill Trail on their preserve</td>
</tr>
<tr>
<td>2</td>
<td>Fox Canyon Trail</td>
<td>F, B</td>
<td>1.03</td>
<td>Mod-Diff</td>
<td>Shelf Road (trailhead) to Foothill Trail</td>
</tr>
<tr>
<td>2</td>
<td>Luci's Trail</td>
<td>F, B</td>
<td>0.75</td>
<td>Mod-Diff</td>
<td>Shelf Road (trailhead) to Foothill Trail</td>
</tr>
<tr>
<td>Ventura River Preserve</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Chaparral Crest Trail</td>
<td>F, B, H</td>
<td>2.9</td>
<td>Mod</td>
<td>West side of river; see map</td>
</tr>
<tr>
<td>3</td>
<td>Fern Grotto Trail</td>
<td>F, B, H</td>
<td>0.3</td>
<td>Mod</td>
<td>West side of river; see map</td>
</tr>
<tr>
<td>3</td>
<td>Kennedy Ridge Trail</td>
<td>F, B, H</td>
<td>1.0</td>
<td>Mod</td>
<td>West side of river; see map. (Trail distance is to the edge of the preserve, not the end of the trail.)</td>
</tr>
<tr>
<td>3</td>
<td>Rice Canyon Trail</td>
<td>F, B, H</td>
<td>1.5</td>
<td>Mod</td>
<td>West side of river; see map</td>
</tr>
<tr>
<td>3</td>
<td>Oso Ridge Trail</td>
<td>F, B, H</td>
<td>1.5</td>
<td>Mod-Diff</td>
<td>West side of river; see map</td>
</tr>
<tr>
<td>3</td>
<td>Wills Canyon Trail</td>
<td>F, B, H</td>
<td>2.2</td>
<td>Easy-Mod</td>
<td>West side of river; see map</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Fuelbreak Road Easement</td>
<td>F, B</td>
<td>1.0</td>
<td>Easy-Mod</td>
<td>OVLC maintains an easement over private property at the far east end of Fuelbreak Road</td>
</tr>
<tr>
<td>State of California Trails</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Emma Wood River Trail</td>
<td>F</td>
<td>0.7</td>
<td>Easy</td>
<td>Loop from Emma Wood Group Campground to estuary and back. Connects to Ocean's Edge Trail. Note: often occupied by transient campers.</td>
</tr>
<tr>
<td>5</td>
<td>Ocean's Edge Trail</td>
<td>F, B</td>
<td>0.6</td>
<td>Easy</td>
<td>Trailhead in Emma Wood State Beach Group Campground. Travels next to coast through Seaside Wilderness Park to Ventura River estuary. Connects with Emma Wood River Trail.</td>
</tr>
<tr>
<td>US Forest Service Trails</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Cozy Dell Trail</td>
<td>F, B, H</td>
<td>2.1</td>
<td>Mod</td>
<td>Hwy 33 (trailhead) to Foothill Trail</td>
</tr>
<tr>
<td>1</td>
<td>Dry Lakes Ridge</td>
<td>F, B, H</td>
<td>2.3</td>
<td>Diff</td>
<td>Hwy 33 (access) to the basin; another 2.9 to Ortega Motorcycle Trail. Accessed by an old, unmaintained bulldozer line.</td>
</tr>
<tr>
<td>2</td>
<td>Foothill Trail</td>
<td>F, B, H</td>
<td>1.3</td>
<td>Mod</td>
<td>From Cozy Dell Trail to dead-end just past Luci's Trail</td>
</tr>
<tr>
<td>2</td>
<td>Fuelbreak Road</td>
<td>F, B, H</td>
<td>2.3</td>
<td>Mod</td>
<td>Connects Gridley Trail to Pratt Trail (and trails in between)</td>
</tr>
<tr>
<td>2</td>
<td>Gridley Trail</td>
<td>F, B, H</td>
<td>7.1</td>
<td>Mod-Diff</td>
<td>North end of Gridley Rd. (trailhead) to Nordhoff Ridge Road</td>
</tr>
<tr>
<td>2</td>
<td>Horn Canyon Trail</td>
<td>F, B, H</td>
<td>4.9</td>
<td>Mod-Diff</td>
<td>Thacher School (trailhead) to Nordhoff Ridge Road</td>
</tr>
<tr>
<td>1</td>
<td>Murrietta Divide Road</td>
<td>F, B, H</td>
<td>4.2</td>
<td>Diff</td>
<td>Main trailhead to Murrietta Divide Road at T-intersection, then up to the divide</td>
</tr>
<tr>
<td>Detail Map #</td>
<td>Trail Name</td>
<td>Trail Uses¹</td>
<td>Miles²</td>
<td>Difficulty</td>
<td>Trailhead, Route &amp; Notes</td>
</tr>
<tr>
<td>-------------</td>
<td>----------------------------------</td>
<td>-------------</td>
<td>--------</td>
<td>------------</td>
<td>----------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>Murietta Trail</td>
<td>F, B, H</td>
<td>2.4</td>
<td>Easy-Mod</td>
<td>Main trailhead to Murietta Trailhead - 0.7 miles, then 1.7 miles to junction with Murietta Divide Road</td>
</tr>
<tr>
<td>2</td>
<td>Nordhoff Ridge Road</td>
<td>F, B, H</td>
<td>12.7¹</td>
<td>Easy</td>
<td>The ridge runs from above Wheeler Gorge to the top of Horn Canyon, then continues into the Santa Clara River watershed</td>
</tr>
<tr>
<td>1</td>
<td>North Fork Matilija Trail</td>
<td>F</td>
<td>8.5</td>
<td>Easy-Diff</td>
<td>Main trailhead to North Fork Matilija Trailhead - 0.6 miles, then 7.9 miles to Cherry Creek Road trailhead</td>
</tr>
<tr>
<td>2</td>
<td>Ortega Motorcycle Trail</td>
<td>F, B, M</td>
<td>8.9</td>
<td>Mod</td>
<td>Hwy. 33 (trailhead) to Cherry Creek Road trailhead. Rough conditions. Seasonal closures.</td>
</tr>
<tr>
<td>2</td>
<td>Pratt Trail</td>
<td>F, B, H</td>
<td>4.8</td>
<td>Diff</td>
<td>N. Signal St. (trailhead) to Nordhoff Ridge Road</td>
</tr>
<tr>
<td>2</td>
<td>Wheeler Gorge Nature Trail</td>
<td>F</td>
<td>0.7</td>
<td>Easy</td>
<td>Loop from Hwy. 33 (trailhead)</td>
</tr>
</tbody>
</table>

¹: ADA Accessible, B-Bike, F-Foot, H-Horse, HC-High-Clearance Vehicles, M-Motorcycle, P-Paved,
²: One-way unless otherwise indicated.
³: Mileage represents only the part of trail within the watershed.
⁴: Not all of the Ventura River Preserve Trails are included here or labeled on the map.

Sources: Carey 2014; Ventura County Trails 2014; LPNF 2014; Walter 2014

**Ojai Valley Trail.** The Ojai Valley Trail (known as the Ventura River Trail below Foster Park), runs 15.8 miles from the City of Ojai down to the coast, following an old railway route for most of the way. The trail is very popular with bicyclists, as well as walkers and horseback riders (on the Ojai Valley Trail segment). At the coast, the trail connects to the Omer Rains Trail, which runs along the coast to the San Buenaventura State Beach.

Photo courtesy of Michael McFadden
Ventura River Parkway

The “Ventura River Parkway” is a vision actively pursued by a coalition of stakeholders. The river parkway would create a continuous network of publicly accessible trails, vista points, and natural areas along the river, from the coast to Matilija Canyon. Existing trails form the beginnings of the parkway. By working with willing landowners on a voluntary basis over time, supporters hope that a parkway will take shape that will yield the many health, quality of life, and economic benefits seen in other communities that have established river parkways.

California River Parkways Act

In 2004, the state Legislature passed the California River Parkways Act, which outlined the following values of river parkways:

(a) River parkways directly improve the quality of life in California by providing important recreational, open space, wildlife, flood management, water quality, and urban waterfront revitalization benefits to communities in the state.

(b) River parkways provide communities with safe places for recreation including family picnics; bicycling and hiking; areas for river access for swimming, canoeing, and fishing; and many other activities.

(c) River parkways help revitalize deteriorated urban neighborhoods and provide an anchor for economic development by providing important recreational and scenic amenities.

(d) River parkways provide accessible open space that helps remedy the severe shortage of park and open-space areas that plague many urban and suburban communities, small towns, and rural areas.

(e) River parkways provide flood protection benefits for communities by providing wider corridors along our waterways that help store, and provide safe corridors for the passage of, storm waters.

(f) River parkways protect and restore riparian and riverine habitat.

(g) River parkways improve or protect the water quality in our rivers and streams.

(h) River parkways provide the recreational and ecosystem components of integrated regional water management and watershed plans.

(i) California can improve the quality of life in this state by assisting public agencies and nonprofit organizations in establishing, developing, and restoring river parkways.

—California River Parkways Act of 2004: California Public Resources Code 5751(b)
In 2010 (with funding from the California Coastal Conservancy, and sponsorship by The Trust for Public Land and VHC), California Polytechnic University Pomona (CalPoly) created a conceptual document, *Vision Plan for the Lower Ventura River Parkway* (vision plan) for the lower parkway (from the coast to Foster Park) (CalPoly 2008/2010). The vision plan, developed by CalPoly’s Department of Landscape Architecture, presents a vision for the lower parkway based on local research and stakeholder input. The 317-page vision plan includes a detailed characterization of the lower watershed, complete with maps, photos, and data graphs. Sketches of potential future parkway features help bring the community vision to life.

The vision plan was intended to educate and engage the community and prospective funders about the potential for a river parkway that is compatible with recreational use, stewardship, river function, and regional ecosystems. Because it was intended to be a visioning document, the project team did not overly constrain themselves with the pragmatic hurdles that would be involved in implementing some of the design features. The plan outlines big ideas to stimulate possibilities.

*Vision Plan Sketch*

*Source: Vision Plan for the Lower Ventura River Parkway (CalPoly 2008/2010)*

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**National Recreation Trail Designation**

Two existing trails form part of the Ventura River Parkway Trail: the Ojai Valley Trail and the Ventura River Trail. These interconnected multi-use trails connect the coast to the City of Ojai. In June 2014, this part of the Ventura River Parkway Trail was designated a National Recreation Trail (NRT). The NRT designation recognizes existing trails and trail systems that link communities to recreation opportunities on public lands and in local parks across the nation. Each designated trail is identified with a set of trail markers.
### Viewpoints

Views of the river and other natural landscapes offer another important way that residents and visitors have access to nature. Viewpoints that are easily accessible by car or an easy walk allow less mobile individuals to see and enjoy these resources. Some of the watershed’s key, readily accessible viewpoints—many of them at bridges—are summarized in this section.

**Main Street Bridge**  
Photo Courtesy of Santa Barbara Channelkeeper

![Image of Main Street Bridge](image-url)

<table>
<thead>
<tr>
<th>Viewpoint</th>
<th>View and Conditions¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Street Bridge</td>
<td>Views of lower Ventura River, just above the estuary. Typically has perennial flow.</td>
</tr>
<tr>
<td>Casitas Vista Bridge</td>
<td>Views of lower-middle Ventura River at Foster Park. Typically has perennial flow.</td>
</tr>
<tr>
<td>San Antonio Creek Bridge (on Ojai Valley Trail)</td>
<td>Views of the convergence of San Antonio Creek with Ventura River and the &quot;confluence pool.&quot; Typically has perennial flow.</td>
</tr>
<tr>
<td>Santa Ana Bridge</td>
<td>Views of upper-middle Ventura River in the river’s dry reach. Typically dry.</td>
</tr>
<tr>
<td>Santa Ana Road</td>
<td>Expansive views of the upper-middle Ventura River along the road. Typically dry.</td>
</tr>
<tr>
<td>Highway 150 Bridge</td>
<td>Views of the upper-middle Ventura River in the river’s dry reach. Typically dry.</td>
</tr>
<tr>
<td>Highway 150 above Lake Casitas</td>
<td>Views of Lake Casitas.</td>
</tr>
<tr>
<td>Surfers’ Point</td>
<td>Ocean views.</td>
</tr>
<tr>
<td>Grant Park</td>
<td>Views of the entire lower watershed, estuary, and coast.</td>
</tr>
<tr>
<td>Highway 33 - State Scenic Highway</td>
<td>Views of the steep, chaparral-covered mountains of the Los Padres National Forest and the Transverse Ranges.</td>
</tr>
<tr>
<td>Dennison Park</td>
<td>Views of the Ojai Valley’s East End.</td>
</tr>
</tbody>
</table>

1. Conditions in the Ventura River are quite variable from year to year. "Typical" here indicates conditions in most years except during extended, multi-year droughts.
Fishing

Lake Casitas is a popular fishing destination known for its “world class” bass fishing. In addition to largemouth bass, the lake is filled with rainbow trout, crappie, red-ear sunfish, bluegill and channel catfish.

Stream fishing in the watershed is permitted (for any species of fish) only above “anadromous waters,” which are inland waters that are accessible to fish migrating from the ocean. This limits stream fishing to Matilija Creek above Matilija Dam, and North Fork Matilija Creek above Wheeler Gorge Campground.

Aquatic Recreation

Swimming, wading, surfing, boogie boarding and other body contact sports are very popular year-round activities in the watershed’s coastal ocean waters. Swimming in the estuary is uncommon, though children can sometimes be seen wading around its edges.

Swimming and other body contact sports are not allowed in Lake Casitas or Matilija Reservoir.

Small, unmarked swimming holes can be found along the Ventura River, Matilija Creek, and North Fork Matilija Creek. Water levels in these swimming holes depend upon local groundwater and surface water levels.
On the rare occasions when the Ventura River water levels are high enough to be navigable by boat, the strong flows and rocky conditions are generally unsafe for boating.

... during each summer in the early years of the 20th century, the county forester built a rock dam across the river at Foster Park to form a free swimming hole for visitors, as instructed by E. P. Foster (Percy 1976).

Environmental Information and Interpretation

More insight into the watershed's natural habitats can greatly enhance visitor's appreciation of and connection to a natural site, greatly enriching their experience there. By providing environmental information and interpreting that information, resource managers aim to cultivate educated and appreciative visitors, and to encourage respect for and stewardship of those resources.

Environmental information is typically communicated through signs, printed materials, and websites.

This section summarizes the watershed's key onsite environmental information and interpretation programs provided by public agencies and nonprofits. Private businesses also offer nature-based interpretive opportunities in the watershed.

Interpreting environmental information is a way of translating factual information into stories, firsthand experiences, or graphic images. Interpretive workshops, field trips, displays, tours, and presentations are all offered in the watershed to help people develop a meaningful connection with environmental resources, relationships, or processes.

Onsite static information in the form of signs or displays is underdeveloped. Vandalism of such resources has been a significant problem. Online information is well developed, especially with the completion of this watershed management plan. Part 3 of this plan, "Watershed Characterization," includes a comprehensive overview of the watershed's geology, hydrology, ecosystems, and water quality—illustrated with a comprehensive atlas of maps that are now available for use in interpretive materials (www.venturawatershed.org/map-atlas).
Information about the watershed's nature-based access opportunities needs to be better communicated to the public through a variety of different media in English and Spanish.

**Wheeler Gorge Visitor Center**

The Wheeler Gorge Visitor Center offers educational information and programs about the flora, fauna, geography, geology, natural history, trails, and camps of the LPNF. The center is located at 17017 Maricopa Highway about eight miles north of the City of Ojai, and across Highway 33 from Wheeler Gorge Campground. It is open weekends year round. Picnic sites are provided at the center. The Los Padres Forest Association manages the facility under an agreement with the USFS.

**Ojai Valley Land Conservancy**

The OVLC offers many ongoing environmental interpretation programs. OVLC's monthly "Wild About Ojai" lecture series offers programs on different topics such as geology, fire ecology, watershed health, Chumash history, and native plants. Guided hikes on OVLC's preserves are offered periodically—some are general interpretive hikes and some focus on specific topics such as birds. Preserve tours are offered on request for groups of six or more; tours cover the preserve's history, ecology, trail system, and more. OVLC also partners with the nonprofit Once Upon a Watershed to host school field trips on their preserves. Kiosks at several OVLC trailheads—Old Baldwin Road, Riverview, Valley View, and Ojai Meadow Preserve (next to Nordhoff High School)—provide trail information and some information on plants and animals found on the preserves.
Ventura Hillsides Conservancy

The VHC offers many educational and outreach programs each year. Partnering with Santa Barbara Channelkeeper (as well as Surfrider Foundation and Audubon Society when possible), VHC coordinates field trips for local schools, introducing children to the issues and environment of the Ventura River watershed. VHC conducts outreach activities at local events, educating the public about the value of the watershed and recruiting volunteers to help clean trash and restore habitat in the lower river. During the wet season, they organize tree planting events on their preserves, removing non-native weeds and replacing them with native trees. VHC hosts guided preserve tours by appointment year-round.

Once Upon a Watershed

Once Upon a Watershed is a nonprofit program that provides hands-on watershed education, restoration, and stewardship experience to 4th, 5th, and 6th grade students in the Ventura River watershed. This nonprofit partners with OVLC to provide school field trips on their preserves.

California State Parks

The Channel Coast District of California State Parks offers summer campfire interpretive programs at Emma Wood State Beach Campground; their staff also provides guided tours, kayak instruction, and ancient native technology classes as time permits. The district offers one of the largest junior lifeguard programs in the state with nearly 1,000 participants a year, ranging from 9 to 17 years old. In addition to water safety and awareness, the lifeguard program incorporates an
introduction to the surrounding flora and fauna. The junior lifeguard program is held at San Buenaventura State Beach, just south of the watershed.

**City of Ojai/Ventura Wild**

The City of Ojai's Recreation Department partners with the Ventura Wild organization to provide wilderness discovery programs, including seasonal camps, for youth in the Ojai Valley.

**City of Ventura's Interpretive Outreach Program**

For over 30 years the City of Ventura has been providing an Interpretive Outreach Program to students (preschool to 6th grade), providing them with interactive education programs both in the classroom and at local parks, beaches, and historic sites. These programs correspond with the California Science and History-Social Science curriculum framework.

*City of Ventura's Interpretive Outreach Program.* The City of Ventura’s Interpretive Outreach Program serves more than 16,000 participants annually.  
Photo courtesy of City of Ventura
and content standards. During a nature study field trip, classroom presentation, or living history field trip, students are actively engaged as they learn through direct hands-on experience. The City of Ventura's Interpretive Outreach Program serves more than 16,000 participants annually, including those from schools outside of the City of Ventura.

**Santa Barbara Channelkeeper**

Santa Barbara Channelkeeper (SBCK) provides watershed education for a variety of students including college, high school, and elementary school students. SBCK meets with classes at sites throughout watershed for field trips. Topics covered include the history of the watershed, current issues, and the importance of water quality monitoring. SBCK also works with teachers individually, and collaborates with community organizations including VHC and Once Upon a Watershed.
3.6.4.2 Nature Access by Area

This section provides descriptions of nature access opportunities in the following five geographic areas:

- Up Highway 33 (Detail Map 1)
- Ojai Front Country (Detail Map 2)
- Ventura River Preserve (Detail Map 3)
- Ojai Valley & Upper Ojai (Detail Map 4)
- Coastal Area (Detail Map 5)

Trailheads are numbered in this section to reflect the number used to identify them on the Detail Maps.

Figure 3.6.4.2.1 Trails & Recreation Areas – Map Detail Reference
1. Cherry Creek Road Trailhead
Located three miles off Highway 33 on a rough dirt road. Cherry Creek Road is approximately 27 miles past Ojai. The trailhead provides access to both North Fork Matilija Trail and Ortega Motorcycle Trail. Trailhead has a dirt parking area. The road is only open from August 1 to December 15.

2. Matilija Canyon Trailhead
Located at the end of Matilija Road, 4.9 miles past the junction with Highway 33. The Matilija Canyon trailhead, provides access to a vast expanse of wilderness. Much of this area lies within the Matilija Wilderness, a federally designated wilderness area. Trailhead has a dirt parking area.
area. The trails that lead from the Matilija Canyon trailhead follow drainages that commonly flow year-round: Upper North Fork Matilija Creek, Murietta Creek, and Matilija Creek. These creeks are the primary headwaters of the Ventura River watershed. Swimming holes exist depending on the current water conditions. Fishing is allowed in these drainages since the endangered steelhead cannot get past Matilija Dam.

### Car Break-Ins at Trailheads

Car break-ins at trailheads do occasionally happen at some of the watershed's trailheads. Do not leave valuables in the car or the trunk, especially where they would be visible from the outside.

### North Fork Matilija Trail

*Hiking, horseback riding, swimming/wading, backcountry camping*

First trail off the main road, on the right, just past the second creek crossing. Follows Upper North Fork Matilija Creek. The trail goes through wilderness so travel is restricted to foot or horseback (no bikes in wilderness). Ends at Cherry Creek Road trailhead.

### Murietta Trail

*Hiking, biking, horseback riding, backcountry camping (Murietta Camp)*

Second trail off the main road, on the left, shortly after the North Fork Matilija Trail. Offers backcountry camping, swimming and fishing. Meets up with and follows Murietta Creek, then merges with Murietta Divide Road.

### Two North Fork Matilija Creeks?

The watershed has two North Fork Matilija Creeks. The one that follows Highway 33 down from the top of the watershed is called “North Fork Matilija Creek;” the one that travels through the Matilija Wilderness in the western corner of the watershed and is an early tributary of Matilija Creek is called “Upper North Fork Matilija Creek.” However, the trail that follows this creek is called the “North Fork Matilija Trail.”
Murieta Divide Road

*Hiking, biking, horseback riding*

Begins at the T-intersection at the end of the main road. Turn left. Goes to Murieta Divide and beyond into Santa Barbara County.

**Scenic Highway**

*Scenic driving, biking*

As Highway 33 climbs out of the Ojai Valley heading north, the landscape quickly turns to the rugged mountains of the Transverse Ranges. The highway follows the Ventura River, and then North Fork Matilija Creek—one of the two tributaries that feed into and form the Ventura River. Nine miles of Highway 33 within the watershed are designated as a National Forest Scenic Byway and a State Scenic Highway. The State Scenic Highway begins where Highway 33 crosses into USFS land 6.4 miles north of Highway 150, and extends to the top of the watershed and beyond to the Santa Barbara County line (CDOT 2014). Considered to be one of the most “picturesque national forest locations” (USFS 2005), the scenic highway features panoramic vistas of steep, chaparral-covered mountains and relatively undisturbed habitats. This scenic drive is itself a recreational destination for many people.
3. Dry Lakes Ridge

*Hiking*

Access to this area starts at an unmarked dirt turnout with parking, located 25 miles past the Wheeler Gorge Campground on the south side of Highway 33. An old, unmaintained bulldozer line leads up to Dry Lakes Ridge and the USFS's Dry Lakes Ridge Botanical Area, an area protected for its special botanical resources. The first segment is an exceedingly steep firebreak. This route is not well used, so some bush-whacking through sharp chaparral along the ridge can be expected.

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4. Ortega Motorcycle Trailhead

*Hiking, biking, motorcycle riding (some parts are inaccessible to motorcycles), backcountry camping (Ortega Camp)*

Located on the west side of Highway 33 1.6 miles above the Wheeler Gorge Campground entrance. The trailhead is a dirt turnout with limited parking and only marked by a small trail sign. The trail is very rough and steep in places and subject to closures. It ends at the Cherry Creek Canyon Road trailhead at the top of the watershed.

**Holiday Group Camp**

*Camping*

Located on the west side of Highway 33 about one mile north of the Wheeler Gorge Campground entrance. The campground is partially shaded with oaks and scrub oaks. This USFS campground has seven campsites.
5. Wheeler Gorge Nature Trailhead

**Hiking**

Located on the west side of Highway 33, one half mile above the Wheeler Gorge Campground entrance. The trailhead has limited parking on either side of the highway. The trail is an easy, 0.7-mile loop that follows the North Fork Matilija Creek then climbs up into chaparral habitat and descends back. Fifteen trail markers identify native plants; a brochure interpreting the self-guided hike is available from the Wheeler Gorge Visitors Center.

**Wheeler Gorge Campground**

*Car-accessible camping, hiking, swimming/wading, fishing*

Located on Highway 33 about eight miles north of the City of Ojai. The campground is located in a shaded riparian corridor surrounded by high, rocky canyon walls. North Fork Matilija Creek and Bear Creek flow through the campground, the North Fork flows year-round. This USFS campground has 72 campsites. Fishing is allowed in the campground on North Fork Matilija Creek upstream of a road crossing that acts as a fish passage barrier. Across the highway is the Wheeler Gorge Visitor Center (described earlier in this section).

6. Cozy Dell Trailhead

**Hiking, biking, horseback riding**

Located near Friends Packing House on the east side of Highway 33, 3.3 miles north of the City of Ojai. There is ample parking on the west side of the highway. The first mile of the trail is fairly steep and often shaded, and at the top offers exceptional views of the watershed. The trail connects to Cozy Dell Road and the Foothill Trail.
A network of publicly accessible trails crisscrosses the foothills and steep mountains that rise up from the Ojai Valley floor to Nordhoff Ridge. Many of these trails lead into the LPNE. The system of trails here provides different opportunities for day hiking, mountain biking, horseback riding, and backcountry access. Many of these trails follow drainages, and all of them provide spectacular views. Some trails are quite steep in places.

Nordhoff Ridge Road

_Hiking, biking, horseback riding, driving (4-wheel-drive vehicles only), parasailing, hang-gliding, backcountry camping_

Nordhoff Ridge Road travels along Nordhoff Ridge at the top of the watershed, providing commanding views all around. Several trails lead up from the watershed and end at this road. A permit from the USFS is
required to drive on the road, which is accessed by vehicle from the Rose Valley Campground (located outside the watershed).

**Fuelbreak Road**

*Hiking, biking, horseback riding*

Runs more-or-less horizontally across the mountainside and connects Gridley Trail with Pratt Trail. The east end of the trail near Gridley Trail is a public easement over private property.

**Foothill Trail**

*Hiking, biking, horseback riding (no horses on OLVC’s portion of Foothill Trail)*

Runs horizontally across the mountainside and connects Cozy Dell Trail, Pratt Trail, Fox Canyon Trail, and Luci’s Trail.

---

**Biking on Foothill Trail**

*Photo courtesy of Chad Ress*

---

**7. Pratt Trailhead**

*Hiking, biking, horseback riding, backcountry camping (Valley View Camp)*

Located above the Stewart Canyon debris basin, up N. Signal Street. The trailhead has a dirt parking area. The lower end of Pratt trail follows Stewart Canyon Creek; the trail then heads up the steep slope of Nordhoff Ridge, ending at Nordhoff Ridge Road and Nordhoff Peak (4,485 ft). The trail’s lower section ties into the Cozy Dell Trail, Foothill Trail, and Fuelbreak Road.
8. Shelf Road Trailheads West and East

*Hiking, biking, horseback riding*

A trailhead is located at each end of Shelf Road. The western trailhead is at the top of N. Signal Street and the eastern trailhead is on Gridley Road. Parking is on-street on N. Signal Street (or at the Pratt trailhead), and there is a small dirt parking area on Gridley Road. Shelf Road is a relatively flat trail.

Valley View Preserve

*Hiking, biking*

Located adjacent to and above Shelf Road. This 195-acre Ojai Valley Land Conservancy preserve includes the mountainside behind the City of Ojai and two short, steep trails that connect to Foothill Trail and Shelf Road. The preserve is accessed from Shelf Road.

9. Fox Canyon Trailhead

10. Luci’s Trailhead

*Hiking, biking*

Both trailheads are accessed by foot off of Shelf Road—Luci’s is bit farther east than Fox Canyon. Both trails are quite steep and connect to Foothill Trail.

11. Gridley Trailhead

*Hiking, biking, horseback riding, backcountry camping (Gridley Springs Camp)*

Located in the East End of the Ojai Valley at the north end of Gridley Road. The trailhead is off of a cul-de-sac and parking is on-street. The trail ends at Nordhoff Ridge Road. A horse trough is located about a third of the way to the top. Question: Is there usually water in this trough? May want to clarify.
Ilvento Preserve

Located in the East End of the Ojai Valley on the private Thacher School campus near the Gymkhana Field. The 80-acre preserve offers great views. Park at the Horn Canyon trailhead parking area and follow the road to the right a short distance to the Ilvento Preserve trailhead (Huntington Trail).

Huntington and Forest N. Cook Trails

_Hiking, biking, horseback riding_

Accessed from the Ilvento Preserve trailhead. These short trails form a loop.

12. Horn Canyon Trailhead

_Hiking, biking, horseback riding, backcountry camping (The Pines)_

Located in the East End of the Ojai Valley on the private Thacher School campus. Turn right after you enter the campus and continue east through the parking lot; keep right to dirt road, stream crossing, and avocado orchard. The trailhead has a dirt parking area. Horn Canyon trail crosses Thacher Creek several times before climbing up the mountain. Near the top of the watershed the trail crosses Sisar Canyon Road and then intersects with Nordhoff Ridge Road.
Ventura River and Ojai Meadow Preserves (Detail Map 3)

Figure 3.6.4.2.4 Trails & Recreation Areas – Ventura River and Ojai Meadow Preserves (Detail Map 3)

Ventura River Preserve

Hiking, biking, horseback riding (allowed on many but not all trails), swimming/wading, wildlife viewing

Located in and west of the Ventura River, next to the communities of Meiners Oaks and Mira Monte on one side and the LPNF on the other. The Ventura River Preserve (VRP) is the watershed's largest preserve, covering 1,583 acres, including 655 acres of floodplain, 2.6 miles of the Ventura River, and adjacent canyons to west of the river.

The VRP has three trailheads with parking adjacent to the Ventura River. A network of over 12 trails, totaling 20 miles, traverse the wide river bottom and connect to trails leading through canyons or along ridges on the west side of the river. The Rice Canyon/Wills Canyon loop is a very popular hike; the lush oak woodlands of Wills Canyon are noteworthy.
for their “enchanted forest” feel. Swimming holes in the river are sometimes available depending on the season and amount of rainfall that year. Provides excellent opportunities for wildlife viewing.

The habitat on the VRP is largely pristine, except for trails and historic orchards that are being restored. The river bottom includes primarily alluvial scrub and mulefat scrub habitats. The river-adjacent terraces comprise mainly grasslands and oak woodlands. Chaparral and oak woodlands dominate the canyons to the west of the river. The terrain is varied. The river bottom is flat with many boulders in some areas; canyons are moderately steep to steep.

![Ventura River Preserve Hike](Image)

Ventura River Preserve Hike
Photo courtesy of Ojai Valley Land Conservancy

13. Oso Trailhead

Located at the end of Meyers Road, off of N. Rice Road in the river bottom. The trailhead has a large gravel parking area that accommodates horse trailers. The trailhead gate opens at 8:00 am and closes at 5:00 pm in the winter (Nov 1 - Mar 31) and 7:30 pm in the summer (Apr 1 - Oct 31).

Oso trailhead connects to a network of trails on the preserve. Two popular destinations are Kennedy Ridge Trail and the Wills-Rice Canyon Loop, described below. See Table 3.6.4.1.4 for more information on the various small connector trails on the preserve.

Kennedy Ridge Trail

*Hiking, biking*

Accessed off of Rice Canyon Trail, across the river bottom and up some gentle slopes. The trail is moderately steep and offers great views.
Wills-Rice Canyon Loop

**Hiking, biking, horseback riding**

Travels through two adjacent canyons. Wills Canyon is a deeply shaded oak woodland with a special “enchanted forest” feel to it; the terrain is relatively flat/gently sloping. Rice Canyon is more exposed with more varied terrain. Both trails begin on the west side of the Ventura River. The loop trail is easily accessed by either the Oso trailhead or the Riverview trailhead.

14. Riverview Trailhead

Located on Rice Road just south of W. El Roblar Drive. The trailhead has a dirt parking area. Riverview trailhead offers connection to a network of trails on the preserve. The Wills-Rice Canyon Loop, described above, is a popular destination, as are the River Trails, Oso Ridge Trail, and Chaparral Crest Trail, described below. See Table 3.6.4.1.4 for more information on the various small connector trails on the preserve.

River Trails

**Hiking, biking, horseback riding**

A network of trail segments run along the east side of the Ventura River along its 2.6-mile extent. These flat trails run through diverse alluvial scrub and grassland habitats studded with oaks and sycamores. Various options are available to cross the river bottom and connect to loop or ridge trails on the other side.

Oso Ridge Trail

**Hiking, biking, horseback riding**

Begins on the west side of the Ventura River; accessed from either Riverview or Oso trailhead. The trail is moderately steep, ascending and dipping as it climbs, and travels through tall stands of dense chaparral. Offers great panoramic views. Connects with Chaparral Crest Trail.

Chaparral Crest Trail

**Hiking, biking, horseback riding**

Begins on the west side of the Ventura River; accessed from either Riverview or Oso trailhead. The trail is accessed off of Oso Ridge Trail, Upper Wills Canyon Trail, or Fern Grotto Trail. The trail travels through a variety of habitats, and the terrain is quite varied, with some steep ascents and descents. Offers spectacular views.
15. Old Baldwin Road Trailhead

Located at the end of Old Baldwin Road, just off of Highway 150. The trailhead has plenty of parking and accommodates horse trailers. The first quarter mile of the trail is ADA-accessible. River bottom trails are accessible from this trailhead, as are the Oso Ridge Trail and the Chaparral Crest Trail, described above. The trailhead gate opens at 7:30 am and closes at 5:00 p.m. in the winter (Nov 1–Mar 31) and 7:30 pm in the summer (Apr 1–Oct 31).

Ojai Meadow Preserve

Hiking/walking, biking, birding

Located in an urban setting at the northwest edge of the City of Ojai, just west of Nordhoff High School off Highway 33. The 57-acre preserve is the site of a restored freshwater marsh wetland that provides flood management services for the surrounding properties. As a wetland site, the preserve is particularly popular for bird watching. Habitats include oak woodland, grassland, freshwater marsh, eucalyptus forest, and southern willow riparian scrub. The terrain is open and flat.

The preserve has two trailheads and a number of winding trails and several scenic resting spots.

16. Ojai Meadow Preserve, East and West Trailheads

The eastern entrance is located on Lomita Avenue in Meiners Oaks, to the right of Meiners Oaks Elementary School. Parking is on-street. The western entrance is located on Highway 33, just north of Nordhoff High School. Parking is on-street.
Lake Casitas Recreation Area

Boating, rowing, fishing, camping, picnicking, biking, hiking, water park activities, other sports, birding, wildlife viewing

Located west of Oak View off of Highway 150 at Santa Ana Road. The expansive LCRA provides a wide variety of recreation opportunities. See the Lake Casitas Recreation Area description above in “Parks and Recreation Areas.”

Habitats include open water lake, marsh, oak woodlands, grasslands, chaparral, and coastal scrub. The accessible terrain is mostly flat or rolling.
Kayaking on Lake Casitas
Photo courtesy of Michael McFadden

Bench on Lake Shore Trail,
Lake Casitas

17. Lake Shore Trailhead

Hiking, biking

Located at the eastern end of the paved road in the LCRA. The trail is a well-maintained dirt road that follows the lakes eastern edge. The habitat is California walnut and oak woodlands, grassland, and riparian scrub. The terrain is mostly flat.

Soule Park

Picnicking, park-related sports, horseback riding

Located in the Ojai Valley's East End. Soule Park consists of a golf course and a large public park that has extensive grassed areas, playgrounds, two equestrian arenas, and other sports facilities. Thacher Creek runs through Soule Park, and the confluence of San Antonio and Thacher Creeks occurs within Soule Park golf course.
Camp Comfort Campground and Park

Camping, picnicking, wading

Located adjacent to San Antonio Creek about one mile south of the City of Ojai. Camp Comfort is a both a small campground and a large day use park. Large oaks and riparian trees shade most of the campground and park.

Dennison Park

Camping, picnicking

Located on the Santa Paula-Ojai Road (Highway 150) at the top of the Dennison Grade, which connects the Ojai Valley with Upper Ojai. Dennison Park is both a campground and a day use park, with expansive views of the Ojai Valley. Mature oaks shade much of the facility.

18. Sulphur Mountain Road East and West Trailheads

Hiking, biking, horseback riding

The eastern trailhead is located 4.6 miles up the upper end of Sulphur Mountain Road, which is off of Highway 150. Trailhead parking is on-street. The trail is a well-maintained fire road that climbs gradually from Casitas Springs to Upper Ojai. The trail is 10.5 miles one way. The lower end travels through oak woodland. Most of the trail travels through grazed grasslands. The terrain consists of rolling hills. The trail offers views of much of the watershed and beyond, including the Channel Islands.

The western trailhead is located 0.3 miles up the lower end of Sulphur Mountain Road, off of Highway 33 just north of Casitas Springs. Trailhead parking is on-street. Sulphur Mountain Road is a well-maintained fire road that climbs from Casitas Springs to Upper Ojai. The trail is 10.5 miles one way.
Confluence Preserve

*Birding*

Located along the Ventura River above and below its confluence with San Antonio Creek. This 13-acre preserve is only accessible along the Ojai Valley Trail, which marks the western edge of the preserve. The habitat is dense riparian forest with willows, tall sycamores, and cottonwoods.

Foster Park

*Picnicking, biking, wading, birding, wildlife viewing*

Located on the east bank of the Ventura River just south of Casitas Springs. A large historical park first developed in 1906. Large sycamores and cottonwoods shade the park. Offers easy access to the Ventura River and the Ventura River/Ojai Valley Trail.

Foster Park Campground

*Camping, wading, birding, wildlife viewing*

Located on the west bank of the Ventura River across from the Foster Park day use park. The campground is set among mature oaks.

19. Ojai Valley Trail Trailhead

*Biking, walking (paved), horseback riding*

Follows an old railroad right-of-way along the Ventura River from Foster Park to Oak View, continuing through urban and open space areas to the City of Ojai. Traveling north along the Ventura River, the Ojai Valley Trail winds through riparian forest habitat, crosses San Antonio Creek, and then offers overlooks of the lower end of the river’s dry reach. A fence separates the paved path from an adjacent dirt bridle path for horseback riders. The south end of the trail connects seamlessly to the Ventura River Trail. The area under the freeway overpass at Casitas Vista Road is used informally for parking.

Big Rock Preserve

*Wading, birding, wildlife viewing*

Located in the Ventura River bottom just south of Foster Park. Ventura Hillside Conservancy's 17.5-acre Big Rock Preserve is accessible from the Ventura River Trail near the watershed mural. The habitat is riparian willow forest.
Seaside Wilderness Park

*Hiking, biking, swimming, surfing, ocean fishing*

Located south of Emma Wood State Beach Group Campground and extending to the east bank of the Ventura River at the estuary. The park is located on the Ventura River delta and covers a long stretch of coast, from the estuary at one end to Emma Wood State Beach North Beach Campground at the other. The park land to the west of the river is state-owned, and a smaller piece of land to the east of the river is owned by the City of Ventura. Open, windswept cobble fields cover much of the area, along with dunes and rare dune swale and rocky intertidal wetlands. The Ocean’s Edge Trail travels through the park.
20. Ocean’s Edge Trailhead

Located in the Emma Wood State Beach Group Campground. The trail begins by going under the railroad tracks, continues into the open cobble field habitat of Seaside Wilderness Park, and follows the coast southeast to the estuary.

Emma Wood State Beach Group Campground

*Camping, picnicking, hiking, biking, swimming, surfing, ocean fishing*

Located on the coast west of the Ventura River estuary, south of Highway 101. The Emma Wood State Beach Group Campground is at the west end of Main Street. Camping is restricted to groups or bicyclists/hikers without vehicles (one night limit). Two miles west (outside of the Ventura River watershed) is the Emma Wood State Beach North Beach Campground, which has paved campsites located immediately adjacent to the beach for self-contained vehicles.

The group campground is an open, grassed area with capacity for four groups of 30 people. On the river side, the campground is adjacent to riparian scrub and forest along the Ventura River estuary. On the ocean side, the campground is adjacent to Seaside Wilderness Park (described below). The campground marks the western edge of the Ventura River delta.

Those not using the campground’s facilities can still access the trails and wilderness park by parking outside the campground on Main Street.

21. Emma Wood River Trailhead

Located at the eastern edge of Emma Wood State Beach Group Campground. The trail makes a short loop to the Ventura River estuary and back through its adjacent riparian habitats. This area has historically been used by homeless individuals for camping.
22. Omer Rains Coastal Trail and Ventura River Trail Access

Biking, walking (paved)

Omer Rains Coastal Trail travels along the coast between Emma Wood State Beach, North Beach Campground, and San Buenaventura State Beach. Passes over the Ventura River at Main Street Bridge then along the river and estuary. The trail is popular for walking and biking, with connections up and down the coast and to the Ventura River Trail.

Ventura River Trail follows an old railroad right-of-way along the Ventura River from the Main Street Bridge to Foster Park. The Ventura River Trail connects to both the Ojai Valley Trail and the Omer Rains Coastal Trail. Much of the trail travels through urban and industrial areas. Paved parking is available east of the Main Street Bridge. At the Foster Park end, the dirt area under the freeway at the Casitas Springs exit is used for trailhead parking. The north end of the trail connects seamlessly with the Ojai Valley Trail.

A Continuous Trail from the Coast to Ojai

Together the Ventura River Trail, the Ojai Valley Trail, and the Omer Rains Coastal Trail provide a continuous multi-use paved path along the Ventura River corridor from the beach all the way to the City of Ojai. This trail network facilitates bicycle commuting in the Ojai and Ventura areas. The trail follows the route of the old Southern Pacific Railroad that once transported Ojai Valley produce to Ventura. The 1969 floods washed out much of the tracks.
Willoughby Preserve

Hiking, wading, birding, wildlife viewing

Located in the Ventura River bottom in Ventura, between the Main Street Bridge and the 101 Freeway, adjacent to the RV park. Paved parking is available east of the Main Street Bridge. A small network of trails on the Ventura Hillsides Conservancy's 9-acre preserve provide a unique look at the lower river where it enters the estuary. The habitat is riparian scrub and forest. Provides excellent opportunities for wildlife viewing.

Surfers' Point/Seaside Park

Located at the coast at the end of Figueroa Street, adjacent to the Ventura County Fairgrounds. Surfers' Point/Seaside Park is a popular location for surfing and kite surfing as well as picnicking and enjoying the beach. The park has parking, outdoor showers, and other amenities (City of Ventura 2007). The Omer Rains Coastal Trail travels through the park.

23. Promenade and Omer Rains Trail Access

Biking, walking (paved)

Travels along the beachfront, from the estuary to the Ventura Pier.

Grant Park Overlook

Picnicking, watershed viewing

Located on a low ridge overlooking downtown Ventura and the lower Ventura River. The overlook at Grant Park lies on the edge of the Ventura River watershed. The park is accessible from Ferro Drive or Braley Road or by foot via the Ventura Botanical Gardens Demonstration Trail behind Ventura City Hall. The overlook provides expansive views of the coastline, Channel Islands, and the Ventura River watershed.
3.6.4.3 Key Data and Information Sources/ Further Reading

Below is a summary of some of key documents that address access to nature in the watershed. See “4.3 References” for complete reference citations.

City of San Buenaventura, 2005 Ventura General Plan (City of San Buenaventura 2005)


History of the Ventura County Parks (VCGSA 2013)


Land Management Plan: Part 2 Los Padres National Forest Strategy (USFS 2005a)

Recreational Impacts on Coastal Habitats: Ventura County Fairgrounds, California (Capelli 1991)

Ojai General Plan – Circulation Element (City of Ojai 1997)

Ojai General Plan – Conservation Element (City of Ojai 1987)

Ventura County General Plan: Ojai Valley Area Plan (VCPD 2008)

3.7 Land Use and Demographics

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3.7 Land Use and Demographics

3.7.1 Political Boundaries and Communities

The Ventura River watershed is located in southern California, in western Ventura County, with a small section in the northwest corner located in eastern Santa Barbara County.

Much of the watershed is rural and undeveloped. Urbanized areas are found on the valley floors in the middle and lower half of the watershed; the upper half is in the Los Padres National Forest.

Cities comprise only 3.17% of the watershed (1.24% City of Ventura; 1.93% City of Ojai). The City of Ojai lies entirely within the watershed and 13% of the City of Ventura lies within the watershed. The rest of the watershed is in unincorporated Ventura County.

Unincorporated communities include Meiners Oaks, Mira Monte, Oak View, Live Oak Acres, Casitas Springs, Matilija Canyon, and part of Upper Ojai. The watershed's most densely urbanized area is in the City of Ventura near the coast, an area known as the Westside or colloquially as "the Avenue." The Westside has an active community council working to improve the quality of life on the Westside.

Two small coastal watersheds—the North Ventura Coastal Streams watershed and the Buenaventura watershed—flank the Ventura River watershed's lower section. Water from the Ventura River watershed supplies users in both of these coastal watersheds (see Figure 3.7.1.2).
Government Jurisdictions

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Acres</th>
<th>% of Watershed</th>
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</thead>
<tbody>
<tr>
<td>Ventura County</td>
<td>71,177</td>
<td>49.14%</td>
</tr>
<tr>
<td>U.S. Forest Service</td>
<td>69,062</td>
<td>47.68%</td>
</tr>
<tr>
<td>City of Ojai</td>
<td>2,795</td>
<td>1.93%</td>
</tr>
<tr>
<td>City of Ventura</td>
<td>1,798</td>
<td>1.24%</td>
</tr>
</tbody>
</table>

Ventura River Watershed
Santa Barbara County
Sphere of Influence

Data Sources:
California Protected Areas Database v1.8
City Boundary - Ventura County
Sphere of Influence - Ventura County
Map Created by GreenInfo Network using ArcGIS software
October 2013 www.greeninfo.org

Figure 3.7.1.1 Government Jurisdictions Map
3.7.2 Demographics

From a watershed management point of view, human and socioeconomic dimensions are no less important to understand and consider than physical characteristics.

This section provides a summary of population, income, employment, and other basic demographic data. Demographic data describe population characteristics, which are different from one watershed to the next. From a watershed management point of view, human and socioeconomic dimensions are no less important to understand and consider than physical characteristics. For example, the demographics of an area can influence water demands as well as the types of water demand management activities that may be most effective.

Demographic data are generally collected for cities, counties, or Census tracts, not watersheds; therefore the data herein are limited and by necessity based upon compilations and estimates.

3.7.2.1 Population

The Ventura River watershed's population is relatively small and slow growing. As of the 2010 Census, the estimated population was about 44,140, including 22,943 people residing in County of Ventura.
unincorporated areas, 13,736 people in the City of Ventura, and 7,461 in the City of Ojai. The population is 58% white, 37% Hispanic or Latino, 2% Asian, and 3% other races. The City of Ventura’s Westside is the area with the most Spanish-speaking households.

Ventura Avenue, City of Ventura’s Westside. The City of Ventura’s Westside is the area with the most Spanish-speaking households. Photo courtesy of WebberBlock.org

Between 2000 and 2014, the population decreased in the City of Ojai by 3.4%, increased in the City of Ventura by 8.0%, and increased in unincorporated Ventura County by 4.5%. (The last two figures do not necessarily reflect growth within the watershed, however.)

Between 2003 and 2012, the number of new residential customers increased by 23 for Casitas Municipal Water District, by 634 for the City of Ventura (citywide), and decreased by one for Golden State Water, which primarily serves the City of Ojai. Between 2000 and 2012, total K-12 public school enrollment for schools within the watershed decreased by 1,149, or 28%. The decrease in the City of Ojai was 53.6% percent.

See “Population Projections” in “3.4.3 Water Demands” for more information on population growth trends.

<table>
<thead>
<tr>
<th>Population</th>
<th>44,140</th>
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<tbody>
<tr>
<td>City of Ojai</td>
<td>7,461</td>
</tr>
<tr>
<td>City of Ventura (within watershed)</td>
<td>13,736</td>
</tr>
<tr>
<td>Unincorporated Ventura County</td>
<td>22,943</td>
</tr>
</tbody>
</table>

Population estimated with a GIS tool using Census Block Groups (except for City of Ojai, which is direct from the 2010 Census).
Population Density (Estimated Total Population within watershed: 44,140)

Because the boundaries of the 2010 Census block groups are not defined by the watershed, a spatial analysis was done using the 2010 Census block groups with total population and intersecting the data with the Ventura River watershed boundary. The results are an aggregate of the census data for each block within the watershed boundary which is a sum of the proportion of area each census block that lies within the watershed boundary.

Data Source:
US Census Data 2010
Map Created by GreenInfo Network using ESRI software
Contact 360-3 www.greeninfo.org

Figure 3.7.2.1.1 Population Density Map
Figure 3.7.2.1.2  Spanish Speaking Households Map
3.7.2.2 Employment and Income

Employment opportunities are diverse in the watershed. Leisure and hospitality jobs, which rely on the watershed's natural beauty and recreational assets to attract visitors, dominate the employment landscape.

The four largest job sectors according to a Southern California Association of Government (SCAG) assessment are leisure and hospitality (art/entertainment) (3,860 jobs in 2012); education and health services (3,750 jobs in 2012); professional and business services jobs (1,493 jobs in 2012); and retail trade jobs (1,323 jobs in 2012). The watershed supported an estimated 15,681 jobs in 2012 (SCAG 2014). Note the jobs provided by key watershed industries, such as agriculture and oil recovery, are sometimes provided by support services that come from outside the watershed or that fall into a different job category; therefore these jobs are not accurately reflected in these SCAG data.

The watershed is home to a number of large private and public schools, a hospital, and several retirement and assisted living facilities.

There is a wide range of incomes, and several areas qualify as disadvantaged or severely disadvantaged communities. The average household income in 2012 was $48,423. 30.5% of the households earn less than $25,000. 12.5% earn greater than $100,000. In the city of Ojai, the 2012 median household income was $64,217, and 2% of the population earn more than $500,000 annually (see Figure 3.7.2.2.1).

The Westside area of the City of Ventura qualifies as a disadvantaged community (with median household incomes below 80% of the state average, or $48,706). The Ventura River watershed coastal area within the City of Ventura qualifies as a severely disadvantaged community (with median household incomes below 60% of the state average, or $36,979).

| Table 3.7.2.2.1 Watershed Income Data, 2008 and 2012 |
|-----------------|-----------------|-----------------|
| Average (weighted) Household Income | $48,387 | $48,423 |
| % of Household by Income | 31.1% | 30.5% |
| Below 25k | 28.4% | 28.5% |
| 25k–50k | 28.2% | 28.5% |
| 50k–100k | 12.3% | 12.5% |
| 100k+ | 12.3% | 12.5% |

Source: Southern California Association of Governments (SCAG 2014)
Figure 3.7.2.2.1 Median Household Income Map

Note: The northwest corner of the watershed is an unpopulated area that is part of a larger Census Track in Santa Barbara County.
### Table 3.7.2.2.2 Jobs by Sector in the Watershed, 2012

<table>
<thead>
<tr>
<th>Sector</th>
<th># of Jobs</th>
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<td>Total Jobs</td>
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<tr>
<td>Leisure and Hospitality (Art/Entertainment)</td>
<td>3,860</td>
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<tr>
<td>Education and Health Services jobs</td>
<td>3,750</td>
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<tr>
<td>Professional and Business Services jobs</td>
<td>1,493</td>
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<tr>
<td>Retail Trade jobs</td>
<td>1,323</td>
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<tr>
<td>Construction jobs</td>
<td>1,179</td>
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<td>Manufacturing jobs</td>
<td>895</td>
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<tr>
<td>Financial Activity jobs</td>
<td>784</td>
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<tr>
<td>Other Services jobs</td>
<td>537</td>
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<tr>
<td>Agriculture</td>
<td>438</td>
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<tr>
<td>Wholesale Trade jobs</td>
<td>360</td>
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<tr>
<td>Public/Administration jobs</td>
<td>301</td>
</tr>
<tr>
<td>Mining</td>
<td>275</td>
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<tr>
<td>Transportation, Warehousing and Utility jobs</td>
<td>269</td>
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<td>Information jobs</td>
<td>217</td>
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</tbody>
</table>

Source: SCAG 2014

Note: In this analysis, jobs are considered to be in the watershed based on the physical location of the company. If a person works in the watershed, but is paid by a company based elsewhere, that job is not reflected in these data.

### 3.7.2.3 Housing

Housing in the watershed is provided predominantly by single-family homes. There were 27,710 occupied single-family dwellings in 2012; 2,967 occupied multi-family homes; 1,124 occupied mobile homes; and 49 occupied RVs/vans/boats. 60% of residents are homeowners and 40% are renters. 60% of the housing stock in the City of Ojai was built before 1970 (SCAG 2014). Over half of the housing stock, 58.3%, was built before 1970. A wide range of housing types and prices exists in the watershed, including areas of very large and expensive estates.

### Table 3.7.2.3.1 Housing Data, 2008 and 2012

<table>
<thead>
<tr>
<th>Percentage of Renters v. Homeowners</th>
<th>2008</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owner</td>
<td>59.8%</td>
<td>60.2%</td>
</tr>
<tr>
<td>Renter</td>
<td>40.2%</td>
<td>39.8%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Single-family v. Multi-family housing permits</th>
<th>2008</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>16,177</td>
<td>16,458</td>
</tr>
<tr>
<td>Single-family Detached Housing Units (occupied)</td>
<td>11,053</td>
<td>11,252</td>
</tr>
<tr>
<td>Single-family Attached Housing Units (occupied)</td>
<td>1,044</td>
<td>1,065</td>
</tr>
<tr>
<td>Multi-family/Apartment/Condo Housing Units (occupied)</td>
<td>2,910</td>
<td>2,967</td>
</tr>
<tr>
<td>Mobile Home Housing Units (occupied)</td>
<td>1,114</td>
<td>1,124</td>
</tr>
<tr>
<td>Boat, RV, Van, etc. (occupied)</td>
<td>55</td>
<td>49</td>
</tr>
</tbody>
</table>

Source: SCAG 2014
Homeless

At the time of the major river bottom cleanup in February 2012, an estimated 100 people were living in the lower Ventura River bottom. City of Ventura staff working on this issue estimated that as of January 2015, there were significantly fewer illegal campers in the Ventura River—perhaps as much as 80% fewer (Brown 2015).

Data from the Ventura County 2014 Homeless Count and Subpopulation Survey are summarized in Table 3.7.2.3.2. Only those persons who met the U.S. Housing and Urban Development Department’s (HUD) definition of homelessness were counted. HUD considers a person homeless only when he/she lives: 1) in places not meant for human habitation, such as cars, parks, sidewalks, and abandoned buildings; 2) in an emergency shelter; and 3) in transitional housing including safe havens (VCCEO 2014). Given that counters did not approach people who might be living in cars or tents, it is likely that there is a significant undercount of the homeless population. In addition, with the transient nature of homeless individuals, these counts are only a snapshot in time.

The overall number of homeless individuals counted in 2014 decreased 18% from the count in 2013. The number of homeless counted in 2014 was the lowest since the count’s inception in 2007 (VCCEO 2014).

<table>
<thead>
<tr>
<th>City</th>
<th>Unsheltered Adults</th>
<th>Chronically Homeless</th>
<th>Male/Female</th>
<th>Seniors (62+)</th>
<th>Mental Illness</th>
<th>Veterans</th>
<th>Unsheltered Children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventura¹</td>
<td>265</td>
<td>47%</td>
<td>65%/31%</td>
<td>11%</td>
<td>30%</td>
<td>12%</td>
<td>19</td>
</tr>
<tr>
<td>Ojai</td>
<td>38</td>
<td>50%</td>
<td>87%/13%</td>
<td>13%</td>
<td>19%</td>
<td>16%</td>
<td>1</td>
</tr>
</tbody>
</table>

¹ Applies to the entire City of Ventura, not just the part within the watershed.

Data Source: VCCEO 2014

3.7.2.4 Key Data and Information Sources/Further Reading

Below is a summary of some of key documents that address demographics in the watershed. See “4.3 References” for complete reference citations.

- Profile of the City of Ojai (SCAG 2013)
- Profile of the City of San Buenaventura (SCAG 2013)
- Profile of the Unincorporated Area of Ventura County (SCAG 2013)
- Ventura County 2014 Homeless Count and Subpopulation Survey: Final Report, April 2014 (VCCEO 2014)

Acronyms

- HUD—U.S. Housing and Urban Development Department
- SCAG—Southern California Association of Governments
3.7.3 Land Use

Much of the land in the Ventura River watershed is relatively undeveloped. The northern half (48%) lies within the Los Padres National Forest, and development in the southern half of the watershed has been tempered by traffic, air quality, and land use regulations, and by a scarcity of water.

SCAG maintains a land use dataset for areas in southern California. The data, though incomplete, provides a fair estimate of existing land uses. SCAG’s 2008 data show that 87% of the watershed’s land falls into either the “vacant” or “water” category, which includes the US Forest land, much of the mountains and foothills, along with Lake Casitas and other waterbodies. Developed land uses comprise about 13% of the watershed. Of this 13%, agriculture (excluding grazing lands) makes up about 5%, residential land 4%, oil and mineral extraction 1.5%, and commercial, industrial, and miscellaneous land uses the remaining 2.5%. (Including grazing, agriculture comprises about 18.5% of the land area.)

City of Ventura’s Westside. The area of greatest population density in the watershed is in the City of Ventura’s Westside.

Much of the watershed’s residential area is rural and low density. The area of greatest population density in the City of Ventura’s Westside; second is in the City of Ojai and the unincorporated community of Meiners Oaks.
Figure 3.7.3.1 Existing Land Uses Map

Note: Data represented on this map are coarse and provide only a general view. For example, oil extraction fields are known to cover 5,190 acres (DOGGR 1992). Also, grazing lands are not represented as part of agriculture in these data.
3.7.3.1 Agriculture

Ventura County is one of the principal agricultural counties in California, ranking number nine among California counties in total crop value in 2012. The most recent national data put Ventura County at number 10 among all counties in the United States (PBVC 2015).

Orchards, Ojai Valley’s East End
Photo courtesy of Michael McFadden

Acreage and Crops

Agriculture is the dominant land use in the watershed and is a critical factor in the management and stewardship of the land and water. Including cattle grazing, 18.5% of the watershed’s land area is used for agriculture. As of January 2015, there were approximately 24,400 acres of agricultural land enrolled in the County’s Land Conservation Act program (described below) (VCRMA 2015).

Citrus is the dominant crop grown in the watershed, with a history that dates back to the 1870s when orange orchards were first planted (Fry 1983). The Ojai Valley is home to a number of family farms; some have been in operation over 100 years. Citrus, mostly oranges and tangerines, comprises about 43% of the agricultural crop acreage in the watershed. Avocados rank second at 25%. Other crops include grains, row crops, other tree crops, berries, and grapes.
Orange Harvest, Ojai's East End  
Photo courtesy of Michael McFadden

Water from the watershed irrigates over 6,000 acres of agricultural land, including some land outside and adjacent to the watershed (in the Rincon area). Figure 3.7.3.1.1 illustrates the areas in the watershed where various crops are grown. See “3.4.3 Water Demands” for information on water use by agriculture.

Even with the relatively recent addition of a couple of large groundwater-dependent agricultural operations (including Taylor Ranch at the bottom of the watershed), the acreage of irrigated agriculture is trending downward. Irrigated agricultural acreage using Casitas water (either in full or supplemental) has gradually dropped from 6,276 acres in 2000 to 5,264 acres in 2013—a reduction of 1,012 acres, or 16%.

**Limitations on Mapped Agricultural Data**

Current data sources about the types and acreages of crops grown in the watershed are not comprehensive. The two agriculture maps provided in this section provide different looks at farming in the watershed. Figure 3.7.3.1.1, the “Agricultural Crops” map shows data collected by the Ventura County Agricultural Commissioner’s office as part of their permitting process. In part because it is linked to permit activity, which may be infrequent, it is neither comprehensive nor up-to-date; however, it provides an approximation of the crops grown in the watershed. Figure 3.7.3.1.2, the “Important Farmlands Inventory” shows data from the state’s Farmland Mapping and Monitoring Program, which produces maps and statistical data used for analyzing impacts on California’s agricultural resources. Agricultural land is rated according to soil quality and irrigation status; the best quality land is called Prime Farmland. The maps are updated every two years with the use of a computer mapping system, aerial imagery, public review, and field reconnaissance.
Agricultural Crops (Total Acreage*: 5,024.95)

<table>
<thead>
<tr>
<th>Types of Agricultural Crops</th>
<th>Crop Acres</th>
<th>Percent of Total Crop Acreage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citrus trees</td>
<td>2,197.24</td>
<td>43.33%</td>
</tr>
<tr>
<td>Avocado trees</td>
<td>1,240.77</td>
<td>24.69%</td>
</tr>
<tr>
<td>Oak, grain, hay and pasture</td>
<td>531.99</td>
<td>10.59%</td>
</tr>
<tr>
<td>Misc. - uncultivated, uncategorized and fallow</td>
<td>448.04</td>
<td>8.92%</td>
</tr>
<tr>
<td>Mac. fruits and nuts</td>
<td>347.82</td>
<td>6.92%</td>
</tr>
<tr>
<td>Row crops, strawberries and sod</td>
<td>256.12</td>
<td>5.14%</td>
</tr>
<tr>
<td>Nursery and cut flowers</td>
<td>10.96</td>
<td>0.22%</td>
</tr>
</tbody>
</table>


Figure 3.7.3.1.1 Agricultural Crops Map
Figure 3.7.3.1.2 Important Farmland Inventory Map
Map of Irrigated Crops, 1932

Source: DWR Bulletin 46 (CDWR 1933)
Hay Harvest, Upper Ojai
Photo Courtesy of Fred Rothenberg

Strawberries, Near Coast
Photo Courtesy of Santa Barbara Channelkeeper
Rincon-Vitova Insectary Beneficial Insect Production Facility on Ventura Avenue. Beneficial insects are being grown on squash.
Photo courtesy of Lisa Brennels.

Integrated Pest Management is used widely by growers in the watershed.

The acreage of certified organic farmland in the watershed is small, however, Integrated Pest Management (IPM) is used widely by growers. IPM is an environmentally sensitive approach to pest management. There are many aspects to IPM, but one of them is the cultivation of beneficial insects—insects that kill pests. Growers practicing IPM minimize the use of pesticides that would harm beneficial insects, and provide the habitat needed for them to thrive. Local insectaries regularly supplement existing populations of beneficial insects to target specific pest outbreaks.

Approximately 21,000 acres of land is used for cattle grazing. The majority of this land is privately held.

During the mid-1800s, the missions were divided into privately owned ranchos. Ventura County contained all or part of 19 ranchos, five of these were in the Ventura River watershed (Rancho Ex-Mission San Buenaventura, Rancho Ojai, Rancho Santa Ana, Rancho Cañada de San Manuelito, and Rancho Cañada Larga o Verde). Of these, only Rancho Cañada Larga is still a working cattle ranch of approximately the same size (about 6,500 acres) as the original land grant.

Cattle and other livestock were prominent throughout the Ventura River watershed through the first half of the 20th century. Taylor Ranch, part of the old Rancho Cañada de San Miguelito on the west side of the Ventura River, operated a 16,000 head feed yard as recently as 1971 (Katz 1987), and a rail yard for shipping cattle existed until the middle of the 20th century at the mouth of Cañada Larga Creek.

There may be close to 1,000 head in the entire watershed in normal years. However, droughts cause a reduction in numbers. A survey conducted by the Ventura County Cattlemen's Association
in 2012, which was the first year of a multi-year drought, reported 612 head on 20,919 acres (Association 2012). After two more consecutive years of drought, cattle numbers are currently likely below 200-300 head.

Operations vary significantly from one ranch to another. Most Ventura River Watershed operations are small, with a majority being cow/calf producers, which maintain their cattle year round. This is done with very low stocking densities to insure adequate forage to last the summer. Some operations also run stockers. These are yearling cattle (6 months to 18 months old) that are brought here in the winter and spring when the grass is good for weight gain. They normally arrive in December or January and stay until June or July depending on rainfall and grass production. Stockers are typically run with higher stocking densities for shorter periods of time.

—Mike Williams, Ventura County Cattlemen’s Association Board Member (Williams 2014)
Benefits from Agricultural Lands

Agriculture plays a critical role in maintaining many services supportive of a healthy watershed. Open agricultural and grazing lands provide expanses of permeable land that infiltrates rainwater, thereby reducing runoff and decreasing the potential for flooding. These lands also serve as wildlife corridors and habitat, and provide attractive views and local food.

Because of the growth restrictions in the Ojai Valley (discussed in “3.7.3.4 Land Use Policies”), profitable land use options are limited. Agriculture is a land use allowed within the growth-restrictions, and relative to other potential land use development options, may offer more watershed benefits and less watershed impacts.
Trends and Challenges

Though agriculture has long been a part of the landscape in the watershed, its future viability, at least in its current form, is seriously challenged. Water supply issues, high land costs, continued threats from exotic pests, and the challenges of competing in the modern industrial-scale farming business all threaten to destabilize the local industry.

A pressing concern as of early 2015 is the Asian citrus psyllid (ACP).

Asian citrus psyllid (ACP) is an invasive, aphid-like insect pest. Although the psyllid (SIL-hd) is not a serious problem by itself, it can transmit a devastating bacterial disease to citrus trees. Known as Huanglongbing (HLB), the disease ruins the taste and appearance of citrus fruit, and eventually kills infected trees. There is no treatment or cure for Huanglongbing (wong-long- Bingo), and all commercially valuable varieties of citrus are vulnerable. If ACP and HLB reach Ventura County, and cannot be eradicated or contained, it is likely that the county will cease to be a significant producer of citrus fruit within a decade.

— Farm Bureau of Ventura County website (FBVC 2015a)

So far, HLB has been found in only one tree in southern California; however, there have been five ACP detections in the Ojai Valley as of January 2015. ACP populations in the adjacent Santa Clara River watershed have increased rapidly. When this pest becomes established growers transition to a suppression strategy employing area-wide treatment—coordinated application of pesticides on a schedule three times per year. Area-wide treatment started in Fillmore and Santa Paula in January 2015. Controlling ACP will have a serious impact on the economic viability of citrus production in Ojai Valley (Brenneis 2015).

Another serious agricultural pest, polyphagous shot hole borer (PSHB), is a new pest in southern California. This boring beetle, from the group of beetles known as ambrosia beetles, drills into trees and brings with it a pathogenic fungus (Fusarium euwallacea). The PSHB attacks many species of trees, and avocado is a preferred species. Besides killing avocados, PSHB infestation can destroy most of the dominant tree species in the watershed’s riparian habitat including coast and valley oak species, California sycamore, red willow, cottonwood, white alder, and California bay laurel. PSHB impact on avocado production is expected to be serious (UCR 2015).

Switching crops in the watershed is not an easy matter. The soil in the Ojai Valley’s East End, where the bulk of the farming occurs, is extremely rocky. Tilling the soil is not an option, which significantly limits the type of crops that can be grown in that area should current crops become untenable.
The Ojai Valley is remote from the centers of Ventura County's agricultural infrastructure. Packing houses, agricultural supplies, and support services are miles away. Farm labor crews are also based closer to the center of agricultural production, which makes it more expensive to farm in the watershed.

Concerns about water are growing. Coping with cyclic droughts has always been part of farming in the region, but the 2012-2014 drought (current as of this writing) took the water level in the Ojai Valley Basin down to levels that haven't been seen since 1965.

When groundwater basins are low, growers who can purchase water from Lake Casitas at a greater cost. Some growers have no backup water when their wells run dry. To purchase a new water allocation is prohibitively expensive, and according to Casitas's Water Efficiency and Allocation Program, less than one acre-foot of water remains available to allocate to the agricultural water user category. A great majority of the established agricultural wells and water distribution systems in place now are also old, in some cases inefficient, and in need of costly upgrades.
Agricultural operators face difficult and time-consuming processes required to secure multiple permits for many regular maintenance or improvement activities, such as clearing debris from channels. New water quality requirements and monitoring have added additional and considerable costs.

A changing climate threatens to magnify the threats that agricultural operators face: longer droughts, increased pest threats, increased risk of fires, and weather anomalies that interfere with fruit setting and plant growth.

3.7.3.2 Oil Extraction & Industry

As with agriculture, the oil extraction industry has a long history in the watershed.

Drawn to Ventura County by reports of “oil struggling to the surface at every available point,” George Shookridge Gilbert, referred to as California’s first true petroleum pioneer, began extraction operations at Sulphur Mountain in 1861 (Triem, 1985)… In 1854, oil collected at Sulphur Mountain was refined in home-made stills. The first commercial oil refinery in the county was built in 1861 by Gilbert. It was located in the Ojai Valley and produced between 300 and 400 gallons of refined oil a week (DOG, 1983).
By the 1880’s almost all of the State’s oil production was in Ventura County, as the discoveries at Sulphur Mountain, Rancho Ojai, Rancho Sespe, and Rancho Santa Paula became known (DOG, 1983). The most successful early well, discovered in 1865, was “Ojai 6”, which is considered to be the first oil well in California to produce commercially (Triem, 1985).

Ventura County experienced tremendous population growth during the 1920’s due primarily to the discovery of the Ventura Avenue Oil Field in 1916. By 1926, this field was producing over 20,000 barrels of oil a day and its level of productivity brought in thousands of oilworkers, geologists, engineers, and oil-related businesses to the City of Ventura and outlying areas (Triem, 1985).

—Ventura County General Plan Resources Appendix (VCPD 2011)

The Transverse Ranges, of which the watershed is part, is a highly folded and faulted geologic province that has some petroleum-rich sedimentary rocks; this province is an important oil-producing area in the United States. Oil extraction is a significant commercial land use in the watershed, making up about 3.6% of the land area.
The major oil field in the watershed is the Ventura oil field, an area that covers approximately 3,410 acres on both sides of Highway 33 in the lower watershed near the coast. The Ojai oil field comprises 1,780 acres of active fields (DOGGR 1992). There are over 700 active oil wells in the watershed. In the Ventura oil field an extensive system of well pads and paved and dirt access roads cover the relatively steep and rugged foothills. Figure 3.7.3.2.1 shows the locations of these wells.

Outside of oil fields, the watershed's major industrial land use is in the lower watershed along Ventura Avenue east of the Ventura River. Various manufacturing, construction, processing, and industrial storage facilities occupy this area, a number of which serve as support services to the oil extraction industry.

**Brownfields**

Brownfields are properties whose reuse, redevelopment, or expansion is hindered by real or perceived environmental contamination. They can be large or small, vacant or developed, abandoned or occupied. Brownfield sites commonly sit idle, or cannot be sold, until contamination concerns are resolved. However, the costs of doing so can be prohibitive.
By the late 1930s, the City of Ventura’s Westside was densely occupied with oil wells and related facilities. Oil-related industries and service companies located in the area in support of the growing oil industry and as the Westside became more industrially developed, other industries also gravitated to the area. Besides the oilfields and the Petrochem refinery, industries that have been located in the Westside area include:

- Oilfield companies providing services such as wireline, perforating, well workovers, etc.
- Oil tool and machine shops
- Vacuum truck services
- Oilfield pipe and equipment storage yards
- Waste disposal services that included sumps
- Chemical suppliers
- Oilfield equipment manufacturing
- Rock quarries
- Metal recycling facilities
- A natural gas compression plant
- Bulk fuel storage and sales
- Commercial laundry
- Auto salvage yards
- Metal fabrication
- Various light manufacturing (WCEE 2011)

By the 1990s, much of the oil and oil supporting industry had left the Westside area, leaving behind many industrial facilities and the perception that these sites could be contaminated. Today, there are an estimated 30 brownfields in the Ventura Avenue area on the City of Ventura’s Westside (City of San Buenaventura 2005). The contaminants potentially associated with these industries include toxic metals, petroleum solvents, chlorinated solvents, semi-volatile hydrocarbons, polychlorinated biphenyls, caustics, and acids (WCEE 2001).

Programs exist at the State and Federal levels to assist communities with assessing and cleaning up brownfields and preparing them for redevelopment. The USEPA’s Brownfields Program includes assessment grants, loans, job training grants, and cleanup grants (USEPA 2013c). Unfortunately, due to a federal “petroleum exclusion,” which excludes many petroleum-based products (such as crude oil, gasoline, and diesel fuels) from the definition of hazardous substance, funding for rehabilitation of brownfields may not be used on properties with only petroleum-based contaminants (WCEE 2001). Therefore, several sites along Ventura Avenue remain in disrepair, but have not been eligible to
receive brownfield-related funding because of the petroleum exclusion policy provision.

One of the actions (Action 4.26) identified in the City of Ventura’s General Plan is to “Seek funding for cleanup of sites within the Brownfield Assessment Demonstration Pilot Program and other contaminated areas in West Ventura.” (City of San Buenaventura 2005)

**Abandoned Petrochem Refinery**

The watershed is home to one brownfield, known as “Petrochem,” that is a familiar site to anyone driving between Ojai and Ventura. This large, blighted and abandoned oil refinery has been part of the landscape in the lower Ventura River for decades. The 98-acre facility is located on the east side of the Ventura River and west of Crooked Palm Road, just south of Brooks School of Photography.

Most of the site is located within the 1% annual exceedance probability (AEP) flood zone (formerly called the 100-year flood zone). When abandoned, the site contained refining units; a tank farm; ammonia, nitric acid, and urea plants; and six underground storage tanks (UST) that stored motor vehicle fuel and fuel additives (Shaw 2005).

*Abandoned Petrochem Facility*

Photo courtesy of Michael McFadden
Petrochem Site in Flood Hazard Zone Map. Petrochem site footprint in red; 1% annual exceedance probability (AEP) flood zone (formerly called the 100-year flood zone) in light blue.

Operational History. Originally a lemon orchard, the site was purchased by Shell Oil Company in 1952 (CDHS 1985). Shell Oil built the Kellogg ammonia plant in 1953, which was expanded in 1959. Ammonia and urea were sold for use as fertilizers to local agricultural operations (Shaw 2005). In 1969, the plant survived a severe flood. One tank, which normally contained a solution of ammonium nitrate and urea, was lost; but the overall impact on the plant was minor (VCERA 1974). The Kellogg system was shut down in 1972 because of the poor ammonia market (VCERA 1976).

The California Oil Purification Company (COPCO) purchased the land from Shell Oil and was granted a Conditional Use Permit (CUP) 1973 to construct and operate an oil refinery (VCERA 1976). U.S.A. Petroleum acquired COPCO in 1973 and started operations in 1974 (CDHS 1985). In November 1974 COPCO was granted a CUP to reactivate the ammonia plant and expand their oil processing and storage tank facilities (VCERA 1976).

Shut Down. In 1983, U.S.A. Petroleum submitted an application to the County to expand the facility. The proposal was strongly opposed by local groups. Citizens to Preserve the Ojai (CPO) filed suit challenging that the County's Environmental Impact Report did not adequately address the cumulative air quality impacts because it did not evaluate the onshore effect of outer continental emissions (Citizens to Preserve the Ojai v. County of Ventura, 1985). CPO won the case.
Abandoned Petrochem Facility. The refinery was shut down in 1984, and has been sitting idle since.

The refinery ceased operation in 1984 (VCEHD 2008) and has sat idle ever since—corroding, rusting, and providing creative opportunities for local graffiti artists. Signs warning of contamination are posted along the perimeter of the property.

Monitoring and Cleanup. Since 1989, various soil and groundwater investigations have been conducted at the site. These investigations have included the installation of exploratory soil borings and a number of monitoring wells (VCEHD 2008). As different monitoring and cleanup efforts have progressed, new monitoring wells have been required in additional locations, some to further define the property's subsurface soil and groundwater impacts.

Six underground storage tanks and associated contaminated soils were removed in 1989 (Shaw 2005), and additional hydrocarbon-contaminated soil has been discovered over the years and requirements issued for its excavation and removal.

A 2005 report concluded that: “A defined plume of groundwater impact exists on the site” (Shaw 2005). In 2006, soil and groundwater assessments indicated that residual hydrocarbons were present in capillary fringe soils and in “pooled” groundwater present in the underground storage tank/dispenser island excavation (VCEHD 2008).

In 2012, the United States Environmental Protection Agency (USEPA) issued an enforcement order to USA Petroleum Corporation related to discharges of oil contaminants at the site. The action also transferred to the USEPA jurisdiction over cleanup operations at the facility.

“The location of the oil discharge noticed herein is in multiple locations throughout the refinery, and the U.S. Environmental Protection Agency ("EPA") has determined that the discharge of oil was created by leaking pipes, process equipment and tanks that threatens the Ventura River.” (USEPA 2012a) The order called for the removal of all “oil, oily sludge,
oil contaminated soil, oil contaminated debris, oily water or refining chemicals.” In a May 2014 letter, the USEPA determined that there was no evidence of an ongoing threat to the Ventura River from the facility and that all required removal actions had been met (USEPA 2014).

The County and the current owner of the property have entered into an agreement which calls for the removal of the remainder of the refinery equipment by the end of 2015. Through the efforts of the County and the property owner, all of the oil storage tanks and most of the equipment outside of the main refinery were demolished and removed in 2014 (Stephens 2015).

**Development Proposals.** There have been a number of proposals for development of the Petrochem site since its closure. Repurposing the site faces many challenges. There is the expense and liability of cleaning it up, along with the fact that it is in the 1% AEP flood zone.

There are overlapping land use jurisdiction issues to overcome. While the property is located in the County unincorporated area, and therefore subject to the County’s land use policies, it is also in the City of Ventura’s Sphere of Influence. Because the property can be annexed into the City, the City would also need to support any development proposed on the site. The City would like a project that provides jobs; the County has traffic policies that precluded increased peak traffic on Highway 33. The City would like mixed use; the County’s development code does not provide for mixed use. Annexation by the City would be appropriate if the site were to be developed, given the County’s Guidelines for Orderly Development. However, the City would have to carefully consider whether the cost to extend City services to the property makes good financial sense.

The most recent development proposal included a proposed dedication of about half of the 98-acre site—the land nearest the river—for preservation purposes.

### 3.7.3.3 Protected Lands

As illustrated in Figure 3.7.3.3.1, protected lands make up a significant part—57%—of the Ventura River watershed.

The Bureau of Reclamation owns 9,401 acres (6.5%) of the watershed surrounding Lake Casitas. Another 3,655 acres (2.5%) is protected as natural habitat, open space, or parkland.

Two local land conservancies, along with the California Coastal Conservancy, are actively acquiring special habitat lands and, in many cases, making those lands accessible to the public to enjoy. Figure 3.7.3.3.2 shows the areas of interest of the Ojai Valley Land Conservancy and the Ventura Hillsides Land Conservancy.
Figure 3.7.3.3.1 Protected Lands Map
Land Conservancy’s Areas of Interest

- Ventura River Watershed
- Ojai Valley Land Conservancy
- Ventura Hillsides Conservancy (interest area extends beyond watershed boundary)

Data Source:
Ojai Valley Land Conservancy
Ventura Hillsides Conservancy
Map Created by Greensite Network using Envi software
October 2013 www.greensite.org

Figure 3.7.3.3.2 Land Conservancy’s Areas of Interest Map
3.7.3.4 Local Land Use Policies

Development is unusually limited in the Ventura River watershed. There are a number of reasons for this. Steep terrain is one factor; only 35 out of the watershed's total 226 square miles have a slope of 10% or less. Citizen activism is another reason. Even before the passage of the California Environmental Quality Act, the Endangered Species Act, and other policies that now serve to protect resources and balance growth, citizens in the watershed were actively engaged in protecting local landscapes. Development proposals—such as one to build a freeway through Ojai from Carpinteria to Santa Paula, and another to mine uranium in Lake Casitas's watershed—were stopped due in large part to citizen activism (Coyne 2009).

Finally, local land use policies and regulations have played and continue to play a very significant role in shaping development on privately owned land in the watershed. This section summarizes some of those key policies and regulations. The water supply management policies of Casitas Municipal Water District (CMWD) also play a significant role in constraining development. See “3.4.3 Water Demands” for a discussion of CMWD's policies.

Key current land use policies include:
- Ventura County:
  - Guidelines for Orderly Development
  - Ojai Valley Area Plan, Minimum Parcel Size & Traffic Policies
  - Ventura County SOAR Ordinance
- City of Ojai's Growth Control Policies
- City of Ventura:
  - City of Ventura SOAR Ordinance
  - Infill First

Guidelines for Orderly Development

In the world of land use planning, Ventura County is held up as a national model for successfully limiting the sprawl-type of development that has characterized much of California. The County's Guidelines for Orderly Development (Guidelines) has been a key policy in this regard. Originally adopted by the County of Ventura and the Local Agency Formation Commission in 1969, and since adopted by all the cities in the County, the Guidelines represent a unique cooperative land use policy.

The Guidelines establish the shared, countywide objective that urban development should occur, whenever and wherever practical, within incorporated cities and not in the unincorporated county (VCPD 2009).
This policy helps prevent urban encroachment into agricultural and open space areas.

According to the Guidelines (VCPD 2009) development shall be considered "urban" if it meets any of the following criteria:

1. It would require the establishment of new community sewer systems or the significant expansion of existing community sewer systems
2. It would result in the creation of residential lots less than two (2) acres in area; or
3. It would result in the establishment of commercial or industrial uses which are neither agriculturally-related nor related to the production of mineral resources.

In the world of land use planning, Ventura County is held up as a national model for successfully limiting the sprawl-type of development that has characterized much of California.

The objective is to allow "for urbanization in a manner that will accommodate the development goals of the individual communities while conserving the resources of Ventura County," as well as to promote "efficient and effective delivery of community services for existing and future residents." (VCPD 2009)

The Guidelines also have policies to ensure that any proposed development in communities that already exist in the unincorporated county is consistent with the intent of the Guidelines.

The result of the implementation of the Guidelines has been that the County does not compete for urban development with cities (LAFCO 2014), and this has helped maintain distinct boundaries between communities, and distinguish urban and rural areas. In the Ventura River watershed, where incorporated cities only comprise 3% of the land area, this is an especially relevant policy.

**Ojai Valley Area Plan**

The Ventura County General Plan (VCGP) includes several "area plans" that contain goals, policies, and programs to shape development in specific geographic areas. Area plans are consistent with the overarching VCGP, but address the particular needs and nuances of a given location. Two area plans are applicable in the Ventura River watershed: Ojai Valley Area Plan and North Ventura Avenue Area Plan. The Ojai Valley Area Plan, which covers a vast area of the watershed and has been important in shaping the watershed's development, is discussed below. The North Ventura Avenue Area Plan covers a much smaller area, much of which is already developed.
Ventura County Area Plans

Area Plans are part of the Ventura County General Plan and contain goals, policies, and programs for specific geographic areas.

- North Ventura Avenue Area Plans (816.60 acres)
- Ojai Valley Area Plans (71,099.03 acres)
- Incorporated City

Data Source: Ventura County Resource Management Agency
Map Created by Geoservices Network using ArcGIS software, 2015 www.geoservices.org

Figure 3.7.3.4.1 Ventura County Area Plans Map
The Ojai Valley Area Plan governs about 74,000 acres—51% of the land in the watershed. Key policies within the plan that have limited development are those establishing large minimum parcel sizes for open space lands, and those that address the limited traffic capacity of Highway 33.

**Large Minimum Parcel Sizes**

With the exclusion of small areas of land of urban development, most of the land area with the Ojai Valley Area Plan is designated as Open Space in the VCGP. Open space (OS) is defined as “any parcel or area of land or water which is essentially undeveloped for human use and devoted to an open space use, such as the preservation of natural resources, managed production of resources, outdoor recreation, and preservation of public health and safety” (VCPD 2013).

When the Ojai Valley Area Plan was written, it established four subcategories for that OS-designated land, each with a different minimum parcel size. The minimum parcel size for the OS 10 subcategory is 10 acres, OS 20 is 20 acres, OS 40 is 40 acres and OS 80 is 80 acres. Of the parcels within the Ojai Valley Area Plan boundaries, very little is designated OS 10 or OS 20. Most land is designated OS 40 or OS 80.

The VCGP requires that subdivisions of land meet the most restrictive minimum parcel size requirements (§3.1.2-6). Once a parcel is subdivided, the landowner has a development right to build a dwelling and a second dwelling with a non-discretionary permit. The large minimum parcel of OS designated lands restricts development by preventing its subdivision into smaller parcels and subsequent development of those properties by right.
Highway 33 Traffic Policies

The VCGRP sets forth acceptable levels of service (LOS) for each roadway within the County. LOS is usually measured during the peak commuting hour(s) of the day, and ratings range from A to F: LOS-A being the best or having the lowest traffic volumes and LOS-F being the worst, or having the highest traffic volumes. The lowest LOS allowed in the VCGRP is LOS-D for county thoroughfares and state highways, however the Ventura County Board of Supervisors has accepted LOS-E for Highway 33 between the northerly end of the freeway (near Casitas Springs) and the City of Ojai.

The Ojai Valley Area Plan established transportation policy §4.1.2-3, which states that Area Plan land use designation changes, zoning changes, and discretionary developments must be evaluated for individual and cumulative impacts on existing and future roads. This is often referred to as the “cumulative traffic analysis.”

The cost to mitigate cumulative impacts is the problem. Ojai Valley Area Plan transportation policy §4.1.2-4 states that Area Plan land use designation changes, zoning changes, and discretionary developments are prohibited unless feasible mitigation measures are adopted that would ensure that the impact does not occur or unless a full funding commitment for roadway improvements is adopted.

Given that the minimum acceptable LOS for Highway 33 (between Casitas Springs and the City of Ojai) is LOS-E, and that portions of the highway are currently operating at LOS E, a full funding commitment to make the necessary roadway improvements would be required before any discretionary development could go forward. However, CalTrans has no approved capital improvement plan or full funding commitment to widen Highway 33. Thus, discretionary development would most likely not be approved if it would add traffic (one trip) to Highway 33 during peak commute times (southbound during AM peak, northbound during PM peak). Ministerial development (e.g., dwellings on an existing lot) is not subject to these traffic policies.

Finally, policy §4.1.2-4-5 states that Highway 33 is limited to two lanes between Oak View and the City of Ojai, and that south of Oak View it is limited to as few lanes as necessary to accommodate projected traffic pursuant to the City of Ojai General Plan and the Ventura County Ojai Area Plan.

These policies have significantly limited discretionary development of any size in the Ojai Valley.
City of Ojai’s Growth Control Policies

Land use policies in the City of Ojai related to air quality and traffic have resulted in the City having a very slow rate of development.

Growth Management Plan

In order to comply with the provisions of the Clean Air Act and the Ventura County Air Quality Management Plan, the City of Ojai adopted a Growth Management Plan in 1979, which has had a substantial impact on the City’s population growth. The plan limits residential development through an annual permit allocation process (City of Ojai 2015).

Air quality in the Ojai Valley is the basis of the City’s Growth Management Plan and associated policies in the Circulation and Air Quality Elements of the Ojai General Plan.

Ozone, the main ingredient of “smog,” is the most serious and widespread of air pollution problems in the country. The federal ozone standard is the only federal clean air standard that the County does not meet and is the focus of regulation under the 2007 Air Quality Management Plan (“AQMP”). Geographic areas that exceed federal clean air standards are referred to as “non-attainment areas.” The County is a “moderate” non-attainment area for the federal eight-hour ozone standard, and is a “severe” nonattainment area under state standard. In the County, smog levels generally reach their peak during summer afternoons. Sea breezes will push the smog inland. As a result, inland areas, such as Ojai, have the highest ozone levels and the most days in which federal and state air quality standards are exceeded.

The City’s Growth Management Plan and associated policies in the Ojai General Plan link population growth to increases in air pollution. Although counterintuitive, dramatic improvement has been realized in the County’s air quality since 1986 despite a 32% increase in total population from 618,880 persons in 1987 and 817,315 persons in 2006. This is explained by increased restrictions on automobile emissions over the same time period; regulations over which the City neither has control nor the authority to implement. Furthermore, Ojai’s air quality is largely influenced by geographic and climatic conditions that transport ozone from population outside of the City. These facts notwithstanding, the City’s moderation of population growth through limits on annual permit allocations dovetails with the AQMP that promotes air quality improvement in gradual increments. Until the County is no longer deemed a “severe” non-attainment area (with Ojai and Simi Valley having the highest ozone concentrations), the
City growth management policies affirmatively further State and Federal air quality goals. Absent full attainment, the community's health and safety is at risk.

—Ojai Housing Element Update, Planning Horizon: 2006 to 2014 (City of Ojai 2012)

Traffic Policies
The City of Ojai's General Plan Circulation Element has policies that are companion to the County's traffic policies (discussed above) addressing the LOS of Highway 33. These policies establish minimum acceptable traffic volumes.

Policies 1, 2 and 3 have direct impact on residential growth by limiting the amount and intensity of future development through the establishment of minimum acceptable traffic volumes. Separate yet related policies appear in the City's Air Quality Element and are translated in the form of a Growth Management Program.

—Ojai Housing Element Update, Planning Horizon: 2006 to 2014 (City of Ojai 2012)

Land Conservation Act
The County of Ventura has long been an enthusiastic participant in the state's Land Conservation Act (LCA) program, which provides tax rate reductions as an incentive for maintaining land in agriculture.

The LCA (also known as the Williamson Act) was adopted by the State Legislature in 1965 and has been implemented in Ventura County since 1969. Under LCA contracts, property owners agree to keep their land in agricultural production, grazing, or open space (wildlife habitat) for a period of 10 or 20 years in exchange for a statutory percentage reduction in the taxable value of the property, depending on the time frame of the contract (20 to 30 percent maximum for prime land and 10 percent maximum for non-prime land under a 10-year agricultural or open space contract, and 35 percent maximum for prime land under a 20-year contract).

—Staff Report to the Ventura County Board of Supervisors on Land Conservation Act Program (VCPD 2013a)

As of January 2015, there were approximately 24,409 acres of land enrolled in the County's LCA program in the watershed. (VCRMA 2015). Because of the 10- to 20-year contracts involved and the financial incentives, the LCA program encourages protection of agricultural and grazing lands.
SOAR Ordinances, Ventura County and City of Ventura

In the late 1990s and early 2000s, there was a coordinated citizen effort to get ballot initiatives passed by all eleven local governments in Ventura County that would require voter approval to develop farmland and open space. The citizen campaign was called “Save Open Space and Agricultural Resources” (SOAR) and it resulted in the adoption of SOAR ordinances by nine local governments. SOAR ordinances effectively put changes to city boundaries and county general plan amendments in the control of voters (Smith 2011).

Two SOAR ordinances affect the Ventura River watershed: the County of Ventura’s, which was enacted in November, 1998 and expires December 31, 2020; and the City of Ventura’s, which was enacted in November, 1995 and expires December 31, 2030. The City of Ojai did not adopt a SOAR ordinance (Smith 2011).

Generally, the SOAR ordinances have been very effective in reducing the conversion of agricultural and open space designated lands to other, more intense land uses. In the County of Ventura, the number of privately initiated General Plan amendment applications fell significantly, and the electorate has approved few amendments (Smith 2015).

Infill First

The City of Ventura’s General Plan outlines an “Infill First” policy which has served to protect open space resources:

The passage of SOAR, the Hillside Voter Protection Area, and other land-use constraints, along with natural boundaries, such as the ocean and the rivers, make it abundantly clear that before we expand outward any further, we must pursue an “Infill First” strategy. Such a strategy will help avoid sacrificing farmland and sensitive areas in our hillsides and along our rivers.

Our “Infill First” strategy for Ventura means avoiding suburban sprawl by directing new development to vacant land in the City and Sphere of Influence (with the exception of SOAR land), and by focusing new public and private investment in carefully selected districts, corridors, and neighborhood centers where concentrated development and adaptive reuse will improve the standard of living and quality of life for the entire community.

—City of San Buenaventura, 2005 Ventura General Plan (City of Ventura 2005)
3.7.3.5 Key Data and Information Sources/ Further Reading

Below is a summary of some of key documents that address land use and associated policies in the watershed. See “4.3 References” for complete reference citations.

City of San Buenaventura, 2005 Ventura General Plan (City of Ventura 2005)

City of San Buenaventura, Downtown Specific Plan (City of Ventura 2007) City of Ventura, 2005 General Plan Environmental Impact Report (City of Ventura 2005a)

City of Ventura Administrative Report, Agenda Item No. 2: Receive Market Overview and Fiscal Analyses of the Westside and North Avenue Area Community Plan, Including Canada Larga (City of Ventura 2011)

Final Environmental Impact Report for California Oil Purification Company Modification to Conditional Use Permit No. 3393. (VCERA 1974)

Final Environmental Impact Report for Modification to Conditional Use Permit No. 3393-A, USA Petrochem (VCERA 1976)

Guidelines for Orderly Development (VCPD 2009)

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

Land Management Plan: Part 2 Los Padres National Forest Strategy (USFS 2005a)

Ojai General Plan – Circulation Element (City of Ojai 1997)

Ojai General Plan – Conservation Element (City of Ojai 1991)

Ojai Housing Element Update, Planning Horizon: 2006 to 2014 (City of Ojai 2012)

Preliminary Endangerment Assessment; Former USA Petroleum Facility (Shaw 2005)

Site Background Information; Former USA Refinery. LUFT Site File C-05021, October 15, 2007-April 2008 (VCEID 2008)

Ventura County General Plan: Goals, Policies and Programs (VCPD 2013)

Ventura County General Plan: Ojai Valley Area Plan (VCPD 2008)

Ventura County General Plan: Resources Appendix (VCPD 2011)

PART 4

References and Supporting Materials

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# 4.1 Acronyms

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<th>Full Form</th>
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<tbody>
<tr>
<td>ACP</td>
<td>Asian Citrus Psyllid</td>
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<tr>
<td>AEP</td>
<td>Annual Exceedance Probability (Flood)</td>
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<tr>
<td>AF</td>
<td>Acre-Feet</td>
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<tr>
<td>AF/yr</td>
<td>Acre-Feet per year</td>
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<td>Best Management Practice</td>
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<td>Bureau of Reclamation</td>
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<td>Biogeographic Population Group</td>
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<td>cfs</td>
<td>cubic feet per second</td>
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<td>California Geological Survey</td>
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<td>Casitas Municipal Water District</td>
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<td>COPCO</td>
<td>California Oil Purification Company</td>
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<td>CPO</td>
<td>Citizens to Preserve the Ojai</td>
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<tr>
<td>CREW</td>
<td>Concerned Resource and Environmental Workers</td>
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<td>cy</td>
<td>cubic yards</td>
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<td>DFIRM</td>
<td>Digital Flood Insurance Rate Maps</td>
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<td>Demand Management Measure</td>
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<td>distinct population segment</td>
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<td>Environmental Impact Report</td>
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<td>Evolutionary Significant Unit</td>
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<td>Federal Emergency Management Agency</td>
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<td>Fine Sediment Study Group</td>
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<tr>
<td>ft</td>
<td>feet</td>
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<td>GAMA</td>
<td>California Groundwater Ambient Monitoring and Assessment</td>
</tr>
<tr>
<td>gpd</td>
<td>gallons per day</td>
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<td>GSWC</td>
<td>Golden State Water Company</td>
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<td>GWUDI</td>
<td>groundwater under the direct influence</td>
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<td>HCP</td>
<td>Habitat Conservation Plan</td>
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<td>IPM</td>
<td>Integrated Pest Management</td>
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<td>LCRA</td>
<td>Lake Casitas Recreational Area</td>
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<td>Locally Important Species</td>
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<td>Level of Service</td>
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<td>MBAS</td>
<td>Methylene Blue Active Substances</td>
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<td>MCL</td>
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<td>Matilija Dam Ecosystem Restoration Project</td>
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<tr>
<td>mgd</td>
<td>million gallon per day</td>
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<td>mg/L</td>
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<td>NPDES</td>
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<td>Ojai Basin Groundwater Management Agency</td>
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<td>OWTS</td>
<td>Onsite Wastewater Treatment Systems</td>
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<td>United States Bureau of Reclamation</td>
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<tr>
<td>Abbreviation</td>
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<tr>
<td>USDA</td>
<td>United States Department of Agriculture</td>
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<td>United States Environmental Protection Agency</td>
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<td>underground storage tanks</td>
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<td>urban water management plan</td>
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1% Annual Exceedance Probability Flood: A flood that has a 1 in 100 chance of being equaled or exceeded in any 1 year, and has an average recurrence interval of 100 years. 1% AEP is the current way of referring to what used to be called a "100-year flood." AEP describes the probability of specific flood flows occurring, rather suggesting the length of time (years) between floods of specific flows.

50-year Flood: A flood whose flow has a 2%, of being exceeded in any given year. Has smaller peak flows than a 100-year flood.

100-Year Flood (also Base Flood): A flood whose flow has a 1% chance of being exceeded in any given year. A misleading term that does not mean a flood that will occur once every 100 years. The preferred term is currently "1% Annual Exceedance Probability Flood."

303(d) List: 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 (stream/river segments, lakes).

A

Acre-foot: The amount of water necessary to cover an acre (43,560 sq. feet) to a depth of one foot, or 43,560 cubic feet, which is equivalent to 325,828 gallons.

Adjudication: With regard to water rights, a legal decision that allocates water to parties in proceedings and is overseen by a court-appointed Watermaster.

Algae: A collective term for several taxonomic groups of primitive chlorophyll-bearing plants which are widely distributed in fresh and salt water and moist lands. This term includes the seaweeds, kelps, diatoms, pond scums, and stoneworts.

Alluvial: Pertaining to material or processes associated with transportation and/or deposition by running water.

Alluvial Deposits: Loose, unconsolidated sediments that have been transported by and deposited from running water.

Alluvial Fan: Cone-shaped fans of rock and sediment that have built up by stream deposition at the mouths of mountain and foothill canyons.

Alluvial Fan Flood: Flooding occurring on the surface of an alluvial fan or similar landform characterized by high-velocity flows; active processes of erosion, sediment transport, and deposition; and unpredictable flowpaths.

Alluvium: Soil, sand, gravel, and other material that has been transported and deposited by flowing water, as in a riverbed.

Anadromous: Pertaining to fish are born in fresh water, migrate to the ocean to grow into adults, and then return to fresh water to spawn.

Annual Exceedance Probability: The Annual Exceedance Probability (AEP) values indicate the chance that specific flood flows will occur in any one year. A 1% AEP means there is a 1 in 100 chance that a flood will occur in any one year.

Anticline: In structural geology, anticline refers to a fold, generally convex upward, in which each half of the fold dips away from the crest and whose core contains the older rocks.
Aquifer: Refers to subsurface deposits and geologic formations that are capable of yielding usable quantities of water to a well or spring, whereas a confining layer (or confining bed) refers to a low-permeability deposit or geologic formation that restricts the movement of groundwater. An aquifer can refer to a single geologic layer (or unit), a complete geologic formation, or groups of geologic formations.

Artesian: Pertaining to groundwater under sufficient hydrostatic pressure to rise above the aquifer containing it.

Atmospheric Deposition: Gases and particulates released to the atmosphere from combustion sources such as motor vehicle emissions, slash burning, and industrial sources, contain nitrogen, sulphur, and metal compounds, which eventually settle to the ground as dust or fall to the earth in rain and snow.

Average (or Mean): In statistics, the sum of all the numbers in a set divided by the number of numbers in the set.

B

Base Flow: The flow of water in streams that remains well after storms have passed. Also referred to as groundwater flow, or dry-weather flow.

Bed Load: Sediment particles resting on or near the channel bottom that are pushed or rolled along by the flow of water.

Bedrock: A general term for the solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Beneficial Uses: The resources, services, and qualities of aquatic systems that water quality 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.

Benthic: Of, relating to, or occurring at the bottom of a body of water.

Best Management Practice (BMP): With regard to water quality, methods that have been determined to be the most effective, practical means of preventing or reducing pollution from non-point sources.

Biodiversity: Refers to the variety and variability among living organisms and the ecological complexes in which they occur. A measure of the variety of organisms present in ecosystems.

Blackwater: Household wastewater from toilets.

Braided Stream: A channel or stream with multiple channels that interweave as a result of repeated bifurcation and convergence of flow around inter-channel bars, resembling the strands of a complex braid. Braiding is generally confined to broad, shallow streams of low sinuosity, high bed load, non-cohesive bank material, and a steep gradient.

C

Channel: An open conduit either naturally or artificially created which periodically or continuously contains moving water, or which forms a connecting link between two bodies of water. Natural channels may be single or braided.

Channelization: Artificial straightening, stabilizing, or diverting of stream channels, resulting in a straighter and deeper channel.

Coastline Armor: The building of protection structures such as seawalls and riprap, intended to prevent coastal erosion.

Cobble: A rock fragment larger than a pebble and smaller than a boulder, rounded or otherwise abraded in the course of aqueous, eolian, or glacial transport.

Conductivity: Conductivity is a measure of the ability of water to pass an electrical current. Conductivity in water is affected by the presence of inorganic dissolved solids such as chloride, nitrate, sulfate, and phosphate anions (ions that carry a negative charge) or sodium, magnesium, calcium, iron, and aluminum cations (ions that carry a positive charge).

Confined Aquifer: An aquifer bounded above and below by impermeable beds, or by beds of distinctly lower permeability than that of the aquifer itself; an aquifer containing confined groundwater.

Confluence: The point where two streams meet.

Conglomerate: Consolidated (sedimentary) stone composed primarily of large, gravel-sized particles.

Critical Habitat: A specific area, identified by NOAA Fisheries and/or US Fish and Wildlife Service, in which are found physical or biological features essential to the conservation of an endangered or threatened species, and which may require special management considerations or protection. Multiple impacts are considered when designating critical habitat.
Debris Basins: A flood control feature in areas where streams carry high sediment loads. Debris basins are typically placed at canyon mouths, debris basins capture the sediment, gravel, boulders, and vegetation that are washed out of canyons during storms. The basins capture the material and allow the water to flow into downstream drainage channels.

Delta: The nearly flat alluvial tract of land at the mouth of a river, commonly forming a triangular or fan-shaped plain resembling the Greek letter “delta.” It is crossed by many distributaries, and results from the accumulation of sediment supplied by the river. Most deltas are partly above and below water.

Detention Basins: Engineered basins that temporarily store stormwater runoff, thereby reducing the peak rate of runoff to a stream or storm sewer. They help to prevent localized flooding and, if designed to do so, provide some water quality benefits and reduce streambank erosion downstream.

Discharge: In the context of water quality regulations, “discharge” means the release of waste to surface water or to the ground.

Distinct Population Segment (DPS): A population segment is considered distinct if it is discrete from and significant to the remainder of its species based on factors such as physical, behavioral, or genetic characteristics; or if it occupies an unusual or unique ecological setting; or if its loss would represent a significant gap in the species’ range. A DPS is the smallest division of a taxonomic species that can be protected under the U.S. Endangered Species Act.

Distributary Channel: A channel that flows away from the main channel, characteristic of a delta.

Diversion: Control or removal of water from its natural course or location by ditch, pipe or other conduit.

El Niño/La Niña: El Niño is characterized by unusually warm ocean temperatures in the Equatorial Pacific, as opposed to La Niña, which characterized by unusually cold ocean temperatures in the Equatorial Pacific. El Niño is an oscillation of the ocean-atmosphere system in the tropical Pacific having important consequences for weather around the globe.

Endangered Species: Animals, birds, fish, plants, or other living organisms threatened with extinction by anthropogenic (man-caused) or other natural changes in their environment. Requirements for declaring a species endangered are contained in the Endangered Species Act.

Environmental Water: Defined by the state of California as “water serving environmental purposes, including instream fishery flow needs, wild and scenic river flows, water needs of fresh-water wetlands, and Bay-Delta requirements.”

Ephemeral Stream: A stream that flows in direct response to and only during and shortly after precipitation events. Ephemeral streams may or may not have a well-defined channel. Their beds are always above the elevation of the water table, and stormwater runoff is their primary source of water. Ephemeral streams include normally dry arid or semi-arid region desert washes.

Erosion: The wearing away of the land surface by running water, waves, or moving ice and wind, or by such processes as mass wasting and corrosion (solution and other chemical processes).

Estuary: The widened tidal mouth of a river where fresh water comes into contact with sea water and where tidal effects are evident; e.g. a partially enclosed coastal body of water where the tide meets the current stream.

Eutrophication. The slow aging process during which a lake, estuary, or bay evolves into a bog or marsh and eventually disappears. During the later stages of eutrophication the water body is choked by abundant plant life due to higher levels of nutritive compounds such as nitrogen and phosphorus. Human activities can accelerate the process.

Eutrophic Conditions: Occur in a body of water that is highly productive of aquatic plants or algae due to the input of large quantities of nutrients.

Evapotranspiration: That portion of precipitation returned to the air through evaporation and plant transpiration.
Evolutionary Significant Unit (ESU): A population (or group of populations) which exhibits two biological characteristics: 1) it is substantially reproductively isolated from other conspecific (of the same taxonomic species) population units; and 2) it represents an important component of the evolutionary legacy of the species.

**F**

**Fault:** In geologic terms, a fracture or fracture zone along which there has been displacement of the sides relative to one another parallel to the fracture.

**Fish Ladder:** A series of small pools arranged in an ascending fashion to allow the migration of fish upstream past construction obstacles, such as dams. Also, an inclined trough which carries water from above to below a dam so that fish can easily swim upstream. There are various types, some with baffles to reduce the velocity of the water and some consisting of a series of boxes with water spilling down from one box to the next.

**Flash Floods:** Floods that occur very quickly after rain.

**Flood or Flooding:** A general and temporary condition of partial or complete inundation of normally dry land areas from:

1) The overflow of inland or tidal waters and/or

2) The unusual and rapid accumulation of runoff of surface waters from any source.

3) The collapse or subsidence of land along the shore of a lake or other body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels or suddenly caused by an unusually high water level in a natural body of water, accompanied by a severe storm, or by an unanticipated force of nature, such as flash flood or an abnormal tidal surge, or by some similarly unusual and unforeseeable event which results in flooding as defined in this definition.

**Floodplain:** The area adjacent to a watercourse or other body of water that is naturally subject to recurring floods.

**Floodplain Terrace:** One, or a series of flat-topped landforms in a stream valley that flank and are parallel to the stream channel, originally formed by a previous stream level, and representing remnants of an abandoned flood plain, stream bed, or valley floor produced during a past state of fluvial erosion or deposition (i.e., currently very rarely or never flooded; inactive cut and fill and/or scour and fill processes). Remnants of constructional valley floors thickly mantled with alluvium are called alluvial terraces.

**Floodway:** The channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot above the elevation of the water surface prior to encroachment into the floodplain.

**Fluvial:** Of or pertaining to rivers or streams; produced by stream or river action.

**Fluvial Deposits:** Sedimentary deposits produced by stream or river action.

**Fry:** Refers to fish in their first year of life (e.g., from spring emergence until the following spring).

**G**

**Gaining Reach:** A stream or reach of a stream whose flow is being increased by inflow of groundwater.

**Geomorphic Province:** Naturally defined geologic regions that display a distinct landscape or landform. Earth scientists recognize eleven provinces in California. Each region displays unique, defining features based on geology, faults, topographic relief and climate.

**Geomorphology:** The geographical study of the form of the earth. Geomorphic means of or pertaining to the shape of the earth or its topographic features.

**Graywater:** Water drained from household sinks, washing machines, tubs, and showers; that is, all water not coming from toilets. All household water except blackwater.

**Groundwater Basin:** An aquifer or system of aquifers that has reasonably well defined boundaries and more or less definite areas of recharge and discharge.

**Groundwater Recharge:** The movement, usually downward, of surface water or precipitation into subsurface soil and groundwater basins.

**H**

**Habitat:** The place where a population (e.g., human, animal, plant, microorganism) lives, along with its surroundings, both living and non-living.

**Headwaters:** The source of a river or stream.
Hydraulic Continuity: the interconnection between groundwater (aquifers) and surface water sources.

Hydrology: The properties, distribution, and circulation of water.

I

Impervious Surface (or Impermeable): A surface that does not allow the passage of water and thus potentially facilitates the generation of runoff.

Infiltration: The process by which water moves downward through the earth's surface, replenishing soil moisture and groundwater basins.

Influent: An inward movement of water, as a stream that flows into another stream or flows entering a wastewater treatment system.

Intermittent Stream: A stream that flows only at certain times of the year when it receives water from springs, groundwater, rain or, or surface sources such as melting snow. Includes intermittently dry desert washes in arid or semi-arid regions.

L

Levee: An artificial embankment along a watercourse or an arm of the sea, to protect land from flooding.

Liquefaction: A process by which water-saturated sediment temporarily loses strength and acts as a fluid, like when you wiggle your toes in the wet sand near the water at the beach. This effect can be caused by earthquake shaking.

Littoral Cell: Discrete coastal regions that can be considered closed systems within which sediment is transported.

Littoral Current (or Transport): The movement of sedimentary material in the littoral zone by waves and currents. Includes movement parallel (longshore transport) and perpendicular (on-shore transport) to the shore.

Littoral Zone: In beach terminology, an indefinite zone extending seaward from the shoreline to just beyond the breaker zone.

Longshore Current: An ocean current caused by the approach of waves to a coast at an angle. It flows parallel to and near to the shore.

Losing Reach: A stream or reach of a stream in which water flows from the stream bed into the ground.

M

Macroinvertebrate: An animal lacking a backbone that is generally visible to the unaided eye.

Maximum Contaminant Level (MCL): Enforceable drinking water quality standards.

Median: The mid-number in a set of numbers, such that half the numbers are above the median and half are below. To be distinguished from “average.”

N

Nitrate: A compound containing nitrogen that can exist in the atmosphere or as a dissolved gas in water and which can have harmful effects on waterbodies, humans and animals. A plant nutrient and inorganic fertilizer.

Nitrogen: A colourless, odourless, tasteless gas that is the most plentiful element in Earth's atmosphere and is a constituent of all living matter.

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.

NPDES Permit: As authorized by the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States.

O

Orographic Lift: The forced rising of moist air up the slopes of hills and mountains.

P

Pathogen: Anything that can produce disease.

Peak Flow: The maximum instantaneous discharge of a stream or river at a given location.
Perennial Stream: A stream that flows continuously during a year of normal rainfall.

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). (Clean Water Act, Section 502(14))

R

Reach: A continuous part of a stream between two specified points.

Redd: The nest constructed by trout or steelhead. Fertilized eggs are deposited in an excavated depression and covered by gravel.

Resident Rainbow Trout: *O. mykiss* that remain in freshwater throughout their life.

Riffle: Shallow water area with rapid current and with flow broken by a substrate of gravel or rubble.

Riparian Habitats: Water-dependent habitats adjacent to streams or other water bodies. Includes both wetland and upland zones.

River Terrace: Floodplain Terrace.

S

Safe Yield: In the context of water reservoirs, safe yield, or "firm yield" is defined as "a quantity of water from a project or program that is projected to be available on a reliable basis, given a specified level of risk, during a critically dry period." (Public Law 108-361). In the context of groundwater basins, safe yield has commonly been defined as "the maximum quantity of water that can be continuously withdrawn from a groundwater basin without adverse effect" (CDWR 2003).

Scour: The powerful and concentrated clearing and digging action of flowing air, water, or ice, especially the downward erosion by stream water in sweeping away mud and silt on the outside curve of a bend, or during the time of a flood; a process.

Scour and Fill: A process of alternate excavation and refilling of a channel, as by a stream or the tides; especially such a process occurring in time of flood, when the discharge and velocity of an aggrading stream are suddenly increased, causing the digging of new channels that become filled with sediment when the flood subsides.

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

Sediment: Material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by water, wind, ice or mass-wasting and has come to rest on the earth’s surface either above or below sea level.

Sedimentary Rocks: A layered rock resulting from the consolidation of sediment, e.g. a clastic rock such as sandstone, a chemical rock such as rock salt, or an organic rock such as coal. Some authors include pyroclastic rocks, such as tuff.

Sediment Load: The amount of sediment carried in a stream.

Semi-Confin ed Aquifer: An aquifer that is partially confined and partially unconfined.

Septic Tank Leachate: The liquid that remains after wastewater drains through septic solids.

Shale: A fine-grained detrital sedimentary rock, formed by the compaction of clay, silt, or mud. It has a finely laminated structure, which gives it a fissility along which the rock splits readily, especially on weathered surfaces. Shale is well indurated, but not as hard as argillite or slate. It may be red, brown, black or gray.

Sheet Erosion: The removal of thin layers of surface material more or less evenly from an extensive area of gently sloping land, by broad continuous sheets of running water rather than by streams; rain wash.

Smolt: Juvenile *O. mykiss* that is physiologically adapted to seawater and emigrates to the ocean.

Spawning. The depositing and fertilizing of eggs (or roe) by fish and other aquatic life.

Steelhead: *O. mykiss* that rears to maturity in the ocean before entering freshwater to spawn.

Stormwater Runoff: Rainfall or snowmelt that runs off over the land surface, potentially carrying pollutants to streams, lakes, or reservoirs.
Subwatershed: A smaller watershed that is part of a larger watershed.

Surface Water: All water naturally open to the atmosphere (rivers, lakes, reservoirs, ponds, streams, impoundments, seas, estuaries, etc.).

Suspended Load: The part of the total stream load that is carried for a considerably period of time in suspension, free from contact with the stream bed; it consists mainly of clay, silt, and sand.

T

Take: Defined in the Endangered Species Act as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect any threatened or endangered species. Incidental take permits authorize the incidental take (i.e., take that occurs incidentally during an otherwise lawful activity) of a listed species, such as steelhead.

Tertiary: The first period of the Cenozoic era thought to have covered the span of time between 65 million and 2 million years ago.

Total Dissolved Solids: The total amount of mobile charged ions, including minerals, salts or metals dissolved in a given volume of water, expressed in units of mg per unit volume of water (mg/L), also referred to as parts per million (ppm).

Total Maximum Daily Load (TMDL): A regulatory term in the federal Clean Water Act describing the maximum amount of a pollutant that a waterbody can receive and still safely meet water quality standards.

Tributary: Any stream that contributes water to another stream.

Turbidity: Cloudiness or muddiness of water or ocean, resulting from suspended or stirred up particles.

W

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).

Water Quality Objectives: Defined by the Water Code 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)

Watershed: A geographic region within which water drains into a particular river, stream, or other waterbody. Also called catchment, drainage, or basin. Every area of land is part of a watershed, each one separated from the next by the ridges between elevation peaks. There are complex interrelationships among the streams, aquifers, lakes, habitats, people and economies that make up a watershed system, such that changes or impacts to one part of a watershed can ripple through and affect other parts.

Water Table: The top of the saturated zone of a groundwater basin, the level below which the ground is saturated with water.

Water Year: A "water year" or "rain year" is defined as October 1 of the previous year through September 30. For example water year 2003 is from October 1, 2002, through September 30, 2003.

Wetland: Lands transitional between obviously upland and aquatic environments.

U

Unconfined Aquifer: Groundwater that has a free water table, i.e. is not confined under pressure beneath relatively impermeable rocks.

Unconsolidated: Soil material that is in a loosely aggregated form.

Unincorporated Area: Land area that is outside of city limits and in the jurisdiction of the county.
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Appendix 4.4.1  Plan Public Scoping Meeting Summary, October 3, 2012

A Public Scoping Meeting to discuss and obtain input for development of the Ventura River Watershed Management Plan was held at the Oak View Community Room, Oak View on the evening of October 3. A total of 60 people showed up for the meeting, which was a good turnout since it was held on the same night as the first Presidential debate. For 28 of the people in attendance, this was their first Watershed Council meeting.

After a brief overview presentation and introductions, participants had the opportunity to write on a card their “biggest concern” and their “best idea” with regard to the watershed. These cards were collected and then read aloud so we could all hear each other’s concerns and ideas.

The group then had a discussion on a variety of watershed topics including groundwater concerns, the cost/hassle/time of permits to clear channels and remove Arundo, the need for education, Matilija Dam, steelhead, the need to affect policy, pesticides, the cost-effectiveness of schemes to enhance our water supplies, the threat of fires, economic considerations, graywater, the need to balance the demands on our limited water, and more.

After hearing the written and spoken ideas of others, participants had an opportunity to fill out another card summarizing what they believe to be the five biggest concerns and five best ideas, as well as any questions they had.

The “biggest concerns” and “best ideas” are summarized below. Many good ideas were received. The ideas have been organized by the seven watershed management plan goal categories, and further organized by the type of project or program. Many of the ideas straddle categories, and sometimes ideas are included in more than one category. Sometimes the ideas weren’t stated clearly enough to be certain of the intent of the author, so some assumptions had to be made. (These factors also make it impossible to do any kind of fair statistical summary.)

The concerns/ideas statements speak for themselves. But there was one theme that came across very strongly in the discussion that is not quite as emphasized in the statements, and that is how frustrated stakeholders are with regulations and permit requirements that effectively prevent them from taking beneficial actions, such as keeping drainage channels cleared so they don’t clog in storms. Related to this is the number of permits required to do any work and lack of an integrated permitting process. There were statements about it taking over a year to get permits
to work in streams, or of one required permit expiring before all the other permits were issued. The prohibitive cost of permits was part of this discussion.

Attendees provided lots of positive feedback about the meeting and the process.

4.4.1.1 **Best Ideas**

**Sufficient Water Supply/Balancing Supply with Competing Demands**

**Educate/Motivate**
- Incentives for residential and commercial use of native plants and water conservation.
- Encourage use of drought resistant plants - less grass/thirsty plants.
- Promote alternative water sources i.e., water conservation, greywater, infiltration, recycled water.
- Conservation education plan that individuals can implement on their own land, e.g. ocean friendly gardens, rainwater capture, etc.
- Settlement/recharge/infiltration incentives.
- Promote infiltration of stormwater.
- Provide incentives for water conservation.
- Provide homeowner landscaping workshops and rain gardens/River Friendly Gardens.
- Ag water use – look at water and importance to meet needs of local/regional food demands, including efficient irrigation, crop selection workshops.
- Reduce demands.
- More education on how to stop using potable drinking water for large lawns, capture rainwater to put into the landscape. Collectively manage our shared resources.
- Make everyone understand what comes out of sewer plant - clean water. No chemicals used.
- Education of water conservation.
- Make everyone aware we have a limited supply.

**Study**
- Hydrogeological study of the watershed.
Amend or Enforce Policies and Regulations/Involve Regulators
- Eliminate requirement of landscaped parkway in residential neighborhoods.
- Groundwater recharge - can we change paving protocols in cities and the County?
- Consumption use restrictions for landowners using groundwater and surface water and water district that are adequate to maintain adequate water for ecosystem, farmers, wildlife use (including fisheries).
- Require ag to harvest and contain rain water and contour land with swales to increase onsite water storage.

Improve Infrastructure
- Capture storm flow via off-stream diversion ponds. If a simple weir gate were installed adjacent to the stream channel that could be overtopped by higher than normal flows, and closed when needed, then some portion of a flood flow could be captured for groundwater recharge. Accumulated sediments could be collected and used.
- Store tertiary treated wastewater in the winter to be released in dry weather.
- Contour ditches to slow it, sink it and store it.
- Groundwater recharge - I liked the idea of 100s of small projects - Is agricultural acreage useful for groundwater recharges?
- Aquifer recharge basin.
- Make groundwater recharge the best it can be in all Ventura River groundwater basins.
- Settlement/recharge/infiltration projects.
- Enhance groundwater recharge in Ojai Basin via Ojai Basin Groundwater Management Agency (OBGMA).
- Increase/optimize water storage in the watershed.
- Drill a horizontal well into Matilija dam.
- Removal of Matilija Dam - I think that it should be reconfigured as an above ground aquifer and be studied as such.
- Increase catching and holding water on our land.
- Create a 'Watershed Corps' to build 100,000 small $1,000 projects to retrofit urban and agricultural lands to enhance water supplies and water quality and reduce flooding.
- Look at ways to expand the use of recycled water to reduce demands.
Plan/Collaborate Regionally

- Water management plan including groundwater management plan.
- Set up a Joint Powers Authority for diverters/goundwater pumpers in main stem of Ventura River.
- Revise OBGMA with change in Golden State Water.
- Improve local cooperation and set our own allocations by forming a Water Users Association (Club) of pumpers/diverters in the Ventura River (Main stem) - include representation by water districts, City of Ventura, agriculture, and habitat. The Club can work on its own solution to a groundwater management plan (GWMP) and would be the local entity to deal with the Regional Board.

Improve Management Methods

- Reuse potable water, store in winter, create "swales" in agricultural land.
- Enhance rainwater capture opportunities.
- Control of invasives out of watercourse to increase water supply.
- Clear weeds, willows, and Arundo from all channels leading to better percolation into groundwater.

Healthy Ecosystem

Restore Habitat & Ecosystem Services

- Matilija dam removal.
- Remove Matilija dam ASAP.
- Take the dam down. Figure out how to make it happen.
- Notch it! (Matilija Dam).
- Matilija Dam removal.
- Removing the Matilija Dam.
- Focus on a reasonable incremental and economically feasible plan to remove the Matilija Dam.
- Assist fish passage conditions by maintaining selected pools.
- Increase native plants and natural functions in creeks and river, reach by reach.
- Remove invasive species/restore native habitats.
- Invasive species eradication projects.
- Grants to remove Arundo from watershed.
- Fund Crew more for Arundo removal.
- Use goats to eat Arundo and other invasive plant species. Prepare study to cover potential impact from goat waste vs. use of pesticides. Plant identification training to goat handlers to avoid goats ingesting native species.

- Improve ecosystem.

- Restoring the Ventura River - the lower portion.

**Acquire Land & Easements**

- Work with Ojai Valley Land Conservancy to obtain and maintain the best examples of ecosystems to be preserved for the public use for passive recreation while preserving habitat value.

**Plan/Collaborate Regionally**

- Remove ability for homeless to illegally live in the riverbed. Remove Arundo removes the ability to build Arundo structures that give privacy. Also getting public eyes through parkway public access, also make river less desirable for illegal encampments.

- Better alternatives for the homeless.

- Find the Homeless a better place than the river bottom.

**Improve Management Methods**

- Transition to organic methods for healthy ecosystems. Funding available through NRCS to transition.

- Transition to organics in agriculture and landscaping/gardening. Discontinue use of Roundup on Arundo and other so-called non-natives. Use of manual labor in mechanical techniques.

**Coordinated Watershed Planning & Education**

- Continue and expand on work of Council.

- Continue developing multi-benefit, integrated projects with multiple collaborators.

- Keep a watershed coordinator in place to keep process moving forward.

- Establish a long-term watershed coordinator position.

- Ensure that Council membership includes all stakeholders affected by watershed plans.

- Be proactive with Ventura River solutions.

- Integrated water management on multiple scales.

- Merge the many water providers/ districts into a Joint Agency to better coordinate and manage both groundwater and recreation –to avoid duplication of effort and improve parkway and river access.
and recreation programs with land conservancies, cities and County of Ventura.

- Include CERT, Cities, County, US Forest Service, water providers in planning and prep.
- Distribute plan to stakeholders/water providers.
- Organize watershed agencies and stakeholders.
- Coordinate emergency preparedness and response for flood, earthquake and fire.
- Self-regulating community groups.
- Maintain a balanced approach to water management. Be realistic about how things have changed in the last 100 years.
- The group should focus on what is right in the watershed and not be lead by unreasonable, new regulations.
- There needs to be an open space or vegetation management plan within the overall plan.

Watershed Education

- Watershed education programs in schools and churches.
- Watershed signage.
- Increase education/outreach regarding watershed issues.
- Environmental center/education program for kids and adults.
- Implement Ocean Friendly Gardens water conservation methods - native planting, greywater use.
- Educate on local hydrology. How does Ventura River act?
- Signs leading to the existing bike path and river access.
- Integrate watershed education and student involvement into the schools within the watershed.
- Keep community informed and upcoming requirements.
- Promote understanding of historical watershed management planning/progress to date.
- Watershed education in community schools and for adults thru Watershed U workshops.
- Watershed, river and creek signage.
- Support for developing Ventura River Parkways/Nature Center/ OVLC Watershed Ed Steelhead Preserve.
- Education and outreach.
- Education & outreach to public about water use and watershed.
- Watershed, river and creek signage and educating the religious community.
- Have Council reach out to local chambers of commerce and/or civic groups such as Rotary, Optimists and make educational presentations.
- The general public and especially children need to be educated about the watershed and invited to experience it and participate in its preservation.
- Get everyone involved/engaged in long-term protection to assure success.
- Massive education for alternatives to pesticides, xeriscaping, saving water-seriously. Use of compost toilets-we poop in pure, beautiful water (that’s nuts). Local laws passed to make all this mandatory.
- Increase public awareness of the challenges and delights of our watershed.
- Education and outreach to public about water use and watershed.

Amend or Enforce Policies and Regulations/Involve Regulators
- Coordinate/reduce permit requirements.
- Develop a watershed plan that will be incorporated into County and Cities’ planning documents as a guide to keep all parties working toward identified goals. Incorporate Ventura River Parkway Plan into the Watershed Plan.

Develop Funding
- Find creative funding mechanisms to finance projects.
- Seek grant funding to support our efforts.

Land and Resource Management

Educate/Motivate
- Promote better ranch land and water evaluation/land management techniques.

Amend or Enforce Policies and Regulations/Involve Regulators
- Work with local government to make changes that promote the goals of the watershed. Smart land use and resources.
- Get resource and regulatory agencies more involved and updated on our efforts.
Improve Management Methods
- Sustainable Agriculture: Best practices; reduce use of pesticides; continue/expand water conservation efforts; eliminate runoff.

Plan and Collaborate Regionally
- Transition plan for agriculture [if ag dies out in watershed].
- Bring in the Ventura County Fire Department to be an active partner in vegetation management.

Support Local Economies
- Create local jobs fixing problems.
- Include economically reasonable solutions. Human use of water is important - especially agriculture.
- Develop economic model to redirect resources.
- Need to integrate economics of the community into watershed plans, e.g. impacts on development, employment. Ability of Council to incorporate all relevant components, e.g. no reference to this in your plan.

Flood Management
- Address flood risks to protect life and property.

Acquire Land & Easements
- Preservation of floodplains for more natural flood protection.
- Preservation of floodplain areas along major watercourses.

Amend or Enforce Policies and Regulations/Involce Regulators
- Bring DFG into flood control issues - their permitting process is really dangerous. Can they be changed?
- Inappropriate building in floodplain: County and cities refuse to permit building in dangerous and inappropriate locations which impact the river and cost taxpayer money to recover from flooding disaster.
- Don't allow development in the floodplain.
- Clean out streambed/back to its original depth of 15' below river crossing. What can be done regarding property owners (next to stream) who illegally store commercial equipment and debris from their business, which creates potential for damming the creek and causing flood problems for other residences? How can we get a grant for a bridge across the Camp Chaffee Road and Coyote Creek bed graded down to a level that will protect the people adjacent to the creek from flooding?
Improve Infrastructure
- Survey existing drainage structures and watershed to improve/replace/upgrade or install new structures.
- Create a ‘Watershed Corps’ to build 100,000 small $1,000 projects to retrofit urban and agricultural lands to enhance water supplies and water quality and reduce flooding.
- Study watershed and identify inadequate structures/repair and replace.

Clean Water

Educate/Motivate
- Promote infiltration of stormwater.
- Teach all to clean up (after) their own pet.

Study
- Identify pollution sources; develop local programs to reduce pollution.
- Study of sources of nitrogen and input to river.
- Study of pesticides and herbicides within watershed.

Improve Management Methods
- Safer water sanitizing methods.
- Questions - driven data collection. Make water testing a community resource.
- Survey waterways for trash and cleanup. May require volunteers or/and grants.
- Reduce pollution to rivers & streams.

Improve Infrastructure
- Use bio-digester or composting program for use of green waste/manures.
- Water quality: expand use of bioswales to capture runoff and allow it to percolate.
- Create a ‘Watershed Corps’ to build 100,000 small $1,000 projects to retrofit urban and agricultural lands to enhance water supplies and water quality and reduce flooding.
- Presently working on a system to clean up the rivers, the air and the land. The most effective being the biodigester to convert organic wastes into energy, fertilizer and compost.
Amend or Enforce Policies and Regulations/Involve Regulators
- Ban Roundup use on lawns etc.
- Encourage work with existing regulatory agencies to do better enforcement on land use issues that result in pollution with the watershed.
- Work for practical TMDLs for trash and nutrients, and help with implementation.

Access to Nature
- Enhance access and recreation through River Parkway.
- Coordinate public recreation and outreach events.
- Provide more public access to river area.
- Encouraging recreational use of the watershed.

Amend or Enforce Policies and Regulations/Involve Regulators
- Implement/incorporate Ventura River Parkway Plan into watershed planning; adopt into all local plans.

Develop Funding/Support Local Economies
- Use implementation of Ventura River Parkway to get funding for improvements (recreational, environmental and infrastructure upgrades). Parkway is an umbrella project across many jurisdictions.

Improve Infrastructure
- Improve trails and provide access to river for schools/classroom learning.
- A walking/nature trail along San Antonio Creek.

4.4.1.2 Biggest Concerns

Sufficient Water Supply/Balancing Supply with Competing Demands
- Lack of water for all users.
- Water conservation
- Is there enough water - will there continue to be?
- Balancing water supply with demand. Sustaining water levels with the pressures on the watershed.
- Given our watershed is finite, I'm concerned about the expansion I see of citrus groves and other agriculture. The river is depleted significantly when irrigation occurs.
- Environmental goals will take priority over the needs of the 42,500 people and 6,000 acres of agriculture.
- Balancing variable water supply with demands for healthy ecosystem.
- Water conservation! What is our supply what we have left?
- Water use and supply for both people and wildlife.
- Forced water right allocations in the main system of the Ventura River by outside agencies.
- Lack of water.
- Water from Ventura Watershed being used outside of Casitas District.
- Making sure there is water enough for people, business, farmers, and the Ventura River habitat.
- Sufficient water supply to meet the conflicting demands in our watershed.
- Protecting water supply for ecosystems and people.
- Water supply
- Balancing needs of all water users during a drought.
- Overuse of our water supply.
- Supplying water to coastal area that has no watershed into Ventura River.
- Water use and supply for people and wildlife.
- Education and outreach.
- Water conservation.
- Maintain independence from state water - self sufficient.
- Water supply.
- Balancing environment with human demands.
- Maintaining our independence from State water.
- Water conservation.
- Water supply; reuse; greywater.
- Loss of Ojai aquifer and the drought.
- Drought
- Drought
- Drought
- Adequate water supply for environment and people
- Water supply - threats and opportunities.
- Waste of water.
• [Need to] balance variable water supply with water demands for ecology, AG, people
• That we bicker our future away and don't take local action on planning water allocations in the main stem of the Ventura River. Forced water rights or allocations from State/Federal Agencies mean loss of local control and will surely bring lawsuits and neighbor against neighbor feuds.

**Clean Water/Toxicity**
• Pesticides/herbicides in the water.
• Protecting water quality for ecosystems and people.
• Water quality.
• Chemical trails, toxic waste & pesticides going into Ventura River.
• Animal waste (from ranches & stables) going into Ventura River.
• Poor or unknown water quality in the estuary.
• Nitrogen inputs to watershed.
• Pesticide/herbicide use.
• Equestrian facilities and horse waste in the watershed.
• Water quality - good data needed, water quality important, needs to be programmed on good data.
• Septic tank system infiltration.
• Pesticides/herbicides use and effect on children and the whole ecosystem.
• Chloramines and other chemicals added to water supply.
• Water quality, reducing runoff.
• TMDL control
• Roundup??
• Health of water basin recharge source - San Antonio Creek, Reeves Creek, Thatcher Creek, etc.
• Improve river water quality
• Better control needed of land use that results in contaminates entering surface and groundwater.
• Maintaining water quality.
• Trash within watershed is waterways/channels/creeks (including asphalt or appliances).
• Pollution and poisoning of our water and land by pesticides used by big ag, County, Land Conservancy, etc. Also toxic chemicals from oil industry and other industries.
Flood Management

- Coyote Creek.
- Flood control
- Flood protection - levee certification of existing levees with FEMA.
- Deteriorating infrastructure (drainage).
- Clearance of streams - why doesn't watershed protection do this? Look at Thatcher Creeks and Reeves Creek - where will the flood water go?
- Difficulty clearing streams of obstructive plants and trees that create flooding hazards.
- Addressing floods.
- Inappropriate building in floodplain.
- Failure of upstream property owners to maintain stream channels create downstream flood problems.
- Keeping development (which restricts river function) out of the flood plain.
- Aging infrastructure (drainage - not sure about supply) - limit property loss and flooding.

Permits/Regulations are Excessive, Ineffective, Expensive or Create Hazards

- Difficulty in getting permits to clear weed and debris from drainage systems for private property owners.
- That regulations being crafted by the Regional Water Board will cause irreparable harm to agricultural producers in the watershed for unknown and/or limited environmental gain.
- More government regulation - such as meters.
- Regulatory issues.
- MS4 regulations.
- Difficulty that private property owners have in getting numerous permits to manage drainage channels.
- Regulations are written that are unachievable.
- Monitoring costs are high with new regulations and are not flexible enough.
- This watershed is in good shape and yet it is facing extreme regulations.
- Regulatory involvement - too much may hurt property use/values.
Healthy Ecosystems

- Arundo and invasive species abatement.
- Control of invasive species such as Arundo.
- Keeping Arundo/invasive species out of river (healthy ecosystems).
- I'd like to get the damn dam gone.
- Stop study of Matilija Dam and get it out of there.
- Removal of Matilija Dam.
- Matilija Dam.
- Pesticides/herbicides use and effect on children and the whole ecosystem.
- Environmental quality - maintain or improve habitat/water quality.
- Improving river and riverside ecosystems.
- Provision of adequate surface water to preserve, maintain and enhance wildlife value.

Climate Change

- Watershed resilience to climate change.

Land and Resource Management

Need to Manage/Protect our Watershed's Character
- Preserving the Valley for the benefit of all residents, people, livestock and wild animals.
- General preservation of watershed values into the future.
- Maintaining beauty and natural character and habitat/environment in watershed.
- Preserving existing character of the watershed.
- General preservation of watershed values (e.g. ecosystems etc.).
- Watershed resilience to population growth.

Need to Keep our Agricultural Industry Viable
- Ag viability.
- Agriculture is getting a bad rap in the area when it is not deserved.
- Agricultural viability and preservation.
- Value of agriculture (citrus and grazing).
- Sustainable agriculture in the watershed; awareness that other uses may not be as desirable; continue/improve best practices.
- Agriculture dies out in the watershed.
• The goals of the watershed do not adequately represent a vital economy or support agriculture.
• There seems to be an illogical fear of the safe use of pesticides in agriculture.

Need to Address Economic Issues
• Economics of various solutions.
• Lack of funding to implement good ideas/projects.
• Funding - misallocation to ineffective projects results in lack of funding for solutions.

Access to the River/Recreation
• Recreational access to the Ventura River.
• Recreational access.
• Public access to river.
• Recreational access to river, habitat restoration.
• Public access to river for recreation and education.

Coordinated Watershed Planning & Education
• Growing polarization of stakeholders e.g. agriculture/land owners and environmental groups.
• Water management.
• Getting diverse interests to work together - farmers, residents, city government, industry.
• Coordination between agencies, Ag. And environmental groups to actually accomplish good things.
• The urgent takes priority over the important.
• Conflicted objectives
• Organization of watershed agencies, stakeholders

Watershed Literacy
• Watershed literacy.
• Potential lack of interest on the part of residents and others living/working in watershed.
• Addressing fires.
• Ignorance and selfishness will stifle progress.
4.4.1.3 Questions

- Have other area or state watershed plans successfully completed groundwater management plans?
- Are there any lessons we can learn from work done in the other Ventura County watersheds that will help us with the Ventura River Watershed Plan?
- From listening here: How can we simplify permitting for constructive, habitat improvement work in the watershed?
- Have we identified a list of best funding sources to assist in achieving projects which will be part of the watershed plan?
- When will the plan be completed?
- What is the impact of the marijuana growers in the Los Padres? The effects on water supply and quantity?
- How are Council members appointed or elected?
- What is the projection for population growth in the Ventura River Watershed?

4.4.1.4 Public Scoping Meeting Outreach

Notice of the Public Scoping Meeting was conducted through a number of methods, including the following:

- Email meeting notices to Watershed Council participants (275)
- Email meeting notices to Watershed U participants (55)
- Letters to residents/landowners (330) with property near the Ventura River and tributaries
- Email messages to Ojai Valley Land Conservancy members (1500)
- Email messages from other groups including Friends of the Ventura River, Ojai Valley Green Coalition and Association of Water Agencies, Ventura County
- Paper announcements in Ojai Valley News, Ventura Reporter and Ventura County Star
- On-line announcements in Ojai Valley News, Ventura County Star
- Radio announcement on KCLU News
Appendix 4.4.2  Tier 1S and Tier2 Projects and Programs

The Watershed Council’s Master Archive of Projects and Programs is divided into two tiers: Tier 1 and Tier 2.

**Tier 1** projects and programs are those that:
1. Meet one or more of the plan objectives,
2. Are feasible,
3. Have clear benefit,
4. Have general stakeholder support, and
5. Have a project lead or supporter.

Tier 1 projects are further divided as to whether the project has a project lead (Tier 1L) or a project supporter (Tier 1S). A lead is defined as an organization that is willing and able to lead and/or be the grant applicant of the project/program. A supporter is an organization willing to actively advance a project/program, but that is not in a position to be the lead. Tier 1L projects and programs are listed in “2.4.2 Priority Projects and Programs.”

**Tier 2** projects and programs are all those that do not meet all Tier 1 criteria, and therefore are not yet ready to move forward with Council support, but remain on the MAPP as concepts.

Tier 1S and Tier 2 projects and programs are listed in the tables on the following pages.

The project and program list is not static. As circumstances and needs change, Council members may wish to elevate a project’s status, such as from a Tier 1S to a Tier 1L, or add a new project or program.
<table>
<thead>
<tr>
<th>ID#</th>
<th>Tier 1S Project or Program</th>
<th>Goal 1: Sufficient Local Water Supplies</th>
<th>Goal 2: Clean Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Upper Ventura River Basin Groundwater Management Group/Organization/JPA. Form a group, organization, cooperative, club or joint powers authority to facilitate communication and collaborative management of the basin's water supply and quality.</td>
<td>x</td>
<td>S: RWQCB, OVSD</td>
</tr>
<tr>
<td>4</td>
<td>Water Supply and Demand Budget and Safe Yield Study. Develop a water budget and safe yield estimate for the watershed. (IWPPI)</td>
<td>x</td>
<td>S: Surfrider</td>
</tr>
<tr>
<td>10</td>
<td>River Storm Flow Capture and Storage Analysis. Investigate opportunities/options to harvest more storm flows, such as in stream/river adjacent storage ponds.</td>
<td>x</td>
<td>S: Ventura Water</td>
</tr>
<tr>
<td>13</td>
<td>Satellite Wastewater Treatment Analysis. Investigate the feasibility/benefits of installing more satellite wastewater treatment plants to increase options for water reclamation/recharge (such as for Lake Cachitas toilets). (Per state policy, recycled water cannot be used until a Salt and Nutrient Management Plan is completed.)</td>
<td>x</td>
<td>S: OVSD</td>
</tr>
<tr>
<td>21</td>
<td>Integrated Water Supply Management Modeling. Use the WEAP (Water Evaluation and Planning) model, or other appropriate modeling tools, to develop management strategies that maximize efficient use of the watershed's water supplies through integration of water supply, water demand, water quality and ecological considerations.</td>
<td>x</td>
<td>S: Ventura Water</td>
</tr>
<tr>
<td>30</td>
<td>Rincon Evapotranspiration Station. Improve irrigation efficiency in the Rincon area by installing an evapotranspiration weather station.</td>
<td>x</td>
<td>S: Casitas</td>
</tr>
<tr>
<td>33</td>
<td>Water Waste Reporting Tool. Work with water purveyors to develop a water waste hotline, bulletin board, phone application or other tool to help catch and stop water waste.</td>
<td>x</td>
<td>S: WPD</td>
</tr>
<tr>
<td>40</td>
<td>Septic to Sewer Conversion. Convert septic to sewers in problem areas, including areas of high groundwater areas (e.g., Arbolada, Siete Robles).</td>
<td>x</td>
<td>S: RWQCB, OVSD</td>
</tr>
<tr>
<td>44</td>
<td>Biodigesters. Build biodigesters for manure management and the creation of biogas.</td>
<td>x</td>
<td>S: RWQCB, RCD, OVGC</td>
</tr>
<tr>
<td>47</td>
<td>Local Water Quality Testing Laboratory Feasibility Analysis. Investigate the feasibility of expanding an existing laboratory to serve some of the watershed's water quality testing needs in order to lower costs.</td>
<td>x</td>
<td>S: OVSD</td>
</tr>
<tr>
<td>50</td>
<td>Integrated and Accessible Water Quality Monitoring Data. Maximize the usefulness of the water quality monitoring data collected by different organizations by compiling and interpreting the data, and offering user-friendly access to the data.</td>
<td>x</td>
<td>S: WPD, OVSD</td>
</tr>
</tbody>
</table>
Table 4.4.1.1 Tier 1S Priority Projects and Programs (continued)

<table>
<thead>
<tr>
<th>ID#</th>
<th>Tier 1S Project or Program</th>
<th>Fill Data Gaps / Analyze</th>
<th>Make Physical Improvements</th>
<th>Educate / Engage / Incentivize</th>
<th>Improve / Use Regulations &amp; Policies Regionally</th>
<th>Leads (L)</th>
<th>Supporters (S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>69</td>
<td><strong>Animal Keeping Policies Update.</strong> Review Ventura County's animal-keeping regulations (e.g., zoning, waste management plan requirements) to determine if improvements can be made to better address animal / livestock density, location and waste management issues.</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>S: SBCK</td>
<td></td>
</tr>
<tr>
<td>71</td>
<td><strong>Green Streets Committees.</strong> Establish Green Streets Committees in the watershed’s three jurisdictions where roads, stormwater, and flood control staff would collaborate on the design of capital improvement and development projects that involve streets, sidewalks or parking lots in order to best integrate stormwater infiltration features and to maximize the flood control-related economic benefits of infiltration.</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>S: SBCK, Surfrider</td>
<td></td>
</tr>
</tbody>
</table>

**Goal 4: Healthy Ecosystems**

<table>
<thead>
<tr>
<th>ID#</th>
<th>Project or Program</th>
<th>Fill Data Gaps / Analyze</th>
<th>Make Physical Improvements</th>
<th>Educate / Engage / Incentivize</th>
<th>Improve / Use Regulations &amp; Policies Regionally</th>
<th>Leads (L)</th>
<th>Supporters (S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>122</td>
<td><strong>Permit Streamlining - Invasives Removal.</strong> Investigate / implement strategies to reduce the cost / burden of Atundo / invasives removal permits, such as clustering projects into one permit.</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>S: OVLC</td>
<td></td>
</tr>
<tr>
<td>123</td>
<td><strong>Invasive Plants Education Program.</strong> Develop / implement an invasive plant species education program.</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td>S: Ojai</td>
<td></td>
</tr>
<tr>
<td>131</td>
<td><strong>Streamside Property Owners Stewardship Program.</strong> Develop / maintain an outreach / education program targeting riparian landowners that addresses invasive plant removal, habitat restoration, steelhead habitat protection, permeable surfaces, stormwater retention, flooding awareness and preparation, livestock BMPs, etc. Address challenges related to required permits for streamside activities.</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td>S: RWQCB, RCD</td>
<td></td>
</tr>
<tr>
<td>136</td>
<td><strong>San Antonio Creek Restoration at Rancho Dos Rios.</strong> Restore this stretch of creek, an important location for steelhead, by stabilizing the bank, reestablishing riparian vegetation, improving in-stream salmonid habitat, and protecting the existing bridge and private access road from scour.</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td>S: Landowner</td>
<td></td>
</tr>
<tr>
<td>137</td>
<td><strong>Estuary Restoration Plan.</strong> Develop an estuary restoration plan; include enhancement of the second river mouth.</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td>S: Coastal Cons.</td>
<td></td>
</tr>
</tbody>
</table>

**Goal 6: Responsible Land and Resource Management**

<table>
<thead>
<tr>
<th>ID#</th>
<th>Project or Program</th>
<th>Fill Data Gaps / Analyze</th>
<th>Make Physical Improvements</th>
<th>Educate / Engage / Incentivize</th>
<th>Improve / Use Regulations &amp; Policies Regionally</th>
<th>Leads (L)</th>
<th>Supporters (S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>152</td>
<td><strong>Watershed Corps.</strong> Fund, through a jobs programs, the installation of 10,000, small-scale (≤$1,000) projects to retrofit urban and ag lands to enhance water conservation / capture / quality and flood mgmt.</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>S: Friends</td>
<td></td>
</tr>
<tr>
<td>153</td>
<td><strong>Wildfire Risk Assessment and Fuels Management Plan.</strong> Work with Fire Safe Councils (state and local), fire departments (including those adjacent to the watershed), USFS, BLM and local experts to develop a strategic, watershed-specific fuels management plan that identifies / prioritizes locations that pose greatest wildfire risk and develops / prioritizes actions to help prevent catastrophic wildfires. Investigate whether groundwater recharge shows a positive response to fuel reduction.</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td>S: Ojai</td>
<td></td>
</tr>
</tbody>
</table>
### Table 4.4.1.1 Tier 1S Priority Projects and Programs (continued)

<table>
<thead>
<tr>
<th>ID#</th>
<th>Tier 1S Project or Program</th>
<th>Fill Data Gaps / Analyze</th>
<th>Make Physical Improvements</th>
<th>Educate/Engage/Incentivize</th>
<th>Improve/Use Regulations &amp; Policies</th>
<th>Plan/Collaborate Regionally</th>
<th>Leads (L) Supporters (S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>158</td>
<td>Outreach to Elected Officials. Offer educational presentations to elected bodies (e.g., city councils, Board of Supervisors, water districts) about the watershed management plan, accomplishments and concerns.</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>S: Coastal Cons.</td>
</tr>
<tr>
<td>160</td>
<td>Alternative Energy Use Study - Ag. Investigate the use of alternative energy sources as a viable means to help meet the needs of the agricultural community.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>S: OVGC</td>
</tr>
<tr>
<td>161</td>
<td>Alternative Energy Use Study - Water Delivery and Treatment. Investigate the use of alternative energy sources as a viable means to help meet the energy needs of the water and wastewater purveyors.</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>S: Casitas, OVSD, OVGC</td>
</tr>
<tr>
<td>162</td>
<td>Wildfire Prevention Education. Ambitiously support efforts to increase public awareness of the consequences of catastrophic wildfires and thus the need for fuels management.</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>S: Ojai</td>
</tr>
<tr>
<td>166</td>
<td>Better Regulation Enforcement - Water Quality. Improve enforcement of existing regulations related to water quality (e.g., animal keeping, septic systems, littering).</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>S: RWQCB</td>
</tr>
</tbody>
</table>

#### Ventura Water—City of Ventura's Water Division

<table>
<thead>
<tr>
<th>ID#</th>
<th>Watershed Literacy. Continue and expand education programs that improve understanding of watershed issues (e.g., hydrology, source water, regulations, functions and value of healthy ecosystems, value of agriculture).</th>
<th>Fill Data Gaps / Analyze</th>
<th>Make Physical Improvements</th>
<th>Educate/Engage/Incentivize</th>
<th>Improve/Use Regulations &amp; Policies</th>
<th>Plan/Collaborate Regionally</th>
<th>Leads (L) Supporters (S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>176</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>S: Ventura Water</td>
</tr>
</tbody>
</table>

Note: "ID#" in the table is only a reference number and does not indicate priority.

1S = A Tier 1 project or program which has a "supporter"—an entity or organization willing to actively advance a project/program, but that is not in a position to be the lead.

**Abbreviations:**

Casitas—Casitas Municipal Water District  
Coastal Cons.—California Coastal Conservancy  
County Planning—Ventura County Planning Division  
Friends—Friends of Ventura River  
Ojai—City of Ojai  
OVGC—Ojai Valley Green Coalition  
OVLC—Ojai Valley Land Conservancy  
OVSD—Ojai Valley Sanitary District  
RCD—Ventura County Resource Conservation District  
RWQCB—California Regional Water Quality Control Board—Los Angeles District  
SBCK—Santa Barbara Channelkeeper  
Surfrider—Ventura Chapter of the Surfrider Foundation  
WPD—Ventura County Watershed Protection District  
Ventura—City of Ventura  
Ventura Water—City of Ventura's Water Division
<table>
<thead>
<tr>
<th>ID#</th>
<th>Tier 2 Project or Program</th>
<th>Goal 1: Sufficient Local Water Supplies</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Upper Ventura River Basin Groundwater Management Plan. Develop a management plan that</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>develops better maps and models of the groundwater basins and recharge areas;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>complies better well and groundwater data for the basins, including data on existing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>wells (whether they are active, permitted, metered), current and historical</td>
<td></td>
</tr>
<tr>
<td></td>
<td>groundwater pumping rates, and locations of potential new wells; and recommends basin</td>
<td></td>
</tr>
<tr>
<td></td>
<td>management priorities.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>High Efficiency Equipment Installations. Install or retrofit, at new and existing homes,</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>buildings, landscapes and farms, state-of-the-art high efficiency water using equipment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>systems and technologies.</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Groundwater Rights Transfers/Purchases/Leases Analysis. Identify value of/opportunities</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>for transfers/purchases/leases to modify where, how and when groundwater is used.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(like Walla Walla)</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Salt and Nutrient Management Plan. Develop a Salt and Nutrient Management Plan, as</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>required by the state's Recycled Water Policy, so that it is in place if recycled water</td>
<td>S: RWQCB</td>
</tr>
<tr>
<td></td>
<td>use is pursued in the watershed.</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Rincon Desalination Facility. Build a small seawater desalination facility in the Rincon</td>
<td></td>
</tr>
<tr>
<td></td>
<td>area to improve drought resiliency and improve the Rincon area's water supply reliability</td>
<td></td>
</tr>
<tr>
<td></td>
<td>This water would be more likely to be available for drought contingency than State water.</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Monitor Water Issues Wherever Watershed Water is Used. Ventura River watershed water is</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>used outside the physical boundaries of the watershed - in the city of Ventura and in</td>
<td></td>
</tr>
<tr>
<td></td>
<td>the Rincon area. Track changes in water policy, programs and use in these areas; support</td>
<td></td>
</tr>
<tr>
<td></td>
<td>efforts to improve water-use efficiency.</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Lower Ventura River Basin Groundwater Management Plan. Develop a management plan that</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>develops better maps and models of the groundwater basins and recharge areas;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>complies better well and groundwater data for the basins, including data on existing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>wells (whether they are active, permitted, metered), current and historical</td>
<td></td>
</tr>
<tr>
<td></td>
<td>groundwater pumping rates, and locations of potential new wells; and recommends basin</td>
<td></td>
</tr>
<tr>
<td></td>
<td>management priorities.</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Groundwater Extraction Estimates - Upper/Lower Ventura River Basin and Upper Ojai Basin.</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>Conduct well surveys, interviews and detailed quantitative estimates of crop coverage and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>water usage to better quantify groundwater extractions, and support analysis of surface</td>
<td></td>
</tr>
<tr>
<td></td>
<td>water-groundwater interactions in the Upper and Lower Ventura River and Upper Ojai</td>
<td></td>
</tr>
<tr>
<td></td>
<td>groundwater basins.</td>
<td></td>
</tr>
<tr>
<td>ID#</td>
<td>Tier 2 Project or Program</td>
<td>Goal Data Gaps / Analyze</td>
</tr>
<tr>
<td>------</td>
<td>---------------------------------------------------------------------------------------------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>177</td>
<td><em>Mutual Water Co. Equipment Upgrades.</em> A number of the older mutual water companies have older, inefficient and manual equipment. Equipment upgrades, including automation, could improve water use efficiency.</td>
<td></td>
</tr>
<tr>
<td>180</td>
<td><em>Sub-Metering.</em> Install sub-meters on multi-family and other water accounts with multiple users or types of use to better isolate waste and efficiency.</td>
<td>x</td>
</tr>
<tr>
<td>181</td>
<td><em>Irrigation Professionals Training.</em> Host a professional training program for irrigation managers of facilities with large landscapes, such as golf courses, schools and parks.</td>
<td></td>
</tr>
<tr>
<td>187</td>
<td><em>Graywater Installations.</em> Install basic graywater equipment in new and existing developments and remolds.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Goal 2: Clean Water</strong></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td><em>Infiltration Systems Installations.</em> Install or retrofit, at new and existing homes, buildings, landscapes and farms, systems (e.g., bioswales, curb cuts, sponge gardens, permeable pavement) for capturing and infiltrating stormwater.</td>
<td></td>
</tr>
<tr>
<td>62</td>
<td><em>Lake Casitas Recreation Area Restroom Conversion to Sewer.</em> Waste is now trucked to the treatment plant daily.</td>
<td></td>
</tr>
<tr>
<td>67</td>
<td><em>LID Funding Study.</em> Research options to address the County of Ventura's limited funding for installation and maintenance of low impact development and green streets infrastructure. This needs to become a standard practice, but is now hampered by lack of maintenance funding.</td>
<td></td>
</tr>
<tr>
<td>68</td>
<td><em>County Road Standards Update.</em> Update the County's Road Standards to include design plates that allow sidewalks with tree wells or bioswales to advance stormwater infiltration.</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td><em>Treatment Wetland Feasibility Study.</em> Research feasibility of installing treatment wetlands for stable/farm runoff.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Goal 3: Integrated Flood Management</strong></td>
<td></td>
</tr>
<tr>
<td>81</td>
<td><em>Floodplain Restoration Study.</em> Develop a floodplain restoration feasibility study. Quantify the savings of natural floodplain management via inundation and floodway easements as compared to structural protections.</td>
<td></td>
</tr>
<tr>
<td>83</td>
<td><em>Overflow Ponds.</em> Create overflow areas and ponds along storm channels to slow down flow and allow for infiltration.</td>
<td></td>
</tr>
<tr>
<td>ID#</td>
<td>Tier 2 Project or Program</td>
<td>Fill Data Gaps / Analyze</td>
</tr>
<tr>
<td>-----</td>
<td>------------------------------------------------------------------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>88</td>
<td>Ordinance Enforcement to Prevent Illegal Floodplain Encroachment. Improve enforcement of floodplain management and land use regulations to prevent encroachment into floodplains and in channels that create potential flood barriers/hazards.</td>
<td>x</td>
</tr>
<tr>
<td>89</td>
<td>Stream Setback Ordinance. Amend the zoning ordinances of Ventura County, the city of Ojai, and the city of Ventura to require a setback buffer from the Ventura river and major streams for development or redevelopment of structures and impermeable surfaces, and for animal keeping.</td>
<td></td>
</tr>
<tr>
<td>90</td>
<td>Permit Streamlining - Channel Maintenance. Investigate strategies to reduce the cost/burden of keeping channels clear for storm flows.</td>
<td></td>
</tr>
<tr>
<td>107</td>
<td>Flood Management Funding Study. Research options to address WPD's limited flood management funding for the watershed due to the low amount of new and existing development (and hence property taxes, benefit assessment fees, and land development fees).</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Goal 4: Healthy Ecosystems</strong></td>
<td></td>
</tr>
<tr>
<td>134</td>
<td>Habitat Conservation Plan (HCP) Completion. HCPs support incidental take permits, which help landowners legally proceed with activities that might otherwise result in the illegal impacts to a listed species like steelhead. An HCP was started on the river but never completed.</td>
<td></td>
</tr>
<tr>
<td>139</td>
<td>“No Fishing” Regulation Enforcement. Fishing is illegal below Matilija Dam and at Wheeler Gorge Campground on the Ventura River; better enforcement is needed.</td>
<td></td>
</tr>
<tr>
<td>145</td>
<td>Beaver Reintroduction Study. Investigate the feasibility of reintroducing beavers into the watershed to create pools, increase water retention and extend flow. Begin with an investigation of the historical evidence of beaver presence in the Ventura River watershed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Goal 6: Responsible Land and Resource Management</strong></td>
<td></td>
</tr>
<tr>
<td>154</td>
<td>Intra-County Land Use Planning Task Force. Coordinate, with the Watersheds Coalition of Ventura County, a countywide task force focused on improving and integrating land use and water resource planning. Raise the funds needed for updates to Ventura County's general plan and zoning ordinance.</td>
<td></td>
</tr>
<tr>
<td>155</td>
<td>Existing Local Policy Assessment. Prepare a report that identifies watershed-relevant local policies (e.g., land use planning, environmental health, flood control, stormwater, fire), analyzes implementation and enforcement status, and recommends improvements.</td>
<td></td>
</tr>
<tr>
<td>ID#</td>
<td>Tier 2 Project or Program</td>
<td>Fill Data Gaps / Analyze</td>
</tr>
<tr>
<td>-----</td>
<td>-----------------------------------------------------------------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>168</td>
<td>Farmland Resources Policies Compliance Monitoring. Review and comment on proposed city and county land use projects and policies for compliance with city and county general plan goals, policies and programs that support preservation of agriculture in the watershed.</td>
<td></td>
</tr>
<tr>
<td>170</td>
<td>Watershed/River-Friendly Business Certification and Marketing Program. Implement a program that promotes businesses that meet watershed- or river-friendly minimum standards/best management practices.</td>
<td></td>
</tr>
</tbody>
</table>

Note: "ID#" in the table is only a reference number and does not indicate priority.

T2 = Projects and programs that do not meet all Tier 1 criteria, and therefore are not yet ready to move forward with Council support, but remain on the MAPP as concepts.

Abbreviations:

Casitas—Casitas Municipal Water District
Coastal Cons.—California Coastal Conservancy
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WPD—Ventura County Watershed Protection District
Ventura—City of Ventura
Ventura Water—City of Ventura's Water Division
Appendix 4.4.3  Rainfall Data: 1873 to 2012

Table 4.4.3.1 Rainfall Data 1873–2012

<table>
<thead>
<tr>
<th>Water Year</th>
<th>Ventura Station #66</th>
<th>Ojai Station #30</th>
<th>Matilija Canyon Station #207</th>
</tr>
</thead>
<tbody>
<tr>
<td>1873</td>
<td>10.47</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>1874</td>
<td>15.00</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>1875</td>
<td>15.24</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>1876</td>
<td>21.00</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>1877</td>
<td>4.62</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>1878</td>
<td>22.07</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>1879</td>
<td>12.82</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>1880</td>
<td>22.06</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>1881</td>
<td>14.97</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>1882</td>
<td>12.42</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>1883</td>
<td>11.51</td>
<td>NA</td>
<td>NA</td>
</tr>
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<td>1884</td>
<td>36.13</td>
<td>NA</td>
<td>NA</td>
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<td>1885</td>
<td>9.46</td>
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<td>1886</td>
<td>20.22</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>1887</td>
<td>14.81</td>
<td>NA</td>
<td>NA</td>
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<td>1888</td>
<td>20.25</td>
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<td>1889</td>
<td>16.85</td>
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<td>1890</td>
<td>26.52</td>
<td>NA</td>
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<tr>
<td>1891</td>
<td>14.52</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>1892</td>
<td>10.12</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>1893</td>
<td>23.49</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>1894</td>
<td>7.47</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>1895</td>
<td>14.05</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>1896</td>
<td>10.10</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>1897</td>
<td>15.70</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>1898</td>
<td>7.03</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>1899</td>
<td>8.03</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>1900</td>
<td>9.48</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>1901</td>
<td>14.23</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>1902</td>
<td>12.51</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>1903</td>
<td>16.26</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Water Year</td>
<td>Ventura Station #66</td>
<td>Ojai Station #30</td>
<td>Matilija Canyon Station #207</td>
</tr>
<tr>
<td>------------</td>
<td>---------------------</td>
<td>------------------</td>
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Data Source: Ventura County Watershed Protection District's website: www.vcwatershed.net/hydrodata
Appendix 4.4.4  Water Year Types Based on Runoff at Foster Park

Average annual runoff from each water year between 1930 and 2013 (as measured at Foster Park) was used to assign one of five water year categories—very wet, wet, normal, dry, and very dry—to each year. An explanation of the method of calculation is provided below the table.

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Table 4.4.1 Water Year Types Based on Annual Average Runoff at Foster Park (continued)

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Data Source: USGS National Water Information System Website (USGS 2014b)

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The amount of runoff the watershed receives influences many factors discussed in the watershed plan. By assigning each year a water year type, the plan has a consistent way of referring to the type of year or years in any given context. Average annual runoff from each water year between 1950 and 2013 (as measured at Foster Park) was used to assign one of five water year categories—very wet, wet, normal, dry, and very dry—to each year. A simple but intuitive division of the runoff years was chosen, which puts the median (12,867 AF/yr) right in the middle of the "normal" category. The table below describes the category divisions that were used. (The historical annual median flow at Foster Park is 17.8 cfs, which translates to 12,867 AF/yr.)
Appendix 4.4.5  Our Most Damaging Flood: 1969

Newspaper Clipping Source: Ojai Valley News

The following is excerpted from a 2004 presentation by Lisa Brenneis and Lauren Coyne hosted by the Ojai Library.

Three significant rainstorms hit Southern California in January and February 1969. Before the storms hit, the Ventura River watershed was experiencing dry conditions and lower than average seasonal rain fall. How quickly things can change.

Gentle rainfall started Saturday, January 18, falling continuously and with increasing intensity. By Tuesday, January 21, 25 inches of rain had fallen in Matilija Canyon.

When the rains began to fall that Saturday there were many hikers and groups in Ventura County's backcountry. Several rescues were carried out during the first couple of days. Most of them were successful, however, one attempt to carry six boys and five men across raging Sespe Creek on a bulldozer turned deadly. The bulldozer stalled midstream; only one man survived.

About 30 hours after the first storm passed, rain began to fall again. Nearly 18 inches of rain fell over the next five days. Watershed soils were already completely saturated so the floodwater, debris, and damage that started in the mountains started to roll down into the valley.
On January 24 over 10 inches fell in 24 hours and flooding became widespread in the Ojai Valley.

This map [see Figure 3.3.2.3.1 1969 Flood Damages Map], produced by the Ventura County Flood Control District, surveys 1969 flood-related damage. The majority of the damage was concentrated in low-lying areas around creeks.

The watershed above Ojai received 43 inches of rain in nine days between January 18 and January 27.

The watershed's infrastructure—reservoirs, mains, pumps, and the diversion canal that feeds water into Lake Casitas—suffered widespread damage.

Lake Casitas' water level had risen 21 feet from January 18 to the 20th before the Robles Diversion Canal, filled with mud and sediment, stopped delivering water to the reservoir.

On January 18 there was only 500 acre-feet of water in Matilija Reservoir but it quickly reached capacity and overflowed on the 21st. Sediment deposited during the storms of 1969 reduced the reservoir's storage capacity from 3,500 acre-feet to just 2,100 acre-feet.

After a disastrous weekend of evacuation rescue and relief efforts, Ojai Valley residents surveyed the wreckage. Floodwaters receded somewhat but Monday found refugees still sheltering at Santa Ana, Nordhoff, and Thacher schools. Power outages flickered up and down the valley all weekend. Highway 33 from Ventura became passable by Saturday afternoon but the roaring Ventura River had severed a water main. Pacific Bell lost the Ojai trunk line at Rancho Arna and telephone service in and out of the valley was severely crippled. Southern California Gas lost a 4-inch gas line where it crossed the river.

Road and sewer mains serving Ojai and Oak View were broken in the flood and raw sewage was dumping into San Antonio Creek and the Ventura River.

Many people were displaced throughout the Ojai Valley. Thacher School took in 200 evacuees from the East End and nearly 600 people went to Santa Ana school for shelter. Supplies were ferried by helicopter because road conditions prevented traffic into and out of the area.

Adamson Towing received 300 calls that weekend to rescue cars trapped in mud and debris.

In the East End of the Ojai Valley, the Grand Avenue dip completely filled with debris and Thacher Creek jumped its course, carving a passage down Grand Avenue and then cross-country to join Reeves Creek around McNeil Road.
East End residents were cut off for a few days. Both the Grand Avenue and Ojai Avenue bridges across San Antonio Creek were impassable.

East End citrus groves sustained heavy damage and two days after Friday night's flood growers faced a freeze with smudge pots washed away and without power for wind machines.

In the mountains north of Ojai the torrential Ventura River scraped Highway 33 off the side of the mountain by the Ojala resort and at various points north. Crews worked throughout the summer to restore Highway 33.

The City of Ojai suffered blocked storm drains, broken sewer pipes, and a lost police car, but things could have been much worse. During the 1938 flood, damaging floodwaters coursed through downtown Ojai. After the 1938 flood made a mess of downtown, plans for construction of a new storm basin began wending their way through Congress and by 1962 the Stewart Canyon debris basin was completed.

Taxpayers got their money's worth in 1969 when the basin filled to capacity, taking on 22 feet of water at the height of flood Saturday morning. The floodwater passed from the Stewart Canyon basin into a storm drain and was conducted under downtown, sparing downtown Ojai.

Reconstruction efforts started immediately after the January flood.

Heavy equipment and construction crews poured into the valley and started to clear up flood debris and restore roads.

Cleanup and stream reconstruction efforts were well underway when another powerful storm series visited the Ojai Valley. From February 22-26 another 25.5 inches accumulated in watershed and the whole cycle started again. The flood runoff was similar in magnitude to the January flood but there was less debris to wreak havoc in the streams. Reconstruction crews stayed out in the creeks during the storm routing the floodwater. After the storms (and valiant efforts to protect their work in progress) the construction crews went back to work and eventually reconstructed the streambeds and banks, completely rebuilding major waterways in Ventura River watershed—until the next time.
### Table 4.4.6.1 Monthly Mean Flow (cfs) near Foster Park (USGS Stream Flow Gauge # 11118500), Water Years 1930–2013



Appendix 4.4.7  Past Floods In Brief

The following descriptions of past floods in the Ventura River watershed were compiled by the Alluvial Fan Task Force for the California Department of Water Resources (Earp 2007). Following these descriptions, a few coastal floods are highlighted.

March 9, 1911
In January and February there was heavy rainfall and by March the soil was completely saturated. In March there was a serious flood on the Ventura River. The Ventura River ran very high and overflowed its banks from Casitas to the ocean. The bridge at Casitas was underwater, although it was built 17 feet above normal flow for the river. The western part of Ventura was flooded, and the steel railroad bridge was torn out and washed out to sea.

January 1914
Extremely heavy rains in January caused widespread flooding. Homes flooded, roads were damaged, and agricultural lands were destroyed by flood waters. Railroad lines were out, transportation severely hampered, telegraph lines down, and utility services interrupted. The estimated cost of this flood for the County of Ventura amounted to $237,301.

March 1–4, 1938
This was a major flood event for much of Southern California. It caused damages and destruction to agricultural lands, to the railroad, to roads and bridges, and to private homes. The cost of the flood was estimated to be $3,640,504. All rivers in Ventura County flooded. One person died as a result of the flood.

January 21–22, 1943
Heavy storms caused flooding on all rivers of Ventura County. Roads, agricultural lands, and bridges all were damaged or destroyed. Road culverts, ditches, and small dikes were destroyed by this event. Mudslides in steeper locations occurred. The estimated total cost of this event to the County of Ventura was $333,500.

January 18, 1952
Flood damage reported for other areas of the County, but not specifically for the Ventura River watershed.
April 1958
This was a large flooding event, flooding on all rivers of Ventura County. Roads, agricultural lands, and bridges all were damaged or destroyed in this event.

February 7–20, 1962
Heavy rain brought about flooding on all rivers of Ventura. President Kennedy declared Ventura County a disaster area. At Live Oak Creek the Soule Park Golf Course experienced some washout along the creek. The Santa Ana Bridge was washed out at the Ventura River; there was channel damage along Ventura River. The estimated peak flows on the Ventura River were 17,800 cfs. The estimated cost of this event was $425,000.

November and December 1965
Heavy flooding washed out utilities, including sewer lines and water supply infrastructure. $490,000 in damages was the estimated cost of this event for the County of Ventura. President Johnson declared Ventura County a disaster area. Roads, agricultural lands, and bridges were damaged or destroyed in this event.

November and December 1967
This flood caused an estimated $510,000 in damages. Ventura County was declared a disaster area by President Johnson. In November the Santa Ana Bridge was washed out by flood waters as well as a few more minor bridges along the Ventura River. State Highway 150 was closed due to landslides and flooding as well as many other roads.

January 1969
The State of California was declared a disaster area by President Nixon during this event. One person lost their life to a mudslide; 12 people died as a result of drowning in January. Sewer and water supply lines were washed out, posing a health risk to residents. Highway damage was heavy in Ventura County.

February 1969
The February event led to the flooding of all rivers of Ventura County. Bridges and roads were destroyed and transportation was interrupted. Sewer plants were damaged and untreated sewage flowed into the Ventura River and San Antonio Creek for two weeks until repairs were made. In Ventura County flood flows were of unprecedented magnitude. The cost of the 1969 flood for Ventura County was estimated at $43 million.
1978
At the Ventura River 26 homes and businesses in the Ojai Valley were damaged. 200 people were evacuated from this area. Roads and bridges in this area were damaged. Railroad lines were damaged. Utilities in this area had severe damages to lines. Power lines were toppled when poles became undermined by flowing water. Seven homes in the Matilija Canyon were damaged. Matilija Lake Campground was 80% destroyed. Main Street Bridge at Ventura River was severely damaged and closed. Total cost for this flood period for Ventura County: $20 million.

February 26–March 1, 1983
Winter storms brought heavy rains to Ventura County, and President Reagan declared it a disaster area. Damages were estimated for the County of more than $39 million. Because this flooding event coincided with extremely high tides—the highest of the year—damages to Ventura County were compounded. Highways, homes, recreational lands, and utilities were all destroyed by this combination of events. The floods closed 28 roads in the County.

February 10–15, 1992
President Bush declared Ventura County a disaster area on February 21 after a series of thunderstorms brought heavy rains to the area earlier in the month. The Ventura River at Highway 101 peak flow was estimated at 45,800 cfs. Live Oak Creek got jammed with debris backing up at bridges in the Oak View area and a nursing home was flooded. The Ventura River overflowed at Ventura and overtopped the west bank at the Highway 101 Bridge. Flows flooded agricultural lands, the Ventura Beach Recreational Vehicle Resort and Highway 101. Highway 101 was closed to traffic for about 3 hours. 110 people were rescued from the resort and motor homes were evacuated from the location. Some were swept out to sea, or flooded however. One person died as a result of flooding in this location.

January and February 1993
Minor flooding occurred in Ventura County, with localized flooding in the Live Oaks Acres area when Coyote Creek overflowed and flooded Santa Ana Road. Mudslides and minor road washouts were the extent of the problems in Ventura County from this event.

January and March 1995
A series of strong storms brought heavy rains to Ventura County and on March 10 President Clinton declared Ventura County a disaster area. Flooding damaged homes, businesses, public faculties, highways, bridges, and flood control infrastructure. It also ruined or damaged.
agricultural lands. One person died in January due to this flooding event. More than 12.5 inches of rain fell on Matilija Creek, and caused homeless encampments to scurry to higher ground. Two people had to be rescued from the river. Highway 101 was flooded and an RV park was flooded with up to 6 feet of water.

Emergency rescue crews in helicopters had to evacuate 33 people stranded in this location. Many transportation routes were hindered by flood waters and debris. La Conchita, a small seaside village along the coast, was hit hard by a landslide that crushed nine houses. Another 140 houses in this location were evacuated, but all 700 residents were given evacuation warnings.

January 7–11, 2005

After 5 days of very heavy rains, a landslide at the small town of Conchita was triggered and demolished 13 houses, severely damaged 23 others, and led to the deaths of 10 people. The landslide coincided with the heaviest rain of this storm. On February 4, President Bush declared seven counties in Southern California disaster areas, including Ventura County.

On the Coast

The following descriptions of a few of the coastal floods experienced in the watershed are from a Federal Emergency Management Agency Flood Insurance Study (FEMA 2010).

December 9, 1907

Four hundred feet or more of the Ventura County wharf was carried out to sea by high, turbulent waves. Shortly after noon, the waves, concurrent with a high tide, lifted the deck of the wharf and deposited the deck and piles into the ocean. The entire deck was destroyed except for one pile indicating where the wharf had been. Later, the wreckage was washed onshore and the beach below Ash Street was strewn with lumber. The entire loss was difficult to estimate. Besides the loss to the structure itself, there was a loss of oil pipes and loading fixtures, a derrick engine, and lumber.

December 1969

High waves stemming from intense storms in the Aleutian Islands hit the Ventura County shoreline from December 4 to 7. The swell was measured at 20 feet. A final set of waves hit the shoreline on December 19. Shorefront homes were damaged. Total damage was estimated at hundreds of thousands of dollars.
Winter 1977–78

A combination of high astronomical tides, strong onshore winds, and high storm waves resulted in significant coastal flooding in Ventura County. Storm wave damage to private property in Ventura County exceeded $300,000. The major impact areas were Mussel Shoals, Faria Beach Colony, and Oxnard Shores. In Faria Beach Colony alone, over 25 beachfront homes suffered broken windows, flooded interiors, and damaged or destroyed seawalls, bulkheads, stairs, patios, and decks.

Approximately $135,000 was required to restore state beaches and facilities damaged by storm waves. For example, at Emma Wood State Beach, the beach and recreational vehicle parking area was eroded, the concrete base of a lifeguard tower was washed away, and the road into the park was destroyed.

Other damages resulting from high waves occurred at various points along the Ventura County coastline. Sections of old U.S. Highway 101 were damaged when protective rock was removed and debris was deposited on the highway by wave action. The Ventura Marina was also damaged by wave action. Armor rock was badly displaced along parts of the marina breakwater, navigation lights were damaged, and a concrete walk was destroyed, requiring repairs amounting to between $200,000 and $300,000.

- Costs of storm damage totaled approximately $50 million in Ventura County.
- Waves overtopped the revetment backing North Rincon Parkway, flooding and damaging a road.
- Waves overtopped a revetment in Faria and flooded areas.
- Waves overtopped the revetment backing Emma Wood State Beach and damaged a road.
- The beach at Surfers’ Point eroded while waves overtopped a revetment and flooded the bike path and parking lot (FEMA 2011).
## Appendix 4.4.8

### Storm Event Peak Flows at Foster Park: 1933–2013

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¹ cfs – cubic feet per second.
² Stage is the level of the water surface above a reference height at a given location.

Data Source: VCWPD’s Hydrologic Data Server (VCWP 2014d)
Appendix 4.4.9  Ventura River Mainstem Flood Risk Areas

The following descriptions of potential flood risk along the Ventura River, unless otherwise cited, were derived from the U.S. Bureau of Reclamation’s 2007 report, *Hydrology, Hydraulics and Sediment Studies of Alternatives for the Matilija Dam Ecosystem Restoration Project* (USBR 2007).

**Matilija Dam downstream to Matilija Canyon Mouth.** This reach contains little development except the closed Matilija Hot Springs facility, the lower grounds of which do get inundated in flows above the 2% AEP (previously known as the 50-year flood).

**Matilija Canyon mouth downstream to Highway 150 Bridge.** In this reach of the river there are a number of structures and facilities located in the 1% AEP flood zone that are at risk of inundation. These include most of the houses and structures upstream and downstream of Camino Cielo Bridge, the Robles Diversion Dam, and the houses, horse stables, and orchards in the river bottom in Meiners Oaks, along Oso, Meyers, and North Rice roads, most of which were built at grade with no significant first floor elevation.

**Below Highway 150 Bridge to San Antonio Creek Confluence.** This reach of the river in Oak View contains the Live Oak Acres neighborhood, which was built in the floodplain and significantly narrows the river channel in this area. The Santa Ana Boulevard Bridge at the south end of the neighborhood is also challenged with managing the flow of the Ventura River in a very constricted space. The Live Oak levee was built to protect the neighborhood, and this runs from the Santa Ana Bridge north for 1.28 miles to about where Riverside Road meets Burnham Road. Given the extreme imposition on the floodplain, this area has had and continues to have flooding and related erosion problems.

**Below San Antonio Creek Confluence to Foster Park.** This reach of the river contains the community of Casitas Springs. The Casitas Springs levee runs along the east bank of the river for about a mile between the community and the river, but does not provide protection from the 1% AEP flood and many homes are at risk of flood inundation. At least 50 mobile homes in Casitas Springs are located close to the river where there is no protective levee. Foster Park is located within the 1% AEP flood zone and has a history of flooding.
Below Foster Park to the River Mouth. The lower end of the river is often one of the first areas to have issues with flooding. This reach of the river contains businesses, industrial areas, a few houses, a school, the Ojai Valley Sanitary District’s wastewater treatment plant, the City of Ventura’s water filtration plant, and agricultural lands. These structures and operations are all located in or near the 1% AEP flood zone. A recreational vehicle park, located adjacent to Highway 101 and actually in the floodway and on the delta of the river, has experienced repeated major flooding. The deltas of sediment-loaded rivers like the Ventura River do not tend to have static channels. The floodplain widens, the water slows, sediments get deposited, and the river splits into multiple “distributary” channels, which move and meander over time (Keller and Capelli 1992). Highway 101 has even been closed in this stretch due to flooding. Emma Wood State Beach, on the delta on the south side of Highway 101, is also subject to flooding. The North Ventura Avenue area can also experience flooding from the river (VCWP 2013b). The Ventura River levee, which protects the City of Ventura and Highway 33, extends on the east side of the river from the Pacific Ocean upriver about 2.65 miles. A smaller estuary to the west of the main estuary floods during major storms.
Appendix 4.4.10  Robles Diversion Data

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Appendix 4.4.11 Ongoing Surface Water Quality Monitoring Programs in Ventura River Watershed

Surface water quality in the Ventura River watershed 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. These programs are subject to change, especially as regulatory requirements change.

Table 4.4.11.1 Ongoing Surface Water Quality Monitoring Programs in Ventura River Watershed

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<tr>
<td>9</td>
<td>Ojai Valley Sanitary District</td>
<td>Surface</td>
<td>1</td>
<td>Ojai River (93), 15 yrs. downstream of discharge</td>
<td>Monthly,</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>10</td>
<td>Ojai Valley Sanitary District</td>
<td>Surface</td>
<td>1</td>
<td>Ojai River (93), 1000 yds. downstream of discharge</td>
<td>Monthly,</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>11</td>
<td>Santa Barbara Channelcoast-Ventura Stream Team</td>
<td>Subsurface</td>
<td>14</td>
<td>Ventura River Estuary, Ventura River at Main Street Bridge, Foster Park, Santa Ana Road Bridge, Highway 130, Casitas Lake, Casitas Reservoir, Ojai Reservoir, Ojai Creek, San Antonio Creek by Confluence with Ventura River,, Lomas Canyon, and Stewart Fox Creek, Lower Santa Clara Reservoir, Lomas Canyon Stewart Fox Creek, N. Park Malibu Creek, Upper Malibu Creek, Upper North Fork Malibu Creek, N. Park, Positiva and Wades Reservoir.</td>
<td>Monthly,</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>12</td>
<td>Santa Barbara Channelcoast-Ventura Stream Team</td>
<td>Surface</td>
<td>14</td>
<td>Ventura River Estuary, Ventura River at Main Street Bridge, Foster Park, Santa Ana Road Bridge, Highway 130, Casitas Lake, Casitas Reservoir, Ojai Reservoir, Ojai Creek, San Antonio Creek by Confluence with Ventura River, Lomas Canyon, and Stewart Fox Creek, Lower Santa Clara Reservoir, Lomas Canyon Stewart Fox Creek, N. Park Malibu Creek, Upper Malibu Creek, Upper North Fork Malibu Creek, N. Park, Positiva and Wades Reservoir.</td>
<td>Monthly,</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>13</td>
<td>Ventura County Agricultural Irrigated Land Group</td>
<td>Surface</td>
<td>2</td>
<td>Thunder Creek, Ojai Creek, San Antonio Creek, Ojai Ave.</td>
<td>4 times per year</td>
<td>X</td>
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<td>14</td>
<td>Ventura County Agricultural Irrigated Land Group</td>
<td>Surface</td>
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<td>Thunder Creek, Ojai Creek, San Antonio Creek, Ojai Ave.</td>
<td>4 times per year</td>
<td>X</td>
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<td>15</td>
<td>Ventura County Agricultural Irrigated Land Group</td>
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<td>Thunder Creek, Ojai Creek, San Antonio Creek, Ojai Ave.</td>
<td>4 times per year</td>
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<tr>
<td>16</td>
<td>Ventura County Agricultural Irrigated Land Group</td>
<td>Surface</td>
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<td>Thunder Creek, Ojai Creek, San Antonio Creek, Ojai Ave.</td>
<td>4 times per year</td>
<td>X</td>
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<tr>
<td>17</td>
<td>Ventura County Agricultural Irrigated Land Group</td>
<td>Surface</td>
<td>2</td>
<td>Thunder Creek, Ojai Creek, San Antonio Creek, Ojai Ave.</td>
<td>4 times per year</td>
<td>X</td>
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</table>

1. Two samples were taken in 2008, none in 2009, and one in 2010.
2. From 2001-2005, Post measurement monitoring was conducted once a year in the fall at 10 sites. A new program, conducted by SCOPW, started in 2009.
3. Mass emission stations are located at the lower reaches of the watershed, and as such, these sites are much larger than the discharge area associated with major outfall stations and include large contributions from other sources of discharge, such as wastewater treatment plants, agricultural runoff, non-point sources, and ground-water discharges. The purpose of mass emission monitoring is to identify pollutant loads to the ocean and identify long-term trends in pollutant concentrations.
<table>
<thead>
<tr>
<th>Cations</th>
<th>Nutrients</th>
<th>Conventional Water Quality Parameters</th>
<th>Metals</th>
<th>Organic Chemicals</th>
<th>Bacteriological</th>
<th>Toxicity/Biological</th>
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<td>Na</td>
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<td>K</td>
<td>NO$_3$ - N</td>
<td>Po</td>
<td>Cr</td>
<td>Phenol</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
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<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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</tr>
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</table>
Appendix 4.4.12 Southern California Steelhead DPS Recovery Action Table for Ventura River Sub-Watersheds

The following table is excerpted from the Southern California Steelhead Recovery Plan (NMFS 2012). DPS stands for "distinct population segment," and BPG stands for "Biogeographic Population Group." See "3.6.2 Steelhead" for more information.

Table 4.4.12.1 Southern California Steelhead DPS Recovery Action Table for Ventura River Sub-Watersheds (Monte Arido Highlands BPG)

<table>
<thead>
<tr>
<th>Action#</th>
<th>Recovery Action</th>
<th>Potential Collaborators</th>
<th>Threat Source</th>
<th>Listing Factors (1A, 1B, 2A, 2B,3A, 3B)</th>
<th>Action Rank</th>
<th>Task Duration</th>
<th>Estimated Costs ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VenR-SCS-3.1</td>
<td>Develop, adopt, and implement agricultural land-use planning policies and standards</td>
<td>NRCS, USFWS, NMFS, CDFG, CT, SCHR, EIL, TCF, VC</td>
<td>Agricultural Development</td>
<td>1, 4</td>
<td>2B</td>
<td>20–refer to regional costs</td>
<td>0</td>
</tr>
<tr>
<td>VenR-SCS-3.2</td>
<td>Manage livestock grazing to maintain or restore aquatic habitat functions</td>
<td>NRCS, BLM, USFWS, NMFS, CDFG, CT, SCHR, EIL, TCF, VC</td>
<td>Agricultural Development</td>
<td>1, 4</td>
<td>2B</td>
<td>5</td>
<td>47,520</td>
</tr>
<tr>
<td>VenR-SCS-3.3</td>
<td>Manage agricultural development and restore riparian zones</td>
<td>NRCS, BLM, USFWS, NMFS, CDFG, CT, SC, HR, EIL, TCF, VC</td>
<td>Agricultural Development</td>
<td>1, 4</td>
<td>2B</td>
<td>2–refer to regional costs</td>
<td>0</td>
</tr>
<tr>
<td>VenR-SCS-2.1</td>
<td>Develop and implement a plan to minimize runoff from agricultural activities</td>
<td>NRCS, NMFS, R WQCB, CDFG, CT, SCHR, EIL, TCF, VC</td>
<td>Agricultural Effluents</td>
<td>1, 4</td>
<td>2B</td>
<td>20–refer to regional costs</td>
<td>0</td>
</tr>
<tr>
<td>VenR-SCS-3.1</td>
<td>Develop and implement plan to remove or modify fish passage barriers within the watershed</td>
<td>USFWS, USFWS, USDOT, NMFS, CDFG, CDOT DWR, CT, SCHR, EIL, TCF, VC</td>
<td>Culverts and Road Crossings (Passage Barriers)</td>
<td>1, 4</td>
<td>3A</td>
<td>20–refer to regional costs</td>
<td>0</td>
</tr>
<tr>
<td>VenR-SCS-4.1</td>
<td>Provide fish passage around dams and diversions (e.g., Foster Park, Robles diversions)</td>
<td>BOR, NMFS, USFWS, SWRCB, CDFG, DWR, CT, SCHR, EIL, TCF, VC</td>
<td>Dams and Surface Water Divisions</td>
<td>1, 3, 4</td>
<td>1A</td>
<td>20</td>
<td>TBD</td>
</tr>
<tr>
<td>VenR-SCS-4.2</td>
<td>Develop and implement a water management plan for diversions operations (e.g., Foster Park, Robles diversions, etc.)</td>
<td>BOR, NMFS, CDFG, CT, SCHR, EIL, TCF, VC</td>
<td>Dams and Surface Water Divisions</td>
<td>1, 3, 4</td>
<td>1B</td>
<td>5</td>
<td>TBD</td>
</tr>
<tr>
<td>VenR-SCS-4.3</td>
<td>Develop and implement a water management plan for dam operations (e.g., Carpinteria, and Matilija)</td>
<td>BOR, NMFS, USGS, CDFG, CT, SCHR, EIL, TCF, VC</td>
<td>Dams and Surface Water Divisions</td>
<td>1, 3, 4</td>
<td>1B</td>
<td>100</td>
<td>TBD</td>
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<tr>
<td>VenR-SCS-5.1</td>
<td>Develop and implement flood control maintenance program</td>
<td>NRCS, ADE, USFWS, NAW, CCC, CDFG, CT, SCHR, EIL, TCF, VC</td>
<td>Flood Control Maintenance</td>
<td>1, 4</td>
<td>2B</td>
<td>100</td>
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</table>

Mainstem Ventura River
<table>
<thead>
<tr>
<th>Action#</th>
<th>Recovery Action</th>
<th>Potential Collaborators</th>
<th>Threat Source</th>
<th>Listing Factors (1-5)</th>
<th>Action Rank (1A, 1B, 2A, 2B, 3A, 3B)</th>
<th>Task Duration</th>
<th>Estimated Costs ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venti-SCS-6.1</td>
<td>Conduct groundwater extraction analysis and assessment</td>
<td>USGS, NMFs, CDFG, CT, SCHR, EL, TCF, VC</td>
<td>Groundwater Extraction</td>
<td>1, 4</td>
<td>1A</td>
<td>5</td>
<td>275550 0 0 0 0 275550</td>
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<tr>
<td>Venti-SCS-6.2</td>
<td>Develop and implement groundwater monitoring and management program</td>
<td>USGS, NMFs, CDFG, CT, SCHR, EL, TCF, VC</td>
<td>Groundwater Extraction</td>
<td>1, 4</td>
<td>1A</td>
<td>10</td>
<td>254350 39775 0 0 0 294125</td>
</tr>
<tr>
<td>Venti-SCS-7.1</td>
<td>Develop and implement stream bank and riparian corridor restoration plan</td>
<td>NRCS, USGS, ACOE, BLM, USFWS, NMFs, CDFG, CT, SCHR, EL, TCF, VC</td>
<td>Levees and Channelization</td>
<td>1, 4</td>
<td>2B</td>
<td>100</td>
<td>4217625 4217625 4217625 4217625 0 16870500</td>
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<tr>
<td>Venti-SCS-7.2</td>
<td>Develop and implement a plan to restore natural channel features</td>
<td>NRCS, USGS, USFWS, ACOE, BLM, NMFs, CCC, CDFG, CT, SCHR, EL, TCF, VC</td>
<td>Levees and Channelization</td>
<td>1, 4</td>
<td>2B</td>
<td>20</td>
<td>4217625 4217625 4217625 4217625 0 16870500</td>
</tr>
<tr>
<td>Venti-SCS-7.3</td>
<td>Develop and implement plans to vegetative levees and eliminate or minimize herbicide use near levees</td>
<td>FEMA, USGS, ACOE, BLM, NMFs, CT, SCHR, EL, TCF, VC</td>
<td>Levees and Channelization</td>
<td>1, 4</td>
<td>2B</td>
<td>100</td>
<td>68030 0 0 0 68030</td>
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<tr>
<td>Venti-SCS-8.1</td>
<td>Review and modify mining operations</td>
<td>USGS, NMFs, USFWS, CDFG, CDMG, CT, SCHR, EL, TCF, VC</td>
<td>Mining and Quaifying</td>
<td>1, 4, 5</td>
<td>3B</td>
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<td>76140 76140 76140 76140 0 304560</td>
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<tr>
<td>Venti-SCS-9.1</td>
<td>Develop and implement a non-native species monitoring program</td>
<td>CDFG, NMFs, CT, SCHR, EL, TCF, VC</td>
<td>Non-Native Species</td>
<td>1, 3, 5</td>
<td>2B</td>
<td>100- refer to regional costs</td>
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<tr>
<td>Venti-SCS-9.2</td>
<td>Develop and implement a watershed-wide plan to assess the impacts of non-native species and develop control measures</td>
<td>CDFG, USFWS, CDFG, CT, SCHR, EL, TCF, VC</td>
<td>Non-Native Species</td>
<td>1, 3, 5</td>
<td>2B</td>
<td>100- refer to regional costs</td>
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<tr>
<td>Venti-SCS-9.3</td>
<td>Develop and implement a public education program on non-native species impacts</td>
<td>CDFG, USFWS, NMFs, CT, SCHR, EL, TCF, VC</td>
<td>Non-Native Species</td>
<td>1, 3, 5</td>
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<td>76140 76140 76140 76140 0 304560</td>
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<tr>
<td>Venti-SCS-10.1</td>
<td>Review and modify development and management plans for recreational areas and national forests</td>
<td>USFS, USFWS, NMFs, CDFG, CT, SCHR, EL, TCF, VC</td>
<td>Recreational Facilities</td>
<td>1, 2, 3, 4, 5</td>
<td>1B</td>
<td>ongoing-cost of doing business</td>
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<td>Venti-SCS-10.2</td>
<td>Develop and implement a public education program on watershed processes</td>
<td>NRCS, USFS, USFWS, NMFs, CDFG, CT, SCHR, EL, TCF, VC</td>
<td>Recreational Facilities</td>
<td>1, 3, 5</td>
<td>2B</td>
<td>20</td>
<td>76140 76140 76140 76140 0 304560</td>
</tr>
<tr>
<td>Venti-SCS-10.3</td>
<td>Review and modify development and management plans for recreational areas and national forests (e.g., U.S. Forest Service Los Padres National Forest Land Management Plan, Southern California National Forest Vision, Forest Strategy, and Design Criteria)</td>
<td>USFS, USFWS, CDPR, CDFG, CT, SCHR, EL, TCF, VC</td>
<td>Recreational Facilities</td>
<td>1, 2, 3, 4, 5</td>
<td>2B</td>
<td>ongoing-cost of doing business</td>
<td>0 0 0 0 0 0</td>
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Table 4.4.12.1 Southern California Steelhead DPS Recovery Action Table for Ventura River Sub-Watersheds (Monte Arido Highlands BPG) (continued)

<table>
<thead>
<tr>
<th>Action#</th>
<th>Recovery Action</th>
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<th>Threat Source</th>
<th>Listing Factors (1-5)</th>
<th>Action Rank</th>
<th>Task Duration</th>
<th>Estimated Costs ($)</th>
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</thead>
<tbody>
<tr>
<td>VenR-SCS-10.4</td>
<td>Review and modify development and management plans for recreational areas and national forests</td>
<td>USFS, USFWS, BLM, NMFS, CDFG, OVLG, CT, SCHR, EIL, TCF, VC</td>
<td>Recreational Facilities</td>
<td>1, 2, 3, 4, 5</td>
<td>2B</td>
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<td>VenR-SCS-11.1</td>
<td>Manage roadways and adjacent riparian corridor and restore abandoned roadways</td>
<td>USDOT, USFWS, NRCS, NMFS, CDFG, CDFG, CT, SCHR, EIL, TCF, VC</td>
<td>Roads</td>
<td>1, 4</td>
<td>2B</td>
<td>20—refer to regional costs</td>
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<tr>
<td>VenR-SCS-11.2</td>
<td>Retrofit storm drains to filter runoff from roadways</td>
<td>NRCS, NMFS, USFWS, USDOT, USFWS, CDFG, CDFG, CT, SCHR, EIL, TCF, VC</td>
<td>Roads</td>
<td>1, 4</td>
<td>2B</td>
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<td>32260 32260 32260 32260 0</td>
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<td>VenR-SCS-12.1</td>
<td>Review and modify applicable County and/or City Local Coastal Plans</td>
<td>CCC, CDFG, NMFS, USFWS, CT, SCHR, EIL, TCF, VC</td>
<td>Uplands/Upstream activities</td>
<td>1, 2, 3, 4, 5</td>
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<td>Develop and implement an estuary restoration and management plan</td>
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<td>Uplands/Upstream activities</td>
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<td>VenR-SCS-13.1</td>
<td>Develop, adopt, and implement urban land-use planning policies and standards</td>
<td>NMFS, CDFG, CT, SCHR, EIL, TCF, VC</td>
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<td>1, 4</td>
<td>2B</td>
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<td>VenR-SCS-13.2</td>
<td>Develop, adopt, and implement urban land-use planning policies and standards</td>
<td>NMFS, CDFG, CT, SCHR, EIL, TCF, VC</td>
<td>Urban Development</td>
<td>1, 4</td>
<td>2B</td>
<td>5</td>
<td>62400 0 0 0 0</td>
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<tr>
<td>VenR-SCS-13.3</td>
<td>Retrofit storm drains in developed areas</td>
<td>NMFS, USDOT, CDFG, CDFG, RWQCB, CT, SCHR, EIL, TCF, VC</td>
<td>Urban Development</td>
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<td>2B</td>
<td>20</td>
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<td>VenR-SCS-14.1</td>
<td>Review California Regional Water Quality Control Board Watershed Plans and modify Stormwater Permits</td>
<td>RWQCB, NMFS, RWQCB, CDFG, CT, SCHR, EIL, TCF, VC</td>
<td>Urban Effluents</td>
<td>1, 4</td>
<td>2B</td>
<td>ongoing—cost of doing business</td>
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<tr>
<td>VenR-SCS-14.2</td>
<td>Review, assess and modify if necessary all NPDES wastewater discharge permits (e.g., Ojai Valley Sanitary District Wastewater Treatment Facility)</td>
<td>RWQCB, USFWS, NMFS, CDFG, CT, SCHR, EIL, TCF, VC</td>
<td>Urban Effluents</td>
<td>1, 4</td>
<td>2B</td>
<td>ongoing—cost of doing business</td>
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<tr>
<td>VenR-SCS-15.1</td>
<td>Develop and implement an integrated wildfire and hazardous fuels management plan</td>
<td>USFS, NMFS, USGS, CDFG, LPIFW, CT, SCHR, EIL, TCF, VC</td>
<td>Wildfires</td>
<td>1, 4, 5</td>
<td>1B</td>
<td>100—refer to regional costs</td>
<td>0 0 0 0 0</td>
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Appendix 4.4.13  Summary of Historical Fish Stocking

The following summary of historical fish stocking in the watershed is excerpted from the Draft Ventura River Habitat Conservation Plan (Entrix & URS 2004).

Rainbow trout were stocked in the Ventura River basin as early as 1878. Various nonnative strains have been stocked into the headwaters and mainstem of Ventura River, and continue to be stocked today. This stocking may have had an influence on the number of fish returning to spawn and the number of resident fish captured above barriers each year. Genetic analysis indicates that the rainbow trout found in the headwater streams of the Ventura River Basin are dominated by fish with a more widespread (not specific to southern California) mitochondrial DNA type.

The USFS has documentation of New Hampshire rainbow trout and Maine Salmon stocking in the basin in February 1878 (Chubb 1997). In 1894, 20,000 easton brook trout, 10,000 rainbow trout, and 15,000 Tahoe trout were planted in the Ventura River headwaters (Chubb 1997). The following year, 62,500 rainbow trout were planted in Ventura County streams (Chubb 1997). Titus et al. (in press) reported that 40,000 and 34,000 steelhead juveniles were stocked in the Ventura River watershed in 1930 and 1931, respectively. The mainstem of the Ventura River was stocked with one to several thousand rainbow trout several times per year between 1942 and 1947 and between 1954 and 1974 (CDFG fish planting receipts). These fish were from several strains including Mount Whitney, Mount Shasta, and Hot Creek. The Ventura River was also stocked with steelhead rescued from the Santa Ynez River: approximately 17,200 in 1943; 20,800 in 1944; and 45,440 in 1945 (Titus et al. 1994). More recently, the mainstem Ventura River was stocked with 11,000 steelhead in June 1976, 9,000 steelhead in June 1977, and 20,000 steelhead in June 1978. All of these fish were released as young-of-the-year and were obtained primarily from Mad River hatchery (2,000 of the 1977 fish were from Humboldt State University Hatchery) (Moore 1980).

As on the mainstem of the Ventura River, thousands of juvenile rainbow trout from both Mount Whitney and Mount Shasta were stocked in Matilija Creek between 1938 and 1948 (CDFG fish planting receipts). The Upper North Fork Matilija Creek was stocked with 4,800 rainbow trout from Mount Shasta in 1948. Murietta Creek (West Fork Matilija Creek) was stocked twice in 1942 with 1,200 rainbow trout from Hot Creek and 1,800 rainbow trout from unspecified origin. The North Fork
Matilija Creek was reportedly stocked annually with trout of unspecified origin at least until 1973 (Commission 1973). Stocking of catchable-size trout continues in the North Fork Matilija Creek today.

Both steelhead and rainbow trout strains were stocked in the San Antonio Creek subbasin between 1933 and 1947 (CDFG fish planting receipts). Approximately 26,000 steelhead trout from Mount Whitney were stocked in San Antonio Creek between 1933 and 1940. Another 16,250 rainbow trout from Mount Whitney, Mount Shasta, and Hot Creek were stocked in San Antonio Creek between 1943 and 1947. There is one record of 10,000 rainbow trout from Mount Shasta stocked in Senior Canyon Creek, a tributary to San Antonio Creek, in 1945.

There is an additional stocking record from 1940 of approximately 2,500 rainbow trout of unspecified origin being stocked into Santa Ana Creek, a tributary to Coyote Creek (CDFG fish planting receipt).

In the past 40 or so years, regular stocking of rainbow trout strain from Mount Whitney, Coleman, and Hot Creek has occurred in Matilija Creek upstream of Matilija Dam and in North Fork Matilija Creek (M. Cardenas, CDFG, pers. comm.). During this time, a few isolated instances of stocking of steelhead strain from Mad River may have occurred. These stockings generally took place several times a year and contained both fingerling and catchable-size trout. Stocking of Matilija Creek upstream of Matilija Dam has continued through 1997.
Appendix 4.4.14  Other Local Water- and Watershed-Related Plans

Below is a summary of other local water- or watershed-related plans that have bearing on Ventura River watershed planning and management. These plans have been developed by public agencies, water and wastewater managers, or land and resource managers.

4.4.14.1  General

Integrated Regional Water Management Plan (IRWMP)

Organization: Watersheds Coalition of Ventura County

IRWMPs are regional plans designed to improve collaboration and integration in water resources management. IRWMP plan development was originally funded through grant programs created by Proposition 50 and, later, by Proposition 84. They are funded by grants from the California Department of Water Resources (DWR), and developed in accordance with DWR requirements. Projects included in IRWMPs become eligible for bond (e.g., Proposition 84) funding from the state.

Ventura County is a “region” for the purposes of IRWM planning. The first Ventura County IRWMP was produced in 2006 following a multi-year effort among water suppliers, wastewater agencies, stormwater and flood managers, watershed groups, the business community, agriculture and nonprofit stakeholders. An update to the 2006 plan was completed in 2014. The IRWMP and associated coordination efforts have resulted in $43 million in grant money for Ventura County water-related projects since 2006.

City and County General Plans

Organization: County of Ventura, City of Ventura, City of Ojai

Local jurisdictions are required by the State of California to prepare and update general plans, which provide the local government’s long-term blueprint for development and land use. General plans of the watershed’s three local governments—Ventura County, City of Ventura, and City of Ojai—are applicable to the watershed. General plans must address certain elements, including land use, circulation, housing, conservation, open space, noise, and safety; and they generally include the equivalent of goals, policies, and programs for each of these elements.
General plans developed by local jurisdictions within the watershed include many policies that influence watershed issues, including water conservation, groundwater management, flood control, open space protection, protection of wetlands and significant biological resources, agricultural preservation, water-related infrastructure, parks and recreation, fire protection and risk management, and more.

The “vision” of general plans is implemented through the jurisdiction's zoning ordinance (sometimes called development code). General plans and zoning ordinances complement one another and must be compatible.

### 4.4.14.2 Water Supply

#### Urban Water Management Plans, 2010

*Organizations: Casitas Municipal Water District, City of Ventura, Golden State Water*

Urban water management plans (UWMP) are comprehensive, long-term plans developed to ensure adequate water supplies are available to meet existing and future water demands.

Every urban water supplier in California that provides over 3,000 acre-feet of water annually or serves more than 3,000 connections is required to submit an UWMP to the state. UWMPs must detail supply and demand projections for the next 20 years, and describe strategies to assure adequate supplies during average, single-year, and multi-year drought conditions. UWMPs also contain plans to implement a 20% reduction in per capita urban water use by the year 2020, as required under the Water Conservation Act of 2009. UWMPs must be updated every 5 years.

Three UWMPs are applicable to the watershed: Casitas Municipal Water District, City of Ventura, and Golden State Water.

#### Groundwater Management Plan, 2007

*Organization: Ojai Basin Groundwater Management Agency*

The first and only groundwater management plan in the watershed was originally adopted in 1995 by the Ojai Basin Groundwater Management Agency (OBGMA). An update was prepared in 2007. The OBGMA is required by law to have a groundwater management plan to guide its operations. The plan includes 5 broad goals and a number of action elements.
Water Efficiency Plan, 2011

*Organization: City of Ventura*

The City of Ventura developed its Water Efficiency Plan to develop strategies to buffer the city from impacts from water supply reductions—such as from extended drought, environmental restrictions, groundwater quality limitations, or litigation actions—and to improve the water reduction targets already attained.

Comprehensive Water Resources Report, 2013 and 2014

*Organization: City of Ventura*

The City of Ventura understands that monitoring its water supply and demand is essential to planning for and managing a stable and reliable water system to support its community and economic growth. The available water supply and demands upon it dramatically influences the City's planning for, development of, and investment in capital improvements to maintain current water supplies and develop new supplies. The preparation of this annual report, which started in 2013, serves as an update of the City's projected water supply and demand.

4.4.14.3 Water Quality

Basin Plan

*Organization: Regional Water Quality Control Board, Los Angeles*

Each of the California'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 Regional Water Quality Control Board (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 (Total Maximum Daily Load) regulations are adopted. The Basin Plan revolves around a concept called "beneficial uses." These are the resources, services, and qualities of aquatic systems that the regulations aim to protect. Examples of beneficial uses include water supply; recreation; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources. Beneficial uses can be existing, potential, or intermittent uses. Once beneficial uses have been designated for various waterbodies, appropriate water quality objectives can then be developed to protect those uses.
Stormwater Management Plans

Organization: Ventura Countywide Stormwater Quality Management Program

Stormwater management planning is addressed within Ventura County’s MS4 permit and the associated Technical Guidance Manual and Hydro-modification Control Plan, developed to implement some of the MS4 permit requirements related to new development and redevelopment.

4.4.14.4 Flood Management

Flood Mitigation Plan, 2005

Organization: Ventura County Watershed Protection District

The Ventura County Flood Mitigation Plan addresses planning for risks associated with flooding, post-fire debris flow, and dam failure. Flood hazards are identified and profiled, assets are identified, and vulnerability as well as capability is assessed. A mitigation strategy for reducing potential hazards, including goals, objectives, and actions, is also included.

4.4.14.5 Resource Management/Ecosystem Protection

Coastal Regional Sediment Management Plan, Central Coast from Pt. Conception to Pt. Mugu, 2009

Organization: BEACON

The Beach Erosion Authority for Clean Oceans and Nourishment (BEACON) is a Joint Powers Authority composed of Santa Barbara and Ventura counties and the six cities of Goleta, Santa Barbara, Carpinteria, Ventura, Oxnard, and Port Hueneme.

Coastal Regional Sediment Management Plans (CRSMP) are part of a larger, statewide effort to address sediment management by the Coastal Sediment Management Workgroup—a collaborative task force of state, federal, and local/regional entities concerned about the adverse impacts of coastal erosion on coastal habitats.

BEACON’s CRSMP is intended to develop comprehensive strategies and practices to better conserve and restore the valuable sediment resources along its coastline; to reduce shoreline erosion and coastal storm damages; protect sensitive environmental resources; increase natural sediment supply to the coast; preserve and enhance beaches; improve water quality along the shoreline; and optimize the beneficial use of material dredged from ports, harbors, and other opportunistic sediment sources.
Lake Casitas Resource Management Plan

Organization: US Bureau of Reclamation, in cooperation with Casitas Municipal Water District

The Bureau of Reclamation in cooperation with Casitas Municipal Water District (CMWD) developed the Lake Casitas Resource Management Plan (RMP) to establish management objectives, guidelines, and actions for the Lake Casitas Recreation Area (LCRA) and the 3,500 acres of open space lands north of the LCRA, which together comprise the Plan Area.

The RMP is a long-term plan intended to guide actions in the Plan Area, and is based on a comprehensive inventory of environmental resources and facilities and input from local, state, and federal agencies; CMWD; and the general public. The primary emphasis of the RMP is to protect water quality, water supply, and natural resources, while enhancing recreational uses at the LCRA. Recreational uses must be compatible with the primary obligation to operate the reservoir for storage and delivery of high-quality water.

The Bureau of Reclamation's mission statement declares that it is "to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public." Planning, through Resource Management Plans, provides specific direction for Reclamation to accomplish its mission at water resource development projects.

Los Padres National Forest, Land Management Plan

Organization: US Forest Service, Pacific Southwest Region

The legislative mandate for the management of national forests requires that public lands be conservatively used and managed in order to ensure their sustainability and to guarantee that future generations will continue to benefit from their many values.

The land management plan for the Los Padres National Forest describes the strategic direction at the broad program-level for managing the land and its resources over the next 10 to 15 years, and in a way that assures the coordination of multiple uses (e.g., recreation and environmental education opportunities; forest health and management; air, soil, and water quality; watershed; and wildlife) and the sustained yield of products and services.

The land management plan also includes monitoring and evaluation requirements that provide a framework for ensuring US Forest Service programs and projects are meeting land management plan direction, and that desired conditions will be achieved over time.
City of Ojai Urban Watershed Assessment and Restoration Plan

Organization: City of Ojai

The City of Ojai Urban Watershed Assessment and Restoration Plan is a comprehensive assessment and restoration plan for the subwatersheds that drain through Ojai's city limits. These subwatersheds include Stewart Canyon, Fox Canyon, and portions of San Antonio and Thacher Creeks. Thacher, Stewart Canyon, and Fox Canyon creeks are all tributaries to San Antonio Creek, which is a major tributary to the Ventura River.

The primary purposes of the assessment and restoration plan are to identify specific problems of the Ojai creeks relevant to southern California steelhead, and develop a plan to restore fish habitat while addressing land use issues that adversely affect that habitat and the ecological health of the watersheds.

Southern California Steelhead Recovery Plan, 2012

Organization: National Marine Fisheries Service

The federal Endangered Species Act (ESA) mandates that the National Marine Fisheries Service (NMFS) develop and implement recovery plans for the conservation (recovery) of listed species. Recovery plans identify recovery actions, based upon the best scientific and commercial data available necessary for the protection and recovery of listed species. Recovery plans published by NMFS are guidance documents, not regulatory documents.

Steelhead in southern California comprise a “distinct population segment” (DPS) of the species O. mykiss that is ecologically discrete from the other populations of O. mykiss along the West Coast of North America. Under the ESA, this DPS qualifies for protection as a separate species.

Ventura River Steelhead Restoration and Recovery Plan, 1997

Organizations: Casitas MWD, City of Ventura, Ventura County Flood Control District, Ventura County Transportation Department, Ventura County Solid Waste Management Department, Ojai Valley Sanitation District, Ventura River County Water District, Ojai Basin Ground Water Management Agency, Meiners Oaks MWD, and Southern California Water Company

In August 1997, the National Marine Fisheries Service (NMFS) listed anadromous steelhead in southern California as endangered under the Endangered Species Act (ESA). This listing means that any project or action that may affect southern California steelhead or their habitats
requires consultation with NMFS to obtain an incidental “take” permit. Since operation and maintenance of water diversions, river and stream channels managed for flood control purposes, transportation facilities, and sewage treatment plants may affect steelhead in the Ventura River, project operators are required to consult with NMFS to obtain permits.

To assist them in addressing steelhead issues and possible permit requirements, a group of local public and private agencies with responsibilities for surface water, ground water, flood control, and other public works facilities collaborated to develop this management plan to be used by these local agencies. The plan considers a wide range of conservation actions that can be implemented by public agencies with facilities and interests in the watershed, as well as other interested individuals, groups, or resource agencies.

Ventura County Oak Woodland Management Plan, 2007

Organization: Ventura County Planning Division

The development of Oak Woodland Management Plans (OWMP) grew out of the California Oak Woodland Conservation Act. As a result of the act, the Oak Woodland Conservation Program was established, which is designed to provide funding to help protect and enhance oak woodland resources. Projects in counties that have an Oak Woodland Management Plan are eligible for funding.

Ventura County's OWMP provides a conservation framework for the preservation of the county's oak woodland resources. The plan provides a summary of the distribution and extent of county's oak woodlands and outlines conservation goals and program recommendations.

4.4.14.6 Public Access Plans

Vision Plan for the Lower Ventura River Parkway

Organizations: Trust for Public Land and California State Coastal Conservancy

The Vision Plan for the Lower Ventura River Parkway (Vision Plan) was created by the 606 Studio, a consortium of faculty and graduate students in the Department of Landscape Architecture at California State Polytechnic University, Pomona; and was sponsored by The Trust for Public Land, Ventura Hillsides Conservancy, and the California Coastal Conservancy.

Although not an adopted plan, this document is important to many stakeholders in the watershed as offering a vision for a river parkway along the lower six miles of the Ventura River. The plan is intended as
an analysis, planning, and design tool for governmental and non-gov-
ernmental agencies, and the surrounding community. The plan's ideas
are aimed at helping in the creation of a river parkway that is compati-
ble with recreational use, stewardship, river function, and regional
ecosystems.

### 4.4.14.7 Hazard/Emergency Response Plans

#### Multi-Jurisdictional Hazard Mitigation Plan for Ventura County

_Organization: County of Ventura_

The Multi-Jurisdictional Hazard Mitigation Plan for Ventura County
(HMP) was prepared to meet the Department of Homeland Security's
Federal Emergency Management Agency (FEMA) requirements of the
Disaster Mitigation Act of 2000 (Public Law 106-390) (DMA 2000) and
Interim Final Rule (the Rule). The Rule establishes the minimum hazard
mitigation planning requirements for states, tribes, and local entities.

Participating organizations include eight local jurisdictions in the county,
along with 20 school districts, the Ventura County Superintendent of
Schools Office, two water districts, Ventura County Fire Protection
District, the Watershed Protection District, and the Ojai Valley Sanitary
Districts.

By preparing the HMP, all 34 participants are eligible to receive federal
mitigation funding after disasters and to apply for mitigation grants
before disasters strike.

The plan is intended to enhance public awareness and understanding,
create a decision tool for management, promote compliance with state
and federal program requirements, enhance local policies for hazard
mitigation capability, provide inter-jurisdictional coordination of mitiga-
tion-related programming, and achieve regulatory compliance.

#### Emergency Response Plans, Public Drinking
Water Systems

_Organization: All water districts with 5 or more connections._

All water suppliers with 5 or more connections are required to have an
Emergency Response Plan. These are comprehensive plans that describe
the actions the water supplier would take in response to various major
events such as natural disasters or security problems that could damage
or disrupt the ability to serve the public potable water.
Ventura County Community Wildfire Protection Plan

Organization: Ventura County Fire Protection District

The Healthy Forest Restoration Act (HFRA) enacted by the US Congress on Jan 7, 2003, established a protocol for the creation of wildfire safety plans for communities at risk from wildland fires—a Community Wildfire Protection Plan (CWPP).

The Ventura County CWPP identifies wildfire risks, clarifies priorities for funding, and describes programs to reduce impacts of wildfire on the communities at risk within Ventura County.

Unit Strategic Fire Plan

Organization: Ventura County Fire Protection District

The Unit Strategic Fire Plan identifies and prioritizes pre-fire and post-fire management strategies and tactics meant to reduce the loss of values at risk within the unit (Ventura County Fire Protection District).

The overall goal is to reduce total cost and losses from wildland fire in Ventura County by protecting assets at risk through focused pre-fire management prescriptions and increased initial attack success.

4.4.14.8 Watershed Management Plans (surrounding watersheds)

Watershed management plans of surrounding watersheds are relevant to the Ventura River watershed's planning effort. Surrounding plans include the following:

Rincon Creek Watershed Plan

Calleguas Creek Watershed Management Plan (Volumes I and II)

Santa Clara River Enhancement & Management Plan