Appendix C

Ventura River Watershed Section

Submitted by the Ventura River Watershed Council

Ventura River Watershed

Ventura River Watershed Section
of the Watersheds Coalition of Ventura County
Integrated Water Management Plan Update, 2014

May, 2014

Photo by David Magney

Note: This document has been excerpted from a draft of the Ventura River Watershed Management Plan, which is still a work in progress. Some sections of that plan have not yet been written; the apparent mistakes in section numbering in this document reflect those unwritten sections. In addition, there could be cross-references to context that has been omitted in this excerpted version.

Part 1 - Introduction

1.2 Ventura River Watershed Council

1.2.1 Participants

The Ventura River Watershed Council (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 in 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 Coalition of Labor, Agriculture and Business
Ventura County Resource Conservation District
Ventura County Supervisor Steve Bennett's Office

Ventura County Watershed Protection District

Ventura Hillsides Conservancy

Ventura River County Water District

Watersheds Coalition of Ventura County

Ventura River Watershed Council
Photo courtesy of Lisa Brenneis

1.2.2 Council History, Structure & 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.

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 hosts this position. The Council's watershed coordinator began in the fall of 2011.

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.

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, regulatory, and more.
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.

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 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. Most of the Ventura River watershed, 49%, 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).

The First District includes the cities of Ojai and Ventura, and the northwestern portion of the city of Oxnard, and reaches from the coast to the Santa Barbara and Kern County lines, an area of 459,660 acres or 718.22 sq. mi. The population is approximately 165,000.

In addition to being the governing body of County government, the Board of Supervisors also governs the Ventura County Watershed Protection District. Supervisor Bennett is also 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 the county. The district is divided into four zones, roughly corresponding to the major watersheds within the county, 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 the Casitas MWD 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 insure implementation of stormwater pollution prevention controls, reviews development plans for stormwater mitigation controls, 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 contained 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 (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 California 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 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 (Casitas) 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 Rincon and beach area to the ocean and 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' water is Lake Casitas, built by the U.S. Bureau of Reclamation in 1959 along with Casitas Dam, 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 County Water District, Meiners Oaks Water District, and others. All of these water agencies, except the City of Ventura, rely on water from Casitas when their groundwater supplies are depleted.

In addition to operating and maintaining the Ventura River Project, 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, 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 County Water District

805/646-3403

www.vrcwd.com

The Ventura River County Water District (VRCWD) 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. VRCWD's service encompasses about 2,220 acres, and includes residential and commercial customers. VRCWD has approximately 2,100 service connections.

VRCWD obtains water from four wells located adjacent to the Ventura River and over the Upper Ventura River Groundwater Basin. Water from Casitas MWD is purchased on a continuing basis for some connections, and the district also has an agreement to purchase water from Casitas during emergencies and drought conditions.

Meiners Oaks Water District

805/646-2114

http://meinersoakswater.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. MOWD's service area encompasses approximately 1,300 acres, and includes residential, commercial, and agricultural customers. MOWD has approximately 1,200 service connections.

MOWD obtains water from five wells located immediately adjacent to the Ventura River and over 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 a 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 3 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 within the basin.

Creation of a local groundwater management agency in California requires a special act of the state legislature. The Ojai Basin Groundwater Management Agency 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 directed 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 12 properties totaling over 2,100 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.vcrcd.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 nine-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, staff support for the Horse and Livestock Watershed Alliance, 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 a powerful activist network. The Ventura County chapter was formed in 1991 by local ocean enthusiasts who were concerned by the threat of beach armoring at Surfer's 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 re-create the human connection to the river that once existed; and Surfer's Point Managed Retreat, an ecosystem-based approach to managing the erosion at Surfer's 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 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. And OVGC works on the ground 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 resource, 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 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.

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, Regional Water Quality Control Board Santa Clara River Basin (4A) Plan, U.S. Bureau of Reclamation Ventura County Water Management Plan, and the Ventura River Trail Plan. Over the years the Friends have participated in a case-by-case review of 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 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 the 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”—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 Friend 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 has several farm properties in the watershed, all with different microclimates. Over the years they have learned which varieties prefer which climate. Tangerines are sweetest on their Matilija canyon property; navels do well in the Ojai Valley’s East End.

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 education 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 mmcf 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.colabvc.org

Ventura County Coalition of Labor, Agriculture and Business, or VC COLAB, is a 501c(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 full-time presence in Ventura County 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 County's 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 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

$3,349,000 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) the San Antonio Creek Spreading Grounds (groundwater recharge), and 3) Senior Canyon Mutual Water Company Equipment Upgrades (to reduce water demand).

April 2010

"Watershed U – Ventura River" was held, a comprehensive educational series for the community. 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 new watershed coordinator position is funded by a grant ($241,600) from the California Department of Conservation, with additional support provided by several Watershed Council partners. Development of a Ventura River watershed management plan is a key objective of the watershed coordinator position. The Ojai Valley Land Conservancy generously hosts 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 held twice a year, in April and October.

May 2012

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.

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.

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: $277,446
- 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 support 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.

Part 2 - Watershed Characterization

2.1 Location and Quick Facts

Figure 2.1.1. Location Map

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 include Ventura River, Santa Clara River, and Calleguas Creek watersheds.

Table 2.1.1. Ventura County's Major Watersheds		
	Square Miles	Acres
Ventura River	226	144,640
Calleguas Creek	343	219,520
Santa Clara River	1,634	1,045,760

Table 2.1.2 Quick Facts	
Main Tributaries	Matilija Creek, North Fork Matilija Creek, San Antonio Creek, Cañada Larga Creek, Coyote Creek
Jurisdictions	County of Ventura (49.1%), US Forest Service (47.7%), City of Ojai (1.9%), City of Ventura (1.2%)
Population	44,140
Headwaters	Transverse Ranges
Mouth	Santa Barbara Channel (Pacific Ocean)
Length	33.5 miles (16.2 miles of main stem, plus 17.3 miles of Matilija Creek headwaters)
Area	226 sq. mi., 144,640 acres
Average Annual Precipitation	15.46” (lower watershed) 21.31” (middle watershed) 35.17” (upper watershed)
Discharge	Average – 65 cubic feet per second (cfs); Maximum – 63,000 cfs (1978)
Elevation	Highest: 6,010 ft. Lowest: sea level

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-mile run from its headwaters at 6,010 feet of elevation 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.

The Ventura River is fed by five significant tributaries that form “subwatersheds” nested within the larger Ventura River watershed. These tributaries, and subwatersheds, are Matilija Creek, North Fork Matilija Creek, San Antonio Creek, Cañada Larga Creek, and Coyote Creek. Elevation peaks form the rims of these subwatersheds. The main stem of the Ventura River, extending from the confluence of Matilija Creek and the North Fork Matilija Creek to the Pacific Ocean, forms a sixth subwatershed.

The watershed maintains relatively natural and undeveloped conditions, with 56% of its land area in protected status and most of streams and drainages unchannelized. The northern half of the watershed lies within the Los Padres National Forest. The southern half of the watershed includes two cities and a number of unincorporated communities. The population in the watershed is approximately 44,140, which represents just 5.2% of Ventura County’s population of 823,318 residents. 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 stretches of the Ventura River.

Figure 2.1.2. Subwatersheds Map

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 above. Lake Casitas serves as the major water supply reservoir in the watershed, and groundwater is also heavily relied upon.

Two small coastal watersheds—the North Ventura Coastal Streams watershed and the Buenaventura watershed—flank the Ventura River watershed's lower section and have important water-related relationships with the Ventura River watershed. For example, 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.

The watershed's rugged topography, largely undeveloped status, and Mediterranean climate combine to make for an area of exceptional biodiversity. The watershed supports at least 17 native vegetation types, including native perennial grassland, coastal sage scrub, red-shank chaparral, valley oak woodland, walnut woodland, southern willow scrub, southern cottonwood-willow riparian forest, sycamore-alder woodland, oak riparian forest, coastal salt marsh, and freshwater marsh.

The watershed's habitats and its water supply benefit from an exceptionally high level of citizen stewardship. From a citizen water quality monitoring program, to land protection by land trusts, to environmental education programs, to the hard work of small, local water districts and treatment plants—a tremendous amount of effort goes into the protection of the small, self-reliant Ventura River watershed.

2.2 Physical Features

2.2.1 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.

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, drier air, and a greater range of daily and seasonal air temperature variation, with summer temperatures averaging 10° to 15°F hotter. The high elevation mountainous area receives the most rain.

Because of the watershed's steep, rugged and variable terrain, different microclimates occur within relatively close proximity. The hillsides are often 15° warmer on average than the floor of the Ojai Valley (Sears 2013).

Air Temperature

August and September are typically the hottest months in the watershed. Beginning in late September, 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. Between September and March, the area averages around 14 Santa Ana wind events, about one-third of which are moderate to strong (Schaeffer 2013). 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 on average two days a year (WRCC 2013).

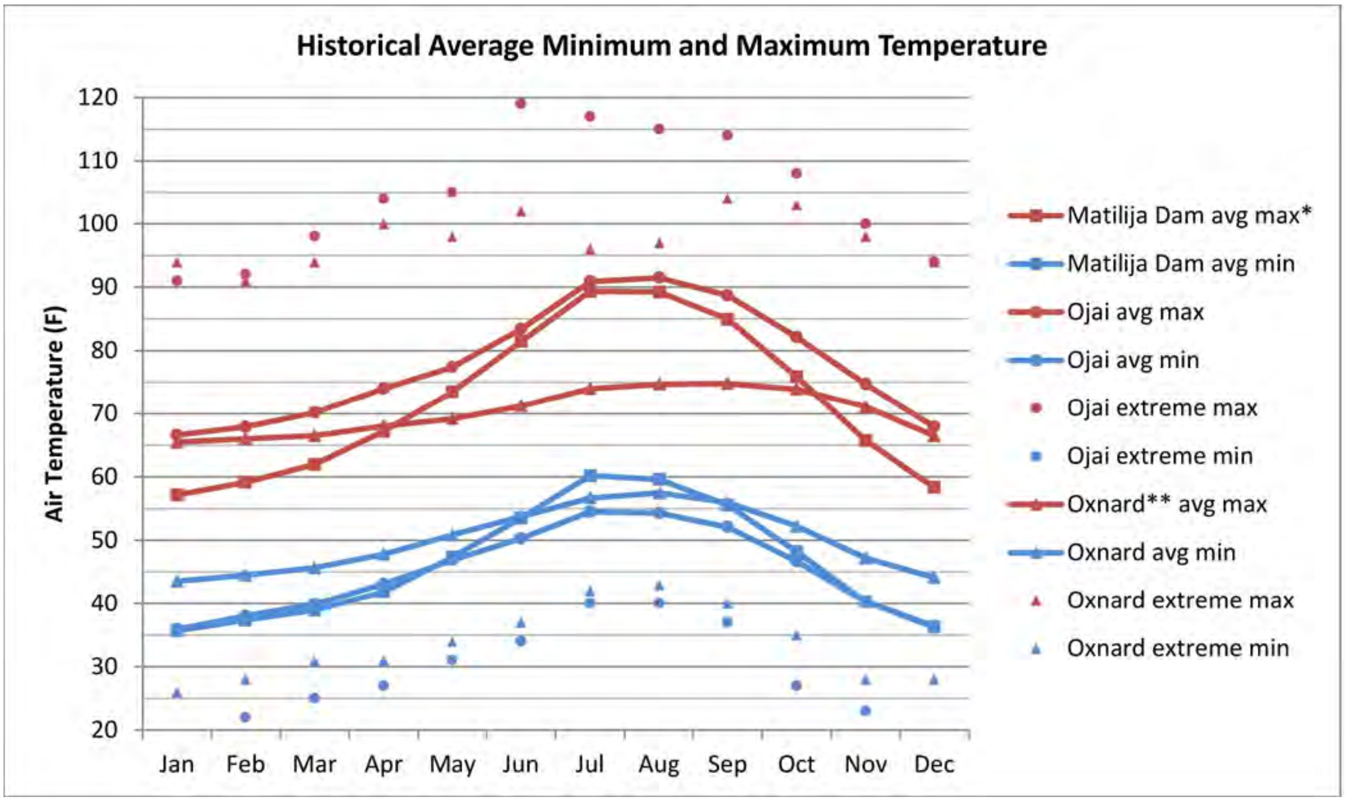


Figure 2.2.1.1 Historical Average Minimum and Maximum Temperature

* Extreme max and min temps 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.

Source: Western Regional Climate Center (WRCC 2013)

Temperatures Over Time

The graphs below illustrate potential trends in the local temperature over time, based on the limited data available. (Note: A rigorous analysis of the quality of the data was not made; this is simply a look at the apparent trends in the readily available data.) Although the data indicate potential trends in climate change, "variability" is the one aspect of local climate that has been reliable in the watershed. The most likely assumption, therefore, is that the watershed will continue to experience variable climate conditions, with the many uncertainties inherent in global climate change perhaps only amplifying this variability.

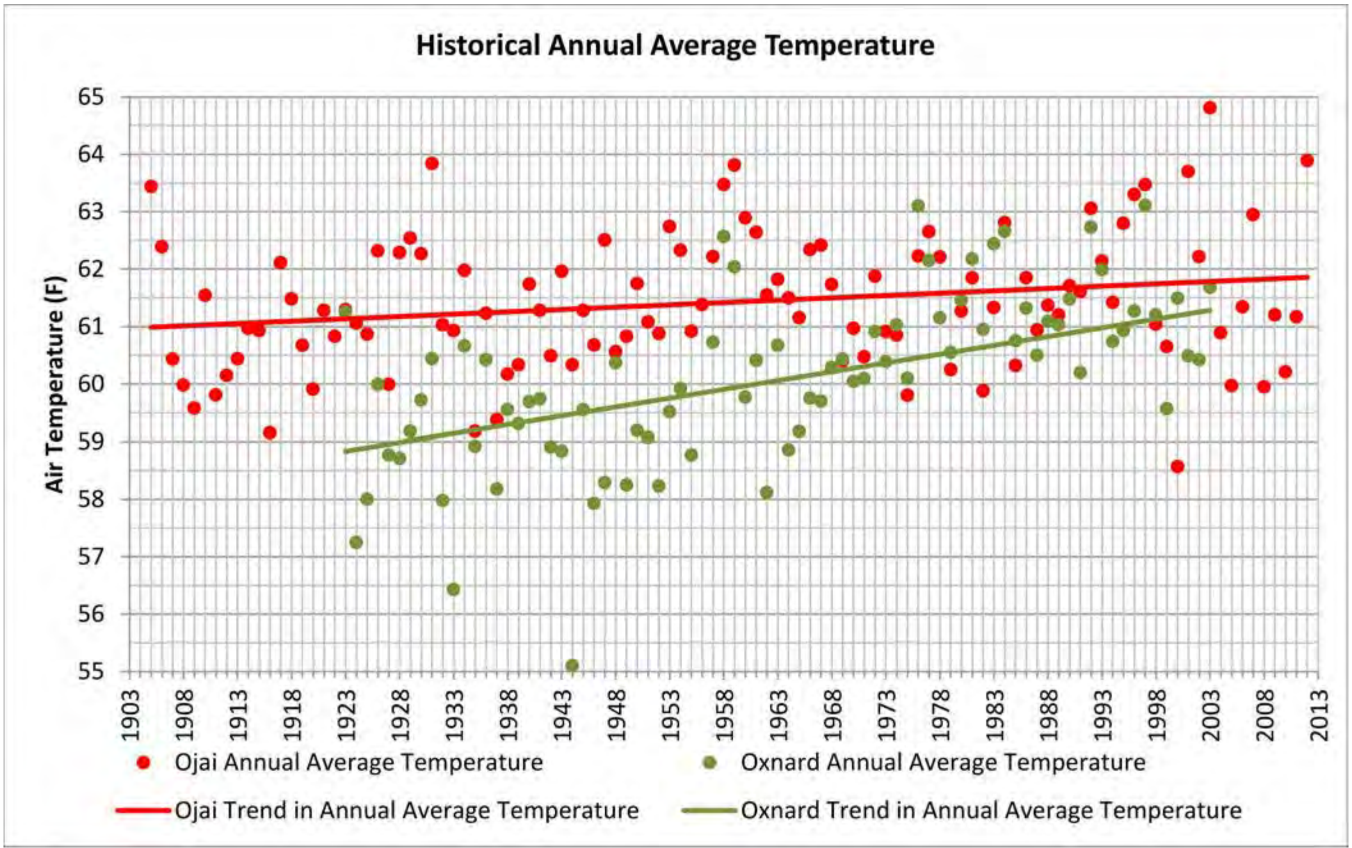


Figure 2.2.1.2 – Historical Annual Average Temperatures, Ojai and Oxnard
* Oxnard is a proxy for missing Ventura data, as a nearby location with similar climate.
Data Source: Western Regional Climate Center (WRCC 2013)

Recent changes in historical temperature trends in the watershed indicate different responses inland versus on the coast. The average annual temperature in downtown Ojai between 1905 and 2012 was 61°F. The chart above of Ojai's historical average annual temperate shows that within the last 12 years Ojai has experienced the warmest (2003) and the coldest (2000) years on record. This seems to indicate an increase in temperature variability inland. The story is different in nearby coastal areas.

The average annual temperature in Oxnard over the years 1924 to 2003 was 60°F. Oxnard is a proxy for missing Ventura data, as a nearby location with similar climate. The chart above of Oxnard's historical average annual temperature indicates a trend in coastal temperatures towards warmer and less variable temperatures. Between 1972 and 2003, only two years were below the historical average temperature.

The charts below summarize the local trend in number of very hot days, indicated by days that reach 100°F or greater, and very cold days, indicated by days that reach freezing or below. This historical data does not show a persistent increase in number of very hot days in either the inland or coastal areas of the watershed. But in both of these areas there is an apparent trend towards fewer days below freezing.

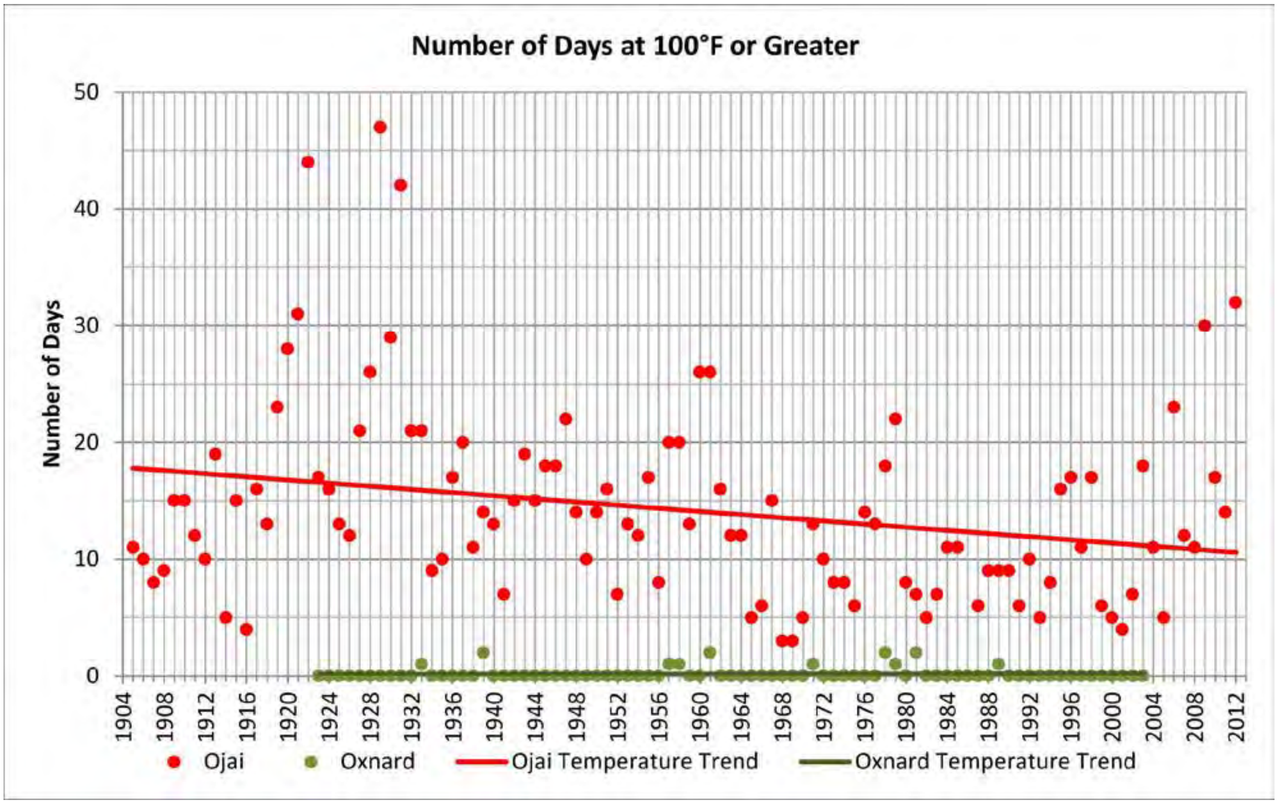


Figure 2.2.1.3 – Number of Days at 100°F or Greater, Ojai and Oxnard

* Oxnard is a proxy for missing Ventura data, as a nearby location with similar climate.

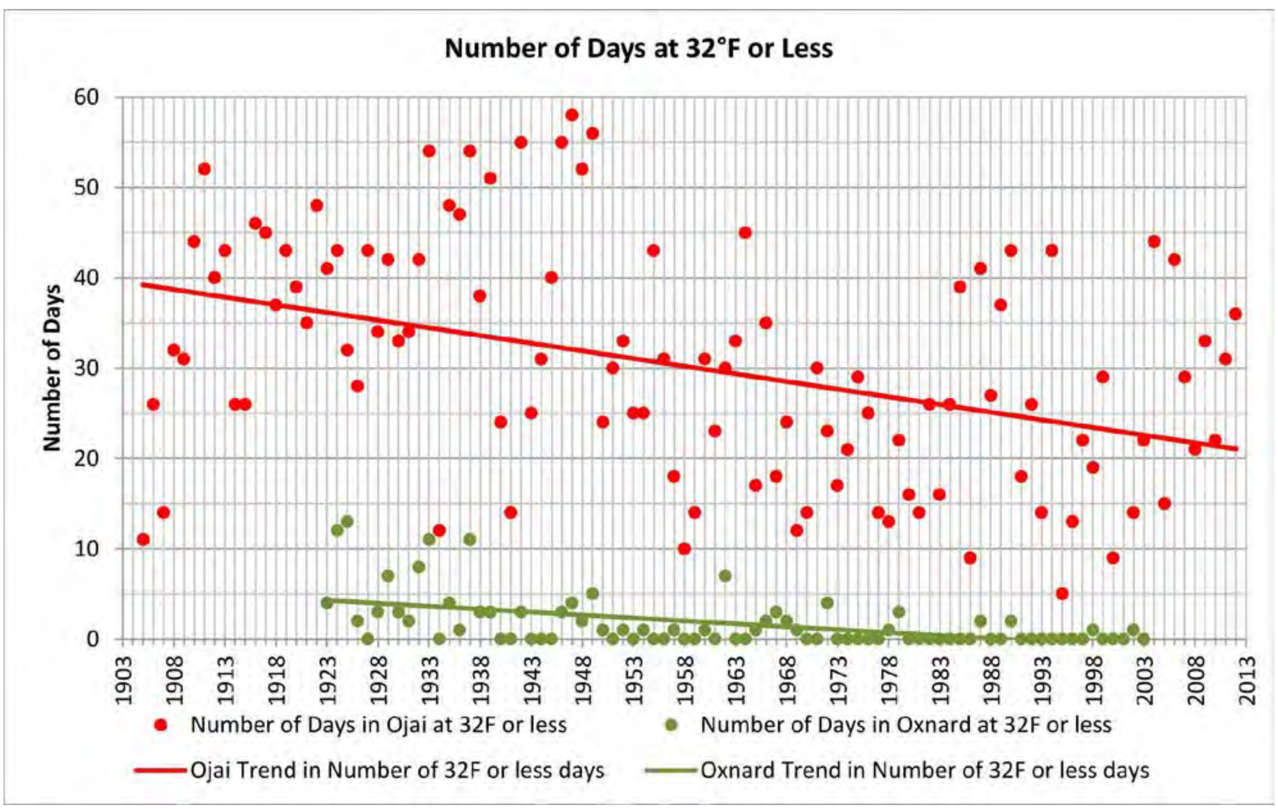


Figure 2.2.1.4 – Number of Days at 32°F or Less, Oxnard

* Oxnard is a proxy for missing Ventura data, as a nearby location with similar climate.

Data Source: Western Regional Climate Center (WRCC 2013)

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 (WPD 2010). Snowfall is generally minimal and short-lived. Annual rainfall totals in Ojai have varied from 6.88 inches in 1924 to 49.20 inches in 1998—a sevenfold variation.

> **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 2.2.1.3 illustrate that, on average, the watershed's upper area receives over twice as much rainfall, almost 20 inches more, as its lower areas.

Table 2.2.1.1 – Rainfall Average and Median (inches/year)

	Station #	Water Years	Average	Median	Min	Max
Matilija Canyon	207	1960-2012	35.17	28.74	9.09	89.05
Downtown Ojai	30	1906-2012	21.31	19.20	6.88	49.20
Downtown Ventura	66	1873-2012	15.46	14.12	4.62	38.65

Data Source: VCWPD Hydrologic Data Server (VCWPD 2013)

Using three "averages" for the watershed's 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 (Figure 2.2.1.1) 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 21.33 inches. Since 1906, 67% of the years have had less than average rainfall in downtown Ojai.

And if we define a "significantly high rainfall year" as one having rainfall at least 150% above the average, or greater than 32 inches, there have been 15 years of significantly high rainfall in downtown Ojai since 1906 (in 1907, 1914, 1938, 1941, 1952, 1958, 1967, 1969, 1973, 1978, 1983, 1993, 1995, 1998 and 2005). This is an average of once every seven years.

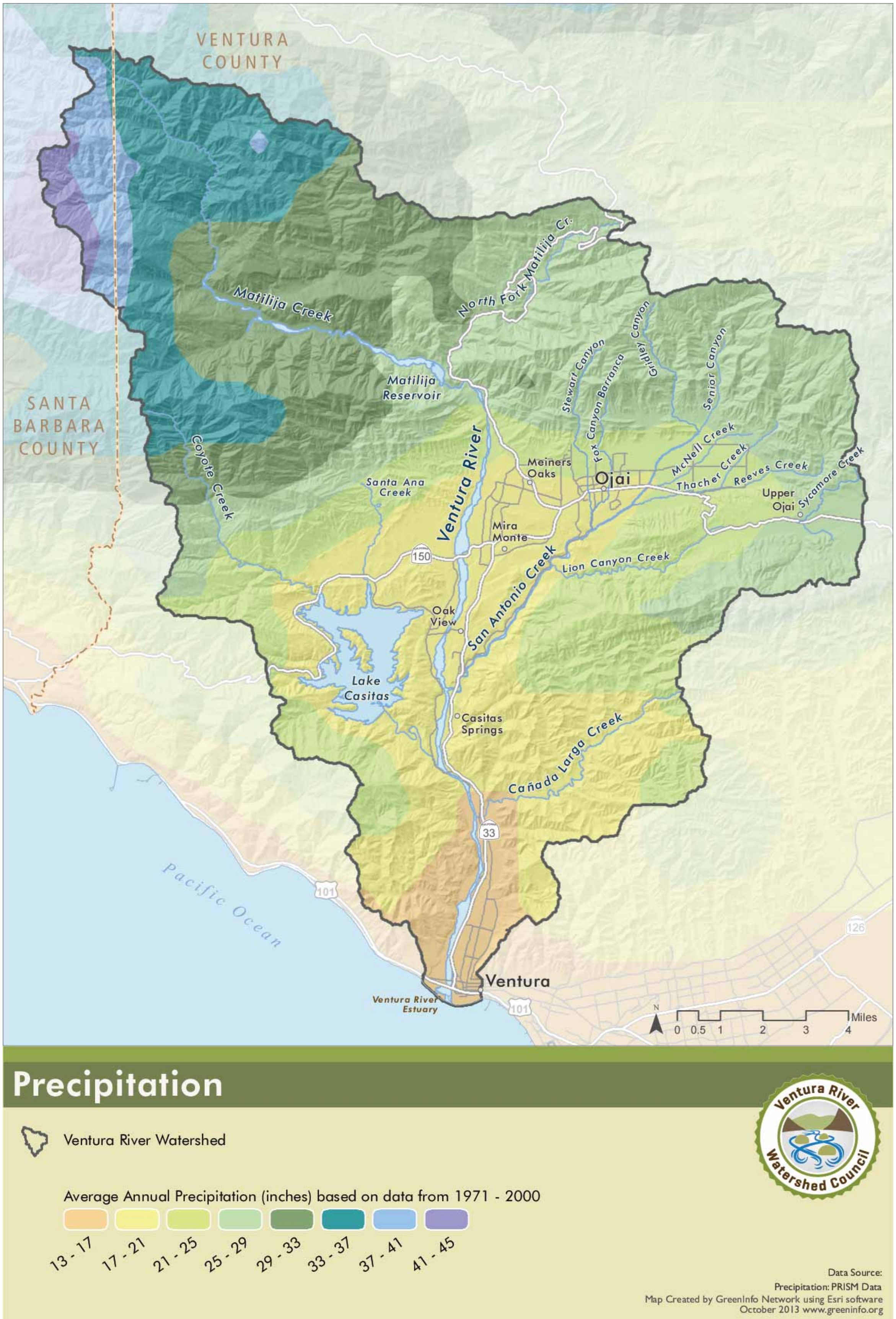


Figure 2.2.1.5 – Precipitation Map

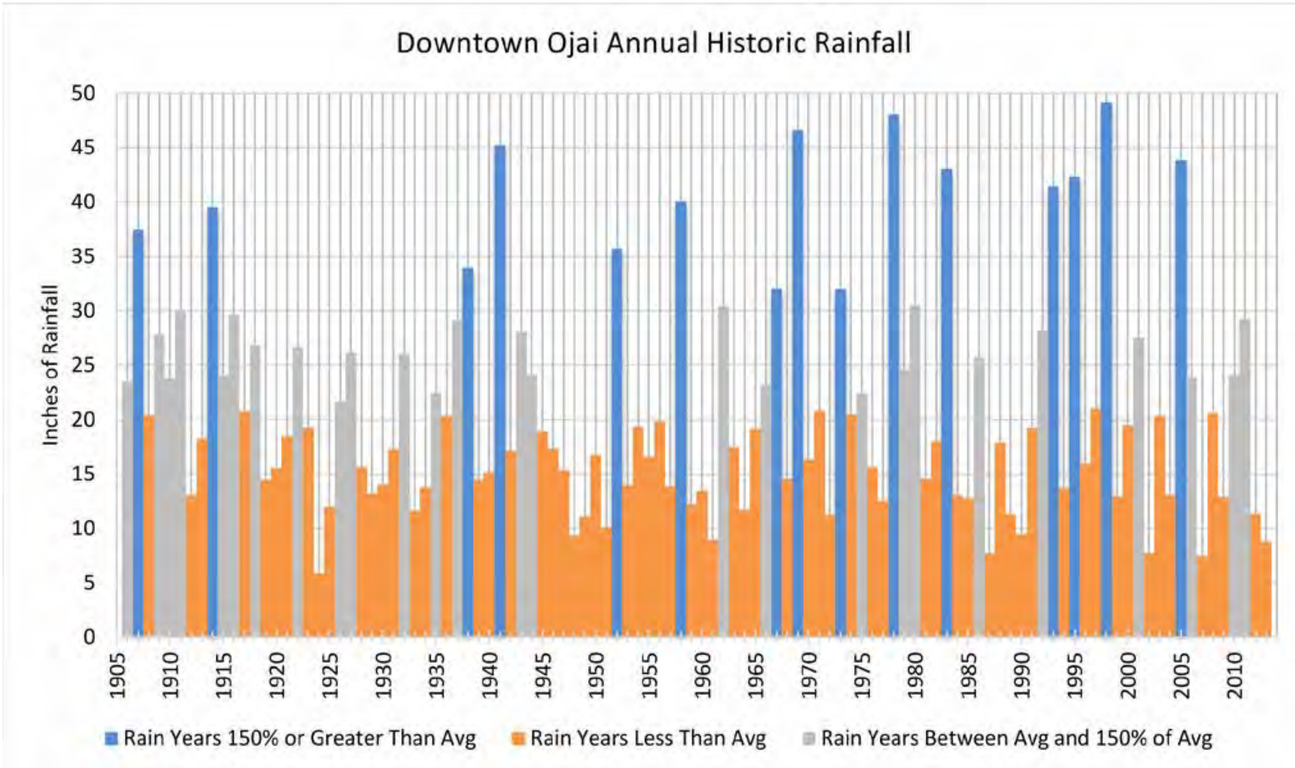


Figure 2.2.1.7 – Ojai Historical Rainfall: Less than Average, 150% or Greater than Average
Data Source: VCWPD Hydrologic Data Server (VCWPD 2013)

As variable as its rainfall may be, the Ventura River watershed does have the distinction of receiving 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, and does, 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).

Wet/Dry Cycles

The watershed has long experienced cycles of wetter years and drier years. Although there is no official definition of "drought," multiple consecutive dry years are generally referred to as "drought years" and the wettest years are called "flood years."

One way to understand the watershed's wet and dry cycles is to look at how the annual rainfall of each year in the past departs from the long-term average annual rainfall—cumulatively, over time. By adding the difference from the long-term average to each successive year, the data indicate whether the trend is up (more rain) or down (less rain), and when these trends cluster they indicate "wet periods" or "dry periods." The watershed's wet and dry periods illustrated Figure 2.2.1.10 were developed using this methodology.

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).

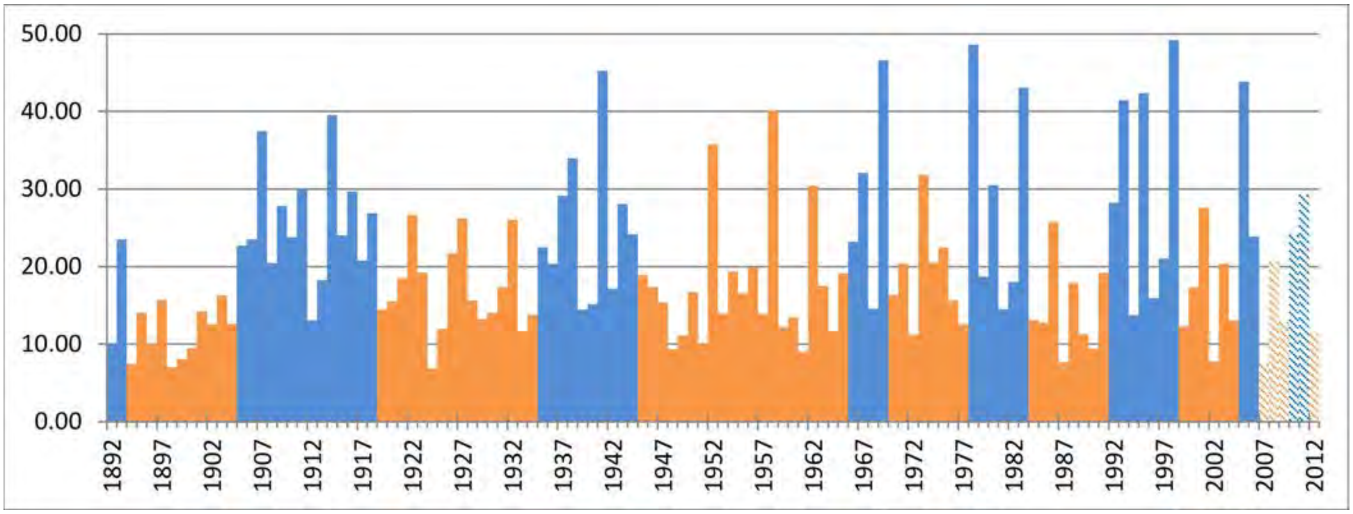


Figure 2.2.1.8 – Wet and Dry Periods in the Ventura River Watershed
Blue bars indicate wet periods and orange bars indicate dry periods. These periods were determined by analyzing how the annual rainfall of each year in the past departs from the long-term average annual rainfall—cumulatively, over time. 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: VCWPD Hydrologic Data Server (VCWPD 2013)

Figure 2.2.1.9 illustrates the trend in wet and dry periods in the watershed. 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.

The storage capacity of Lake Casitas was designed by the Bureau of Reclamation based upon the longest dry period on record, the years 1944 to '65. (This is shown in Figure 2.2.1.9 as the years 1945 to 1965 because of the type of statistical analysis used to make the graph.)

Climate Monitoring

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).

Western Regional Climate Center (WRCC). The Regional Climate Centers deliver climate services at national, regional and state levels working with 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).

Casitas Municipal Water District. The Casitas Municipal Water District maintains two weather stations, one in the recreation area and one at the 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 1905. 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.
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

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.

2.2.2 Geology

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.

Just 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

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, “flashy” storm flows.

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 Topatopa 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.

Figure 2.2.2.1. Elevation Map

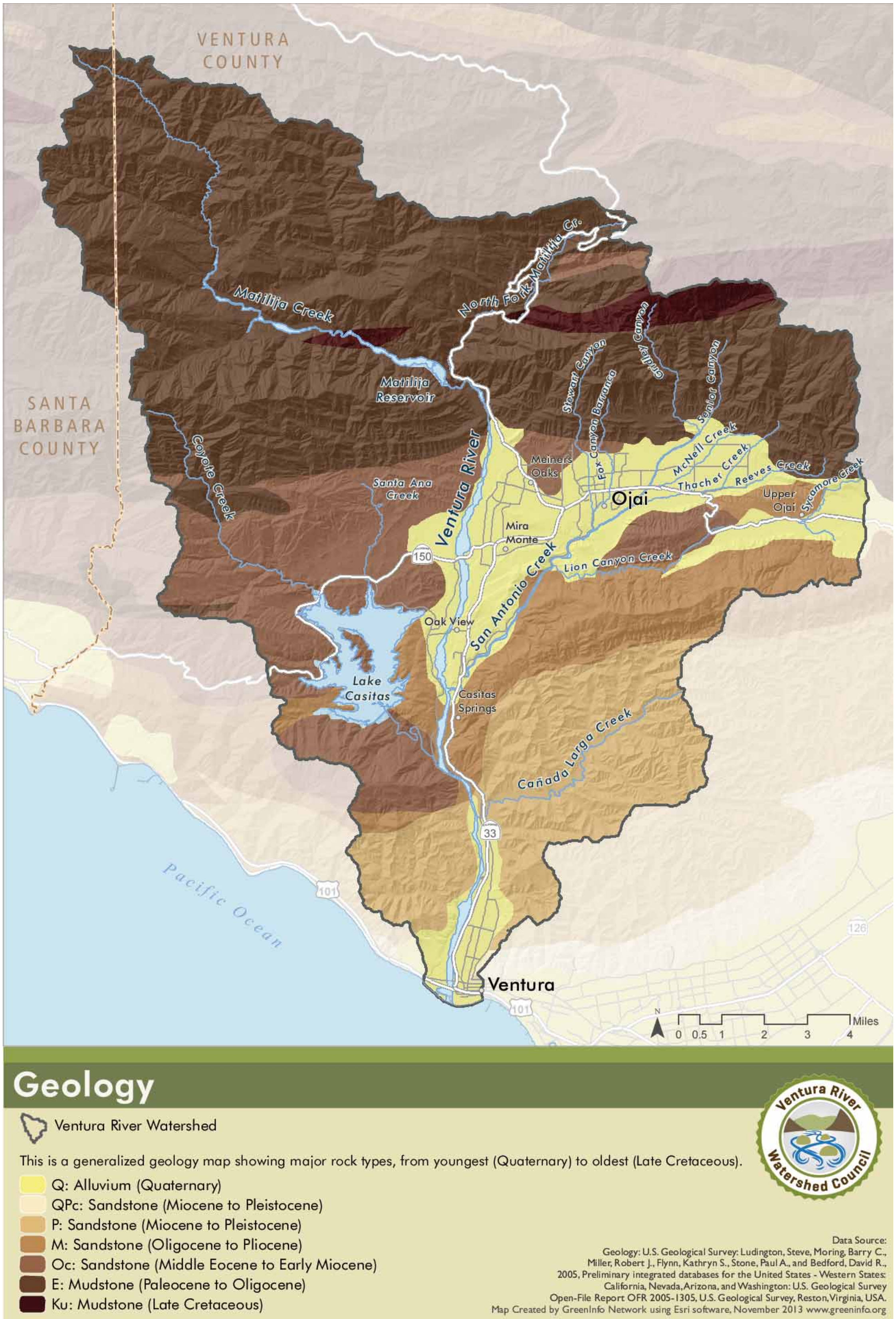


Figure 2.2.2.4 Geology Map

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 Map).

Valley Floors

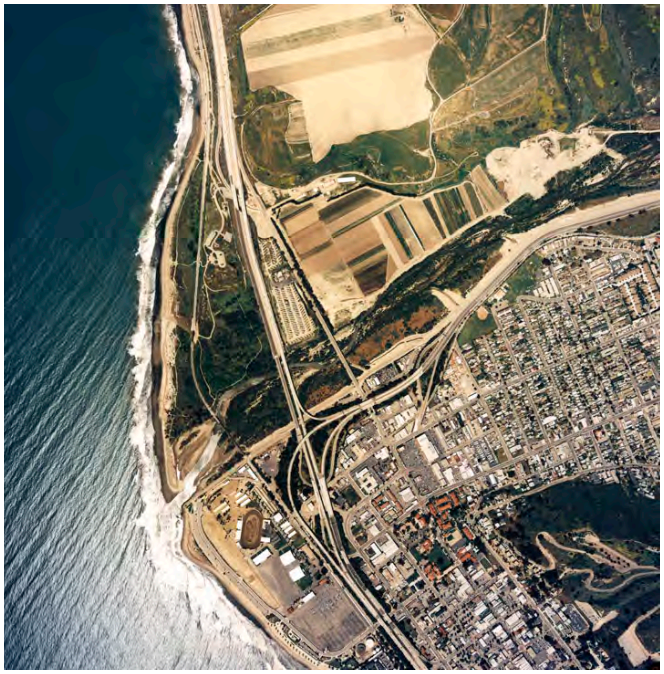
The 15% of the watershed that is relatively flat is found largely along the broad valley floors associated with the Ventura River, its stream channels, alluvial fans, and river terraces. This includes the area of the city of Ojai, the East End of the Ojai Valley (where much of the citrus grown in the watershed is located), the valley floor of Upper Ojai, and the broad valley along the main stem of the Ventura River, from the confluence of Matilija Creek and North Fork Matilija Creek creeks to the estuary.

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 (Entrix 1997). Numerous terraces, caused by vertical uplift, are present along both the west and east sides of the Ventura River.

Floodplain Terrace, Rancho Matilija
Photo courtesy of Rick Wilborn

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.



Aerial View of Ventura River Delta, 1993
Photo copyright © 2002-2013 Kenneth & Gabrielle Adelman, California Coastal Records Project, www.Californiacoastline.org

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. The diversity of habitats within estuaries supports enormous abundance and biodiversity of species.

Ventura River Estuary, February 2014
Photo courtesy of Rick Wilborn

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 river to the coast, and 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.

Petroleum

In California, oil and gas are found in the parts of the state that, for the last 100 million years or so, have alternated between dry land and shallow sea bottom. Layers of organic matter accumulated in dry times, layers of sediment in wet times, then all this got compacted and heated by the weight of overlying layers, then moved around by tectonic forces and trapped in reservoirs by impermeable rock beds (Ritzius 1993; Ventura County 2011).

The Ventura River watershed is one of those parts of the state. In fact, the petroleum-rich sedimentary rocks of the Transverse Ranges, of which the watershed is a part, make this geologic province one of the important oil-producing areas in the United States (CGS 2002).

The Ventura field is the major oil field in the watershed and covers approximately 3,410 acres on both sides of Highway 33 near the coast. The Ojai Oil Field comprises 1,780 acres of active fields spread out in a number of small oil fields, 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).

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 block water that would otherwise flow downriver and out to sea. Faults can sometimes cause the channel pattern to abruptly bend—sometimes by 180 degrees—around the faulted zone, often widening the upstream floodplain. San Antonio Creek typically runs longer into the year than the upper Ventura River because it runs along a fault block and in places the creek bottom is bedrock.

Many 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).

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.

Rock Outcrops at Ventura River Swimming Holes
Photo courtesy of Rick Wilborn

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). The major effects of earthquakes are ground shaking, surface rupture and other forms of ground failure including liquefaction and subsidence.

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 as well as oil and gas pipelines and production, processing, and storage facilities are subject to potential damage from liquefaction (Ventura County 2011a).

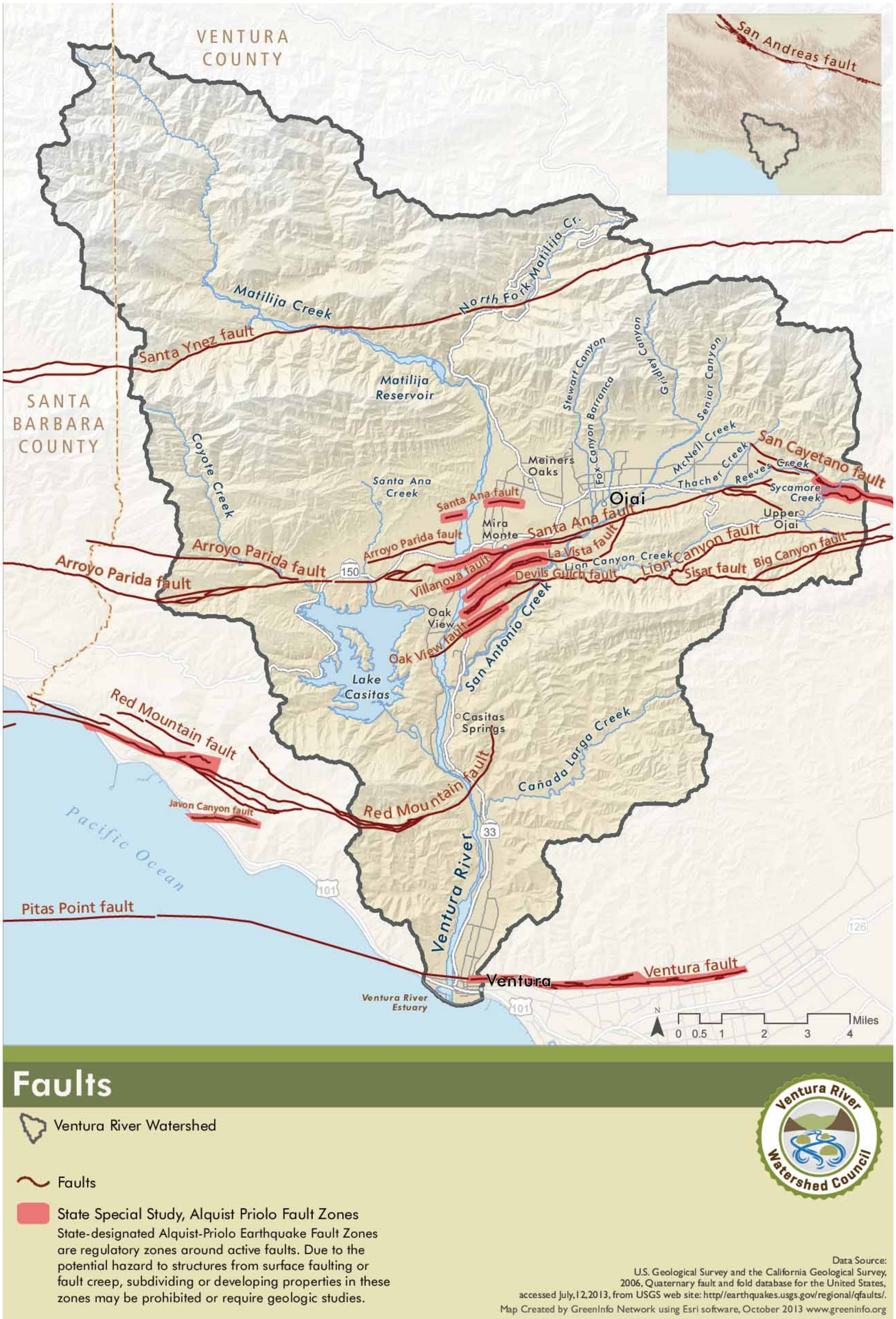


Figure 2.2.2.6. Major Faults Map

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, Lake Casitas dam underwent a major modification in response to help 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 had 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* (USACE 2004)

Areas where groundwater tables are more than 40 feet below the ground surface are typically not considered potential liquefaction zones (CGS 2003). The Liquefaction Hazards map (Figure 2.2.2.7) is a compilation of the quadrangle maps prepared by State of California Geologic Survey and/or Division of Mines and Geology that include the areas of potential liquefaction in the watershed.

Gaps in Data Information

Besides the hydrologic soils group categories, no readily available description of the soils in the watershed was found. A laymen's description of where the soils are thin versus deep, for example, would have been nice to include, especially giving the large amount of agriculture in the area.

2.2.3 Geomorphology and Sediment Transport

Sediment Production and Transport

The Ventura River has the highest suspended and bedload yield of sediment per unit area of watershed in southern California (Keller, Capelli 1992). The headwaters and upper tributaries of the watershed produce large amounts of cobble and sediments that flow downward and are deposited on the valley floors.

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 what occurs in a winter dominated by very large storms 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).

Sediment Transport in Ventura River at Highway 150 Bridge, Winter 2006
Photo courtesy of Scott Lewis

The high rates of erosion and sliding in the watershed present significant challenges to flood management, protection of water and wastewater infrastructure, and protection of in-stream habitats.

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 out away from the mouths of mountain and foothill canyons. 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 2.2.3.1). As discussed more in "2.3.2 Flooding," alluvial fans present a special kind of flood hazard risk because the stream channels associated with alluvial fans are shallow, not well defined, and unpredictable.

Figure 2.2.3.1 – Alluvial Fans, East Ojai Valley
Source: VCWPD 2009

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. This series of photos was taken looking upstream from the Main Street Bridge.
Top, left to right (annual rainfall/annual runoff, in inches, shown in bold face for each year):
June 2005 (algal takeoff after the big winter; **23.3/43.8**).
Oct. 2006 (aquatic plant dominance in the fall of a moderately wet year; **5.2/23.9**).
Sept. 2007 (aquatic plant dominance throughout a dry year; **0.6/7.4**).
Bottom, left to right:
May 2008 (algae following a wet winter; **5.3/20.6).**
Nov. 2008 (aquatic plants dominating by fall); **5.3/20.6).**
June 2009 (aquatic plant dominance throughout another dry year; **0.6/12.6**).
Summary of observations: a stream-scouring winter implies algal dominance throughout the dry season; a moderately wet winter with large storms means algal dominance in the beginning but aquatic plants by the end of the season; the absence of large storms means dominance by aquatic plants.
Source: Leydecker 2010b

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). Several debris basins at the base of the foothills trap additional sediment.

The Matilija Dam originally provided for 7,018 acre-feet of water storage. Rapid sedimentation, however, reduced its capacity to only 500 acre-feet as of 2003 (Tetra Tech 2009). The vast majority of this sediment has come in a few big storm years, with the floods of 1969 alone being a major contributor (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)

Beach and Delta Sediments

Sand and other sediments get deposited on the beaches by both longshore littoral (sand and rock) transport and direct buildup from the Ventura River. A longshore littoral 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 sediment from steep-gradient creeks and rivers being the primary source (BEACON 2009).

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. The wide fluctuation in the shoreline at Surfers Point, just south of the Ventura River mouth, provides an example. Every 4 to 5 years, a flood occurs that transports an average of 42 times more sand than in the dry years between floods. Because these flood years bring more sand than waves can transport, a bulge of sand is formed. Over time, the "bulge" moves east across the delta and along Surfers Point in the form of a traveling wave. Within a year or two, it has moved beyond Surfers Point, and the beach is replaced by a cobble berm (City of Ventura, Rincon Consultants 2008).

Table 2.2.3.1 – Estimated Sediment Supply to the Coast from Rivers and Streams			
Watershed	Fluvial Delivery Volume (cy/yr)		Reduction (%)
	Pre-dam	Post-Dam	
Santa Maria River	811,000	261,000	68
San Antonio Creek	60,000	(no dams)	0
Santa Ynez River	713,000	347,000	51
Santa Ynez Mountains Watershed	195,000	(no dams)	0
Ventura River	216,000	102,000	53
Santa Clara River	1,634,000	1,193,000	27
Calleguas Creek	65,000	(no dams)	0

Data Source: Coastal Regional Sediment Management Plan (BEACON2009)

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). The impediments to the Ventura River's natural sediment transport, discussed above, are largely to blame, but another contributor 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 the most fortified sections of coastline within the entire Santa Barbara Littoral Cell (BEACON 2009), with 77% of this 17-mile stretch of coastline armored with seawalls and revetments (CDBW, SCC 2002).

Coastline at Ventura County Fairgrounds 1972 & 2008

Such armoring has been documented to ultimately reduce beach widths because of 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.

The erosion at Emma Wood State Beach, just west of the mouth of the Ventura River, is an example of how much beach sand can be lost because of armoring: The beach here has eroded approximately 150 feet in 50 years—a retreat that is equivalent to an erosion rate of 2 to 3 feet per year (USBR 2007).

Beach and delta erosion is an important 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 Surfer's Point Managed Retreat Project is designed to restore the beach profile to more natural and sustainable conditions (City of Ventura, Rincon Consultants 2008).

Profile: Surfer's Point Managed 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 visionary 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 Surfer's 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.

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 further 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 provide 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).

Before (2008) and After (2013) Managed Retreat Project, Surfer's Point
Photo copyright © 2002-2013 Kenneth & Gabrielle Adelman, California Coastal Records Project, www.Californiacoastline.org

2.3 Hydrology

2.3.1 Surface Water Hydrology

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 remarkable feature of the Ventura River watershed is that its primary stream network remains largely unchannelized with relatively natural stream shape and hydrologic patterns, despite the presence of two dams (Beller et al 2011). A number of smaller tributaries that flow through urban areas have been channelized with concrete culverts, pipes, or cement.

Figure 2.3.1.1 – Drainage Network Map

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 below.

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 these steep canyons to flatter land and the exit of these drainages from the Los Padres National Forest.

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 below the Robles Diversion to just above the river's confluence with San Antonio Creek (just below Oak View) is the river's "dry reach." (The exact boundaries of the dry reach depend on the time of year, magnitude of the previous rainy season, and the state of groundwater storage.) This stretch of the river to just above the Santa Ana Boulevard Bridge is also referred to as the "Robles Reach" (CMWD 2010). In this part of the river, except in very wet rainfall years, surface water 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 (Carno-Entrix 2012).

A historical ecology assessment of the river by 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 river picks up a number of 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.

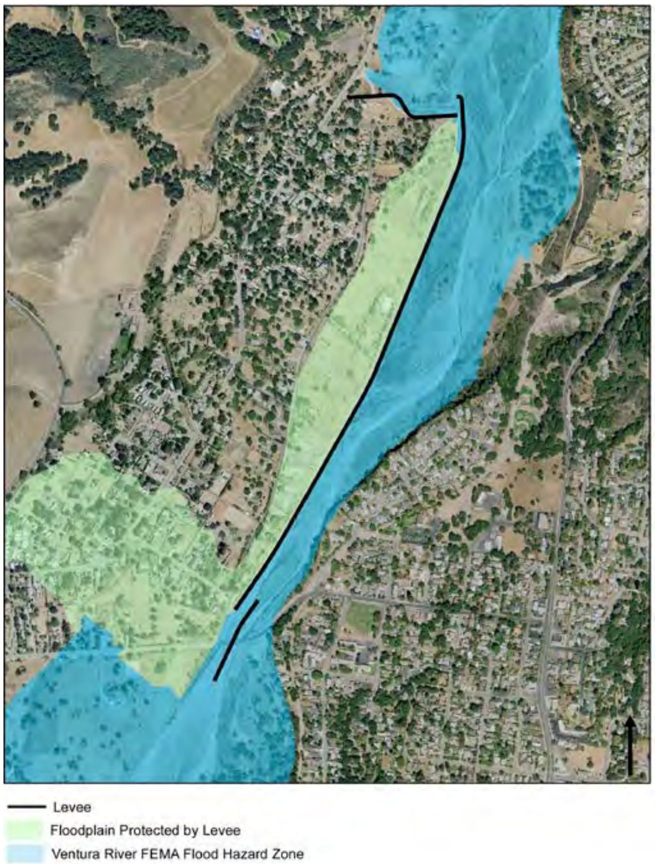


Figure 2.3.1.3. Live Oak Levee Protects Live Oak Acres Community
Live Oak Acres, to the left, is protected by the Live Oak Levee. Oak View is to the right.

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.

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. In wetter years or winter rainy periods, the increase in the Ventura River's flow in this area begins above the San Antonio Creek confluence because of rising groundwater springs in the river.

A large pool forms at the confluence of 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, the river picks up Coyote Creek from the west, although since the construction of Casitas Dam, this drainage contributes very little water to the river. Here also, Highway 33, the river's constant companion, turns into a freeway.

Because of the significant contributions of water from both San Antonio Creek and natural 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 continues to flow 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 because the main channel of the river has meandered, this location has been dry since the mid 1990s.

In the mile between Foster Park and the Ojai Valley Sanitary District's wastewater treatment plant, there are several good-sized pools tucked into the denser vegetation typical of this area.

Then the river receives the wastewater treatment plant's treated effluent, a significant input which in many years accounts for the perennial flow in the remaining stretch of the Ventura River.

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

In its final stretch, the Ventura River flows through the Ventura River estuary, which extends from around the 101 freeway junction to the ocean. The estuary is a shallow body of water that sits next to the ocean and 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; but when winter storms breach the sandbar, 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 flushed during very large floods (RWQCB 2002).

Ventura River Estuary, Sandbar Breached, March 2014

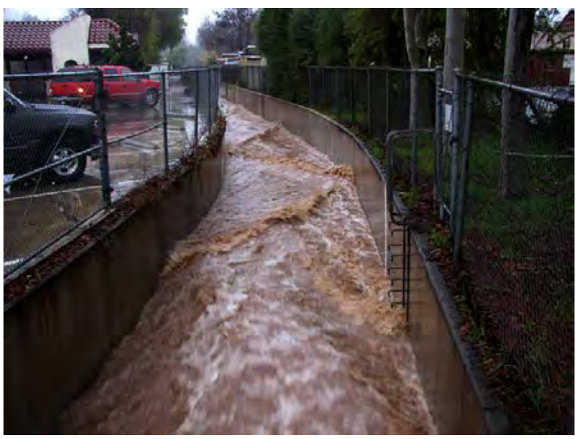
San Antonio Creek

In terms of volume of water, 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. A major tributary, Lion Canyon 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. 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.

Thacher Creek (San Antonio Creek tributary) at Highway 150

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).



Fox Canyon Barranca, Downtown Ojai

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 it passing under Highway 33 above Casitas Springs.

Upstream of the Thacher Creek confluence in Soule Park Golf Course, San Antonio Creek is ephemeral—typically going dry fairly quickly after storm flows have passed. After the confluence with Thacher Creek, San Antonio Creek is typically perennial downstream to about a half mile past the Lion Canyon Creek confluence. From that point until the Ventura River confluence, San Antonio Creek's flow characteristics typically alternate between perennial (~65%), intermittent (~10%), and ephemeral (~25%) (Lewis 2014).

San Antonio Creek is 9.66 miles long and is, except for revetments at bridges, primarily unchannelized.

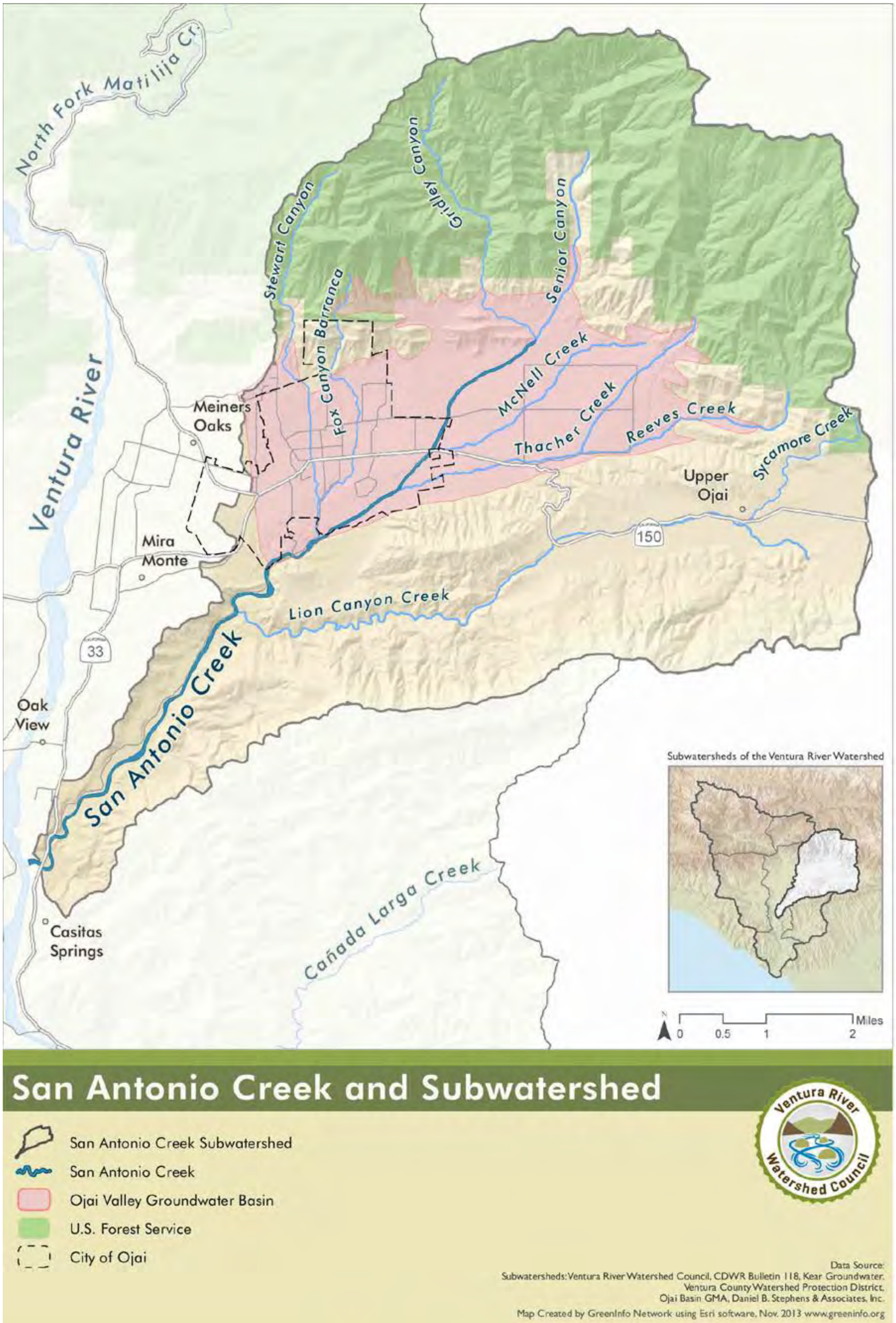


Figure 2.3.1.4 - San Antonio Creek Subwatershed

Streamflow

In the often dry and ever-variable Ventura River watershed, flowing water is a precious resource. Streamflow is vital for habitat and wildlife on all levels in the food chain, both aquatic and terrestrial. Streamflow determines how much Lake Casitas gets refilled 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. Based on 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, based on water years 1997-2007).

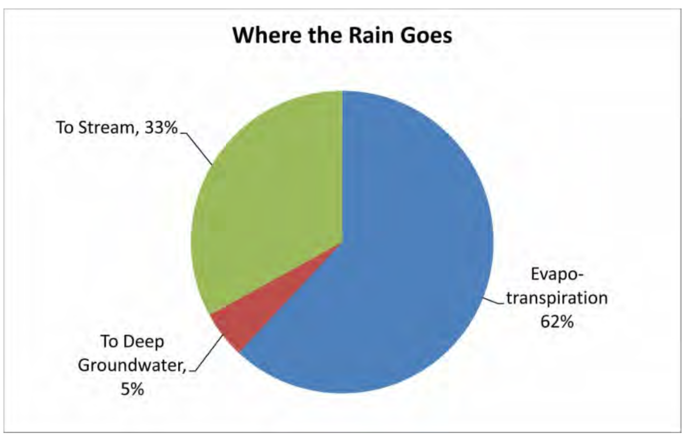


Figure 2.3.1.5 – Where the Rain Goes: 33% of Rainfall Becomes Streamflow
Source: Baseline Model Calibration and Validation Report (Tetra Tech 2009a, Table 6-6)

SURFACE WATER/GROUNDWATER INTERACTION

Exchanges between surface water and groundwater have an important effect on the total amount of streamflow in the watershed. The Ventura River and San Antonio Creek are known to have “gaining reaches” and “losing reaches”—stretches of the river where the stream “gains” water from groundwater and stretches where it “loses” water to groundwater (Entrix 2001a). This surface water/groundwater relationship is dynamic and influenced by many variables. Changes in either the surface water or groundwater system can affect the other in both positive and negative ways.

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.

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 Road below Matilija Dam to the confluence with Weldon Canyon, just north of Canada 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 impacting the cold freshwater habitat needed by the endangered southern California steelhead (USEPA 2012).

The link between groundwater pumping and streamflow in the Ventura River watershed is not well understood at this time, because neither the collection of sufficient field measurements nor the development of a groundwater model have been undertaken. A model developed in 2009 to understand surface water hydrology in the watershed lacked critical information about these surface water–groundwater relationships, and this missing information prevented a comprehensive model of the watershed's overall hydrology.

Improving 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 considered a significant "data gaps" in the watershed for better managing water supplies among multiple competing needs.

Over the years, various studies have made preliminary estimates of the amount of water flowing between surface water and groundwater. Without more sophisticated measurements and analyses, these findings are understood to be preliminary and based on insufficient data. Here are the key studies focused on this interaction and some of their findings:

> The *Draft Environmental Impact Report for the Ventura River Conjunctive Use Agreement,* prepared by EDAW [consultants] in 1978, found 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 as part of work towards 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 between 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, developed by Tetra Tech in 2009, 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 2,290 AF of surface water from the river, plus 2,003 AF of water from Lake Casitas, 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 about this area of the river: "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 are discharged to San Antonio Creek from the Ojai Valley Basin (DBS&A 2011).

In addition to the contribution to streamflow that comes from groundwater basins, natural springs that contribute flow are found throughout the watershed (Entrix & URS 2004).

Wastewater

The watershed's primary wastewater treatment plant sits 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 cubic feet per second (cfs). During the rainy season, this contribution to streamflow is a relatively small portion of the total volume of water. However, during the dry season, the effluent can exceed 50% of the streamflow below the treatment plant (Entrix & Woodward Clyde1997).

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 Runoff in Fox Canyon Barranca, Summer After Two Dry Winters

Urban development—specifically impervious surfaces such as roads, parking lots, and rooftops—also prevents natural infiltration of rain water, thus decreasing recharge to groundwater, and increasing the amount of water entering the drainage network. In addition, 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 channel capacity (because there is insufficient width and depth to carry additional storm flows) and/or levees built to protect such developed areas.

Excess agricultural irrigation water is also a possible contributor 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 that about 71% of the water entering the stream network makes its way fairly quickly to the ocean by way of the Ventura River, 16% is diverted for consumption, while approximately 6% recharges groundwater basins, and 7% is lost to stream and reservoir evaporation (Tetra Tech 2009a).

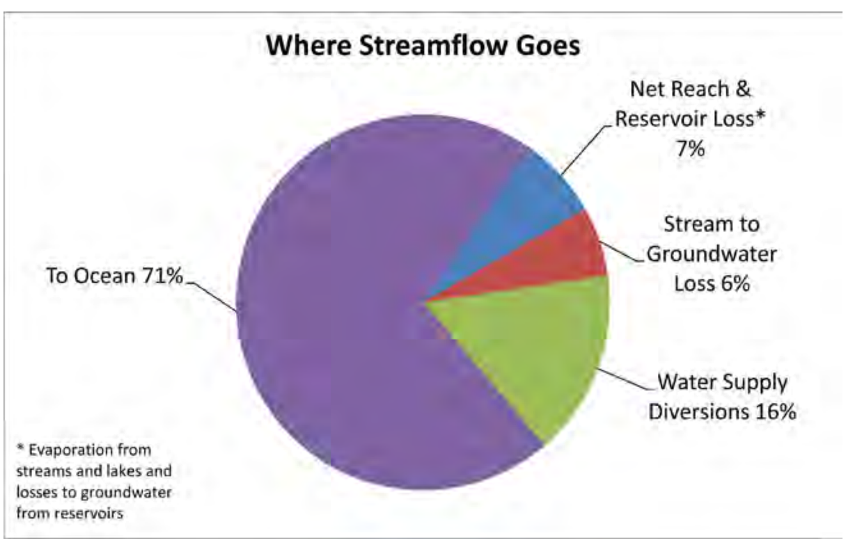


Figure 2.3.1.6 – Where Streamflow Goes: 16% of Streamflow Is Diverted for Use
Data source: Baseline Model Calibration and Validation Report (Tetra Tech 2009a, Table 6-6)

Streamflow Characteristics

Storms contribute the greatest volume of water to streamflow, and 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 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).

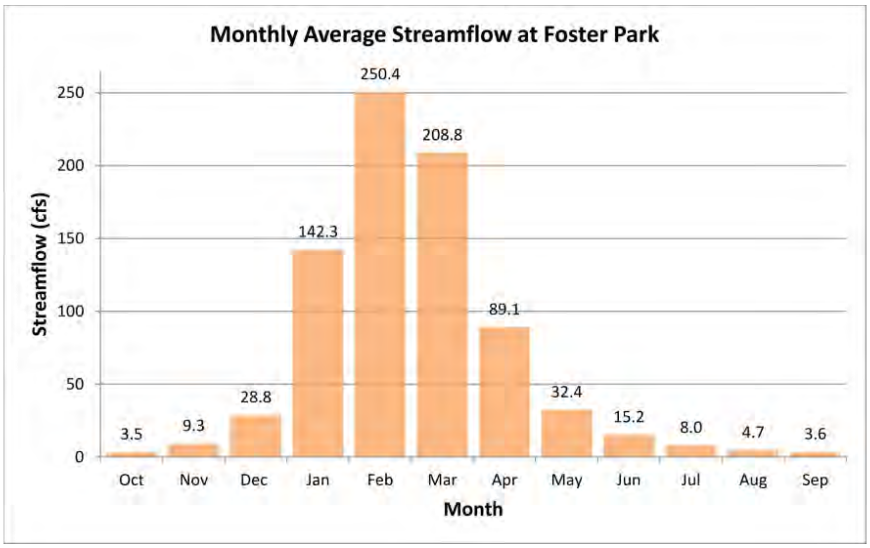


Figure 2.3.1.7 –Monthly Average Streamflow at Foster Park, Water Years 1930-2013

Data Source: USGS National Water Information System Website (USGS 2014b)

Table 2.3.1.2 Monthly Average Streamflow (cfs) at Foster Park, Water Years 1960-2012

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	3.5	9.3	28.8	142.3	250.4	208.8	89.1	32.4	15.2	8.0	4.7	3.6
Median	0.6	1.4	5.0	12.6	34.1	30.7	18.3	9.2	5.1	2.9	1.5	0.5
Highest	41	278	234	1880	2919	1954	1351	408	158	64	36	29
Water Year	1984	1966	1966	1969	1998	1938	1958	1998	1998	1998	1941	1998
Lowest	0	0	0	0	0	0	0	0	0	0	0	0
Water Year	Multiple Years											

Data Source: USGS National Water Information System Website (USGS 2014b)

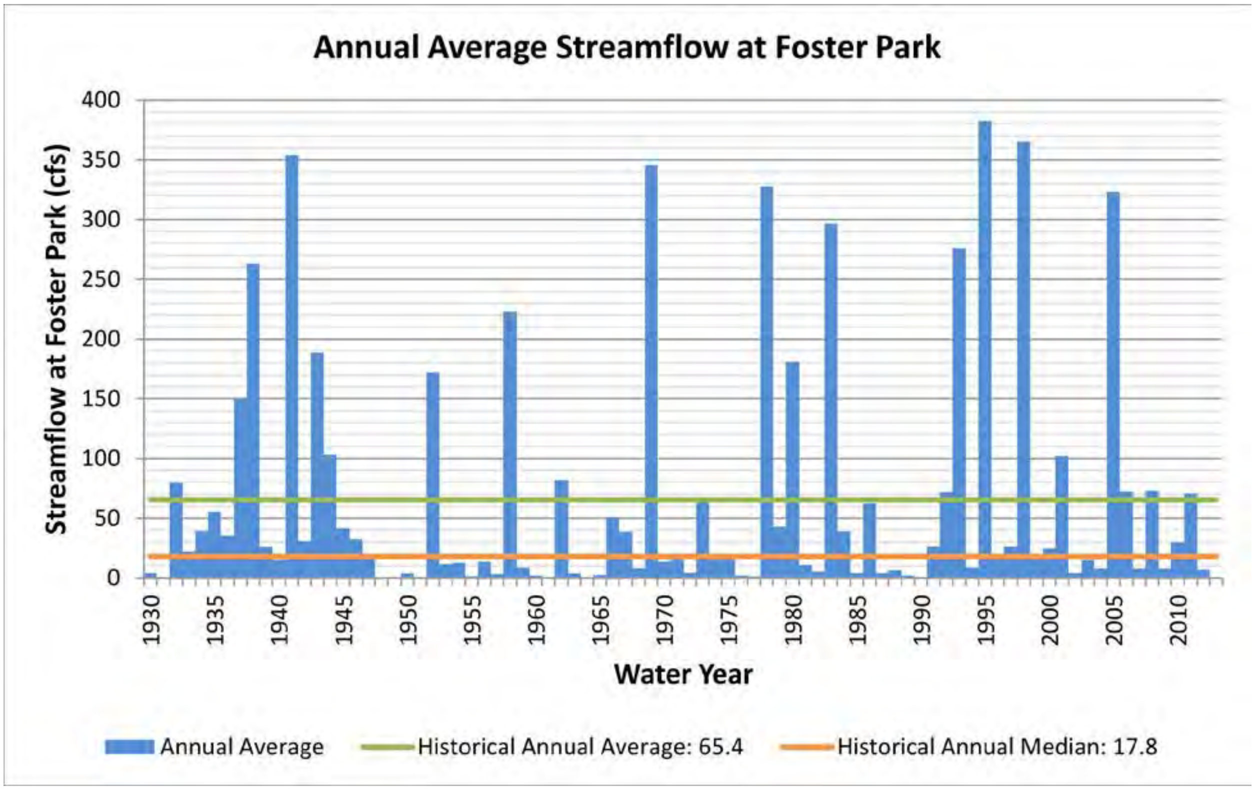


Figure 2.3.1.8 –Annual Average Streamflow at Foster Park, Water Years 1930-2013

As this chart indicates, the historic annual average streamflow in the watershed, indicated by the green line, rarely occurs in actuality. This is because occasional extreme flows skew the average. Historic annual median streamflow, indicated by the orange line, are 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.

Data Source: USGS National Water Information System Website (USGS 2014b)

Table xxx. Storm Peak Flow Estimates (cfs) Based on Modeling		
Stream Name	**10-Yr Peak**	**50-Yr Peak**
Ventura River & Smaller Tributaries		
Below Matilija Ck/N Fork Ck Confluence	15,000	24,000
Ventura River Baldwin Rd	16,000	24,800
Ventura River Casitas Springs	35,200	56,600
Ventura River Gauge at Foster Park	36,400	59,700
Ventura River at Shell	41,300	67,900
Matilija Creek		
Matilija Ck below dam and above N. Fork	12,500	18,800
North Fork Matilija Creek		
N Fork Matilija (upper part)	3,830	10,380
N Fork Matilija (lower part)	3,960	10,740
San Antonio Creek & Tributaries		
Senior and Gridley	4,590	12,440
San Antonio Ck below McNell Ck	5,760	15,630

Table xxx. Storm Peak Flow Estimates (cfs) Based on Modeling		
Stream Name	**10-Yr Peak**	**50-Yr Peak**
Reeves Ck above Thacher Ck	1,530	4,150
Thacher Ck above San Antonio Ck	2,860	7,750
San Antonio Ck below Thacher Confl.	7,490	20,330
San Antonio Ck above Stewart Ck	7,620	20,690
Stewart Cyn abv San Antonio Ck with Fox	1,070	2,920
San Antonio after Stewart Confl.	8,590	23,320
San Antonio Ck above Lion Confl.	7,760	21,050
Big Canyon (Upper Ojai)	690	1,880
Lower Lion Canyon Ck	3,430	9,310
San Antonio after Lion Cyn Confluence	10,430	28,300
San Antonio Ck above Ventura River Confl.	9,960	27,020
Coyote Creek		
Coyote Creek above Ventura River	680	1,980
Cañada Larga Creek		
Canada Larga above Ventura River	5,370	14,580

This table shows model-generated estimates of 10-year and 50-year peak flows of various streams and stream reaches in the watershed. 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.
*Of the watershed's major tributaries, Matilija Creek and San Antonio Creek are the biggest contributors of water.
Source: Ventura River Watershed Design Storm Modeling Final Report (VCWPD 2010)

EXTREMELY VARIABLE

Like other watersheds in the region, streamflow patterns reflect the same extreme variation found in rainfall patterns. As shown in Table xxx, between 1930 and 2012, 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 xxx also indicates the equivalent volume of water from these flow rate amounts. The annual average runoff volume of the wettest water year was 139,712 AF—over 585% greater than the annual average and 2,244% greater than the annual median. These numbers help illustrate the extremely variable nature of streamflow in the watershed.

Table xxx. Annual AVERAGE Streamflow at Foster Park, Water Years 1930-2013				
	Avg.	Median	Low (1951)	High (1995)
Cubic feet/second	65.4	17.8	0.0	382.8
Acre feet/year	23,863	6,226	0.0	139,712

The annual average was calculated based on monthly average daily flows. 2012-2013 data is provisional.
For comparison purposes, the annual average rate of flow (cfs) was converted into acre-feet *for the year*.
Data Source: USGS National Water Information System Website (USGS 2014b)

Table xxx. Annual PEAK Flows at Foster Park, Water Years 1933-2011				
	Avg.	Median	Low	High

			(1951)	(1978)
Cubic feet/second	10,675	3,660	0.0	63,600
Acre feet/second	0.25	0.08	0.0	1.46

For comparison purposes, the peak rate of flow (cfs) was converted into acre-feet per second.
Data Source: Ventura County Watershed Protection District Hydrologic Data Server (VCWPD 2013)

The median rate of flow is also provided in Table 2.3.1.4. 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. Table 2.3.1.5 shows similar data for peak flows at Foster Park between the years 1933 and 2011.

Flashy & 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 "2.3.2 Flooding" for a look at streamflow and flood events.

Outside the rainy season, the amount of streamflow that persists, called "base flow," depends upon how much rain fell the previous winter and therefore 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 some streams, 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 exceptional drought periods.

Of the six major streams in the watershed, only two, Matilija Creek and North Fork Matilija Creek, are typically perennial for their entire lengths, although sections of Matilija Creek do sometimes dry up. Some of the tributaries of the 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.

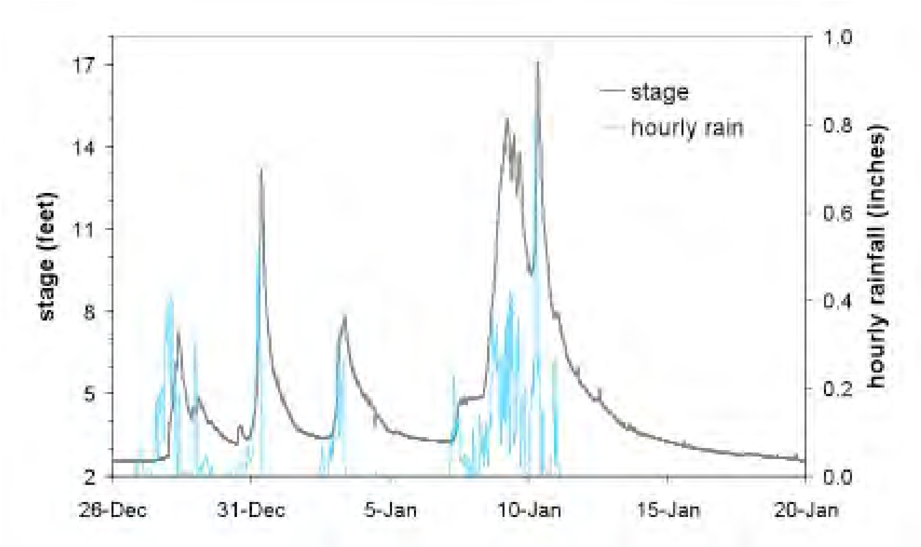


Figure 2.3.1.9 – Flood Hydrograph at Foster Park, December 2004 to January 2005

Hydrographs illustrate how long it takes for streamflows (or "discharge") to build up in response to rain. This example compares the intensity of rainfall (in blue) with the flood stage (in grey) in the Ventura River at Foster Park during the December 2004 to January 2005 flood events. The term "stage" refers to how high water levels rose at the streamflow gauge; when the gauge reads 2.5 feet, the river is flowing at a trickle. The hydrograph shows that streamflow had a delayed response to rainfall at the beginning of the storm, because the watershed's dry and porous soils absorbed the initial rain. Twenty-three inches of rain fell during the period shown on the graph, but only about 6 inches of this rain flowed down the river, most of it during the second storm pulse.

Data source: Ventura Stream Team 2001-2005 (Leydecker & Grabowsky 2006)

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's, in their Historical Ecology study of the Ventura River, demonstrated that the intermittent nature of the Ventura River mainstem has been a condition of the river going back for over one hundred year. As it does today, when the river dropped out of the mountains and entered flatter terrain, surface flows commonly became intermittent. At the confluence with San Antonio Creek, and from Foster Park to the mouth of the river, flows were perennial (Beller et al. 2011).

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 "2.3.3 Groundwater Hydrology" and "2.4 Water Supply and Demand" 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). The rights to divert smaller amounts of surface water are also held, and used, by many others in the watershed, including individuals, farms and ranches, and small water companies (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 2013). 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, little or no surface flow is the usual situation 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 document called the Robles Fish Passage Facility Biological Opinion (NMFS 2003). The Biological Opinion was prepared by the National Marine Fisheries Services as a required part of construction of a fish passage facility (which became operational in 2006) at the Robles Diversion. It also 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.

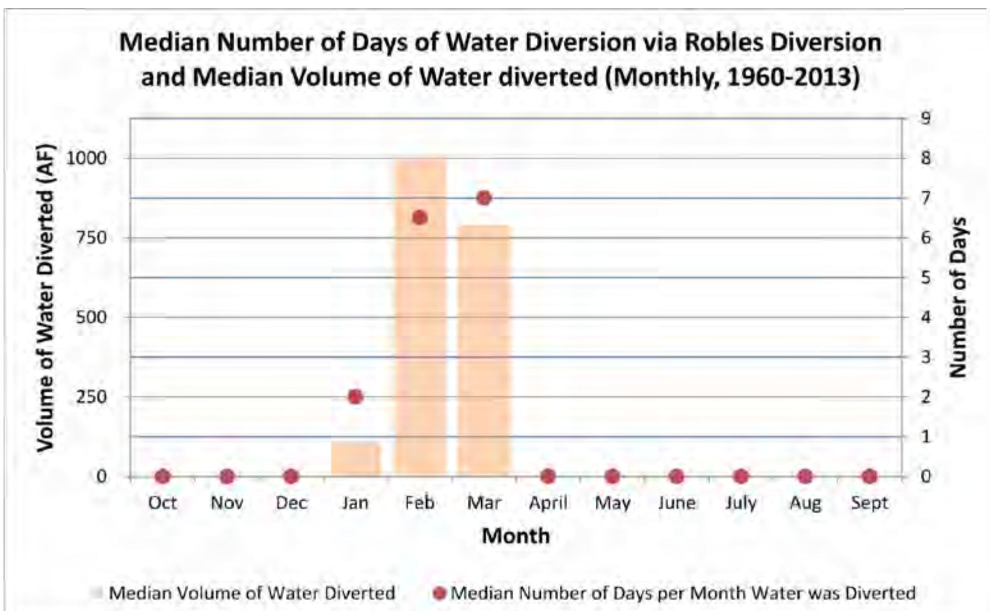


Figure 2.3.1.10 – Median Number of Days of Water Diversion via Robles Diversion & Median Volume of Water Diverted, Monthly: Water Years 1960-2013

Source: Casitas Municipal Water District, 2014

Table 2.3.1.6. Diversion via Robles Diversion, Water Years: 1960-2012							
Number of Days of Diversion				**Volume** (acre-feet per year)			
Annual Average				Annual Average			
Avg.	Median	High (1967)	Low (1990, 1999, 2002, 2007, 2013)	Avg.	Median	High (1969)	Low (1990, 1999, 2002, 2007, 2013)
52	38	198	0	11,376	6,007	50,080	0

Source: Casitas Municipal Water District, 2014

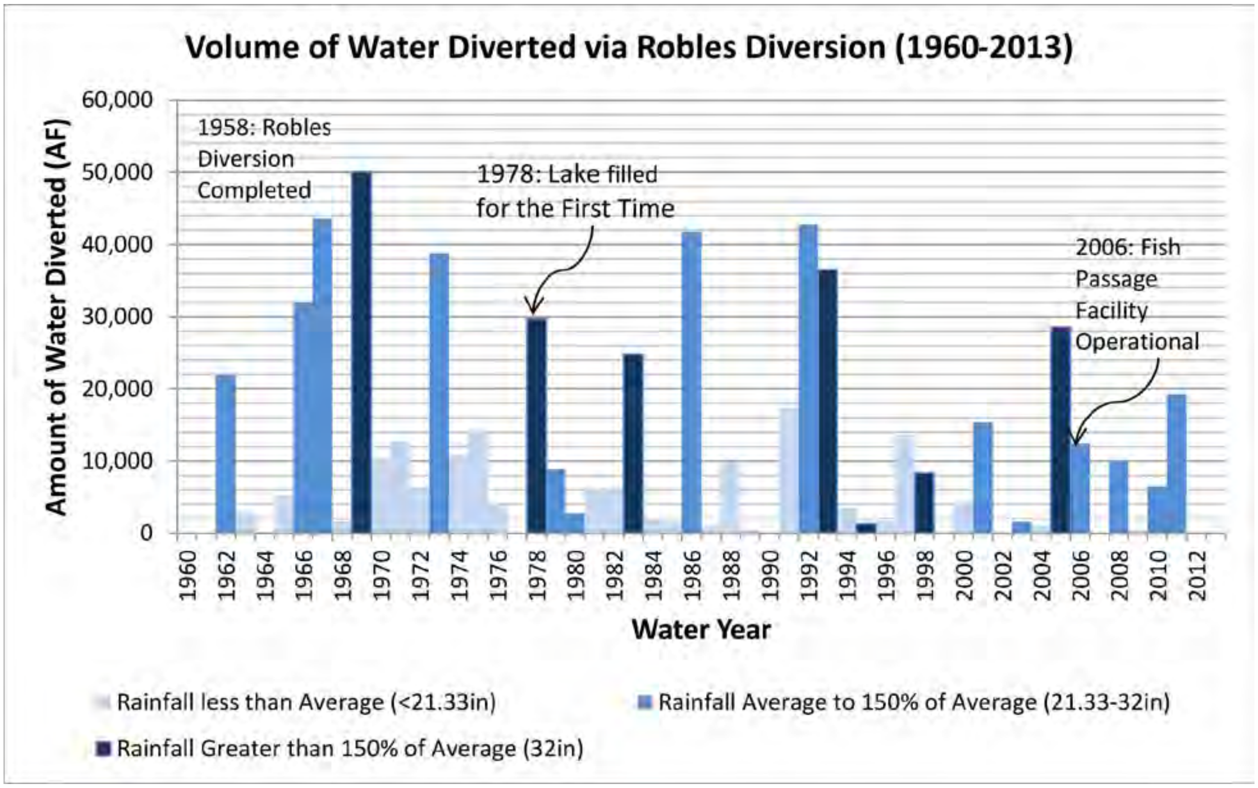


Figure 2.3.1.11 – Volume of Water Diverted via Robles Diversion, Water Years 1960-2012

Source: Casitas Municipal Water District, 2014

Matilija Reservoir and Dam

Matilija Dam and Reservoir

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, in 2011 this practice was discontinued because of regulatory concerns over in-stream water quality (Evans 2013).

A concerted, multi-stakeholder effort to remove Matilija Dam has been underway since 1998 because the reservoir is no longer providing 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 "2.6.4 Matilija Dam" for a more detailed discussion about the dam.

Foster Park Subsurface Dam and Diversion

Foster Park Subsurface Dam & Diversion, August 2013
This photo was taken in August after two dry winters.

A small dam also exists in the Ventura River at Foster Park, an area of the river that naturally has regular flow, in part because underground geologic structures force subsurface flow to the surface. In 1906, in order to enhance the amount of water available for diversion to the City of Ventura, this natural geologic feature was enhanced by construction of a subsurface diversion dam across the river. 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.

The City of Ventura also has a surface diversion in the Ventura River in this area, however the intake for the surface diversion is located in a part of the river that has been dry since the mid-1990's, so no direct surface water diversions have occurred since that time (Hopkins 2013). In addition, the City has four wells, referred to as the Nye well field, located between 1,000 to 2,890 feet north of the subsurface dam (Entrix & Woodward Clyde 1997). Water from the city's diversions and wells is conducted to the City's water treatment plant downstream.

Streamflow Monitoring

Streamflow data is 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. See also "2.6.3 Habitat Connectivity" for information on in-stream pool monitoring programs.

Key Data and Information Sources/Further Reading

HSPF Model

In 2008, under contract from the Ventura County Watershed Protection District (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),

Baseline Model Calibration and Validation Report, Ventura River Watershed Hydrology Model (Tetra Tech 2009a).

2.3.2 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. 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.

Some flood-related topics are covered in other sections of this report: precipitation in "2.2.1 Climate," topography as well as the flood-related hazards of landslides, debris flows, and liquefaction in "2.2.2 Geology and Soils," fires in "2.2.4 Fire Regime," and surface water flows in"2.3.1 Surface Water Hydrology."

San Antonio Creek Ranch, 1969 Flood
Photo courtesy of Ventura County Star

Flood Frequency & 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 once 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 occur once every 5 years on average. 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; and of the 18 major and moderate flows on record, three occurred during the 2005 flood. Table 2.3.2.1 and Figure 2.3.2.1 summarize and illustrate significant flood flows since streamflow monitoring began in 1933.

Table 2.3.2.1. Ventura River Flood Flows Greater than 15,000 cfs, 1933-2011

Date	Water Year	Peak Flow cubic feet per second	% Annual Exceedance Probability**	Flood Category ***
1978, February	1978	63,600	1.5%	Major
1969, January	1969	58,000	2.2%	Major
1992, February	1992	45,800	5.2%	Major
1995, January	1995	43,700	6.0%	Major
2005, January	2005	41,000	7.3%	Major
1969, February	1969	40,000	7.8%	Major
1938, March	1938	39,200	8.2%	Moderate
1998, February	1998	38,800	8.5%	Moderate
1980, February	1980	37,900	9.0%	Moderate
1943, January	1943	35,000	11.0%	Moderate
1952, January	1952	29,500	16.1%	Moderate
2005, January	2005	29,400	16.2%	Moderate
1983, March	1983	27,000	19.1%	Moderate
1952, March	1952	24,600	22.5%	Moderate
1934, January	1934	23,000	25.2%	Moderate
1986, February	1986	22,100	26.8%	Moderate
2004, December	2005	20,600	29.7%	Moderate
1944, February	1944	20,000	30.9%	Moderate
2011, March	2011	19,100	32.9%	Flood
2001, March	2001	19,100	32.9%	Flood
2005, February	2005	18,800	33.6%	Flood
1958, April	1958	18,700	33.8%	Flood
1945, February	1945	17,000	38.1%	Action
1969, January	1969	16,600	39.1%	Action
1973, February	1973	15,700	41.6%	Action
1941, March	1941	15,200	43.1%	Action

*Peak flows are as measured at the Foster Park gauging station.
**The Annual Exceedance Probability (AEP) values indicate the chance that a flood 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.
***Flood Category thresholds are different in different parts of the watershed, as determined by Ventura County Watershed Protection District.
Data Source: Hydrologic Data Server (VCWPD 2013); (VCWPD 2014)

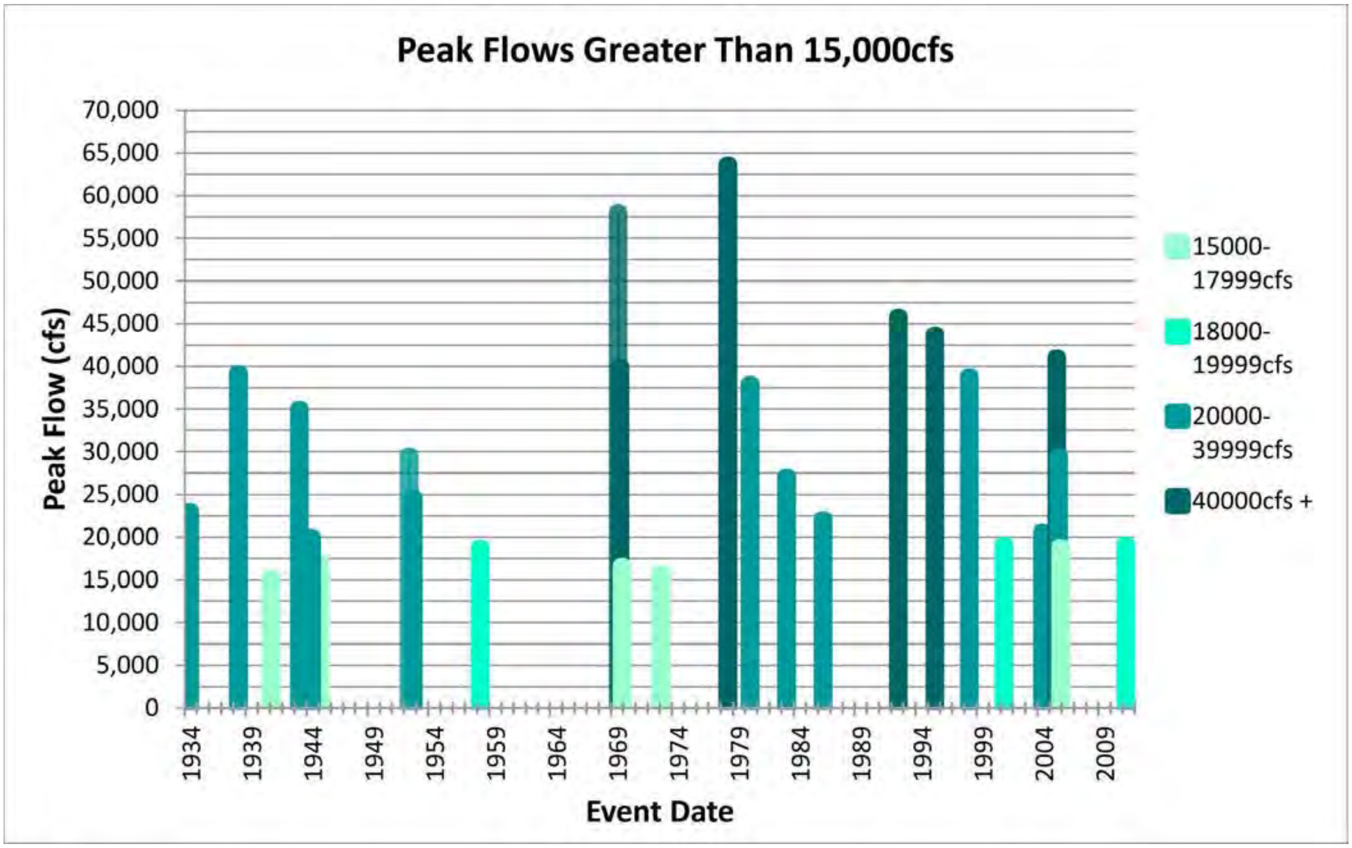


Figure 2.3.2.1 – Peak Flows Greater Than 15,000 cfs at Foster Park, 1933-2011
The peak flows in this chart correspond to the flows described in Table 2.3.2.1.

Definition: 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 that 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 exceed in any given year.

1% Annual Exceedance Probability Flood—"Annual Exceedance Probability Flood" (AEP) is the current preferred term, because the intent is to describe the probability of a flood occurring, rather than the length of time (years) between floods. A 100-year flood could occur more than once in a short period of time.

According to FEMA's statistics, a 100-year flood has a 26% chance of occurring during a 30-year period, which also happens to be the length of many mortgages. People with mortgages 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 (VCWPD 2014). **Since streamflow measuring began in 1929, the Ventura River has never experienced a 100-year (1% AEP) flood.**

Table 2.3.2.2 Presidentially Declared Major Flood Disasters in Ventura County
1962, February (Kennedy)
1965, November-December (Johnson)
1967, November-December (Johnson)
1969, January (Nixon)
1983, February-March (Reagan)
1992, February (Bush)
1995, January-March (Clinton)
2005, January (Bush)

Since 1962, there have been eight Presidentially declared major flood disasters in Ventura County.
"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)
Data Source: Flood Histories of the Counties in the Alluvial Fan Task Force Study Area (Earp 2007)

As described in more detail in "2.3.1 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 2.3.2.1, 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; it also matters when and how intensely the rain falls, how much rain previously fell, how saturated the soils are, and the condition of the stream channels, among other factors. Snowmelt is rarely a significant contributor in the Ventura River watershed. The snow that sometimes does fall on the mountains of the watershed generally melts gradually and fairly soon after falling—not lasting long enough for a warmer storm to come along and cause the fast melting that boosts flood flows.

As discussed later in the Coastal Flooding section, coastal flooding, caused by ocean water tide and wave inundation, often occurs when riverine flooding occurs, but can also occur independent of inland flooding. Table 2.3.2.3 (Significant Coastal Floods) summarizes past floods in the watershed.

Table 2.3.2.3 Significant Coastal Floods in the Watershed
1907, December
1939, September
1969, December
1977-78, Winter
1982-83, Winter
1988, January
1997-98, Winter
2010, January

Coastal flooding, caused by ocean water inundation, often occurs when riverine flooding occurs, but can also occur independently of inland flooding. The years of significant coastal flooding have not always been the same as those of significant riverine flooding.
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 either makes its way 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.

Sediment Flowing Out to Sea, 2005 Flood
Photo copyright David L. Magney

Flood Hazard Zones

FEMA, the Federal Emergency Management Agency, manages the National Flood Insurance Program and as part of that program creates and updates flood hazard maps, called Flood Insurance Rate Maps (or FIRM), for communities across the country. These maps indicate areas where there is a 1% or greater probability of inundation by flood 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 (FEMA 2013).

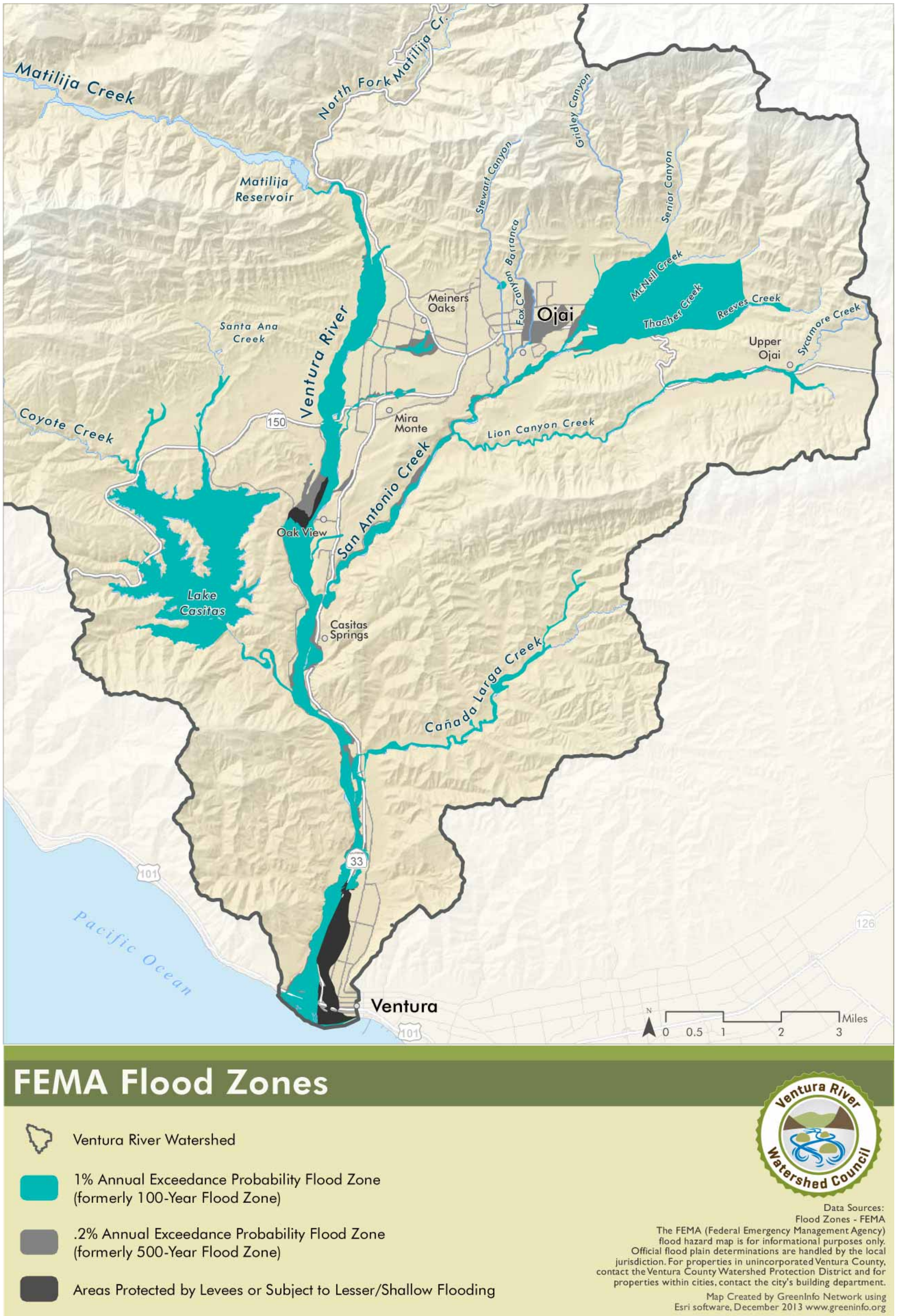


Figure 2.3.2.3 – Flood Hazard Zone Map

Types of Floods & Where They Occur

The Ventura River watershed experiences several distinct types of flooding: riverine flooding, alluvial fan flooding, coastal flooding, and urban drainage flooding, and 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 cycle of successive vegetation.

The steep terrain of the Ventura River watershed is carved by a network of streams that do their job of discharging 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. Couple that with the intense downpours that can occur in the upper watershed, and the result is that streamflows 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 cubic feet per second—an increase of 46,600%—within about three hours. The Ventura can be a fiercely flashy river.

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 Feb. 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 loads 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.

Another important contributor to flooding is the wildland fires that occur in the forest and chaparral habitats that frame the watershed. After an intense fire, a waxy substance can be left on the soil from the burning of brush and trees, which makes the soil repel water. These “hydrophobic” soils decrease infiltration and increase runoff. A pattern of floods following fires has been observed for more than 90 years in southern California (Earp 2007).

Highway 33 Destroyed at North Fork Matilija Creek, 1969
The most damaging recorded riverine flood in the Ventura watershed occurred in 1969.
Photo courtesy of *Ventura County Star*

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 not well defined, and their path is unpredictable. In heavy rains, water runs off the steep mountains above alluvial fans very fast 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.

East Ojai Avenue, 1969 Flood
The stream channels associated with alluvial fans are shallow, not well defined, and unpredictable.
Photo courtesy of Ventura County Star

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).

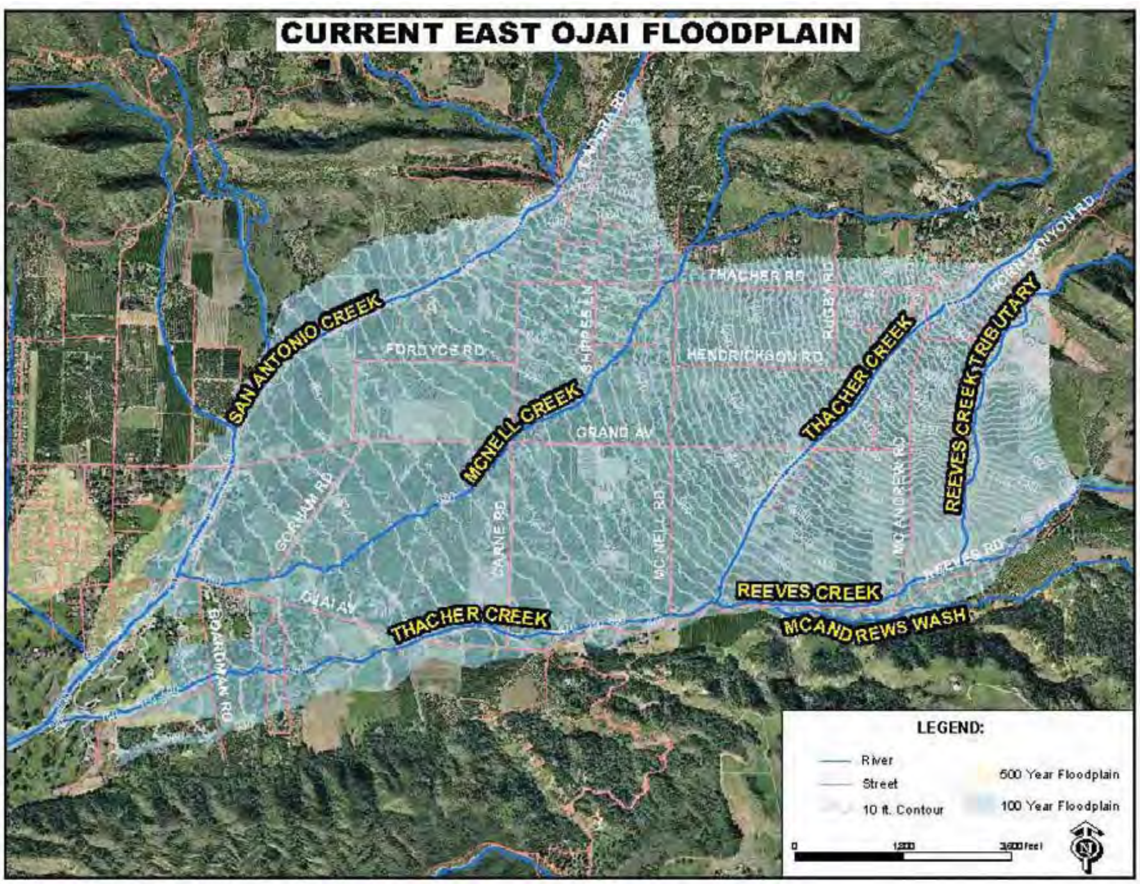


Figure 2.3.2.4 - East Ojai 100-Year (1% AEP) Floodplain
Note: These floodplain boundaries are scheduled to be revised in the fall 2014.
Source: Alluvial Flood Plain Mapping (VCWPD 2009)

San Antonio, Thacher, McNell, 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.

East End Alluvial Floodplain Map Update

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. In 2012, the Watershed Protection District jointly with FEMA completed the revision of the floodplain map as shown in Figure xxx. The revised map, which is very different than the current effective map, is scheduled by FEMA to become effective in September of 2014.

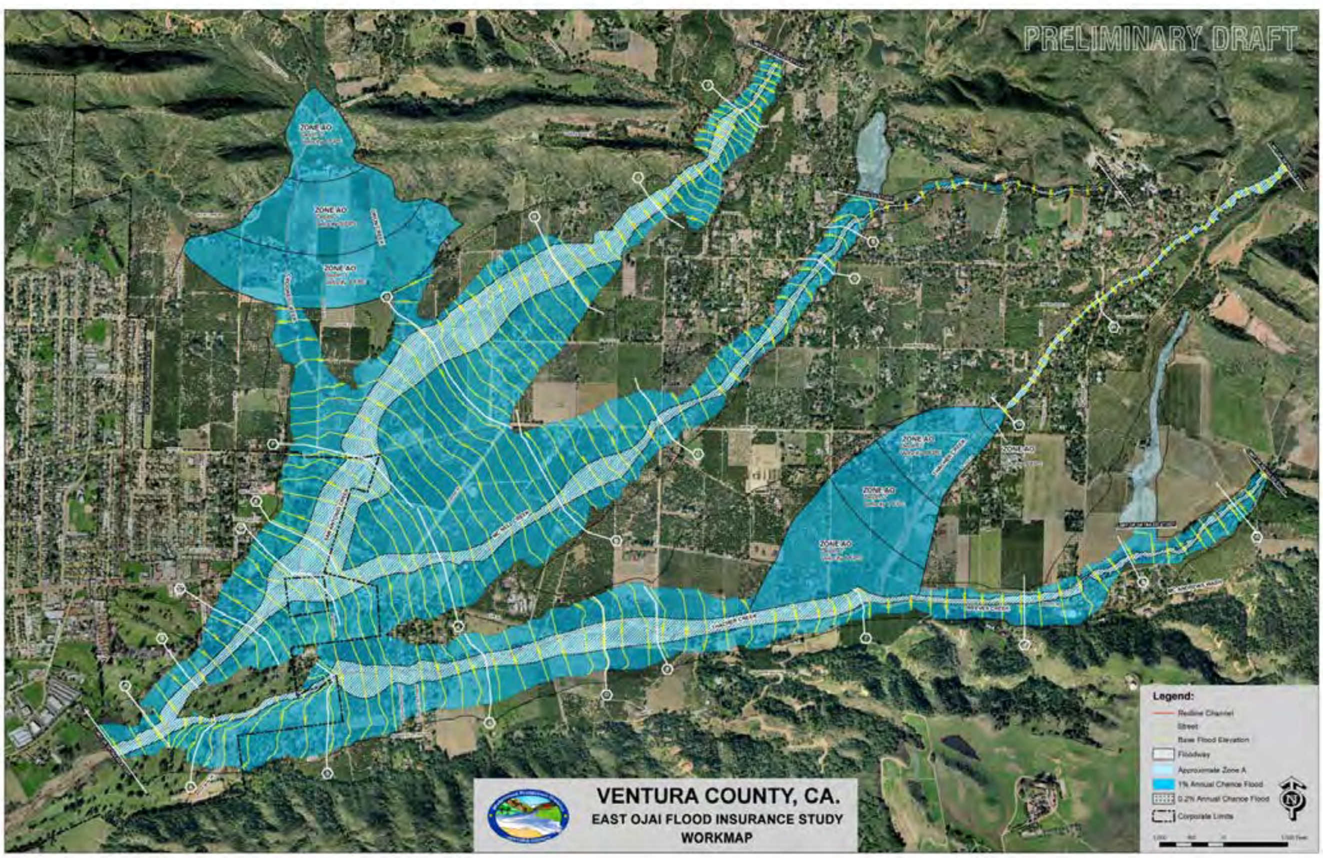


Figure xxx – Revised East Ojai 100-Year (1% AEP) Floodplain Map, Scheduled to be Effective September 2014
Source: Addendum to East Ojai Alluvial Fan Flood Insurance Study, Technical Support Data Notebook (VCWPD 2012)

Coastal Floods

Coastal flooding occurs when water from the ocean is driven onto land by storm surges, by storm-generated wind, tides and waves, or by tsunamis.

Damaging erosion of the coast, beaches, and structures along the coast is the hazard presented by coastal flooding, 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. An example of backwater flooding that regularly occurs just outside of the watershed is the drainage to the coast on San Jon Road in Ventura.

Backwater Flooding at San Jon Road, Ventura
Photo courtesy of Paul Jenkin

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 in the watershed.

Ventura Pier 1998
Photo courtesy of Paul Jenkin

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 (Ventura County 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 all protected with either seawalls or revetments that were installed to protect the railroad, freeway, and development from erosion and the impact of waves (BEACON 2009).

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 is 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 "Surfer's Point." Erosion of the beach in this area is a significant issue of concern in the watershed. The bike path and parking area lost more than 60 feet of land in some places since originally installed. See "2.2.3 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.

Surfer's Point in Front of Ventura County Fairgrounds, 1995
Photo courtesy of Paul Jenkin

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 also be overwhelmed by storm flows and cause flooding. These systems can be undersized or poorly designed, become damaged, or get clogged by debris. When this happens, flooding can occur 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.

The siting of 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, has quite a number of fault-associated wetlands scattered throughout the area (Ferren 2004). Some areas in the watershed are known for having a very high water table, which can also present urban drainage flooding problems.

Ojai Meadows Preserve Restoration
The restoration of the Ojai Meadows Preserve in Meiners Oaks by the Ojai Valley Land Conservancy is addressing a historic urban drainage problem by re-establishing the natural wetland drainage in that area.
Photo courtesy of Rick Wilborn

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 evapotranspire; 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. Another impact of impervious surfaces is that they 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 such things as 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, Surfer's Point, Ventura

Bioswale, Hwy 33, Mira Monte

Pervious Parking Lot, Ojai
Photo courtesy of Lisa Brenneis

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 are 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, and the dam associated with Stewart Canyon Debris Basin. Because of the size of Lake Casitas, the Casitas Dam poses the greatest flooding threat. Depending on whether the 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 2.3.2.4 summarizes the four dams/debris basin in the watershed.

Table 2.3.2.4 Regulated Dams in the Ventura River Watershed

Dam	Owner	Regulatory Jurisdiction	Capacity acre-feet	Flood Route
Casitas Dam	U.S. Bureau of Reclamation	U.S. Bureau of Reclamation	254,000	Coyote Creek, Ventura River
Matilija Dam	Ventura Co. Watershed Protection District	California DSOD	500	Matilija Creek, Ventura River
Senior Canyon Dam	Senior Canyon Mutual Water Company	California DSOD	78	Senior Canyon, San Antonio Creek
Stewart Canyon Debris Basin	Ventura Co. Watershed Protection District	California DSOD	64.6	Stewart Canyon Creek Channel, Stewart Canyon Creek, San Antonio Creek

Data Source: (URS 2005; Cardno Entrix 2012; USACE 2004 and 2004b, Magney 2005)

Figure 2.3.2.5 - Casitas Dam
Photo courtesy of US Bureau of Reclamation

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_w7. 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 (Ventura County 2011a).

To address concerns about the potential liquefaction of the alluvium substrate under Casitas Dam in a severe earthquake, upgrades to the facility were made in 2001, including stabilization of the downstream slope and modification of the crest to accommodate instability of the upstream slope (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).

Flood Protection Infrastructure

The primary flood control infrastructure in the watershed consists of levees; debris basins; stormwater channels, drainages, 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 has a levee on one side.

Federal regulations administered by FEMA require levee owners and operators to certify that their levees will continue to provide a barrier to the base flow 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 (VCWPD) completed the mandated engineering evaluations for the levees in the watershed.

The three levees in the watershed were found to have deficiencies such that in their current condition they could not be certified, by the November 2009 compliance deadline, as fully meeting federal standards.

Table 2.3.2.5- Levees in the Ventura River Watershed				
Levee	**Year Built**	**Location**	**Length (miles)**	**Built to Protect**
Ventura River Levee	1948	From Pacific Ocean to Canada de San Joaquin, city of Ventura	2.65	City of Ventura
Live Oak Levee	1978	From Santa Ana Blvd. Bridge to the Live Oak Diversion (~where Riverside Rd. meets Burnham Rd.), Oak View	1.28	Live Oak Acres
Casitas Springs Levee	1979	From Santa Ana Blvd north to Riverside Rd., Casitas Springs	1	Casitas Springs

Data Source: (Cardno Entrix 2012; USACE 2004b)

One of the consequences of not meeting certification requirements is that property owners behind the non-certified levees would, when new FEMA flood hazard maps are created, be in a flood hazard zone. 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 steps need to happen before they are updated for the Ventura River watershed. FEMA has not yet released an official date when it plans 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 VCWPD is engaged in preliminary design engineering work in support of levee retrofit and/or enhancement projects required to certify the levees, and is researching possible sources of funding.

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.

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 2.3.2.6 Debris Basins in the Ventura River Watershed					
Basin	**Year Built**	**Location**	**Watershed Area** (acres)	**Maximum Debris Storage Capacity** (cubic yards)	**Expected Debris Production for 1% AEP* Flood** (cubic yards)
Dent Debris Basin	1981	Ventura, behind De Anza Middle School	19	4,100	1,624
Live Oak Diversion Dam	2002	Oak View, west of Burnham Rd. between Santa Ana Rd. and Hwy 150	794	28,700	20,952
McDonald Canyon Detention Basin	1998	Meiners Oaks, east of Hwy 33/Fairview Rd junction	573	23,400	20,179
Stewart Canyon Debris Basin	1963	Ojai, at north end of Canada St.	1,266	328,300	209,000

*Annual Exceedance Probability
Data Source: (VCWPD 2005a; Cardno Entrix 2012)

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)

MAIN street in Ojai — corner Montgomery.

Downtown Ojai Before Stewart Canyon Debris Basin was Built, 1938 Flood

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 by the January and February 1969 storms (City of Ojai 1991).

Dams and Reservoirs

The Matilija Reservoir no longer serves a significant flood control function due to being 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 "2.3.1 Surface Water Hydrology" for more information on the watershed's dams and reservoirs.

Flood Monitoring

The Ventura County Watershed Protection District (VCWPD) 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. By clicking on a specific monitoring location icon, a window opens with last observed flow data and forecast information. By then clicking on the monitoring location link within this window, more detailed information is provided on flood flow categories and potential flood impacts for that location. Website: www.vcwatershed.net/fws/VCAHPS/#.

See "2.3.1 Surface Water Hydrology" for a summary of the other streamflow monitoring programs in the watershed.

2.3.3 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 "2.5.2 Groundwater Quality," and for the water supply aspects of groundwater in the watershed, see "2.4 Water Supply and Demand."

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, and finer-grained deposits, such as clay and silt.

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 the groundwater basins are full, the water table often occurs at relatively shallow depths, sometimes a matter of feet below ground surface, with depths varying depending on location.

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. Some sources consider the Upper and Lower Ventura River Basins to be sub-basins of one large Ventura River basin. A fifth small basin, the San Antonio Creek Basin, was identified as a separate basin in the extensive 1971 study prepared by the Ventura County Flood Control District (now

Watershed Protection District (Entrix 2001), but this small, shallow basin is now considered part of the Upper Ventura River Basin by the State of California (CDWR 2003) and the Ventura County Watershed Protection District.

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 relatively deep, bowl-shaped, 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 the "Unconfined and Confined Aquifers" section later), and much shallower than the Ojai Valley Basin (SWRCB 1956; Entrix 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 (VCFCD 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 below in the "Groundwater Basins" section.

Groundwater Basins

Ventura River Watershed

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

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

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

Figure 2.3.3.1 – Groundwater Basins Map

Data source: See the Groundwater Basins Map Data Sources table below.

Table 2.3.3.1 – Groundwater Basins Map Data Sources	
Map Table Column	**Data Source**
Acres & Sq. Mi.	VCWPD map (shapefiles).
Shallow Depth to Water	Lower VR Basin—*2012 Groundwater Section Annual Report* (VCWPD 2012). Other basins—Estimates provided by local groundwater consultants Jordan Kear (Kear Groundwater) & Greg Schnaar (DBS&A).
Max. Capacity	All basins except Lower VR - *Bulletin 118: California's Groundwater* (CDWR 2003). Lower VR Basin—The capacity provided in Bulletin 118 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&A) prepared a calculation that estimated the capacity for just the unconsolidated, onshore alluvium basin.
Avg. Well Yield	*Bulletin 118: California's Groundwater* (CDWR 2003).
Active Wells	Watershed Protection District database
Approx. Safe Yield	Upper & Lower VR Basin—Estimate by Greg Schnaar (DBS&A) based on the report *Groundwater Budget and Approach to a Groundwater Management Plan Upper and Lower Ventura River Basin* (DBS&A 2010). Note: this report estimated the safe yield of the Upper VR Basin as 12,732 AF, however this included the Coyote Creek drainage/Lake Casitas area as part of the basin. These areas are now not considered by VCWPD to be part of the Upper VR Basin, so Schnaar provided a revised estimate of 9,482 AF. Ojai Valley Basin—*Groundwater Model Development, Ojai Basin* (DBS&A 2011), median well yield.

Recharge and Discharge

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); and
5) Septic system effluent seepage (to a minor extent).
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).

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 and, by inhibiting subsurface underground flows, can delay or retain available water, enhance percolation time, and cause springs (Entrix 2001).

The following study excerpt describes, for example, how important the inflow of San Antonio Creek is to the recharge of the groundwater basin (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)

As an example of the rapidity of recharge, the heavy rainfall that occurred in winter of 1952 was enough 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). In a more recent example, following a four-day, 7.3-inch storm in the spring of 2014, the groundwater level in one of Ventura River County Water District's (non-pumping) wells in the Ventura River floodplain (just above the Highway 150 Bridge) was raised 15 feet within 20 days and 22 feet within 40 days (Rapp 2014).

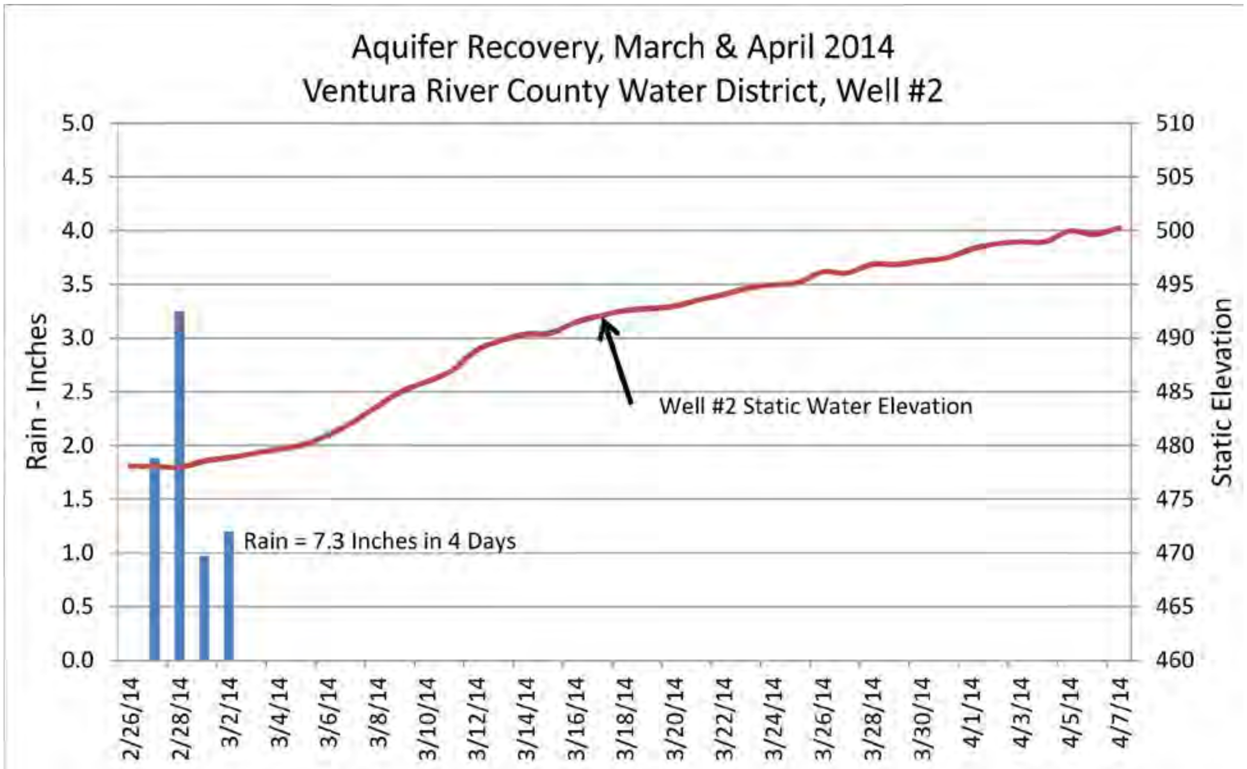


Figure 2.3.3.2 – Aquifer Recovery, March & April 2014, Ventura River Co. Water District Well #2
Following a four-day, 7.3-inch storm in the spring of 2014, groundwater levels in one of Ventura River County Water District's (static/non-pumping) wells in the Ventura River floodplain (just above the Highway 150 Bridge) were raised 15 feet within 20 days and 22 feet within 40 days.
Source: Ventura River County 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 southwest 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—almost *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).

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.

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. 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 are relatively limited in terms of their water-holding capacity; they can be quickly depleted 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 an "underground slide" rather than a "basin," because the water flows down "stream" just like the aboveground river.

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. 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).

SEASONAL GROUNDWATER LEVELS

The following excerpt describes typical seasonal groundwater level variations in the two basins that are most developed 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)

Groundwater Basins

Ojai Valley Basin

The Ojai Valley Basin is one of the two 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 has value on many fronts including supporting the survival of the endangered steelhead.

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 northeast 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 north 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).

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).

> **Ojai Basin Groundwater Model.** The Ojai Basin Groundwater Management Agency commissioned the development of an advanced, linked distributed-parameter groundwater model (completed in 2011) to provide a quantitative method for understanding the impacts of rainfall cycles and droughts on groundwater levels in the Ojai Valley Basin, including the basin's safe yield and the associated impacts to flow in San Antonio Creek (DBS&A 2011).

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 to 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 also 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 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 where the Santa Ana Fault crosses the Ventura River, alluvium attains a thickness of about 65 feet, whereas just north of the fault the thickness is greater than 200 feet (VCFCD 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.

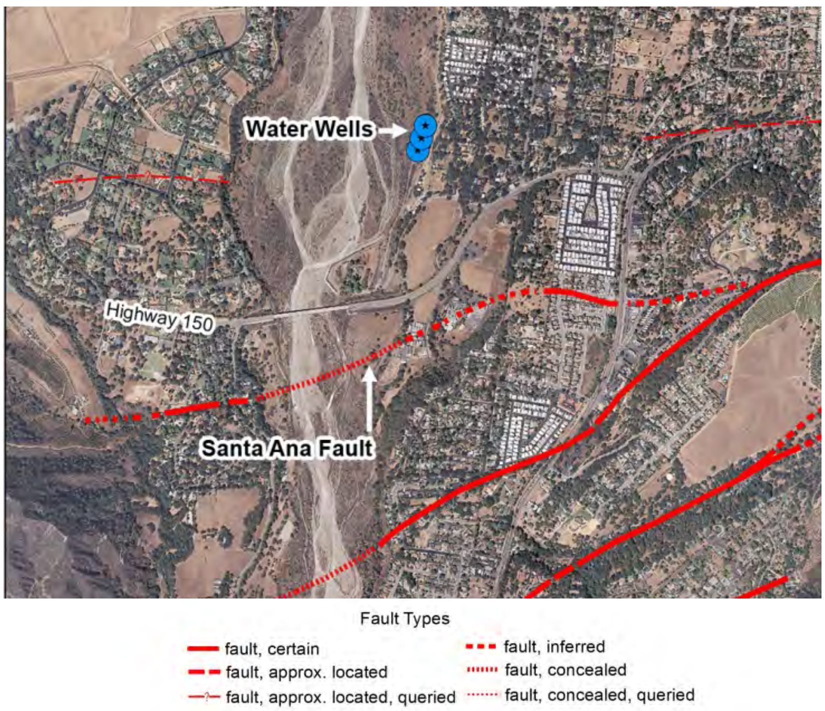


Figure 2.3.3.3 – Santa Ana Fault Crossing Ventura River

Fault Data Source: Gutierrez, C.I., Tan, S.S., and Clahan, K.B, 2008, Geologic map of the east half Santa Barbara 30' x 60' quadrangle, California: California Geological Survey, Preliminary Geologic Map, scale 1:100,000

This unconfined groundwater basin has an open and direct relationship with the surface water of the Ventura River (EDAW 1978; VCFCD 1971; Entrix 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 "2.3.1 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 Wilborn

Geographically, this reach is where the tallest mountains in the watershed—the ones that catch the most rainfall—"dump their load" of boulders, cobble, and sediments 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).

Just above the Highway 150 bridge, above where the Santa Ana Fault crosses the river, well logs and historic accounts of abundant rising water tend to support the idea that this fault is slowing the flow of underground water (VCFCD 1971), though the extent to which this is true remains to be studied. The Ventura River County Water District's wells are located in this area to take advantage of this effect.

Upstream of the San Antonio Creek confluence, a groundwater constriction again forces water in the basin's upper cell to the surface (USBR 2007).

Groundwater is known to upwell via in-river springs in the area just above Foster Park (EDAW 1978). It is apt that the community in this area is named "Casitas Springs." Farther downstream at Foster Park, groundwater becomes indistinguishable from surface water where the shallow, 33-foot-deep (DBS&A 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
Originally built in 1906 as a subsurface diversion dam, the top of the diversion is now exposed, possibly because of the trapping of sediment behind Matilija Dam. 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.

This point 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:

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 County Water District, one of two water districts that have water wells in the river here, has found that the section of the basin where it pumps tends to hold about 18 months 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 rain (Rapp 2013).

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 (DBS&A 2010), and it has 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 by 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, and 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 with 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 2,412 AF a year, is estimated to be 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 on the west, Sulphur Mountain on the south, and the convergence of the Topatopa Mountains and Sulfur Mountain on the east. A surface and groundwater structural arch or divide is found in the eastern part of the basin that separates groundwater flow westward toward Lion Canyon Creek and eastward toward Santa Paula Creek and into the Santa Clara River watershed (CDWR 2003).

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, 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).

Gaps in Data/Information

Having 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, where and how much—surface and groundwater supplies could be better managed to provide for both the in-stream water needs of the endangered steelhead at critical times of the year, and the ongoing water supply needs of homes and businesses.

Further investigation is warranted for many groundwater hydrology parameters throughout the Ventura River system including:

- groundwater extraction[1]
- 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] Groundwater extractions are now only comprehensively reported and monitored in the Ojai Valley Basin; however, anyone with wells having aggregate extractions of more than 25 acre-feet (or 10 acre-feet 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 eWRIMS (electronic Water Rights Information Management System) database is incomplete.

2.4 Water Supply and Demand

2.4.1 Water Suppliers & Managers

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 body. 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—Somewhat like PUC-regulated water companies but with much fewer restrictions, mutuals 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.

Major Urban Water Suppliers

There are 5 major urban water suppliers in the Ventura River Watershed: Casitas Municipal Water District, Ventura Water, Golden State Water Company, Ventura River County Water District, and Meiners Oaks Water District.

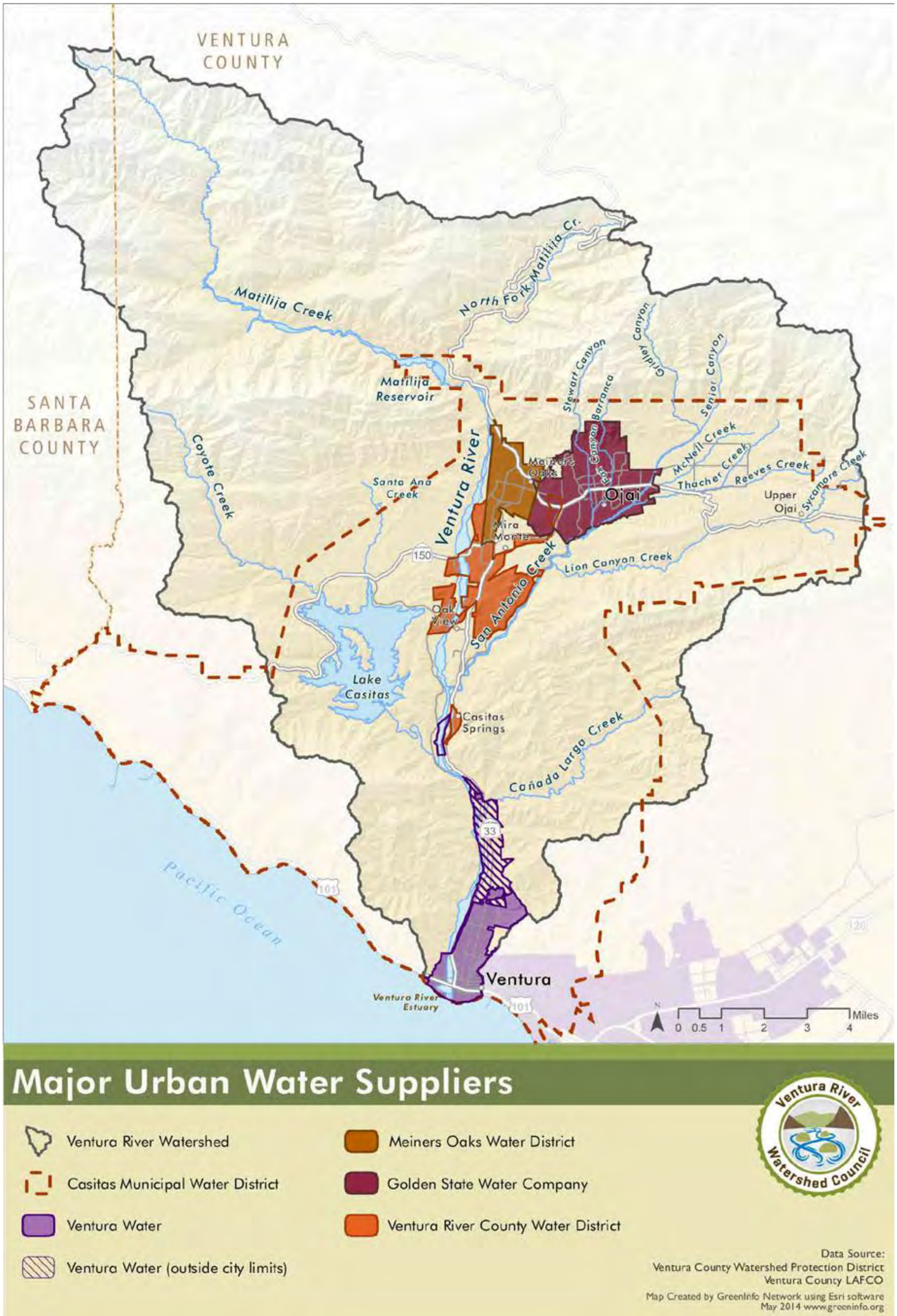


Figure 2.4.1.1 – Major Urban Water Suppliers Map

Casitas Municipal Water District

Year Formed: 1952

Purveyor Type: Special District

Estimated Population Served: 9,379 retail; 68,557 retail + wholesale

Service Area: Casitas Municipal Water District's (CMWD) 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 Rincon and beach area to the ocean and Santa Barbara County line.

Water Sources: Lake Casitas and 1 well in the Mira Monte area.

Facilities: 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 1 well in Mira Monte.

Connections: CMWD has approximately 3,200 service connections, including 300 agricultural connections.

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 9 water suppliers as well as farmers, when groundwater supplies become depleted.

(CMWD 2011, CDWR 2013)

Ventura Water

Year Formed: 1923

Purveyor Type: City

Estimated Population Served: Ventura Water (the City of Ventura's water department) may use Lake Casitas water only within CMWD's service area, which extends to about Mills Road; this restriction does not apply to use of Ventura River water from the City's Foster Park facilities. The city's total population is 106,433 (2010 Census); the population within the CMWD service area is approximately 31,604[2].

Service Area: 4,112 acres of the city is within CMWD's service area and 1,798 acres of this are within the watershed. In addition, the city provides water to about 944 acres within the watershed that are outside their city limits but within their sphere of influence. Water from Ventura Water's Foster Park diversions may be used anywhere within the city's jurisdiction (2,208 square miles) or service area.

Water Sources (from the Ventura River watershed): CMWD and Foster Park diversions. Ventura Water operates 4 groundwater wells at Foster Park (one of which is not currently operational because of damages sustained in the 2005

[2] Estimated with a GIS tool using Census Block Groups.

flood), and both a surface and subsurface intake on the Ventura River at Foster Park. Groundwater is extracted from the Upper Ventura River Groundwater Basin.

Facilities (related to the Ventura River watershed): Ventura Water operates the Avenue Water Treatment Plant and the Foster Park diversions, including wells, subsurface diversions, and surface diversions.

Connections: Ventura Water has approximately 32,000 service connections; approximately 30% of those accounts (~9,600) are located within the CMWD service area (RBF 2013).

Golden State Water Company

Year Formed: 1928

Purveyor Type: Investor-Owned Utility

Estimated Population Served: 8,202

Service Area: City of Ojai proper and some fringe county areas outside the city. 3,300 acres.

Water Sources: 5 wells in the Ojai Valley Groundwater Basin, plus water from CMWD.

Connections: 2,899

(Kennedy/Jenks 2011, CDWR 2013)

Ventura River County Water District

Year Formed: 1957

Purveyor Type: Special District

Estimated Population Served: 5,988

Service Area: Casitas Springs to the city of Ojai at the Vons shopping center. 2,220 acres.

Water Sources: 4 wells in the Upper Ventura River Groundwater Basin, plus CMWD water as backup.

Connections: 2,150

(Rapp 2013, CDWR 2013)

Meiners Oaks Water District

Year Formed: 1948

Purveyor Type: Special District

Estimated Population Served: 4,000

Service Area: Meiners Oaks community on the east side of the Ventura River. 1,300 acres.

Water Sources: 5 wells in the Upper Ventura River Groundwater Basin, plus CMWD water as backup.

Connections: 1,260

(Hollebrands 2013, CDWR 2013)

Table 2.4.1.1 Major Urban Water Suppliers				
Major Urban Water Supplier	**Purveyor Type**	**Year Formed**	**Area Served**	**Est. Pop. Served**
Casitas Municipal Water District	Special District	1952	Wholesale boundaries include the city of Ojai, Upper Ojai, Ventura River Valley area, the city of Ventura to Mills Road, and the Rincon and beach area to the ocean and Santa Barbara County line. 150 sq. mi.	9,379 R 68,557 R+W
Ventura Water	City	1923	City of Ventura* In watershed: 1,798 acres within city + 944 acres within city's sphere of influence, Overall: 2,208 sq. mi. of city + 944 acres within city's sphere of influence	31,604
Golden State Water Company	Investor-Owned Utility	1928	City of Ojai proper and some fringe county areas outside the city. 3,300 acres.	8,202
Ventura River County Water District	Special District	1957	Casitas Springs to the city of Ojai at the Vons shopping center. 2,220 acres.	5,988
Meiners Oaks Water District	Special District	1948	Meiners Oaks community on the east side of the Ventura River. 1,300 acres.	4,000

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.

* Ventura Water may use Casitas water within Casitas' 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.

Small Water Suppliers

Besides these 5 major urban water suppliers, there are 11 smaller water companies in the watershed:

Casitas Mutual Water Company

Gridley Road Water Group

Hermitage Mutual Water Company

North Fork Springs Mutual Water Company

Old Creek Road Mutual Water Company

Rancho Matilija Mutual Water Company

Rancho del Cielo Mutual Water Company

Senior Canyon Mutual Water Company

Siete Robles Mutual Water Company

Sisar Mutual Water Company

Tico Mutual Water Company

There are also 8 private water companies that deliver water in the watershed along with 3 public water suppliers, which supply water such as at county parks and facilities.

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 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 (OBGMA 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 5 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 (1 directed is elected to represent 3 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.

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 agriculture 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.

2.4.2 Water Sources

One of the Ventura River watershed's remarkable attributes, given its location in coastal southern California, is that no imported water is used in the watershed. Local surface water and groundwater sources supply the water demands within the watershed as well as to adjacent coastal watersheds. Currently, reclaimed water, or treated wastewater, is not used (directly) as a water supply source. While entitlements to State Water Project water are held by the Casitas Municipal Water District (CMWD) and the City of Ventura, no pipeline exists to deliver that water to the watershed.

Surface water is extracted for use directly from the Ventura River and some of the tributaries in the watershed, but the primary source of surface water in the watershed comes from Lake Casitas. Groundwater is extracted from the watershed's four groundwater basins by urban water suppliers, growers, and other private landowners.

Table 2.4.2.1 Approximate Annual Water Use by Major Supply Source	
Water Supply Source	**Approx. Annual Use acre-feet**
Lake Casitas	17,858[1]
Foster Park surface diversion	0[2]
Groundwater Basins	
Ojai Valley	4,939[3]
Upper Ventura River	9,300[4]
Lower Ventura River	523[4]
Upper Ojai	*Data not available*
Total	**32,620**

1. Average deliveries to the main conveyance system between 1975 and 2008. (CMWD)
2. City of Ventura's surface water diversion at Foster Park has been inactive since the mid-1990s because the location where the intact is located in the river has been dry.
3. Average groundwater extraction rate between 1996 and 2009. (DBS&A 2011)
4. These numbers are rough estimates due to data limitations. (DBS&A 2010) [Note: DBSA used 4603 AF for City of Ventura's extractions. The city's latest report says 4,200 AF is the recent 10-year average of diversions/extracts, and 6,000 AF is the 50-year average. (RBF 2013)]

Lake Casitas

Lake Casitas is the cornerstone of the water supply infrastructure in the watershed, and its value cannot be overstated. The lake, built in 1959 by the U.S. Bureau of Reclamation, was designed to hold enough water to carry water users through a 20-year drought. And although the lake has not yet been put to a 20-year drought test, it has been a reliable source of water in many multi-year droughts when wells were dry and the river barely flowed. Water from the lake is the primary water source for many users, and it is also a critical "backup" source for most groundwater users in the watershed. Casitas' high-quality water is also blended with poorer quality groundwater by some water purveyors to improve its quality and extend supplies.

The Casitas Municipal Water District (CMWD) manages the lake and is a wholesale and retail water supplier (see "2.4.1 Water Suppliers & Managers" for more information on CMWD). CMWD also extracts approximately 300 acre-feet (AF) of water from 1 well in the Mira Monte area. With the addition of the Mira Monte well water, the annual safe yield supply of the Casitas MWD is 20,840 AF (CMWD 2004).

The Ventura River Project

"The Ventura River Project" is the name given to the project to build Lake Casitas, 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, 5 pumping stations, and 6 balancing reservoirs located throughout the project area. Construction of the Ventura River Project was remarkably fast. Construction of Casitas Dam began in July 1956 and was completed in March 1959; the Robles Diversion and 5 pumping plants were completed in 1958; other distribution works were started in 1957 and completed in

1959. A fish passage facility was added to the Robles Diversion in 2006 to allow for the passage of southern California steelhead.

Lake Casitas Dam and Reservoir
Photo courtesy of Rick Wilborn

Lake Casitas was designed to hold 254,000 AF of water. The lake is filled by water from the surrounding Coyote Creek and Santa Ana Creek drainages, which flow directly into the lake, and by water diverted from the Ventura River by way of the Robles Canal. The percentage contribution from these sources varies depending on conditions, but generally about 55% of the inflow to the lake now comes from runoff in the surrounding drainages. The remaining 45% is transported to the lake from the Ventura River through the 5.4-mile Robles Canal.

Table 2.4.2.2 – Lake Casitas Quick Facts

Maximum Storage Capacity	254,000 acre-feet
Safe Annual Yield	20,840 acre-feet per year
Water Course Built On	Coyote Creek
Original Construction	1956–1959
Water Sources	Ventura River via Robles Diversion Canal, Coyote Creek, Santa Ana Creek
Surface Area (when full)	2,760 acres
Miles of Shoreline	32
Deepest Depth	200 feet
Maximum Diversion Rate at Robles Diversion	500 cubic feet per second

Source: Ventura River Project website (USBR 2014)

Foster Park Diversions

The following excerpt describes the City of Ventura's multiple water diversions in the Foster Park area:

"Surface water from the Ventura River is collected via surface diversion, subsurface collector, and shallow wells and delivered to the Avenue Treatment Plant through the City's Foster Park facilities. Production from this source is a function of several factors including diversion capacity, local hydrology, environmental impacts, and the storage capacity of the Ventura River alluvium and upstream diversions.

"The Ventura River water source is dependent upon local hydrology. Currently, the surface intake structure at Foster Park is unused due to the natural channeling of the active river channel bypassing the structure. Each year the flows can change the position of the active river channel in relation to the intake structure. According to a model of the Ventura River developed in 1984 and modified in 1992, the Upper Ventura River Basin fills after one or more years of above average rainfall. Once full, it takes three successive years of drought, with below average rainfall, to deplete the river basin subsurface storage and cause river water production to drop until the drought ends. More recent ongoing studies are looking at the interaction between groundwater diversion and surface water flow in the Foster Park reach.

"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 (RBF 2013)

Groundwater

Precise data on the quantity of groundwater extracted in the watershed is not available because private well extractions are generally not reported. Extraction data is 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 have been developed for the Upper and Lower Ventura River Basins (*Groundwater Budget and Approach to a Groundwater Management Plan, Upper and Lower Ventura River Basin*, DBS&A 2010). The least is known about extractions from the Upper Ojai Basin. "Figure 2.3.3.1 Groundwater Basins" in "2.3.3 Groundwater Hydrology" provides additional information about the watershed's groundwater basins.

Reclaimed Water

Sewer system wastewater generated in the watershed is treated at 1 of 2 wastewater treatment facilities. Most sewer system wastewater is treated at the Ojai Valley Sanitary District's (OVSD) wastewater treatment plant located below Foster Park next to the Ventura River. Treated effluent from this facility is not reclaimed for reuse; its effluent is discharged into the Ventura River, where it supports valuable aquatic habitat. Any efforts to reclaim this water for reuse must address the drawbacks of removing this flow from the river. The City of Ventura is the owner of the land where OVSD's treatment plant is located, and it holds first rights to any reclaimed water from that facility.

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. Ventura Water's facility does reclaim its treated effluent for reuse, however, that reuse occurs outside of the Ventura River watershed.

Imported Water

The City of Ventura and CMWD both hold rights to, and pay for, water imported from the California State Water Project, however, there is no physical pipeline or canal in place to bring that water into the watershed.

> "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 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."
>
> —Casitas Municipal Water District, Comprehensive Financial Annual Report (CMW 2012)

2.5 Water Quality

2.5.1 Surface Water Quality

In the Ventura River watershed, where the only available water supply comes from local streams or groundwater, and where surface water and groundwater readily trade places (EDAW 1978; VCFCD 1971; DBS&A 2006; Entrix 2001; TetraTech 2009a; Hopkins 2010; DBS&A 2010), both surface water quality and groundwater quality are important and interrelated concerns.

Surface water quality has been monitored in the watershed for decades, but in response to new regulatory requirements and citizen monitoring programs the number of different programs, monitoring locations, and constituents tested for has increased significantly since 2001.See "Surface Water Quality Monitoring" later in this section for more detailed information about monitoring.

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 later in the context of water quality regulations, and are more thoroughly described in other sections ("2.3 Hydrology" and "2.6 Ecosystems & Access to Nature," respectively).

Figure 2.5.1.1 – Water Quality Impairments Map
Source: Regional Water Quality Control Board – Los Angeles, 303(d) List of Impaired Waterbodies

Surface Water Impairments

Algae, Nitrogen, Dissolved Oxygen, & Eutrophication

Ventura River Reaches 1 and 2 and the estuary are on the Section 303(d) list of impaired waterbodies for algae, and 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 2.5.1.1 (Water Quality Impairments Map) for an illustration of the river reaches and Table 2.5.1.2 (Water Quality Impairments by Waterbody) for a description of the river reaches.

All of these issues—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 by diminishing environmental conditions. For example, algal respiration at night, and the decomposition of large 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 temperature, can also lower dissolved oxygen concentrations, independently of algae.

The growth rates of algae in any aquatic system depend on several variables, such as sunlight, water depth, water temperature, circulation of water, nutrients (bioavailable forms of nitrogen and phosphorus, and sometimes other elements such as silicon), and consumption of algae by aquatic animals (e.g., insects, snails, fish). In streams, the availability of stable material for attachment (e.g., logs, gravel, rocks) 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. The frequency, duration, and intensity of algal blooms are increased when excess nutrients are available providing that other factors such as sunlight, warm temperatures, and moderate flows waters are present to sustain and/or promote algal growth. Each factor is important as observed in the Ventura River watershed during the many years of on-going observations and water quality monitoring efforts.

Left: Researcher Studying Algal Bloom (*Cladophora*) in Matilija Creek, March 2010
Right: Abundant Aquatic Plants Outcompete Algae Downstream of OVSD Effluent Discharge, 2009
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. Impressive algal blooms have been witnessed in the upper watershed with low levels of nitrogen but plenty of sunlight and calm

waters (Left). On the other hand, sites where nutrient levels are high, but water is shaded by aquatic plants or trees, may not experience algal blooms, as shown on the right.
Photo courtesy of Diana Engle

Algae Growth Can Vary Significantly in Different Years

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

In 2009, a study was conducted by UCSB (and sponsored by the Regional Water Quality Control Board) to determine, in part, which nutrients—nitrogen or phosphorus—were "limiting" in the Ventura River watershed. A limiting nutrient is the nutrient that is in shortest supply in an ecosystem relative to biological demand. In the UCSB study it was found that in some locations nitrogen was limiting—indicating excessive phosphorus—and in some locations neither was limiting—indicating that both were in excess (Klose et al 2009).

Ventura River Reaches 1 and 2 (see Figure 2.5.1.1 – Water Quality Impairments Map) and the estuary are on the Section 303(d) list of impaired waterbodies for algae, and 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 2.5.1.1 (Water Quality Impairments Map) for an illustration of the river reaches and Table 2.5.1.2 (Water Quality Impairments by Waterbody) for a description of the river reaches.

A TMDL regulation was adopted in December 2012, called the "Algae, Eutrophic Conditions, and Nutrients TMDL for Ventura River and its Tributaries (Algae TMDL)." (TMDLs are discussed further in the "Regulations – Surface Water Quality" section.)

The Algae TMDL stipulated 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's hope is that compliance with these nutrient allocations will facilitate achievement of desired levels of algae, dissolved oxygen, and pH in the river. Ultimately, it is these targets related to algae, dissolved oxygen, and pH that are the aim of the Algae TMDL, and this is the case 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 potential contributions of horses and livestock to nutrient pollution in the Ventura River watershed.

Risk of Pathogens

Contamination of water by human or animal feces poses a health risk to humans if they come in contact with or ingest the water, because of potential exposure to pathogenic (disease-causing) bacteria, viruses, or protozoans. 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 one or another type of indicator bacteria.

The Ventura Countywide Stormwater Quality Monitoring Program (VCSQMP) monitors 3 three sites in the watershed: 2 two urban storm drain sites (Fox Canyon Barranca storm drain and Happy Valley Drain) and 1 one instream site located in the Ventura River just upstream of the Ojai Valley Sanitary District wastewater treatment plant outfall (VCWPD 2013e). Wet-weather concentrations of indicator bacteria are typically detected above Basin Plan objectives (the Basin Plan is further described in "Regulations – Surface Water Quality"). Dry-weather concentrations of fecal indicator bacteria at the Ventura River site usually meet water quality objectives, however, those at the urban storm drain sites usually do not. For example, *E. coli* concentrations at Fox Canyon Barranca 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.

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

The Basin Plan objectives for indicator bacteria vary based on the "beneficial uses" of a given waterbody. Most waterbodies in the watershed are held to the Basin Plan objectives that assume both water contact and noncontact water recreational use, the former having the most stringent standards. Since concentrations of indicator bacteria increase dramatically during storms and may remain elevated for several days afterwards, these are the times when body contact in potentially contaminated waterbodies should be most avoided. Since 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 a lot of uncertainty related to the potential impacts of bacteria-laden stormwater on human health, and a pilot epidemiology study is currently underway in San Diego to address this issue (more information on www.sccwrp.org).

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, one of the "beneficial uses" of the Ventura River estuary is shellfish harvesting, which has slightly different but very stringent bacteria water quality standards. Shellfish are frequently harvested at the river mouth.

A TMDL regulation to address indicator bacteria is scheduled to be adopted in 2019.

Trash

Just as drops of rain eventually find their way to waterbodies in a watershed, trash has a similar way of flowing downstream and into waterbodies. 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, the Ventura River estuary has been found to be a particular problem.

The Ventura River estuary is on the Section 303(d) list of impaired waterbodies for trash. A Ventura River 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 that finds its way into the estuary are actively being implemented by the responsible parties to that 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 (left) and at a drainage culvert that feeds into the Lower Ventura River (right). A TMDL regulation was adopted in 2008 with a target of zero trash in or on the water and on the shoreline.

Trash Excluder
New trash excluders, which 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 made the Ventura River bottom near the mouth of the river their "home." 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 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.

Efforts to address the situation over the years, 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 2.5.1.1) in cooperation with private property owners (i.e., Ventura Hillsides Conservancy, Taylor Ranch, and Aera Energy) are committed to sustaining the changes that have been made in the river and preventing reestablishment of any camps; regular patrols are now made in the area and volunteer cleanup events continue to be held.

River Bottom Camp, 2011
Photo courtesy of Santa Barbara Channelkeeper

River Bottom Camp Cleanup, 2012
Photo Courtesy of Ventura Hillsides Conservancy

Before and After a River Bottom Camp Cleanup, 2012 & 2013
Photos courtesy of Ventura Hillsides Conservancy

Ongoing River Bottom Trash Cleanup
Trash cleanups in the lower Ventura River bottom now occur regularly.
Photo courtesy of Ventura County Watershed Protection District

Total Dissolved Solids

Total dissolved solids (TDS) is the term used to describe the inorganic salts and small amounts of organic matter present in solution in water. The principal constituents are usually calcium, magnesium, sodium, and potassium cations and carbonate, hydrogencarbonate, chloride, sulfate, and nitrate anions. The presence of dissolved solids in water may affect its taste (WHO 1996).

Conductivity is used as an indirect indicator of the amount of dissolved solids in water, and it varies 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, the highest of all. The primary cause of a change in conductivity on the river is rain: a big storm can drastically drop in-stream conductivity values (Leydecker 2004). In late summer and fall, especially during periods of drought, high evaporation rates cause dissolved solids to become more concentrated, raising conductivity (Leydecker & Grabowsky 2006).

The highest conductivity is seen in Cañada Larga Creek. Conductivity readings in Lion Canyon and Stewart Canyon creeks are also elevated, but lower than in Cañada Larga Creek. High conductivity on Cañada Larga and Lion Canyon creeks is probably due to geologic strata. Lion Canyon Creek flows down one side of Sulphur Mountain and Cañada Larga Creek flows down the other side (Leydecker 2013b). The Monterey Shale Formation is a geologic feature predominant in the Sulphur Mountain area, and is naturally rich in salts that can be dissolved out of the rock by flowing water. This could also cause the slightly elevated levels of phosphate in Cañada Larga as well. It has been speculated by researchers studying the "saltiness" of the Malibu Creek that the Monterey Formation found in its northern headwaters could be contributing significant concentrations of sulfate to the creek (Orton 2013). See "2.2.2 Geology and Soils" for a map of the Monterey Formation.

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

Mercury

Lake Casitas water is used for municipal and agricultural purposes. Water quality is generally good in the lake, however, the lake, like many others in California, is on the Section 303(d) list of impaired waterbodies for mercury.

(Lake Casitas' water quality in terms of drinking water is addressed in "2.5.5 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 on the list, and that number is expected to increase as more data are collected (SWRCB 2009; 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).

Casitas Municipal Water District is required to test the raw lake water on an annual basis for regulated inorganic chemicals, including mercury. 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, in July 2013 the California Environmental Protection Agency, Office of Environmental Health Hazard Assessment, issued a health advisory for California's lakes and reservoirs. The advisory provided recommendations on how much and what type of fish from lakes and reservoirs in California is safe for consumption. The recommendations are stricter for women under 45 years of age and children (OEHHA 2013).

A TMDL to address the mercury impairment is scheduled for adoption in 2021.

Other Impairments

In the past, surface water quality was considered primarily a question of whether the water contained chemical pollutants, and the use for which water cleanliness was measured was as a municipal, agricultural, or industrial supply. This view has evolved; regulators and scientists now hold a broader perspective. The measure of "clean enough" 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."

As a largely undeveloped watershed with many stretches of the stream network unchannelized, the watershed is host to abundant riparian and aquatic organisms, all of which depend upon water of a high enough quality to be supportive of their life cycles—just as the people who live in or visit the watershed depend upon its cleanliness when swimming or wading.

Lack of streamflow and barriers to fish migration, discussed below, are identified by the Regional Water Quality Control Board as water quality impairments for a number of waterbodies in the watershed. Another important surface water quality issue is "constituents of emerging concern" (CECs), which include a wide range of chemicals, such as in pharmaceuticals and personal care products. 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 "2.5.3 Wastewater Quality."

Lack of Streamflow

For aquatic life and recreational uses, having no water in the stream can be more detrimental than having plentiful, but low quality water. 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 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 in dry years surface water often disappears underground after storm flows have passed.

The extent to which water pumping and extractions influences whether certain reaches of the river and its tributaries go dry, and when, is an issue that needs more study. A historical ecology 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 at least the turn of the century (Beller et al. 2011). See "2.3.3 Groundwater Hydrology" and "2.3.1 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 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 State Water Board, through its Water Rights Division, has the authority to regulate surface flow volumes; fisheries agencies influence these decisions through Biological Opinions for projects that affect surface flows.

There are several regulatory options for addressing 303(d)-listed impairments that cannot be dealt with using 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, USEPA issued a resolution (*Ventura River TMDL – Resolution 2013-0005,* USEPA 2013) that found (1) pumping and diversion in Reaches 3 and 4 contributes to nutrient- and algae-related impairments, (2) the Regional Board 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 authorities to address *other* potential impacts of pumping and water diversion within Reaches 3 and 4.

Barriers to Fish Migration

The Matilija Dam presents the greatest migration barrier in the watershed for the endangered southern California steelhead, effectively blocking access to perhaps as much as 50% of the steelhead's prime spawning habitat in 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 1998 and are still underway. Developing environmentally acceptable and economically feasible solutions for what to do with the enormous amount of sediment and organic material behind the dam has been a key challenge of that effort. The RWQCB is scheduled to address this impairment by 2019. (See "2.6 Ecosystems" for a more in-depth discussion of Matilija Dam and fish passage barriers).

Contributions

Pollutants in local streams are contributed by a variety of sources. Potential sources of nutrients, for example, as identified by RWQCB–LA, include point sources such as urban runoff into storm drains, wastewater treatment plant effluent, and nonpoint sources such as inputs from agriculture, livestock, septic systems, groundwater, undeveloped open-space, wildlife, and atmospheric deposition (RWQCB – LA 2011).

Contributions of pollutants from urban runoff are discussed below. See "2.5.3 Wastewater Quality" and "2.5.2 Groundwater Quality" for information about the contribution of these sources of water to surface water quality.

Stormwater Runoff

The quality of water in the watershed's streams and rivers when it isn't raining—by far most days of the year—is much different than the quality of water during those rare days of rainfall. Water quality conditions change significantly when it rains because of stormwater runoff.

Before stormwater runoff reaches streams or the river, it has the opportunity to 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.

> **Definition: Stormwater—** Stormwater runoff is generated when precipitation from rain and snowmelt events flow over land or impervious surfaces in excess of what percolates into the ground or is held in puddles. Stormwater that runs off surfaces such as horse corrals, paved streets, highways, or parking lots can carry with it pollutants such as oil, pesticides, sediment, trash, bacteria, and metals. The runoff can then drain directly into a local stream, lake, or the ocean. Often, the runoff drains into storm drains, which eventually drain untreated into a local waterbody. Stormwater draining from an MS4 urbanized area is now regulated as a point source.

Stormwater Contributions from Natural Landscapes

Large portions of the Ventura River watershed are natural, with hardly any direct influences of man-made activities. These portions are in the mountainous headwaters, e.g. Upper North Fork Matilija Creek, but also in the lower watershed. However, even those natural catchments produce dry weather and stormwater runoff with measureable and sometimes relatively high concentrations of the same water quality constituents that are causing water quality impairments in urbanized areas. Knowledge of natural background levels is important for defining pollution problems and for setting appropriate targets for remediating impaired water bodies.

A study performed by the Southern California Coastal Water Research Project (Stein & Koon 2007) sampled dozens of natural sites in southern California, including Bear Creek, a tributary to North Fork Matilija Creek in the Ventura River watershed. Natural concentrations and loads of what may be considered pollutants (e.g. nutrients, bacteria, metals) varied greatly between watersheds, but were generally orders of magnitude lower than in developed watershed, with few exceptions (e.g. total suspended solids). However, in some cases water quality standards or other guidelines were frequently exceeded in natural watersheds. For instance, indicator bacteria during wet weather routinely test over the water quality objectives. While natural contributions of pollutants should not be assumed to be negligible, more sampling data is needed to improve estimates of dry and wet weather background conditions for the Ventura River watershed.

Urban Stormwater Runoff

The Ventura Countywide Stormwater Quality program regularly monitors the quality of stormwater in the watershed at two urban storm drains ("major outfall"), one in Meiners Oaks at Happy Valley Drain, and in Ojai at Fox Canyon

Barranca; and one location in the Ventura River ("mass emission") at Ojai Valley Sanitary District (above the district's effluent discharge).

In dry weather, water quality results at the site monitored on Ventura River consistently meet applicable water quality objectives. These water quality objectives do not apply directly to the storm drain sites monitored, however, they are useful in understanding the water quality. High concentrations of chlorides and total dissolved solids are commonly seen in storm drains during dry weather when groundwater, high in dissolved salts, is the main source of flow. This is especially true when the area is served by well water. Elevated pH levels are commonly seen in the Happy Valley Drain, and it is currently unknown what may be causing this. Dry weather concentrations of indicator bacteria are frequently elevated in urban outfalls as well, as is commonly observed in southern California.

In wet weather, some constituents frequently exceed water quality objectives at the mass emission station as well as the 2 major outfalls. Bacteria are always found in high quantities in stormwater, as is the case throughout California. Aluminum concentrations are also high in wet weather, primarily in the storm drain samples. Aluminum is a ubiquitous natural element in sediments throughout Ventura County geology and concentrations in soils routinely exceed 3% (30,000 µg/g). Sediments are mobilized during stormwater runoff events from urban, agriculture, and natural sources, including creek beds, resulting in concentrations of aluminum in excess of the 1,000 ug/l Basin Plan objective (a drinking water objective). Samples taken near Wheeler's Gorge above the urbanized areas of the watershed show a total aluminum concentration of 19,000 ug/l, far over the drinking water objective applied to the river. In Fox Canyon Barranca the pesticides Chlorpyrifos and Malathion have been detected, though with less frequency. These pesticides do not have adopted water quality objectives in the Basin Plan, but were compared to the U.S. EPA national recommended water quality criterion for a better understanding. 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.

Runoff from Other Activities

During construction, rainfall could more easily mobilize sediments and pollutants from exposed soil and materials if special precautions are not put in place. Similarly pollutants from industries that are performing operations outdoors need to have management practices in place to prevent stormwater from washing pollutants into the river. The state has adopted 2 general permits to cover these activities and prescribe Storm Water Pollution Prevention Plan (SWPPP) be written and implemented to prevent polluted runoff. These permits are discussed in the regulations sections. In both cases no runoff is permitted in dry weather.

A Look at Key Waterbodies

San Antonio Creek Water Quality

San Antonio Creek drains the largest urban area in the watershed—the city of Ojai and adjacent unincorporated suburban development, home to residences, businesses, industries, golf courses, and many expansive landscapes. The population density immediately adjacent to much of San Antonio 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 not only pollute the water in the creek, 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 can contribute to algae blooms and the highest in-stream nutrient concentrations in the watershed 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.

Estuary Water Quality

The Ventura River Estuary is on the 303(d) list of impaired waterbodies due to algae, eutrophic conditions, low dissolved oxygen, trash, total coliform.

Regulations – Surface Water Quality

All watersheds in the nation are subject to the standards of the Clean Water Act, considered the cornerstone of water quality protection in the United States, and 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, outlined below.

Basin Plan

California Water Code establishes water quality policy for state and regional water resources. Each of the state's 9 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 are adopted. A more complete update is in progress. 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. Beneficial uses include things like 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 be developed to protect those uses.

The Basin Plan explicitly identifies 23 different waterbodies in the watershed (including individual reaches of streams/rivers), assigns different beneficial uses to each of these waterbodies, and establishes water quality objectives for those waterbodies. (All waterbodies, even those not listed, actually come under the jurisdiction of the RWQCB per the Basin Plan and the "tributary rule").

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 2.5.1.2 (in order from the top to the bottom of the watershed), have been identified.

Regulations called TMDLs, for Total Maximum Daily Loads, have either been developed or are scheduled to be developed to address these impairments. TMDLs outline the loading (pounds per day) or concentration (ppm) 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 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 State Water Quality Control Board and the USEPA, with the RWQCB typically handling enforcement.

TMDL	Responsible Parties	Status
Ventura River Estuary Trash TMDL	City of Ventura, Ventura County, Ventura County Watershed Protection District, California Department of Food and Agriculture, Caltrans	Adopted in 2008. Many improvements being implemented such as installation of trash excluders in the storm drains, increased trash collection in public places, education, and better enforcement of regulations.
Algae, Eutrophic Conditions, and Nutrients TMDL for Ventura River and its Tributaries	Ojai Valley Sanitary District, City of Ojai, City of Ventura, Ventura County, Ventura County Watershed Protection District, Caltrans, and agricultural dischargers (growers, horse, and livestock owners).	Adopted in February 2013. Monitoring plans related to attainment of the TMDL targets are now under development by the various responsible parties.

Table 2.5.1.1 – Adopted TMDLs

Waterbody	Water Quality Impairment[1]	TMDL[2] & USEPA Approval Date Actual or Estimated
Matilija Reservoir	Fish barriers (fish passage)	2019
Matilija Creek Reach 1: Matilija Reservoir to confluence w/North Fork Matilija Creek Reach 2: Above Matilija Reservoir	Fish barriers (fish passage)	2019
San Antonio Creek: Tributary to Ventura River. Runs from East End of Ojai, along Creek Rd., to confluence with Ventura River, just above Casitas Springs	Nitrogen Bacteria Total Dissolved Solids	Algae TMDL[3] - 2/19/13 2021 2023
Lake Casitas	Mercury	2021
Ventura River Reach 4: Camino Cielo Rd. below Matilija Dam to confluence with Coyote Creek, just south of Foster Park	Pumping Water Diversion	6/28/13[4] 6/28/13[4]
Ventura River Reach 3: Confluence with Coyote Creek, just south of Foster Park, to confluence with Weldon Canyon, just north of Cañada Larga	Indicator Bacteria Pumping Water Diversion	2021 6/28/13[4] 6/28/13[4]
Ventura River Reach 2: Weldon Canyon to Main St.	Algae & Low Dissolved Oxygen	Algae TMDL[3] - 2/19/13
Ventura River Reach 1: Main St. to Estuary		
Cañada Larga Creek: Tributary to Ventura River. Runs along Cañada Larga Rd. to confluence with Ventura River, south of wastewater treatment plant)	Fecal Coliform Total Dissolved Solids	2019 2021
Ventura River Estuary: Main St. to Estuary	Trash Algae, Eutrophic Conditions Total Coliform	Ventura River Trash TMDL - 2/27/08 Algae TMDL[3] - 2/19/13 2019

Table 2.5.1.2 - Water Quality Impairments by Waterbody

1. Water quality impairment as listed under the Clean Water Act Section 303(d).
2. TMDL = Total Maximum Daily Load
3. Algae TMDL is short for: Algae, Eutrophic Conditions, and Nutrients TMDL for Ventura River and its Tributaries
4. In June 2013 the USEPA determined that the recently adopted Algae, Eutrophic Conditions, and Nutrients TMDL provides "equivalent protection of water quality in 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 2013). See additional discussion above in the "Lack of Streamflow" section.)

Discharge Permits & 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 laws (i.e., the Clean Water Act). Initially, NPDES permits focused on regulating more traditional point-source pollution, which originates from a definite source, such as industrial facilities, and discharges at a specific point. In 1987, an amendment to the Clean Water Act directed the NPDES program to address urban and stormwater runoff discharged into rivers, lakes, and along the coast from storm drains that are owned and managed by cities and counties. Urban and stormwater runoff contain pollutants from streets, parking lots, construction sites, homes, businesses, and many other sources.

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 2013a).

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. MS4 NPDES permits are issued by the RWQCB and are usually issued to a group of co-permittees encompassing an entire metropolitan area.

Ventura Countywide Stormwater Water Quality Program

Educational Sign, Ventura Countywide Stormwater 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 best management practices (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 housekeeping for municipal operations
- Programs to reduce illicit storm drain connections and illicit discharges
- Water quality monitoring

(VCWPD 2013e)

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

Industrial Activities General Stormwater Permit

The EPA 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. This general permit was recently revised with implementation required by July 2015. 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 perform limited monitoring of stormwater runoff from their facility. Facilities that do not have exposure to stormwater can file a non-exposure exclusion and be relieved of many of the permit requirements.

Construction Activities General Stormwater Permit

Construction activity resulting in a land disturbance of 1 acre or more, or less than 1 acre but part of a larger common plan of development or sale, must obtain 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.

To obtain coverage under this General Permit, dischargers shall electronically file the Permit Registration Documents (PRDs), which includes a Notice of Intent (NOI), Storm Water Pollution Prevention Plan (SWPPP), and other compliance-related documents required. A major requirement of the Construction General Permit is that operator(s) of the construction activity prepare and implement a stormwater pollution prevention plan (SWPPP) to reduce the pollutants in stormwater discharged from the construction site, including mud tracked offsite by vehicles. The SWPPP will identify 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 waste discharge requirements are commonly combined into 1 permit. WDRs also cover the many other types of discharges not covered by NPDES permits such as discharges to percolation ponds from treatment plants and the disposal of waste at landfills.

Nonpoint Source Discharge Regulation

The RWQCB regulates nonpoint source discharges in 1 of 3 ways: waste-discharge requirements, conditional waivers, and waivers. The RWQCBs in charge of enforcing state and federal water quality standards historically waived the waste-discharge requirements 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 9 regional boards to come up with an alternative (FBVC 2013).

Conditional Waiver for Agriculture

In 2005, the Los Angeles Regional Water Quality Control Board 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 measure and control discharges from their property, including irrigation return flows, flows from tile drains, 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."

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 VCAILG (Ventura County Agricultural Irrigated Lands Group), which is intended to act as 1 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 VCAILGs members. A 7-member VCAILG Executive Committee develops the proposed program budget each year and recommends policy. Budget and policy recommendations are reviewed and approved by a 20-member Steering Committee consisting primarily of growers.

Through the Conditional Waiver program, landowners and growers are asked to provide VCAILG with information on their management practices, to participate in education efforts, and to implement best management practices to reduce or eliminate contaminated discharges. The Conditional Waiver program also performs water quality monitoring and reporting. (The preceding description is largely from the Farm Bureau of Ventura County's website (FBVC 2013).)

The RWQCB discharge permits and waivers in the watershed are summarized in Table 2.5.1.3.

#	Entity	Permit/Waiver
Stormwater		
1	Ventura County Watershed Protection District, County of Ventura, the 10 cities in Ventura County	NPDES (MS4) Permit
16	Any construction activity causing 1 acre or more of soil disturbance	General Construction Stormwater NPDES Permit

#	Entity	Permit/Waiver
31	Industrial facilities meeting the statewide industrial stormwater permit's Attachment 1 Eligibility Criteria	General Industrial Stormwater NPDES Permit
Non-Stormwater		
1	Ojai Valley Sanitary District	NPDES Permit
1	Casitas Municipal Water District	NPDES Permit
1	City of Ventura	NPDES Permit
1	Golden State Water Company	NPDES Permit
1	County of Ventura	NPDES Permit
1	Ventura River County Water District	NPDES Permit
18	Various individuals and businesses	Individual or General Waste Discharge Requirements (Non-NPDES)
Waivers		
1	Ventura County Agricultural Irrigated Lands Group (owners and operators of agricultural lands working together as a "discharger group")	Conditional Agricultural Waiver

Table 2.5.1.3 – Discharge Permits and Waivers

Data Source: Birosik 2013

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, which is administered by the Ventura County Environmental Health Division (EHD), provides regulatory oversight for the following 6 statewide environmental programs: Hazardous Waste, Hazardous Materials Business Plan, California Accidental Release Prevention Program, Underground Hazardous Materials Storage Tanks, Aboveground Petroleum Storage Tanks/Spill Control and Countermeasure Plans, and Onsite Hazardous Waste Treatment/Tiered Permit.

CUPA facilitates compliance with state and federal hazardous materials laws and regulations, county ordinance code, and local policies through routine and follow-up inspections, educational guidance, and enforcement actions. CUPA also is involved with hazardous materials emergency response, investigation of illegal disposal of hazardous waste, and public complaints (Casitas 2011a).

Surface Water Quality Monitoring

Surface water quality is routinely monitored by a number of agencies and organizations in the Ventura River watershed. The location, frequency, and constituents tested for are different depending upon the purpose of the monitoring. Figure 2.5.1.2 illustrates the locations of the most significant ongoing, current water quality monitoring programs.

Figure 2.5.1.2 – Surface Water Quality Sampling Locations

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 made available as "information" comprehensible to the general public. Importantly, there is limited "big picture" analysis of the findings of the mandated water quality monitoring—such as what the risks are of elevated levels of a given constituent, assessing trends over time and regionally, potential sources of contaminants, or cause/effect relationships.

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, based on "best available data," did an imperfect job of quantifying the various contributions. 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.

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.

2.5.2 Groundwater Quality

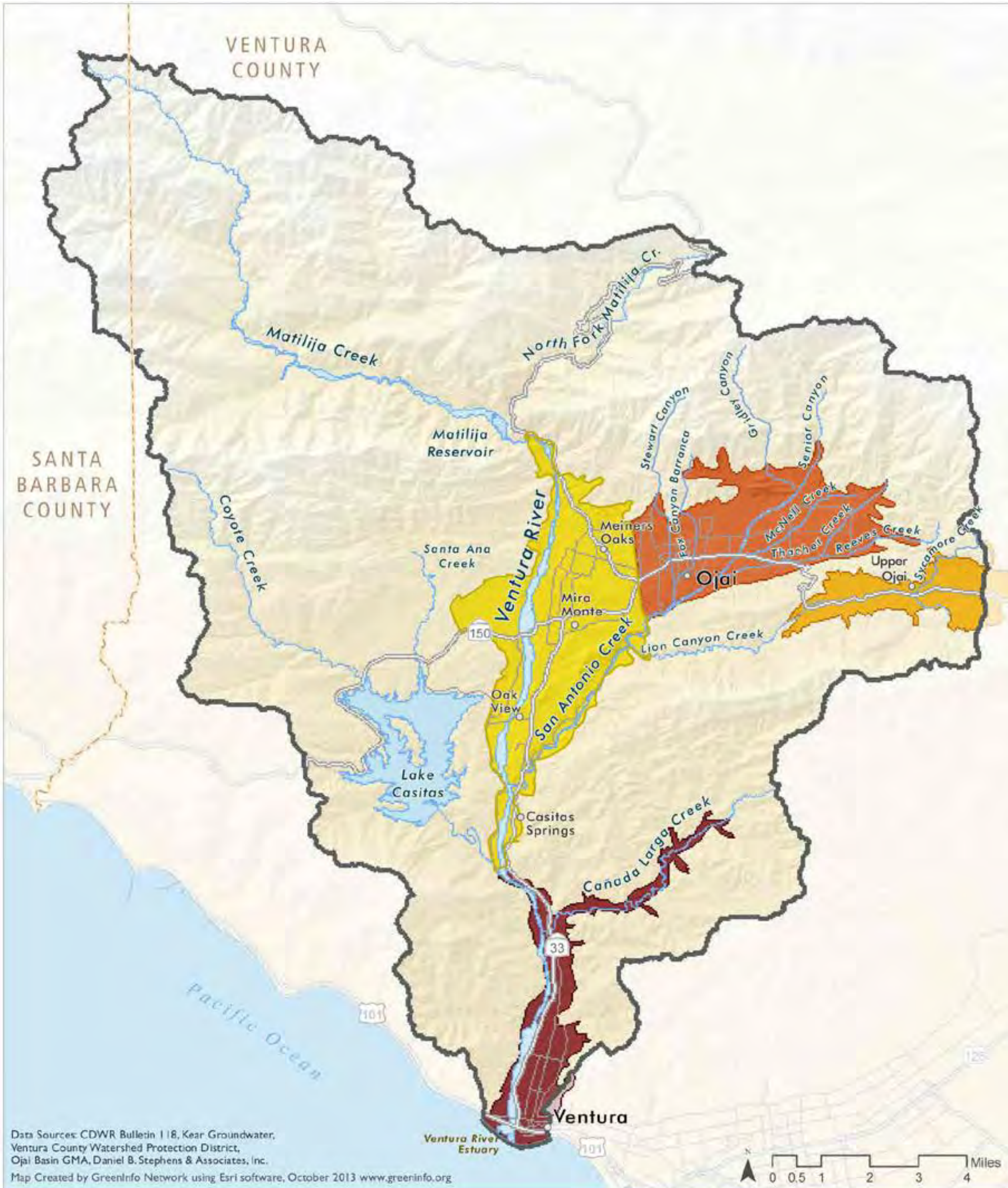
Groundwater supplies a significant percentage of the water used for drinking and irrigation in the watershed, and is the source of much of the streamflow for most of the year except in very wet years. The quality of groundwater is important for drinking, irrigation, aquatic ecosystem health, and other uses. See "2.3.3 Groundwater Hydrology" for a description of the four important groundwater basins in the watershed.

Groundwater in the watershed is generally of good enough quality for drinking and irrigating, though a few parameters must be regularly watched, 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, as well as by the natural interaction of groundwater with the sediments in the surrounding geologic formations. Other factors that can influence groundwater quality include the type and intensity of 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 in confined aquifers.

Nitrate is the primary groundwater quality concern in the watershed. Total dissolved solids (TDS) are also elevated in groundwater in much of the watershed and chloride and boron are also sometimes found in elevated concentrations. Elevated concentrations of these constituents can impact agricultural operations and are monitored by agricultural water users. Sulfate, which can affect the taste and odor of water, tends to be high in certain areas. Many of the constituents that are elevated in groundwater, such as boron and sulfate, are naturally occurring from surrounding geology. In the lower watershed, where there significant oil, gas, and other industrial land uses have existed for decades, potential chemical contamination presents concerns that need further investigation.

Regional groundwater quality has been analyzed less frequently and at fewer locations than surface water quality, 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. In addition, the Ventura County Watershed Protection District performs annual monitoring of about 15 wells in the watershed, in each of the four groundwater basins. 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 groundwater 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. (See "Groundwater Quality Monitoring" later in this section for more information about monitoring.)

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.



Groundwater Basins

Ventura River Watershed

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

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

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

Figure 2.5.2.1– Groundwater Basins Map

Regulations – Groundwater Quality

Drinking Water Standards

Groundwater quality is generally defined in terms of drinking water quality standards. As described in "2.5.5 Drinking Water Quality," 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 California Department of Public Health (CDPH) 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 total dissolved solids, CDPH 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 CDPH 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. 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 "2.5.1 Surface Water Quality."

Table 2.5.2.1 Basin Plan Groundwater Quality Objectives						
Groundwater Basin	**Bacteria** (ml*)	**Nitrogen** as N (mg/L)	**TDS** (mg/L)	**Sulfate** (mg/L)	**Chloride** (mg/L)	**Boron** (mg/L)
Upper Ojai Basin						
W. of Sulphur Mountain Road	1.1/100	10	1,000	300	200	1.0
Central area	1.1/100	10	700	50	100	1.0
Sisar area	1.1/100	10	700	250	100	0.5
Ojai Valley Basin						
W. of San Antonio-Senior Canyon Creeks	1.1/100	10	1,000	300	200	0.5
E. of San Antonio-Senior Canyon Creeks	1.1/100	10	700	200	50	
Upper & Lower Ventura River Basins						
Upper Ventura River area	1.1/100	10	800	300	100	0.5
San Antonio Creek area	1.1/100	10	1,000	300	100	0.5
Lower Ventura River area	1.1/100	10	1,500	500	300	1.5

*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.
Source: Basin Plan (RWQCB-LA 1994)

Septic System Regulations

Refer to "2.5.3 Wastewater Quality" for an overview of the regulations in place to prevent septic systems from polluting groundwater.

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 somewhat different quality characteristics and concerns, based largely on geology, land use, and overlying hydrology, but the water is generally suitable for use.

The fourth groundwater basin—Lower Ventura River—is not used for drinking water and is minimally used for agricultural irrigation. This aquifer is naturally brackish in nature. In addition, it is located under the watershed's most industrialized area. Data on the overall impact of these current and historic industries on groundwater quality is limited.

Table 2.5.2.1 provides an at-a-glance look at which basins have wells that have tested over the MCL or SMCL standards for a few key water quality constituents. The highest percentage of exceedances has been recorded for TDS. The lowest percentage of exceedances has been recorded for boron and chloride. While nitrate had a low percentage of exceedances, they did apply to public health standards (MCL), which require more scrutiny than the secondary standards. Many of the constituents that are high in the watershed's groundwater—including manganese, iron, sulfate, and boron—are naturally occurring because of the surrounding geology.

More detailed information, including findings from local water quality monitoring, is provided in the sections that follow.

Table 2.5.2.2 – Number of Monitoring Wells with Results Above MCLs Between 1953-2013							
	Nitrate as NO_3	**Chloride**	**TDS**	**Manganese**	**Iron**	**Sulfate**	**Boron**
	number of exceedances / number of samples in the dataset (% exceedances)						
Lower Ventura River Basin	0/13 (0%)	5/23 (22%)	23/23 (100%)	16/22 (73%)	14/22 (64%)	22/23 (96%)	4/20 (20%)
Upper Ventura River Basin	27/307 (9%)	0/261 (0%)	301/342 (88%)	17/210 (8%)	33/145 (23%)	88/250 (35%)	4/203 (2%)
Ojai Valley Basin	14/399 (4%)	14/335 (4%)	409/450 (91%)	79/191 (41%)	63/184 (34%)	39/328 (12%)	1/204 (1%)
Upper Ojai Basin	5/67 (8%)	0/64 (0%)	43/97 (44%)	16/32 (50%)	13/31 (42%)	7/61 (12%)	0/36 (0%)
Drinking Water Quality Maximum Contaminant Levels							
MCL* Standard	45 mg/L						
SMCL** Standard		250-500 mg/L	500-1,000 mg/L	.05 mg/L	0.30 mg/L	250-500 mg/L	
Notification Level***							1 mg/L

This table indicates the number of samples taken (denominator) and of those, the number that exceeded the MCL or SMCL. Where an SMCL consists of a range, the lower number was used to calculate exceedances.
*MCL—Maximum Contaminant Level; ** SMCL—Secondary Maximum Contaminant Level (esthetic issues such as taste).
***Notification levels are health-based advisory levels for chemicals in drinking water that lack MCL. Some SMCL's values have a recommended lower and upper range.
Source: Ventura County Watershed Protection District's groundwater monitoring data (2013f)

Nitrate

As is 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 or SMCL standards, particularly in the Upper Ventura River Basin and the Ojai Valley Basin. This is illustrated in Figure 2.5.2.2 and Table 2.5.2.3. A few wells in these basins regularly test over the drinking water quality standard (45 mg/L as NO_3 - nitrate, or 10 mg/L as N - nitrogen), and other wells in these basins occasionally test near the standard (SWRCB 2014a). Water suppliers using these wells blend the high-nitrate water with cleaner sources.

Nitrate is a nutrient that is naturally present at low concentrations in groundwater. Other than natural sources, surface water recharge, septic systems, and fertilizers and manure that migrate to groundwater via infiltration are also causes of elevated nitrate concentrations in groundwater (RWQCB 2012).

Nitrate can affect biological activity in aquifers and in surface waterbodies that receive groundwater discharge. High concentrations of nitrate in drinking water can adversely affect human health, particularly the health of infants (Montrella and Belitz 2009). Nitrate poisoning in infants is commonly referred to as "blue baby syndrome." See "2.5.3 Wastewater Quality" for a discussion on septic systems and their contribution to groundwater quality.

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

Table 2.5.2.3 - Nitrate (as NO_3) by Groundwater Basin (mg/L)						
MCL = 45 mg/L as NO_3	**Average**	**Median**	**Range**	**# of Exeedances**	**# of Samples**	**Date Range**
Upper Ojai Basin	16.86	12.20	0–57.70	5	67	1961-2012
Ojai Valley Basin	20.72	18.70	0–67.00	14	399	1953-2012
Upper Ventura River Basin	15.27	8.10	0–102.00	27	307	1967-2012
Lower Ventura River Basin*	0.93	0.00	0–13.00	0	13	1991-2012

MCL—Maximum Contaminant Level
Source: Ventura County Watershed Protection District groundwater monitoring data (2013f)

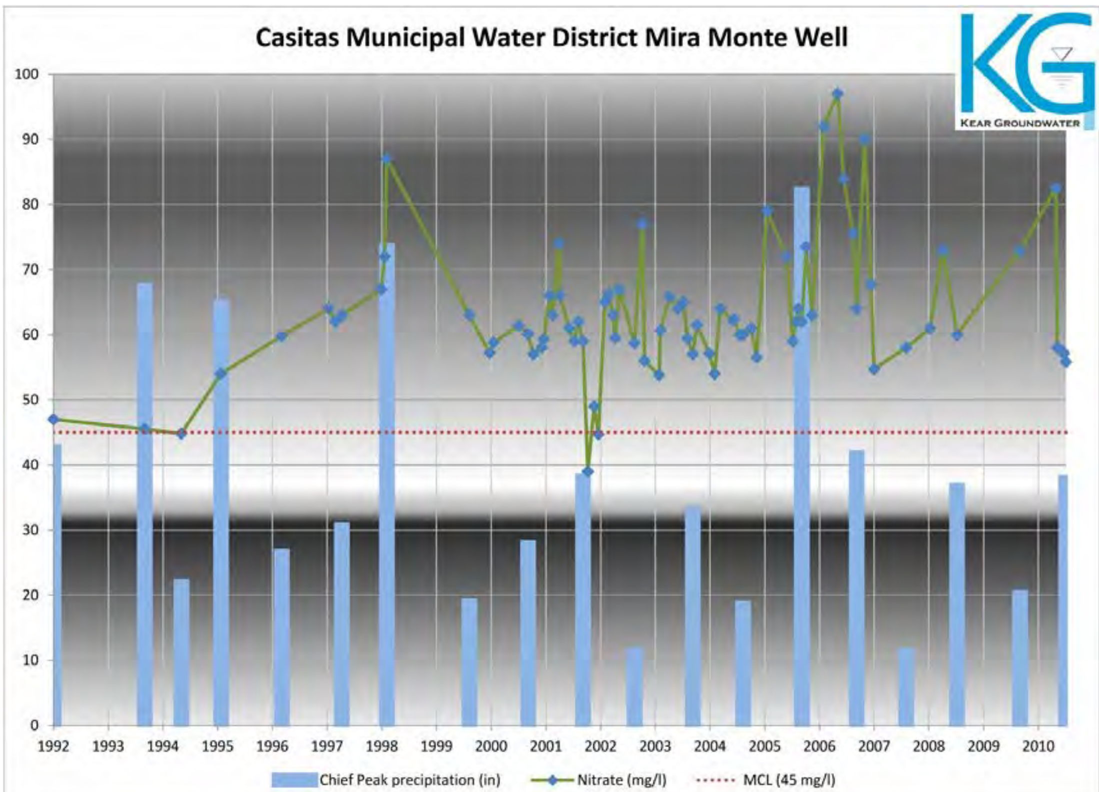


Figure 2.5.2.2– Groundwater Nitrate Compared with Precipitation, Mira Monte Well
x-axis = time, y-axis = nitrate mg/l (as nitrate - NO_3). This chart corroborates USGS findings that the occurrence of high nitrate concentrations in shallow and younger groundwater indicates surficial or near-surface sources of nitrate.
Source: Kear Groundwater 2013

Total Dissolved Solids and Salts

Total dissolved solids (TDS) is a measure of all the dissolved substances in water, which includes inorganic salts as well as a small amount of organic matter. Common inorganic salts in water include calcium, magnesium, potassium, and sodium (cations), and carbonates, nitrates, bicarbonates, chlorides, and sulfates (anions).

The water quality guideline for TDS ranges from 500 mg/L to 1,000 mg/L. This is a non-mandatory secondary maximum contaminant level (SMCL). For growers of subtropical fruit trees (citrus and avocado) in the watershed, the Ventura County Farm Advisor recommends levels less than 1,000 mg/L in irrigation water (Faber 2013).

TDS tends to be elevated in the watershed's groundwater basins, as it does in surrounding watersheds (Burton et al 2011). The Lower Ventura River Basin tends to have the highest TDS. This correlates to the high TDS measured in surface water: Cañada Larga Creek has the highest TDS of the watershed's streams (Leydecker & Grabowsky 2006).

Table 2.5.2.4 - Total Dissolved Solids by Groundwater Basin (mg/L)

SMCL = 500–1,000 mg/L	Average	Median	Range	# of Exceedances*	# of Samples	Date Range
Upper Ojai Basin	545	449	189–1,250	43	97	1961-2012
Ojai Valley Basin	717	670	100–2,960	409	450	1953-2012
Upper Ventura River Basin	704	657	285–5,040	301	342	1967-2013
Lower Ventura River Basin*	1,577	1,130	963–3,650	23	23	1991-2012

*The lower number of the SMCL range was used to calculate exceedances.
SMCL—Secondary Maximum Contaminant Level (esthetic issues such as taste)
Sources: Ventura County Watershed Protection District (WPD) database (2013f)

The causes of high TDS in groundwater can be both natural and the result of human activities. Groundwater in the Ventura River watershed tends to have relatively high TDS naturally because of the high and readily dissolved mineral content of the rock in groundwater basins. In general, the older the groundwater the longer water sits in contact with the marine sediments in the basins, and the higher the conductivity—a measure of TDS—tends to be (Leydecker & Grabowsky 2006). In addition, the streams with the highest conductivity in the watershed (Cañada Larga Creek, Lion Canyon Creek, and San Antonio Creek) drain down either side of Sulphur Mountain, a rich source of inorganic salts.

High TDS indicates hard water, which can affect taste, odor, and color, and cause corrosion, staining, and scaling on plumbing fixtures. Many users of groundwater "soften" the water to avoid some of these problems. For growers, high TDS is a concern because it reduces the ability of plant roots to extract sufficient water from the salty solution, and can quickly clog sprinklers, drippers and irrigation emitters. Growers in the watershed rely on winter rains to leach the soil of built up salts, but when there are no significant winter rains, they must sometimes leach the soil with a volume of water in excess of the plant need to help reduce the concentration of salts (Faber 2013a).

Sulfate

Sulfate is a naturally occurring mineral in water. High concentrations of sulfur may be attributed to the presence of Miocene and Pliocene marine sediments from the surrounding mountains (Burton et al 2011). The Monterey Shale Formation, a geologic feature predominant in the Sulphur Mountain area of the watershed, is naturally rich in salts, such as magnesium sulfate (epsom salt), that can be dissolved out of the rock by flowing water. It has been speculated by researchers studying the "saltiness" of the Malibu Creek that the Monterey Formation found in its northern headwaters could be contributing significant concentrations of sulfate the creek (Orton 2013). It is possible that this formation is similarly contributing to the high sulfate levels found in the Lower Ventura River Basin.

High concentrations of sulfate in water can cause scale buildup in water pipes, may be associated with a bitter taste, and can cause diarrhea.

Table 2.5.2.5 - Sulfate by Groundwater Basin (mg/L)						
SMCL = 250–500 mg/L	**Average**	**Median**	**Range**	**# of Exceedances***	**# of Samples**	**Date Range**
Upper Ojai Basin	101.3	59.0	1.0–412.0	7	61	1961-2012
Ojai Valley Basin	202.6	204.0	0–480.0	39	328	1953-2012
Upper Ventura River Basin	247.5	230.0	2.0–2,940.0	88	255	1967-2013
Lower Ventura River Basin*	524.0	358.5	310.0–1,470.0	22	23	1989-2012

*The lower number of the SMCL range was used to calculate exceedances.
SMCL—Secondary Maximum Contaminant Level (esthetic issues such as taste)
Source: Ventura County Watershed Protection District (WPD) database (2013f)

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.

The Ventura Oil Field was discovered in the early 1900s; by the late 1920s 113 oil wells were in production in the Avenue area on the city of Ventura's Westside; by the late 1930s the area 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.

By the 1990s, much of the oil and 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 (PCBs), and caustics and acids (WCEE 2001).

Groundwater monitoring is occurring at a few sites on the Westside as a part of remedying violations, and these records are available on the State's GeoTracker GAMA website. However, reports that clearly assess the threat to groundwater or surface water quality from these sites were not found.

One of the actions identified in the City of Ventura's General Plan addresses the brownfields on the Westside:

"Action 7.26: Seek funding for cleanup of sites within the Brownfield Assessment Demonstration Pilot Program and other contaminated areas in West Ventura."

—*2005 Ventura General Plan* (City of San Buenaventura 2005)

Groundwater Quality Monitoring

What follows is a summary of the ongoing groundwater quality monitoring programs in the watershed, as well as an important focused analysis of groundwater quality that was conducted in the region by the USGS. In addition, 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 California Department of Public Health, and integrated into the State's GeoTracker GAMA 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 once per year in approximately 15 wells within the watershed, including approximately 7 to 8 in the Ojai Valley Basin, 4 to 5 wells in the Upper Ojai Basin, 2 to 6 wells in the Upper Ventura River Basin, and 1 to 3 in the Lower Ventura River Basin.

Wells are typically sampled in August through December. The VCWPD 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. Bacteria, inorganic chemicals, and a couple of additional tests that are normally part of the drinking water testing series are not included in this monitoring. Results and maps of wells are published VCWPD's Groundwater Section Annual Report.

OBGMA

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.

USGS 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.

Only four wells in the watershed were analyzed as part of this study, but it 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. Figure xxx illustrates the location of the wells included in the study.

Most constituents that were detected were reported at concentrations below the California Department of Public Health's drinking water quality standards (called primary maximum contaminant levels, or MCLs; and secondary maximum contaminant levels, or SMCLs). Concentrations of nitrate were reported above the primary MCL; manganese and TDS were above their respective SMCL (USGS, 2004a). 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 allows a comparison of groundwater quality in the neighboring Santa Clara River watershed (Burton et al 2011; Montrella and Belitz 2009).

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 with other basins.

There is also a lack of data and analysis on the pollutants, extent of contamination, and risk to groundwater quality in the Lower Ventura River Basin contributed by 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 quite different (different regulations, different agencies in charge). This makes it challenging to correlate contributions from groundwater to surface water (or vice versa) of various pollutants.

Although groundwater is sampled annually by the Ventura County Watershed Protection District, there is limited analysis of the findings of those data, including trends over time, correlation with nearby surface water quality, or identification of potential sources of groundwater constituents of concern.

2.5.3 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. These two system types utilize different treatment processes (except that both depend upon microbes for decomposition), 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), as the name implies, treat wastewater onsite and typically release effluent into the soil and groundwater. Graywater systems can reduce the flow of wastewater to either the central wastewater treatment plant or the onsite treatment system by using this non-potable supply for landscape irrigation.

Wastewater can potentially affect water quality in the watershed through sewer system leaks and spills, through the quality and impact of treated effluent on receiving waters, and from improperly functioning septic systems. In the Ventura River watershed, stormwater drains into a separate system of channels and is not part of the wastewater flows.

Figure 2.5.3.1 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 of concern to water quality, including pathogens, bacteria, nutrients, pharmaceuticals, perfumes, toxic chemicals, and many other products.

Wastewater includes both "blackwater" and "graywater." Blackwater refers to wastewater from toilets; graywater refers to all used household water except blackwater.

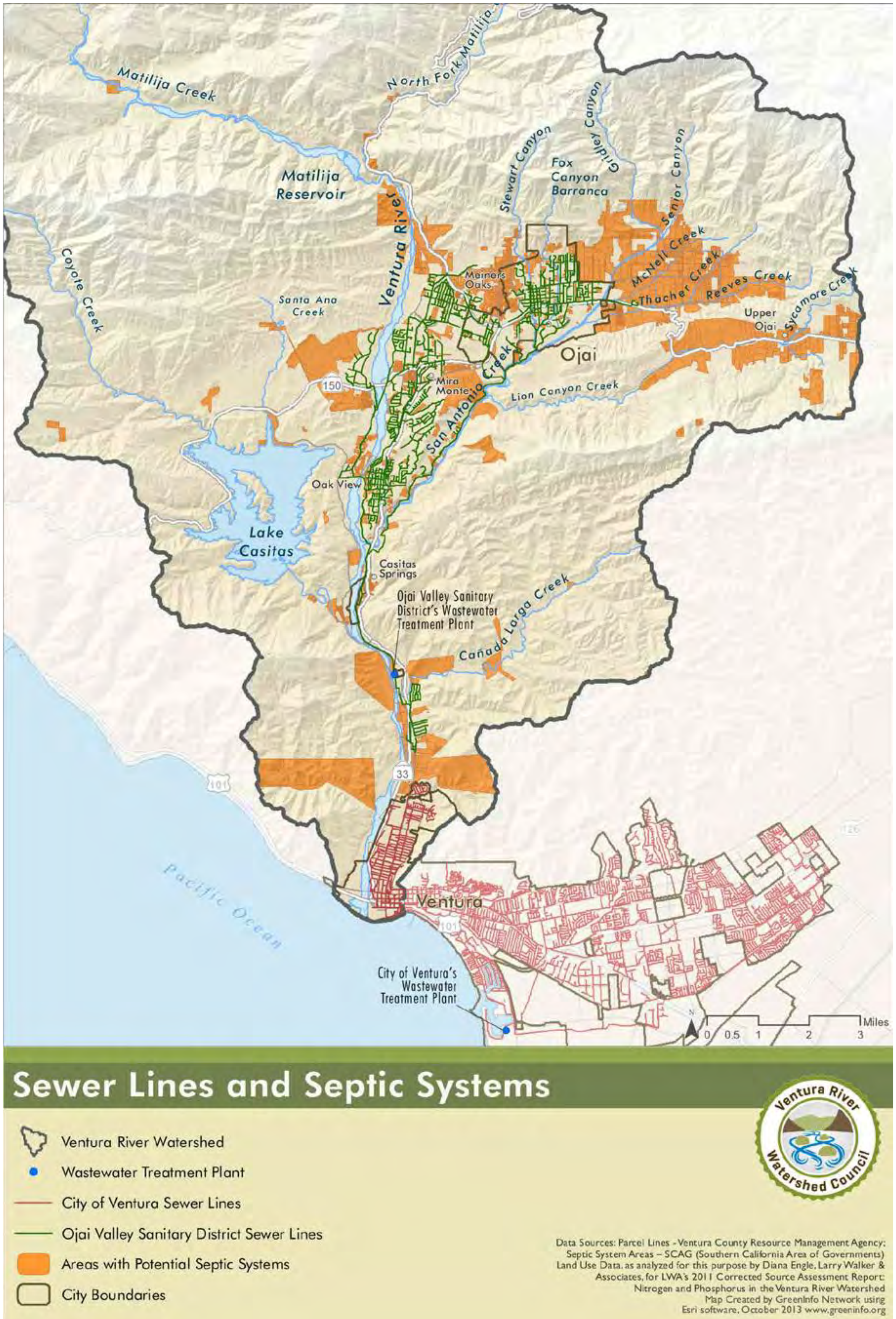


Figure 2.5.3.1 – Sewer and Septic Systems Map

Sewer Systems

Sewer systems transport and treat the sewage from homes and commercial buildings. There are two separate sewer systems in the watershed: one operated by the Ojai Valley Sanitary District (OVSD) and one by the City of Ventura's department (Ventura Water). OVSD covers the largest service area in the watershed, including most of the Ojai Valley, Meiners Oaks, and Casitas Springs. OVSD serves a population of about 23,000 people at roughly 8,500 different locations via 120 miles of sewer pipeline. Wastewater is treated at OVSD's treatment plant near Foster Park before being released into lower Ventura River (Palmer 2013).

Ventura Water provides sewer services to most properties within the City's jurisdiction in the watershed, which comprises about 3,500 accounts that serve an estimated population of 10,500 people (Barajas 2013). The wastewater produced in Ventura Water's jurisdiction is transported outside of the watershed to the Ventura Water Reclamation Facility, located in Ventura Harbor. Both OVSD's and Ventura Water's treatment plants are publicly owned treatment works, commonly referred to as POTWs.

Figure 2.5.3.2 – Ojai Valley Sanitary District Wastewater Treatment Plant
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.

Two smaller wastewater treatment plants can be found in the east end of the Ojai Valley. Thacher School, a private school on the east end of the Ojai Valley, has a 40,000 gallon per day (gpd) capacity treatment plant and an average dry season flow of 16,926 gpd (RWQCB-LA 2007). Ojai Valley School's Upper Campus, another privately owned and operated school located on Reeves Road, has a capacity of 19,500 gpd and operates an average dry season flow of 11,000 gpd. Both of these privately owned and operated systems disperse treated effluent underground (RWQCB-LA 2011a).

Table 2.5.3.1 – Sewer Statistics

	Ojai Valley Sanitary District	Ventura Water	
		In the watershed	Total
Population Served	23,000	10,500	109,000
Miles of Sewer Pipeline (excluding private lateral lines)	120	22	300
Average Influent (million gallons/ day (mgd))	1.6	1.3 - 4.5*	8.5
Plant Capacity (mgd)	3.0	n/a	14
Pretreatment Program** Locations	80	131	718

Source: Palmer 2013; Barajas, Landis, Pfeifer, Rungren & Waln 2013

* 1.3 mgd is calculated based on land use (Impact Sciences 2011), and 4.5 mgd is estimated by Ventura Water representatives.

** Pretreatment programs are described below under Regulations – Sewer Systems.

Leaks and Spills

Both OVSD and Ventura Water utilize "separate sewer systems," which means that 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. However, during dry weather, a combined system has the advantage of being able to fully treat urban runoff at the receiving treatment plant.

One of the important benefits of keeping stormwater separate from wastewater is that the stormwater remains available as a resource for groundwater recharge and in-stream flow. Even with separate sewer systems, there is still the potential for stormwater and groundwater to enter the sewer system through leaky pipes, lateral lines, and manhole covers, primarily during the rainy season. Infiltration of freshwater accounts, in part, for the seasonal variation in the amount of influent that enters sewer systems.

As shown in Table 2.5.3.1, OVSD's average annual daily flow is 1.6 mgd measured over the course of a year. Seasonal flows can be quite variable. In the dry season, average flows can be as low as 1.5 mgd. During the rainy season, when groundwater levels are high and infiltration is common, influent into the treatment plant ranges from 2.0 mgd up to 4 or 5 mgd depending on the storms. The all-time high was 9.5 mgd (Palmer 2013; RWQCB 2011).

Older infrastructure is more prone to leaks, spills, and breaks. Pipes degrade, get compressed, and leak over time, contributing to infiltration of freshwater into the system.

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, most of the sewer lines, around 70%, 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 date back to the 1920s, but these are also reported to be in relatively good condition (Pfeifer 2013).

Over the last three years, Ventura Water and OVSD have not had a wet weather overflow in the watershed.

Flood-related sewage spills are a serious water quality concern in the watershed. Several sewer lines are 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 the major flood of 2005, an OVSD sewer mainline in San Antonio Creek was damaged, causing a sewage spill, and an OVSD mainline at the Hwy 150 Bridge was similarly damaged in the major flood of 1998.

Sewer Manhole on the Ventura Riverbank During 2005 Flood

Photo courtesy of Ojai Valley Sanitary District

Besides the public health threat such spills pose from contact with the water, the City of Ventura must also curtail extractions of water from the Ventura River until the waters have been confirmed to be clear of contamination.

Wastewater Treatment Plant Effluent and Biosolids

As previously mentioned, OVSD operates the only publicly owned treatment works in the watershed, as the Ventura Water Reclamation Facility is located at the Ventura Harbor. OVSD's facility treats all of the wastewater collected in the sewer system above the plant, as well as a small amount (5% of OVSD's total flow) of the wastewater that is produced below the plant (down to Shell Road).

Because there is very little industry contributing to the sewer system in the Ventura River watershed, and because an advanced tertiary treatment system is used, the effluent produced is considered 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 3.25 cubic feet per second. In 2012 annual daily average was 1.61 mgd (Palmer 2013).

The amount of effluent discharged from the plant is greater in the winter than in the summer, though in the summer, and especially in dry years, effluent can constitute the majority, or at times all, of the lower river's flow (RWQCB

2011). This addition of relatively high-quality water to the river, especially near the end of the dry season in drought years when effluent provides most of the flow, has significant ecosystem value 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, or at times all, of the flow of the lower Ventura River (RWQCB-LA 2011).

NITRATE

The water quality issue of greatest concern with regard to effluent is the contribution of nitrate to the river. OVSD's treatment plant is one of two point source contributors of nitrogen identified in the Algae TMDL, the other being contributions from storm drains. (See "2.5.1 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 very near the bottom 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. The Thacher School and Ojai Valley School wastewater treatment facilities are not directly accounted for in either the point or non-point source contributors listed in the Algae TMDL (RWQCB-LA 2011).

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 2012).

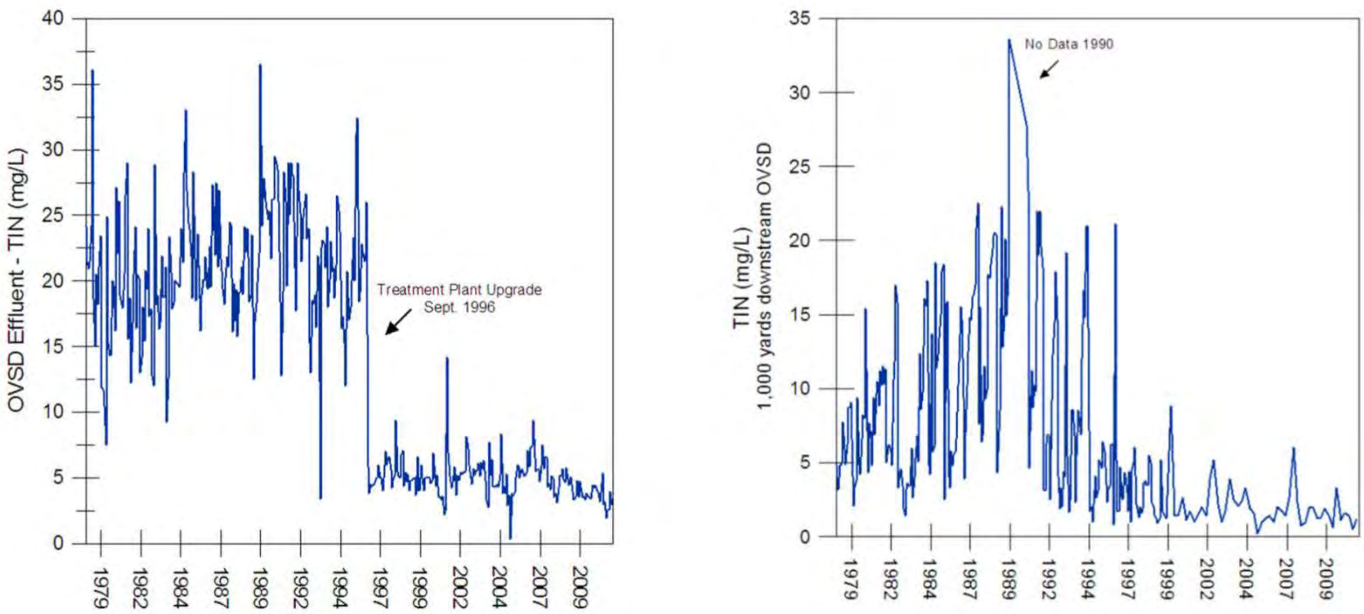


Figure 2.5.3.3 – Historic Nitrogen in OVSD Effluent and Below Treatment Plant

1) The figure on the left shows OVSD effluent total nitrogen (TIN) concentration from 1979 to 2009. 2) The figure on the right shows the concentration of TIN 1,000 yards downstream from the OVSD discharge during the same period. Since 1979, total nitrogen (of which nitrate is by far the greatest part) in OVSD's effluent has been reduced by 89%, and Ventura River TIN downstream of the plant has been reduced 80.8%.
Source: RWQCB-LA 2011

Between 2000 and 2012, OVSD's effluent concentrations of total nitrogen ranged from 2.6 mg/L to 21.1 mg/L, with an average of 5.86 mg/L (RWQCB-LA 2011). The target of the Algae TMDL is to have the average dry-weather concentration of total nitrogen in the effluent at 3 mg/L or less.

Treatment plant upgrades in 1982 and 1997 made the wastewater treatment system one of the most advanced in the state and country. OVSD utilizes virtually no chemicals in its treatment processes, relying predominantly on physical and biological processes to sanitize the wastewater and solids that the community produces.

When the nutrient removal upgrades required by the 2013 Algae TMDL go online, plant performance will be further improved, with removal capabilities that only a small number of plants in the entire nation can achieve (Palmer 2013).

Constituents of Emerging Concern

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

These chemicals enter the environment primarily through wastewater discharges, since the chemicals dissolve in water and wastewater treatment plants are generally not capable or designed to remove them. Concerns about the safety of these chemicals is 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), estrodiols (from birth control pills and other estrogen treatment), and steroid hormones (from pesticides) all alter sexual development and sexual differentiation in fishes and invertebrates. Bisphenol A, a chemical used extensively in the manufacture of certain types of plastics, has been shown to affect the central nervous system and to act as an endocrine disruptor when present in very low doses (Okada et al. 2008). Also, effects of some CECs can be transgenerational—when animals are exposed in utero, effects are transmitted not only to the offspring, but are inherited for many generations thereafter, from exposures to the grandmother or the great-grandmother animal. In addition, scientists are concerned that combining chemicals may have an additive or synergistic biochemical effect."
>
> —*Water Quality Characterization of the Channel Island National Marine Sanctuary and Surrounding Waters (SBCK & Engle 2010)*
>
> "New sampling data shows that endocrine disruptors are commonly found downstream of intensely urbanized areas and animal production facilities…. While these chemicals have likely been present in our water supply sources for as long as such consumer products have been in use, they have gone virtually undetected until recently as better technology has improved our ability to detect them."
>
> —Association of California Water Agencies website (ACWA 2014)

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 the monitoring of CECs in municipal recycled water.

The Los Angeles Regional Water Quality Control Board now requires the Ojai Valley Wastewater Treatment Plant, as part of its NPDES 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 dropoff bins, have begun in order to help address the problem.

Biosolids

Biosolids—the nutrient-rich, semi-solid byproduct of wastewater treatment—from the treatment plant are made into compost that meets US EPA criteria for a Class A product for unrestricted use. In warmer months the biosolids are composted onsite and made available to the public free of charge. However, when winter or wet weather conditions make composting more difficult, the biosolids are trucked to the San Joaquin Valley for further processing and application. As a result, OVSD recycles 100% of the wastewater it treats. The water is used by the river, ecosystem, and groundwater recharge and the compost is used for landscaping and soil rejuvenation.

Regulations – Sewer Systems

Operators of sewer systems and wastewater treatment facilities that discharge to surface waters are issued NPDES permits from the Regional Water Quality Control Board (RWQCB) (and those discharging to the ground are issued waste discharge requirements). These permits outline very specific requirements to prevent impacts to surface water, and also integrate other water quality requirements, including those of TMDL regulations. See "2.5.1 Surface Water Quality" for a discussion of these various regulations.

As part of meeting their NPDES requirements, both OVSD and Ventura Water must implement a pretreatment program. Pretreatment programs are used at commercial and industrial operations to remove difficult-to-treat or hazardous constituents—such as heavy metals, restaurant grease, and oil—before they are discharged into the sewer system. Through their pretreatment programs, wastewater treatment plant operators protect the sewer system as well as the waters that receive treated effluent.

OVSD is required to complete thousands of water quality tests on its discharge each year, including daily, weekly, monthly, semi-annual and annual tests. Wastewater treatment plant operators are also required to test for a long list of "constituents of emerging concern," including pharmaceuticals, pesticides and personal care products. These are substances that are not currently being treated for or regulated, but which are monitored because of the risks they may pose. See "2.5.1 Surface Water Quality" for information about the water quality monitoring performed in the watershed by the Ojai Valley Sanitary District.

Table 2.5.3.2 – Sewer System Regulations

Sewer System Component	Regulation/Administer
Wastewater Influent	Pretreatment programs (administered by treatment plant operators to meet NPDES requirements)
Wastewater Plant Effluent	NPDES permit (includes WDR, TMDL and constituents of emerging concern testing requirements)/RWQCB administers

Septic Systems

Septic systems are underground, self-contained systems that treat sewage onsite. In locations where it is difficult or too expensive to install or operate sewer systems, septic systems have served as an alternative. Septic systems can eliminate the need to transport the waste, which can require considerable energy, and they keep treated water higher in the watershed and available for groundwater recharge.

Data on the exact locations and number of septic systems in the watershed are imprecise. An assessment done by Larry Walker and Associates in 2011 conservatively estimated that the watershed has about 2,131 septic systems (LWA 2011). Using this estimate, and Ventura County's average of 3.04 people per household, it can be deduced that at least 6,500 people in the watershed use septic systems at home.

Conventional systems follow a basic treatment process including a solid pipe that transports household wastewater out to a subsurface septic tank. Treatment boxes are typically made of concrete, plastic, or metal and involve an anaerobic environment, which breaks down harmful pathogens and bacteria that are present in excreta. Because not all solids break down in the tank over time, septic tanks must be pumped periodically. Liquids in the treatment boxes are slowly dispersed into the surrounding soils via a *leach field*—a network of perforated pipes laid in underground gravel-filled trenches. Once liquids (also called effluent or leachate) reach the leach field, soil microbes (naturally present in the top couple of feet of soil) break down the remaining bacteria and solids, and the leachate eventually percolates down to groundwater.

Alternative systems operate in a similar manner as conventional systems, but follow different designs in order to address specific site constraints. For example, high groundwater levels or solid bedrock may require different designs. Some alternative systems known as Advanced Treatment Units have been designed to remove nitrate from effluent (VCEHD 2012). However, these denitrifying systems typically require more energy to operate and are more costly than conventional systems.

Septic Tank Leachate

Septic tank leachate is the liquid that remains after wastewater drains through septic solids. Septic tank leachate can be a significant source of pollution to groundwater and surface waters when systems are not property sited or functioning.

PATHOGENS

Well-maintained septic systems are effective at eliminating pathogenic (disease-causing) bacteria. Poorly maintained, or "failing," systems, however, can become ineffective; soils surrounding septic systems can also become saturated over time and no longer percolate wastewater in a safe manner.

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 indicator bacteria or coliform (see the Water Quality Impairments Map (Figure 2.5.1.1) in "2.5.1 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.

NUTRIENTS

Poorly sited or functioning septic systems can be significant sources of nutrients to shallow groundwater, which may then seep into surface waters. Nitrogen is particularly mobile in groundwater, while phosphorus has a tendency to be absorbed by the soils (RWQCB-LA2011).

The depth of groundwater, soil type and saturation levels make estimating the exact amount and timing of nutrient leaching from septic systems highly variable. In the Ventura River Algae TMDL regulation, a nutrient groundwater/surface water interaction study for the Malibu Lagoon was used to estimate the "nutrient load" of septic systems in the watershed—that is the percentage of the various nutrients coming from septic system leachfields that eventually make their way to surface waters. That study reported nutrient loss rates to surface water of 32% for nitrogen and 10% for phosphorus (RWQCB-LA 2011).

Regulations – Septic Systems

New and retrofitted septic systems (technically referred to as onsite wastewater treatment systems—OWTSs) are subject to a complex set of regulations and permit requirements that address both construction and effluent discharge. In the watershed, construction is governed by the Ventura County Building Code, which integrates requirements from Title 24 of the California Code of Regulations. The Ventura County Environmental Health Division (VCEHD) is responsible for permitting and post-construction record keeping of septic systems (VCEHD 2012). Effluent discharge is governed by elements of the State Porter-Cologne Water Quality Act and the Federal Clean Water Act. The

RWQCB has responsibility for enforcing these regulations, but in some jurisdictions has delegated this authority via a memorandum of understand to local enforcement agencies. The Ventura County Environmental Health Division handles enforcement in unincorporated areas for discharges less than 5,000 gallons per day; and local cities are in the process of establishing similar arrangements with the RWQCB.

Table 2.5.3.3 – Regulation of New or Retrofitted Septic Systems (or Onsite Wastewater Treatment Systems (OWTS))		
	Water Quality Regulation	**Enforcing Agency**
Construction of New or Retrofitted OWTS	City and county building codes	Ventura County Environmental Health Division, and city and county building departments
Retrofitted OWTS	State Porter-Cologne Water Quality Act Federal Clean Water Act	Regional Water Quality Control Board – Los Angeles (RWQCB). The RWQCB has delegated its enforcement authority to the Ventura County Environmental Health Division for unincorporated areas; and the cities are in the process of establishing similar arrangements with the RWQCB.

In 2000, the California State Legislature adopted a significant new policy, AB 885, which required the State Water Resources Control Board (SWRCB) to establish new regulations for permitting and operation of septic systems to address groundwater and surface water quality contamination resulting from septic systems (SWRCB 2012). In response, in 2012 the SWRCB approved a new risk-based, tiered approach for the regulation and management of septic system installations and replacements and set expected levels of performance and protection. The new regulation requires owners of existing septic systems located near an identified surface water body that exceeds water quality standards for bacteria or nitrogen compounds such as nitrates to retrofit their septic system. The regulation also applies to new home or replacement septic systems. These new standards took effect in May 2013.

In the Ventura River watershed, however, the Algae TMDL regulation subjects septic systems to additional requirements that effectively override the state's new "OWTS Policy." The Algae TMDL requires that all septic systems in the entire watershed, including existing systems, be upgraded or modified to meet nitrogen removal treatment standards. This is because the TMDL applies to all reaches and tributaries of the Ventura River and because of the demonstrated connectivity between groundwater surface water throughout the watershed. However, the TMDL also recognizes that in some cases discharges from septic systems in the watershed may not contribute to water quality impairments, and it has a provision allowing for a "special study" to investigate which systems are in fact contributing and which ones are not.

The Ventura County Environmental Health Division is pursuing funding to conduct such a special study, which needs to be concluded by June of 2016. If funding is secured and the special study findings are approved by the RWQCB, the owners whose septic systems that were found to be contributing to the impairments will be required to come into full compliance with the Algae TMDL nitrogen removal treatment standards by June of 2023.

The standards adopted in OWTS Policy may be enforced directly by the RWQCB, unless the VCEHD can submit a plan acceptable to RWQCB outlining how these state standards will be enforced through VCEHD's Local Agency Management Plan. Local enforcement has several benefits including retained local control of the building and record-keeping of OWTS's.

Gaps in Data/Information

As mentioned in the Surface Water Quality section, 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, based on "best available data," did an imperfect job of quantifying the various contributions. A more robust source assessment could better help stakeholders address the true problem, and possibly reduce regulatory costs where they may be inappropriate.

2.5.4 Near-Shore Water Quality

[Under development.]

2.5.5 Drinking Water Quality

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 is handled differently 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 California Department of Public Health (VCEHD 2013).

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.

Analysis for the primary drinking water standards includes indicator bacteria, aluminum, antimony, arsenic, asbestos, barium, beryllium, cadmium, cyanide, fluoride, mercury, nickel, nitrate (as NO3), nitrate & nitrite (sum as nitrogen), nitrite (as nitrogen), perchlorate, selenium, and thallium.

Analysis for the secondary (esthetic) drinking water standards 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.

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

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.

CMWD's 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" from its Foster Park Subsurface Diversion Dam, and could also make use of surface water via its surface diversion at Foster Park. The City's first sanitary survey for its Avenue water treatment plant was completed in October 1995; updates were prepared in 2001, 2006, and 2011.

Ordinances & Resolutions to Protect Lake Water Quality

Lake Casitas and its Watersheds
Photo courtesy of Bruce Perry, Department of Geological Sciences, CSU Long Beach

Lake Casitas 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 lake is fed by water from the Ventura River and by direct runoff from subwatersheds surrounding the lake. In order to prevent contamination of the lake's water, the Casitas Municipal Water District (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 are primarily flows from the mountains of the US Forest Service lands. In compliance with California Health and Safety Code § 115825, Casitas has enforced its rule against body contact recreation in the lake to protect the lake's water quality.

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

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

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

Ordinance 10-01 – Public Use of Lake Casitas

Lake Casitas Sign: No Swimming or Body Contact

CMWD operates Lake Casitas Recreation Area in conformance with Casitas Municipal Water District 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 Quagga/Zebra Mussels Sign

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 CMWD concerning use of lands acquired under the Casitas open space program. The United States Bureau of Reclamation acquired these lands, as authorized by Congress, for the protection of Lake Casitas water quality. The lands are commonly referred to as the Casitas Watershed Lands or the Teague Memorial Watershed. The acquisition of the lands was followed by the removal of many homes and ranches in the area 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.

Key Data and Information Sources/Further Reading

Key documents that address drinking water quality issues in the watershed are listed below. See "5.5 References" for complete reference information.

Sanitary Surveys

The Surface Water Treatment Rule (SWTR) requires that all water systems subject to the SWTR conduct a sanitary survey of their watersheds at least once every five years. The purpose of a watershed sanitary survey is to identify actual or potential sources of contamination in the watershed, and any other watershed-related factors that are capable of producing adverse effects on the quality of water used for domestic drinking water. In the Ventura River watershed, Casitas Municipal Water District (CMWD) and the City of Ventura prepare sanitary surveys for the specific drainage areas that feed into their water systems. These sanitary surveys are comprehensive assessments of 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)

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

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: www.casitaswater.org/lower.php?url=annual-water-reports

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

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

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

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

2.6 Ecosystems

2.6.1 Habitats

[Under development.]

2.6.2 Species

Special Status Species

The Ventura River watershed is home to numerous special status plant and animal species: species protected at either the federal, state, or local level. One of those species, the southern California steelhead trout, is of particularly significance to water managers because of its need for in-stream water for its survival.

Southern California Steelhead

The Ventura River watershed is designated as critical habitat for southern California steelhead trout (Oncorhynchus mykiss irideus), a federally listed endangered species. The following excerpt describes this specific population of steelhead:

> "NOAA Fisheries listed the southern California steelhead, *O. mykiss,* as endangered in 1997 under the Endangered Species Act (ESA) of 1973. Steelhead were organized into stocks of evolutionary significant units (ESU) and represented groupings that were considered to be substantially isolated from other steelhead stocks reproductively and were an important part of the evolutionary legacy of the species. The southern California steelhead ESU includes steelhead populations from the Santa Maria River in San Luis Obispo County south the US/Mexican border in San Diego County in 2002. In a later delineating approach, NOAA Fisheries recognized the anadromous life history form of *O. mykiss* as a distinct population segment (DPS) under the ESA.
>
> "The DPS policy differs from the ESU by delineating a group of organisms by "marked separation" rather than "substantial reproductive isolation". In the case of *O. mykiss* of the southern California steelhead ESU, this marked separation between the two life history forms was considered valid because of physical, physiological, ecological, and behavioral factors related to its anadromous life history characteristics. Both resident and anadromous *O. mykiss*, where the two forms co-occur and are not reproductively isolated, are still part of the ESU; however, the anadromous *O. mykiss* (steelhead) are now part of a smaller subset identified as the southern California steelhead DPS. "
>
> —2008 Progress Report for the Robles Diversion Fish Passage Facility (Casitas 2008)

The following excerpt describes the life history of the steelhead:

“Steelhead (Oncorhynchus mykiss) are the anadromous form of coastal rainbow trout, spending part of their life in the ocean and part in fresh water. Resident rainbow trout exhibit a nonanadromous life-history type of O. mykiss that spends its entire lifecycle in fresh water. Historically, steelhead were present in most coastal California streams, and resident rainbow trout were present in lakes and streams that did not have access to the ocean. In many historical steelhead streams, passage barriers have blocked migration to and from upper stream reaches, resulting in residualization of steelhead populations. On the Ventura River, as in many coastal California streams, natural and man-made barriers (e.g., dams and road crossings) to upstream migrations separate populations of steelhead and resident rainbow trout. In addition, barriers upstream of habitat accessible to steelhead trout potentially separate populations of resident rainbow trout. It should be noted, however, that some mature resident rainbow trout have been documented downstream of barriers, some resident populations may seed downstream habitats with juveniles that have the potential to become steelhead, and a range of migratory behaviors may occur.

“Steelhead generally spend 1 to 2 years in the ocean before returning to spawn for the first time. Unlike other anadromous Pacific salmonids, steelhead may survive spawning, return to the ocean, and spawn again in a later year Steelhead typically migrate upstream when streamflows rise during a storm event, 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, and can potentially occur through June in the Ventura River. Steelhead generally spawn at the heads of or in riffles with gravel substrate, or in the tail of a pool. Optimal size of gravel substrate ranges from 0.6 to 10.2 centimeters (cm). The female digs a pit in the gravel where she deposits her eggs. Often, more than one male will fertilize the eggs before the female covers the eggs with gravel, creating a redd.

“During incubation, sufficient water must circulate through the redd to supply embryos with oxygen and remove waste products. Abundant fine sediments can interfere with this process and result in embryo mortality. Juvenile steelhead emerge from the gravel in approximately 5 to 8 weeks, between March and April, depending on water temperature. In water temperatures around 15.6°C (60°F), which is typical in the Ventura River, steelhead can emerge from the gravel in as short a timeframe as 3 weeks.”

Figure 2.6.2.1 – Critical Habitat

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. Problems posed by invasives range from outcompeting native species for habitat, to significantly increasing the water demand of riparian vegetation, increasing fire hazard, and potentially increasing the management costs of Lake Casitas—dramatically.

Arundo donax is a particularly significant invasive plant because of the extraordinary amount of water it consumes relative to native riparian vegetation.

Arundo

Every day during the warm season in the watershed, the invasive alien plant *Arundo donax* steals water—up to three times as much water as the native streamside plants that it outcompetes, or about 26,000 gallons of water (1 inch of water over an entire acre) per day per acre infested. Assuming only four warm season months a year, this translates to 3.2 million gallons of water (10 feet of water over an acre) per infested acre every year. That is enough water to support 16 households or 4 acres of citrus—all year. And that is just for one infested acre.

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 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 cane or 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 stealing water and destroying 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 Ventura River 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 this could be considered a bargain as water supply projects go.

2.6.3 Habitat Connectivity

[Under development.]

2.6.4 Matilija Dam

In 1948, Matilija Dam was constructed at the lower end of Matilija Creek in order to provide water storage and flood control. The reservoir was originally built to hold 7,000 acre-feet (AF) of water; but the dam height was lowered to address safety concerns, and 6 million cubic yards of sediment from the highly erosive mountains along Matilija Creek has accumulated behind the dam. The reservoir's capacity, as of 2004, was estimated at 500 acre-feet (AF)—7% of its original capacity. By 2040, if the dam still stands, the reservoir will likely be completely full of sediment (USACE 2004a).

Matilija Dam
Photo courtesy of Mark Capelli

Besides no longer providing a significant water storage or flood control function, the dam also blocks access by the endangered southern California steelhead to prime spawning habitat above the dam.

> "Historically, the Ventura River system supported a substantial number (approximately 4,000 to 5,000 spawning fish) of southern California steelhead, an endangered species of migratory trout. NOAA Fisheries' most recent population estimates for steelhead are less than 100 adults for the entire Ventura River system. The steelhead habitat upstream from Matilija Dam was historically the most productive spawning and rearing habitat in the Ventura River system. It is estimated that about 17.3 miles of prime steelhead habitat was lost due to the construction of Matilija Dam."
>
> —*Matilija Dam Ecosystem Restoration Feasibility Study* (USACE 2004b)

In addition, the dam has altered the flow of sediment downstream, thereby diminishing the amount of sand replenishing local beaches.

> "Downstream beaches have narrowed measurably since construction of Matilija Dam. Since its construction, the dam has blocked approximately 6,000,000 cubic yards of sediment. With a diminished supply of river-based sand replenishment, beaches in the region are becoming increasingly eroded, causing habitat reduction and a loss of beach sand for recreational use."
>
> — *Draft Environmental Impact Statement/Environmental Impact Report for the Matilija Dam Ecosystem Restoration Project (USACE 2004)*

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.

In the 1990s, the local chapter of the Surfrider Foundation took up the charge and began urging the County of Ventura to remove the dam. In 1998, the County of Ventura officially resolved to remove the dam. The Bureau of Reclamation completed an appraisal investigation in 1999. In 2001 the *Matilija Dam Ecosystem Restoration Project* was initiated.

Matilija Dam Ecosystem Restoration Project

The Matilija Dam Ecosystem Restoration Project (MDERP) is a joint effort between the Ventura County Watershed Protection District (VCWPD), 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 on the project for hydrology, hydraulics, and sediment modeling; the California Coastal Conservancy has been the primary local funding agency. Additionally, 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).

The MDERP feasibility study, including CEQA (California Environmental Quality Act) and NEPA (National Environmental Policy Act) documents, was completed in 2004 and at the time 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:

- Improve aquatic and terrestrial habitat along Matilija Creek and Ventura River.
- Restore fish passage for the endangered southern California steelhead.
- Restore natural processes to support beach sand replenishment.
- Enhance recreational opportunities.

The study identified a number of key constraints that influenced the formulation and evaluation of the various alternatives, including:

- Maintain the current level of flood protection along the Ventura River downstream of Matilija Dam.
- Limit adverse impacts to normal water supply quantity, quality, and timing of delivery to Casitas Reservoir via Robles Diversion Dam.
- Limit impacts to water quality in Lake Casitas by potentially turbid flows resulting from the release of the finer sediments trapped behind Matilija Dam.

(USACE 2004b)

The most challenging issue involved in the dam's removal is management of the 6 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: 4 million cubic yards of mixed fine and coarse sediments would be contoured within the dam basin area and allow for natural transport to the ocean and beaches in future flood events; and the 2 million cubic yards of fine silts and clay closest to the dam would be dredged and slurried in a pipeline to various locations downstream of the Robles Diversion—to avoid impacting water diversions to Lake Casitas.

In 2007, 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—most of that from bonds issued by the state.

Costs and Stakeholder Acceptability

Once project design began, however, the USACE calculated that slurrying the 2 million cubic yards of sediment would cost about double what was estimated in the feasibility study. Additionally, 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 majority of stakeholders found the USA alternative unacceptable due the deviation from the authorized project, as well as the permanent impacts to the canyon and potential downstream risks.

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 a number of times in 2010 and 2011. A Technical Advisory Committee (TAC) grew out of this effort in order to address the data and research needs that could resolve the sediment management issue.

The TAC began work in 2011, which led to hiring a consultant team began to perform several studies deemed necessary to move forward. The studies, which began in March 2014, will focus on cost-effective methods to remove the dam and manage the 6 million cubic yards of sediment behind the dam. In addition to refinements to the federally-authorized MDERP, the consultants will analyze the potential for natural sediment transport of all sediment behind the dam in a way that will minimize impacts to Robles Diversion and develop methods to offset any residual impacts to Robles Diversion. Methods to evacuate sediment from behind the dam will include progressive notching as well as other control methods including gates and a low-level outlet.

Mitigation

A long list of projects to accommodate expected downstream changes in the Ventura River that would occur as a result of the dam's removal must be implemented before the dam can be removed. Projects include the redesign and improvement of two bridges to increase hydraulic capacity, modifications to the Robles Diversion and Fish Passage Facility, installation of contingency water wells, redesigning of two existing levees as well as a new levee, and other flood management measures.

As part of this project, the removal of *Arundo* and other invasive exotic plants above and below the dam was started in 2007. This project has been very successfully implemented, as witnessed by the elimination of *Arundo* and the numbers and variety of native animals returning to the treated areas. Ongoing treatment and monitoring is planned for many years to come.

2.6.5 Access to Nature

With over half of the land in protected status, there are many opportunities for people to come into contact with nature in the Ventura River watershed. The watershed's natural areas are highly valued for their aesthetic, social, recreational, therapeutic, and spiritual values, and provide opportunities for people of all ages to interact with the outdoor environment. Through interaction with nature, people gain an appreciation for natural processes and are more likely to support watershed protection efforts and have healthier, happier lives.

The variety of landscapes and features in the Ventura River watershed provide for a wide range of activities including walking, hiking, wildlife-viewing, picnicking, camping, cycling, horseback riding, fishing, boating, canoeing, kayaking, swimming, and surfing.

In addition to publicly-owned recreational opportunities, there are also privately owned golf courses and camping areas, and nonprofit land conservancies make a significant contribution to the amount of land and miles of trails available for enjoyment in the watershed.

Table2.6.5.1 Acres of Recreation Area and Miles of Trails		
Nature Preserves	2,112.2	acres
Park and Recreation Areas	1,238.3	acres
US Forest Service	69,062.0	acres
Trails	131.8	miles

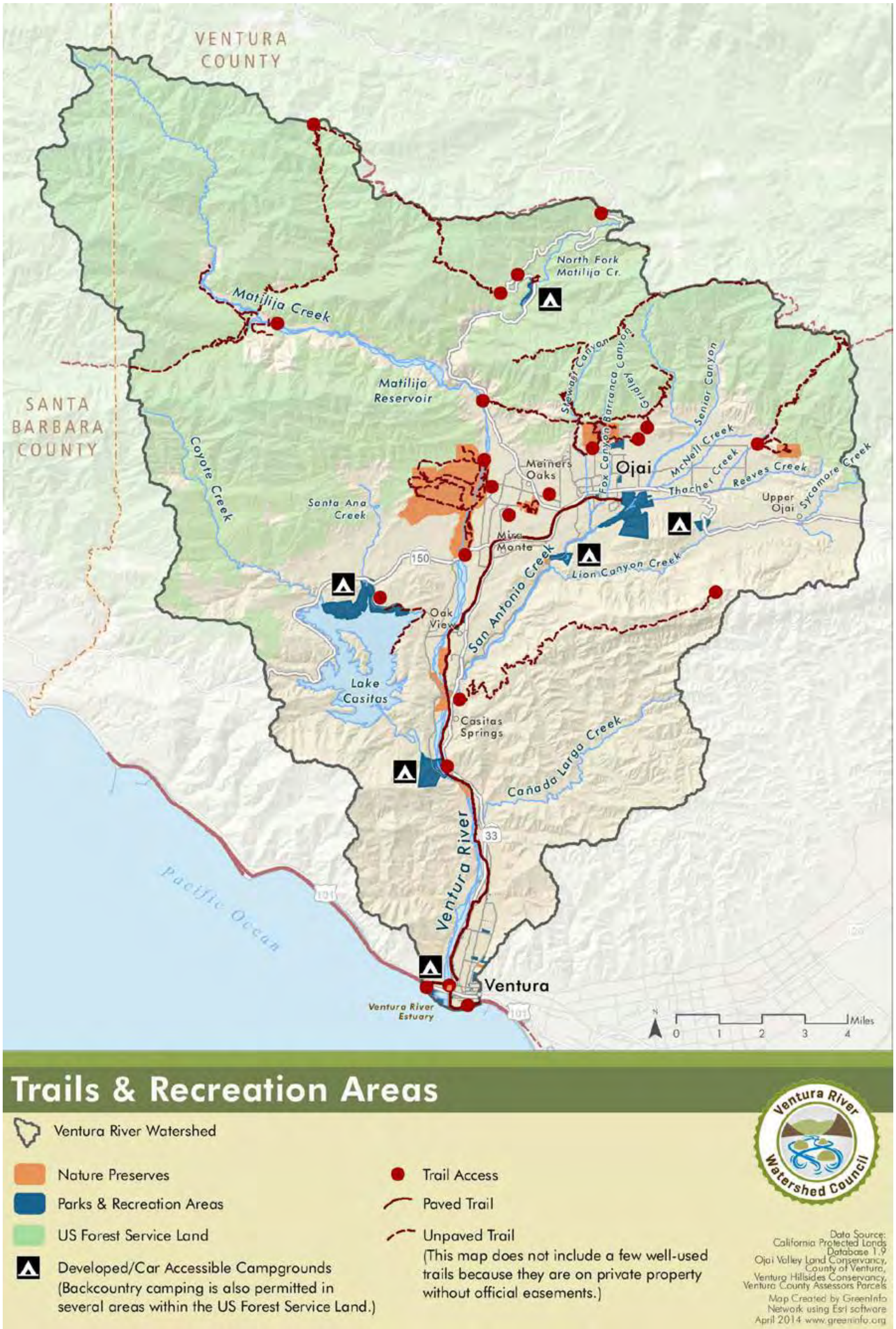


Figure 2.6.5.1 – Trails & Recreation Facilities Map

2.7 Socioeconomics

2.7.1 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.

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 locally as "the Avenue." Two small coastal watersheds—the North Ventura Coastal Streams watershed and the Buenaventura watershed—flank the Ventura River watershed's lower section and have important water-related relationships with the Ventura River watershed.

Jurisdiction	Acres	% of Watershed
Ventura County	71,177	49.14%
U.S. Forest Service	69,062	47.68%
City of Ojai	2,795	1.93%
City of Ventura	1,798	1.24%

Figure 2.7.1.1. Government Jurisdictions

2.7.2 Demographics

This section provides a summary of population, income, employment, and other key demographic data.

Table 2.7.2.1. Population*	
Watershed Total	44,140
City of Ojai	7,461
City of Ventura (within watershed)	13,736
Unincorporated Ventura County	22,943

* Estimated with a GIS tool using Census Block Groups (except for City of Ojai, which is direct from the 2010 Census).

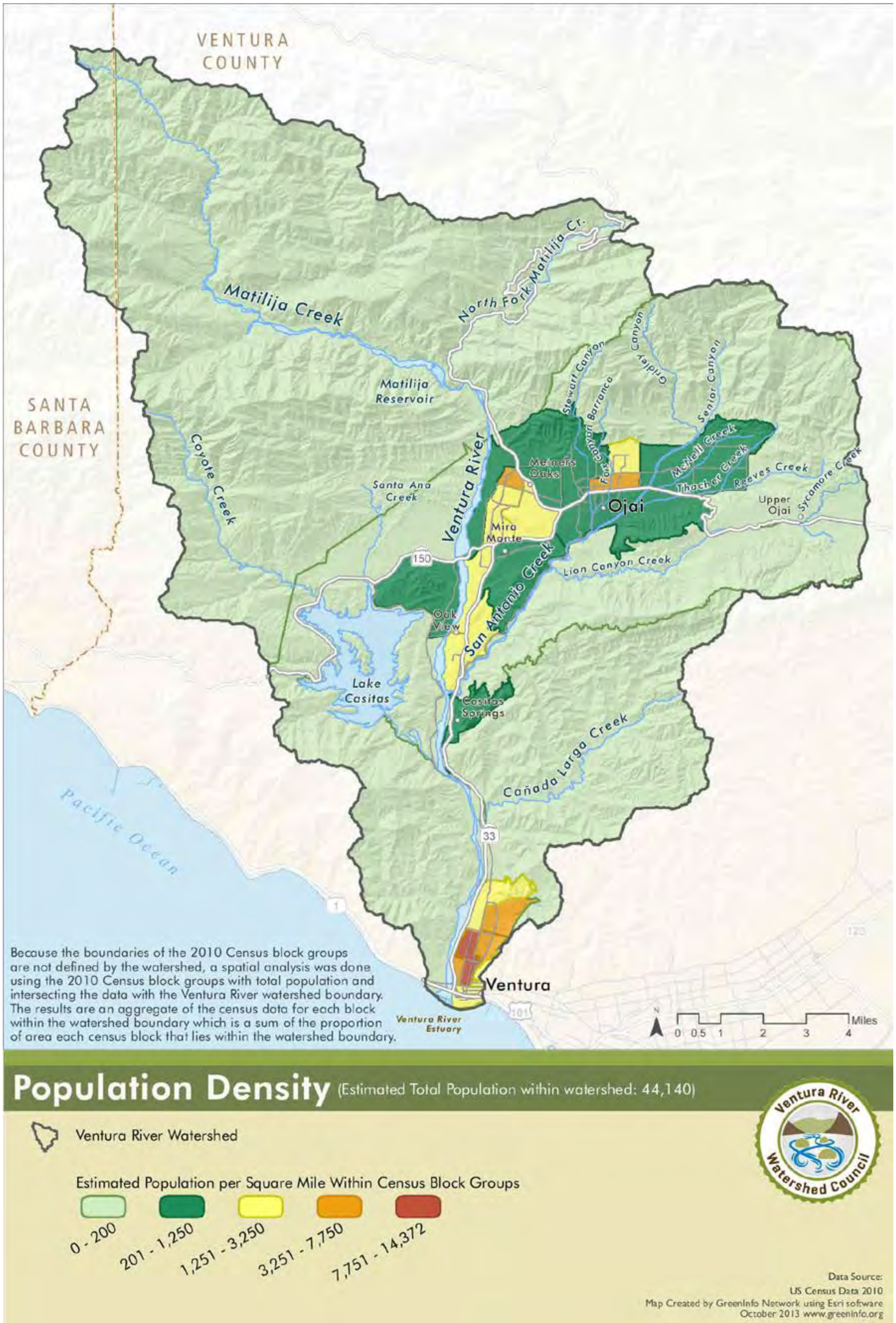


Figure 2.7.2.1 Population Density

Table 2.7.2.2. Socioeconomic Data, 2008 and 2012		
	2008	**2012**
Average (weighted) Household Income	$48,387	$48,423
% of Household by Income		
Below 25k	31.1%	30.5%
25k-50k	28.4%	28.5%
50k-100k	28.2%	28.5%
100k+	12.3%	12.5%
Percentage of Renters v. Homeowners		
Owner	59.8%	60.2%
Renter	40.2%	39.8%
Single-family v. Multi-family housing permits		
Total	16,177	16,458
Single-family Detached Housing Units (occupied)	11,053	11,252
Single-family Attached Housing Units (occupied)	1,044	1,065
Multi-family/Apartment/Condo Housing Units (occupied)	2,910	2,967
Mobile Home Housing Units (occupied)	1,114	1,124
Boat, RV, Van, etc. (occupied)	55	49
Jobs by sector		
Total	18,624	17,916
Agriculture & Mining jobs	3,814	4,214
Leisure and Hospitality (Art/Entertainment) jobs	2,840	2,604
Information jobs	54	55
Construction jobs	821	587
Education and Health Services jobs	4,078	3,954
Financial Activity(FIRE) jobs	744	711
Manufacture jobs	924	786
Other Services jobs	1,426	1,241
Professional and Business Services jobs	2,055	1,951
Public/Administration jobs	12	29
Retail Trade jobs	987	931
Transportation and Warehousing and Utility jobs	527	441
Wholesale Trade jobs	342	410

Source: Southern California Association of Governments (SCAG 2013)
This local profile was prepared by SCAG on special request using the Ventura River watershed's boundaries. SCAG's local profiles utilize the most up-to-date information from a number of publically available sources, including the Census Bureau, California Department of Finance, and the National Center for Educational Statistics.

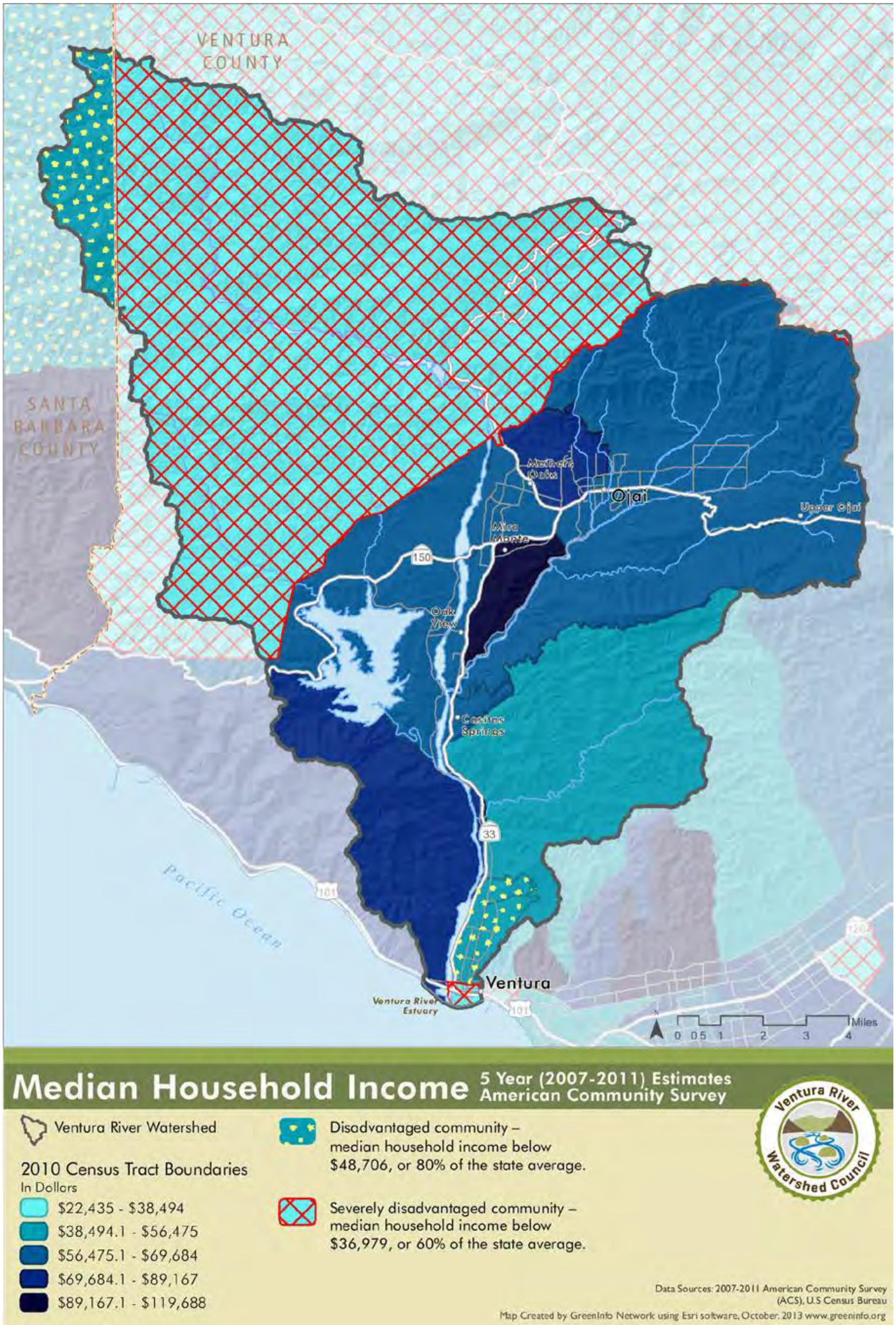


Figure 2.7.2.2 Median Household Income

Figure 2.7.2.3 Spanish Speaking Households

2.7.3 Land Use and Management

Much of the land in the Ventura River watershed is relatively undeveloped. The northern half lies within the Los Padres National Forest, and development in the southern half of the watershed has been tempered by air quality and land use regulations, and by a scarcity of water.

The Southern California Association of Governments (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 only about 13% of the land area in the watershed. Of this, agriculture makes up 5%, residential land uses 4%, oil and mineral extraction 1.5%, and commercial, industrial, and miscellaneous land uses the remaining 2.5%.

Agriculture

Current data sources about the types and acreages of crops grown in the watershed are not comprehensive. The two agriculture maps provided below provide a different look at farming in the watershed. The "Agricultural Crops" map shows data collected by the Ventura County Agricultural Commissioner's office as part of their permitting process. Because it is linked to permit activity, it is neither completely comprehensive nor up-to-date, but it provides a good approximation of the crops grown in the watershed. 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.

Oil Extraction

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 one of the important oil-producing areas in the United States. 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. The "Oil Wells" map below shows the locations of oil wells in the watershed.

Protected Lands

As illustrated in Figure 2.7.3.5, protected lands make up a significant part—57%—of the Ventura River watershed. 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 2.7.3.6 shows the areas of interest of the Ojai Valley Land Conservancy and the Ventura Hillsides Land Conservancy.

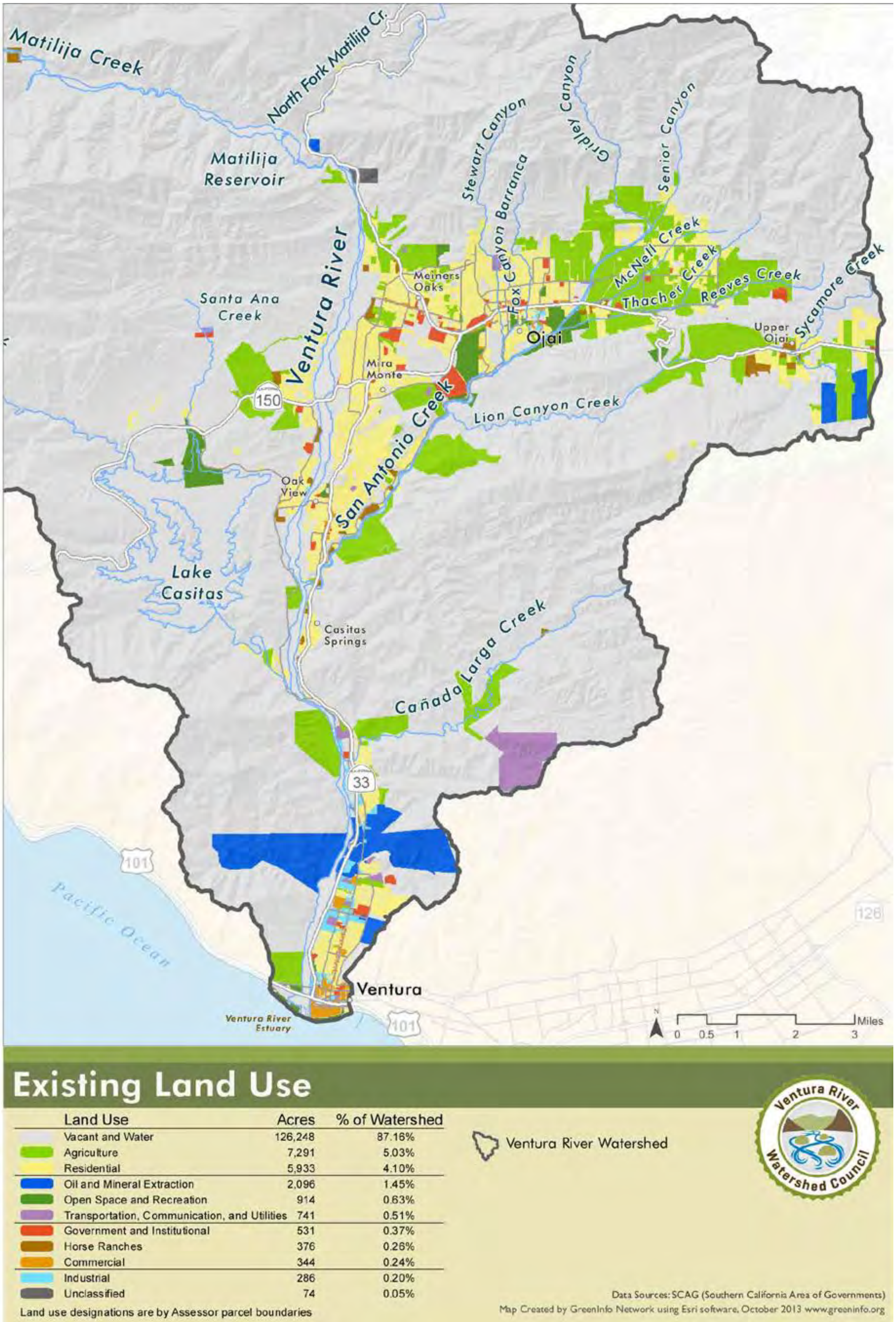


Figure 2.7.3.1 Existing Land Uses

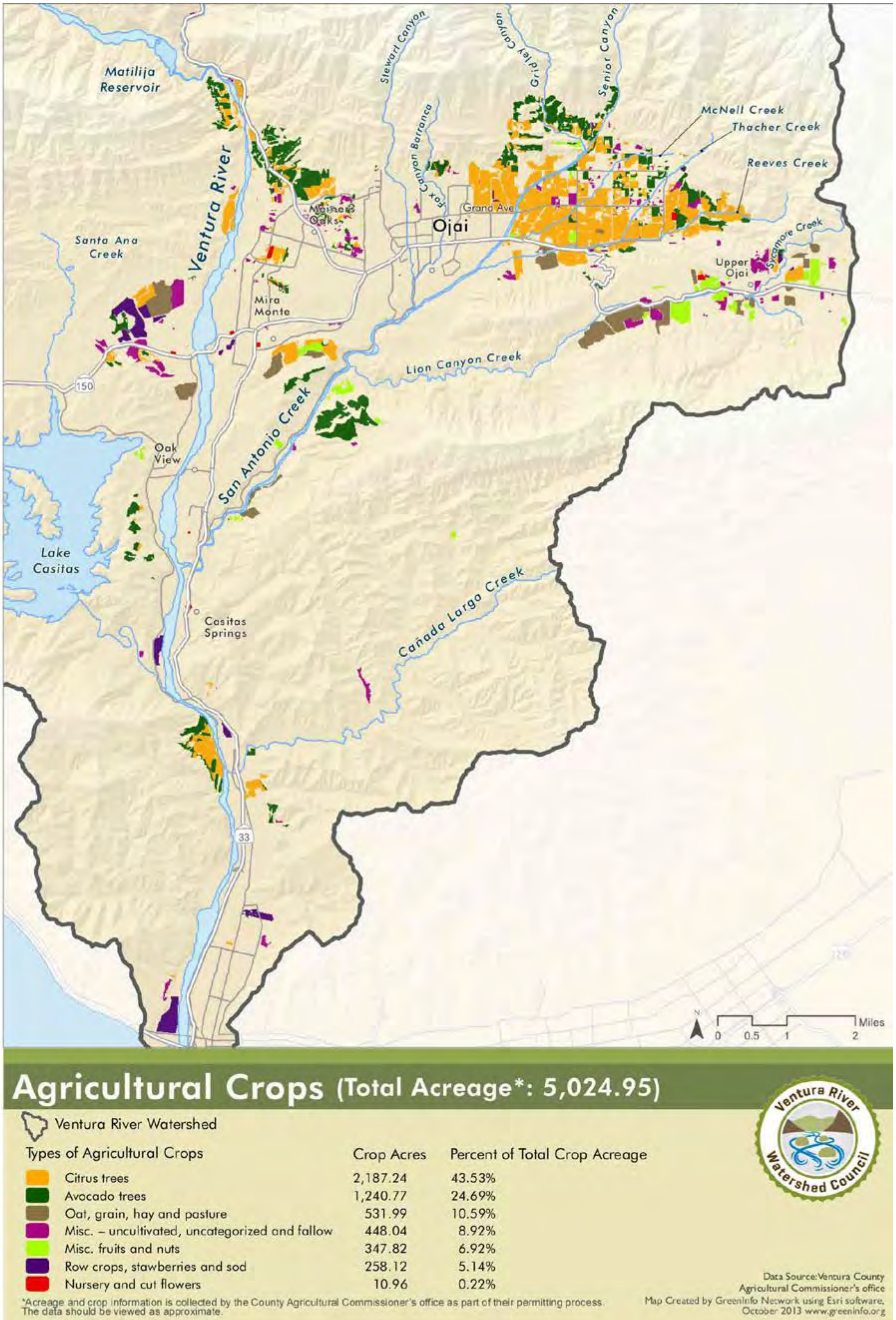


Figure 2.7.3.2 Agricultural Crops

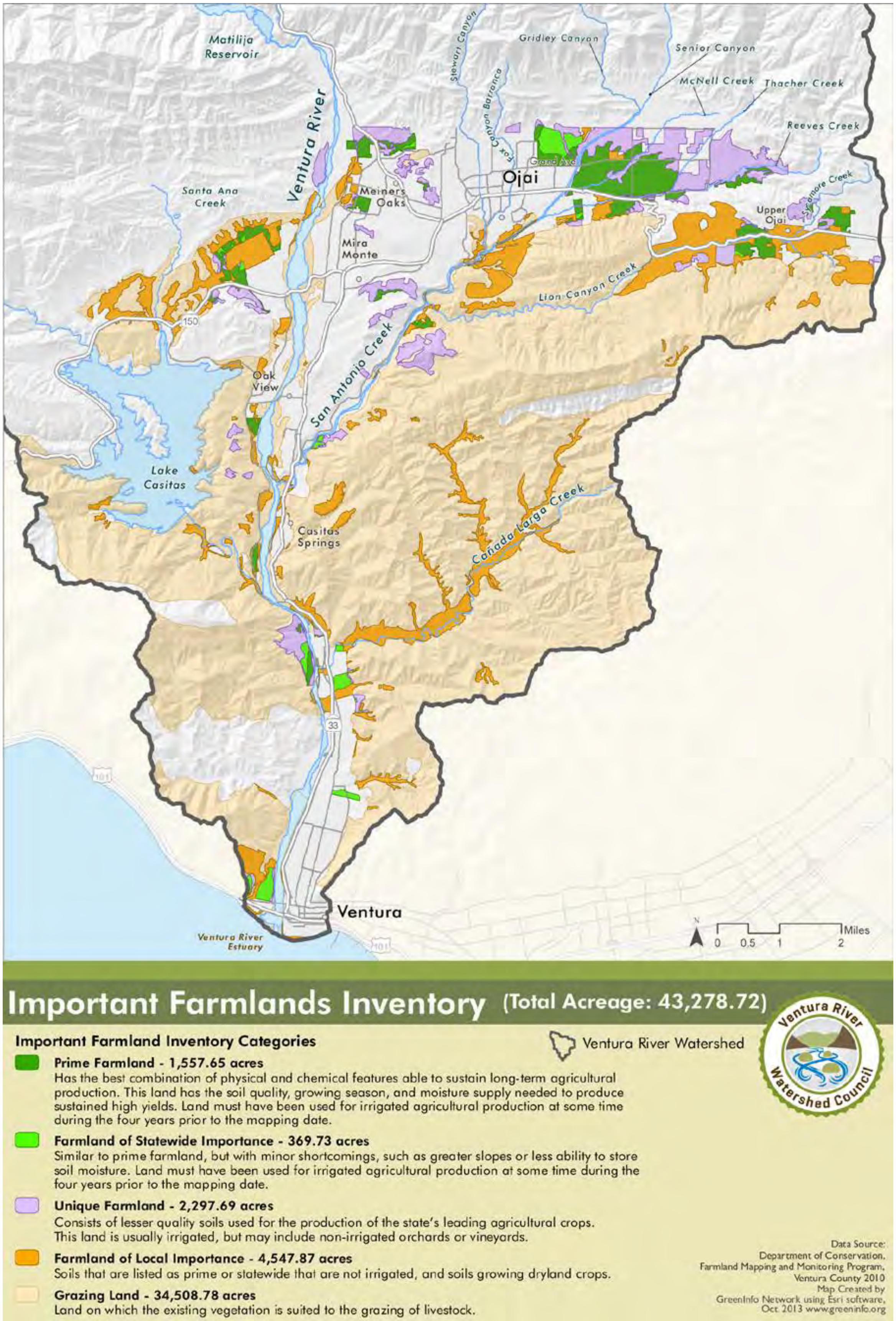


Figure 2.7.3.3 Important Farmland Inventory

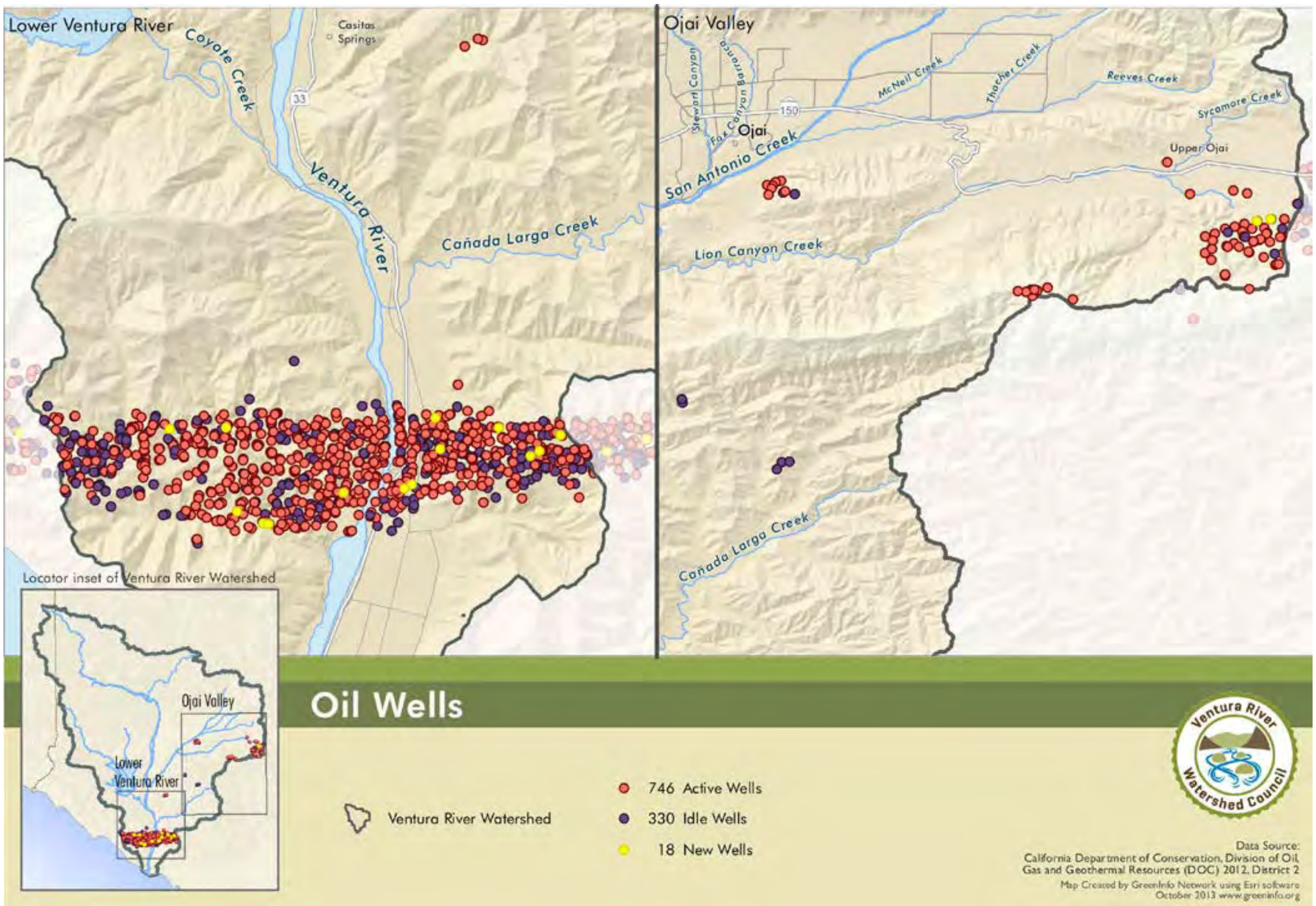


Figure 2.7.3.4 Oil Wells

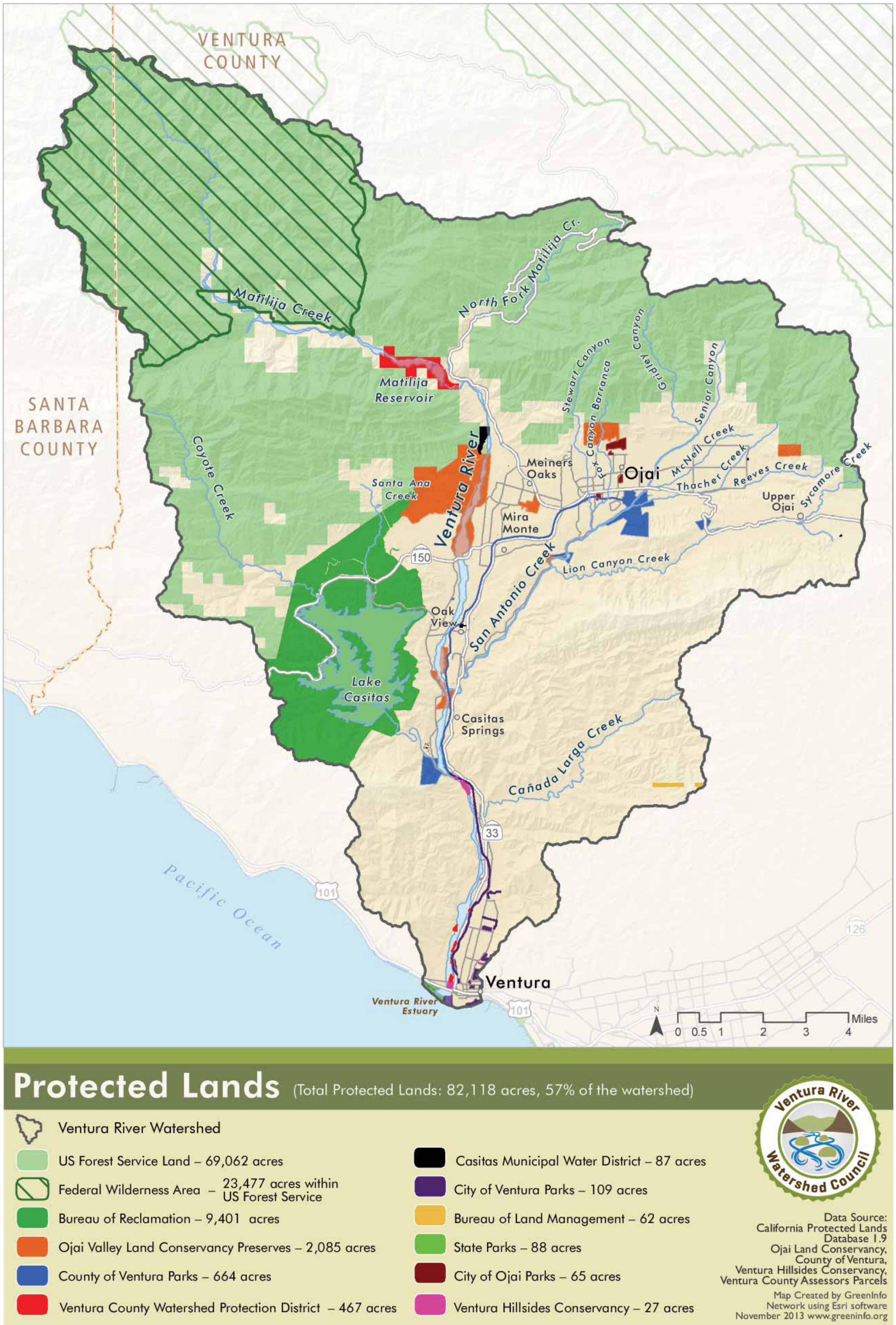


Figure 2.7.3.5 Protected Lands

Figure 2.7.3.6 Local Land Conservancy's Areas of Interest

Part 3 - Watershed Plan, Projects and Programs

3.1 Plan Guiding Framework

The guiding framework for the Ventura River Watershed Management Plan comprises the purpose of the plan, its 7 goals and 44 associated objectives, and a set of 8 values—all of which were agreed upon by the Ventura River Watershed Council. The framework serves as the structure or foundation upon which the watershed management plan was built, and constitutes a vision for where the Watershed Council intends to go with its watershed planning and management efforts.

3.1.1 Purpose

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. Here 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.

3.1.2 Goals and Objectives

The Watershed Council approved 7 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.
- 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.

Each goal statement below is followed by a list of objectives. Each objective addresses a key facet of the goal. Together, the objectives identify the assumptions about what needs to be accomplished in order to achieve the goal. Objectives, with their greater specificity, are also the measuring stick against which progress can be gauged.

1. 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.

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

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.

2. Clean Water

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

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.

3. 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.

a. Minimize risks to human life and property due to flooding adjacent to Ventura River, 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.

4. Healthy Ecosystems

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

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.

5. Access to Nature

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

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 natural areas.

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.

6. 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.

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 in the watershed.

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

7. 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.

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.

3.1.2 Guiding Values

The Watershed Council established 8 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.

3.2. Existing Projects, Programs, and Accomplishments

Watershed stakeholders are already making great advances individually and in some cases together. Table 3.2.1 summarizes watershed-related accomplishments in the Ventura River watershed over a 3-year period: 2011 to 2013. The list includes 108 different projects and programs that have 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.

Table 3.2.1. List of Accomplishments, 2011 - 2013

ID#	Years	Primary Lead/ Other Leads*	Project/Program
Sufficient Local Water Supplies			
1	2011-2012	Casitas MWD	**Free Landscape and Indoor Water Use Surveys.** 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.
2	2011-2012	Casitas MWD	**Free Leak Detection Surveys.** Conducted 189 free leak detection surveys for direct customers.
3	2012-2013	Casitas MWD	**Water Infrastructure Improvements – Casitas MWD.** Made repairs and upgrades to pump electrical equipment to improve safety and operational efficiency. Made repairs and seismic improvements to Casitas' only water tank in Upper Ojai.
4	2011	Casitas MWD	**Demonstration Landscape.** Installed a demonstration low-water-using landscape at Casitas MWD headquarters.

Table 3.2.1. List of Accomplishments, 2011 - 2013			
ID#	**Years**	**Primary Lead/ Other Leads***	**Project/Program**
5	2011-2012	Casitas MWD / Ventura River CWD, Meiners Oaks WD	**Water Efficient Equipment – Distributed for Free and Rebated**. 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, 1993 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 & commercial high-efficiency toilets, 97 residential & commercial weather-based irrigation controllers.
6	2011-2013	Casitas MWD	**Water Conservation & Efficiency Workshops/Classes and Education.** Hosted 8 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.
7		Casitas MWD / Senior Canyon MWC	**Water Infrastructure Improvements – Senior Canyon.** Casitas MWD 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.
8	2011-2014	Meiners Oaks WD	**Water Infrastructure Improvements – Meiners Oaks WD.** 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.
9	2012	Meiners Oaks WD	**Surface and Groundwater Interaction Preliminary Study, Ventura River Groundwater Basin.** Commissioned a preliminary analysis of the interaction between groundwater pumping in the Ventura River Basin and surface flows in the Ventura River.
10	2011-2013	Meiners Oaks WD	**Water Conservation & Efficiency Education.** Provided informational materials to customers through website and information on bills.
11	2011	Ojai Basin GMA	**Groundwater Model.** 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.
12	2013	OV Green Coalition	**Water Awareness Month Exhibits.** During Water Awareness Month, installed a greywater exhibit at Ojai City Hall and a water conservation exhibit at Ojai Library.
13	2013	OV Green Coalition	**Educational Workshops.** Provided 2 workshops (Greywater: Rehydration for a Thirsty Land) during Water Awareness Month. Also organized a Rainwater Harvesting presentation.
14	2007-2012	RCD	**Mobile Lab Irrigation Efficiency Evaluations.** Conducted 14 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 a various cost-sharing opportunities.
15	2013	UCSB/ Surfrider	**Bren School Study "Sustainable Water Use in the Ventura River Watershed."** 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 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.

Table 3.2.1. List of Accomplishments, 2011 - 2013			
ID#	**Years**	**Primary Lead/ Other Leads***	**Project/Program**
16	2011	VCWPD/ Ojai Basin GMA	**San Antonio Creek Spreading Grounds Rehabilitation Preliminary Work.** 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 (scheduled for completion 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.
17	2011-2013	Ventura River CWD	**Water Infrastructure Improvements – Ventura River CWD.** 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.
18	2012	Ventura River CWD/ OV Green Coalition	**Demonstration Landscape.** Installed a demonstration low-water-using and ocean-friendly landscape at Ventura River County Water District headquarters.
19	2011-2013	Ventura River CWD	**Water Conservation & Efficiency Education.** Provided informational materials to customers through newsletters and website.
20	2011-2013	City of Ventura	**Water Efficient Equipment – Distributed for Free and Subsidized**. Provided free showerheads and toilet flappers to customers. Provided rain barrels at half price.
21	2013	City of Ventura	**Report – "Comprehensive Water Resources."** This report provided the City Council with a comprehensive evaluation of current and projected water supply needs.
22	2011	City of Ventura	**Plan – Water Efficiency Plan.** Plan developed to address the City's increased water supply risks, including from 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.
23	2011-2013	City of Ventura	**Water Conservation & Efficiency Education.** 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.
24	2011-2013	VCWPD	**Groundwater Elevation Monitoring.** Monitored water levels of all the groundwater basins in Ventura County.
Clean Water			
111	2011-2013	Casitas MWD, City of Ventura, Channelkeeper, OVSD, Farm Bureau, VCEHD, VCWPD, Ventura Countywide Stormwater QMP	**Water Quality Monitoring.** Thousands of water quality samples were collected throughout the watershed (some monthly, quarterly, annually, & biannually), analyzed and results provided to regulatory agencies. Includes both surface waters and groundwater.

Table 3.2.1. List of Accomplishments, 2011 - 2013			
ID#	**Years**	**Primary Lead/ Other Leads***	**Project/Program**
23	2011-2013	Al Leydecker	**Water Quality Reports/Analysis.** Produced over 10 analyses of different water quality constituents and associated patterns and relationships within the watershed.
24	2012	Casitas MWD / Watershed Council	**Water Awareness Month Promotion.** 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.
25	2012	City of Ojai/ OV Green Coalition	**Single-Use Bag Ban.** Ojai City Council passed a single-use bag ban, with considerable advocacy and support by the Green Coalition.
26	2011-2013	Farm Bureau	**Agricultural Water Quality Classes**. 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
27	2011	OVSD	**Study – "(Corrected) Source Assessment Report: Nitrogen and Phosphorus in the Ventura River Watershed."** The purpose of this report was 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.
28	2011-2013	OVSD	**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.
29	2012	OVSD	**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.
30	2012	OVSD	**Plant of the Year Award.** Won Small Plant of the Year award from the California Water Environment Association.
31	2012	OVSD	**Water Infrastructure Improvements – Ventura Ave. Sewer.** Completed $6.5 million Ventura Avenue Sewer Improvement Project to update aging infrastructure and reduce energy demand.
32	2013	RCD/ VC Public Works	**Horse and Livestock Watershed Alliance Formed.** 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.
33	2011-2013	Responsible Parties – Trash TMDL/ CCC	**Trash Reduction – Cleanups and Monitoring.** Contracted with the Calif. Conservation Corps to conduct several cleanup events in the estuary, and to conduct weekly and monthly trash monitoring events.
34	2011-2013	Channelkeeper	**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.
35	2013	Channelkeeper	**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.

Table 3.2.1. List of Accomplishments, 2011 - 2013			
ID#	**Years**	**Primary Lead/ Other Leads***	**Project/Program**
36	2011	Channelkeeper	**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.
37	2013	Channelkeeper	**Continuous Data Loggers.** Upgraded the quality of water quality monitoring data through the deployment of an array of sensors and continuous data loggers.
38	2012-2013	Surfrider/ City of Ventura, OV Green Coalition	**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 2 training events for professionals; 3 private and 2 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.
39	2011-2013	Taylor Ranch	**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.
40	2011-2013	VC Public Works, City of Ventura, City of Ojai	**Trash Reduction – Event Trash Collection Requirements.** Required permittees of public events to provide for adequate trash collection and disposal facilities.
41	2012	VC Public Works	**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.
42	2011-2013	VC Public Works, City of Ventura, City of Ojai	**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.
43	2011-2013	VCWPD / VC Behavioral Health	**Trash Reduction – Illegal Encampment Removal**. Implemented 2 Arundo / homeless encampment / trash removal projects on Watershed Protection District-owned properties. 300 tons of trash was collected in 2012 and over 2 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.
44	2011-2012	Ventura Countywide Stormwater QMP/ VC Public Works, City of Ventura, City of Ojai	**Trash Reduction – Single-Use Bag Ban EIR.** Endorsed a pro-rata share of funding for a regional Environmental Impact Report, 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.

Table 3.2.1. List of Accomplishments, 2011 - 2013			
ID#	**Years**	**Primary Lead/ Other Leads***	**Project/Program**
45	2013	Ventura Countywide Stormwater QMP/ VC Public Works, City of Ventura, City of Ojai	**Watershed Signs.** Erected 6 "Ventura River Watershed – Keep it Clean" signs near drainages in the watershed.
113	2011	City of Ojai	**Drains to Ocean Signs.** Erected 10 "Do Not Dump, Drains to Ocean" signs near drainages within the city.
46	2013	VCWPD / Waste 2 Energy	**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.
47	2011-2012	Ventura County Fairgrounds	**Trash Reduction – New Trash Cans Along Beach.** Instituted daily trash pickup for 6 new trash cans placed along the bike path near and installed several recycling bins targeting beverage containers in the same area.
48	2011-2013	Ventura Countywide Stormwater QMP/ VC Public Works, City of Ventura, City of Ojai	**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.
49	2011-2013	Ventura Countywide Stormwater QMP/ VC Public Works, City of Ventura, City of Ojai	**Trash Reduction – Cleanups.** Sponsored 2 cleanup events: Earth Day Beach Cleanup and Coastal Cleanup Day; and conducted 2 cleanup events in the lower Ventura River (under Main Street bridge and near Front Street storm drain).
50	2011-2012	City of Ventura	**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 Arundo have been removed from the river bottom.
51	2011-2012	City of Ventura	**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.
101	2011	Ventura Countywide Stormwater QMP/ VCWPD, VC Public Works, City of Ventura, City of Ojai	**Plan – "Ventura County Technical Guidance Manual for Stormwater Quality Control Measures" Manual Update 2011.** This plan was updated to incorporate new stormwater retention and treatment requirements for new development and redevelopment projects as required by the Ventura Municipal Stormwater Permit.
102	2011-2013	VC Public Works, City of Ventura, City of Ojai	**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.

Table 3.2.1. List of Accomplishments, 2011 - 2013			
ID#	**Years**	**Primary Lead/ Other Leads***	**Project/Program**
103	2011-2013	VC Public Works, City of Ventura, City of Ojai	**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.
104	2011-2013	VC Public Works, City of Ventura, City of Ojai	**Illicit Discharge and Illicit Connection (ID/IC) Elimination Program.** Maintained Stormwater Hotlines 805/ 650-4064 or 805/652-4582 or http://vcstormwater.org and responses to the ID/IC reports.
105	2011-2013	VC Public Works, City of Ventura, City of Ojai	**Stormdrain, Flood Channel & Catch Basin Cleaning.** Municipal storm drains, flood control channels, and catch basins were inspected and cleaned (annually, more often in some cases).
106	2011-2013	VC Public Works, City of Ventura, City of Ojai	**Stormwater Pollution Prevention Training – Municipal Employees/Contractors.** Ventura Municipal Stormwater Permitees provided annual stormwater pollution prevention trainings to employees and contractors.
115	2013	City of Ojai	**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.
116	2013	City of Ojai	**Fulton Street Parkways & 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.
Integrated Flood Management			
52	2008-2011	VCWPD	**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 Cañada de San Joaquin.
53	2013	VC Public Works, VCWPD	**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.
54	2011-2013	VCWPD	**Levee Improvements.** Began levee evaluation, design engineering, CEQA compliance, and improvements required to certify the existing levees in the watershed.
56	2011-2012	VC Public Works / VCWPD	**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.

Table 3.2.1. List of Accomplishments, 2011 - 2013			
ID#	**Years**	**Primary Lead/ Other Leads***	**Project/Program**
57	2013	VCWPD	**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 EIR is underway.
58	2013	Ventura Countywide Stormwater QMP/ VCWPD, VC Public Works, City of Ventura, City of Ojai	**Plan – "Ventura County Hydromodification Control Plan.**" Prepared the Hydromodification Control Plan to minimize hydromodification (changes to runoff patterns) impacts associated with applicable new development and redevelopment in Ventura County.
Healthy Ecosystems			
59	2011	California Coastal Conservancy	**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 2 centuries of local documents, the report and accompanying maps help to improve understanding of the natural forces that have shaped the local landscape.
60	2011-1012	VC Parks/ VCWPD, California Coastal Conservancy	**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 1 acre with native hydroseed mix, 0.38 acres with willow stakes and .05 acres of cottonwood and sycamore seedlings. Restoration included removing 0.5 acre of Arundo.
61	2011-2012	VC Parks	**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.
62	2009-2013	OV Green Coalition/ CREW	**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.
63		OV Land Conservancy	**Ecosystem Restoration – Ojai Meadows.** Installed approximately 5,000 native plants around the drainage channels and associated wetlands. Weed management has been underway on an additional 30 acres in preparation of seeding with native grasses and wildflowers of these areas. Once seeding is complete, approximately 500 new oak trees will be planted. The primary measure of success for this project is the number and diversity of bird species. Over 100 new bird species are utilizing the site that were not observed to be present prior to restoration activities.
64	2013	OV Land Conservancy/ CCC, CREW	**Fox Canyon Barranca & 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.

Table 3.2.1. List of Accomplishments, 2011 - 2013			
ID#	**Years**	**Primary Lead/ Other Leads***	**Project/Program**
65	2012-13	OV Land Conservancy	**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.
66	2011	Surfrider/ CDFW	**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.
67	2011-2013	Taylor Ranch	**Arundo Removed – Taylor Ranch.** Removed Arundo, largely in monoculture stands, on 13.5 acres. Those acres, plus 32 acres where Arundo was previously removed (in 2008), were monitored and re-treated as needed.
68	2011	VC Public Works	**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.
70	2011-2013	VCWPD/ USACE, California Coastal Conservancy	**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.
73	2013	Ventura Hillsides Conservancy	**Acquired Willoughby Preserve.** Acquired an 8-acre property on the lower Ventura River and created the Willoughby Preserve.
74	2012-2013	Ventura Hillsides Conservancy/ CREW	**Ecosystem Restoration – Ventura Hillsides Conservancy Big Rock Preserve.** Removed 2 acres of *Arundo* and planted willows within a 23.18 acre area. Re-treatments ongoing.
108	2011-2013	VCWPD	**Arundo Removal & Re-treatment.** Removed (in 2009-2011) approximately 6 acres of Arundo (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 Arundo were previously removed.
Access to Nature			
75	2013	Friends of Ventura River	**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.
76	2011	Friends of Ventura River/ Surfrider, Ventura Hillsides Conservancy	**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.

Table 3.2.1. List of Accomplishments, 2011 - 2013			
ID#	**Years**	**Primary Lead/ Other Leads***	**Project/Program**
77	2013	OV Land Conservancy	**Acquired Valley View Preserve.** Acquired a 195-acre property within the city of Ojai and created the Valley View Preserve. Reclaimed 2 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.
78	2011	OV Land Conservancy/ California Coastal Conservancy	**Acquired Steelhead Preserve.** Acquired a 65-acre property (Hollingsworth Ranch) located along 1 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.
79	2011-2013	OV Land Conservancy/ Once Upon a Watershed	**Organized Hikes & 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.
80	2012	OV Land Conservancy / Ojai Valley Lions Club	**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.
81	2011	VCWPD / OV Land Conservancy	**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.
82	2013	Ventura Hillsides Conservancy/ Friends of Ventura River, CCC, Surfrider	**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.
Responsible Land and Resource Management			
83	2013	VCEHD	**Advanced the Petrochem Site Cleanup**. Requested USEPA oversight of some of the cleanup operations at the site. Preliminary investigation and cleanup has occurred.
84	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.
85	2011	Friends of Ventura River	**Watershed Document Online Library.** Compiled a watershed document library on the Friends of Ventura River's 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 3.2.1. List of Accomplishments, 2011 - 2013			
ID#	**Years**	**Primary Lead/ Other Leads***	**Project/Program**
86	2012	Friends of Ventura River/ California Coastal Conservancy, Surfrider, Ventura Hillsides Conservancy	**Ventura River Parkway Concept Approved by Board of Supervisors.** Calif. Coastal Conservancy, Trust for Public Land, Friends of the Ventura River, Surfrider Foundation, and Ventura Hillsides Conservancy 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.
87	2013	OV Green Coalition	**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.
88	2011-2013	OV Land Conservancy	**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.
89	2011-2013	Once Upon a Watershed	**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.
112	2011-2013	Channelkeeper/ Ventura Hillsides Conservancy, City of Ventura, Ventura College	**Student Education.** Educated over 1,500 students about the Ventura River watershed, often through partnerships with the Ventura Hillsides Conservancy, City of Ventura, Ventura College, and local Brownie troops.
90	2012-2013	VCCOLAB	**Engaged Businesses in Watershed Issues & Planning**. Expanded channels of communication between local business interests and watershed-related issues and planning efforts. Facilitated a proactive response to water quality regulations, specifically the Algae TMDL, by local horse and livestock owners.
91	2012	Ventura Hillsides Conservancy	**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."
92	2011-2013	City of Ventura/ Surfrider, California Coastal Conservancy	**Surfer's Point Managed Retreat.** Implemented a multi-part, ecosystem-based project designed to manage erosion at Surfer's 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 is ongoing to establish the native plants on the dunes.
93	2012	Ojai Unified School District Green Team/ Ojai Valley Garden Club	**Demonstration Landscape.** Installed a demonstration low-water-using, ocean friendly, and habitat friendly native landscape at Matilija Jr. High.
Coordinated Watershed Planning			
109	2012	VCWPD	**Report – "Ventura River Watershed Protection Plan Report."** This report summarized existing information and reports prepared for the Ventura River watershed.

Table 3.2.1. List of Accomplishments, 2011 - 2013			
ID#	**Years**	**Primary Lead/ Other Leads***	**Project/Program**
94	2013	Watershed Council	**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.
95	2011	Watershed Council	**Watershed Coordinator Hired.** The new watershed coordinator position is funded by a 3-year grant, with additional support provided by several Watershed Council partners. The Ojai Valley Land Conservancy generously hosts the staff position.
96	2012	Watershed Council	**Watershed Council Organizational Identity Strengthened.** Developed a mission statement, logo, brochure, and website for the Council. (www.venturawatershed.org)
97	2012	Watershed Council	**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.
98	2012	Watershed Council	**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.
99	2012-2013	Watershed Council	**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.
100	2012	Watershed Council	**Watershed Management Plan Goals & Objectives.** Approved a set of 7 goals and corresponding objectives to serve as the framework for the watershed management plan.

*Acronyms & Abbreviations:
CCC—California Conservation Corps
Casitas MWD—Casitas Municipal Water District
CDFW—California Department of Fish and Wildlife
Channelkeeper—Santa Barbara Channelkeeper
Farm Bureau— Farm Bureau of Ventura County
Meiners Oaks WD—Meiners Oaks Water District
Ojai Basin GMA—Ojai Basin Groundwater Management Agency
OV Green Coalition—Ojai Valley Green Coalition
OV Land Conservancy—Ojai Valley Land Conservancy
OVSD—Ojai Valley Sanitary District
RCD—Resource Conservation District
Senior Canyon MWC—Senior Canyon Mutual Water Company
Surfrider—Surfrider Foundation
UCSB—University of California Santa Barbara
USACE—United States Army Corps of Engineers
Ventura Countywide Stormwater QMP—Ventura Countywide Stormwater Quality Management Program
VC Behavioral Health—Ventura County Behavioral Health Department
VCCOLAB—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 River CWD—Ventura River County Water District

3.3 Future Projects and Programs

3.3.1 Project/Program List Development Process

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, or archive, of project and program ideas. The 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/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.

The MAPP is maintained in a comprehensive spreadsheet that indicates a variety of features about each project/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/programs list was to categorize the projects assembled in the MAPP archive into one of two "tiers":

Tier 1 Project/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/Programs must have either a lead or a supporter. A *lead* is defined is 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.

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

The Tier 1L list of projects and programs, which is still quite extensive even after filtering, acts as a reference for the Watershed Council. This list forms the basis for developing the watershed management plan's "Short-Term Action Plan" (Action Plan).

The Action Plan includes those Tier 1L projects/programs that the project leads decide are priorities and can be feasibly implemented within a three-year time span. The list can be referred to craft "integrated" projects in response to specific grant applications.

Tier 2 Projects/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.

3.3.2 Priority Projects and Programs

Table 3.3.2.1 represents a subset of projects and programs from the Tier 1L list that may be appropriate for Proposition 84 funding through the Integrated Regional Water Management Program.

Table 3.3.2.1. IRWMP Potential Projects and Programs

	Fill Data Gaps / Analyze	Make Physical Improvements	Educate/Engage/ Incentivize	Improve/Use Regulations & Policies	Plan/Collaborate Regionally
Goal 1: Sufficient Local Water Supplies					
Studies/Analyses to Help Fine Tune Water Supply Management	x				
Groundwater Extraction Estimates - Upper and Lower Ventura River Basins	x				
Surface Water-Groundwater Interaction Analysis	x				
Conjunctive Use Study	x				
Water Rate Analysis	x				
Ojai Basin Safe Yield Study	x				
Analyses of Opportunities to Increase Water Supply Recharge, Reuse, & Capture	x				
Reclaimed Water Analysis	x				
On-Farm Water Detention/Retention Analysis	x				
Water Supply Infrastructure & Reliability Improvements		x			
Casitas MWD Reservoir Tank Seismic Retrofit		x			
Contingency Water Storage		x			
Casitas MWD - City of Ventura Conduit Intertie		x			
Casitas MWD Exposed Main Line (San Antonio Creek) Burial		x			
Casitas MWD Lake Aeration System		x			
Meiners Oaks WD Replacement Water Well		x			
Meiners Oaks WD Standby Electric Generator		x			
Meiners Oaks WD Water tank Replacement		x			

Table 3.3.2.1. IRWMP Potential Projects and Programs					
	Fill Data Gaps / Analyze	Make Physical Improvements	Educate/Engage/ Incentivize	Improve/Use Regulations & Policies	Plan/Collaborate Regionally
Ventura Water Automated Meter Infrastructure		x			
Mutual Water Company Equipment Upgrades		x			
Sub-Metering		x			
Water Supply System Loss Minimization		x			
OVSD Sewer Main Lining		x			
Water Supply Recharge, Reuse & Capture Improvements		x			
Ventura Water Foster Park Wellfield Restoration		x			
Storm Water Capture and Storage		x			
Ocean/River Friendly Gardens Installation Rebate Program		x			
Ventura Water North-Side Satellite Wastewater Treatment Plant		x			
Water Use Efficiency, Reuse & Capture BMP Education & Stewardship Programs			x		
Large Landscape Irrigation Efficiency Evaluations			x		
Graywater Equipment Installations					
High Efficiency Equipment Installations (Interior & Exterior)			x		
Agricultural & Hobby Orchard Irrigation Efficiency Evaluations			x		
Ocean/River Friendly Gardens Education Program			x		
Water Use Efficiency & Reuse Education Program			x		
Native & Climate Appropriate Plant Education			x		
Irrigation Professionals Training			x		
Goal 2: Clean Water					
Studies & Equip. to Improve Understanding of Water Quality Problems	x				
Dissolved Oxygen Loggers	x				
In-Situ Water Quality Monitoring Equipment	x				
Ventura River Stream Team Citizen Monitoring Program	x				
Septic System TMDL Special Study	x				
Geologic Nitrogen Sources - TMDL Special Study	x				
Analyses & Programs to Increase the Value of Water Quality Monitoring	x				
Integrated & Accessible Water Quality Monitoring Data	x				
Plans & Studies to Improve Water Quality Impacts of Development	x				
Stormwater Runoff Retrofit Plan (LID & Green Streets)	x				
Sewer & Septic System Infrastructure Improvements		x			
OVSD Sewer Trunk Relocation - Ventura River		x			
OVSD Sewer Trunk Relocation - Ventura River/Meiners Oaks		x			
Stormwater Infrastructure Improvements		x			
Stormwater Runoff Retrofits (LID & Green Streets)		x			
Dry Weather &/or First Flush Diversions		x			
City of Ventura San Jon/Prince Barranca Urban Stormwater/Flood Control Retrofit Pilot Project		x			
Stormwater Parking Lot Retrofits		x			

Table 3.3.2.1. IRWMP Potential Projects and Programs					
	Fill Data Gaps / Analyze	Make Physical Improvements	Educate/Engage/ Incentivize	Improve/Use Regulations & Policies	Plan/Collaborate Regionally
Trash Excluders		x			
Brownfield Project Remediation		x			
Water Quality Education & Stewardship Programs			x		
Stream Protection Fencing			x		
Slow It/Spread It/Sink It Campaign			x		
Farm & Stable Nutrient Management Program			x		
Water Pollution Prevention Campaign			x		
Manure/Composting Storage Demonstration Site			x		
San Antonio Creek Watershed Alliance			x		
Adopt-a-River Program			x		
Coordinated Water Quality Monitoring					x
Illegal River Activities Prevention					x
Goal 3: Integrated Flood Management					
Models for Flood Improvements	x				
Flood Modeling - McNell Creek Flood Mitigation.	x				
Flood Modeling - Thacher Creek Flood Mitigation.	x				
Plans to Prioritize Flood Improvements	x				
Ventura River Integrated Watershed Protection Plan Annual Update	x				
Levee Improvements		x			
Bring Levees up to FEMA Standards/Mitigate for Matilija Dam Removal - Casitas Springs Levee		x			
Bring Levees up to FEMA Standards/Mitigate for Matilija Dam Removal - Live Oaks Levee		x			
Bring Levees up to FEMA Standards - Ventura River Levee & Parkway Enhancement		x			
Flood-Related Mitigation for Matilija Dam Removal		x			
Matilija Dam Removal Mitigation- Meiners Oaks Levee		x			
Matilija Dam Removal Mitigation - Santa Ana Bridge Upgrades		x			
Mitigate for Matilija Dam Removal - Camino Cielo Bridge Replacement		x			
Channel Improvements		x			
Canada de San Joaquin Bank Stabilization		x			
Channel Improvements - Canada Larga		x			
Channel Improvements - Canada Larga Channel Invert Repair		x			
Channel Improvements - Rebuild East Ojai Drain		x			
Channel Improvements - Fox Barranca		x			
Channel Improvements - Howard Ave. Drain		x			
Channel Improvements - Skyline Drainage Rock RipRap Stabilizer		x			
Channel Improvements - Thacher Creek - Grand Ave		x			
Channel Improvements - Thacher Creek @ Siete Robles		x			
Channel Improvements - Vince Street Drain Outlet to Ventura River		x			

Table 3.3.2.1. IRWMP Potential Projects and Programs	Fill Data Gaps / Analyze	Make Physical Improvements	Educate/Engage/ Incentivize	Improve/Use Regulations & Policies	Plan/Collaborate Regionally
Channel Improvements - Dent Drain Outlet		x			
Stormdrain Improvements - Ojai Avenue (Eastside)		x			
Culvert Improvements - Maricopa Hwy at Besant Meadow		x			
Debris Basin Improvements		x			
Debris Basin Installation/Maintenance - Coyote Creek		x			
Debris Basin Installation/Maintenance - Dent Canyon		x			
Debris Basin Installation/Maintenance - Dron Creek		x			
Debris Basin Installation/Maintenance - Fresno Canyon Flood Mitigation		x			
Debris Basin Installation/Maintenance - Senior Canyon		x			
Right-of-Way Acquisitions for Flood Management		x			
Right-of-Way Acquisition - Coyote Creek		x			
Right-of-Way Acquisition - Fox Canyon Debris Basin		x			
Right-of-Way Acquisition- Fresno Canyon Flood Mitigation		x			
Right-of-Way Acquisition - Manuel Canyon		x			
Right-of-Way Acquisition - Parkview Drain		x			
Extreme Flood/Climate Change Preparation					x
ARkStorm Scenario Drill					x
100-Year Flood Event Drill					x
Goal 4: Healthy Ecosystems					
Plans for Ecosystem Restoration & Protection	x				
Steelhead Restoration Plan	x				
Land Protection Plan	x				
Invasive Plant Removal & Monitoring		x			
Arundo (Giant Reed) Retreatment/Mitigate for Matilija Dam Removal		x			
Arundo (Giant Reed) Retreatment - San Antonio Creek		x			
Steelhead Habitat Improvements		x			
Fish Passage		x			
Steelhead Pool Development/Maintenance on San Antonio Creek		x			
Riparian Habitat & Wetland Restoration		x			
San Antonio Creek Restoration at Soule Park Golf Course		x			
Foster Park Infrastructure and Bank Protection and Restoration		x			
Confluence Wetland Mitigation		x			
Land Acquisition for Ecosystem Protection		x			
Land & Public Access Protection		x			
Matilija Dam Removal and Related Improvements		x			
Matilija Dam Sediment Removal		x			
Matilija Dam Removal		x			
Matilija Dam Desilting Basin		x			
Matilija Dam Removal Mitigation - Robles Diversion High Flow Bypass		x			
Interim Notch of Matilija Dam		x			

Table 3.3.2.1. IRWMP Potential Projects and Programs					
	Fill Data Gaps / Analyze	Make Physical Improvements	Educate/Engage/ Incentivize	Improve/Use Regulations & Policies	Plan/Collaborate Regionally
Ecosystem Education & Stewardship Programs			x		
Invasive Plants Education Program			x		
Streamside Property Owners Stewardship Program			x		
Existing Regulation Monitoring/Enforcement/Streamlining				x	
Permit Streamlining - Invasives Removal				x	
Goal 5: Access to Nature					
Ventura River Parkway Plan	x				
New Trails, Access Points & Parks		x			
New Family-Oriented Picnic Areas/Parks		x			
New & Improved Trails		x			
Lower Ventura River Public Access		x			
Trail Maintenance		x			
Trails/Nature Education & Stewardship Programs			x		
Trails Guide			x		
Interpretive Signs			x		
Goal 6: Responsible Land and Resource Management					
Plans & Assessments for Land & Resource Management	x				
Existing Local Policy Assessment	x				
Water Efficient Crop Study	x				
Watershed Corps		x			
Outreach to Elected Officials			x		
Land & Resource Management Education & Stewardship Programs			x		
Agricultural Best Management Practices			x		
Policy/Regulation Improvements				x	
Intra-County Land Use Planning Task Force				x	
North Ventura Avenue Area Plan				x	
Extended Drought/Climate Change Preparation					x
Goal 7: Coordinated Watershed Planning					
Watershed Education & Stewardship Programs			x		
Watershed Literacy Programs			x		
Watershed & River Signs			x		
Watershed Education Center			x		
Youth Education			x		
Watershed Council & Coordinator				x	
Watershed Management Plan				x	

Part 4 Short-Term Action Plan

[Under development]

Part 5 References & Supporting Material

5.3 Other Local Water- and Watershed-Related Plans

Below is a summary of other local water- or watershed-related plans that have been developed by public agencies, water and wastewater managers, or land and resource managers that have bearing on Ventura River watershed planning and management.

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. Development of many of these plans 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 will be 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

Organizations: 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.

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 either provides over 3,000 acre-feet of water annually or serves more than 3,000 or more connections is required to submit an UWMP to the state that includes supply and demand projections for the next 20 years, and describes 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 provide a road map 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.

Water Quality

Basin Plan

Organization: Regional Water Quality Control Board, Los Angeles

Each of the California's 9 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, then appropriate water quality objectives can 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 Hydromodification Control Plan, developed to implement some of the MS4 permit requirements related to new development and redevelopment.

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.

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, which is 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 a comprehensive road map that addresses how to 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 plan identifies the tools resource staff will use to accomplish the objectives that contribute to the realization of the desired conditions. In addition, the rules or design criteria that the US Forest Service will adhere to in implementing projects and activities are outlined. 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 watersheds that drain through Ojai's city limits. These watersheds 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 and to address the 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.

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 6 miles of the Ventura River. The plan is intended as an analysis, planning, and design tool for governmental and non-governmental agencies, and the surrounding community. The plan's ideas are aimed at helping in the creation of a river parkway that is compatible with recreational use, stewardship, river function, and regional ecosystems.

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 8 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 mitigation-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.

Watershed Management Plans (surrounding watersheds)

The watershed management plans of surrounding watersheds can be informative 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

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