STATE OF THE WATERSHED – Report on Surface Water Quality
The Ventura River Watershed

California Regional Water Quality Control Board – Los Angeles Region
May 2002

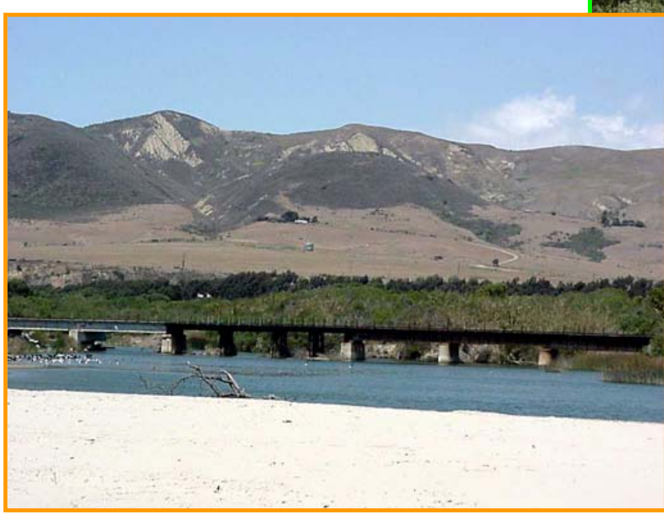

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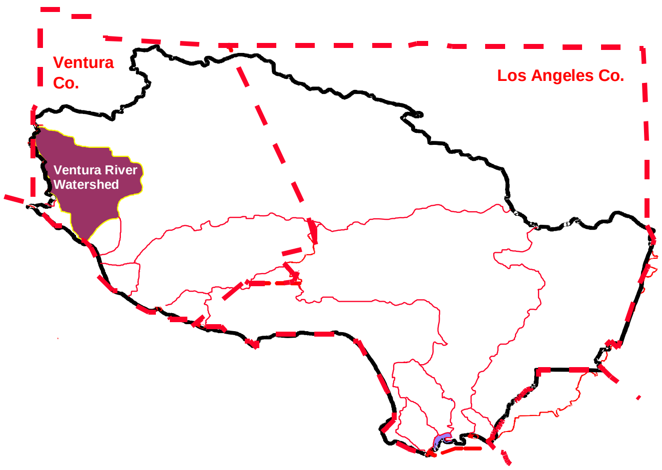
TABLE OF CONTENTS

EXECUTIVE SUMMARY



The Ventura River and its tributaries drain a coastal watershed in western Ventura County. The watershed covers a fan-shaped area of 235 square miles, which is situated within the western Transverse Ranges (the only major east-west mountain ranges in the continental U.S.). From the upper slopes of the Transverse Ranges, the surface water system in the Ventura River watershed generally flows in a southerly direction to an estuary, located at the mouth of the Ventura River. Groundwater basins composed of alluvial aquifers deposited along the surface water system, are highly interconnected with the surface water system and are quickly recharged or depleted, according to surface flow conditions. Topography in the watershed is rugged and as a result, the surface waters that drain the watershed have very steep gradients, ranging from 40 feet per mile at the mouth to 150 feet per mile at the headwaters.

Precipitation varies widely in the watershed. Most occurs as rainfall during just a few storms, between November and March. Summer and fall months are typically dry. Although snow occurs at higher elevations, melting snowpack does not sustain significant runoff in warmer months. The erratic weather pattern, coupled with the steep gradients throughout most of the watershed, result in high flow velocities with most runoff reaching the ocean.

Beneficial Uses in Watershed:

Estuary	*Above Estuary*
Navigation	Municipal supply
Commercial & sportfishing	Industrial service supply
Estuarine habitat	Industrial process supply
Marine habitat	Agricultural supply
Contact & noncontact water recreation	Contact & noncontact water recreation
Warmwater habitat	Warmwater habitat
Wildlife habitat	Wildlife habitat
Preservation of rare & endangered species	Preservation of rare & endangered species
Migratory & spawning habitat	Migratory & spawning habitat
Wetlands habitat	Wetlands habitat
Shellfish harvesting	Coldwater habitat
	Groundwater recharge
	Freshwater replenishment

The majority of water quality problems involve eutrophication (excessive nutrients and effects), especially in the estuary/lagoon although some DDT and metals have been found in mussel and fish tissue (on the 303(d) list for these). A TMDL is currently scheduled for 2004/05 to address algae problems. A large storm drain enters the river near the estuary and homeless persons live in and frequent the river bed. Sediment in the estuary, however, appears relatively uncontaminated and little sediment toxicity is apparent. In some subwatersheds, high TDS concentrations impair the use of water for agriculture. The watershed's water quality problems are, for the most part, nonpoint source-related. There have also been incidents of releases of toxic materials into storm drains entering the lower river.

Water diversions, dams, and groundwater pumping also are thought to limit surface water resources needed to support a high quality fishery. Reduced water supplies affect water quality and thus beneficial uses, particularly with regards to the endangered steelhead trout (steelhead trout are known to utilize the River and some of its tributaries historically supported annual steelhead runs of 5000 – 6000 adults). Removal of the Matilija Dam (upper river) has recently been identified as a high priority.

The Ventura River Watershed

- 5 NPDES discharges: one major (POTW) and four discharges covered by general permits
- 21 dischargers covered under an industrial storm water permit
- 4 dischargers covered under a construction storm water permit
- Eutrophication concerns, especially in lagoon
- Some bioaccumulation of DDT and metals
- TDS concerns in some subwatersheds
- Impediments to steelhead trout migration (but much high quality habitat)
- More nonpoint source rather than point source problems

There is only one major discharger, a small POTW (3.0 MGD) in the middle reach of the Ventura River which has recently upgraded to tertiary treatment The treatment plant effluent had been implicated in nuisance growth of aquatic plants and low dissolved oxygen found at times downstream of the discharge. For much of the year, the facility's effluent can make up two-thirds of the total river flow. The most recent monitoring has shown the quality of the effluent has significantly improved with regards to nutrients. DO levels in the river have also improved dramatically and algal growth is greatly reduced below the plant; however, nonpoint sources (agriculture and horse stables) still appear to be contributing to algal growth above the plant.

There are four minor NPDES dischargers under general permits and 27 dischargers are enrolled under the general industrial storm water permit in the watershed. Permits in the watershed were targeted for renewal in FY 2000/01.

In August 1997, the National Marine Fisheries Service (NMFS) listed the steelhead trout in Southern California as endangered under the Federal Endangered Species Act (ESA). The listing means that any project or action that may affect steelhead trout or their habitats will require consultation with NMFS to obtain an incidental take permit. In order to prepare for the listing and deal with possible regulatory requirements as a result of the listing, the Casitas MWD, City of Ventura, Ventura County Flood Control District, and seven other local public and private agencies collaborated and developed the Ventura River Steelhead Restoration and Recovery Plan in December 1997. The plan also contains large amount of background information on the watershed such as hydrology, biology, steelhead habitat conditions, and the operations and maintenance of water, wastewater, solid waste, transportation and flood control facilities of the sponsoring agencies. The same public agencies have joined together in a cooperative effort to develop a Habitat Conservation Plan (HCP) for their activities in and adjacent to the Ventura River.

STATE OF THE WATERSHED

Watershed management is an integrated strategy for managing resources. As characteristics and resources vary widely from watershed to watershed, this strategy customizes efforts to manage resources and address problems unique to each watershed.

Watershed management can be applied on many different levels, from an overall system for managing resources, restoring and protecting aquatic ecosystems, and protecting human health, to a more focussed effort that addresses one resource, such as water. The scope of the Regional Board's approach is limited to the quality of water resources in the Ventura River watershed. Our efforts to apply watershed management to water resources may later be incorporated into more comprehensive efforts to manage other resources in the watershed.

The Regional Board initiated the Watershed Approach in the summer of 1994 after consultation with USEPA. Previously, the Regional Board regulated dischargers of waste waters throughout the area without regard to geographic location. Now the Regional Board plans for issuance of discharge permits, National Pollutant Discharge Elimination System (NPDES) permits and the Waste Discharge Requirements, by watershed. In addition, nonpoint source pollution, or pollution from diffuse sources such as urban runoff, aerial deposition, animal stables, and construction sites, will be considered as components of a watershed.

An important element of the Watershed Approach is the integration of all stakeholders of a watershed into the planning and assessment process. The Regional Board intends to continue work with local watershed planning groups to allow for local determination of issues of concern. More information on our watershed approach may be found by viewing our *Watershed Management Initiative Chapter* located on our website at http://www.swrcb.ca.gov/rwqcb4/html/programs/regional_programs.html.

A preliminary report, *Ventura River Watershed--Water Quality*, was prepared by staff at the California Regional Water Quality Control Board in 1996 with the assistance of staff from the Casitas MWD and others in the watershed. It was a working document that presented an assessment of water quality, using reasonably available data. We envisioned that the information in this report, together with information since developed, would be used as a starting point for assessing impacts to the various uses of waters, which range from domestic and municipal supply, industrial supply, irrigation, recreation, and aquatic habitat. As resources allow, and as additional information became available, the report would be updated as is now occurring.

This State of the Watershed report is intended to serve as a resource document for water quality planning at the Regional Board as well as for the stakeholder groups of the watershed. The document covers a broad range of topics, from water supply to land use to water quality and quantity issues, because the watershed approach requires an integrated resource management effort.

Physical Description of River, Subwatersheds, Reservoirs, and Structures

The Ventura River Watershed (Figure 1) is located in the northwestern portion of Ventura County draining an area of 226 square miles roughly half of which is on Forest Service land (USFS, 1997). The Ventura River has several major tributaries including Matilija, North Fork Matilija, San Antonio and Canada Larga. Two reservoirs, Lake Casitas and Matilija Reservoir serve as water supply and flood control areas respectively. The watershed is minimally developed and compared to other watersheds of the Los Angeles Region has large areas of good water quality and excellent aquatic habitat. About 30 miles of the upper Main Fork Matilija and its tributaries are designated as Wild and Scenic Rivers (USFS, 1997). The watershed, however, has been degraded, particularly in the lower areas by both nonpoint and point sources. The major point source is the Ojai Valley Wastewater Treatment Plant which was recently upgraded. Nonpoint sources include urban runoff, road building, agriculture and grazing (including confined animal facilities), air deposition, and recreation. Water quantity is an important issue in this watershed. Ground water is used for domestic and irrigation purposes and the alluvial basins must be carefully managed and recharged. Groundwater basins generally are aligned with the surface flows and are made up of alluvial material that is quickly recharged and depleted and is highly interconnected with surface flows. The steelhead trout and other fisheries are restricted or diminished by diversions and dams that have cut off important spawning areas, by diminished flow in the main stem of the river and by poor water quality.

The Ventura River watershed has a relatively steep gradient ranging from forty feet per mile at the mouth to ninety feet per mile at the headwaters (Ventura County, 1973). The highest point in the watershed is 1830 m (6,025 feet) in the Santa Ynez Mountains. About 50% of the watershed land area lies below 500 m elevation, 25% between 500 and 1000 meters, and 25% lies between 1000 and 1800 meters. Using the US Bureau of Reclamation classification, the watershed land areas roughly correlate with 15% valley, 40% foothill and 45% mountain categories. The calculated number, based on the average basin bifurcation ratio, of streams gullies, and bedrock channels is 1800. These headwater channels are steep and short "yielding approximately 600 km of waterways in the highest and steepest parts of the basin." The flood plain of the Ventura River has a maximum width of 2 km. The river gradient averages 15m/km. (Mertes, et al., 1995).

Most of the watershed bedrock is non-water bearing with the best water-bearing units being the shallow alluvium in the valley bottoms. In Ojai Valley, the maximum alluvial depth is 700 feet while in the Ventura River, the alluvium averages 60 to 80 feet deep with maximum of 100 feet between Meiners Oaks and Foster Park. Within the bedrock sequences there are lenses of permeable and porous sandy material that hold significant reserves of petroleum and natural gas, especially in the lower watershed area (Ojai Valley, 1993eir; Mertes et al., 1995). Approximately 85% of the exposed area in the watershed is composed of relatively impervious materials or bedrock (Ventura County, 1973).

The Ventura River watershed can be divided into three distinct fluvial zones. The headwaters and upper tributaries, including Matilija Creek, North Fork Matilija Creek and San Antonio Creek is an area characterized by production of water and sediment. The middle zone from the confluence of Matilija Creek and North Fork Matilija Creek to the estuary is an area of storage and transfer of sediment. Mid-channel islands, sand and gravel bars, bank erosion areas and migrating channels make up this dynamic zone. There are a number of active geologic structures in this zone including a fault system near Oak View, the Red Mountain Fault near Canada Larga and the Ventura Avenue anticline in the lower watershed. The lower zone is the delta/estuary system that is characterized by sediment deposition and shifting channels (Ojai Valley, 1992au).

The coast is characterized by a Mediterranean climate with mild, moist winters and moderately warm, generally rainless summers. Point Conception, about 70 miles west of the Ventura River estuary, is considered a major climatic boundary because it marks the approximate boundary between relatively cool, moist conditions to the north and warmer and drier conditions to the east and south (Ferren, Jr., 1990).

The climate of the Ventura area is influenced primarily by the prevailing westerly transoceanic air currents but with cooling of the adjacent land surface at night, air movement during the night and early morning is offshore. Dry, warm offshore winds (Santa Ana Winds) may be generated in the fall and winter. Coastal fog is also an important characteristic of the study area. The coastline of southern California is subjected 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 Ventura River valley acts as a corridor through which moisture-laden marine air moves inland. As ocean temperatures increase during the summer, the occurrence of fog decreases (Ferren, Jr., 1990).

Rain generally occurs between October and March with 75% of the runoff occurring from January through April. Mean annual precipitation near the mouth of the river is about 15.5 inches (40 cm). The higher mountains in the upper watershed receives about 40 inches (103 cm) and the average amount for the watershed is about 22 inches (56 cm). Some snow does occur in the higher mountains but snowmelt has little effect on stream flow (Ferren, Jr., 1990).

The watershed drains the interior portions of the Transverse Range and extends 23 miles (36 km) north of the Pacific Ocean. It is fan-shaped and includes a surface water basin of 226 square miles (585 sq. km.). Relief of the watershed is about 6,000 ft (1,829 m), extending from sea level at the river mouth to the crest of the mountains. Mountains and foothills are generally underlain by sedimentary rock, whereas valley bottoms are filled with shallow alluvium (Ferren, Jr., 1990).

Unlike some coastal basins in southern California (Santa Clara River), no submarine canyon occurs off the coast, apparently because the continental slope has a gentle rather than steep gradient and therefore none was cut during periods of lower sea level (Ferren, Jr., 1990).

The features of main stem of the Ventura River and the contributing tributaries are described in more detail below (in order from the top to bottom of watershed).

Matilija Creek: Matilija Creek drains an area of about 56 square miles and has an average gradient of 200 feet per mile. The main stem is 15.6 miles long. Prior to construction of the Robles Diversion Structure in 1958, the Matilija Creek subwatershed provided 46 percent of the long-term natural flow in the Ventura River, as gauged at Foster Park (U.S. Bureau of Reclamation, 1954).The two main tributaries are the North Fork of Matilija Creek and Murietta Creek (Ventura County, 1973; Moore, 1980). This subwatershed is primarily managed by the US Forest Service (Casitas MWD, 1995).

Matilija Reservoir: The Matilija Dam was constructed in 1948 by the Ventura County Flood Control District to provide water supply reserves and reduce flood hazards. The structure is a concrete arch dam that was built across a narrow section of the Matilija Creek about 0.6 miles upstream from the confluence with the North Fork of Matilija Creek. The reservoir and dam had an initial capacity of 7,000 acre feet. As the result of siltation, especially after the 1969 flood, and a large notch (due to deteriorating concrete) that was cut in the dam's face in 1965, the reservoir now has a capacity of less than 1000 acre feet. During the summer and fall months, Casitas MWD conducts releases for downstream water rights, in accordance with a 1959 agreement, while maintaining a minimum pool behind the dam. The VCFCD owns and maintains Matilija Dam while Casitas MWD operates and maintains the dam outlet works. The reservoir is now used primarily to temporarily store flows and release waters at less than the 500 cfs capacity of the Robles Canal in order to maximize diversions to the Casitas Reservoir (Ventura County, 1973; Casitas MWD and San Buenaventura, 1978; Casitas MWD, 1995; Casitas MWD, et.al., 1997).

North Fork Matilija Creek: The North Fork Matilija Creek has an average gradient of about 460 feet per mile and drains an area of 15.5 square miles (Ventura County, 1973; Moore, 1980). Hot springs in the Santa Ynez Mountains have high levels of boron (Ojai Valley, 1993eir). This subwatershed is primarily managed by the US Forest Service (Casitas MWD, 1995).

Upper Ventura River: Matilija Creek and the North Fork Matilija Creek merge and form the main stem of the Ventura River, a gravel bottomed channel that varies in width from 700 to 2000 feet wide that extends 16.2 miles to the estuary (Casitas MWD and San Buenaventura, 1978). The upper reach of the river is bounded downstream by a diversion dam at Foster Park. This reach includes the Robles Diversion structure, the San Antonio tributary, Casitas Springs area and Foster Park.

Ventura River near the San Antonio Creek confluence had salinities that ranged from 0.3 to 0.8‰ which is higher than the normal river salinity determined by Ferren et al (1990) and "suggest that natural runoff from the watershed may be slightly saline or that effluent discharged to the river might be saline" (Mertes et al., 1995).

The Casitas Springs area of the Ventura River (approximately 2.8 kilometers long) was studied by Moore (1980) because it has high quality water and steelhead trout spawning and rearing habitat. Moore examined this reach (June and October of 1976, 1977 and 1978) for number of pools and riffles, flow level, plants, and water quality. This section of the Ventura River has perennial flows, even during drought years, due to a natural bedrock barrier that forces subsurface flow to the surface. The river channel occurs as a wide flood plain and during high flows is "characterized by a typical pool riffle continuum found in low gradient streams." Vegetation such as Watercress and Water veronica are consistent with the spring-fed nature of this reach (Moore, 1980).

Robles Diversion: The Robles diversion dam, approximately 2 miles downstream of Matilija Dam, was constructed in 1959 as part of the Ventura River Project to divert up to 500 cubic feet per second flows of winter runoff from the Ventura River to Lake Casitas. The watershed above the diversion is approximately 75 square miles (Casitas MWD, 1995). The diversion consists of a small rockfill dam, headgate and four miles of concrete channel. The initial operating criteria was supposed to be for a five year pilot but the diversion is still operated under the original agreement. Under the agreement, the first 20 cfs of surface flow must be allowed to pass down the Ventura River and all flows above 20 cfs and up to 500 cfs may be diverted to the Robles Canal. The low flows help support a flow in the river from Casitas Springs down to the estuary. The initial operating criteria specified that the 20 cfs amount would be varied according to certain ground water and surface flow conditions. That is, the 20 cfs flow may be decreased if surface flow occurs at Santa Ana Boulevard or if rising groundwater above the confluence with San Antonio Creek is enough to provide flows to supply all downstream users and allow water to flow to the ocean (Ventura County, 1973; Casitas MWD and San Buenaventura, 1978; Ojai Valley, 1993eir). Diversions to Lake Casitas through the Robles Diversion historically make up about 55% of the inflow to Lake Casitas (Casitas MWD and San Buenaventura, 1990).

San Antonio Creek: San Antonio Creek originates in Senior Canyon and drains 52 square miles of the southerly slope of the Topa Topa Mountains. About 40 square miles are steep mountainous terrain and 12 square miles cover valley area (U.S. Bureau of Reclamation, 1954). This subwatershed represents the northeast portion of the Ventura River watershed. The average gradient is sixty feet per mile and the length of the main stem is 11.4 miles. The headwaters are in rugged mountain terrain and have stream gradients of 250 feet per mile. The river then flows through the alluvial plain of the Ojai Basin with a gradient of 100 feet per mile, five miles in a narrow canyon with an average gradient of 500 feet/mile before joining the Ventura River two miles above Foster Park. Major tributaries include Gridley, Thacher, Reeves and Lion Creeks (Ventura County, 1973; Casitas MWD and San Buenaventura, 1978; Moore, 1980).

Lower San Antonio Creek does not have favorable steelhead trout habitat (lacks good pools and riffles and cover but the quality of upstream areas of the creek (total 14.4 km reach) is unknown (Moore, 1980). The lower creek between Highway 33 and the abandoned Southern Pacific right-of-way is bounded by a levee with riprap and willows and alders (Casitas MWD and San Buenaventura, 1984).

Foster Park Dam: An underground weir extending across Coyote Creek and Ventura River beds approximately 1200 feet north of Foster Park Bridge was constructed in 1906 by the Ventura Power Company. The weir was designed to raise the water table in order to supply municipal pumps located upstream. The concrete weir is 973 feet long and maximum of 65 feet deep and stops short by 300 feet from extending the full breadth of both streams. A surface diversion is near the eastern side of the river bottom. Water from the surface water diversion and the subsurface collectors accumulates in a single receiving chamber that discharges to a 36-inch diameter concrete pipe that drains by gravity to the Kingston Reservoir at the City's water treatment plant. It was not completed all the way across due to construction problems. The City of San Buenaventura maintains 4 wells approximately 300 to 1500 feet upstream of the weir. In 1946, 300 feet of the weir was exposed to a height of 4 feet. Efforts to construct a fish ladder, in 1946, by the California Department of Fish and Game were never brought to fruition (Ventura County, 1973; Casitas MWD, et.al., 1997)

Coyote Creek: Coyote Creek drains an area of 41 square miles (30 sq. mi. are mountainous and the rest are rolling foothills and valley floor) and has an average gradient of 260 feet per mile. The length of the main stem of Coyote Creek is 16.6 miles although Lake Casitas now covers an area starting 2.5 miles above the confluence of Coyote Creek with the Ventura River. The lowest 2.5 mile reach of Coyote Creek has an average gradient of 35 feet per mile. Santa Ana Creek, a tributary to Coyote Creek, has an average gradient of 380 feet per mile. Coyote Creek below Casitas Dam is usually dry except for short periods after storms and spillage from the reservoir (Bureau of Reclamation, 1954; Ventura County, 1973; Casitas MWD and San Buenaventura, 1978; Moore, 1980).

Lake Casitas: The Lake Casitas watershed directly drains 33 square miles of open space (non-agricultural) lands and indirectly, via the Robles Diversion drains an additional area of 75 square miles of the upper Ventura River watershed (from Matilija, North Fork Matilija, Upper North Fork Matilija, and Murietta Creeks via the Robles Diversion Dam and Robles-Casitas Canal) making at total drainage area of 108 square miles. Lake Casitas was constructed in 1959 by the U.S. Bureau of Reclamation to provide domestic, agricultural and industrial water. The dam is a 285 foot high earth and crushed rockfill structure. The Bureau owns the lake, dam and surrounding shoreline land while the Casitas MWD owns the system. The lake covers 2,710 acres with a 244 acre island in the middle; the shoreline contour is 30 miles. The capacity is 254,000 acres feet and safe yield is 20,000 acre-feet. The spillway elevation is 567 feet (Casitas MWD, 1995). In 1973, there was no year-round flow in Coyote Creek, downstream of the dam, that reached the Ventura River. The Casitas MWD indicated that they only were required to release 6 acre-feet per year to satisfy 1 prior water right (Ventura County, 1973; Casitas MWD and San Buenaventura, 1978). In 1986, a wet year, the Casitas Dam spilled 742 acre feet from April 23 to May 14. In each of the years from 1984 to 1987, 73 acre feet was released to Coyote Creek (Casitas MWD and San Buenaventura, 1990).

Lower Ventura River: The lower Ventura River flows from the Foster Park dam to the top of the estuary. The river is a gravel bottomed channel generally wider than 700 feet. The lower river, below highway 150 bridge was channelized after the 1969 flood in earthen levees 15 to 30 feet high along the eastern side of the river. The river is directed to a straightened and deepened channel in the modified area. The gradient is 40 feet/mile at Foster Park and 40 feet/mile from Foster Park to the ocean (Casitas MWD and San Buenaventura, 1978). Base flows below the municipal diversion at Foster Park are reduced although a small subsurface flow "usually passes around the eastern end of the City of San Buenaventura's submerged diversion dam, even during drought years, and re-surfaces several hundred meters downstream where it is augmented by the discharge from the Oak View Sanitary District's sewage plant." Flow at Foster Park does flow continuously during some years, as in 1983. From Foster Park to the estuary, the river is perennial with the same water sources as the upper reach combined with flows from the Oak View Plant (Ventura County, 1973; Moore, 1980; Casitas MWD and San Buenaventura, 1984).

The area known as North Ventura Avenue area mostly contains oil fields, oil-related industries and the Ojai Valley Treatment Plant, San Buenaventura Water Treatment Plant, orchards, salvage yards, single family homes and two mobile home parks (Ojai Valley, 1993eir).

Weldon Canyon: Weldon Canyon is an area that is currently used for grazing with some agricultural and oil production. It was originally known as Canada de la Brea or the Canyon of the Asphalt and there are some tar seeps within the canyon. Remains of historic asphalt mines are still found. The canyon was part of the land grant of 6,659 acres known as Rancho Canada Larga o Verde owned by Joaquin Alvarado (later Moraga) from 1841. The canyon was part of 2,843 acres acquired by Samuel Weldon in 1882 (Ventura County, 1992eir).

Weldon Canyon drains an area of about 2.2 square miles (Ojai Valley, 1992). The upper creek has intermittent flows. The lower section of the creek is perennial. Surface water is used for livestock watering during and after periods of rainfall. These surface waters have high sodium sulfate and total dissolved solids (greater than 5,000 mg/L) and is not suitable for drinking water. Shallow alluvial groundwater areas have total dissolved solids ranging from 5,000 to 28,700 mg/L and is not suitable for irrigation. At a proposed landfill site, flora and fauna were surveyed. A number of snags were found providing excellent habitat. The diversity and abundance of cryptogams, lichens, mosses and liverworts, was low and this was attributed to past wildfires at the site. Wildlife values overall at the site were judged to be low due to extensive livestock grazing and the scarcity of year-round surface water. For example, only four of an expected 51 species of mammals were observed during 4 surveys from 1987 to 1990 (Ventura County, 1992eir).

Canada Larga: Canada Larga drains an area of about 19 square miles (Ojai Valley, 1992). Alluvial deposits within the Canada Larga and tributaries is thin and contain only minor amounts of water. Land uses include open space, agricultural (dryland farming, avocado and walnut orchards, dryland farming), grazing, oil production, scattered residential uses, nurseries, and livestock boarding facilities. The section of the creek between Canada Larga Road and Highway 33 is degraded by human activity. There is much trash and the banks have been de-vegetated by erosion and trampling. Hammond Canyon is a 1,868 acre tributary to Canada Larga and has intermittent surface water flow. One spring is located in the middle of the canyon. Leon Canyon, Reynolds Canyon, and Canada Seco are tributaries to Canada Larga that are used for limited cattle grazing. Because of the lack of heavy grazing, these canyon contain extensive woodland and sage communities. Each has an active well or spring that are used for livestock watering (Ventura County, 1992eir).

Canada del Diablo: Canada del Diablo is a steeped walled canyon that drains from the western side of the lower Ventura River watershed. Many slopes in the upper subwatershed are 1:1. The dominant land use is oil production and currently Shell Western Exploration and Production leases the area as an oil field and has installed numerous oil-related facilities. There are substantial oil reserves in the area which may be drilled in the future. The area lies on the flank of the east-west rending Ventura Anticline that is a geologic structure that has trapped petroleum reserves in Ventura County and extends out into the ocean. Additional land uses include cattle grazing and dry land farming (Ventura County, 1992eir).

Ventura River Estuary: The Ventura River terminates at the Ventura River Estuary that includes wetlands. The Estuary area is approximately 30 acres and incorporates portions of the City of San Buenaventura, Seaside Wilderness Park and Emma Wood States Park. The estuary includes a main lagoon that is separated from the ocean by a sand/cobble bar during the dry season. When full, the lagoon covers approximately 1.5 surface hectare and ranges in depth from 0.6 to 2.4 meters.

The lagoon sandbar gets breached by winter storm flows and then through the summer slowly rebuilds as sand is deposited by the long-shore drift. The process is slow and typically the bar does not fully rebuild until August or September. In some extremely wet years, such as 1986, the lagoon remains open to the ocean and thus tidal exchange all year. In some dry years the sand bar never gets breached in the winter and water flows over the sand bar, as in 1987 (Casitas MWD and San Buenaventura, 1990).

For most years, the lagoon is dominated by freshwater during most of the year (CRWQCB-LA, 1993; Moore, 1980). When the lagoon is open to the ocean tidal water level changes are observed to about 150 meters upstream of the railroad bridge (Casitas MWD and San Buenaventura, 1984). The estuary salinity is controlled by tidal flushing during the periods when it is open to the ocean (and ranged in 1988-89 from 2-17 ‰ for surface and up to 20‰ at bottom) and by perennial freshwater inflows during rest of the year. During July and August, when the lagoon is closed, stratification may result in surface salinity of 10‰ and up to 31‰ at the bottom. If the mouth does not open during the summer, the salinity may drop to 0‰ by the fall.

During closed periods, the height of water in the lagoon (up to 1.8 m above mean high tide) is controlled by the amount of freshwater inflows (Mertes et al, 1995). When the lagoon is open, and during low tides the estuary is fresh (conductivity of 1,900 μMHO) to the railroad bridge and then is brackish to just above the breakers at the sandbar (conductivity of under 5000 μMHO) as was measured in early 1983. Pooled areas, however, as far upstream as the railroad bridge can have higher salinities (conductivities of up to 35,000 μMHO). At high tide, that lagoon stratifies with saline water near the bottom having conductivities of up to 43,000 μMHO (Casitas MWD and San Buenaventura, 1984).

The Ventura Estuary is flushed by tides when the sandbar is open and is dominated by slightly brackish to fresh water when the sandbar is closed (Ferren, et. al., 1990 in Ojai Valley, 1993eir). The amount and timing of freshwater inputs determines the depth and salinity patterns of the estuary area (Smith and Robinson, 1986 in Ojai Valley, 1993eir). In the summer, the estuary is dominated by freshwater that tend sot form a floating lens of less saline water over the more saline water. If there is less freshwater inflows then the layers tend to not mix resulting in increased temperatures and reduces dissolved oxygen in the lower saline layer and impacting aquatic habitats (Ojai Valley, 1993eir).

The wetlands and lagoon area support coastal salt marsh, dune swale wetland, scrub/shrub wetland. Along the west side of the estuary is dominated by nonpersistent emergent (annual) vegetation that is unique in the Los Angeles Region. Adjacent are southern arroyo willow riparian forest, alluvial scrub and southern riparian scrub (CRWQCB-LA, 1993; Moore, 1980). An estuary at the second mouth continues to exist to the west of the main lagoon but is only flushed during catastrophic floods. It does not dry out apparently due to a persistent high water table. Salinities are between 10 and 20 ppt (Ferren, et. al, 1990).

A smaller estuary to the west of the main estuary floods during major storms. The side estuary area typically remains flooded and dominated by freshwater (salinity ranging from 9 to 13 parts per mil) when the main estuary is in lagoonal stage due to a raised groundwater level caused by the lagoon water (CRWQCB-LA, 1993).

At the mouth of the river, a sand and cobble aquifer holds large amounts of fresh and brackish water especially if the lagoon is closed and the water table is high. Water is flowing seaward in the deltaic sediments, and brackish water has been observed to seep from berm during low tide (Mertes et al., 1995).

Groundwater Basins

In the Ventura River watershed there are two major alluvial groundwater basins (Figure 2): Ojai Valley/Upper Ojai Basin (under the City of Ojai and extending east although not extending around Lake Casitas as shown in Figure 2) and Upper/Lower Ventura River (area north and south of Oak View). The Sulphur Mountain aquifer is a bedrock aquifer located south of Ojai and Upper Ojai (Ventura County, 1994). Good quality water pumped from the Ojai Basin, the Upper Ojai Basin and the Upper Ventura River Basin is used for agricultural and domestic uses by farmers, homeowners, and two water districts (Casitas MWD and San Buenaventura, 1978).

Ojai Groundwater Basin: The Ojai Groundwater Basin is a fault bounded basin that has been downdropped relative to adjacent mountains and contains alluvium ranging in thickness from 500 to 700 feet. The basin is believed to hold 70,000 acre feet when full. The Upper Ojai Basin is a small basin located southeast of the main Ojai Basin (Casitas MWD and San Buenaventura, 1978). The Ojai Valley groundwater basin is approximately five miles long and extends in an east-west direction, comprising about 7.5 sq. mi. and having a storage capacity of about 70,000 acre-feet. The groundwater is generally in an unconfined condition and recharge is primarily through percolation from active streambeds. However, a confining clay layer is located in the southwest corner of the basin along San Antonio Creek at depths of up to 200 feet where well may be artesian at times (Casitas MWD, et.al. 1997).

Upper Ventura River Groundwater Basin: The upper basin has been partly downdropped along the Arroyo Parida fault to the north. The upper part of the basin has a maximum thickness of 200 feet. The lower part of this basin has a maximum thickness of 100 feet and is approximately 60 to 70 feet thick beneath the riverbed from the confluence with San Antonio Creek to Foster Park. The basin is believed to has a capacity of 14,000 acre feet when full. A natural subsurface obstruction blocks subsurface flow below the Ventura River just above San Antonio Creek causing groundwater to rise as springs. The City of San Buenaventura withdraws water at a surface diversion, a subsurface collector, and four wells at Foster Park. Between 1961 and 1976, the City had an average yield of 5091 acre feet per year. The maximum was 7714 and the minimum was 1706 acre feet. In 1951, the lowest historical water yield was 1463 acre feet (Casitas MWD and San Buenaventura, 1978).

In 1978, EDAW, Inc. reviewed groundwater production in the Upper Basin from 1947 to 1973. Twenty-six wells produced between 1458 and 6268 acre feet per year and since 1963 production was above 4000 acre feet/year. The Ventura County Flood Control District monitors water levels in the basin. 1961 was a dry year and water in the basin was nearly depleted, some wells went completely dry. Water levels as well as water quality in wells closely corresponds to surface flows and quality in the river between San Antonio Creek and Foster Park as the ground water surfaces as springs in the Casitas Springs area. A flow of 1 cfs or more in the river corresponds with a water level of greater than elevation 507 in a well located just above the confluence of San Antonio Creek with the Ventura River. The same relationship occurs in the lower Ventura River Basin as subsurface water that makes it around the Foster Park weir rises as springs below Foster Park contributing to base flow (Casitas MWD and San Buenaventura, 1978).

There are over 300 private wells along the Ventura River and its tributaries, extracting groundwater from the Ventura River Alluvial Basin, outside of the Ojai Basin. The greatest concentration of wells is in the Oak View, Live Oak Acres, and western Mira Monte area where there is significant residential development. A high number of wells is also located along San Antonio Creek.

The Upper Ventura River Basin aquifer is a very shallow, unconfined aquifer consisting of alluvium about 60 feet deep. The total storage capacity is about 14,000 acre-feet and is typically empties during a 1-3 year critical dry period. The dominant source of recharge is direct infiltration of precipitation and percolation from local streambeds. Areas of naturally shallow bedrock underlie portions which cause water levels to remain or rise near the surface (Casitas MWD, et.al., 1997).

San Antonio Creek Basin: A thin alluvium, up to 20 or 30 feet thick, along San Antonio Creek holds relatively good quality water that is used for agricultural and domestic purposes (Casitas MWD and San Buenaventura, 1978).

Lower Ventura River Groundwater Basin: The Lower Ventura River Groundwater Basin has a thickness on the order of 100 feet and probably thickens to 200 to 300 feet thick near the ocean. The boundary between the lower and upper Ventura Basin is the City of Ventura underground diversion weir located at Foster Park. The primary recharge for the lower basin is subsurface flow around the diversion weir. The storage capacity of the lower basin is 1,400 acre-feet. The basin extends to the Pacific Ocean and becomes part of the Oxnard Plain at the coast. The lower basin is made up of sediments and rocks with poor permeability. Ground water within the basin is unconfined with the main water-bearing units being unconsolidated to semi-consolidated alluvial deposits. Depth to water table ranges from 0 to 40 feet with the shallowest levels near the Ventura River Channel. The water level varies significantly with seasons and drought conditions. The basin has historically poor water quality due to high total dissolved solids and is not generally suitable for agricultural or domestic use. The weir that was constructed at Foster park in 1906 cut off a significant flow of good quality ground water, surface flows has been reduced by Robles diversions, and poor-quality water seeps in from the adjacent bedrock areas and from surface flows that are dominated by effluent from the Ojai Valley Wastewater Treatment Plant. "Sources of the degradation have included oil field waste, including discharge of brines into the river, unlined sumps and poor quality recharge from Canada Larga (Casitas MWD and San Buenaventura, 1978; Ojai Valley, 1991; Weldon Canyon Landfill EIR, 1992 in Ojai Valley, 1992 rs; Ojai Valley, 1993eir).

There is only one known well in the Lower Ventura River Basin and it provides irrigation water for a recreational vehicle park at the mouth of the river (LaVerne Hoffman, personal communication in Ventura County, 1992eir).

Weldon Canyon*:* In the Weldon Canyon area, sandstones and conglomerates of the Pico Formation form an aquifer that could be developed for agricultural and industrial uses. It does not meet drinking water standards due to high total dissolved solids, chloride, iron, sulfate and sodium. Groundwater wells from the "deep" area of the aquifer are productive and have safe yields of up to 25 gallons per minute (Ventura County, 1992eir).

Inter-connectiveness of ground and surface waters

The important groundwater basins in the Ventura River are in alluvial deposits below and adjacent to the surface waterbodies. A study by Casitas MWD and the City of San Buenaventura (1990) showed the interconnection between the Ventura River and the Upper Ventura River Groundwater Basin. After each rainstorm in 1985 and 1986, stream gages recorded immediate increases in streamflow. Groundwater levels increased with each new storm but not as quickly. Groundwater in the basin shows a seasonal variation as well (Casitas MWD and San Buenaventura, 1990).

Flows and Precipitation

Flow in the Ventura River fluctuates seasonally and from year to year as is typical with many southern California systems. In addition, it is an interrupted stream made up of reaches that flow perennially with intervening intermittent reaches. From headwaters to the Robles dam, the river is perennial (for a distance of approximately 10 km). The flow is intermittent from Robles Dam to the confluence with San Antonio Creek. Historically, there has been little or no surface flow in the river in the summer between Hollingsworth Ranch (8 miles above estuary) to the former Soper's Ranch (14 miles inland). There is a geologic discontinuity at Casitas Springs that causes ground water to rise and feed a perennial stretch of the surface flow below San Antonio Creek. Surface flows in this reach comes from San Antonio Creek, Live Oaks Acres Creek, small springs and rising ground water. Between the confluence with San

Antonio Creek and Foster Park (described in more detail below) flow is perennial with some disruption at Foster Park by the groundwater extraction. The gradient at Robles dam is 70 feet per mile, at highway 150 is 70 feet/mile, 50 feet/mile at confluence with San Antonio Creek, 40 feet/mile at Foster Park and 40 feet/mile from Foster Park to the ocean (Ventura County, 1973; Moore, 1980; Casitas MWD and San Buenaventura, 1984; Casitas MWD and San Buenaventura, 1978).

The river has a perennial flow to the estuary due to rising groundwater and water discharges which have been reduced significantly by various diversion projects. Another major influence on habitats is the seasonal and at times catastrophic winter floods that can significantly alter the path of the river channel, topography of the floodplain and delta, and location of estuarine wetlands. Floods that cause extensive damage have occurred about every 12 years. The largest flood event between 1929 and 1971 occurred in 1969 and was recorded at 58,000 cfs. Channel migration in 1978 and 1982 also caused damage even with lesser flows. Large floods temporarily remove most of the vegetation, greatly alter topography, and completely redefine the habitats and occurrence of vegetation. Floods also transport and restore various plant species of the lower watershed that may have been artificially removed (Ferren, Jr., 1990).

Water flows in the River as a whole have been reduced since the 1940's by diversion dams (described below) and by ground water wells located within the river alluvial sediments. The river terminates at the Ventura River Estuary that is separated from the ocean by a sandbar that is regularly naturally breached by water backing up behind it in the dry months and by winter storm flows (Ventura County, 1973; Moore, 1980). The combined effect of Matilija Reservoir, Robles Diversion and Casitas Dam results in the control of flows in the mid-range from 0 to 14.5 cms. Flows on the Ventura River from 0.556 to 14.5 cms are diverted to the Robles Diversion (Moore, 1980).

Major floods occur in the watershed irregularly with the potential for more than one flood in a given year. In the last 60 year period, based on stream gage records, significant floods in the Ventura River Valley occurred in 1938, 1943, 1952, 1958, 1969, 1978, 1980, 1983, 1992 (Ojai Valley, 1992) and 1995. The Ojai Valley Plant was damaged in the 1969 flood (Friends of the Ventura River, 1992). At the USGS Gage near Foster Park, the 100-year flood is 75,184 cfs (Ojai Valley, 1992au).

Flows in the Ventura River are governed by precipitation (rainfall and snowmelt), discharge from springs, seepage into and out of groundwater aquifers, and by storage and release of flows from reservoirs, particularly Lake Matilija and Lake Casitas (Casitas MWD and San Buenaventura, 1978). Within the watershed, there are a total of four NPDES permitted surface water dischargers (three regulated by general permits) with a combined maximum permitted volume of 3.85 mgd, 3 mgd of which is accounted for by a municipal wastewater treatment plant discharging tertiary treated waste water. Ventura River flows are measured by the Ventura County Flood Control District at eleven gauging stations (Figure 3) and the U.S. Geological Survey at one gauging station (in the lower watershed). Three of the County gages record peak flows only: Canada Larga at Ventura Avenue, Fox Canyon Drain below Ojai Avenue, and Happy Valley Drain at Rice Road. Information on a variety of stream parameters at the USGS station (including flows and precipitation) may be found at http://water.usgs.gov/ca/nwis/rt.

There are sixteen rain gage stations within the Ventura River. Long term annual average precipitation in the watershed is about 24 inches. Precipitation ranges from seven inches per winter month in the highest elevations to less than five inches per winter month in lower elevations. Annually, up to 40 inches fall in the high areas and fifteen inches at the estuary. Average annual precipitation in Ojai is 21.67 inches mostly falling between November and March. This is higher than nearby Ventura and Oxnard that only average 14.45 inches per year (NOAA, 1982 in Ojai Valley, 1993eir). Over 80% of the precipitation occurs during the winter months (Mertes, et al., 1995; Casitas MWD and San Buenaventura, 1984). Ventura Flood Control rain gages are located at the Ventura River Mouth, Casitas Station and Matilija Station.

Water Agencies and Water Use

County-wide, water supplies (approximately 425,500 acre feet per year) are obtained from surface water (10.5%), ground water (67%), imported water (22 %) and reclaimed water (0.5%). In 1992, water demand was by agricultural users (68%), residential (22%) and commercial and industrial users (10%). Demand is greater than supplies and so many of the county's groundwater basins are overdrafted. In addition, many basins of the county contain naturally high amounts of inorganic compound such as total dissolved solids that make it necessary to blend the water with other, less mineralized, water before use as drinking water. Ventura County has several management programs in place that promote water conservation such as tiered rate schedules and plumbing retrofit. The county imported water entitlement is 20,000 acre feet per year. Conjunctive use is encouraged (Ventura County, 1994a).

Meiners Oaks County Water District is an independent special district formed in 1949 and provides water to residential, commercial, and agricultural customers (about 1,200 connections) in the Meiners Oaks area via four wells (Casitas MWD, et.al. 1997).

The *Ventura River Municipal Water District* was formed in 1952 (later renamed *Casitas Municipal Water District*) for the purpose of investigating and solving the water supply problems existing within its boundaries. The water district has wells that produce from the Upper Ventura River Ground Water Basin (Casitas MWD, et.al. 1997). Casitas Municipal Water District supplies potable water to 60,000 people in the Ojai Valley, the City of Ventura and the county North Coast through 2,606 connections, 250 agricultural connections and 33 other utility connections (Ventura County, 1994a; Casitas MWD, 1995). There are four service areas within the district: Gravity, Rincon, lower Ojai Valley and upper Ojai Valley. All property owners within the district are eligible to be served water without discrimination because all property owners within the district's boundaries pay fees to cover the cost of Casitas Dam and distribution facilities (Ventura County, 1992eir).

The source water is from Lake Casitas and is supplemented by water from the Mira Monte Well. The water from the Mira Monte Well exceeds the nitrates MCL and must be blended with lake water prior to delivery to customers (Ventura County, 1994a; Casitas MWD, 1995).

Ojai Valley municipal and industrial uses are supplied by the Casitas MWD and local groundwater wells (Ventura County, 1994a).

A contract for additional State Water Project entitlement of 20,000 acre feet was transferred from the County to Casitas MWD in 1971. Casitas in turn contracted portions of the entitlement to United Water Conservation District (5,000 acre feet/year) and the City of Ventura (10,000 acre feet/year). These waters were not delivered, however, because of lack of delivery systems. In 1990, United Water Conservation District did receive 5,000 acre feet by releases to Lake Piru from the California Department of Water Resources controlled Pyramid Reservoir; this release was cut back to 1,500 acre feet in 1991 (Ventura

County, 1994a). Casitas Reservoir is operated to maximize storage and does not have a planned reserve storage capacity for stormwater (Friends of the Ventura River, 1992).

The *Ojai Basin Ground Water Management Agency* was formed by the state legislature in 1991 in response to the needs and concerns of local water agencies, water users and well owners in the Ojai Basin. The quality of ground water in the basin is generally good, with the exception of localized nitrate concentrations. Agricultural water use is the largest single demand in the Ojai Basin. It is met by private wells and imported water from the Casitas MWD. Municipal and industrial water demands in the City of Ojai are met by the Southern California Water Company, mostly from four wells in the center of the basin. The remainder of its production is derived from purchases of water from Casitas (Casitas MWD, et.al. 1997).

The *Southern California Water Company* provides municipal and industrial water to the city of Ojai and also provides for a small area outside of the city limits. About 90 percent of its production is from four wells which extract from the Ojai Ground Water Basin. The remainder of its production is derived from purchases from the Casitas MWD (Casitas MWD, et.al. 1997).

The *Ventura River County Water District* is an independent county water district which provides retail water service to the Meiners Oaks area, and obtains its water supply from wells in the Ventura River and from purchases from the Casitas MWD (Don Davis, pers. comm.).

California Department of Water Resources determines water balance in the state by region. The Los Angeles Regional Board and all of its watersheds fall within the South Coastal Region which includes the coastal watersheds between Santa Barbara County and Mexico. Although this area covers about 7% of the state's total land, this region is home to about 54% of the state's population and is an area that places extreme demands on the state's water resources. In the South Coast region about 67% of the 1990 water supply came from imports, 25% was supplied by ground water (1,083,000 acre feet), 6% from surface water and 2% from reclaimed water (CA DWR, 1994wp). The Department of Water Resources conducts a field program during which instantaneous flow rates are measured or estimated.

The *City of San Buenaventura* obtains its water from Casitas MWD, surface and groundwater from the Foster Park Diversion at Ventura River, and groundwater wells in the Mound, Fox Canyon and Santa Paula Basins (Ventura County, 1994a). The City of Ventura obtains approximately 6,000 acre feet/year of water from four ground water wells (Nye wells No. 1, 2, 7 and 8) and from the Ventura River (36 inch intake pipe upstream of diversion; average production was 1.82 acre feet per day in 1983) at a diversion near Foster Park (Ventura County, 1994a; Casitas MWD and San Buenaventura , 1984). The City has owned and operated the Foster Park facilities since 1923 and have appurtenant water rights dating back to 1870 (Casitas MWD and San Buenaventura, 1978). Surface water is not diverted when the water has high turbidity or when the active river channel is not adjacent to the surface diversion structure. From Foster Park, the diverted water flows by gravity to Kingston Reservoir at the Avenue Water Treatment Plant where there is a master flow gage (Casitas MWD and San Buenaventura, 1990). The city generally uses it water supplies in the following order: Ventura River (Foster Park facilities), Lake Casitas (through Casitas MWD), and ground water (Mound Ground Water Basin, Oxnard Plain Ground Water Basin, and Santa Paula Ground Water Basin) (Casitas MWD, et.al. 1997).

Supply water is treated at the City of Ventura Water Treatment Plant that is located adjacent to the Ojai Valley Wastewater Treatment Plant in the lower watershed. The treatment plant has a capacity of 13.5 million gallons per day and treats water from the Ventura River at Foster Park and water from the Casitas MWD (Ventura County, 1992eir; Don Davis, pers. comm.).

Historical Events/Development in Watershed

Human habitation has occurred over the last 6,000 years but the most significant impacts have resulted from agricultural operations over the last 150 years and more recent urban developments during the last 75 years (Ferren, Jr., 1990).

Native American Occupation, 6,000 BC – 1,542 AD: There are two recorded pre-historic and several Native Indian sites near the mouth of the river. The Native Americans were largely hunter-gatherer-fisher people and appear to have little altered the native vegetation of the area through agricultural or hunting practices (Ferren, Jr., 1990). The Chumash people lived in the Ventura River watershed area. and full development of their culture occurred from 800 to 150 BP (Ojai Valley, 1993eir).

Early European Development: The Spanish Period, 1542-1822: Juan Cabrillo first visited the coast of Ventura County in 1542. A densely vegetated river believed to be the Ventura River was described. The area was visited by Sebastian Viscaino in 1602 and again a substantial stream was noted. Spanish settlers began to colonize the mainland coast of California in 1769 with the De Portola expedition. A site was selected for the future San Buenaventura Mission during this expedition; the mission was founded in 1782 (Ferren, Jr., 1990).

The city of San Buenaventura was founded in 1782 and used the Ventura River as its source of water. Streamflow was diverted south of the present-day Foster Park and conveyed in an aqueduct to a reservoir (Don Davis, pers. comm.).

Land began to be cleared for agricultural fields with the founding of the mission. Most of the development occurred to the east of the river. Cattle were introduced by the mission and Spanish ranchos which impacted native vegetation and was concurrent with the introduction of nonnative species (Ferren, Jr., 1990; and Casitas MWD, et.al. 1997). Grazing and vineyards were the most noticeable land use changes associated with the Spanish missions in the 1700s and the rancheros of the early 1800s (USFS, 1997).

Early European Development: The Mexican Period, 1822-1848: California became a territory of the newly created nation of Mexico in 1822. The mission agricultural lands were already in decline and declined further with secularization of mission lands in 1833. A large land grant was given in the area in 1846 and was used primarily for ranching and farming although the first significant agricultural impacts did not begin until 1949 with the Gold Rush (Ferren, Jr., 1990).

The San Buenaventura Mission was broken up and large ranchos were established during the 1830s (Ojai Valley, 1993eir). Most of Ventura county's arable land was divided into nearly 20 ranchos. The largest was about 113,000 acres (Ventura County, 1992eir).

Early American Development: 1848-1900: California became a state in 1850. Claims to land ownership were determined and the remaining land was open to homesteading under the National Homesteading Act of 1862. After 1849, the San Buenaventura area experienced considerable expansion of agriculture. Oil production started in 1861 (Ojai Valley, 1993eir). By 1870, the entire east side of the lower river floodplain had been converted to agriculture while the western floodplain remained largely undeveloped. California Ranchos sprung up from 1849 to 1870 with large herds of cattle grazing on open lands (Ferren, Jr., 1990).

The extension of the Southern Pacific Railroad line across the Ventura River estuary in 1887 was the first major urban intrusion into the west side of the delta. Other than bridges needed to span the main river, the line was constructed in an earthen berm 50 feet wide at the base. Various wetland habitats were filled in. A large land purchase in 1870 resulted in expanded agricultural and cattle ranching operations with much remaining vegetation on elevated marine terraces and upper floodplain terraces being cleared. Principal crops were lima beans and fodder for cattle. The ranch was also used for sheep grazing during the 1880s (Ferren, Jr., 1990).

Modern American Development: 1900-present: The existing single truss railroad bridge over the main Ventura River estuary was constructed in 1909; a double truss bridge was constructed in 1914 over the second mouth estuary of the river (Ferren, Jr., 1990).

Water facilities were developed and operated for the city by several companies between 1869 and 1923 and when the city acquired the water system from Southern California Edison and assumed responsibility for providing water to the residents. In years following, the city developed additional sources of water including wells in the eastern portion of the city (Casitas MWD, et.al. 1997).

Major deposits of oil was discovered in the 1920s in the Ventura River Valley and the Ventura Avenue oilfields were developed in 1925. Aquatic vegetation was impacted through discharge of oilfield wastes, such as drilling muds and brines, into the river (Ferren, Jr., 1990).

In 1908, the Ventura Power Company completed construction of a subsurface barrier of concrete beneath Coyote Creek and the Ventura River, approximately 1,200 feet north of Foster Park Bridge. This barrier (also referred to as a weir), is 973 feet long and extends 40 feet into the subsurface. It was designed to alter the flow of ground water in order to recharge a well field developed by the City of Ventura at Foster Park. By 1946, about 300 feet of the weir were exposed to a height of 4 feet. To date, a fish ladder over this exposed portion of the weir has not been constructed.

During WWII, construction of a artillery battery unit in the dunes west of the estuary resulted in substantial damage to the habitat which is still evident today (Ferren, Jr., 1990).

In 1948, a permanent levee was constructed by the US Army Corps of Engineers on the east side of the river from the mouth upstream approximately 2.6 miles (Ferren, Jr., 1990).

In 1948, the hydrology of the watershed was significantly modified when the Ventura County Flood Control District completed construction of a concrete arch dam across Matilija Creek. This dam, which was originally 163 feet high, was designed to store 7,000 water in the Matilija Reservoir (Casitas MWD and San Buenaventura,1978) as well as bring water into the Ojai Valley, via the Matilija Conduit, for water recharge of the Ojai groundwater basin (Steven Wickstrum, pers. comm.).

The Ventura River Municipal Water District was formed in 1952 for the purpose of investigating and solving the water supply problems existing within its boundaries (Bureau of Reclamation, 1954).

During the 1950s, the area's principal economic development centered around agriculture, oil and gas production, commercial, service, and recreational activities. The agricultural industry included both irrigated and dry farming. Oranges, lemons, walnuts, avocados, deciduous fruits, irrigated hay and pasture, and vegetables were the principal irrigated crops. Dry farmed crops included grain hay, barley, beans, nuts, deciduous fruits, and grapes . Three major and several minor oilfields were in production with the largest, Ventura Avenue Oilfield, ranked second in the State by quantity of crude oil produced (Bureau of Reclamation, 1954).

The City of Ventura obtained its water supply during the 1950s from the Ventura River near Foster Park both by gravity and pumping from river gravels. The city also had three relatively deep wells along the beach. During 1953 a total of 6,250 acre-feet were taken from these two sources (~80% from the river). In excess of 2,000 acre-feet of the city's total supply was used by the industrial area in or near the Ventura Avenue Oilfield. Over the previous 10 years nearly 15% of the city's supply was used for irrigation below Foster Park (Bureau of Reclamation, 1954).

A drought prior to 1954 pointed out the need to augment the water supply since the City of Ventura had to rely heavily on the beach wells which were considered a temporary source due to salt water encroachment occurring after continued pumping (Bureau of Reclamation, 1954).

In 1959, the US Bureau of Reclamation constructed Casitas Dam in order to store water to meet demands for potable water and irrigation. The dam is a 285 foot high earth and crushed rockfill structure which holds back water in Lake Casitas which is distributed to residential, commercial, and industrial users in the Casitas MWD. The Robles Diversion was also constructed, which is a low concrete structure that can divert up to 500 cubic feet per second from the upper Ventura River. Diverted waters flow through a concrete-lined canal that empties into Lake Casitas.

Southern Pacific Milling sand and gravel operations in floodplain were initiated during the 1960s (Keller and Capelli, 1992 in Mertes et al, 1995)

Between 1962 and 1964, the 101 freeway was constructed across the Ventura River delta between the Southern Pacific Railroad and Main Street bridge. Part of the crossing was built on fill material which further dissected the habitat. During the mid-1960s, further development occurred in the area; much of the agricultural operations ceased. Construction of the 101 freeway subjected the area to increasing pressures from urbanization, although the river itself and the levee on its eastern side act as a relatively stable urban-rural boundary. And, despite the extensive and repeated disturbance to native vegetation, many plant habitats have remained intact and some have naturally re-established when left undisturbed. This latter phenomenon is particularly evident with Riverine Wetlands and Palustrine Wetlands that are naturally subjected to periodic disturbance from flooding (Ferren, Jr., 1990).

In 1963, the Oak View Sanitary District constructed the Ojai Valley Sanitary District Wastewater Treatment Plant (formerly known as the Oak View Treatment Plant). This plant currently treats a maximum of 3 million gallons per day of domestic, commercial, and industrial wastewaters collected from the City of Ojai and unincorporated areas. After treatment, the effluent is discharged to the Ventura River, just below Foster Park. Up until 1982, the plant was capable of treating to a secondary level. In 1982, rotating biological contractors were added for oxidation of ammonia into nitrate. Even with this nitrification capability, the wastewaters still do not meet requirements for tertiary-treated wastewaters.

In 1969, an oil and gas line was laid along the inland side if the Southern Pacific Railroad right-of-way. As a result, the majority of open water area of the second mouth was filled. Then, in 1971, more railroad bridge work resulted in a berm being constructed that eliminated virtually all of the second mouth open water area (Ferren, Jr., 1990).

The Casitas MWD and the City of San Buenaventura began negotiations in 1973 that resulted in a five year trial conjunctive use agreement starting in December 1983. The trial operating period was designed to 1) evaluate the impact of the agreement on water quantity, water quality, fishery resources and rights of other users; 2) determine the need for and effectiveness of mitigation measures; 3) determine the need for additional changes in the agreement; and 4) determine whether the agreement should extend beyond the trial period. The agreement included requirements for extensive monitoring of water quality, riparian and aquatic habitat and fishery resources in order to evaluate changes as a result of the change in operations, in particular, in the riparian zone of the "live stretch" of the river extending upstream from Foster Park and including lower San Antonio Creek. Monitoring commenced in the summer of 1982 (Casitas MWD and San Buenaventura, 1984). The Agreement's Environmental Impact Report was challenged in court and was negated by the court in June 1988. The Agreement was not re-formalized or implemented (Casitas MWD and San Buenaventura, 1990).

State Park camping facilities completed in 1982 increased human activity in the area and further impacted the Southern Coastal Dune vegetation to the point of elimination. The dunes began to migrate inland as a result. Construction of a recreational vehicle park and an additional parking lot for the nearby fairgrounds increased traffic and use of the area with more impacts to habitat (Ferren, Jr., 1990).

The largest U.S. fire of the year, the Wheeler Fire (118,000 acres), occurred in the Los Padres National Forest in July of 1985. Approximately 95% of the Ventura River watershed was burned (Casitas MWD and San Buenaventura, 1990).

The Regional Board issued Cease and Desist Order No. 90-063, which directed the Ojai Valley Sanitary District to construct the necessary upgrades for meeting tertiary-level requirements by January 1, 1998. The District completed the upgrade in fall 1997.

Biological Setting

The Ventura River watershed includes several habitat blocks including the Ventura River estuary area, a large block of open space in the Santa Ynez Mountains within the Los Padres National Forest, and Sulfur Mountain (120 square miles) bounded by Ojai Valley, Santa Paula Creek and Highway 126 (Ojai Valley, 1993eir). The following sections summarizes flora and fauna from the watershed with special emphasis on the estuary as that area has been most extensively studied.

Vegetation: The upper mountainous portions of the Ventura River watershed is dominated by chaparral. Coniferous forest occurs at the highest elevations. At lower elevations, plant communities include southern oak woodland, riparian woodland, coastal sage scrub, coastal strand and coastal fresh and saltwater marsh. Riparian plants changes from Black cottonwood, California Sycamore and White alder in the upper watershed to Willow dominating in the lower elevations (Moore, 1980). The Ventura River Estuary/lagoon area contains nonpersistent emergent (annual) vegetation, composed on coast goosefoot, spear-leaved saltbush, and salt march sand spurrey, that is a unique vegetation type within the Los Angeles Region (CRWQCB-LA, 1993).

Plant/animal associations in the Ventura River Watershed include Coastal Sage Scrub, Chaparral, Grassland, Oak Woodland, Riparian Scrub and Woodland, Walnut woodland, Oak savanna, Rockland, and Freshwater Habitat.

Riparian vegetation helps to stabilize mid-channel sand bars and banks during moderate floods, however, during high-magnitude floods this riparian vegetation tends to get ripped out. Debris flowing downstream creates a potential hazard when it gets caught on bridges and other obstructions. In addition, the presence of riparian vegetation alters the stream flow by increasing "roughness" of channel and banks resulting in slower water velocities allowing flood levels to rise. Vegetation also reduces channel capacity (Ojai Valley Sanitary District, 1992au). Vegetation and riparian habitat are often scoured during heavy winter storms and some regrowth is observed within the year (Casitas MWD and San Buenaventura, 1984).

In the estuary: 1) palustrine wetlands cover more area (>55 acres = 37%) than other wetland types, 2) subtidal deepwater habitats are the most abundant estuarine category (11 acres = 7%), 3) the rarest unit of vegetation is estuarine aquatic bed (0.028 acres = .02%, 4) ruderal habitats are the second largest group of categories (>30 acres = 20%) (Ferren, et. al., 1990).

Vertebrates: An inventory of vertebrates in 110 acres of the lower watershed was conducted as part of the Ventura River Estuary Plan. The area surveyed included Emma Wood State Beach-Ventura River Group Camp, Seaside Wilderness Park and the Hubbard Property. 170 genera and 265 species of vertebrates ranging from birds to amphibians, fish and bats were found by the researchers who used live traps, traplines, and visual observations. Of note were the eleven species of natives fishes found with six introduced species. Only one native and one introduced species each of amphibian was found and five species of reptile, all native. The vast majority of bird species were native while about one-third of the mammal species were introduced (San Buenaventura, 1992).

Amphibians: In the estuary, conditions are marginal for amphibians because of the lack of freshwater and the widespread saline soils and associated halophytic vegetation. The only amphibian found in the 1992 study at the estuary was the Pacific Chorus Frog. Upstream, under more freshwater conditions, Bullfrogs (non-native) and Western Toad are abundant (San Buenaventura, 1992). In Ventura River primary and secondary channels 1 to 2 miles upstream of the Main Street Bridge these three frogs were observed in 1990 and again in 1992 (Hunt, 1991 and 1992, in San Buenaventura, 1992). The Black-bellied Slender Salamander is found in tributaries to the Ventura River (San Buenaventura, 1992). The Western Toad occurs in riparian habitats from the estuary to at least one mile north of Main Street bridge (Martin and Snider, 1973 in San Buenaventura, 1992). The California red-legged frog is found primarily in quiet pools in tributaries to the Ventura River (Ojai Valley, 1993eir).

Reptiles: Reptiles found in the 1992 Estuary survey include Western Fence Lizard, Side-blotched Lizard, Gopher Snake, Common Kingsnake, Silvery Legless Lizard and Southwestern Pond Turtle. Upstream along the Ventura River and/or in upper tributaries, California Horned Lizard, Western Skink, Southern Alligator Lizard, Ringneck Snake, Night Snake, Striped Racer, Common Kingsnake, Two-striped Garter Snake are found (San Buenaventura, 1992).

Birds: The estuary area was classified as good, but not excellent bird habitat during the 1992 estuary survey. Raptors should be present in the lower watershed but are "conspicuously absent...This finding is surprising because the lower Ventura River is one of only a few locations along the coastal southern California migratory corridor that combine a prominent geographic location with contiguous arid uplands and relatively well-developed riparian habitats." At least 237 species of migratory and resident waterfowl, and shorebirds use the estuary area for resting, bathing, breeding and feeding. Largest numbers of birds are seen when water levels are low exposing mudflats. Regionally declining and/or endangered species that have been observed include the Osprey, Peregrine Falcon, Snowy Plover, and Least Tern. Upstream in the riparian areas adjacent to the lower river sensitive species include Tree Swallow, Yellow Warbler, and Yellow-breasted Chat. In the upland grassland areas, declining species include the Black-shouldered Kite. (San Buenaventura, 1992). The one pair of the endangered Least Bell's Vireo was spotted in a 1993 survey, located approximately one mile north of the river mouth. Tricolor blackbirds, yellow-breasted chats and yellow warblers were also found in this area (Greaves, personal communication, 1993, in Ojai Valley, 1993eir).

Mammals: The lower river and estuary have local areas of dense rodent populations. These rodents and other prey animals may contribute to the absence of bird and reptilian predators in the area. Mice found in palustrine, dune, riparian and estuarine habitats include Western Harvest Mouse, Deer Mouse, California Mouse, California Vole, Dusky-footed Woodrat, House Mouse, and Black Rat. Rodents tended to be confined to primary habitat areas but the California Mouse which normally occupies riparian and chaparral areas was found in large densities in the coastal saltmarsh vegetation.

Three resident, but introduced mammals species in the lower watershed include House Mouse, Black Rat, and Feral Cat. A large bat roost is located under the Main Street Bridge and is the largest roost "known to date on the coastal slope of Santa Barbara and Ventura Counties." The bridge was built in 1932 and provides vertical crevices that are suitable for roosts. The bats number over 1000 and include Big Brown Bats, Yuma Myotis and Mexican Freetail Bats.

Fisheries: Indigenous fish to the Ventura River are steelhead trout, rainbow trout, partially armored threespine stickleback, and santa ana sucker. Threespine stickleback are common in clear water areas throughout the river. The arroyo chub is native to the Santa Clara River and may have been introduced to the Ventura River as bait in the early 1900's; there is now a healthy, large population in the Ventura River . Additional, non-native fish include common trout, mosquitofish, largemouth bass and green sunfish. Largemouth bass and common carp were not found in the river in a survey in 1976-1977 and may have been introduced into the river when Lake Casitas spilled between 1978 and 1986 (five spills). Green sunfish may also have been introduced into the river from Lake Casitas. Rainbow trout are stocked in Lake Casitas and are planted by the California Department of Fish and Game in North Fork Matilija Creek (Casitas MWD and San Buenaventura, 1990; San Buenaventura, 1992; Ojai Valley, 1993eir).

The estuary serves as an important primary and nursery habitats for several fish species including Topsmelt, Prickly Sculpin, Staghorn Sculpin, surfperches, California Killifish, Steelhead Trout, and Tidewater Goby. Freshwater areas of the estuary are important for the Tidewater Goby and the population in the Ventura River estuary is one of the largest of the 43 known occurrences. Anadromous fish that use the estuary as a pass through include Pacific Lamprey, Steelhead and California Killifish (Casitas MWD and San Buenaventura, 1990; San Buenaventura, 1992; Ojai Valley, 1993eir).

Steelhead trout run on the Ventura River is estimated to have been 4,000 to 5,000 prior to1948 when a prolonged drought and the construction of Matilija Dam occurred. The largest runs occurred in Coyote and Matilija Creeks (Casitas MWD, et.al. 1997). It was estimated that a minimum average run of between 2,000 and 2,500 adult steelhead annually entered the Matilija tributary representing about half of the adult steelhead entering the watershed. Historical records indicate that in the 1880's, the Ventura River was advertised as a trout fishing stream for tourists (Ventura County, 1973; Clanton and Jarvis, 1946 in Moore, 1980). Flows were apparently adequate to support fish throughout most of the mainstem except during droughts. Sections of the mid to upper Matilija Creek are thought to have been the primary spawning habitat (USFS, 1997). Runs of steelhead reported started after the rains in the fall and lasted until early April with schools of trout averaging 10 to 13 pounds each (Henke, 1970 in Ventura County, 1973). Trout fishing helped support a tourist industry in San Buenaventura. Trout fishing contests occurred as late as 1948. Local hotels reserved the ground floors for fishing guests during the trout season. It was estimated in 1946 that trout and steelhead sport fisheries of the Ventura River watershed contributed $100,000 to the county's economy (Clanton and Jarvis, 1946, in Ventura County, 1973).

In 1948, the Matilija Dam was constructed cutting off access to spawning areas on Matilija tributary. Robles Diversion Dam constructed on the Ventura River and Casitas Dam on Coyote Creek in 1958, further reduced the spawning areas. Other than the physical barriers, and during a few specific years where the influence of water development operations can be detected, analysis of flow information indicates the most important control on availability of passage has been climate-driven streamflow regime (Casitas MWD, et.al. 1997).

Currently the migration routes and spawning areas are limited to the lower 14 miles of the Ventura River, the North Fork, and San Antonio Creek. In addition, many holes and other habitat areas have been filled in and riparian habitat has been removed (Ventura County, 1973; Keep the Sespe Wild, 1994). By 1980, only about one or two hundred steelhead entered the river to spawn (Moore, 1980). In 1991, EPA researchers observed between 14 and 25 adult steelhead, ranging in size from 14 to 24 inches, in the estuary approximately 30 meters upstream of the Southern Pacific Railroad bridge (Leidy, 1991).

As of 1973, California Fish and Game annually stocked the North Fork with trout and small numbers of trout were observed between Las Robles and Matilija dams and between San Antonio Creek and the Oak View Plant. Small numbers of fish populations persisted in the effluent-dominated reach below the Oak View Plant although no sports fisheries existed along this stretch. Steelhead trout persisted up all streams to the dams (Ventura County, 1973).

The 1973 County Fish and Game Commission report recommended "1) the restoration of a live stream along the lower reaches of the river, free from pollution and development incompatible with a live recreation stream, and 2) the restoration of the river's once highly productive sport fisheries... including cessation of pollution, pit mining, channelization, and building in the river and on its immediate flood plain." The Commission estimated that between five and ten cubic feet per second flows of water would be needed to create a series of riffle, rapids and pools along a live stream in the lower reaches of the river. Specifically, they recommended using local controls or tax incentives to reduce urbanization and agricultural encroachments on the river, creating a permanent corridor of open space along the river, upgrading the Oak View Plant to tertiary treatment, prohibiting removal of material from the channel for commercial purposes, developing a flood control plan and a comprehensive land use plan for the river area, adjusting the safe yield for Casitas Reservoir to provide for water releases in the critical spring and summer months, providing a fish ladder at Robles diversion dam (this was done), and developing a fisheries management restrictions (Ventura County, 1973).

From 1976 through 1978, Mark Moore studied survival factors for steelhead trout in the Ventura River. 40,000 juvenile steelhead were marked and released and survival rates were assessed. Results indicated that the rearing habitat in the river was productive and the quantity and quality of habitat remained constant throughout the study period except following severe flooding and subsequent emergency flood control activities in the winter of 1978. Groundwater extraction lowering the summer-fall base flow effected survival and growth rates. Moore recommended that minimum flows be established through control of surface diversions and groundwater extractions, that water quality be improved and that a smolt rearing facility be developed (Moore, 1980).

In 1978, EDAW Inc. conducted a fish survey about 1,000 feet above the Ojai Valley Wastewater Treatment Plant. They observed juvenile rainbow trout, arroyo chub, partially armored three-spined stickleback, mosquitofish, and green sunfish. They estimated that 100 adult steelhead spawned each year in the 1970's (Casitas MWD and San Buenaventura, 1978 in Ojai Valley, 1993eir). The number apparently decreased during the 1984 to 1991 drought but had increased by 1993 (Cardenas, personal communication, 1993, in Ojai Valley, 1993eir).

A survey conducted in 1995 captured steelhead trout in six separate sections of the river covering 4.25 miles. A total of 52 specimens were captured including as far upstream as the Robles Diversion and as far downstream as the Shell Road Bridge (14miles upstream and 2.5 miles upstream of the mouth, respectively). The majority of these were of non-hatchery origin. The fish ranged in length from 19 cm to 39.5 cm and averaged 25 cm (CDFG, 1997).

Under normal runoff conditions, steelhead trout are expected to migrate upstream after the first major winter storm that creates continuous flow from Casitas Springs to the ocean, usually in December or January. The normal run is estimated to be about 100 fish. Spawning areas will typically be at lower ends of pools where flow enters a riffle or in a riffle stretch, usually in coarse, open gravel (Kelley in Casitas MWD and San Buenaventura, 1984).

The only area on the Ventura River available and suitable for both steelhead trout spawning and rearing is the 3.2 km reach between the just upstream of San Antonio Creek downstream to approximately Shell Road. Parts of the San Antonio Creek Subwatershed are also considered suitable for both spawning an rearing. Natural variation in stream flows and the potential effects of water withdrawal can affect the quality and quantity of steelhead habitat. Passage barriers and impediments, both natural and manmade, as well as low or complete lack of stream flows during summer and fall (limits availability of juvenile rearing habitat in much of the watershed), problems with streams sediments, lack of riparian vegetation, water quality (especially high temperatures), and low numbers of adult spawners (returning adults) are also limiting factors. Canada del Diablo and Canada Larga are considered unsuitable for both spawning and rearing (Casitas MWD, et.al. 1997). It has been projected that with current resident trout production and access to historically available spawning habitat, Forest lands could support an adult steelhead run of between 2,000 and 3,000 individuals which would be in-line with historical estimates for Matilija Creek (USFS, 1997).

Steelhead rainbow trout (*Oncorhynchus mykiss*) are an anadramous form of resident rainbow trout, spending part of their life in the ocean and part in freshwater. Southern steelhead and rainbow trout are of the same species and potentially interbreed (USFS, 1997). Steelhead trout were historically present in most coastal California streams and resident rainbow trout were present in lakes and streams that do not have access to the ocean. Steelhead usually spend one to two years in the ocean before returning to spawn for the first time. Unlike other anadramous pacific salmonids, steelheads may survive spawning, return to the ocean and spawn again in a later year. Steelhead typically migrate upstream when stream flows rise during a storm event and any sandbar is breached. Depending on rainfall, migration and spawning occur from January to March in most southern California streams and can potentially occur through June in the Ventura River. They usually spawn at the heads of or in riffles with gravel substrate. Optimal size of gravel ranges from 0.6 to 10.2 cm. The female digs a pit in the gravel where she deposits eggs that may be fertilized by more than one male. The female then 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 and result in embryo mortality. Juvenile steelhead emerge in about five to eight weeks, between March and April depending on water temperature. In water temperatures around 60^{o}F, which can be the case in the Ventura River, steelhead can emerge in as short as three weeks. Juveniles generally spend one to three years in freshwater before migrating to the ocean between March and June. It also appears the southern California steelhead may have adapted to the unpredictable climate by being able to remain landlocked for many years or generations before returning to the ocean with flows permit. Young-of-the-year often utilize riffle and run habitat during the growing season and move to deeper, slower water during the high flow months. Coastal lagoons can also provide important rearing habitat for juvenile steelhead, potentially providing the majority of summer and fall rearing habitat in small coastal streams depending on water quality and proximity to spawning habitat (Casitas MWD, et.al. 1997).

Juvenile steelhead can typically tolerate warmer temperatures than other pacific salmonids. Mortality of eggs begins at 56^{o}F. At temperatures greater than 70^{o}F, steelhead have difficulty obtaining sufficient oxygen from the water. The preferred temperature range is reportedly 55.0-60.1^{o}F, although steelhead in the Ventura River have been reported at temperatures as high as 82.4^{o}F. The highest temperature survivable is 84.9^{o}F. Warmer water requires more abundant food resources for fish survival, because of the resultant increase in their metabolic rate (Casitas MWD, et.al. 1997).

<u>Water Resources and Beneficial Uses</u>

Demands for potable water in the Ventura River watershed are entirely met through local supplies of surface and ground waters. Given the adequacy of these supplies to meet the current demand for potable water, reclamation of treated wastewaters has not occurred to any significant degree. The Ojai Valley Sanitation District, however, is assessing the future needs for reclaimed water (Ventura County, 1994a). Likewise, facilities for transferring imported waters into the watershed have not been constructed. At present, the County of Ventura transfers an annual entitlement to 20,000 acre-feet of water imported through the California Aqueduct from the Bay-Delta Estuary in northern California to Casitas MWD who administers the entitlement in the following proportion: Casitas MWD (5,000 acre-feet), United Water Conservation District (5,000 acre-feet), and the City of San Buenaventura (10,000 acre-feet) (Don Davis, pers. comm.).

In addition to meeting demands for potable waters, the local supplies of surface and ground waters also meet demand for irrigation and industrial supplies. Certain surface waters in the watershed also support recreational activities such as hiking, camping, and boating. Prior to 1947, surface flows also supported thriving sport fisheries, including trout and steelhead (Ventura County Fish and Game Commission, 1973). Since extensive hydromodification and increasing developments along the floodplains of the watershed, most of these valuable fisheries have been lost, and the remaining aquatic life throughout much of the watershed is impaired.

The various uses of waters described above are referred to as beneficial uses. The Regional Board designates beneficial uses of all waterbodies in the *Water Quality Control Plan for the Ventura and Los Angeles Coastal Watersheds* (usually referred to as *Basin Plan*). These beneficial uses are the cornerstone of the State and Regional Board's efforts to protect water quality, as water quality objectives are set at levels that will protect the most sensitive beneficial use of a waterbody. Together, beneficial uses and water quality objectives form water quality standards.

Twenty-one beneficial uses for waters in the Ventura River watershed are designated in the Regional Board's *Basin Plan*. These beneficial uses are listed by waterbody and hydrologic unit in the table below. Certain site specific water quality objectives, namely TDS, sulfate, chloride, boron, and--for surface waters--nitrogen, reflect background levels of constituents in the mid-1970s, in accordance with the State Board's Antidegradation Policy. Water quality objectives for these and for other constituents and parameters can be found in the Basin Plan (CRWQCB-LA, 1994).

Watershed[a]	Hydro Unit #	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	REC1	REC2	COM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
VENTURA RIVER WATERSHED												E													
Ventura River Estuary c	402.10							E		E	E	E		E			E	E	E		Ee	Ef	Ef	E	E
Ventura River	402.10	P*	E		E	E	E			E	E			E	E				E		E	E	E		E
Ventura River	402.20	E	E	E	E	E	E			E	E			E	E				E		Eg	E	E		E
Canada Larga	402.10	P*		I	I	I	I			I	I			I	I				E			I	I		
Lake Casitas	402.20	E	E	E	E	P	P		P	Ph	E			E	E				E		E				
Lake Casitas tributaries	402.20	E*			P	E				E	E			E	E				E		P	E	E		E
Coyote Creek below dam	402.20	P*				E				P				E	E				E			E	E		E
San Antonio Creek	402.20	E	E	E	E	E				E	E			E	E				E			E	E		E
San Antonio Creek	402.32	E	E	E	E	E	E			E	E			E	E				E			E	E		E
Lion Creek	402.31	I*	I	I	I					I	I			I	I				E						
Reeves Creek	402.32	I*	I	I	I	I				I	I			I	I				E			I	I		
Mirror Lake	402.20	P*				E				P	E			E					E						E
Ojai Wetland	402.20	P*								P	E			E					E						E
Matilija Creek	402.20	P*				E				E	E				E				E			E	E		E
Murietta Canyon Creek	402.20	P*				E				E	E				E				E			E	E		E
North Fork Matilija Creek	402.20	E*	E	E	E	E				E	E			E	E				E		E	E	E		E
Matilija Reservoir	402.20	E			E	E	E			E	E			E	E				E			E	E		E

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E, P, and I shall be protected as required
* Asterixed MUN designations are designated under SB 88-63 and RB 89-03 Some designations may still be considered for exemptions at a later date. (See pages 2-3, 4 for details).

Footnotes are consistent on all beneficial use tables.

a Waterbodies are listed multiple times if they cross hydrologic area or sub area boundaries
Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
b Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.
c Coastal waterbodies which are also listed in Coastal Features Table (2-3) or in Wetlands Table (2-4).
e One or more rare species utilize all ocean, bays, estuaries, and coastal wetlands for foraging and/or nesting.
f Aquatic organisms utilize all bays, estuaries, lagoons and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.

k Public access to reservoir and its surrounding watershed is prohibited by the Los Angeles Department of Water and Power
m Access prohibited by Los Angeles County DPW in concrete-channelized areas.
u This reservoir is covered and thus inaccessible.
x Owner prohibits public entry..
z Listed twice in this table (see next page).

Beneficial Use Definitions

Beneficial uses in the Los Angeles Basin are listed as defined below. The uses are listed in no preferential order.

Municipal and Domestic Supply (MUN)
Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.

Agricultural Supply (AGR)
Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.

Industrial Process Supply (PROC)
Uses of water for industrial activities that depend primarily on water quality.

Industrial Service Supply (IND)
Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well re-pressurization.

Ground Water Recharge (GWR)
Uses of water for natural or artificial recharge of ground water for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers.

Freshwater Replenishment (FRSH)
Uses of water for natural or artificial maintenance of surface water quantity or quality (e.g., salinity).

Navigation (NAV)
Uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.

Hydropower Generation (POW)
Uses of water for hydropower generation.

Water Contact Recreation (REC-1)
Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs.

Non-contact Water Recreation (REC-2)
Uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.

Commercial and Sport Fishing (COMM)
Uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.

Aquaculture (AQUA)
Uses of water for aquaculture or mariculture operations including, but not limited to, propagation, cultivation, maintenance, or harvesting of aquatic plants and animals for human consumption or bait purposes.

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

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

Inland Saline Water Habitat (SAL)
Uses of water that support inland saline water ecosystems including, but not limited to, preservation or enhancement of aquatic saline habitats, vegetation, fish, or wildlife, including invertebrates.

Estuarine Habitat (EST)
Uses of water that support estuarine ecosystems including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds).

Wetland Habitat (WET)
Uses of water that support wetland ecosystems, including, but not limited to, preservation or enhancement of wetland habitats, vegetation, fish, shellfish, or wildlife, and other unique wetland functions which enhance water quality, such as providing flood and erosion control, stream bank stabilization, and filtration and purification of naturally occurring contaminants.

Marine Habitat (MAR)
Uses of water that support marine ecosystems including, but not limited to, preservation or enhancement of marine habitats, vegetation such as kelp, fish, shellfish, or wildlife (e.g., marine mammals, shorebirds).

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

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

Stakeholder Groups

Ventura River Steelhead Restoration and Recovery Plan Group A Plan was developed in response to the listing of steelhead trout as an endangered species by the National Marine Fisheries Service (NMFS) in August 1997. The plan was developed 1) to identify measures to mitigate impacts of ongoing operations and maintenance activities, 2) to identify future projects and, 3) identify and evaluate opportunities to promote recovery and restoration of the steelhead trout in the watershed. One staff person will continue to remain involved with the group, as needed.

Ventura River Habitat Conservation Plan (HCP) Group: The group, mostly comprised of resource agencies, cities, and water districts, began meeting in 2000. The cities and water districts involved all operate and maintain facilities that may affect sensitive resources or their habitats in the river. In order to comply with the Endangered Species Act they are engaging in consultation with the National Marine

Fisheries Service and US Fish and Wildlife Service and are in the process of developing a HCP that, with monitoring program and implementation agreements, would serve as the basis for an Incidental Take Permit.

Matilija Dam Steering and Executive Committees: The USACE, Ventura County Flood Control District, US Bureau of Reclamation, and other agencies and entities began convening in 2000 to begin discussions on the possible removal of Matilija Dam as part of an ecosystem restoration. An USACE and VCFCD sponsored feasibility study will begin shortly to consider the benefit to the ecosystem from various alternatives. Information on the progress of this study may be found at http://www.matilijadam.org/.

Population, Jurisdictional, and Land Use Characteristics

Ventura County covers approximately 2,010 square miles and 90% is rural. The Los Padres National Forest covers about half of the county (Ventura County, 1994). Development in the Ventura River watershed has generally been limited to floodplain areas. In the upper watershed, there are a number of vacation homes along the watercourses. Most of the land in the Ventura River Valley is privately held.

Communities

Although much of the watershed is undeveloped, pockets of urbanized areas are found throughout the middle and lower watershed and the river empties out at the City of San Buenaventura. Watershed cities include Ojai (7,615 population in 1990/4.7 sq. miles), San Buenaventura (92,575 population/19.4 sq. miles; partly drains to other watersheds)(Ventura County, 1994). Housing stock in the City of Ojai is estimated at 3,150 (Ojai Valley, 1992 rs).

The bulk of the watershed falls within unincorporated Ventura County and includes the unincorporated communities of Casitas Springs, Foster Park, Oakview, Valley Vista tract and areas along Ventura Avenue (1,427 people), Mira Monte, Meiners Oaks, Upper Ojai, and Live Oaks Acres (Ventura County, 1992eir; Jean Melvin, personal communication in Ventura County, 1992eir

Other jurisdictions in the watershed includes the Los Padres National Forest, Casitas Municipal Water District, Teague Memorial Area (exclusion lands), Ojai Area Plan (74,000 acres of unincorporated portions of Ojai and Ventura River valleys), and the Ventura County Fire Protection Department (est. 1928). The River and flood plain at the mouth are owned by the state and the City of San Buenaventura. The Ventura County Flood Control District holds flowage easements along portions of the Ventura River (Ventura County, 1973).

Cultural Resources

The Ventura River watershed lies within the historic Chumash Native American territory and the entire Ojai/Ventura River valley is considered culturally sensitive to the Chumash people. In the lower watershed, remnant trees stand that were part of a grove that contained a tree known as the Wind Sycamore which is of significance to the Chumash people (Ventura County, 1992eir; Ojai Valley,1992 rs).

Remains of the San Buenaventura Mission including a massive aqueduct are protected under the National Register of Historic Places (Ventura County, 1992eir).

Land use

The Ventura River watershed supports a variety of land uses (Figure 4). The proportion of land uses for the future are controlled by a variety of plans that are described in this section. This section describes land use types within the watershed.

<u>Natural areas</u>

Riparian areas: Riparian areas make up an estimated 500 acres in the Casitas and Robles subwatershed (Casitas MWD, 1995). The width of the riparian zone is about 3 meters in the upper steep headwater areas, widens to 5 meters in the less steep lower channels and supports some scrub/shrub vegetation. Lower, in the upper areas of main tributaries, the zone widens to 15 to 25 meters. The main tributaries, such as San Antonio Creek the alluvial cross section varies from 25 to 100 meters on average. The riparian corridor of the Ventura River averages 300 meters and widens to 600 meters in the braided reach.

Wetland areas: Mertes et al (1995) characterized Ventura River watershed wetlands and determined relationship between wetland type and function. They visited over 100 sites between April, 1993 and July 1994. Due to the lack of cooperation of some private landowners, many other sites were identified using fine resolution aerial photography. Additional information was obtained from previous field work by Ferren et al (1990) and Capelli and others from April 1987 to October 1989. Twelve reference sites were chosen for the watershed. For most of the watershed, the wetlands are in pristine or only moderately impacted. A diversity of wetland types were observed in the watershed types representing the full range of wetland types found in southern California. In general, the wetlands serve to exchange nutrients, reduce toxic substances, retain flood waters, and in some areas, stabilize sediment. Below are brief description of the identified wetland land types. In brackets are the calculated areal extent of each type:

Marine wetlands (0.01 km^2 of the watershed): Thirteen types of marine wetlands were identified based on the dominant species and the degree of tidal flooding. Different algae types were found in areas with different tidal regimes. The substrates are rock and cobble.

Estuarine wetlands (0.11 km^2 of the watershed): Twenty-six estuarine wetlands on mud, sand and cobble substrates, were distinguished by hydrogeomorphic habitats, dominant species, salinity and degree of flooding. The wetlands provide habitat for sensitive species including California Least Tern, Tidewater Goby and entry point of Steelhead Trout.

Lacustrine wetlands(1.4 km^2 of the watershed): Wetlands occur around almost all of Lake Casitas and fall into eleven classifications. These wetland types do not have a large amount of vegetation cover and are distinguished by duration of flooding, dominant species and hydrogeomorphic unit. These wetlands serve to stabilize shoreline and provide areas for groundwater recharge. The development of tules of California Bulrush has provided an increased habitat for the Tricolored Blackbird.

Riverine wetlands: 85 distinct types of riverine wetlands are characterized by non-persistent vegetation that reflects the stressful stream environment. The wetlands range from types associated with springs, ephemeral streams, intermittent and perennial creeks. In the lower reaches, there is "potential habitat for numerous species but few have been collected...The apparent lack of native submerged rooted-vascular species could be the result of a combination of water-pollution and invasion by exotic species such as Watercress." Other impacts include grazing, groundwater pumping reducing flows, loss of anadromous fish due to downstream fish barriers, flood control channelization, urbanization, and invasion of exotic species. The "rejuvenation of the riparian substrate through reworking by flood flows is restricted to catastrophic flows and may have the long term effect of reducing diversity."

Palustrine wetlands: There are 265 types of palustrine wetlands that are further divided into riparian, vernal and other:

> Riparian Corridor wetlands: Riparian corridor palustrine wetlands are distinguished by topography, hydrology, degree and frequency of disturbance, and variation in local substrate. They vary in a systematic way as one moves upstream and into higher elevations and as one moves away from the water source. The sequence changes from aquatic vegetation to emergent annuals, scrub/shrub, and then forest.
>
> Vernal wetlands(1.0 km^2 of the watershed): Three types of vernal wetlands occur in the watershed. The most common type is freshwater marsh and often is associated with faults. Vernal wetlands provide areas for accepting and subsequently releasing groundwater from springs. One of the most significant vernal habitats is the Mirror Lake wetland. The Mirror Lake wetland area has been severely impacted by construction of roads, homes and a care facility that have reduced the size and amount of flooding. Many indicator species have been lost including a candidate 2 endangered species *Sagittatia sanfordii* (it was the only location in southern California where this species occurred until ca. 1980). Vernal wetlands in the watershed have also been severely threatened by grazing and plowing
>
> Vernal wetlands associated with seeps and falls: Most of the seeps and springs in the watershed support extensive saturated wetlands. Many of the watershed springs have sulfur and or petroleum (tar) concentrations.

Riverine and palustrine wetland area, excluding vernal wetlands, is calculated at 19.3 km^2. Total wetland area is approximately 22 km^2 representing about 3.8% of the total watershed surface area. The preponderance of faults in the watershed helps to increase the total wetland acreage by creating wider floodplains along creek just above the juncture of creeks with faults. Although the wetlands have been impacted by human activities, the wetlands are resilient and have made recoveries. A gravel extraction site that was mined for 25 years by Southern Pacific Milling was planted with native vegetation in 1992. The restoration has been so successful that the endangered Least Bell's Vireo has returned to nesting sites there (Mertes et al., 1995).

Human-impacted

Grazing: Rancho Canada Larga is a 6,474 cattle ranch in Weldon and Canada Larga Canyons (Ventura County, 1992eir).

Oil fields: There are several areas of active oil production within the watershed. The Ojai oil field has been operated by Union Oil Company since the 1950's. This field includes Weldon Canyon #1, #2, and #3 which range in depth from 3,171 to 3,535 feet. In 1988 the oil production from these wells was approximately 600 barrels per month (Patrick Moran, personal communication in Ventura County, 1992eir).

Corrals/ Confined animal areas: Livestock within the Casitas Lake subwatershed were all penned over 100 feet from the nearest creek (Casitas MWD, 1995).

Recreational areas: The watershed has many recreational facilities and parks. Casitas MWD owns and operates the Casitas Lake Recreation Area. Body-contact water recreation is prohibited at the recreation area, but camping, boating, and fishing are allowed. The average daily recreational visitor usage from May to September 1994, was 2,966. 80% of the shoreline is closed to the public. All waste water from the recreation area is hauled away except for disposal of shower water in one septic system. 100 camping site US Forest Service Campground is located on the upper Ventura River (Casitas MWD, 1995).

The County operates Foster Park which provides day use and camping facilities (Ojai Valley, 1993eir).

Emma Wood State Beach, Ventura River Group Camp and City of San Buenaventura's Seaside Wilderness Park are located adjacent the estuary. Informal access to the river and estuary also occurs.

There are several multiple-use trails serving bicyclists, equestrians, and pedestrians in the watershed. The Ojai Valley Trail follows the abandoned Southern Pacific Railroad right-of-way and is located along ht west side State Route 33 from Ojai to northern Foster Park. In the City of San Buenaventura, the Omer Raines Trail terminates at Main Street. A Class I trail, following the Southern Pacific Railroad easement connects the Ojai Valley Trail with the Omer Raines Trail (Ojai Valley, 1993eir; Don Davis, pers. comm.).

National Forest lands: Land use in National Forest areas is restricted to recreation and cattle grazing (Casitas MWD, 1995).

Highways, roads: Transport of hazardous waste is prohibited on Highway 33 but not on highway 154 (Casitas MWD, 1995).

Developed areas: Charles M. Teague Memorial Watershed (exclusion lands) was purchased by the US Bureau of Reclamation and present homeowners are leasing the land. The Casitas MWD enacted Rules and Regulation for the management of the memorial watershed on June 24, 1981.

The watershed includes most of the land draining to Lake Casitas outside of the Nation Forest. All septic systems in this area were constructed in conformance with the Ventura County Critical Watershed Ordinance (Casitas MWD, 1995).

Chronology of Studies, Plans, and Regulations

This section is a chronological history of major studies, plans and regulations enacted over the years in the watershed. Recommendations from earlier studies are included and as often as possible the status of the recommended actions is listed.

1958: Ventura County adopted a critical Watershed Ordinance on January 14, 1958 that regulated areas outside of incorporated cities, that regulates disposal of human and animal waste.

1973: An investigation into pollution of the Ventura River was initiated in 1970 by the Ventura County Fish and Game Commission and evolved into a study to protect and restore the Steelhead Trout run. The resulting1973 report *Ventura River Recreation Area and Fishery Report* recommended “1) the restoration of a live stream along the lower reaches of the river, free from pollution and development incompatible wit a live recreation stream, and 2) the restoration of the river's once highly productive sport fisheries... including cessation of pollution, pit mining, channelization, and building in the river and on its immediate flood plain." (Ventura County, 1973).

1974: Ventura County was designated as a Federal Clean Water Act Section 208 planning area in 1974. The county assessed water quality problems between 1975 and 1978. In 1978, the *208 Water Quality Management Plan* was adopted by 23 local agencies. The plan recommended short term solutions for immediate water quality problems (Ventura County, 1994a).

1978: Ventura County adopted the *Section 208 Water Quality Management Plan* in 1978. Ventura County designated as the implementing agency of the 208 Water Quality Management Plan.

1978: A *Ventura River Conjunctive Use Agreement Environmental Impact Report* was released in 1978. This proposed project was never implemented (Casitas MWD and San Buenaventura, 1978).

1979: The *Ventura County General Pan* was adopted by the Board of Supervisors in 1979 and was most recently updated and adopted by the Board of Supervisors in 1995. The Plan has a policy document with goals and policies relevant to development in unincorporated Ventura County and four technical appendices, Land Use, Resources, Hazards, Public Facilities and services (Ojai Valley, 1993eir). The Plan governs biological resources and includes provisions to protect and preserve significant biological resources, listed species, locally unique species and communities and significant wildlife migration corridors (Ventura County, 1992eir).

1979: The *Ojai Valley Area Plan* was adopted in 1979. The Plan covers the unincorporated areas of the Ojai Valley including Oak View, Mira Monte, Meiners Oaks, and Casitas Springs (Ventura County, 1992eir).

1980: *Ventura County 208 Areawide Water Quality Management Plan* is a document that establishes water quality improvement programs and policies. The plan was updated by the County in conjunction with the Regional Board. The plan is a guidance for land use decisions capital improvement projects and treatment plant upgrades or expansions. Population forecasts are included in order to assess whether population growths are in line with capital improvement projects within the county. New projects must be in conformance with population and dwelling projections as well as goals and guidelines in order to be considered consistent with the 208 Plan (Ojai Valley, 1993eir). The plan was recently updated.

1980: Moore concluded a study of Factors influencing survival of juvenile steelhead rainbow trout in the Ventura River. Recommendation from this study included:

Develop management practices for routine maintenance and emergency flood control activities that take into account impacts on riparian vegetation, water quality, base flow channel morphology, and associated aquatic fauna. These practices should include minimizing amount of flood control activity; remove vegetation by hand; maintain a single, confined sinuous flow channel inside pilot channels; if possible, restrict flood control maintenance to times of year when majority of vegetation is in dormant or non-reproductive phase; if possible, avoid direct contact with base flow channel; and when flood control work is performed in a live stream, utilize effective silt curtains or other means to reduce sedimentation downstream.

Regulate surface and groundwater extractions for out-of-stream uses to ensure adequate flow for steelhead trout migratory and rearing needs.

Upgrade the treatment of all point sources into lower river.

Develop a steelhead smolt rearing facility to mitigate the loss of historical steelhead rearing and spawning habitat.

Retain current sport fishing regulations restricting winter fishing season to the lower Ventura River below Foster Park and limiting method of take to use of artificial lures with single barbless hooks until current run of adult steelhead can be augmented by a smolt rearing facility.

1981: County adopted Hillside Erosion Control Ordinance No. 3539 on April 7, 1981, that established minimum standards and regulations for construction and maintenance of fill, excavation and grading within new developments. Hillside Erosion Control Plans must be approved for construction within Critical Erosion Areas designated on official Erosion Hazard Maps, Southern Ventura County, on file with the county Public Works Agency and the Ventura County Resource Conservation District.

1982: Ventura County adopted Resolution No. 431, based on review of the 208 Areawide Plan, that established a countrywide plan for the "protection, preservation and enhancement of countywide water resources." Areas that were specifically covered included:

Seawater intrusion: Completion of Phase I and II of the joint County-UWCD Seawater Intrusion Abatement Project. *[1994 Update: Construction completed of Pumping Trough Pipeline from the Santa Clara River for irrigation purposes and of Lower Aquifer System Wells that provide* *groundwater to the pipeline when surface water is unavailable. 37 Upper Aquifer System wells were removed from service. Freeman Diversion Dam (up to 53,000 acre feet/year) completed]*;

Water conservation: Adoption and implementation of a Countrywide Water Conservation Plan;

Local state water entitlement: Development of the 20,000 acre-feet water entitlement from the State Water Project, jointly held by the City of Ventura, Casitas MWD and United Water Conservation District *[1994 Update: Portions of the 1990 through 1993 entitlement were delivered through an interim delivery method by the United Water Conservation District. Currently, obtainment of the jointly held entitlement is no longer being actively pursued while other options such as desalination are evaluated]*.

1984: *North Ventura Avenue Area Plan* was adopted by the County Board of Supervisors in 1984 and most recently amended in 1990. It is a joint city-county long range plan for future development in the unincorporated area north of the City of San Buenaventura that might eventually be annexed to the city (Ojai Valley, 1993eir).

1988: Coastal Conservancy, City of San Buenaventura and California Department of Parks and Recreation spearhead an estuary management plan. In 1990 and 1992 reports on botanical and vertebrate resources at Emma Wood State Beach and the Ventura River Estuary (Ferren, Jr. et al, 1990; San Buenaventura, 1992) were released.

1989: *City of San Buenaventura Comprehensive Plan* was adopted in August 1989 and is made up of a policy documents, land use plan and circulation maps. Technical appendices include Housing, Safety and Noise. The plan covers development issues within the city of San Buenaventura and within unincorporated areas that fall within the City Planning Area (Ojai Valley, 1993eir).

1990: In May 1990, Regional Board Requirements directed the Ojai Valley Sanitary District to perform studies to determine the cause of and potential relationship between low dissolved oxygen concentrations and nuisance plant growth in the Ventura River and identify corrective measures. James Montgomery Consulting Engineers conducted the Ventura River Study (1991) that included an examination of historical water quality data (1984-199) and new water quality monitoring from 1990-91 (Ojai Valley, 1993eir).

1991: A permanent *Protected Tree Ordinance* was adopted by the County Board of Supervisors in 1991 and protects certain types of trees against trimming or removal unless specific conditions are met. Example trees include oaks and sycamores (Ventura County, 1992eir).

1992: In 1987, Waste Management of California, Inc. proposed a Class III sanitary landfill on a 551 acre site in Weldon Canyon to succeed the short-term Bailard Landfill in the Santa Clara River watershed. An Environmental Impact Report was prepared in 1992 but the project was eventually dropped (Ventura County, 1992eir).

1994: Ventura County Water Management Plan (also referred to as the Water Management Plan Update) prepared by the County Resource Agency and the Public Works Agency. This plan is a continuation of the Water Quality Management Planning Program that was started with he 208 planning and assessment program in the 1970's.

1994: Regional Water Quality Control Board adopted Ventura County Municipal Stormwater NPDES (National Pollution Discharge Elimination System) permit on August 22. The lead permittee is the County of Ventura. Co-permittees include 10 cites in the County. The County and co-permittees began implementation of public education programs (including stenciling catchment basins), a "Clean Business" approach that includes education, inspections and incentives programs, monitoring, controlling illicit discharges, and RCD administration of Erosion Program.

1995: The Casitas MWD conducted a Watershed Sanitary Survey for Lake Casitas as requested by the California Department of Health Services (mandated under US Public Health Services Drinking Water Standards). All potential sources of contamination were examined including waste disposal systems and livestock corrals. The authors of the report recommend that CalTrans be prohibited from hauling hazardous waste on Highway 150, septic system information should be referred to the county for further review, livestock pens should be inspected weekly, and improvement of conditions at the Casitas Fire Station septic systems and elimination of a transpiration pond (Casitas MWD, 1995).

1995: Wetlands Study performed by Leal Mertes et al. (1995) under a contract from the US EPA, characterized the variability of wetlands within the watershed and related them to the hydrogeology.

1997: The *Ventura River Steelhead Restoration and Recovery Plan* was released. A range of potential conservation actions to promote recovery and restoration of steelhead was identified through analysis of limiting factors and discussions with regulatory agencies, plans sponsors, and public groups. These 44 actions address factors limiting the freshwater portion of the steelhead life cycle and are divided into four categories: 1) passage measures to facilitate upstream and downstream migration, 2) non-flow related measures to improve habitats, 3) flow-related measures to improve habitat, and 4) population augmentation through supplementation of fish to increase steelhead populations. These potential actions were then ranked and prioritized.

Providing access to habitats upstream of Robles Diversion is one of the most important actions that can be taken to improve steelhead populations in the river. Habitat improvement projects were recommended as pilots for some of the tributaries such as San Antonio Creek and North Fork Matilija Creek. Some stream flow enhancement were suggested that could result in more natural flows and includes providing passage and continuing bypass flows.

2000: Process of developing Habitat Conservation Plan begun.

2001: The Matilija Dam Ecosystem Restoration Feasibility Study Project Management Plan is released by the USACE, Los Angeles District.

2001: The City of San Buenaventura conducted the Ventura River/San Antonio Creek Watershed Sanitary Survey as requested by the California Department of Health Services. All potential sources of contamination were examined including waste disposal systems and livestock corrals.

Discharges into the Watershed

Point Sources

Ojai Valley Wastewater Treatment Plant: The plant was constructed in 1963 with a design flow of 1.4 mgd and was formerly known as the Oak View Treatment Plant. The plant was upgraded in 1965 to its present dry weather capacity of 3.0 mgd and wet weather capacity of 9.0 mgd. The Ojai Valley Sanitary District was formed in 1985 consolidating the Ventura Avenue, Oak View and Meiners Oaks Sanitary Districts and the Sanitation Department of the City of Ojai. The District serves 5600 acres of watershed and the treatment plant provides wastewater collection services for an estimated population of 23,000 people in the city of Ojai and in the unincorporated communities of Meiners Oaks, Mira Monte, Oak View, Casitas Springs, and Foster Park. The plant discharges an average of 2.17 MGD through an outfall located about 3,000 feet upstream from the confluence with Canada Larga. Approximately 95% of the flow is from residential and commercial sources and 5% from industrial sources. The facility is the watershed’s one major discharger and is located in the middle reach of the Ventura River at 6363 North Ventura Avenue, Ventura.

Prior to upgrade to tertiary treatment in 1997, the treatment plant effluent had been implicated in nuisance growth of aquatic plants and low dissolved oxygen found at times downstream of the discharge. For much of the year, the facility's effluent can make up two-thirds of the total river flow. The major concern was the facility's inability to meet the nutrients and suspended solids discharge limitations in its NPDES permit. Additionally, high biochemical oxygen demand (BOD) in the effluent resulted in dissolved oxygen concentrations in the river that could not support cold water aquatic habitat. The facility was required to upgrade under a Regional Board Cease and Desist Order. The most recent monitoring has shown the quality of the effluent has significantly improved including a reduction of nitrate-nitrogen from 20 mg/l to 4 mg/l, a reduction of suspended solids from 12 mg/l to 2 mg/l, and a reduction of BOD from 10 mg/l to 2 mg/l. DO levels in the river have improved dramatically to about 11 mg/l and algal growth is greatly reduced below the plant; however, nonpoint sources (agriculture and horse stables) still appear to be contributing to algal growth above the plant (Ojai Valley, 1991, 1992, 1993eir).

Solid Waste: Solid waste in the Ventura River watershed are directed towards a landfill that is outside of the watershed boundaries, the Bailard Landfill in the Santa Clara River watershed. The 180 acre Bailard Landfill, located along the Santa Clara River is operated by the Ventura Regional Sanitation District.

Summary of types of permitted wastes discharged into the Ventura River Watershed:

Nature of Waste *Prior* to Treatment or Disposal	# of Permits	Types of Permits
Nonhazardous (designated) domestic sewage & industrial waste	1	Major
Inert wastes from dewatering, rec. lake overflow, swimming pool wastes, water ride wastewater, or groundwater seepage	1	General
Nonhazardous (designated) wastes from dewatering, rec. lake overflow, swimming pool wastes, water ride wastewater, or groundwater seepage	3	General

Designated wastes are those influent or solid wastes that contain **nonhazardous** wastes (prior to treatment or disposal) that pose a significant threat to water quality because of their high concentrations
Inert wastes are those influent or solid wastes that do not contain soluble pollutants or organic wastes (prior to treatment or disposal) and have little adverse impact on water quality

Major discharges are POTWs with a yearly average flow of over 0.5 MGD or an industrial source with a yearly average flow of over 0.1 MGD and those with lesser flows but with acute or potential adverse environmental impacts. This was a targeted watershed for permitting purposes in FY95/96 and FY00/01.

Minor discharges are all other discharges that are not categorized as a Major. Minor discharges may be covered by a general permit, which are issued administratively, for those that meet the conditions specified by the particular general permit.

Of the 27 dischargers enrolled under the general industrial storm water permit in the watershed, the largest numbers fall in the *Motor Freight Transportation and Warehousing*; *Food and Kindred Products*; and *Oil and Gas Extraction* categories.

Current Water Quality Impairments

The table below gives examples of typical data ranges which led to the 1998 303(d) listings.

Impairments:

Impairments	Applicable Objective/Criteria	Typical Data Ranges Resulting in Impairment	303(d) Listed Waters/Reaches
DDT	Basin Plan narrative objective	23.0 ng/g (tissue)	Ventura River Estuary
Algae	Basin Plan narrative objective		Ventura River Reach 2 (Main St. to Weldon Canyon) Ventura River Reach 1 (estuary to Main St.) Ventura River Estuary
Pumping, Water diversions	Basin Plan narrative objective		Ventura River Reach 4 (Coyote Creek to Camino Cielo Rd.) Ventura River Reach 3 (Weldon Canyon to confl. w/ Coyote Cr.)
Copper	Basin Plan narrative objective	4.1 ug/g (tissue)	Ventura River Reach 2 (Main St. to Weldon Canyon) Ventura River Reach 1 (estuary to Main St.)
Silver	Basin Plan narrative objective	0.03 ug/g (tissue)	Ventura River Reach 2 (Main St. to Weldon Canyon) Ventura River Reach 1 (estuary to Main St.)
Zinc	Basin Plan narrative objective	40.0 ug/g (tissue)	Ventura River Reach 2 (Main St. to Weldon Canyon) Ventura River Reach 1 (estuary to Main St.)
Trash	Basin Plan narrative objective		Ventura River Estuary
Se	Basin Plan narrative objective	2.2 ug/g (tissue)	Ventura River Reach 2 (Main St. to Weldon Canyon)

Currently Scheduled TMDLs

Type of TMDL	Listed Waters/Reaches in TMDL	Year Scheduled for Completion (FY)
eutrophication	Ventura River Reaches 1 and 2 Ventura River Estuary	04/05

Historical Water Quality

Background water quality in the Ventura River watershed was summarized by in 1978 (Casitas MWD and San Buenaventura, 1978). Temperatures systematically rise from upstream to downstream reaches, especially below the Ojai Valley Wastewater Treatment Plant.

Lake Casitas: Initially the lake had problems with phytoplankton blooms in spring through fall Originally, the District used a mixture of copper sulfate and citric acid to control the algae blooms; since the 1970's, they have used an aeration system (Casitas MWD, 1995).

In 1973, the most polluted stretch of the Ventura River was considered to be from Foster Park to the ocean. Reports of large amounts of particulate matter, detergents, and algae were thought to be from sewage effluent, industrial wastes and fertilizers. There was low biodiversity and low populations of aquatic invertebrates and fishes (Koebig and Koebig, 1972 in Ventura County, 1973). A 450 foot long levee, designed to divert water to a private pump, constructed in the middle of the river at the outfall of the Ojai Valley Wastewater Treatment Plant, serves to separate river water from effluent-dominated water. On the effluent side, vegetation is abundant but fish populations are sparse; on the other side of the levee trout fry and other fish were observed in the "marginal but clear water" (Johnson, 1970 and Capelli, 1973 in Ventura County, 1973).

A Shell Oil Company urea-production plant operated from 1951 to 1973, discharging ammonia to the river, and was cited by the California Department of Fish and Game and the Regional Board for polluting water (Ventura County, 1973; Ojai Valley, 1993eir).

Companies in the Ventura Avenue Oil Fields area, utilizing a number of sumps, holding ponds and other facilities, were cited for polluting the Ventura River in the 1970's (Ventura County, 1973).

The Ventura oil field exploration and expansion started in the 1920's and have, over the years, discharged oil brine, drilling mud and oil wastes (Ojai Valley, 1993eir).

Canada Larga and the Lower Ventura River Subwatersheds: Trout 96-hour bioassays were conducted at four sites in the Ventura River during the fall of 1977 by Moore (1980). Trout were placed in live cages anchored in well-oxygenated riffle water sites at four stations: Casitas Springs area, and at 7.2 (25 meters downstream from Oak View POTW), 4.8 (Shell Road Bridge) and 0.4 kilometers (Main Street bridge) upstream from the river's mouth. Water quality field tests were conducted coincidentally at these stations. Results indicate that toxicity decreased with distance from the POTW discharge. All trout survived at the

Casitas Springs site. All trout died within 24 hours at the 7.2 km site 0.2 km downstream of the POTW. All trout died within 24 hours at the Shell Road Bridge site in September and October but survived the November bioassay. All trout survived the test at the Main Street bridge station. The mortality downstream of the POTW can be in part attributed to drought conditions in the fall of 1977 because there was no surface flow from upstream diluting the waste discharge. "A comparison of the bioassay results from the four stations and a review of the discharge records of the Oak View Sanitary District suggests the presence of unionized ammonia and/or chromate in lethal concentrations was one of the principal causes of test trout mortality at the Oak View Sanitary District and Shell Road bridge stations." Water quality appears to improve below the Shell Road bridge leading to a potentially suitable juvenile steelhead rearing habitat (Moore, 1980).

Moore (1980) planted a total 40,000 juvenile steelhead trout at the end of June in 1976, 1977 and 1978 in the Casitas Springs area in order to assess mortality and growth rates. Fish were retrieved by electro-shocking, counted and measured. Due to drought conditions and well withdrawals, the length of flow in the reach decreased but the ratio of riffles to pools and the areas remained a relatively constant 19 pools, 23 riffles in October 1976 and 17 pools, 21 riffles in October 1977). After winter floods of 1978, however, the configuration of the river was altered separating into two channels producing 37 riffles and 36 pools in June, 1978. In spite of drought conditions and an extremely heavy flooding season (highest flows since 1911), the Casitas Springs area of the Ventura River was shown to be a highly productive area for the trout with high growth and survival rates. Favorable (warmer) and a longer growing season may be responsible for accelerated growth of juveniles in the Ventura River as compared to those in more northerly Pacific Coast streams (Moore, 1980).

A preliminary Regional Board survey of sediment chlorinated pesticides levels in the Ventura River estuary was conducted in 1987. Sediments collected from beneath the railroad bridge were very low in pesticides.

<u>Existing Monitoring Programs</u>

Each agencies' monitoring is briefly described below. Sample locations are either described or may be found on the maps which follows. Many sampling locations did not have georeferencing information (latitude and longitude) and thus were not mapped.

Regional Water Quality Control Board

The Regional Board participates in several long-term monitoring programs including those that evaluate tissue, water column and sediment quality.

State Mussel Watch Program: The annual California State Mussel Watch (SMW) Program is a long-term coastal water quality program administrated by the State Water Resources Control Board. Actual sampling and analysis are performed under contract by the California Department of Fish and Game in coordination with Regional Board staff.

The purpose of the SMW program is to provide long-term monitoring of toxic trace metals and toxic synthetic organic compounds, such as pesticides and PCBs, in coastal marine waters, and try to identify areas where concentrations of these toxic substances are elevated above normal background levels. For this purpose, the program utilizes the common Bay mussel, *Mytilus edulis*, and the California mussel, *M. californianus*, because they stay in one place, are long-lived, can be transplanted easily to areas in which they do not normally occur, and concentrate toxic pollutants from the water.

In areas with low salinities, such as estuaries and freshwater tributaries, where mussels cannot survive, freshwater clams, *Corbicula fluminea*, have been used successfully. In some instances, especially where salinity may fluctuate considerably, sediment samples are collected instead as was the case in 1992 when a sediment sample for organics analysis was collected from the Ventura River estuary.

More information about the program, as well as data, may be found at http://www.swrcb.ca.gov/programs/smw/index.html.

Toxic Substances Monitoring Program: The State Toxic Substances Monitoring Program is a program to assess the quality of waters throughout the state. Fish, other organisms, and sediment are collected and analyzed for metals and organic chemicals (primarily pesticides).

Sampling has occurred in:

- Ventura River Estuary downstream of the train bridge for metals and organics during 1993 and 1994
- Ventura River mainstem about 1.5 miles upstream of the Main Street bridge locations during 1982, 1983, 1984, 1989, 1990, and 1991 for metals and organics (except only organics in 1984)
- Ventura River mainstem downstream of the Ojai Valley Sanitation District discharge for metals and organics in 1993, 1998, 1999, 2000, and 2001
- Ventura River mainstem upstream of the Ojai plant discharge for metals and organics in 1998, 1999, 2000, and 2001
- Castaic Lake in the Willow, Chismahoo, and Ayers Creeks arms during 1988 and 1992 for metals and organics (except only organics in 1988)

Some of the more recent data are not yet available. More information about the program, as well as data, may be found at http://www.swrcb.ca.gov/programs/smw/index.html.

Bay Protection and Toxic Cleanup Program: In 1989, State legislation added Sections 13390 through 13396 to the California Water Code which established the Bay Protection and Toxic Cleanup Program (BPTCP). The program has recently concluded but a program description and data are available at http://www.swrcb.ca.gov/bptcp/. The program had four main goals: (1) provide protection of existing and future beneficial uses of bays and estuarine waters, (2) identify and characterize toxic hot spots, (3) plan for the cleanup or other remedial or mitigating actions, and (4) contribute to the development of effective strategies to control toxic pollutants and prevent creation of new hot spots or the perpetuation of existing hot spots.

Identification and characterization involves the implementation of regional monitoring programs at each of the coastal Regional Boards. Based on the results of monitoring, which typically utilizes sediment toxicity tests and chemical analyses, each bay or estuarine water body was classified with regards to its toxic hot spot status. Water bodies were generally "prescreened" for contamination with more intensive followup monitoring utilized to both confirm the existence and spatial extent of contamination. Sediment in the Ventura River Estuary was collected in 1993 in order to be evaluated for toxicity to amphipods.

Ambient Monitoring Program: The Regional Board has developed and implemented its own ambient surface water monitoring program to meet state and regional monitoring and assessment objectives. This monitoring network originally consisted of 60 primary stations on rivers and streams throughout the Region (Figure 5). Stations were placed to most effectively assess Regional waters and measure long term trends at certain historic stations developed by the Regional Board or other agencies. Stations were sampled at least once a year. In addition to water quality sampling, observations were made of existing beneficial uses, surrounding land use(s), potential sources of pollutants, and other conditions.

Due to recent legislation, the ambient monitoring programs of all the Regional Boards are being revamped. Sampling will generally occur in the year prior to the watershed being targeted in the watershed cycle, every five years starting in FY04/05. Sampling may take a stratified random approach or be tributary-based.

Lakes Study: A report was produced in 1994 concerning the study of 23 different lakes in the Los Angeles Region by the University of California, Riverside, who were the principal investigators of this study. This study was funded by a grant from the State Water Resources Board. Lake Casitas was part of this study. Apart from biological, chemical and physical characteristics for each lake, the document also rates each lake according to their degree of impairment and also describes land use impacts surrounding lake.

Monitoring by Other Entities (Figure 6)

Ventura County Environmental Health Department: Coastline bacteriological monitoring for total and fecal coliform and enterococcus began in November 1998 and occur weekly at a number of stations along the Ventura County coast. There are two stations in the immediate vicinity of the Ventura River, one upcoast and one downcoast. Monitoring results are at posted at http://www.ventura.org/env_hlth/ocean.htm.

The Environmental Health Department also monitors bacterial indicators along the mainstem as well as in Matilija Creek.

Ojai Valley Sanitary District: A receiving water monitoring program is implemented by the, supplemented by ambient or special monitoring conducted by Regional Board staff. The monitoring supports compliance evaluation, nonpoint source identification, and potential TMDL development.

Ojai currently monitors for a broad array of conventional pollutants as well as bacterial indicators at eight sites in the mainstem, as well as in San Antonio Creek and Canada Larga.

California Department of Water Resources: The Department of Water Resources monitors minerals and conventional pollutants at few locations on the mainstem as well as on Matilija Creek below the dam.

Casitas Municipal Water District: The Casitas Municipal Water District produces an Annual Water Quality Report for customers that includes information about Lake Casitas and Mira Monte wells including general, bacteriological, organic chemicals, radiological data.

The Casitas MWD also monitors in the mainstem, Lake Casitas, and in tributaries leading into and out of the lake for total and fecal coliform as well as minerals. MTBE is also monitored for in the lake.

Ventura County Flood Control District: The current Stormwater NPDES permit adopted in 2000 includes a monitoring and reporting program which requires monitoring at mass emissions stations in the County and more specifically requires bioassessment monitoring in the Ventura River. The mass emissions site was established on the Ventura River mainstem at Foster Park west of Highway 33, on the south side of Casitas Vista Road, just west of Foster Park bridge. This site was sampled three times during spring 2001 during wet weather for conventional pollutants, metals, bacterial indicators, pesticides, semi-volatiles, and chronic toxicity. The bioassessment program shall include an analysis of the community structure of the instream macroinvertebrate assemblages in urban runoff-impacted stream segments at experimental sites. The County will begin monitoring fifteen such sites in Fall 2001 on a watershed-wide scale. Many sites will overlap with water quality monitoring sites of the Ventura River Stream team sponsored by the Santa Barbara ChannelKeeper.

City of San Buenaventura: The City monitors four locations in the watershed on a weekly, monthly, or annual basis: Ventura River at Foster Park, Ventura River at Casitas Springs, Ventura River at Santa Ana Boulevard, and San Antonio Creek. Conventional pollutants, minerals, coliform, and metals are monitored at Foster Park while conventional pollutants and minerals are monitored at the other sites.

Ventura River Stream Team: The Santa Barbara ChannelKeeper, in conjunction with the Regional Board, Ventura County Flood Control District, the city of San Buenaventura, and the Ojai Valley Sanitation District, started a Ventura River Stream Team to conduct a watershed-wide water quality monitoring program which began in 2001. Fourteen sites are monitored for conventional pollutants and bacterial indicators. The group is pursuing additional funding for continue the effort as well as conduct additional work on habitat condition.

<u>Overview of Existing Monitoring Data</u>

Reviewing and interpreting data by watershed and subwatershed that were collected by disparate agencies and programs with differing objectives is a challenge but worth the effort to establish some kind of general baseline from which to proceed with further work, which may be filling in data gaps, or recommending improvement strategies. Most of the available data are in the form of water column chemistry. There are also a limited amount of sediment chemistry, sediment toxicity, and bioaccumulation data available. Older data in the Regional Board database contained data from multiple agencies as well as results of Regional Board sampling. More recent data were obtained in electronic format from the monitoring entities and were incorporated into the original Regional Board database (to the extent practicable) to facilitate grouping of information where sampling sites overlapped closely and to evaluate data by subwatershed. For graphing purposes, values reported as “non-detects” were changed to values half-way between zero and the reported detection limit. Values reported as “greater than” were changed to the reported numeric value (i.e., >1600 mpn/100ml was changed to 1600 mpn/100ml). Coliform results of “0” were changed to “1” for the purposes of graphing on a logarithmic scale.

If the location of the sites could not be identified through the use of a GIS layer, latitude/longitude, or by precise narrative description of the site, these data were not utilized for overall comments on water quality. This was a shortcoming of even more recently available data. Database formats were too different to allow for complete integration of all information and this was not particularly useful where new sampling sites now exist. Data were depicted graphically when sampling occurred on a monthly or more frequent basis (only for more recent data) and few non-detects were seen. Data were grouped by subwatershed and then averaged by constituent and organized from top to bottom of the watershed. Averaging was only done when at least three data points were available for a major constituent of concern. The relative amount of samples was identified as well as the general time period over which sampling occurred. The full dataset may be obtained in electronic form as venturariverdata.xls.

Matilija Creek Subwatershed

This subwatershed includes Matilija Creek, its tributaries, and the North Fork Matilija Creek as well as Matilija Reservoir. As most water quality monitoring efforts have been focused in the other subwatersheds or on the mainstem, only limited data for the Matilija Creek subwatershed are available. No graphs were created due to the scarcity of recent data. There are no 303(d)-listed impairments in the subwatershed.

There are two active (data from 2001) Ventura River Stream Team sites in the subwatershed, one below the dam and one in the North Fork. There are also recent data from the Department of Water Resources and the Ventura County Environmental Health Department. Older data (from 5-10 years ago) were generated by the Regional Board, Department of Water Resources and US Geological Survey at four sites. Some sites overlap among agencies.

The Stream Team data are from the first six months of 2001 and include such constituents as DO, temperature, conductivity, turbidity, pH, and bacterial indicators (total coliform, *E. coli*, and enterococcus). A pending Basin Plan update for bacterial indicators includes a proposed single sample objective of 235/100ml for *E. coli* and 400/100ml for fecal coliform. All samples from this subwatershed were well below the proposed objectives. Total coliform was generally below 1,000/100ml and enterococcus densities were comparable to that of *E. coli*. pH levels were within a tight range of 8.1 – 8.4; DO concentrations were always over 7 mg/l and generally did not exceed 100% saturation. Turbidity was low even during the winter months.

A look at older data showed similar patterns in bacterial indicators, and conventional water quality parameters. Additionally, nutrients were found at very low concentrations; organics were not detected; and metals were not detected or were detected at very low levels. Minerals (boron, sulfate, chloride, and total dissolved solids) fall below Basin Plan objectives.

Upper Ventura River Subwatershed

The drainage area that extends between the confluence of Matilija Creek with North Fork Matilija Creek and the confluence of the Ventura River with Coyote Creek is referred to as the upper Ventura River subwatershed. This reach includes the Robles Diversion Structure.

There is one active (data from 2001) Ojai Valley Sanitation District current sampling site, two active City of San Buenaventura sites, two active Ventura River Stream Team sites, the current Ventura County mass emissions storm water sampling site and one active Casitas MWD site in the area. Ventura County

Environmental Health has also sampled recently in the area. Older data (from 5-10 years ago) were generated by the Regional Board, at one site. Some sites overlap among monitoring entities.

The bacterial indicators total coliform and enterococcus (for which there are no Basin Plan objectives) were in general somewhat elevated in the Foster Park and Robles Dam areas of the river (Figures 7-9). The proposed single sample Basin Plan objective for fecal coliform (400 mpn/100 ml) was occasionally exceeded; *E. coli* sampling has only just begun with too few samples from which to draw conclusions. Bacterial indicators tested for in storm water samples (total and fecal coliform, fecal streptococcus) were highly elevated.

Minerals (boron, sulfate, chloride, and total dissolved solids) as well as total nitrogen at all sites fall below Basin Plan objectives. Conventional parameters such as dissolved oxygen and pH are well within Basin Plan objective ranges. Hardness ranged from 122-272 mg/l during storm water sampling at Foster Park.

Cadmium, copper, and zinc at Foster Park were found at total concentrations potentially high enough to cause acute or chronic problems during one or more storm water samples. Dissolved concentration were generally much lower. However, samples from two of the storms were tested for chronic toxicity to fish (silversides) and no toxicity was found. Mostly very low to nondetect levels of pesticides and semi-volatile organics were found.

Coyote Creek Subwatershed

Coyote Creek, Santa Ana Creek, Lake Casitas, and their tributaries drain 33 square miles along Laguna Ridge and the southern slopes of the Santa Ynez Mountains. Additionally, significant flows from the Matilija subwatershed are transferred to this subwatershed through the Robles Diversion, as discussed earlier. There are five active (data from 2001) Casitas MWD sampling sites in West Fork Santa Ana Creek which drains into the lake, one site on Coyote Creek before it drains into the lake, five sites in the lake, and one at the water treatment plant intake from the lake. Much of these are coliform data. Older data (from 5-10 years ago) were generated by the Regional Board at two sites on Coyote Creek before its confluence with the Ventura River (below the lake). There is minimal overlap of sample sites in this subwatershed among monitoring entities.

Coliform data for the lake show consistently low levels of coliform while occasional high coliform levels (fecal coliform over 400 mpn/100 ml) occur in drainages leading to the lake (Coyote Creek and Santa Ana Creek). The higher levels appear to occur mostly in late spring to early summer (Figures 10-12).

Largemouth bass were collected in 2000 through the TSM Program. No organic chemicals were detected in the samples; however, QA/QC checks have not been finished on these samples. Largemouth bass collected in 1992 also showed nondetects for organics, except for DDT isomers found at very low concentrations.

San Antonio Creek Subwatershed

There are four active (2001 data) Ventura River Stream Team sample sites in the subwatershed, one near the confluence with the Ventura River, one each on the tributaries Fox Canyon and Lion Canyon Creeks, and one on San Antonio Creek above these tributaries. The City of San Buenaventura and the Ojai Valley Sanitation District each have one active sample site on San Antonio Creek near the confluence with the Ventura River. Sites from three sampling entities overlap in this area. Older data (from 5-10 years ago) were generated by the Regional Board and Ventura County Flood Control District at two sites on San Antonio Creek near its confluence with the Ventura River and two sites on the Lion Creek tributary.

Sampling for the bacterial indicators *E. coli* and Enterococcus has only just begun by the Ventura River Stream Team. Fecal coliform levels are almost always below 400 mpn/100 ml. pH averages close to 8.0 mg/l and dissolved oxygen is generally over 10 mg/l. Chloride levels are high and average slightly over the Basin Plan objective of 60 mg/l. Nitrogen is mostly below the Basin Plan objective of 5.0 mg/l (Figure 13).

Weldon Canyon Subwatershed

There are no current sample sites and there are only a very limited number of older data for this subwatershed.

Canada Larga Subwatershed

There are two active (2001 data) Ventura River Stream Team sample sites in the subwatershed, one in the upper part and one in the lower part. There is also one active Ojai Valley Sanitation District site close to the Stream team site near the confluence with the Ventura River. Older data (from 5-10 years ago) were generated by the Regional Board and Ventura County Flood Control District at one site each in proximity to the current lower Canada Larga sites but these datasets are very limited.

Dissolved oxygen has been highly variable over the past several years, ranging from less then 5 mg/l to more than 10 mg/l and averaging about 9 mg/l. pH is also somewhat variable, ranging from about 7.3 mg/l to 8.4 mg/l and averaging about 8 mg/l. The majority of bacterial indicator data is for total coliform which does not have a Basin Plan objective; however, concentrations have generally been over 1000 mpn/100 ml with a median of 1700 mpn/100 ml.

Canada del Diablo Subwatershed

There are no current sample sites or older data for this subwatershed.

Lower Ventura River Subwatershed

<u>Water chemistry</u>: This is the part of the river downstream of the confluence of Coyote Creek and includes the estuary. There are numerous sampling sites in the lower part of the river. In the stretch between Coyote Creek and to just below Canada Larga, sampling is currently being conducted by the City of San Buenaventura, the Ojai Valley Sanitation District (their discharge occurs in this area), and the Ventura River Stream Team. Another Ojai Valley Sanitation District site as well as a Ventura River Stream Team

site are located downstream of this clump of sites. Further downstream (past Canada del Diablo) is a Stream Team site and a final Stream Team site is located in the estuary. The Department of Water Resources and the Ventura County Environmental Health Department also sample periodically in the lower watershed. Older data (from 5-10 years ago) were generated by the Regional Board and the Department of Water Resources at seven sites in the lower watershed.

Dissolved oxygen has been consistently in the 8-10 mg/l range over the last several years. During the early to middle 1990s (prior to the Ojai Treatment Plant upgrade), however, DO levels at times fell below 5 mg/l (Figures 14, 15). pH occurs in a fairly narrow range averaging about 8 mg/l.

Fecal coliform has been generally below the proposed single sample Basin Plan objective of 400 mpn/100 ml except for in the estuary where more frequent exceedances are seen. The majority of bacterial indicator data is for total coliform which does not have a Basin Plan objective; however, concentrations have generally been over 1000 mpn/100 ml with a median of 1600 mpn/100 ml at several locations (Figures 16, 17). *E. coli* and enterococcus sampling has only recently begun with too few samples to draw conclusions. The 2000 Sanitary Survey Update also noted that coliform levels at the Foster Park Diversion were at times quite high. The cause has not yet been identified. Limited sampling for Giardia and Cryptosporidium cysts have occurred at the surface water diversion with only minor presence of cysts being found (San Buenaventura, 2001).

Total nitrogen averages below the Basin Plan objective of 5.0 mg/l; however, there are occasionally single-sample excursions above that number. The 2000 Sanitary Survey Update (San Buenaventura, 2001) also noted elevated nutrient levels in the vicinity of Foster Park. Although no cause was determined, potential causes identified included rising groundwater and inadequate manure management.

Relatively few samples for minerals have been taken in this stretch of the river; no apparent problems are evident from the available data. However, the 2000 Sanitary Survey Update (San Buenaventura, 2001) noted that river turbidity is very high during and immediately after heavy storms which was considered due to an uncontrollable watershed characteristic (i.e., steep terrain). Limiting the use of the surface water diversion at Foster Park in favor of withdrawing shallow groundwater was one measure identified in the Sanitary Survey to mitigate the problem.

<u>Sediment chemistry</u>: A preliminary Regional Board survey of sediment chlorinated pesticides levels in the Ventura River estuary was conducted in 1987. Sediments collected from beneath the railroad bridge were very low in pesticides. Subsequently, sediments were collected from the same general area under the State Mussel Watch Program in 1991. Most chlorinated pesticides were at nondetect levels; a few others, mainly PCBs, chlordane, and DDT were found at very low levels. The sediments were not analyzed for metals since agriculture was seen as a greater potential source for contaminants than urban runoff. The low levels of pesticides did not warrant further sampling of the site under the Mussel Watch Program. There is one Ojai Valley Sanitation District sampling site, last sampled in 1998 for metals and organics in the sediment, located at the railroad bridge at the north end of the lagoon. Organics were not detected while metals concentrations did not exceed any thresholds of concern. A site upstream of the treatment plant was also last sampled in 1998 for metals. Metals were mostly not detected above the discharge. Both metals and organics concentrations in the lower watershed are generally below various thresholds of concern for sediment; no sediment quality objectives currently exist, however.

Sediment toxicity: The Ventura River estuary was prescreened for sediment and water toxicity in February of 1993. Sediment and water were collected from under the railroad bridge. An amphipod survival test utilizing *Eohaustorius* resulted in 97% survival. There was 100% survival of *Mytilus edulis* larvae in undiluted sediment porewater and estuary subsurface water; 100% normal development of the larvae was also observed. The good survival and development exhibited during prescreening did not warrant further investigation of the estuary under this program.

Bioaccumulation: Arroyo chub were collected in 1998 by the TSM Program both upstream and downstream of the Ojai POTW in the mainstem of the river. A few organics, including DDT isomers and chlordane (both banned pesticides), were found but at low concentrations (below various thresholds of concern)and were lower than in 1992 when fish were previously collected. Metals concentrations were also low. The TSM Program has not sampled in the estuary since 1993 when low levels of DDT isomers were found.

Recommendations for Future Water Quality Monitoring

It is clear certain areas of the watershed are severely undermonitored (although less so now that citizen monitoring is underway) while other areas contain many duplicative sites sampled by multiple agencies. Some of this variability is likely caused by lack of water during much of the year while agency mandates are another major contributor. The objectives of the various monitoring programs are often not clear, the sampling sites are often difficult to locate if not identified in a GIS layer, and electronic versions of the data are often formatted very differently making information difficult to integrate. A general improvement in communication among the monitoring entities is needed.

Some sampling sites are visited only once a year or even more sporadically while being sampled for bacterial indicators and conventional water quality parameters. The usefulness of that kind of data is limited when so few samples are obtained at such a low frequency. Pooling the available monitoring dollars among the monitoring agencies in order to evaluate subwatersheds (and areas immediately below confluence) more frequently for those parameters of greatest concern would be a more effective approach. Those parameters of concern that need more frequent sampling include bacterial indicators and conventional water quality parameters (pH, DO, total nitrogen, chlorides, temperature, and turbidity). Those that likely could be sampled less frequently are metals, minerals, and organics. Metals and organics in sediment and tissue may also be sampled less frequently. However, followup of “hot spots” may require more intensive sampling.

The 2000 Update of the Sanitary Survey (San Buenaventura, 2001) also identified the need for additional sampling over the next one to two years so that suspect watershed land uses could be evaluated and their involvement in water quality issues be determined.

Summary of Water Quality and Quantity Issues

The 2000 Update of the Ventura River River/San Antonio Creek Watershed Sanitary Survey (San Buenaventura, 2001) concluded that the following potential contaminant (generally nonpoint) sources may be significant:

- Discharges of raw sewage due to lift station failures or washouts of pipelines near or crossing the river during floods
- Leach field runoff from poorly functioning septic systems during rainy weather
- Animal manure stockpiled close to the creek
- Sewage contamination due to human recreation or vandalism
- Runoff from grazed areas
- Unauthorized activities which may result in diversion or blockage of river flow and damage to sewer lines

Overall watershed issues, at times specific to certain subwatersheds, are as follows:

Water quantity: Water is diverted from the Ventura River at the Robles Diversion Dam and Canal for delivery to Lake Casitas Reservoir. The Canal has a capacity of 550 cfs. A minimum of 20 cfs must be permitted to flow down the Ventura River (Casitas MWD, 1995). In the lower river, effluent from the Ojai Valley Wastewater Treatment Plant dominates the stream flow (Ojai Valley, 1993eir).

Temperature: Low flows and reduced cover have reduced suitability for steelhead trout in some areas of the watershed. Studies have shown that removal of vegetation results in increases of 6 to 9 C (Moore, 1980).

Hydromodification: Many parts of the watershed have been modified including construction of the levee on the lower three miles of the main stem of the Ventura River and construction of Matilija Dam on Matilija Creek. The City of San Buenaventura installed concrete channelization in Weldon Canyon Barranca in 1939. This was updated in 1980. In 1972 and again in 1980, bank stabilization including installation of boulders and concrete walls was performed along the Ventura River adjacent to the Ojai Valley plant (Ojai Valley, 1992).

Natural water quality: Above Foster Park, surface water quality in the Ventura River is controlled in large part by the tributary water quality. In the upper tributaries, boron is contributed by hot springs in the Santa Ynez Mountains (Ojai Valley, 1991); boron can be as high as 6.5 ppm in Matilija Creek above Matilija Reservoir during low flow conditions. The high boron water is diluted in the reservoir so that water down stream is of higher quality (Casitas MWD and San Buenaventura, 1978). Boron levels in well and surface water collected in the upper and lower Ventura River Basin area rarely exceeds 0.5 mg/L and thus is suitable for irrigation of sensitive crops such as citrus and avocado present in the watershed (Casitas MWD and San Buenaventura, 1990). Turbidity in the watershed can rise as high as 600 turbidity units (TU) following storms (Casitas MWD and San Buenaventura, 1978).

Corralled animals: Uncontrolled stockpiling and storage of horse manure has been observed at some locations in the watershed which could lead to nutrient and coliform problems (San Buenaventura, 2001).

Pesticides: The predominant crops in the watershed are oranges, tangerines, and lemons. Information on pesticide use in the watershed was summarized in the 2000 Update to the Sanitary Survey. Organic chemical analysis of raw water by the City of San Buenaventura in 1997 and 1999 did not find organic chemical at detectable levels (San Buenaventura, 2001).

Septic Systems: Private disposal systems in the Casitas Lake subwatershed, especially those constructed after 1958, were examined and determined not to be threats to water quality. None were within 100 feet of the nearest creek. There are approximately 60 homes and cabins on septic systems or other types of private disposal systems in the subwatershed above the Matilija Reservoir. Fifty cabins and homes are located in the upper Ventura River subwatershed above the Robles Diversion Dam (Casitas MWD, 1995).

Mining operations: Three mining sites are located in the Ventura River watershed including a rock quarry near Matilija Reservoir (Schmidt Construction), a clay and shale open pit along the lower river (Ventura Aggregates), and a closed sand and gravel open pit site south of the lower river (S.P. Milling). Problems related to aggregate mining include loss of rising water and evaporation, mineralization and contamination, reduction of groundwater recharge capacity, and post-mining water quality degradation. Wash water, petroleum hydrocarbon, solvents, septic systems can all contribute to contamination (Ventura County, 1994).

Nutrients: Existing excessive growth of vascular plant and algae, particularly the non-native water primrose, in the lower Ventura River has several adverse impacts on the river including decreased dissolved oxygen levels, displacement of foraging and rearing habitat for native fish, inhibiting the growth of native submerged aquatic plants and obstructing low flow channel. A 1991 study (Ojai Valley, 1991) established that Ojai treatment plant effluent dominates the downstream baseflow. The plant upgrade lead to a reduction of biomass below the plant. The study also showed that there is a strong development of algae above the treatment plant. There is also nutrient loading from horse rearing, septic tanks, and agricultural operations. Channel morphology of the lower Ventura River (above and below the treatment plant) has a series of stepped, shallow pools separated by short, low riffles. These pools provide an ideal environment, in combination with sunlight and warmth, for algae and larger plants (Ojai Valley, 1991).

Eutrophication: "Lake Casitas is naturally eutrophic and develops anaerobic conditions in water deeper than 20-30 feet. In some years, anaerobic conditions begin 15 feet below the surface and there are no outlet gates to the distribution system above 24 feet. Anaerobic waters contain hydrogen sulfide and high concentrations of manganese, rendering them unacceptable as a domestic source. Manganese in the distribution system causes 'dirty water' that stains fixtures and generates customer complaints throughout Casitas service area.. In addition, these waters often exhibit a high pH (up to 8.5) thereby reducing the effectiveness of chlorine as a disinfectant." This problem is controlled by use of an aeration system from April 1 through November 1 of each year (Casitas MWD, 1995 and Steven Wickstrum, pers. comm.).

Dissolved oxygen: In the lower river, below the discharge point from the Ojai Valley wastewater Treatment Plant, dissolved oxygen generally remains above 7.0 mg/L but seasonally in the late summer and early fall dissolved oxygen levels fall. With the first major winter or spring storm and corresponding increased flows in the Ventura River, the dissolved oxygen levels tend to return to desirable values. During the drought of 1984 to 1991, low flow conditions in the river were extended, causing more persistent low dissolved oxygen conditions. A study performed by James Montgomery, concluded that the low dissolved oxygen levels correlated with discharge of high biological oxygen demand (BOD) concentrations from the treatment plant (Ojai Valley, 1991). The subsequent treatment plant upgrade resulted in improvements in BOD and dissolved oxygen concentrations in the effluent.

Sedimentation: As is typical of southern California coastal watersheds, sediment yields in the Ventura River is larger than for rivers in other parts of the United States, although lower than for those in northern California. Suspended sediment yields for the Ventura River is estimated as 650 tons/km2/yr (with dams; 42 % of drainage is controlled by dams) and 1367 tons/km2/yr (natural) (Ojai Valley, 1992au). The Ventura River was included on a list of relatively small rivers that have relatively large sediment loads to the ocean because of the steep terrain and coastal location (Milliman and Syvitski, 1992 in Mertes, et al., 1995). Wildfires increase sediment flushing in small watersheds and possibly this flushing aggrades downstream channels. The July 1985 Wheeler Fire created large sediment inputs during the subsequent winter storms to the north fork of Matilija Creek (Ojai Valley, 1992au). Floods of 1969 deposited more than 2 meters of gravel upstream from Casitas Springs burying an automobile (Keller and others in, 1981 in Ojai Valley, 1992au).

Exotic species: The Ventura River estuary is impacted by the invasion of exotic species including Giant Reed, Kikuyu Grass and Fennel (Mertes et al., 1995). These plants threaten native species and habitats. Arundo removal is a high priority project for funding by the Southern California Wetlands Recovery Project (SCWRP).

Restoration: Recommendations in one report (San Buenaventura, 1992) include: The lower river and estuary have been highly disturbed and are in close proximity to urban areas ...The estuary and lower creek has great potential "as an area of high species density and diversity. Preservation and restoration of particular habitats within the study area and upstream riparian corridor, in addition to maintaining freshwater flows and water quality in the Ventura River, may allow the area to increase its potential as bird habitat." Entrix suggested in their 1997 study (Casitas MWD, et. al., 1997) a number of possible restoration actions to improve rearing and spawning habitat for steelhead trout. The SCWRP considers the removal of Matilija Dam priority project for funding.

Wetlands-loss of native vegetation: In order to improve the quality of wetlands in the watershed, more native vegetation needs to be planted. Additional land should be acquired and restored to natural conditions (Mertes et al., 1995). The SCWRP considers land acquisitions of primarily riparian habitat at the mouth of the river (the Zellerbach Property) a high priority project for funding.

Recreational use: Expanding urban corridors are impacting fragile habitat areas. Public access to sensitive areas needs to be controlled (Mertes et al., 1995).

Oil spills: Oil storage tanks within the watershed are susceptible to spillage during and after heavy rainstorms. After the winter storms of 1995, several events occurred in March including flushing of oil out of the cellar of a rig and rupturing of pipelines by mudslides. These spills cause oil to spill into canyons and in some cases as much as 100 gallons reached the Ventura River (LA Times, 1995ol).

Potential Sources of Specific Pollutants:

Silver: waste-activated sludge bacteria bioaccumulate large amounts of silver; may be revealing potential sewage and/or storm drain problems

Cadmium: also associated with municipal effluent; used in electroplating, paint, and pigment manufacture and as a stabilizer in plastics manufacture; industrial strength zinc often contains cadmium

Chromium: added to water as an anticorrosive and has in the past been eliminated as boiler water blowdown; a component of zinc chromate, one type of primer used on boats

Copper: found in boat antifouling paints; wood pilings may be treated with copper containing substances

Mercury: has in the past been used in antifouling paints; sediment acts as a sink and the chemical may re-enter the water at times; there is an historic layer of mercury in Los Angeles Harbor sediments

Lead: found in leaded gasoline, residual from previous use reaching waters through stormwater runoff; lead found in primers on boats

Zinc: a natural occurring element which appears in most unpolluted waters; zinc chromate used on boats as a primer; found in stormwater runoff from roads (a component of tires)

PCBs: has been used in transformers, hydraulic fluids, plasticizers, and pesticide extenders; is transported through the atmosphere; when contamination becomes sufficiently high, sediments may serve as a reservoir for re-solution. This has important ramifications for areas where PCBs are spilled; even after the initial degradation in water quality, release of these compounds by sediments cause long-term pollution. PCBs have an even greater affinity for oil than for sediments. In areas polluted by both oil and PCBs, microbes capable of degrading each of the pollutants separately appear to be inhibited by the high concentration in combination.

Regional Board and Other Agency Programs

The Regional Board and other local, state and federal agencies have jurisdiction over specific aspects of water quality and resource planning and regulation in the Ventura River Watershed. This section briefly summarizes the role of each agency.

Regional Water Quality Control Board Programs

Responsibility for the protection of water quality in California rests with the State Water Resources Control Board (State Board) and nine Regional Water Quality Control Boards. The Los Angeles Regional Board performs many functions in the watershed including planning and assessment, regulation of point sources, control of nonpoint sources, regulation of stormwater, and monitoring.

Regulatory

Permits in this watershed were renewed together in June 1996; this watershed was targeted again in FY2000-01. Continuing regulatory activities include compliance inspections, reviewing of monitoring reports, response to complaints, and enforcement actions as needed.

Regulation of Point Sources: The USEPA has delegated responsibility for implementation of portions of the CWA to the State and Regional Boards, including water quality planning and control programs such as the National Pollutant Discharge Elimination System (NPDES). The Code of Federal Regulations (Title 40, CFR) and USEPA guidance documents provide direction for implementation of the CWA.

All wastewater discharges in the Region, whether to surface or ground waters, are subject to Waste Discharge Requirements (WDRs). Likewise, all reuses of treated wastewaters are subject to Water Reclamation Requirements (WRRs). In addition, because the USEPA has delegated responsibility to the State and Regional Boards for implementation of the federal National Pollutant Discharge Elimination System (NPDES) program, WDRs for discharges to surface waters also serve as NPDES permits. These programs are the legal means to regulate controllable discharges. It is illegal to discharge wastes into any waters of the State and to reuse treated wastewaters without obtaining appropriate WDRs, WRRs, or NPDES permits (all of which are hereinafter referred to as Requirements).

Any facility or person who discharges, or proposes to discharge, wastes or makes a material change to the character, location, or volume of waste discharges to waters in the Los Angeles Region (other than into a community sewer system) must describe the quantity and nature of the proposed discharge in a report of waste discharge (ROWD) or an NPDES application. Upon review of the ROWD or NPDES application and all other pertinent information (including comments received at a public hearing), the Regional Board will consider the issuance of Requirements that incorporate appropriate measures and limitations to protect public health and water quality. The basic components of the Requirements include:

- discharge limitations (including, if required, effluent and receiving water limits);
- standard requirements and provisions outlining the discharger's general discharge requirements and monitoring and reporting responsibilities; and
- a monitoring program in which the discharger is required to collect and analyze samples and submit monitoring reports to the Regional Board on a prescribed schedule.

WDRs or WRRs usually do not have an expiration date but are reviewed periodically on a schedule based on the level of threat to water quality. NPDES permits are adopted for a five-year period.

Most Requirements are tailored to specific waste discharges. In some cases, however, discharges can be regulated under general Requirements, which simplify the permit process for certain types of discharges. These general Requirements are issued administratively to the discharger after a completed ROWD or NPDES application has been filed and the Executive Officer has determined that the discharge meets the conditions specified in the general Requirements.

Point source discharges include wastewaters from municipal sewage treatment plants, industrial and manufacturing facilities, shipyards and power generation stations. The Regional Board currently administers approximately 1,200 Requirements for these discharges, including 37 sewage treatment facilities with design flows of over 100,000 gallons per day. In the Ventura River Watershed five discharges are regulated. The major discharge, the Ojai Valley Wastewater Treatment Plant, was described earlier.

Regulation of Stormwater: Storm water runoff flows from land surfaces into storm drains or directly into natural waterbodies during rainfall. In the upper Ventura River Watershed the water quality is good but water quality in the lower reaches is of lesser quality due to a combination of municipal wastewater discharges and agricultural, urban and oil industry nonpoint sources. Many of these nonpoint source pollutants are carried to the river by stormwater, urban runoff and/or agricultural irrigation runoff flows.

Storm water runoff was not regulated by the NPDES program until after the 1987 amendments to the Clean Water Act. Historically, many large manufacturers or industrial operators collected runoff (non-process wastewater) within their properties and discharged it to storm drains or sent it to a sewage treatment plant. However, most small industries and construction sites did not collect or monitor their runoff. The NPDES program now requires that this runoff be eliminated or regulated under a storm water permit.

In November 1990, USEPA published initial permit application requirements for certain categories of storm water discharges associated with industrial activity and for discharges from separate municipal storm sewer systems located in municipalities with populations of 100,000 or more (55 FR 47990). These NPDES storm water discharge permits provide a mechanism for monitoring the discharge of pollutants to "waters of the United States" and for establishing appropriate controls to the maximum extent practicable.

In cases where there are existing NPDES permits for wastewater discharges, the Regional Board incorporates storm water discharge provisions into the same permit. Currently two types of NPDES storm water permits have been promulgated by the State and Regional Boards:

- *Municipal permits* for separate storm sewer systems located in urban areas with populations of 100,000 or more.

- Statewide general permits for *industrial and construction activities*.

Municipal stormwater permit

Municipal storm water regulations at 40CFR 122.26 require that pollutants in storm water discharges be reduced to the maximum extent practicable (MEP). The definition of MEP has generally been applied to mean implementation of controls to reduce the discharge of pollutants to the maximum extent practicable using appropriate management practices, control techniques and system, design and engineering methods. Municipalities are required to implement or require the implementation of the most effective combination of BMPs for storm water/urban runoff pollution control. A Countywide Municipal Stormwater Permit for Ventura County (including the Ventura River Watershed) was first adopted by the Regional Board on August 22, 1994. Municipal storm water runoff is covered under municipal permits for a single city, county, or groups of cities and counties. Most urban areas in Ventura County, including this watershed, are implementing Best Management Practices under the current Municipal Storm Water Permit (adopted in 2000). The “Discharger” consists of the co-permittees Ventura County Flood Control District, the County of Ventura, and the Cities of Camarillo, Fillmore, Moorpark, Ojai, Oxnard, Port Hueneme, San Buenaventura, Santa Paula, Simi Valley, and Thousand Oaks. The Ventura River receives municipal storm drain discharges from the City of Ojai, City of San Buenaventura (part), and unincorporated Ventura County (part).

An important part of the municipal permit is the Ventura Countywide Stormwater Quality Urban Impact Mitigation Plan (SQUIMP). The SQUIMP similarly addresses conditions and requirements for new development and significant redevelopment which were adopted on March 8, 2000 and implemented by municipalities beginning in February 2001. The SQUIMPs are designed to ensure that storm water pollution is addressed in one of the most effective ways possible, i.e., by incorporating BMPs in the design phase of new development and redevelopment. It provides for numerical design standards to ensure that storm water runoff is managed for water quality and quantity concerns. The purpose of the SUSMP requirements is to minimize, to the maximum extent practicable, the discharge of pollutants of concern from new development and redevelopment.

The numerical design standard is that post-construction treatment BMPs be designed to mitigate (infiltrate or treat) storm water runoff from the first ¾ inch of rainfall, prior to its discharge to a storm water conveyance system. Other standards also apply; additional information on the SUSMP may be found on the Regional Board Storm Water website at http://www.swrcb.ca.gov/rwqcb4/html/news/susmp/susmp_details.html.

Retail gasoline outlets (RGOs) were given a categorical exemption by State Board to the SQUIMP requirements, partly because the threshold to mitigate developed by the Regional Board which was based on size and RGOs were deemed too small. During the renewal process of the Los Angeles County municipal storm water permit, storm water staff conducted research and developed a proposed threshold for the implementation of design criteria for BMPs at RGOs. The threshold and its technical explanation is described in a technical paper called *Retail Gasoline Outlets: New Development Design Standards for Mitigation of Storm Water Impacts* (06-01). This paper can be found on the Regional Board Storm Water website at http://www.swrcb.ca.gov/rwqcb4/html/programs/Stormwater/stormwater.html.

Industrial stormwater general permit

The 1987 amendments to the Clean Water Act established a framework for regulating municipal and industrial storm water discharges under the NPDES Program. In 1990, the USEPA published final regulations that established application requirements for storm water permits. The regulations require that storm water associated with industrial activity that discharges either directly to surface waters or indirectly through municipal storm drains must be regulated by an NPDES permit.

State Board adopted the Industrial Activities Storm Water General Permit in 1997. The permit requires facility operators to (1) eliminate unauthorized nonstorm water discharges, (2) develop and implement a Storm Water Pollution Prevention Plan (SWPPP), and (3) perform monitoring of storm water discharges and authorized nonstorm water discharges. Facilities that discharge storm water associated with industrial activity requiring a General Permit are listed by category in the Code of Federal Regulations. These categories include manufacturing, mining/oil, recycling, steam electric generating, and light industry, among others. Of the 21 dischargers enrolled under the general industrial storm water permit in the watershed, the majority are in the city of Ventura. Wineries and oil-related activities are most prominently represented. Most of the facilities are under ten acres in size.

Construction stormwater general permit

In 1990, USEPA published final regulations that establish storm water permit application requirements for specified categories of industries. The regulations provide that discharges of storm water to waters of the United States from construction projects that encompass five or more acres of soil disturbance are effectively prohibited unless the discharge is in compliance with an NPDES permit.

State Board adopted a general permit for storm water discharges associated with construction activity in 1999 (State Board order No. 99-08-DWQ). It contains narrative effluent limitations and requirements to implement appropriate Best Management Practices (BMPs) which emphasize source controls.

Elimination or reduction of nonstorm water discharges is a major goal of the general permit. It prohibits the discharge of materials other than storm water and authorized nonstorm water discharges. It also requires development of a Storm Water Pollution Prevention Plan (SWPPP) and monitoring program.

The Construction General Permit was modified in 2001 by State Board Resolution No. 2001-046. The modifications require that a sampling and analysis strategy and sampling schedule for discharges from construction activity be developed and included in projects' Storm Water Pollution Prevention Plans. More information about the sampling requirement can be found in the *Construction Storm Water Sampling and Analysis Guidance Document*, developed by the California Stormwater Quality Task Force. This document can be downloaded from the Regional Board Storm Water website at http://www.swrcb.ca.gov/rwqcb4/html/programs/Stormwater/stormwater.html.

The four dischargers in the watershed under the general construction storm water permit are all on sites of less than ten acres.

Wetlands Protection and Management

The Southern California Wetlands Recovery Project considers the removal of Matilija Dam on Matilija Creek, a tributary to the Ventura River northwest of Ojai a priority project for funding. According to the US Fish & Wildlife Service, the removal would accomplish 1) restoration of the Ventura River ecosystem and contribute to recovery of endangered steelhead trout, 2) provide needed sediment for beach nourishment and coastal erosion control, and 3) facilitate recreational access to Matilija Wilderness Area in the Los Padres National Forest. Other high priority projects involve land acquisitions of primarily riparian habitat at the mouth of the river (the Zellerbach Property) and removal of Arundo.

Section 401 Water Quality Certification Program

This program primarily involves the review of projects requiring US Army Corps of Engineers' permits and deals with discharge of fill and dredge materials into US waters (includes wetlands) and any corresponding activities. Certifications or waivers are issued on the majority of projects. Projects are reviewed for impacts to water quality standards, including beneficial uses, and the implementation of mitigation measures, including BMPs. SWRCB maintains a database on actions taken. However, we could benefit from this program by documenting the impacted areas, including the types of modifications made. At this time, no specific information is readily available because we have not internalized a database for this use.

Nonpoint Source Program

Nonpoint source pollution, as opposed to "point source" pollution (a discharge at a specific location or pipe with the exception of irrigation return flows), generally consists of diffuse runoff of pollutant-laden water from adjacent land. These pollutants are transported to waters by precipitation, irrigation, and atmospheric deposition. Nonpoint sources have been grouped by the USEPA into categories that include agriculture, urban runoff, construction, hydromodification, resource extraction, silviculture, and land disposal. These categories, however, are not exclusive. For example, agricultural operations contain both point (concentrated animals) and nonpoint source (irrigation return flow) categories.

With the addition of specific nonpoint source language in the 1987 amendments to the CWA (particularly §319), new direction focusing on implementation of state nonpoint source management programs have been authorized.

The State of California's approach to control of nonpoint source pollution is described in *Nonpoint Source Management Plan* which includes a three-tiered management approach to address nonpoint source problems. Each Regional Board will decide which management option(s) will be required for individual situations. Generally, the least stringent option (in terms of regulation) that will protect or restore water quality will be employed, followed by more formal regulatory measures if timely improvements in water quality are not achieved. Regional Boards usually will not impose effluent limits on nonpoint source dischargers who are implementing Best Management Practices in accordance with a State or Regional Board formal action. The three tiers (in order of increasing regulatory control) are outlined below:

(i) Voluntary implementation of Best Management Practices

Land managers or property owners voluntarily or cooperatively implement Best Management Practices.

(ii) Regulatory-based enforcement of Best Management Practices

The Regional Board can encourage the use of Best Management Practices by waiving WDRs on the condition that the dischargers implement effective Best Management Practices .
The Regional Board can enforce Best Management Practices indirectly by entering into Management Agency Agreements (MAAs) with other agencies that have the authority to enforce Best Management Practices .

(iii) Effluent limitations

The Regional Board can adopt and enforce WDRs on any proposed or existing waste discharge, including discharges from nonpoint sources.

A priority issue is continued work to determine the scope of water quality impacts from agricultural runoff in the Region. Some agricultural activities occur in the Ventura River Watershed. Development of solutions to any impacts is also a high priority and will be a major concern of the nonpoint source program and, by extension, watershed groups which will be addressing this as well as other problems. Equestrian stables in the San Antonio Creek tributary of the river were identified by Regional Board and U.S. Army Corps of Engineers staff as existing and potential sources of problems in the watershed.

Facility owners are working to improve their operations from a water quality standpoint in an effort to avoid implementation of management practices under Waste Discharge Requirements.

<u>Planning and Assessment</u>

The State Board sets statewide policies and develops regulations for the implementation of water quality control programs mandated by state and federal water quality statutes and regulations. Regional Water Quality Control Boards develop and implement Water Quality Control Plans (Basin Plans) that consider regional beneficial uses, water quality characteristics, and water quality problems.

The Los Angeles Regional Board's Basin Plan is designed to preserve and enhance water quality and protect the beneficial uses of all regional waters. Specifically, the Basin Plan (i) designates beneficial uses for surface and ground waters, (ii) sets narrative and numerical objectives that must be attained or maintained to protect the designated beneficial uses and conform to the state's antidegradation policy, and (iii) describes implementation programs to protect all waters in the Region. Beneficial uses and objectives for the Ventura River Watershed are shown in Table v-x.

The Clean Water Act (CWA), enacted by the federal government in 1972, was designed to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. One of the national goals states that wherever attainable water quality should provide for the protection and propagation of fish, shellfish, and wildlife, and provide for recreation in and on the water (i.e., fishable, swimmable). The CWA (§303[c]) directs states to establish water quality standards for all "waters of the United States" and to review and update such standards on a triennial basis. Other provisions of the CWA include Section 208, which authorizes the preparation of waste treatment management plans, and Section 319 (added by 1987 amendments) which mandates specific actions for the control of pollution from nonpoint sources. Water quality assessments for the Ventura River watershed are included in Part Three of this report.

Other Agencies' Programs

<u>Ventura County</u>

Mining: A Conditional Use Permit (CUP) is required for mining operations. All permits include conditions "to mitigate potential environmental impacts including water quality degradation and water losses" (Ventura County, 1994a). The County of Ventura issues County Conditional Use Permit (CUP) for mining operations. These CUPs have been issued for the past 25 years. These permits have become increasing more stringent in recent years. Permits include prohibition against mining below the "red line" or the average high groundwater table, mining depth and profile standards, establishment of a river corridor, slope and setback restrictions, and buffer zones. (Ventura County, 1994).

Water quality: Environmental Health Division oversees drinking water, hazardous materials, leaking underground tank cleanup, liquid waste, and solid waste programs.

Ventura County Tree Protection Ordinance (No. 3993) requires replacement of protected trees calculated by cross-section of trees.

<u>California Water Resources Control Board</u>

The Water Code authorizes the Board to consider public interest, specifically instream beneficial uses, when issuing permits for water appropriation (CA DWR, 1994wp).

California Department of Fish and Game

Endangered, threatened and rare plants and animals are protected under the California Endangered Species Act of 1984, as amended, along with the California Native Plant Protection Act of 1977. The Department of Fish and Game has the authority to review projects for their potential impacts to listed species and their habitats. In addition, the Department uses a list of Species of Special Concern as a planning tool. Species of Concern are ranked in three levels of sensitivity. Priority one are species that face local extinction if current trends continue. Priority 2 are species with obvious population declines within most of their range in California. Priority 3 species are not in danger of local extinction but have low population numbers. (Ventura County, 1992eir).

Minimum flow requirements for instream uses are determined by the Stream Flow Evaluation Unit.

The Department also approves Streambed Alteration Agreements (Fish and Game Code §1601 and 1603) for projects that include activities that will change the existing state of any river, stream or lake in California (Ventura County, 1992eir). These agreements usually include detailed conditions to mitigate temporary and permanent impacts.

The Department is authorized to develop plans to protect habitats under the Natural Community Conservation Planning Act of 1991. Pilot projects to protect coastal sage scrub have been established in some southern California watersheds (CA DWR, 1994wp).

U.S. Army Corps of Engineers, Ventura Office

Department of the Army permits are administered by the U.S. Army Corps of Engineers pursuant to section 404 of the Clean Water Act and section 10 of the River an Harbor Act of 1899. These are permits for fill and dredge activities within the nation's waters. A permit is required if a project will involve filling or dredging on any waterbody or wetland.

U.S. Fish and Wildlife Service, Ventura Office

The U.S. Fish and Wildlife Service is required by their mandate to provide comments on any public notices issued for a Federal permit or license affecting any of the nation's waters. They review Department of the Army permits administered by the U.S. Army Corps of Engineers pursuant to section 404 of the Clean Water Act and section 10 of the River and Harbor Act of 1899. When they review section 404 permits, they generally recommend avoidance of impacts to waters and wetlands. For any project that is "non-water dependent" or does not require proximity to waters or special aquatic sites, the Service recommends denial of the permit. In addition, the Service administers portions of the Endangered Species Act of 1973, as amended. Section 7 of the Act requires Federal agencies to consult with the Service if their actions may impact listed threatened to endangered species (see table v-x for species within this watershed). Section 9 of the Act prohibits the "taking", including harming or destruction of necessary habitat or disruption of reproductive behavior, of any listed species (USFW, 1993eir).

Ventura County Agricultural Commissioner's Office

They are responsible for permitting and monitoring of local use of pesticides; the agency has previously inquired about RWQCB's concerns

California Coastal Commission

The Commission provides permitting for coastal zone activities through Coastal Zone Act (contacts include Mark Delaplaine & Jim Raives, San Francisco Office)

California Department of Forestry and Fire Protection

In 1994, the Department developed a GIS-based mapping system of "Planning Watersheds." These are small scale land units, ranging in size from 3,000 to 10,000 acres, for organizing data for soils, rainfall, land use, land cover, and other data.

Los Padres National Forest

The Los Padres National Forest staff has been planning on a comprehensive watershed analysis within their jurisdiction, for some time now. The latest information is that they are putting together a draft outline (sort of a guidance document) which is supposed to come out this September. I have requested for a copy. They plan to do the Sespe Watershed first (which is their priority) after which they intend to focus on the Ventura River Watershed probably by the end of next fiscal year). They intend to focus on, aside from other impacts, impacts from forest fires , recreation and road construction. My contact at Los Padres National forest is George Garcia, who is a wildlife biologist.

Ventura County RCD

Ventura County Hillside Erosion Program is administered by the Ventura County RCD (Ventura County, 1994a).

California Resources Agency

In 1992, the California Resources Agency, in cooperation with other agencies and conservation groups, began the California Rivers Assessment. The goals are to assess riparian and aquatic conditions of many of the state's rivers, to develop a data inventory, and to make the database assessable to governmental decision-makers and the public. The program will include a Geographic Information System (GIS) and is based on the US EPA River Reach File System. (CA Resources Agency, 1995).

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Ojai Valley	Ojai Valley Sanitary District
USFW	United States Fish and Wildlife Service
Casitas MWD	Casitas Municipal Water District
San Buenaventura	City of San Buenaventura
CRWQCB-LA	California Regional Water Quality Control Board – Los Angeles Region
USFS	United States (Department of Agriculture) Forest Service

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Figure 1

The Ventura River Watershed

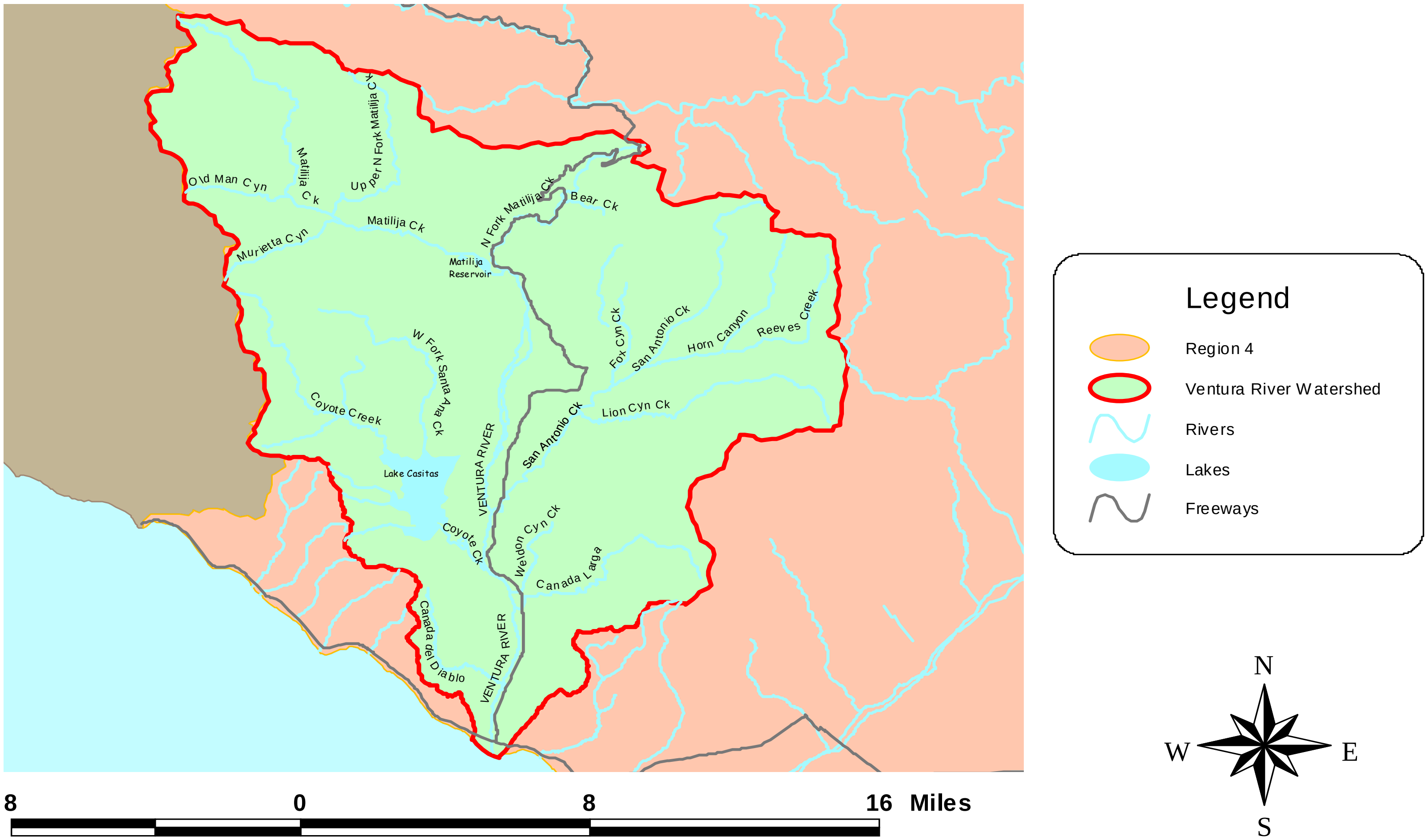


Figure 2

Groundwater Basins in the Ventura River Watershed

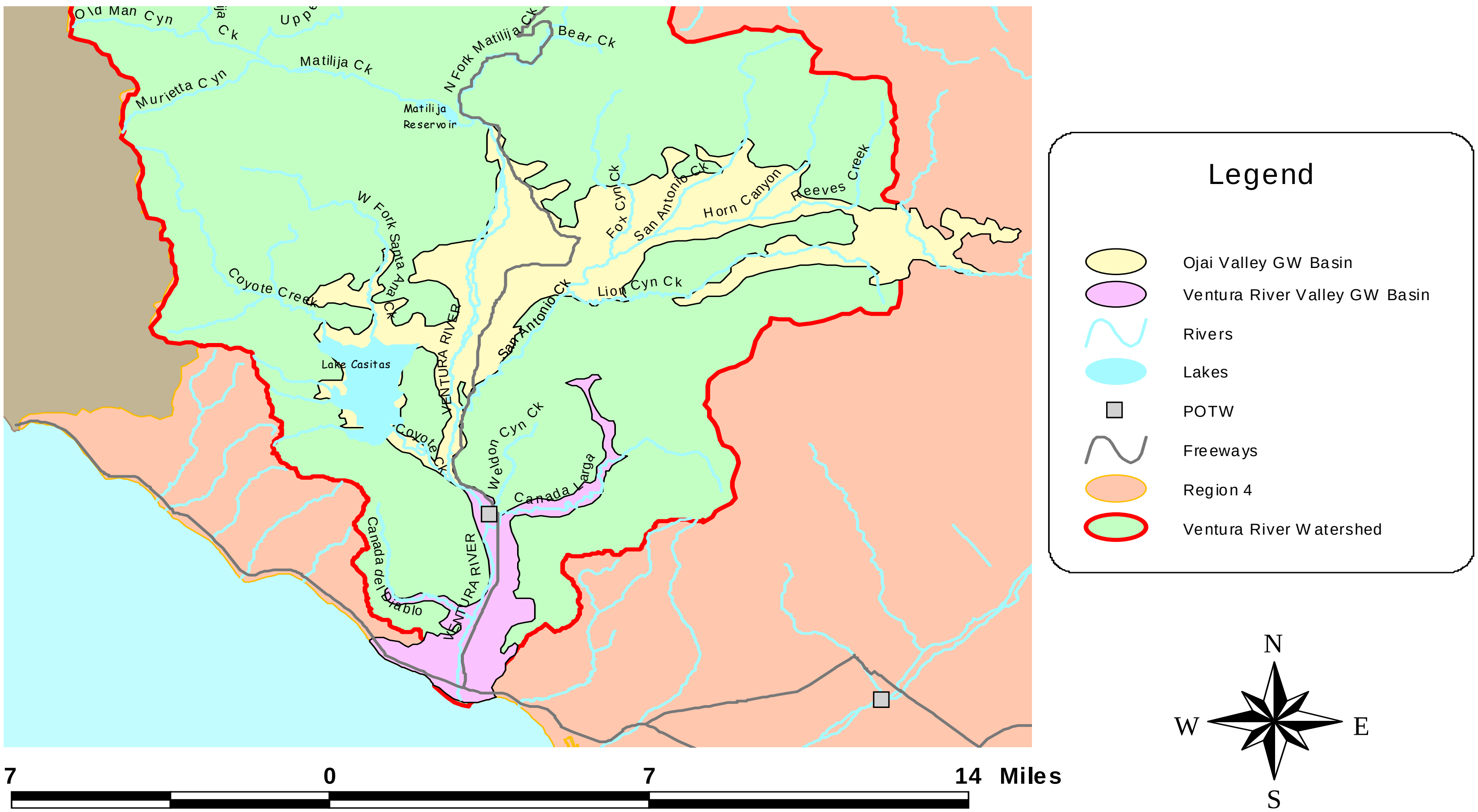


Figure 3

Stream Gages in the Ventura River Watershed

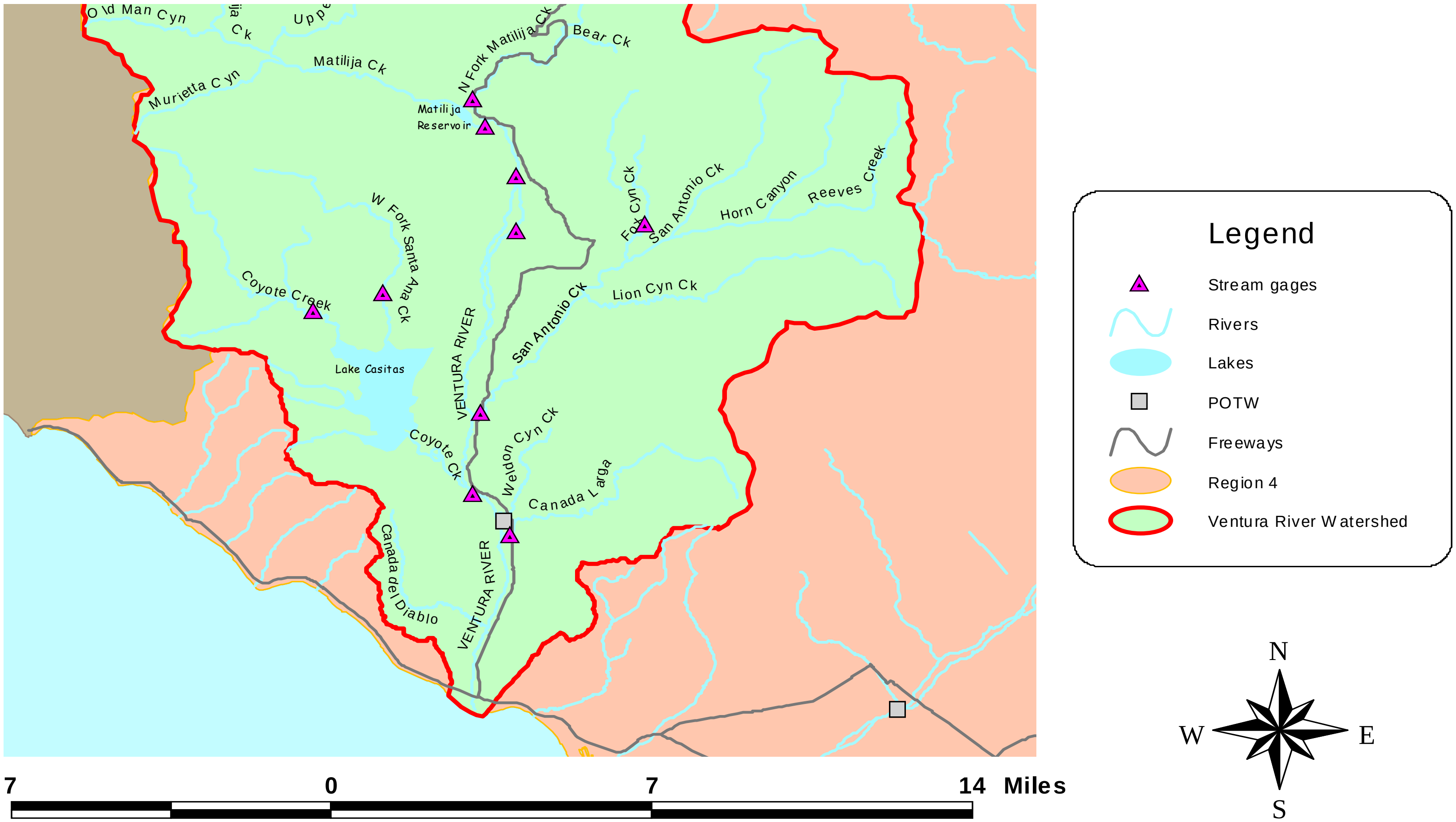


Figure 4

Land Use in the Ventura River Watershed

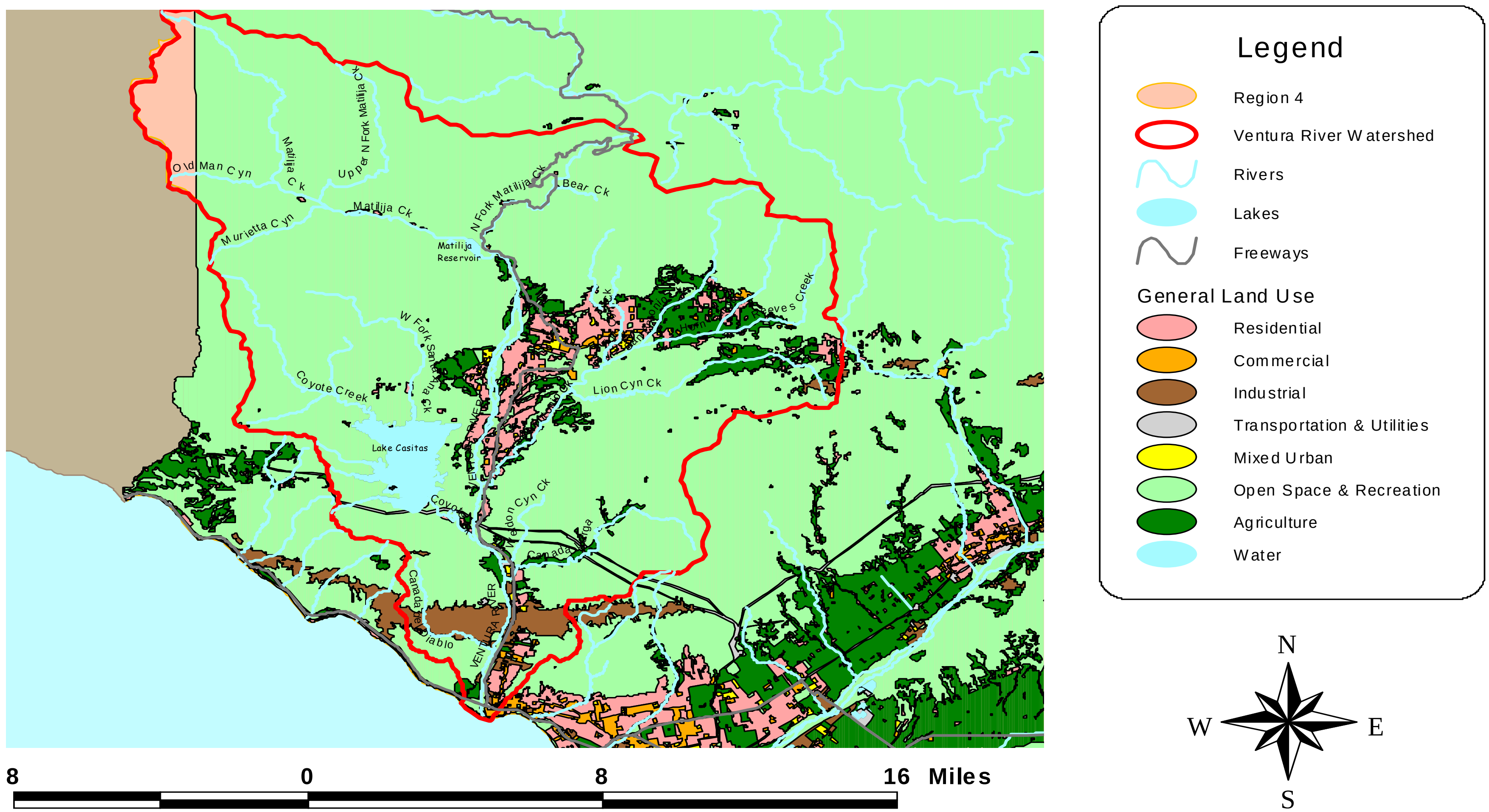


Figure 5

Historic Regional Board Monitoring in the Ventura River Watershed

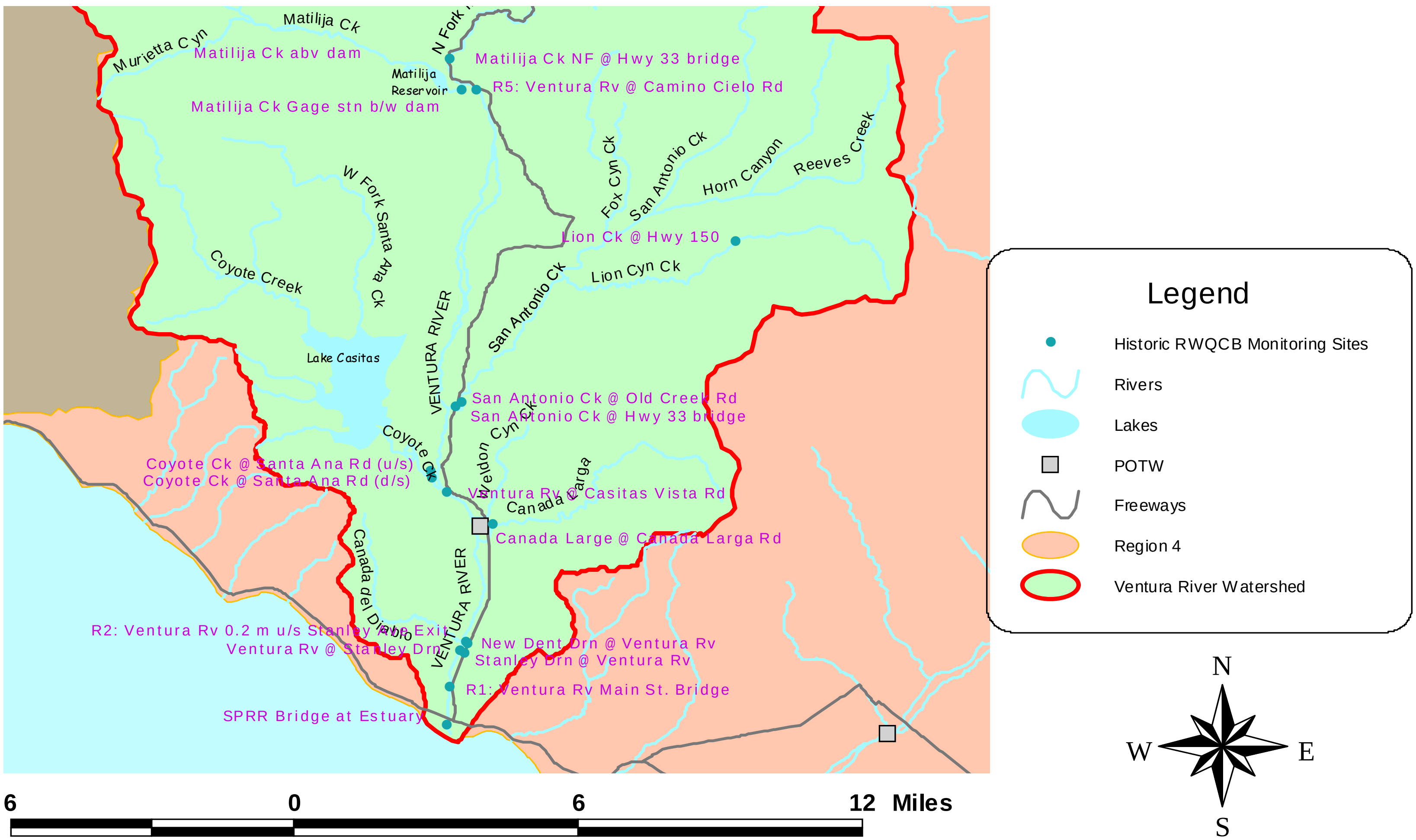


Figure 6

Local Agency and Citizen Monitoring in the Ventura River Watershed

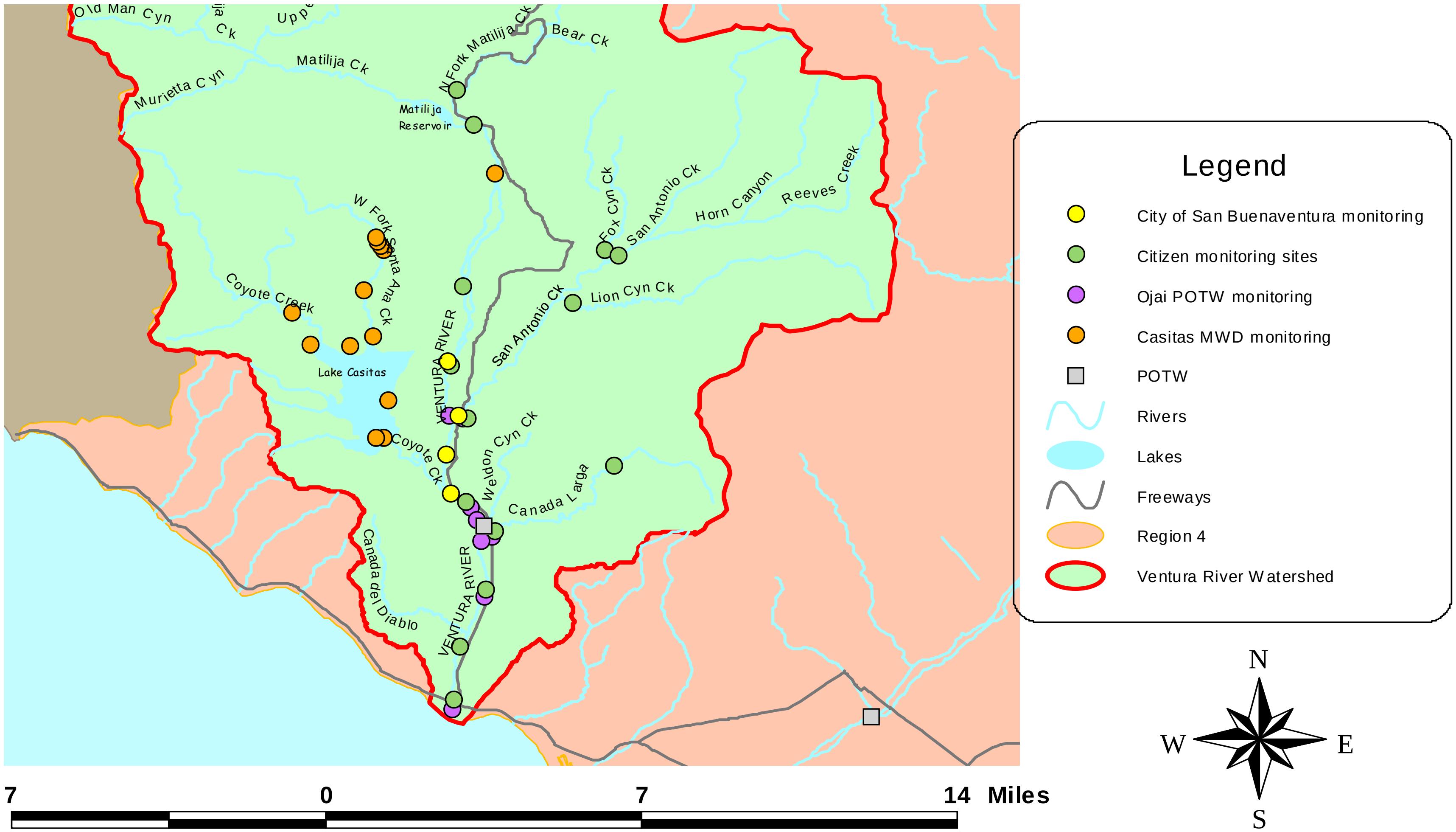
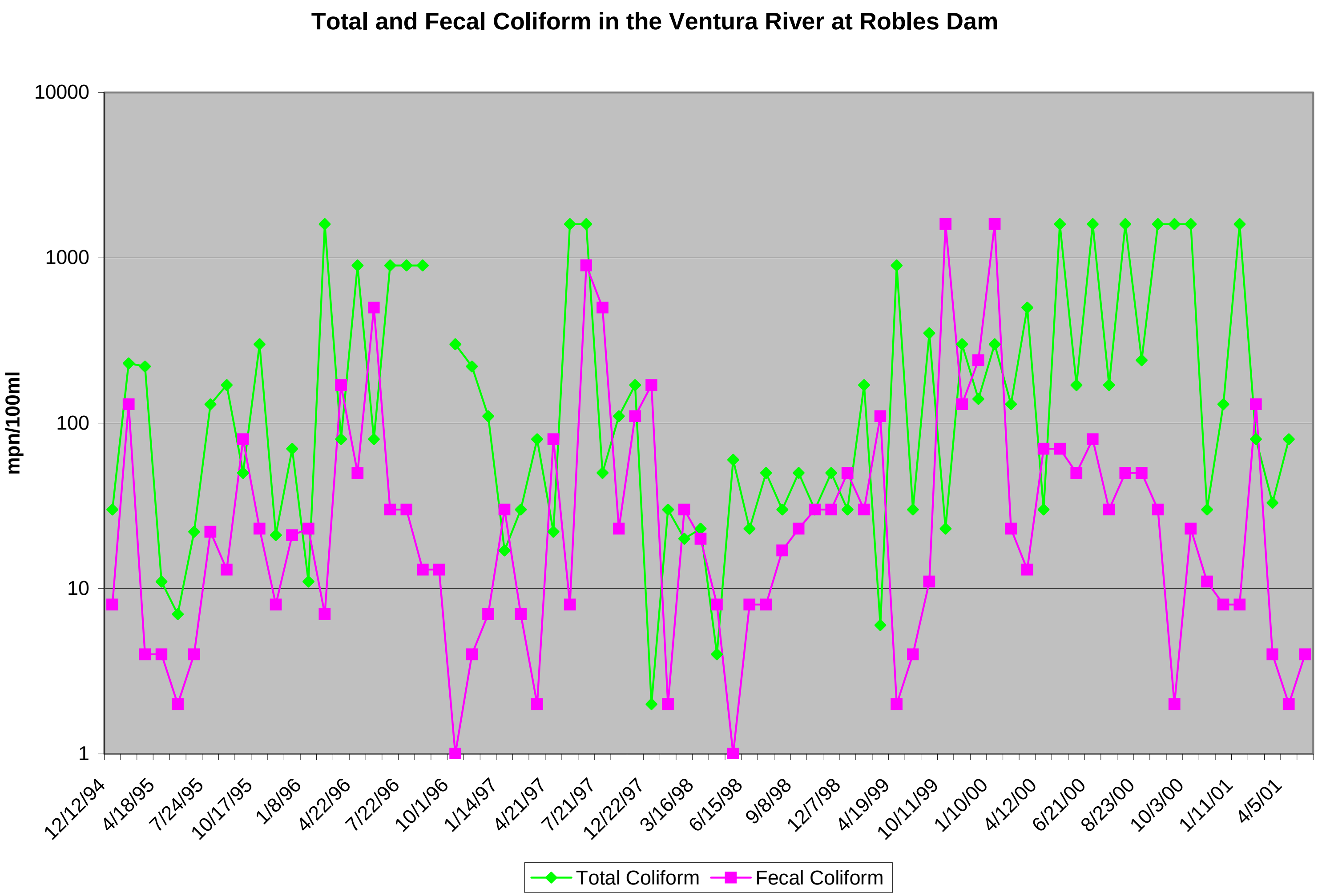


Figure 7



Total and Fecal Coliform in the Ventura River at Robles Dam
mpn/100ml
10000
1000
100
10
1
12/12/94
4/18/95
7/24/95
10/17/95
1/8/96
4/22/96
7/22/96
10/1/96
1/14/97
4/21/97
7/21/97
12/22/97
3/16/98
6/15/98
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10/11/99
1/10/00
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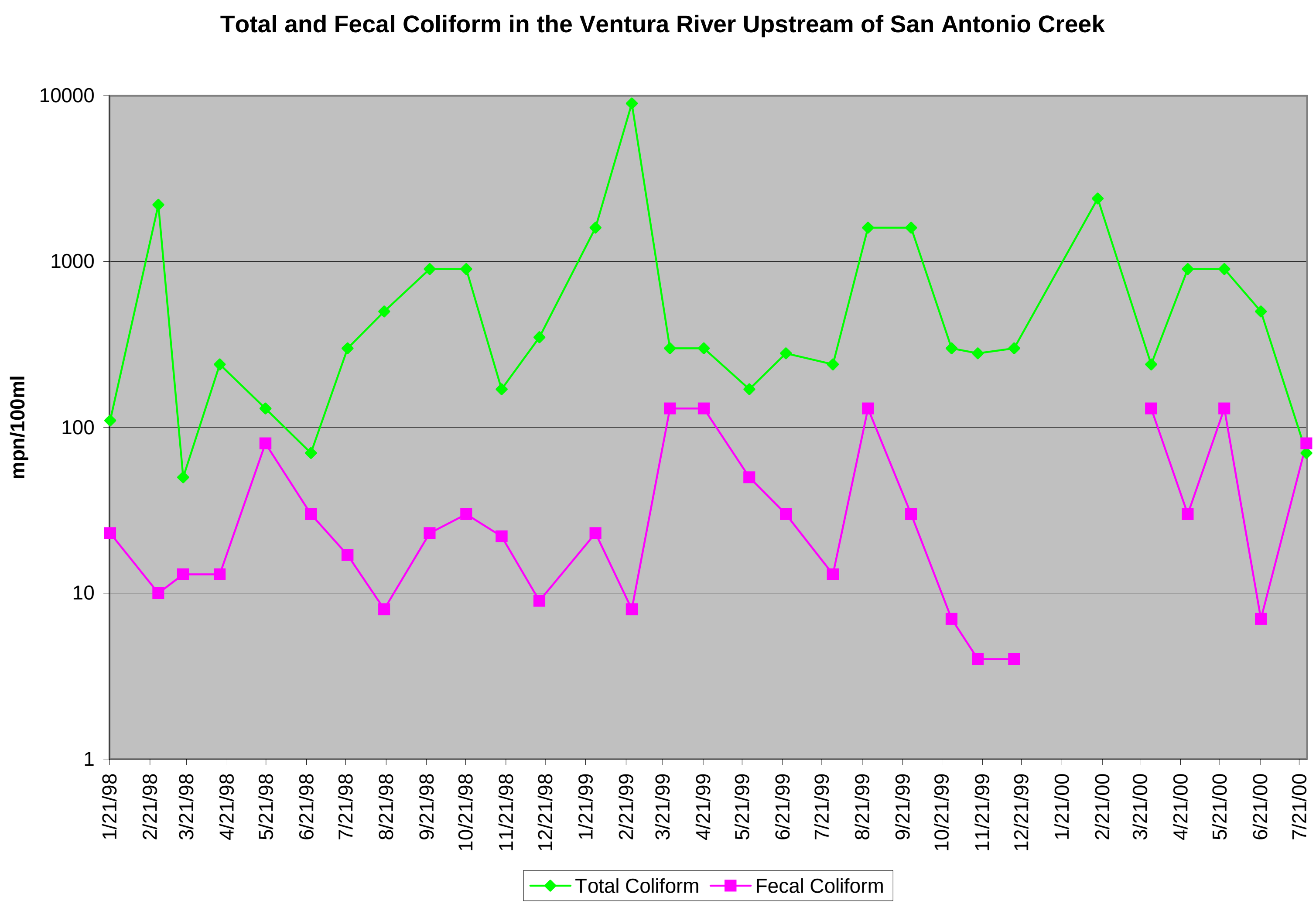
1/11/01
4/5/01
Total Coliform
Fecal Coliform

Figure 8



Total and Fecal Coliform in the Ventura River Upstream of San Antonio Creek
mpn/100ml
10000
1000
100
10
1
1/21/98
2/21/98
3/21/98
4/21/98
5/21/98
6/21/98
7/21/98
8/21/98
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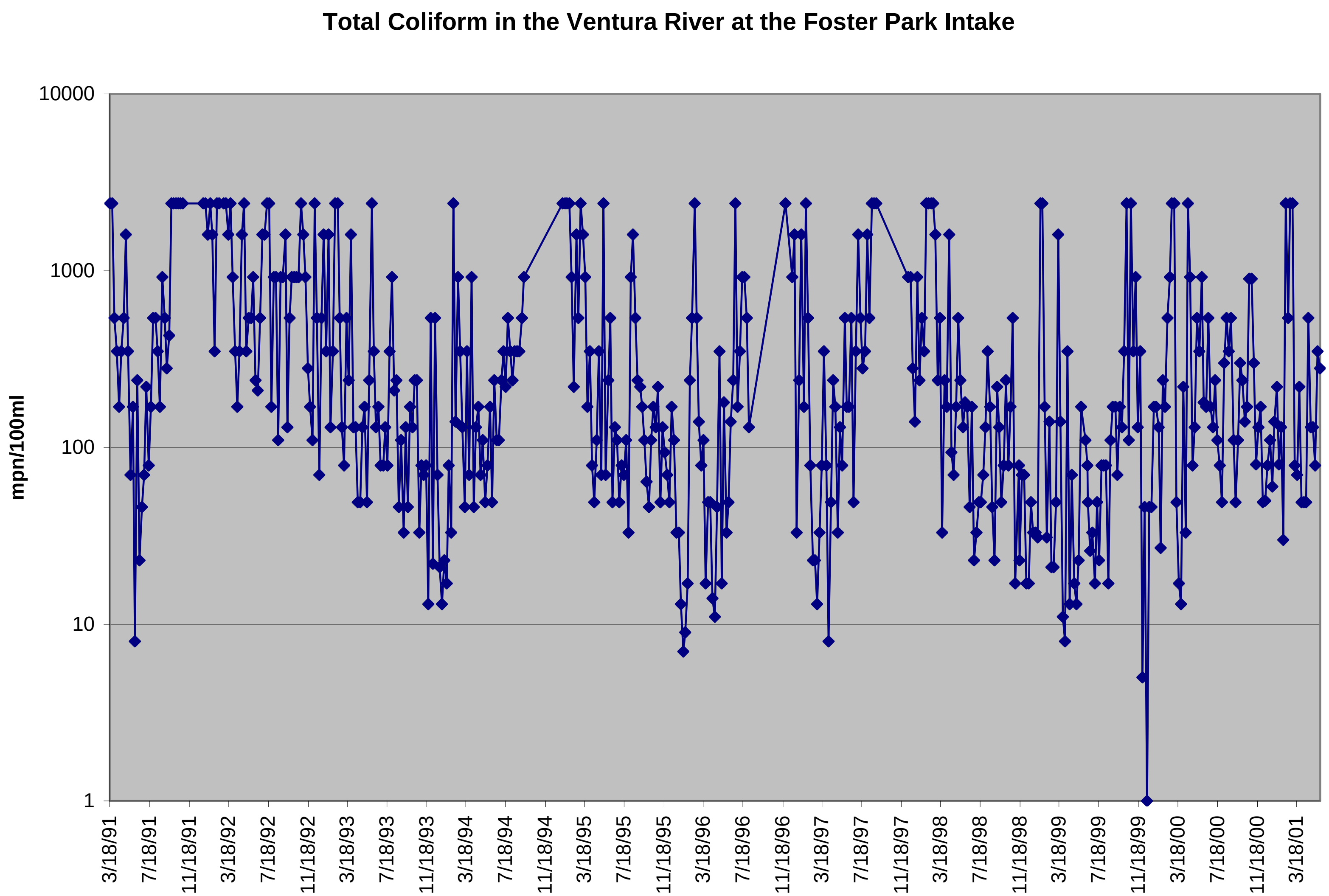
Total Coliform
Fecal Coliform

Figure 9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mpn/100ml
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1000
100
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1
3/18/91
7/18/91
11/18/91
3/18/92
7/18/92
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3/18/93
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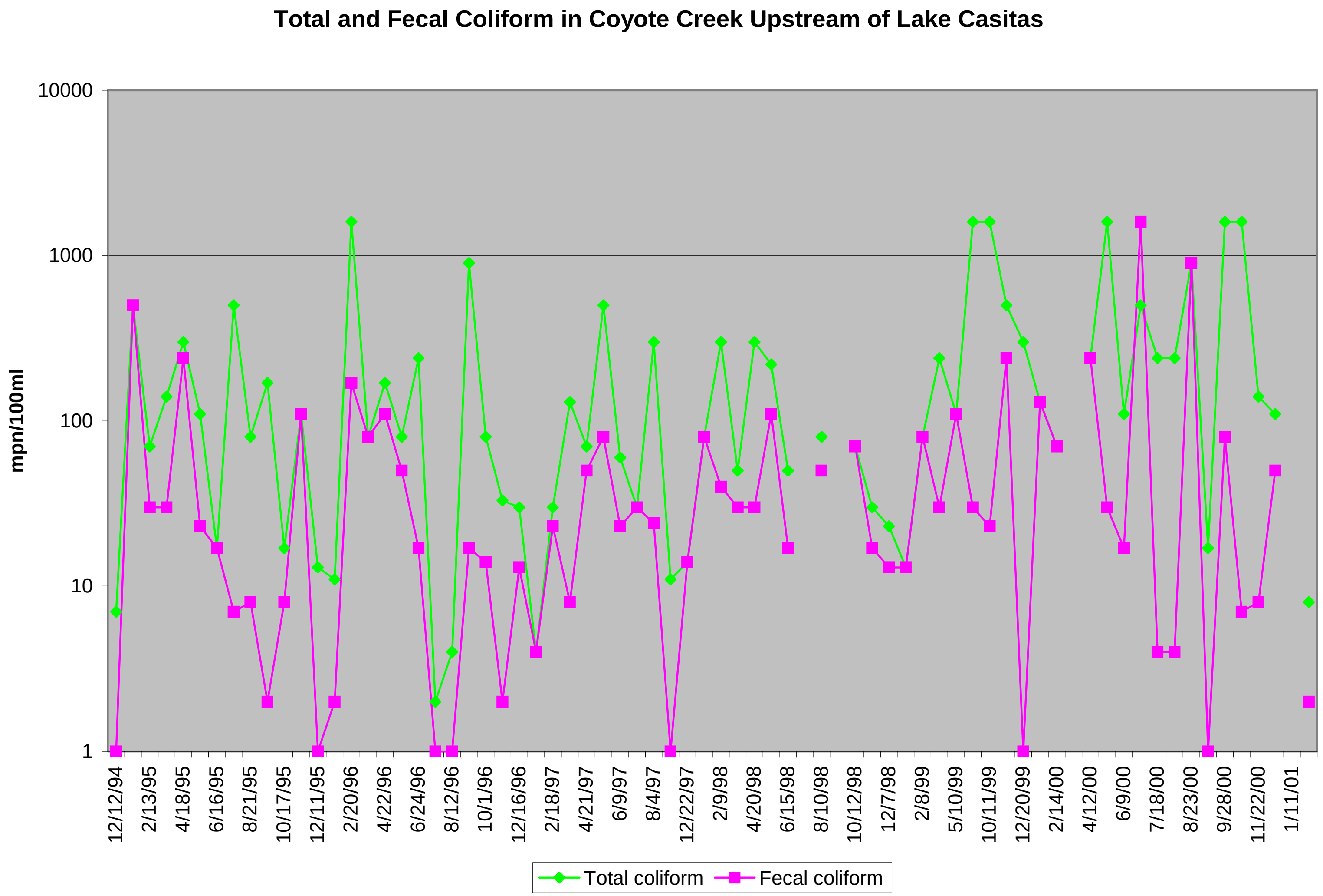
Figure 10



Total and Fecal Coliform in Coyote Creek Upstream of Lake Casitas
mpn/100ml
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10
1
12/12/94
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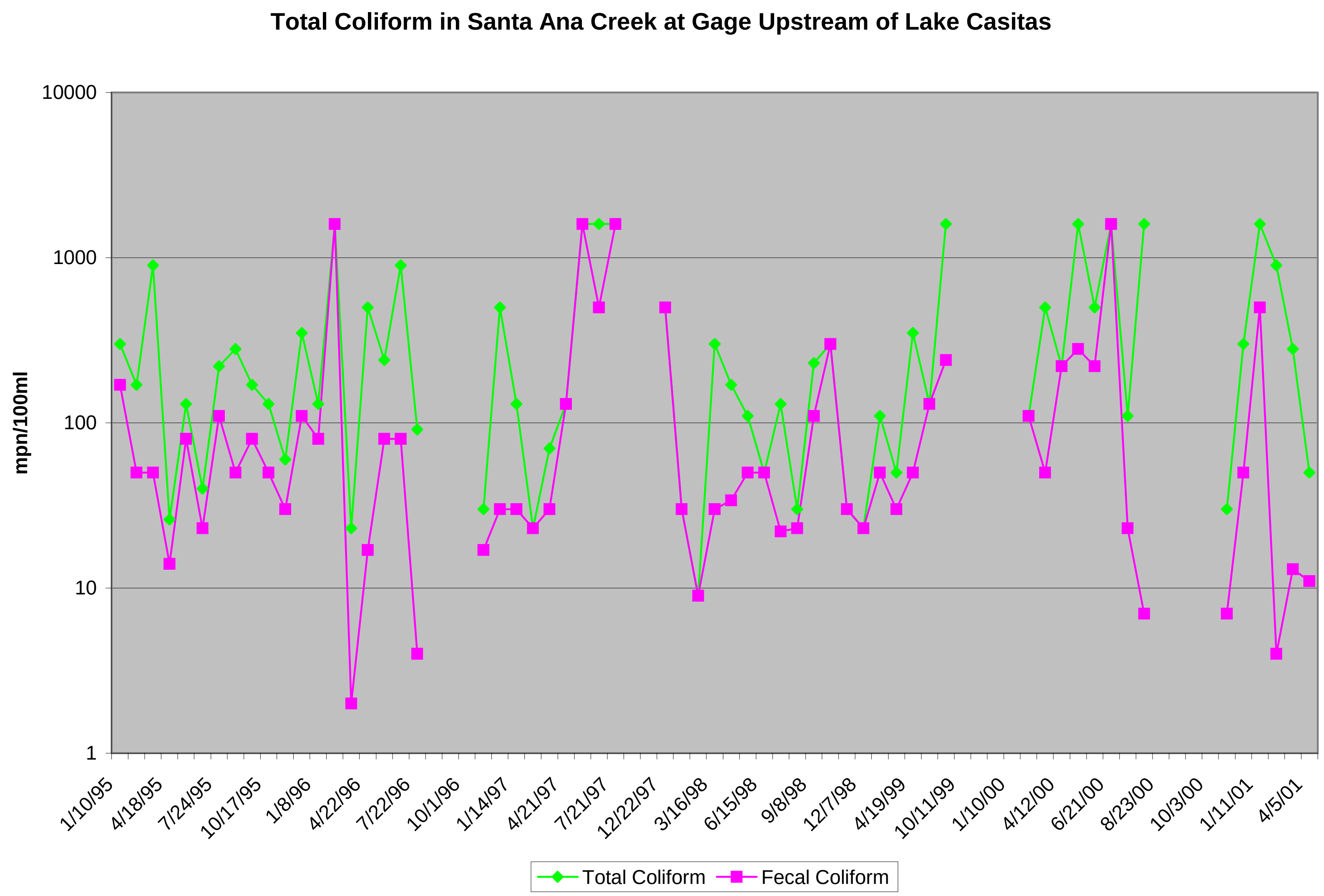
1/11/01
Total coliform
Fecal coliform

Figure 11


Total Coliform in Santa Ana Creek at Gage Upstream of Lake Casitas
mpn/100ml
10000
1000
100
10
1
1/10/95
4/18/95
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6/21/00
8/23/00
10/3/00
1/11/01
4/5/01
Total Coliform
Fecal Coliform

Figure 12

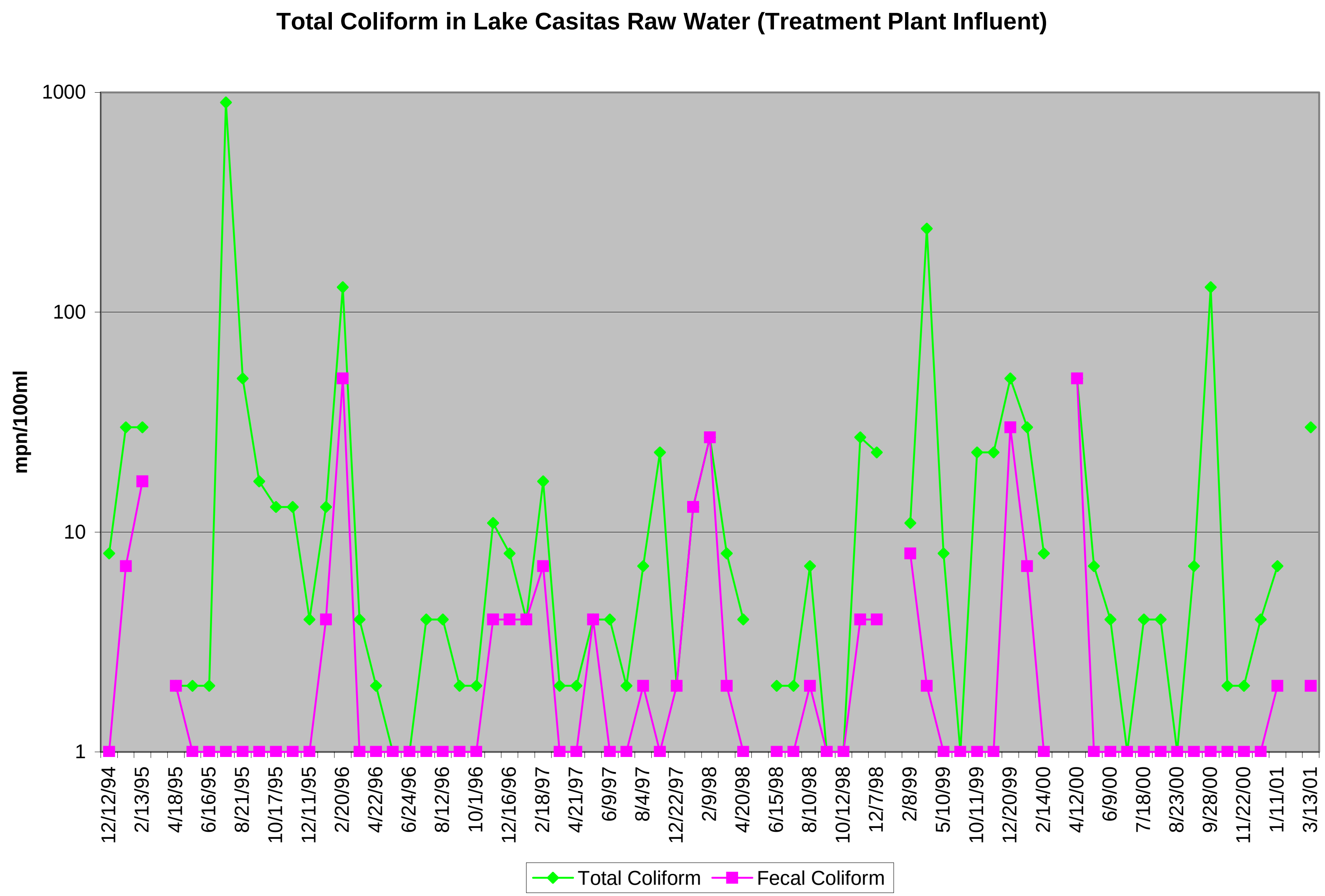

Total Coliform in Lake Casitas Raw Water (Treatment Plant Influent)
mpn/100ml
1000
100
10
1
12/12/94
2/13/95
4/18/95
6/16/95
8/21/95
10/17/95
12/11/95
2/20/96
4/22/96
6/24/96
8/12/96
10/1/96
12/16/96
2/18/97
4/21/97
6/9/97
8/4/97
12/22/97
2/9/98
4/20/98
6/15/98
8/10/98
10/12/98
12/7/98
2/8/99
5/10/99
10/11/99
12/20/99
2/14/00
4/12/00
6/9/00
7/18/00
8/23/00
9/28/00
11/22/00
1/11/01
3/13/01
Total Coliform
Fecal Coliform

Figure 13

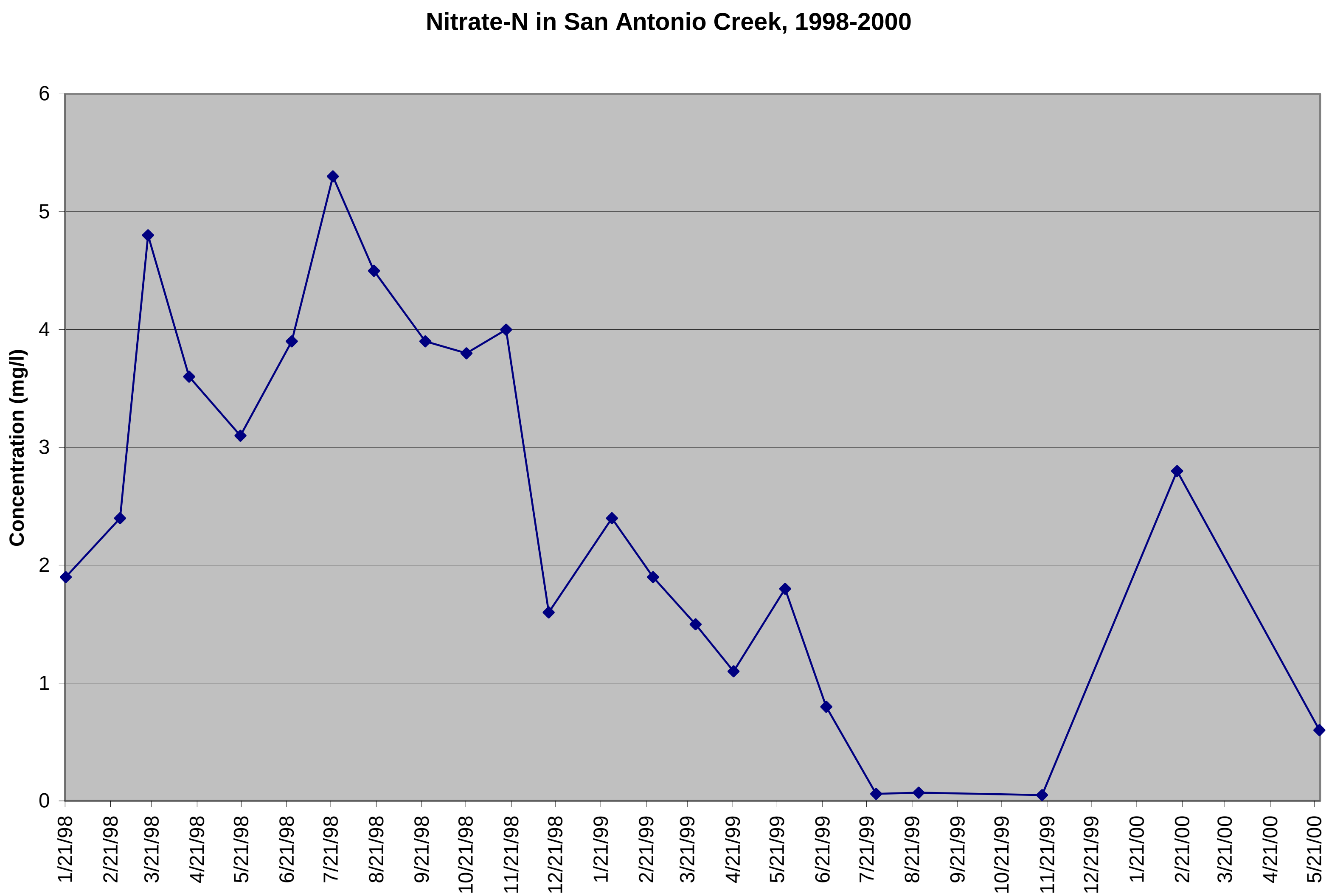
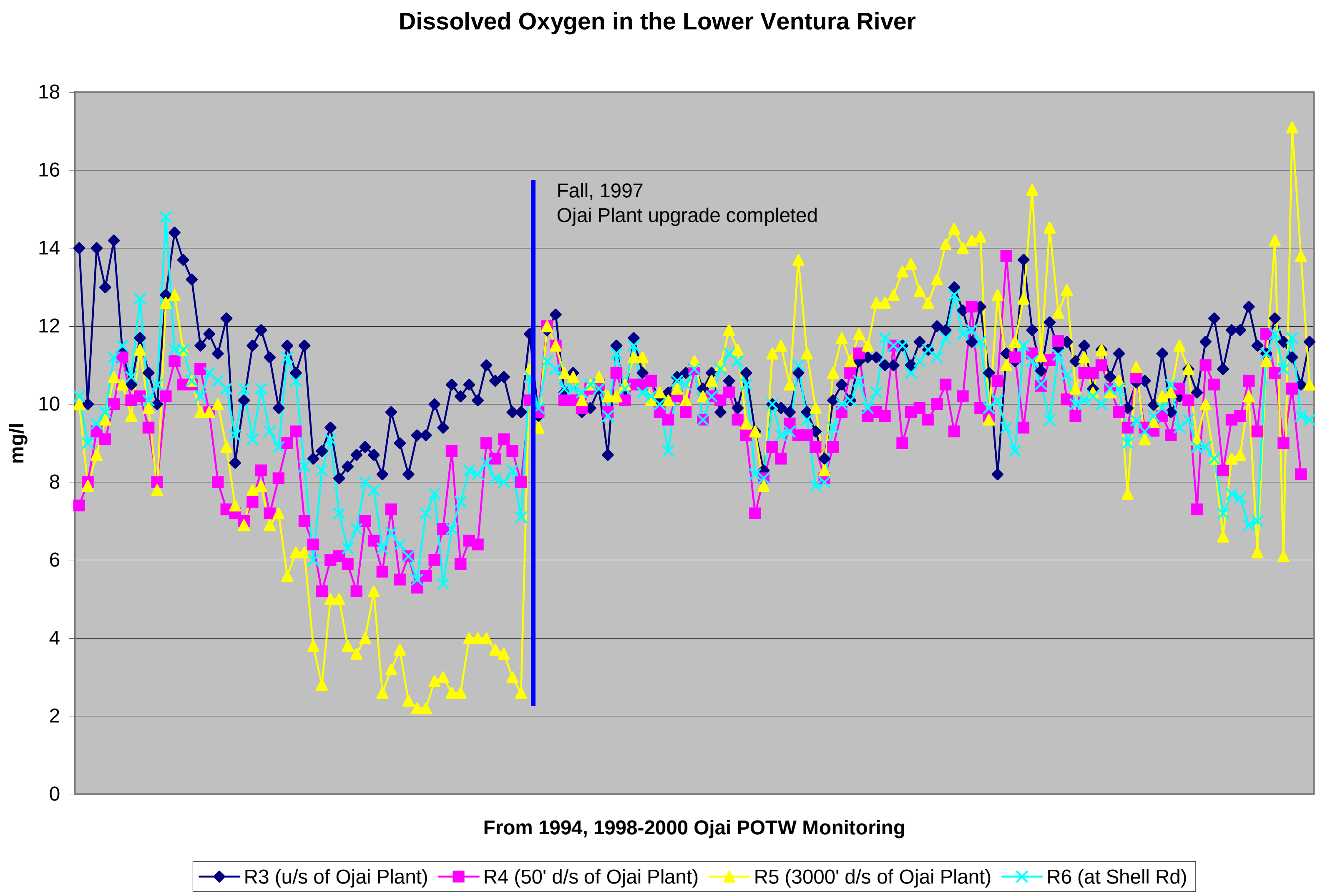
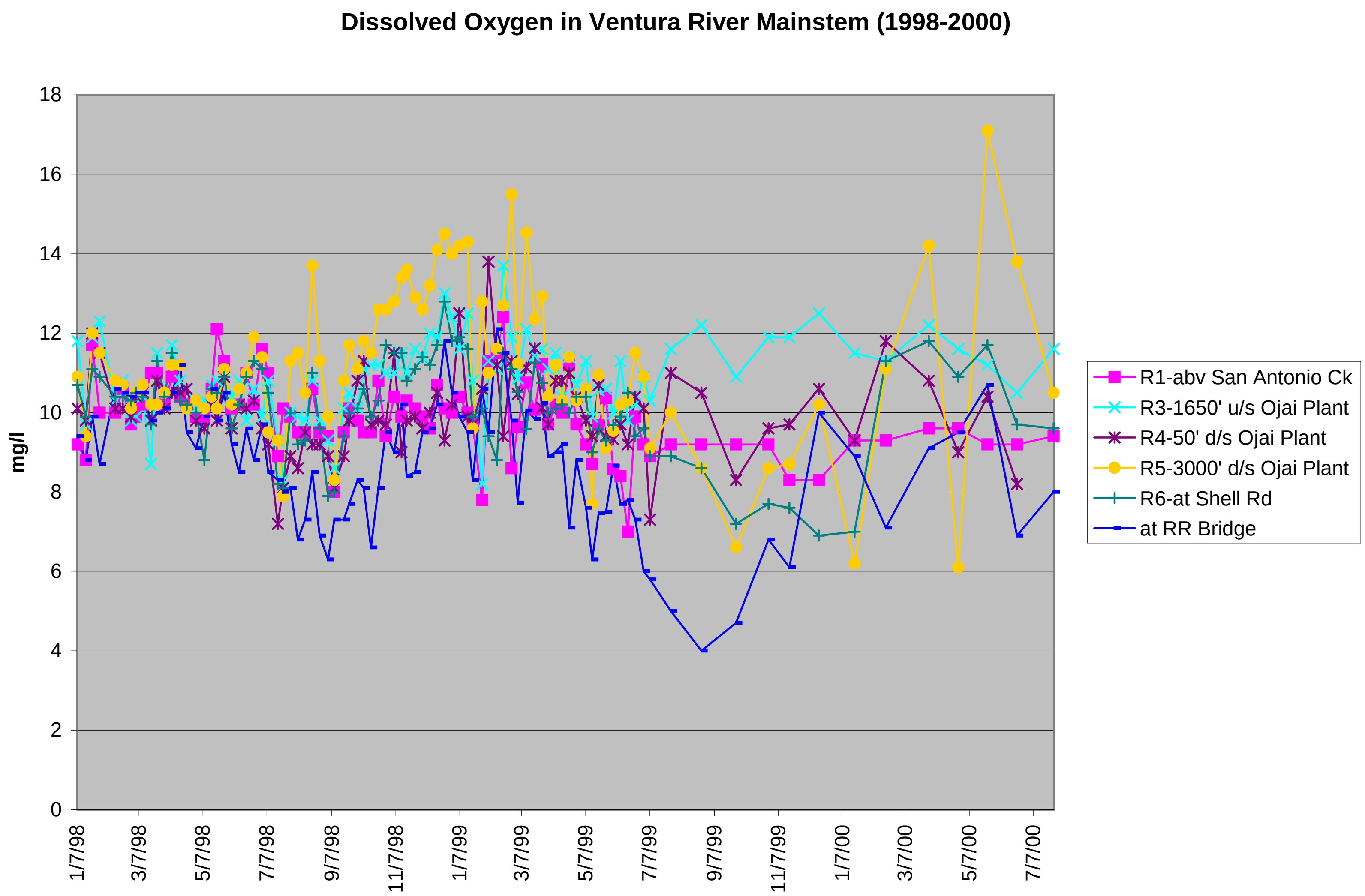

Nitrate-N in San Antonio Creek, 1998-2000
Concentration (mg/l)
0
1
2
3
4
5
6
1/21/98
2/21/98
3/21/98
4/21/98
5/21/98
6/21/98
7/21/98
8/21/98
9/21/98
10/21/98
11/21/98
12/21/98
1/21/99
2/21/99
3/21/99
4/21/99
5/21/99
6/21/99
7/21/99
8/21/99
9/21/99
10/21/99
11/21/99
12/21/99
1/21/00
2/21/00
3/21/00
4/21/00
5/21/00

Figure 14



Dissolved Oxygen in the Lower Ventura River
18
16
14
12
10
8
6
4
2
0
mg/l
Fall, 1997
Ojai Plant upgrade completed
From 1994, 1998-2000 Ojai POTW Monitoring
R3 (u/s of Ojai Plant)
R4 (50' d/s of Ojai Plant)
R5 (3000' d/s of Ojai Plant)
R6 (at Shell Rd)

Figure 15



Dissolved Oxygen in Ventura River Mainstem (1998-2000)
mg/l
18
16
14
12
10
8
6
4
2
0
1/7/98
3/7/98
5/7/98
7/7/98
9/7/98
11/7/98
1/7/99
3/7/99
5/7/99
7/7/99
9/7/99
11/7/99
1/7/00
3/7/00
5/7/00
7/7/00
R1-abv San Antonio Ck
R3-1650' u/s Ojai Plant
R4-50' d/s Ojai Plant
R5-3000' d/s Ojai Plant
R6-at Shell Rd
at RR Bridge

Figure 16

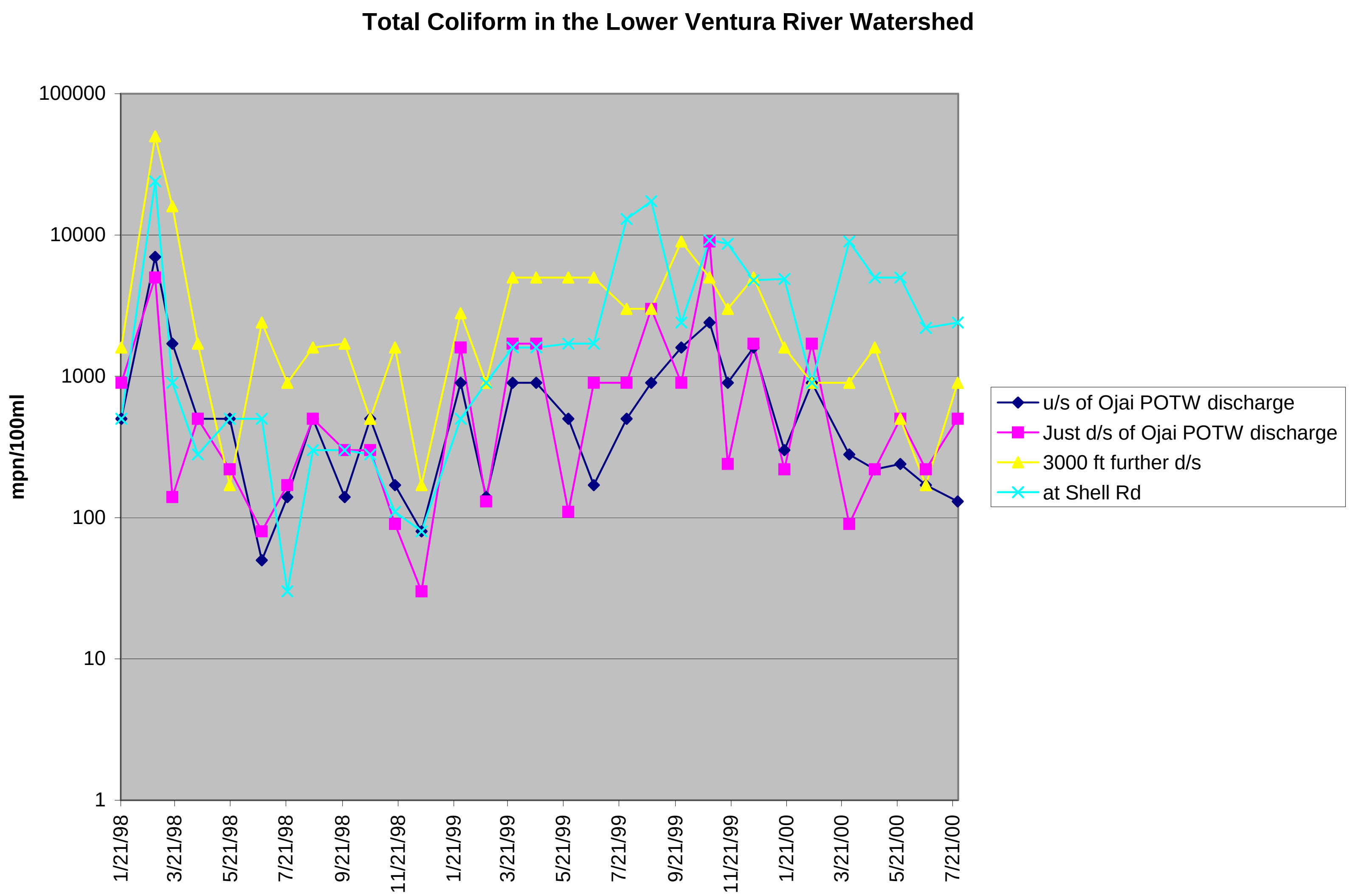
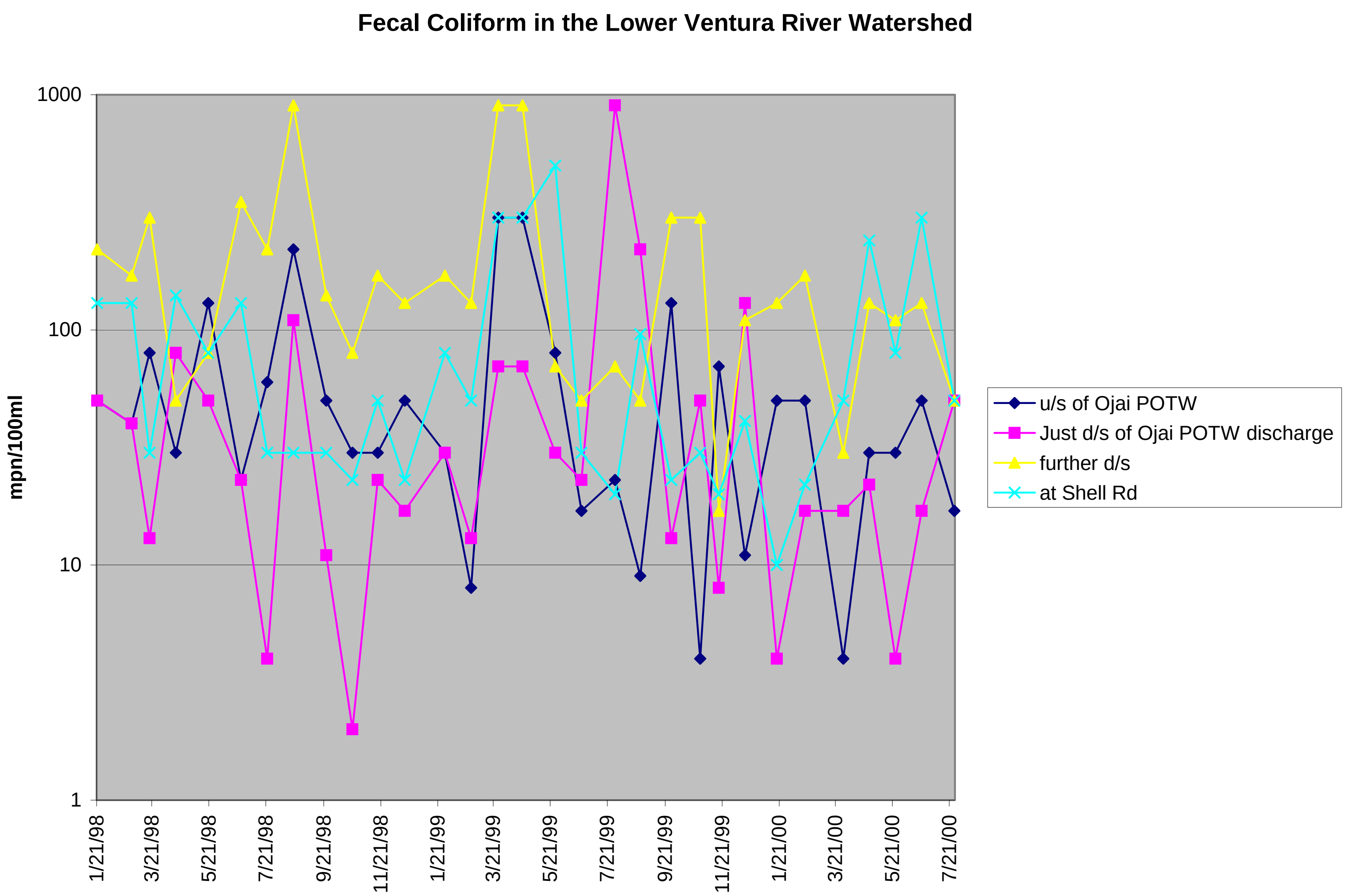

Total Coliform in the Lower Ventura River Watershed
mpn/100ml
100000
10000
1000
100
10
1
1/21/98
3/21/98
5/21/98
7/21/98
9/21/98
11/21/98
1/21/99
3/21/99
5/21/99
7/21/99
9/21/99
11/21/99
1/21/00
3/21/00
5/21/00
7/21/00
u/s of Ojai POTW discharge
Just d/s of Ojai POTW discharge
3000 ft further d/s
at Shell Rd

Figure 17



Fecal Coliform in the Lower Ventura River Watershed
mpn/100ml
1000
100
10
1
1/21/98
3/21/98
5/21/98
7/21/98
9/21/98
11/21/98
1/21/99
3/21/99
5/21/99
7/21/99
9/21/99
11/21/99
1/21/00
3/21/00
5/21/00
7/21/00
u/s of Ojai POTW
Just d/s of Ojai POTW discharge
further d/s
at Shell Rd