# 4.7 Water Resources and Water Quality

## *4.7.1 Introduction*

This section of the Environmental Impact Report (EIR) describes the environmental setting for water resources and water quality conditions across California. Water resources include the distribution and circulation of water, both on land and underground. Water quality deals with the quality of surface and groundwater. Surface water is water on the surface of the land and includes lakes, rivers, streams, and creeks. Groundwater is water below the surface of the earth. The quantity and quality of surface water resources are affected by precipitation, topography, soil type, vegetation, agricultural practices, urbanization, and general land use practices.

The quality and quantity of water produced by California's watersheds support a broad range of uses referred to as beneficial uses. The alteration of vegetative cover from wildfire and vegetation management practices can have significant impacts on water infiltration, soil erosion, stream sedimentation, and water temperature. This in turn has the potential to degrade or limit the beneficial uses supported by a waterbody.

## *4.7.2 Regulatory Framework*

### Clean Water Act

The federal Water Pollution Control Act (also known as the Clean Water Act [CWA]) is the principal statute governing water quality. The CWA establishes the basic structure for regulating discharges of pollutants into the waters of the United States and gives the EPA the authority to implement pollution control programs, such as setting wastewater standards for industry. The statute's goal is to end all unpermitted discharges entirely and to restore, maintain, and preserve the integrity of the nation's waters. The CWA regulates both the direct and indirect discharge of pollutants into the nation's waters. The CWA sets water quality standards for all contaminants in surface waters and makes it unlawful for any person to discharge any pollutant from a point source into navigable waters, unless a permit is obtained under its provisions. The CWA mandates permits for wastewater and stormwater discharges, requires states to establish site-specific water quality standards for navigable bodies of water, and regulates other activities that affect water quality, such as dredging and the filling of wetlands. The CWA also funded the construction of sewage treatment plants and recognized the need for planning to address non-point sources of pollution. Section 402 of the CWA requires a permit for all point source (a discernible, confined, and discrete conveyance, such as a pipe, ditch, or channel) discharges of any pollutant (except dredge or fill material) into waters of the U.S.

### National Pollutant Discharge Elimination System

Under the National Pollutant Discharge Elimination System (NPDES) program promulgated under Section 402 of the CWA, all facilities that discharge pollutants from any point source into waters of the U.S. are required to obtain an NPDES permit. The term "pollutant" broadly includes any type of industrial, municipal, and agricultural waste discharged into water. Point sources are discharges from publicly owned treatment works (POTWs), discharges from industrial facilities, and

discharges associated with urban runoff. While the NPDES program addresses certain specific types of agricultural activities, the majority of agricultural facilities are defined as non-point sources and are exempt from NPDES regulation. Pollutant contributors come from direct and indirect sources. Direct sources discharge directly to receiving waters, whereas indirect sources discharge wastewater to POTWs, which in turn discharge to receiving waters. Under the national program, NPDES permits are issued only to direct point source discharges. The National Pretreatment Program addresses industrial and commercial indirect dischargers. Municipal sources are POTWs that receive primarily domestic sewage from residential and commercial customers. Specific NPDES program areas applicable to municipal sources are the National Pretreatment Program, the Municipal Sewage Sludge Program, Combined Sewer Overflows (CSOs), and the Municipal Stormwater Program. Non-municipal sources include industrial and commercial facilities. Specific NPDES program areas applicable to these industrial/commercial sources are: Process Wastewater Discharges, Non-Process Wastewater Discharges, and the Industrial Stormwater Program. NPDES issues two basic permit types: individual and general. Also, the EPA has recently focused on integrating the NPDES program further into watershed planning and permitting. The NPDES has a variety of measures designed to minimize and reduce pollutant discharges. All counties with storm drain systems that serve a population of 50,000 or more, as well construction sites one acre or more in size, must file for and obtain an NPDES permit. Source: EPA, <http://www.epa.gov/npdes/pubs/101pape.pdf>, September 2004.

**Porter-Cologne Water Quality Act**

The Porter-Cologne Water Quality Act (Water Code sections 13000 et seq.) is the basic water quality control law for California. Under this Act, the State Water Resources Control Board (SWRCB) has ultimate control over state water rights and water quality policy. In California, the EPA has delegated authority to issue NPDES permits to the SWRCB. The state is divided into nine regions related to water quality and quantity characteristics. The SWRCB, through its nine Regional Water Quality Control Boards (RWQCBs) carries out the regulation, protection, and administration of water quality in each region. Each regional board is required to adopt a Water Quality Control Plan or Basin Plan that recognizes and reflects the regional differences in existing water quality, the beneficial uses of the region's ground and surface water, and local water quality conditions and problems. The Basin Plan gives direction on the beneficial uses of the state waters, describes the water quality that must be maintained to support such uses, and provides programs, projects, and other actions necessary to achieve the standards established in the Basin Plan.

Approximately 50 percent of the state's timberlands are located in the Sierra, and approximately 45 percent of the statewide harvest of commercial timber occurs in this region. The Lahontan Regional Water Quality Control Board (LRWQCB) and the Central Valley Regional Water Quality Control Board (CVRWQCB) address water quality issues across the Sierra. As of March, 2010 all State Regional Water Quality Control Boards require a waiver for vegetation management, including timber harvesting, prior to implementing projects. The waiver provides assurances for water quality protection while avoiding the more costly and time intensive permitting process. The waiver divides eligibility into six categories; each with different requirements based on the potential for water quality impacts. For example, vegetation condition for defensible space is considered a low threat activity. Projects of this type are in category 1 and often proceed with minimal conditions. Timber harvesting is considered a higher threat to water quality and falls under

categories 5 and 6 and is subject to more conditions to enroll in the waiver. Typical conditions to enroll in the waiver include mitigation measures to prevent erosion and monitoring before, during, and after a treatment. For more information on the water quality control board's waiver program, visit: http://www.swrcb.ca.gov/centralvalley/board_decisions/adopted_orders/waivers/r5-2010-0022.pdf.

**National Flood Insurance Program**

The National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973 mandate the Federal Emergency Management Agency (FEMA) to evaluate flood hazards. FEMA provides Flood Insurance Rate Maps (FIRMs) for local and regional planners to promote sound land use and floodplain development, identifying potential flood areas based on the current conditions. To delineate a FIRM, FEMA conducts engineering studies referred to as Flood Insurance Studies (FISs). Using information gathered in these studies, FEMA engineers and cartographers delineate Special Flood Hazard Areas (SFHAs) on FIRMs. The Flood Disaster Protection Act (FDPA) requires owners of all structures in identified SFHAs to purchase and maintain flood insurance as a condition of receiving federal or federally related financial assistance, such as mortgage loans from federally insured lending institutions. Community members within designated areas are able to participate in the National Flood Insurance Program (NFIP) afforded by FEMA. The NFIP is required to offer federally subsidized flood insurance to property owners in those communities that adopt and enforce floodplain management ordinances that meet minimum criteria established by FEMA.

## *4.7.3 Background on Watershed Condition and Geomorphology*

The following section describes the diversity of California's watersheds and the major ecological processes that could be affected by implementation of the VTP program.

**Watershed Condition**

The major watersheds across California differ distinctly in climate, geology, ecosystems, and land use. What is common among these watersheds is that all of the major rivers that drain them originate in forested or vegetated landscapes. Accordingly, the forested watersheds of California play an important role in providing clean water for a variety of uses (agriculture, domestic water supply, fish and wildlife, recreation, hydropower, etc.). The forest filters and meters the movement of rainfall, and at the higher elevations the forest snow pack acts as a natural reservoir. The rainfall replenishes aquifers and delivers water to streams. Forest and rangeland vegetation and soils are valuable for absorbing snowmelt and rain, storing moisture, cooling and cleansing water, and slowing storm runoff. This vegetation also helps to hold soil and hillslopes in place.

In all watersheds, physical and biological processes combine to create the ecological condition of a watershed and define the services (e.g., beneficial uses) that a watershed can support. The natural variability of these processes in space and time gives rise to a diverse array of environmental conditions across a watershed. In many cases, the relationship between the physical process (hillslope erosion, for example) and the eventual biological response (successful rearing of young salmon, for example) is poorly understood. The high variability combined with a limited understanding of watershed dynamics further complicates land management decisions. However, there are some basic principles that help explain the diversity of conditions that occur across a watershed. Changes in the quantity and quality of water often directly affect the health of the

watershed. Land management activities and land use changes affect soil and water resources. Ignoring these effects can lead to unwanted consequences upslope and downstream.

Watersheds across California are immensely diverse, from the wet coastal watersheds on the North Coast to the arid desert landscapes in portions of southern California (Table 4.7.1). This biophysical diversity creates a broad range of uses supported by California's watersheds and a considerable resource management challenge within each watershed.

**Table 4.7.1**
**California Watershed Variability**

| Region | Size (in million acres) | Major Rivers, Waterbodies | Stream Miles (in 1000s) | Precipitation (in) and Runoff (Million Acre Feet) | Dominant Vegetation (%) | Agriculture/Urban (%) |
|---|---|---|---|---|---|---|
| North Coast Watersheds | 12.4 | Klamath, Eel, Mad, Van Duzen, Trinity, Salmon, Smith, Russian | 22.1 | 55.9, 28.9 | Conifer (57), Hardwood (17), Herbaceous (7), Shrub (11) | Agriculture (5), Urban (1) |
| Sacramento River Basin | 17.4 | American, Pit, Yuba, Sacramento, McCloud, Feather, Cache, Putah, Stony, Clear, Cottonwood | 32.8 | 52.4, 22.4 | Conifer (38), Hardwood (15), Herbaceous (10), Shrub (15) | Agriculture (15), Urban (3) |
| San Joaquin and Tulare Lake | 20.6 | Consumnes, Mokelumne, Stanislaus, San Joaquin, Tuolumne, Merced, Kings, Kaweah, Tule, Kern | 41.1 | 35.7,11.2 | Conifer (20), Hardwood (13), Herbaceous (22), Shrub (6) | Agriculture (29), Urban (4) |
| Eastern Sierra | 21 | Owens, Truckee, Carson, and Walker, Lake Tahoe and Mono Lake | 33 | 15.3,3.2 | Desert (62), Shrub (16), Conifer (10) | Agriculture (2), Urban (2) |
| Central Coast and San Francisco Bay Region | 10.2 | Santa Ynez, Carmel, Pajaro, Salinas, Big Sur, Napa, Sonoma, Petaluma, Walker Creek, Lagunitas Creek, Alameda Creek | 21.8 | 17.8, 3.7 | Hardwood (20), Herbaceous (29), Shrub (24) | Agriculture (8), Urban (11) |
| South Coast and Colorado River watersheds | 19.8 | Colorado, San Diego, Santa Margarita, San Jacinto, Los Angeles, Santa Ana, Mojave | 33.9 | 15.1, 1.4 | Desert (52), Shrub (18) | Agriculture (7), Urban (11) |

Geologic hazards, soils, and vegetative cover contribute to the condition of watersheds and their susceptibility to flooding and water quality. All watersheds have a natural flooding regime related to climatic, topographic, hydrologic, geologic, and soil conditions. Although flooding is the natural process through which stream channels are formed, sediments are redistributed or flushed, and alluvium is deposited in floodplains, it can also pose a threat to human safety and cause severe damage to structures located in the floodplain and to aquatic and riparian habitats.

## Geomorphology

Geomorphology is not an environmental resource like biology or cultural resources. Potential effects on fluvial geomorphic processes are not direct environmental impacts, but geomorphic effects have the potential to lead to other environmental effects through further changes in channel conditions. Changes in vegetative cover associated with VTP projects and the increase or decrease in the amount of high severity fires can in turn influence the delivery of sediment and large woody debris to stream channels; these in turn modify the geomorphic characteristics of a stream. Changes in geomorphology can affect both sediment transport and, through aggrading channel beds, can increase the frequency or severity of flooding.

Fluvial geomorphology is the study of sediment transport by flowing water and its effect on the size and shape of stream channels. When sediment transport is in equilibrium, sediment is neither deposited in the channel, nor removed from it (erosion). Sediment deposition in a channel is an indication that conditions are not in equilibrium with the existing balance of flow, sediment transport and natural channel forming processes so that sediment is deposited in a reach rather than transported downstream. Similarly, erosion and subsequent bank instability occur where the pattern of flow directs excess energy against the channel bottom or sides.

### Fluvial System Zones

A fluvial system can generally be divided into three zones. The upper zone is the watershed where most of the water and sediment for the system originates, and is called the Source Zone. The middle zone is the reach where the stream/creek/river channel is the most stable and where its configuration is the best defined and sediment from the upper zone moves through. This middle zone is called the Transport Zone. The lower zone is near the stream/creek/river mouth, where the alluvial river slope is reduced. This zone is called the Deposition Zone.

### Channel Dynamic Equilibrium

As indicated by these fluvial system zones, stream channels are dynamic. Stream channels generally attempt to evolve toward a state of quasi-equilibrium. That is, the channel adjusts its slope to provide, with the available discharge and the prevailing channel geometry, just the power required to transport the sediment load supplied from the drainage basin.

### Stream Deposited Sediment

The increase in sediment supply following high severity wildfires has been shown to lead to downstream channel aggradation in higher order streams (Benda et al., 2003). The headwaters in the upland watersheds are typically steep and can contain erosive terrain that produces relatively high volumes of sediment. The combination of steep terrain, generally fine grained and deeply weathered bedrock and the occurrence of moderate to extreme rainfall events favor episodic mass wasting or landsliding of hillsides into steep mountain streams, often during major floods.

The mountain and foothill streams emerge onto alluvial fans that straddle the edges of the valleys where rapid reductions in channel slope and increases in flood plain width cause sediment deposition. The alluvial fans merge with alluvial flood plains of larger streams on the valley floor.

The ability of a given stream or flood protection channel to carry sediment is a function of flow, hydraulics, channel slope, sediment sizes and sediment volume. Coarse sediments (boulders and cobbles) are often easily transported in steep, confined mountain streams. Coarse sediments

generally settle immediately below the mouths of upland canyons, foothills, valleys and at the heads of the alluvial fans that straddle the mountains. Foothills (generally older, uplifted alluvial fans) and modern alluvial fans extend into valley streams. Alluvial streams of the valley floor transport sediment through processes of channel bed scour and fill in straighter, steep channels and point bar building and lateral erosion in meandering channels. The dimensions (channel width and depth) and the patterns (straight, meandering or braided) of alluvial streams reflect the sensitive balance between sediment, flow and human induced activities.

## *4.7.4 Setting For Water Resources And Water Quality*

With a state as large as California (over 100 million acres), the climate is immensely diverse so it is important to review regional differences. The intensity, frequency, and duration of precipitation have a great influence on runoff characteristics. The Coastal Mountains, the Sierra Nevada, and the Transverse Ranges of southern California all produce significant orographic effects which alter the distribution of precipitation. The distribution of precipitation exhibits strong latitudinal gradients as well, from the rivers along the far North Coast that drain forested watersheds that receive up to 100 inches of rain, to the Mojave and New Rivers that run through arid deserts that can receive less than two inches annually. Table 4.7.2 provides a summary of the primary rivers by hydrologic regions that are within the project area.

**Table 4.7.2**
**Principal Rivers in Program Area by Region**

| North Coast | Sacramento/ San Joaquin/Tulare Basin | | Central Coast | Lahontan | South Coast |
|---|---|---|---|---|---|
| Upper Klamath | American | McCloud | Big Sur | Susan | Los Angeles |
| Lost | Bear | Merced | Carmel | Truckee | Owens |
| Eel | Calaveras | Mokelumne | Cuyama | Lake Taho | San Diego |
| Klamath | Clavey | Pit | Estrella | Blackwood | San Luis Rey |
| Mad | Cosumnes | Sacramento | Nacimiento | Ward | Santa Ana |
| Napa | Chowchilla | San Joaquin | Pajaro | Mammoth | Santa Clara |
| Russian | Feather | Stanislaus | Salinas | Owens | Santa Margarita |
| Salmon | Fresno | Tule | San Antonio | | Ventura |
| Scott | Kaweah | Tuolumne | San Benito | | |
| Shasta | Kern | Yuba | San Lorenzo | | |
| Smith | Kings | | Sisquoc | | |
| Trinity | | | Santa Ynez | | |
| Van Duzen | | | Sisquoic | | |

Source: California Department of Water Resources, 1994

## *4.7.5 Impaired Waterbodies*

Section 303(d) of the Clean Water Act requires states to identify and develop a list of impaired waterbodies. The waterbodies on the list do not meet water quality standards. The state is required by EPA to prioritize the 303(d) list and to develop a Total Maximum Daily Load (TMDL), followed by an implementation plan, to improve water quality. States are required in even numbered years to review and update the 303(d) list. Further, under section 305(b) the State Water Resources Control Board (SWRCB) must report biannually to the EPA on the status of water quality across the State. Table 4.7.3 provides a summary of impaired waterbodies by source categories for the entire state.

Table 4.7.5 provides a tabular summary for each of the nine regional water boards. A review of these tables shows that the greatest extent of water quality impairments from forest activities is found in the North Coast (Region 1), the Lahontan Region (east side of the Sierra Nevada and Mojave Desert) (Region 6) and the Central Coast (Region 3). For rangeland the water quality impairments are also commonly occurring in the North Coast (Region 1), Lahontan (Region 6) and Central Coast (Region 3), as well as the Central Valley (Region 5). Typical water pollutants associated with forestry and range activities are sediment, water temperature, and nutrients.

**Table 4.7.3**
**Statewide Summary of Impaired Waterbodies Listed by Source Category (SWRCB, 2012)**

| SOURCE CATEGORY | Lakes, Bays, Estuaries, Wetlands (acres) | Streams (miles) |
|---|---|---|
| Agriculture (Total) | 1,343,528 | 67,883 |
| *Agriculture (Non Grazing)* | 984,903 | 45,727 |
| *Agriculture-grazing* | 925 | 2,490 |
| *Grazing-Related Sources* | 349,986 | 5,743 |
| *Pasture Grazing Upland/Riparian* | 5,394 | 3,037 |
| *Range Grazing Upland/Riparian* | 2,320 | 10,886 |
| Atmospheric Deposition | 1,271,815 | 477 |
| Construction/Land Development | 703,324 | 14,045 |
| Groundwater Related | 98,874 | 775 |
| Habitat Modification | 658,128 | 74,166 |
| Hazardous Waste Sites And Storage | 16,075 | |
| Hydromodification | 1,232,998 | 84,348 |
| Industrial Activities (Oil) | | 49 |
| Industrial Wastewater | 738,044 | 5,595 |
| Marinas And Recreational Boating | 135,183 | 12 |
| Miscellaneous | 673,136 | 5,281 |
| Municipal Wastewater | 336,763 | 8,813 |
| Natural Sources | 1,288,535 | 21,520 |
| Other Runoff | 385,677 | 2,878 |
| Recreation Areas And Activities | 393,975 | 425 |
| Resource Extraction | 628,676 | 18,184 |
| Sediment | 279,524 | 42 |
| Silviculture | 297,500 | 41,459 |
| Source Unknown | 1,598,973 | 27,456 |
| Unpermitted Discharges | 163,325 | 360 |
| Unspecified Nonpoint Source | 3,078,227 | 30,516 |
| Unspecified Point Source | 1,129,091 | 3,416 |
| Urban Runoff | 1,658,525 | 8,775 |
| Vessels And Shipping (Non Recreational) | 316,618 | |
| Waste Storage And Disposal | 60,860 | 3,341 |
| **Grand Total** | **18,487,373** | **419,817** |

## *4.7.6 Hydrologic Regions*

The major characteristics of the river systems are discussed below (modified from Mount, 1995; DWR 2005; SWRCB, 2002). Note that the discussion is for Hydrologic Regions or combined groups of Hydrologic Regions and not by Bioregions. There are 10 Hydrologic Regions in California that correspond with major drainage basins within the state (Figure 4.7.1). Watersheds within Hydrologic Regions tend to share similar climatic regimes, geology, and soils. The setting for water quality is also organized around Hydrologic Regions. The discussion of setting for water quality is limited to beneficial uses and specific pollutant loads that may be affected by the VTP program.

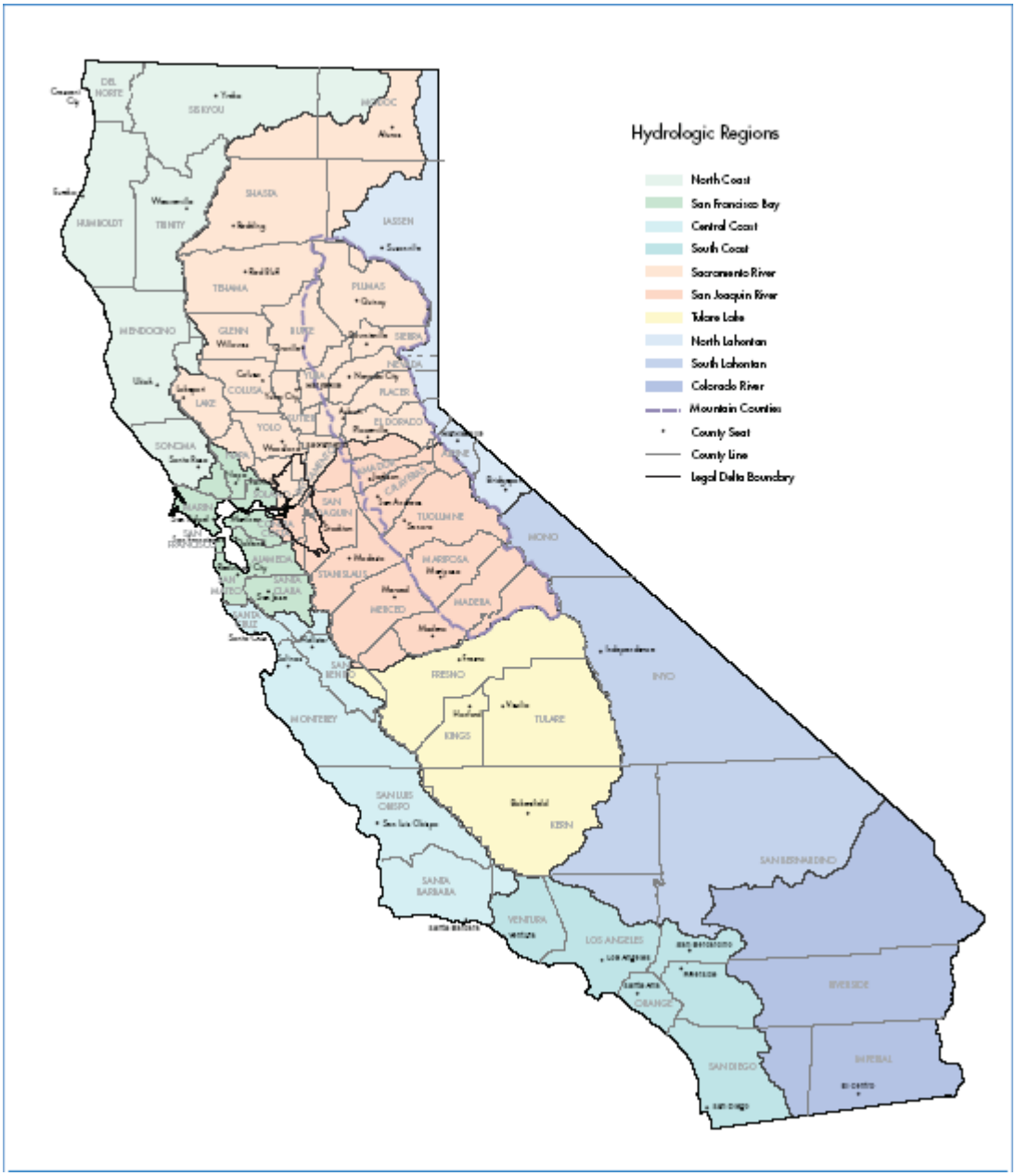


Figure 4.7.1 Hydrologic Regions for California

### *North Coast Hydrologic Region*

The North Coast region extends from the Oregon border south to San Francisco Bay, covering roughly 19,500 square miles. The region is characterized by rugged mountains, cool coastal watersheds, and warmer and more arid inland valleys. This region receives some of the highest precipitation totals and some of the highest intensity rainfall events in the state. With abundant water supply the region produces an estimated 41% of the state's runoff (DWR, 2005). Most precipitation occurs as rainfall and the streams exhibit high peak runoff. The rivers have documented some of the highest sedimentation rates.

#### Known Water Quality Issues

Abundant water supply and a rural landscape dominated by forests and agriculture support a broad range of beneficial uses. Still, nonpoint source pollution (sediment, temperature, and nutrients) are the main pollutants of concern from the NCRWQCB's 303(d) list. Many of these watersheds have steep rugged terrain and highly erodible soils and are subject to high rates of landsliding. Timber harvesting and agricultural practices have improved and still operate in watersheds where land management was historically much more intensive then current practices. As a result, many watersheds are subject to persistent water quality problems. Channel modifications and water diversions can also alter water quality conditions in the region by reducing natural flows, increasing contaminant concentrations, and reducing aquatic habitat. In the southern portion of the region, the development of new hillside vineyards is an increasing source of erosion and pesticides. Many of the water quality issues in North Coast rivers affect aquatic habitat for salmonids and other beneficial uses.

The Klamath and Eel Rivers are the two largest rivers in the North Coast region and both have a number of unresolved water quality issues that are aggravated by non-point source pollution associated with forest practices, agricultural and water diversions to support irrigated agriculture. The Russian River is another primary river along the North Coast. It originates north of Ukiah and flows south, and then west, before entering the Pacific Ocean near Jenner. The entire basin is listed as sediment and temperature impaired, but there are many other water quality impairments (i.e. bacteria, mercury, nutrients, dissolved oxygen).

The North Coast Water Quality Control Board provides detailed information on water quality conditions (http://www.swrcb.ca.gov/northcoast/water_issues/programs/tmdls/russian_river/).

### *San Francisco Bay Hydrologic Region*

Despite being governed by separate Regional Water Quality Boards, the San Francisco Bay and the Delta operate hydraulically as a system. The San Francisco Bay delivers waters of the Sacramento and San Joaquin rivers through the Delta, into the Bay, and into the Pacific Ocean. The San Francisco Bay - Delta is the largest estuary on the West Coast and functions as the only drainage outlet for waters of the Central Valley. The Sacramento River delivers roughly 85% of the freshwater flows to the Bay (DWR, 2005). These regions cover an area of 4,506 square miles and on average receives 25" of precipitation annually, but can also receive intense rainfall from tropical storms.

The tidal influence and the interface between freshwater and saltwater intrusion creates highly dynamic and complex environmental conditions. As a result the Bay's system supports an extraordinarily diverse and productive ecosystem. Salinity levels range from hyper-saline to fresh

water, and water temperature varies throughout the Bay's system. These factors greatly increase the number of species that can live in this estuary and enhance its biological stability.

The Bay system's deepwater channels, tidelands, marshlands, freshwater streams, and rivers provide a wide variety of habitats that have become increasingly vital to the survival of several plant and animal species as other estuaries are reduced in size or lost to development. These areas sustain rich communities of crabs, clams, fishes, birds, and other aquatic life and serve both as important wintering sites for migrating waterfowl and as spawning areas for anadromous fish. Unfortunately, the San Francisco Bay has lost most of the historic tidal wetlands due to bay filling. This is a loss of not only habitat, but the tidal areas also serve as a sponge, filtering sediments and pollutants, as well as accommodating large water flows.

**Known Water Quality Issues**

The San Francisco Bay is a heavily urbanized region and as a result stormwater runoff is considered a primary source of nonpoint source pollution (SWRCB, 2002). The water quality of the Bay is affected both by point and nonpoint sources from the highly urbanized watersheds as well as the delivery of pollutants through the Delta. There are also legacy pollutant such as PCB's and Mercury that are trapped in sediment deposits still present in the Bay's system. Loss of freshwater flows due to water diversions serves as an impairment to properly functioning condition of the San Francisco Bay estuary. Decreased flows have a variety of effects including increased temperatures, change in water column habitat conditions, and lethal salinities.

***Central Coast Hydrologic Region***

These watersheds receive less precipitation than the North Coast, ranging from 14 to 45" annually. The presence of infrequent high intensity storms combined with erosive soils can produce high sedimentation rates in coastal watersheds. Many of the coastal watersheds are characterized as small drainage basins that can exhibit short response times to storm events and correspondingly high peak flows. The Central Coast's rivers generally have a northwest- southeast alignment, reflecting the topographic trend of the region's mountains and hills. The Pajaro, Carmel, and Salinas Rivers drain the northern part of this region, the Estrella River and San Juan Creek are in the central portion, and the Cuyama, Santa Maria, and Santa Ynez Rivers are in the southern portion. All of the rivers within this hydrologic region drain into the Pacific Ocean.

**Known Water Quality Issues**

The Central Coast region has a mixture of agricultural and rangeland with some urbanized coastal areas. The water quality reflects these land use patterns. Water quality concerns are associated with sediment, nutrients, and pesticides from agriculture, ranching, and some timber activities, along with increasing concerns regarding beach water quality from urban stormwater runoff. The Watershed Management Initiative report identifies pollutants of concern in the highest priority watersheds (Table 4.7.4).

**Table 4.7.4**
**Water Quality Concerns for High Priority Watersheds (SWRCB, 2002 WMI report)**

| Targeted Watershed | Pollutants Of Concern | Water Quality Problems |
|---|---|---|
| San Lorenzo River | Nutrients, sedimentation, pathogens | Erosion from roads and timber harvested areas, urban development and runoff. |
| Pajaro River | Sedimentation, heavy metals, nitrates | Erosion from inactive and abandoned mines, urban development and runoff, agricultural activities, hydromodification, gravel mining |
| Salinas River | Seawater intrusion, nitrates and minerals in groundwater, nutrients, pesticides, heavy metals, sedimentation | Overpumping of groundwater, agricultural activities, urban development and runoff, past mineral mining, gravel mining |
| Morro Bay | Sedimentation, pathogens, nutrients, heavy metals | Urban development and runoff, agricultural activities, septic systems |
| San Luis Obispo Creek | Nutrients, sedimentation | Urban development and runoff, agricultural activities, hydromodification |
| Santa Maria River | Sedimentation, nitrates | Erosion from reservoir operation, agricultural activities, urban development and runoff |
| Santa Ynez River | Sedimentation | Erosion from ranching and land development, habitat loss |
| South Coast (Santa Barbara County) | Pathogens | Urban development and runoff, illegal and unsanitary encampments, septic systems |

***Sacramento and San Joaquin Rivers and Tulare Lake Hydrologic Regions***

The Sacramento River drains the northern part of the Central Valley. The Sacramento River's basin covers 27,246 square miles. The principal streams are the Sacramento River and its larger tributaries: the Pit, Feather, Yuba, Bear, and American Rivers to the east; and Cottonwood, Stony, Cache, and Putah Creeks to the west. Major reservoirs and lakes include Shasta, Oroville, Folsom, Clear Lake, and Lake Berryessa. The Sacramento River basin supplies more than 80% of the fresh water flows to the Sacramento-San Joaquin Delta (DWR, 2005).

The San Joaquin River originates in the high Sierra and drains into the Delta. The San Joaquin River is roughly 300 miles long and the watershed covers 32,000 square miles. This region has highly variable precipitation from very low amounts of rainfall on the valley floor (10 to 20 inches) to substantial snow accumulations in the high Sierra. The Sacramento and San Joaquin Rivers drain the Central Valley. Contrasting with North Coast watersheds the granitic watersheds in the Sierra Mountains generally have low sedimentation rates. A much higher percentage of precipitation occurs as snowfall. As such there is a much greater lag time in runoff. With warming conditions all major rivers experience spring runoff and can be subject to flooding.

The Tulare Lake Basin is a closed basin bounded on the east by the southern Sierra Nevada, on the south by the Tehachipi and San Emegdio Mountains, and on the west by the Coast Ranges. The basin extends north toward the San Joaquin River. The central portion of the basin was historically filled with shallow lakes and associated marshes. During wet years the lakes would fill and spill northward into the San Joaquin River and then ultimately to the Delta. This area has roughly the same precipitation regime as the San Joaquin region.

The Sierra Nevada and Tehachapi mountain ranges that bound the east and southeastern extent of the basin are composed of crystalline granitics with relatively low sedimentation rates. The west and southwestern boundaries of the basin, are bounded by the Coastal Ranges and San Emigdeo Ranges, both composed of sedimentary marine layers and prone to higher erosion rates. Due to diversions, the primary source of water in the Tulare Lake Basin is a confined aquifer. Thus, in this basin, groundwater issues are of primary concern.

**Known Water Quality Issues**

The Sacramento Hydrologic Region covers the Northern Sacramento Valley and the headwaters extend up into the Sierras. The Watershed Management Initiative report from the Central Valley Water Quality Control Board identifies the following pollutants of concern:

- Agricultural Surface Water Discharges – Widespread impairments resulting from elevated pesticide concentrations, increased nutrients, and selenium, from agricultural runoff.
- Stormwater Discharges – Many of the cities in the Central Valley are increasing in population.
- Nitrates in groundwater – Elevated levels of nitrates and salts that are derived principally from irrigated agriculture and dairies.
- Mercury from past mining activities.
- Sediment and Erosion – Much less of a concern than in the North Coast, but has the potential to be accelerated by timber harvesting, land use conversion, rural development, and grazing.

Although forest and rangeland activities are potential pollution sources, the extent or contribution has not been extensively studied. Pollution from agriculture and legacy pollutants from past mining activities has been a primary focus of concern.

***Eastside Sierra (North and South Lahontan) Hydrologic Region***

The eastside of the Sierras is represented by both the North and South Lahontan Hydrologic Regions. Many of the watersheds in this region reside within the rain shadow of the westside of the Sierras and experience low to moderate precipitation. The headwaters of most of these watersheds originate in the high Sierra and have significant snowpacks. Runoff is dominated by spring snowmelt. The North Lahontan covers an area of 270 square miles from the Oregon border to the Walker River. The region is primarily Alpine, high desert with broad valleys. Elevations run from 4,000 to 5,000 feet in the valley and can exceed 10,000 feet in the mountains. The principal rivers include the Truckee, Carson, and Walker Rivers. Precipitation is highly variable ranging from less

than five inches in the valleys of eastern Modoc to more than 60 inches in the higher elevations of the Truckee, Carson, and Walker Rivers. Summers are mostly dry and winter precipitation is associated with significant snowfall accumulation. A significant feature of the North Lahontan is Lake Tahoe, a freshwater alpine lake with over 122 million acre feet of water. The South Lahontan extends from the high mountains of the eastern Sierra and Mono Lake to the north through the Owens River watershed and through Death Valley and the Mojave Desert to the south, covering an area of 26,732 square miles. The climate is mostly arid with an average annual precipitation of 7.8 inches. Due to much lower precipitation totals than found in the North Lahontan, there are fewer permanent rivers or streams. The Owens River is the largest river in the region. Running North to South the river drains the eastside of the Sierras and originally flowed into Owens Lake. Since 1913, a majority of the flow has been diverted to Los Angeles for urban water supply. The Mojave River is the other primary river in the region. Although it does not maintain regular surface flow it provides an important contribution to groundwater in the Mojave River basin.

**Known Water Quality Issues**

Most of the water in this region originates from high elevation headwater streams and is derived from snowmelt, and is assumed to be of good quality (Lahontan Regional Water Quality Control Board, 2002). Conversely, many of the waterbodies in the desert regions are considered to have naturally poor water quality from high concentrations of salts and minerals. Most water quality problems in this region are related to nonpoint sources. In the Lake Tahoe Basin accelerated erosion from development has become a water quality issue. The Lake Tahoe Basin is considered sensitive to sediment and nutrient accumulations and its effects on turbidity. Atmospheric deposition has recently been identified as a pollutant source that potentially affects both water clarity and nutrient loadings in Lake Tahoe (SWRCB, 2007). This may well be an issue for many high elevation lakes in the Sierra. Older, overstocked forests in the Lake Tahoe Basin are also susceptible to wildfire, which contribute sediment to the lake as well as atmospheric deposition of ash.

***South Coast Hydrologic Region***

The South Coast region extends from Ventura to San Diego counties and covers 110,925 square miles. Many of the coastal watersheds are heavily urbanized with a total population for the region that exceeds 18 million. There are many prominent rivers in this region including: Ventura, Santa Clara, Los Angeles, San Gabriel, Santa Ana, San Jacinto, Santa Margarita, and San Luis Rey Rivers. Many of these rivers flow through densely populated cities and have been lined or modified to provide flood control.

This region has high variability in terms of precipitation. Watersheds can experience several consecutive dry years broken up by occasional wet years. Warm winter and spring storms can also produce very high rainfall intensities. South Coast watersheds can exhibit high rates of landsliding and abundant wildfires. In rural watersheds this can lead to high sediment yields. The South Coast region also has the greatest population and many of the watersheds are predominately urbanized.

**Known Water Quality Issues**

Water quality issues in the South Coast watersheds are typically associated with urban development and stormwater runoff. Stormwater runoff delivers a host of contaminants to streams and also degrades coastal water quality. This results in health risks to recreationists along beaches

and coastal waters. The coastal waters in major bays receive excess nutrients that can lead to algal blooms.

The Santa Ana watershed provides a well-known example of the water quality issues in this region that are related to wildfires. Prolonged drought and high fuel accumulation, associated with Pine Beetle infestation, lead to a series of destructive fires in 2003 that burned over 120,000 acres (SAWPA, 2004). This has resulted in increased sedimentation and nutrient loadings that affect both water quality and water supply.

***Colorado River Basin Hydrologic Region***

The watersheds in this hydrologic region have a desert climate and receive the lowest annual precipitation totals (average annual precipitation 5.5 inches), and infrequent but occasional wet years and occasional storms with high rainfall intensity. Due to the dry arid climate many of the streams and rivers are ephemeral. The Colorado River runs along the south eastern boundary of the hydrologic region.

**Known Water Quality Issues**

The Salton Sea is the primary focus of water quality issues within this hydrologic region. Water quality concerns stem from agricultural runoff which has led to increased levels of nutrients, higher salinity, presence of pesticides and selenium. The Salton Sea receives surface water from the New and Alamo Rivers and the Imperial Valley agricultural drainage. The New River, originating in Mexicali, Mexico, is a highly polluted river (i.e. urban runoff and partially treated municipal waste) that worsens water quality within the region.

**Table 4.7.5**
**Impaired Waterbodies (Streams – units in miles). Note grazing, shown in italics, is a subset of agriculture. (SWRCB, 2010)**

| SOURCE CATEGORY | Region 1 | Region 2 | Region 3 | Region 4 | Region 5 | Region 6 | Region 7 | Region 8 | Region 9 |
|---|---|---|---|---|---|---|---|---|---|
| Agriculture | 48,912 | 97 | 10,424 | 630 | 4,702 | 315 | 2,639 | 69 | 137 |
| *Agriculture-grazing* | *2,092* | | | | *398* | | | | |
| *Pasture Grazing-Upland/Riparian* | *2,538* | - | *386* | - | *6* | *108* | - | - | - |
| *Range Grazing-Upland/Riparian* | *10,736* | - | *33* | - | - | *117* | - | - | - |
| Atmospheric Deposition | | 1 | | 345 | | 124 | | | 7 |
| Construction/Land Development | 13,112 | 379 | 405 | | 18 | 122 | | 8 | 1 |
| Groundwater Related | | | 185 | 584 | | | | 6 | |
| Habitat Modification | 72,976 | 189 | 662 | 12 | | 308 | | 6 | 12 |
| Hazardous Waste Sites And Storage | | | 0 | | | | | | |
| Hydromodification | 83,334 | 80 | 426 | 26 | 133 | 284 | | 6 | 59 |
| Industrial Activities (Oil) | | | 49 | | | | | | |
| Industrial Wastewater | 5,472 | | 75 | | 16 | | | | 32 |
| Marinas And Recreational Boating | | | 12 | | | | | | |
| Miscellaneous | 4,612 | | 332 | 67 | 9 | | 255 | | 6 |
| Municipal Wastewater | 7,491 | 1 | 710 | 368 | 6 | | 198 | | 40 |
| Natural Sources | 17,127 | | 3,496 | 69 | 55 | 442 | | | 333 |
| Other Runoff | 2,685 | | 67 | | | 117 | | | 10 |
| Recreation Areas And Activities | | | 108 | 91 | 12 | 185 | | 9 | 19 |
| Resource Extraction | 15,627 | 65 | 813 | | 1,485 | 174 | | | 19 |
| Sediment | 19 | | | | | | | | 23 |
| Silviculture | 41,186 | | 105 | | 9 | 160 | | | |
| Source Unknown | 7,658 | 105 | 2,471 | 1,185 | 5,031 | 282 | 9,157 | 231 | 956 |
| Unpermitted Discharges | | 246 | 99 | | | | | | 16 |
| Unspecified Nonpoint Source | 26,282 | 80 | 653 | 1,870 | 11 | 172 | | 163 | 1,419 |
| Unspecified Point Source | 1,384 | | 83 | 802 | | 20 | 66 | | 1,073 |
| Urban Runoff | 999 | 1,134 | 4,261 | 538 | 332 | 102 | | 58 | 1,361 |
| Waste Storage And Disposal | 2,778 | | 391 | 90 | 2 | 46 | | | 34 |
| **Grand Total** | **351,654** | **2,377** | **25,827** | **6,679** | **11,818** | **2,852** | **12,316** | **556** | **5,557** |

Notes: Source categories are based on staff assessments and not considered definitive. In many cases water pollution stems from multiple source categories.

**Table 4.7.6**
**Impaired Waterbodies (Lakes, Bays, Estuaries… – units in acres). Note grazing, shown in italics, is a subset of agriculture. (SWRCB, 2010)**

| SOURCE CATEGORY | Region 1 | Region 2 | Region 3 | Region 4 | Region 5 | Region 6 | Region 7 | Region 8 | Region 9 |
|---|---|---|---|---|---|---|---|---|---|
| Agriculture | 2,446 | 17,091 | 32,226 | 2,805 | 303,132 | 511,537 | 466,680 | 2,073 | 5,585 |
| *Agriculture-grazing* | | | | | | | | | *925* |
| *Grazing-Related Sources* | | | *4,573* | | *40,070* | *305,343* | | | |
| *Pasture Grazing-Riparian and/or Upland* | | | *1* | | | *5,393* | | | |
| *Range Grazing-Upland/Riparian* | *398* | - | *1,922* | - | - | - | - | - | - |
| Atmospheric Deposition | 17,399 | 950,637 | | 1,050 | | 302,729 | | | |
| Construction/Land Development | | | 2,046 | | | 694,896 | | 6,383 | |
| Groundwater Related | | 9,204 | 608 | 653 | 3,045 | 85,364 | | | |
| Habitat Modification | 4,144 | | 2,476 | | 40,070 | 610,785 | | 653 | |
| Hazardous Waste Sites And Storage | 16,075 | | | | | | | | |
| Hydromodification | 5,945 | 273,903 | 6,036 | 136 | | 942,095 | | 653 | 4,230 |
| Industrial Wastewater | 16,075 | 458,296 | | | | 30,211 | 233,340 | | 122 |
| Marinas And Recreational Boating | | 2,439 | 505 | | | 132,001 | | | 239 |
| Miscellaneous | | 206,455 | 1 | | | | 466,680 | | |
| Municipal Wastewater | | 291,597 | 19 | 653 | 1,603 | 41,572 | | | 1,319 |
| Natural Sources | 48,219 | 481,336 | 12,310 | 4,125 | | 739,433 | | | 3,112 |
| Other Runoff | | | | 180 | | 385,479 | | | 18 |
| Recreation Areas And Activities | | | | 1,414 | 1,603 | 388,093 | | 2,865 | |
| Resource Extraction | 23,453 | 326,136 | 14,096 | | 262,125 | | | 2,865 | |
| Sediment | | | 2,034 | | 1,603 | 275,120 | | 767 | |
| Silviculture | | | | | | 297,500 | | | |
| Source Unknown | 52,208 | 16,796 | 40,386 | 28,394 | 185,106 | 82,298 | 1,166,742 | 23,150 | 30,726 |
| Unpermitted Discharges | | 163,266 | | 59 | | | | | |
| Unspecified Nonpoint Source | 33,251 | 1,804,425 | 6,660 | 803,670 | | 390,337 | | 9,468 | 30,417 |
| Unspecified Point Source | | 94,049 | | 779,133 | | | 233,340 | | 22,569 |
| Urban Runoff | | 432,863 | 7,514 | 2,141 | 130,504 | 1,071,006 | | 874 | 13,624 |
| Vessels And Shipping (Non Recreational) | | 316,618 | | | | | | | |
| Waste Storage And Disposal | | 10,984 | 2,518 | 703 | | 46,636 | | | 18 |
| **Grand Total** | **219,214** | **5,856,095** | **129,432** | **1,625,115** | **928,792** | **7,027,090** | **2,566,782** | **49,750** | **111,981** |

Notes: Source categories are based on staff assessments and not considered definitive. In many cases water pollution stems from multiple source categories.