Kennedy/Jenks Consultants

10850 Gold Center Drive, Suite 350
Rancho Cordova, California 95670
916-858-2700
FAX: 916-858-2754

DRAFT Tuolumne-Stanislaus Integrated Regional Water Management Plan

SECTION 2 – REGION DESCRIPTION

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Prepared for

Tuolumne Utilities District
18885 Nugget Boulevard
Sonora, California 95370

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Section 2: Region Description

2.1 Introduction

This section describes the Tuolumne-Stanislaus Region (T-S Region, Region). This section is intended to portray the Region's vast water resources and its linkage to the geographical and socioeconomic makeup. Each subsection has been developed to address the IRWM Plan Requirements of Proposition 84 for the Region Description standard. The following description covers topics ranging from depictions of physical and climatological features, summary of water resources and demand projections, groundwater and surface water quality, ecological and environmental resources, and climate change considerations.

2.2 Region Overview

The T-S Region includes the Upper Tuolumne River, Upper Stanislaus River, and Upper Rock Creek-French Camp Slough watersheds. The Region boundaries, topography and key features are shown on Figure 2-1, with the watershed boundaries depicted on Figure 2-2. The Region land base varies significantly in topography, spanning the entire western slope of the Sierra Nevadas, rising from the lower Sierra foothills to the crest of the Sierra Nevada (a range of about 1,000 to 13,000 feet in elevation). The North Fork and mainstem Stanislaus River drainages delineate the northern boundary of the Upper Stanislaus River watershed, which also defines the boundary between Tuolumne and Calaveras counties. A series of ridgelines to the south delineate the drainage divide between the Upper Tuolumne River watershed and the Merced River watershed. The Rock Creek subwatershed catchment delineates the northern boundary of the Rock Creek-French Camp Slough Watershed.

The Region is a sparsely populated area, consisting of communities situated in the foothills including Sonora, Angels Camp, Murphys, Groveland, and surrounding towns. Nearly all of the population of approximately 70,000 within the Region is in the Sierra foothill communities along the corridors of State Highways 4, 108 and 120 which are the Ebbetts, Sonora and Tioga Pass roads respectively. Upslope of these more developed communities are areas dominated by largely undeveloped forested lands.

The Stanislaus National Forest and Yosemite National Park occupy about two-thirds of the land area within the T-S Region. The total area of the T-S Region covers approximately 2,700 square miles (1,735,421 acres) as shown in Table 2-1 and encompasses all of Tuolumne County, the southern portion of Calaveras County, and southwestern Alpine County.

Table 2-1: T-S Region Boundary Areas

Land Category	Acres	Square Miles
Tuolumne County	1,459,110	2,280
Calaveras County	191,540	300
Alpine County	84,771	132
Total Area within Region Boundary	**1,735,421**	**2,712**

Figure 2-1: Region Boundary

Figure 2-2: Major Watersheds

2.2.1 History of Water Development

The waters of the Stanislaus and Tuolumne rivers are relied upon as critical supplies for invaluable river ecosystems, millions of people, hundreds of thousands of acres of prime farmland, and hydroelectric resources that are used throughout California. The history of the Region and development of specific linkages between the abundant water resources of the upper watersheds of the T-S Region to the downstream water users in the Bay Area, San Joaquin Valley, and southern California is described throughout this IRWM Plan.

Understanding the historical influences on water supply development and use in the Region provides essential context for the complex relationships that surround water management and the way these relationships have affected the water resources landscape over time. Historical understanding also provides a common foundation for addressing the Region's challenges and opportunities in the IRWM Plan.

2.2.1.1 Early History

The earliest known inhabitants within the T-S Region are Native Americans, thought to have first inhabited the area roughly 12,000 years ago. The Region was most recently inhabited by the Central Sierra Me-Wuk Indians. The Me-Wuk Indians had several villages throughout the lower foothills of the Region, located on ridges near small creeks and springs to use the associated resources such as willows for basket making and fish for consumption.

2.2.1.2 19th Century

Before the discovery of gold, few westerners settled within the Region. The discovery of gold in 1848 and the resulting influx of prospectors into California dramatically changed the makeup of the Region. Hillsides soon became pockmarked from mining operations. Channels and tunnels were cut to divert water so that streambeds could be mined. Invasive mining techniques were used such as dredging and re-routing waterways as well as the use of toxic chemicals such as mercury and cyanide. Mining in the Sierra Nevada was intimately connected to the development of lumber and water resources and promoted the development of camps and towns, such as Jamestown, Sonora, and Jacksonville, to supply the needs of miners and loggers. Water was necessary for gold production, and in later times it provided power for mining activities. Lumber was required to carry water in flumes, to support excavations, to provide fuel for steam engines and pumps, and to support tunnels. Lumber was also needed for housing and business structures. In addition, agriculture and livestock became a growing industry between the late 1800s to early 1900s, to support the growing population. Growth of logging and agriculture industries within the Region led to the development of an extensive roadway and rail system, much of which exists today and forms the base of the expanded road network.

2.2.1.3 Development of Water Supply Infrastructure

Rapid growth in mining activities during the mid 1800s created a need for reliable sources of water throughout the Region. Except during the rainy season and spring, the diggings were often dry, with too little water available to separate gold from the gravels. By 1850, the horde of miners who had poured into the area began to look for additional sources to provide a year-round supply of water. Potential sources were the creeks and rivers higher in the foothills, principally the watersheds of the South and Middle forks of the Stanislaus River and the North Fork Tuolumne River and their tributaries. Most other major drainages had ditches or small dams as well, and were often dammed later in the 19th century for hydropower generation.

Soon, there was an intricate set of ditches and flumes throughout the Region. Flumes were constructed of wood to divert water from streambeds, requiring the cutting of adjoining forests. This water was used and reused farther downstream.

During this period, much of the water infrastructure was poorly built and maintained. Flumes often leaked or collapsed, creating erosion gullies. Water storage dams burst, generating great surges of water that pushed mud, stones, and trees before the flood.

With the general exodus from the county after the gold was exhausted, many of the ditches throughout the Region were abandoned for a period. Over the ensuing years, the use of these ditches shifted from placer mining to hard-rock mining, on to agriculture, and, finally, to domestic use and hydropower, thus reflecting the changing economic pattern of not only Tuolumne County, but the entire foothill region.

2.2.1.4 20th Century and Development of Water Systems

As need for water in other areas within the State grew during the early 1900s, many agencies from outside the Region secured water rights along the Tuolumne and Stanislaus Rivers. These agencies include Pacific Gas and Electric Company (PG&E), San Francisco Public Utilities Commission (SFPUC), Modesto Irrigation District (MID), South San Joaquin Irrigation District (SSJID), Oakdale Irrigation District (OID) and Turlock Irrigation District (TID). Many of these agencies built and/or own the dams and hydroelectric facilities along the Tuolumne and Stanislaus Rivers and their tributaries. Below is a brief summary of the history of some of the major facilities that were constructed within the Region. Each of the facilities listed below are still operational today (although ownership of some facilities has changed).

- PG&E Hydropower Facilities: Spring Gap-Stanislaus Hydroelectric Project: Spring Gap Dam was built to form Pinecrest Lake (also known as Strawberry Reservoir) in 1914. The impoundment was built to provide water through a series of ditches and flumes to the lower elevation communities such as Columbia and to generate power through the Spring Gap powerhouse. In 1923, PG&E purchased the Spring Gap dam and currently operates the 18,310 AF Pinecrest Lake under Federal Energy Regulatory Commission (FERC) license 2130. Most of the Spring Gap-Stanislaus Project is located within the Stanislaus National Forest (SNF) and project operations must also be consistent with the SNF's Land Resource Management Plan. In addition, Tuolumne Utilities District (TUD) has a contract whereby PG&E provides 95% of TUD's water supply, delivered through the ditches and flumes, many of which were constructed in the early 1900s. See Figure 2-1.

- Hetch Hetchy Project: In the late 1800s, the City of San Francisco decided to develop its own water supply system which culminated in the planning, financing, and construction of the Hetch Hetchy Project, along the Upper Tuolumne River, with construction beginning in 1914. A series of tunnels and aqueducts were built that span from Hetch Hetchy Reservoir to San Francisco (SFPUC, 2010). The Hetch Hetchy Project includes three reservoirs, associated hydroelectric facilities, and a major diversion to the Hetch Hetchy tunnel and aqueduct system which transports water over 150 miles across the Central Valley to the San Francisco Bay Area for municipal use. Water transferred from the 360,000 acre-feet (AF) Hetch Hetchy Reservoir provides an average of 220 million gallons per day (246,000 acre-feet per year (AFY)) to more than 2.4 million people in the San Francisco Bay Area. See Figure 2-1.

- New Don Pedro Reservoir: As irrigation became a growing industry in the San Joaquin Valley, agencies realized the need for additional water sources. TID and MID secured water rights on the Tuolumne River in the early 1900's and built the original Don Pedro Dam in 1923. A larger Don Pedro was completed in 1971 creating what is known today as the New Don Pedro Reservoir. Water passes through a powerplant at the dam and then down the Tuolumne River to La Grange Dam, 2.5 miles downstream, where it is diverted into the Turlock and Modesto Canals for irrigation. See Figure 2-1.

- Tri-Dam and New Melones Lake: In 1910 the OID and the neighboring SSJID purchased Stanislaus River water rights and some existing conveyance facilities from previous water companies. The districts continued to expand their facilities and infrastructure over the next several decades. Since their creation, OID and SSJID have constructed dams and reservoirs to regulate surface water storage and deliveries. Most dams were constructed in the 1910s and 1920s, including Goodwin Dam (1913), Rodden Dam (1915), and Melones Dam (1926). Sites were approved in 1948 for the Tri-Dam Project which included Donnells Dam and Beardsley Dam on the Middle Fork Stanislaus River, and Tulloch Dam above Goodwin. In the 1970s, the United States Bureau of Reclamation (Reclamation) replaced the Melones Dam with the larger New Melones Dam and Reservoir, which is part of the Federal Central Valley Project. See Figure 2-1.

2.3 Social and Cultural Makeup

The story of the Region's development earlier in this section hints at the broad range of social and cultural values that characterize the Region. Although there is not a large population within the Region, much of the community areas that do exist are considered disadvantaged communities.

2.3.1 Population

The estimated permanent residential population of the T-S Region is 70,200 (2010 U.S. Census Data). Regional population growth was estimated through 2035, as provided in Table 2-2. The growth rates used in the projections were based on historical growth rates presented in the Calaveras County General Plan Housing Element Update (2010) for Calaveras County (period from 2000-2009). Because the Tuolumne County General Plan is currently being updated, TUD's projections presented in the 2010 UWMP were used for Tuolumne County. Because the portion of Alpine County that is a part of the T-S Region is a small, relatively isolated part of the county, it was assumed that population projections for Tuolumne County more closely represented this portion of Alpine County; therefore, the same growth rates assumed for Tuolumne County were also assumed for Alpine County.

As stated above, the population estimates in Table 2-2 represents the permanent residential population. There are multiple reasons why community-specific and seasonal populations vary considerably across the Region. A significant percentage of the community lives outside the Region for much of the year and maintains a second home or part-time residence within the Region. For this reason, the actual population within the Region can fluctuate widely between seasons, with notable peaks occurring during the summer months. Large residential development proposals in recent years in certain areas within Calaveras County, and to a lesser extent Tuolumne County, could also significantly affect population growth patterns within the T-S Region. The areas with the greatest projected growth within the Region are the areas of

Copper Cove/Copperopolis area, located in the southern portion of Calaveras County, and Sonora in Tuolumne County.

Modern historical population growth rates in Tuolumne County were the highest in the 1970s and 1980s with an average annual 6% growth rate. Similarly, Calaveras County, as a whole, had a high of approximately 5% annual population increases in the 1980s. Recent growth trends and current projections for the entire T-S Region are much lower and are in the range of 1-2% annual population growth. Low growth rates in the T-S Region are due to a number of factors including higher than average unemployment rates, low median household income, and lack of affordable housing. Additionally, infrastructure to support growth within the Region is limited, and when combined with development fees and requirements, land values and permit processing, make providing affordable housing for growth for new residents challenging. (Tuolumne County General Plan, Appendix)

Table 2-2: Population Projections

Area within T-S Region	2010[3]	2015	2020	2025	2030	2035
Portion of Alpine County[1]	120	127	134	141	149	157
Portion of Calaveras County[2]	14,704	15,685	16,731	17,847	19,038	20,308
Tuolumne County[1]	55,365	58,420	61,644	65,045	68,634	72,421
Total	70,189	74,232	78,508	83,033	87,821	92,886

1. County-wide projections based upon TUD 2010 UWMP, non-acquisition growth rate, estimated for period 2010-2035.
2. Calaveras County General Plan Housing Element Update (2010), average of period 2000-2009.
3. 2010 U.S. Census Data.

2.3.2 Socioeconomic Conditions

The T-S Region's socioeconomic conditions have greatly changed since its early development in the 1850s. Prior to western industrialization, mining, and agricultural, the area was sparsely populated, primarily by Native Americans residing in the foothills. In 1848, the discovery of gold brought a new economic boom to the area, which led to the creation of many of the small towns in the Region that are still in existence today. After World War II, gold mining was largely abandoned and industries such as lumber, mining of other minerals, and agriculture, originally support industries, became the key industries. Today, the economy is continuing to evolve from the historic industries of agriculture, mining and timber, to a more service-based economy. This trend is expected to continue into the future. (Tuolumne County General Plan, Housing Element)

The median 2010 household income in Tuolumne County is $47,462, $54,971 in Calaveras County, and $63,478 in Alpine County (see Table 2-3 below). The unemployment rate within the Region has been generally higher than the average unemployment rate within California. According to the California Employment Development Department, Tuolumne County reported unemployment to be 12.8% in December 2011. The unemployment rate in Calaveras County is even higher at 14.1%. These rates have increased from around 6% since 2000, following trends in the State and national economy. In recent years, the closure of lumber mills, tourist-oriented businesses, and other commercial and industrial-based enterprises in the Region have prompted a continued and sustained decline in prosperity. Table 2-3 provides a summary of demographic data including age, gender, race and income for the counties of Calaveras, Tuolumne, and Alpine based on 2010 5-year data from the American Community Survey.

Table 2-3: Demographic Data

	Calaveras County	Tuolumne County	Alpine County
Age			
Under 5 years	4.1%	4.3%	9.4%
5 to 9 years	4.8%	4.7%	8.0%
10 to 14 years	6.6%	5.2%	3.3%
15 to 19 years	6.4%	5.9%	9.3%
20 to 24 years	4.4%	5.6%	6.2%
25 to 34 years	7.6%	10.8%	3.9%
35 to 44 years	10.8%	11.7%	16.2%
45 to 54 years	17.6%	16.2%	21.9%
55 to 59 years	8.5%	8.9%	7.5%
60 to 64 years	9.1%	7.3%	4.4%
65 to 74 years	11.8%	10.4%	6.8%
75 to 84 years	5.5%	6.4%	2.7%
85 years and over	2.7%	2.4%	0.3%
Gender			
Male	50.0%	53.1%	56.6%
Female	50.0%	46.9%	43.4%
Income			
Less than $10,000	4.7%	4.7%	4.1%
$10,000 to $14,999	5.4%	6.7%	2.7%
$15,000 to $24,999	10.4%	13.4%	7.3%
$25,000 to $34,999	9.6%	11.5%	14.4%
$35,000 to $49,999	15.1%	15.5%	13.7%
$50,000 to $74,999	18.5%	19.1%	21.2%
$75,000 to $99,999	13.6%	11.4%	10.0%
$100,000 to $149,999	15.7%	11.4%	15.1%
$150,000 to $199,999	4.4%	3.0%	7.6%
$200,000 or more	2.6%	3.2%	3.9%
Median household income (dollars)	54,971	47,462	63,478

Source: 2006-2010 American Community Survey

2.3.3 Disadvantaged Communities

Disadvantaged Communities (DACs), as defined by both Propositions 50 and 84, are communities whose average Median Household Income (MHI) is less than 80 percent of the statewide annual MHI. Severely disadvantaged communities are defined as communities whose average MHI is less than 60 percent of the statewide annual MHI. In 2010, 80 percent of the state of California's MHI was $48,706, with a statewide MHI of $60,883. A number of communities within the T-S Region have been identified as DACs. Figure 2-3 shows the areas based on Census Blocks within the T-S Region that are considered a DAC based on the 2006-2010 5-year data from the American Community Survey. The communities that are considered to be DAC include the Angels Camp, Arnold, Murphys, Twain Harte as well as portions of Sonora, and Groveland and unincorporated county areas.

Figure 2-3: Disadvantaged Communities

2.3.4 Native American Tribes

The earliest recorded history of the Region begins with Native Americans. Research suggests that people have inhabited the Sierra Nevada region for roughly 12,000 years, with the most recent Native American occupants being the Central Sierra Me-Wuk. Due to the severe weather in the upper Sierras, the Me-Wuk tribes historically lived in the lower foothills of the Sierra Nevada's. Most of their villages were located on ridges or terraces above streams. Movement of westerners to Tuolumne County, during the gold rush, greatly impacted the lives of the Me-Wuk tribes. Disease, disturbance of hunting and fishing grounds, and skirmishes with the Westerners led to a large decrease in population by the early 1900s.

The T-S Region is home to two federally recognized Me-Wuk tribes, the Tuolumne Band and the Chicken Ranch Band. Protection of sacred lands, waters, and natural resources (i.e., native plants, birds, animals, and medicines of the land) continue to be a priority for these tribes. Water is seen as sacred and goes beyond just quantification. Water is seen as a cycle of life, from the ocean to the top of the mountain snows, and natural filtration of streams and rivers. Water stewardship is important in managing headwaters, mountain meadows, watersheds, and major rivers. Among many of the current Tribal concerns relating to water include restoration of meadows that have dried and are no longer available for gathering and have become inundated with invasive species such as star thistle.

In 1910, Congress purchased 290 acres to establish the Tuolumne Rancheria, also known as the Cherokee Rancheria, located within Tuolumne County for the tribe that is now known as the Tuolumne Band of Me-Wuk Indians. Today, there are over 1,700 acres, with approximately 200 residents living on the Rancheria, and an additional 200 non-resident members of the Tuolumne Tribe. The Tribe has its own governing body and is a federally recognized Indian tribe. Today, the Tuolumne Tribe continues to maintain their cultural history through events such as the annual Acorn Festival and Indian Market. Additionally, creation of local groups and projects such as the cultural and historic preservation committee and the native language preservation project help maintain the Me-Wuk culture into the future.

A second Rancheria, named Chicken Rancheria, located near Jamestown, was established within the Region for the Me-Wuk tribe now known as the Chicken Ranch Band of Me-Wuk Indians. The tribal areas within the Region are shown on Figure 2-4.

2.3.5 Water-Dependent Recreation

The Stanislaus River, Tuolumne River and their associated reservoirs and lakes provide extensive opportunities for water-dependent recreation. Fishing, boating, rafting, and kayaking are among many water-based activities that are popular in the Region. Some of the popular recreation reservoirs include New Melones Lake, Don Pedro Reservoir, and Pinecrest Lake.

Snowmelt from Mount Lyell forms the headwaters of the Tuolumne. The headwaters of the Tuolumne River begin at 13,000 feet in Yosemite National Park in the Sierra Nevada mountains. As the river increases in flow, it carves out canyons that provide 27 miles of world-class whitewater for rafters and kayakers.

Figure 2-4: Native American Tribes

2.4 Climate

The T-S Region dramatic elevation differences from the crest of the Sierras to the low elevation foothills creates a wide range of temperatures, precipitation, and snowfall. The lower elevation Sierra Nevada foothill areas experience hot, dry summers with little to no precipitation and mild, wet winters with moderate to heavy precipitation. The higher elevations, generally above 5,000 feet, typically experience long and severe winters, accompanied by heavy snowfall. In the foothill region, total annual rainfall averages range from approximately 32 inches (in.) in the lower foothills to 55 inches in the upper foothills, with little to no snowfall in the lower foothills and minimal snow pack in the upper foothills.

The higher elevation, mountainous terrain of the Sierras receives large amounts of snow fall, which during periods of snowmelt provides significant seasonal runoff of stored water that feeds the watersheds streams and rivers throughout the spring and early summer. For example, an upper Sierra snow monitoring station (Gaylor Meadow) at elevation 9,200 feet has experienced an average maximum snow accumulation of 82 inches between 2007 and 2011. Snow depths throughout the Sierras vary widely due to terrain composition, vegetation, and elevation changes. An example of monthly snow depth variation within the T-S Region is shown in Figure 2-5.

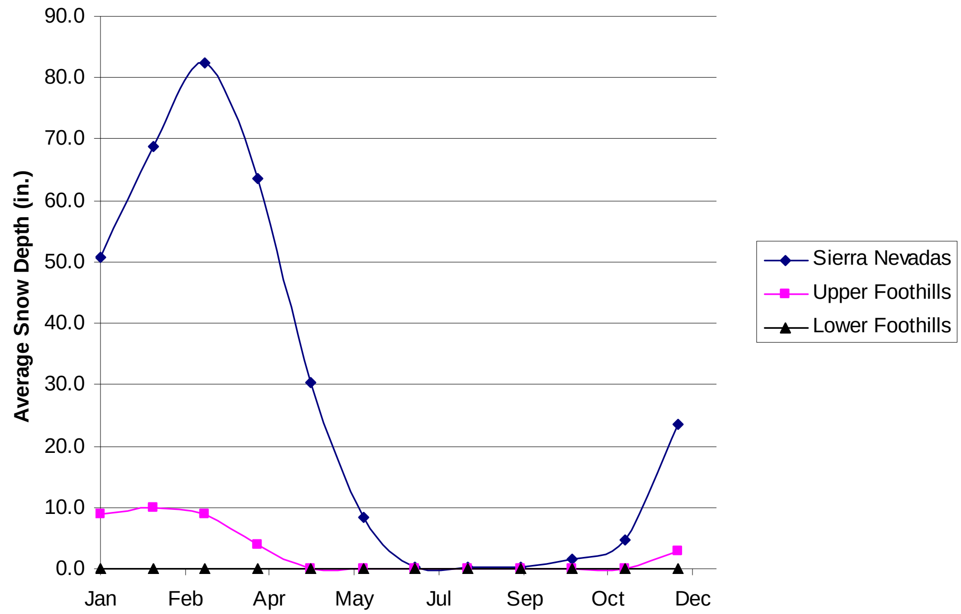


Figure 2-5: Snow Depth Variation within the T-S Region

The Western Regional Climate Center records temperature, rainfall, and snowfall at various stations throughout the Western United States and provides the data on their website (www.wrcc.dri.edu).Three stations were chosen to provide a representative sample of the varying climates in the Region: the stations are located at elevations of 1,000 feet above sea level (New Melones Dam Station), representative of the lower foothills; 4,700 feet above sea level (Calaveras Big Trees Station), representative of the lower Sierras; and 9,200 feet above sea level (Gaylor Meadows), representative of the Sierra Nevadas. The average daily rainfall, temperature averages, snowfall, and snow depth, provided in Table 2-4, Table 2-5, and Table 2-6 are based on averages of record temperatures measured over an extended period of time, dependent on the available station data.

Evapotranspiration is the loss of water to the atmosphere by the combined processes of evaporation (from soil and plant surfaces) and transpiration (from plant tissues). Evapotranspiration rates are affected by temperature, relative humidity, wind and air movement, soil-moisture availability, and type of plant. Similar to the Western Regional Climate Center, the California Irrigation Management System (CIMIS) web site (Http://www.cimis.water.ca.gov) tracks and maintains records of evapotranspiration (ETo) for select cities. ETo statistics used for the Region come from a nearby foothill region as there are no CIMIS stations located within the T-S Region. The average ETo is calculated from the foothill stations, with historical records ranging from 1 to 28 years. As most agriculture and populated areas are located in the lower foothills, ETo was included for this elevation only.

Table 2-4: Climate Information for Lower Foothills, Elev. 1000 ft

	Standard Monthly Average Eto (in.)	Average Total Precipitation (in.)	Average Total Snowfall (in.)	Average Snow Depth (in.)	Average Max Temperature (F)	Average Min. Temperature (F)
January	1.21	6.93	0	0	56.3	38.1
February	1.77	5.36	0	0	59.2	39.9
March	3.02	4.21	0.3	0	64.8	43.2
April	4.54	2.55	0	0	69.2	45.1
May	5.92	1.75	0	0	79.3	52.3
June	7.34	0.52	0	0	88.3	58.2
July	8.64	0.03	0	0	96.7	65
August	7.83	0.05	0	0	95.9	63.9
September	5.88	0.21	0	0	90.5	59.7
October	4.04	1.56	0	0	78.8	52
November	1.86	2.8	0	0	65.1	43.6
December	1.21	5.78	0	0	56.5	38[1,2]
Total	53.26	31.75	0.30	Not applicable	Not applicable	Not applicable

Table 2-5: Climate Information for Lower Sierras, Elev. 4700 ft

	Average Total Precipitation (in.)	Average Total Snowfall (in.)	Average Snow Depth (in.)	Average Max Temperature (F)	Average Min. Temperature (F)
January	10.39	29.6	9	45.2	27.6
February	9.43	23.6	10	46.9	28.5
March	8.06	27.3	9	50.4	30.1
April	4.57	16.1	4	56.4	33.6
May	2.23	2.1	0	65.2	39.7
June	0.65	0.1	0	74.6	46.3
July	0.14	0	0	83.2	52.3
August	0.15	0	0	82	51.1
September	0.68	0	0	75.9	46.9
October	2.94	0.4	0	65.4	39.9
November	5.76	8.2	0	53.5	32.6
December	9.37	22	3	46.6	28.7
Total	54.37	129.40	35.00	Not applicable	Not applicable

1. Climate Data based on Station number 046174 (Calaveras Big Trees), period of record 3/1/1992-10/31/2011. www.wrcc.dri.edu

[1] Evapotranspiration (ETo) based on foothill region data from http://www.cimis.wataer.ca.gov/cimis/welcom.isp

[2] Other Climate Data based on Station number 046174 (New Melones Dam), period of record 3/1/1992-10/31/2011. www.wrcc.dri.edu

Table 2-6: Climate Information for Sierra Nevadas, Elev. 9270 ft

	Average Total Precipitation (in.)	Average Snow Depth (in.)	Average Max Temperature (F)	Average Min. Temperature (F)
January	1.72	50.6	32.5	21.4
February	2.4	68.9	30.9	19.3
March	2.5	82.5	35.1	21.5
April	2.2	63.6	36.8	23.8
May	2.3	30.3	45.1	31.2
June	0.8	8.3	53.5	38.5
July	0.3	0.4	62.0	46.4
August	0.4	0.4	60.0	44.7
September	0.7	0.4	55.2	40.5
October	2.6	1.6	41.1	29.0
November	1.7	4.6	37.1	26.6
December	3.8	23.4	31.4	21.6
Total	21.42	335.00	Not applicable	Not applicable

1. Climate Data based on Station number 043611 (Gaylor Meadows), period of record 1/1/2003 to 12/31/2011, except for snow depth which was from 1/1/2007 to 12/31/2011. www.wrcc.dri.edu
2. Snow fall data was not available for Gaylor Meadows station.

2.5 ~~Climate Change~~Land Use

As discussed in Section 2.1, the Region has had a unique history over the past few centuries which is essential to understanding the manmade transformation the Region has undergone and the influence these land use activities have had on the management of water resources. Since Westerners first began to populate the Region in the 1850s, a portion of the landscape was largely transformed through forestry, mining, construction of roadways, urban development and construction of dams on streams and rivers within the Region.

Today, land use in the T-S Region remains diversified, ranging from small developed urban areas, rural communities, large ranches and agricultural areas, to vast areas of federally managed National Forest and National Park lands, as shown in Table 2-7. The Region affords an abundance of natural resources, including water, and provides extensive recreational opportunities. The T-S Region as a whole is sparsely populated, with the majority of its communities located along the corridors of state Highways 4, 108 and 120 – the Ebbetts, Sonora and Tioga Pass roads. These towns include Angels Camp, Murphys, Copper Cove, Copperopolis, Sonora, Twain Harte and Groveland.

Table 2-7: Land Use in T-S Region

Land Use	Acres	Percentage
Native (including National Forest and National park areas)	1,695,527	97.7%
Agricultural	3,074	0.2%
Urban	29,585	1.7%
Commercial	1,779	0.1%
Industrial	2,021	0.1%
Other	3,434	0.2%
	1,735,421	100%

Source: Land Use Survey, Department of Water Resource
Tuolumne (1997), Calaveras County (1998), Alpine County (2001)

A majority (approximately two thirds) of the T-S Region is dominated by coniferous forests. The forests consist primarily of federally owned land including the Stanislaus National Forest and Yosemite National Park, which are managed by the U.S. Forest Service (USFS) and the National Park Service (NPS). Approximately 90% of the 898,099 acre Stanislaus National Forest area is within the T-S Region; a portion of this is privately owned for timber harvesting and other uses. The *Stanislaus National Forest Plan-Forest Plan Direction,* along with the *Forest Service Manual,* promulgates the policies and regulations governing the Stanislaus National Forest. The portion of the Stanislaus National Forest within the T-S Region contains portions of dedicated wilderness, called the Emigrant Wilderness and the Carson-Iceberg Wilderness. There are various recreational opportunities for visitors throughout the Forest including camping, swimming, hiking, and fishing.

The State of California manages the 6,498 acre Calaveras Big Trees State Park, which is located in Calaveras County along Highway 4, just north of the unincorporated area of Arnold. The *Calaveras Big Trees State Park General Plan* lays out the policies and regulations governing the Park including future development of visitor facilities, protection of resources and park operations. The federal and state parks/forests comprise the majority of the eastern portions of the T-S Region.

The northern portion (about 50 %) of the 761,266 acre Yosemite National Park (Yosemite) is located within the southeastern portion of the T-S Region. Yosemite is best known for its waterfalls, notably those present in the southern portion of the park; however, the park also contains large areas of wilderness, meadows and giant sequoias. The park is managed by the NPS.

In addition to agriculture and timber production, mineral resources and grazing are a fundamental part of the Region's economy. Although gold mining dominated the mining industry between the 1850s and the 1940s, since then, other mining operations of mineral commodities within the Region have increased. These include, asbestos, clay, chromite, construction aggregate, copper, decorative rock, diatomite, dimension stone, dolomite, graphite, lead, limestone, magnesite, manganese, platinum, silver, talc, tungsten, uranium, and zinc. The most important of these in tonnage and value are construction aggregate, dimension stone, dolomite, limestone, and silver. Additionally, grazing is an important land use within the T-S Region. Originally grazing within the area was dominated by sheep; however, since the 1900's, cattle have replaced sheep on many grazing areas with the Region.

The T-S Region, like many regions in California, is facing increased growth and development pressures. Significant residential and agricultural developments have been considered for areas within the T-S Region, particularly in Calaveras County near the Copperopolis and Salt Springs Valley communities, where increased water use projections for agricultural and residential use in the area increase by approximately 38,000 AFY by the year 2035. An increase in agricultural development would create an increased need for water resources within the area. In Tuolumne County, much of the growth is expected to be focused on urbanization and expansion of Sonora and the surrounding communities; agricultural water use projections are much smaller, with a projected increase of approximately 900 AFY by the year 2035. Figure 2-6 shows the current general plan land use designations for the entire T-S Region.

2.6 Jurisdictional Boundaries

A number of natural boundaries such as groundwater basins and watersheds as well as jurisdictional boundaries such as county lines, municipalities, water service areas, wastewater service areas, and land use agencies exist within the boundaries of the Tuolumne-Stanislaus Region. Jurisdictional boundaries are discussed in this section.

The T-S Region's boundary includes all of Tuolumne County and part of Calaveras County and Alpine County, as shown on Figure 2-1. The Region's main communities are situated in the foothills and include Copperopolis, Copper Cove, Angels Camp, Murphys, Arnold, Sonora, Groveland, Tuolumne and Twain Harte. The only two incorporated cities are Sonora and the City of Angels; the remaining communities are unincorporated and are governed by their respective counties. Upslope of these developed areas the Stanislaus National Forest – managed under the authority of the USFS and Yosemite National Park, managed by the NPS occupy about two-thirds of the land base within the T-S Region's boundaries. Additionally, Calaveras Big Trees State Park is located near Arnold.

The larger water providers in the Region include Tuolumne Utilities District (TUD), Groveland Community Services District (GCSD), Calaveras County Water District (CCWD), Utica Power Authority (UPA), Union Public Utilities District, Lake Don Pedro Community Services District, and City of Angels. Additionally there are a number of mutual and private water agencies; which include areas such as mobile home parks and campgrounds.

Special districts within the T-S Region provide agricultural and municipal water and wastewater collection and treatment services. Wastewater collection and treatment agencies include TUD, City of Angels, CCWD, Tuolumne Sanitary District, Jamestown Sanitary District, GCSD, Murphy's Sanitary District, and THCSD. Unsewered areas within the T-S Region are served by onsite septic systems.

Figure 2-7 and Figure 2-8 provide the jurisdictional and service area boundaries for all of the internal political boundaries described in Table 2-8 and Table 2-9 below.

Figure 2-6: General Plan Land Use

Figure 2-7: Land Management Agencies

Figure 2-8: Major Water Agencies

Table 2-8: Governmental and Land Management Agencies

Agency	Jurisdictional Role
Tuolumne County	County
Calaveras County	County
Alpine County	County
City of Angels	City/Water/Wastewater Provider
City of Sonora	City
United States Forest Service	Management of Stanislaus National Forest
National Park Service	Management of Yosemite National Park
California State Parks	Management of Calaveras Big Trees State Park
Bureau of Land Management	Federal Agency

Table 2-9: Water and Wastewater Agencies

Agency	Jurisdictional Role
Calaveras County Water District	Water/Wastewater Provider
Groveland Community Services District	Water/Wastewater Provider
Tuolumne Utilities District	Water/Wastewater Provider
Twain Harte Community Services District	Water/Wastewater Provider
Utica Power Authority	Water Provider, Joint Powers Authority for Union Power Utilities District (UPUD) and City of Angels
Union Public Utilities District	Water Provider
Lake Don Pedro Community Services District	Water Provider
Tuolumne Sanitary District	Wastewater Provider
Jamestown Sanitary District	Wastewater Provider
Murphy's Sanitary District	Wastewater Provider

Although their water service areas are not geographically located within the Region, entities that export water or own major water infrastructure also play a key role in water management activities. Table 2-10 lists these entities along with their role within the Region. The key water infrastructure features owned and/or operated by each of these entities is further discussed in Section 2.10.

Table 2-10: Out-of-Region Export and Hydropower Entities

Agency	Jurisdictional Role
San Francisco Public Utilities District	Water Exporter; Water/Hydropower Infrastructure Owner
Oakdale Irrigation District	Water Exporter; Water/Hydropower Infrastructure Owner
Tuolumne Irrigation District	Water Exporter; Water Infrastructure Owner
Modesto Irrigation District	Water Exporter; Water/Hydropower Infrastructure Owner
South San Joaquin Irrigation District	Water Exporter; Water/Hydropower Infrastructure Owner
United States Bureau of Reclamation	Water Exporter; Water Infrastructure Owner
Pacific Gas and Electric Co.	Hydroelectric power generation
Northern California Power Agency	Hydroelectric power generation Operator/Owner

2.7 Watersheds

The three major watersheds of the Region: the Upper Tuolumne River, Upper Stanislaus River, and the Upper Rock Creek-French Camp Slough (shown in Figure 2-2) are tributary to the San Joaquin River, which is a major river supplying the Sacramento River Bay-Delta.

The North Fork and mainstem Stanislaus River delineate the northern boundary of the Upper Stanislaus River watershed, which also defines the boundary between Tuolumne and Calaveras Counties. This drainage divide is a result of the Calaveras Table Mountain geologic sequence situated along the southwestern boundary of Calaveras County and Summit Level Ridge further east. A similar Table Mountain sequence forms the division between the Upper Tuolumne and Stanislaus Rivers systems. A series of ridgelines to the south delineate the drainage divide between the Upper Tuolumne River and Merced River watersheds, which also corresponds to the Tuolumne and Mariposa County boundaries. The western edge of the boundary for each portion of the three (3) watersheds corresponds to the county lines for Tuolumne and Calaveras County, rather than the full watershed boundary.

Surface water generally flows from the river headwaters at the crest of the Sierra Nevada mountain range in the east, towards the San Joaquin Valley in the west. The streams flow out of deeply incised watersheds with extensive coniferous forests in the mountains, to foothill regions with brush and annual grasslands. The physical natural and man-made key features that depict the hydrology of each watershed are significantly interconnected and complex, as shown on the watersheds schematic shown on Figure 2-9 and described in greater detail in the following sections.

2.7.1 Upper Tuolumne River Watershed

The Upper Tuolumne River Watershed (Figure 2-10), located entirely in Tuolumne County, includes an extensive, mountainous terrain draining 1,900 square miles of west-sloping Sierra Nevada Mountains in southern Tuolumne County and Yosemite National Park. The watershed produces an average unimpaired runoff of 1.85 million acre feet (MAF) (DWR, 2007). The Upper Tuolumne River presents a dichotomy of breathtakingly scenic natural stretches with multiple manmade reservoirs, hydroelectric, and water diversion facilities which provide water for millions of people in the San Francisco Bay Area and irrigation of hundreds of square miles of prime agricultural land in the San Joaquin Valley. The Tuolumne River Watershed drains snowmelt and rainfall that flows between the Upper Merced River watershed to the south and Stanislaus River Watershed to the north.

The headwaters of the mainstem Tuolumne River are formed by snowmelt from Mount Lyell in Yosemite National Park and flow west through several lakes and reservoirs to its confluence with the San Joaquin River in the Central Valley. The Upper Tuolumne River meanders unimpaired for 48 miles through the Wild and Scenic Designated stretch including a 3 mile long stretch flowing through Tuolumne Meadows, until the river reaches the 200,000 AF Hetch Hetchy Reservoir, which was created by the construction of O'Shaughnessy Dam by the SFPUC in 1923. SFPUC also maintains two additional reservoirs as part of its Hetch Hetchy System on the Tuolumne River: Cherry Reservoir is fed by the Cherry Creek Watershed, which is a tributary to the Tuolumne River downstream of Hetch Hetchy. Likewise, Eleanor Creek supplies Lake Eleanor, which is also a tributary to Cherry Creek below Cherry Reservoir.

Figure 2-9: Surface Water Schematic

Figure 2-10: Upper Tuolumne River Watershed

Once water re-enters the river downstream of the O'Shaughnessy Dam, the mainstem Tuolumne River flows unimpaired until it reaches the 2,030,000 AF Don Pedro Reservoir, the sixth largest reservoir in California. The Don Pedro Reservoir, constructed in 1923 and enlarged significantly in 1971, is owned by, and stores water for, Turlock and Modesto Irrigation districts, which use the water for agricultural irrigation, flood control, and municipal use in the San Joaquin Valley. TID and MID are currently undergoing a Federal Energy Regulatory Commission (FERC) license renewal process for the hydroelectric project at Don Pedro. The current FERC license expires in 2016. Water is diverted by TID and MID from the Lower Tuolumne River (downstream of Don Pedro Dam) at the La Grange Diversion Dam, which is just outside the T-S Region boundary.

The mainstem of the Tuolumne River forms from the Dana and Lyell Forks. It has several major tributaries which contribute flow throughout the year including the middle, north and south forks, Clavey River, Cherry Creek, and Turnback Creek. The middle and south forks of the Tuolumne River also begin in Yosemite National Park and join the mainstem near the confluence with the Clavey River, approximately 20 miles downstream of O'Shaughnessy Dam. The north fork of Tuolumne River originates in the Stanislaus National Forest just south of Pinecrest Lake on the South Fork Stanislaus River and flows southwest to its confluence with the mainstem Tuolumne River. The Clavey River is one of three natural unimpaired rivers in the Sierra Nevada's. Turnback Creek originates in the community of Twain Hart and flows southwest, generally parallel to the North Fork Tuolumne River.

2.7.2 Upper Stanislaus River Watershed

The Upper Stanislaus River Watershed (Figure 2-11) drains an area of about 997 square miles of deeply-incised mountainous topography, with about a 2,000 feet elevation drop from ridge top to the river and has an average annual unimpaired runoff of 1,050,000 AF of water. The watershed, which occupies portions of Alpine, Tuolumne, and Calaveras counties is dominated by three major forks of the Stanislaus River: the North Fork, South Fork, and Mainstem. The headwaters of the Upper Stanislaus River originate at elevations in excess of 9,000 feet near the crest of the Sierra's in the Emmigrant Wilderness area of the Stanislaus National Forest. The Upper Stanislaus River Watershed drains snowmelt and rainfall that flows between the Mokelumne Watershed to the North and the Tuolumne River watershed to the south. Similar to the Tuolumne River, the Stanislaus River forks have been modified to include manmade water storage, diversion, and hydroelectric power generation facilities.

The 39-mile long North Fork Stanislaus River originates in Alpine County near Mosquito Lake and flows generally southwest as it passes through Union Reservoir, Utica Reservoir, and flows through a deeply incised canyon until it reaches the confluence with the Middle Fork Stanislaus River. New Spicer Meadows is an 184,298 AF reservoir owned by CCWD which is fed by Highland Creek, a tributary to the North Fork Stanislaus River. Hydroelectric projects along the North Fork include the New Spicer Meadows powerhouse, Collierville Tunnel and powerhouse (FERC Project No. 2409), owned by CCWD (operated by NCPA) and the Murphys and Angels powerhouses on the Utica Power Authority canal system. The North Fork also provides water supplies for communities along the Ebbett's Pass/Highway 4 corridor including Murphy's and Angels Camp.

Figure 2-11: Upper Stanislaus River Watershed

The Middle Fork of the Stanislaus River begins at Relief Reservoir, and flows southwesterly for approximately 50 miles, as it passes through Donnell's and Beardsley Reservoirs until it reaches the confluence with the mainstem river. Beardsley and Donnell's Reservoirs each have powerhouses owned and operated by the Tri-Dam Project (FERC Project No. 2005). Tri-Dam is a joint powers authority whose members are OID and SSJID. Tributaries that feed into the Middle Fork include Kennedy Creek in the Emigrant Wilderness Area, Summit Creek, and the Clark Forks of the Stanislaus River.

The South Fork Stanislaus River begins near Bay Meadow (elevation 8,800 feet) and travels for approximately 35 miles downstream until it reaches the confluence with the mainstem Stanislaus River. The two reservoirs along the South Fork Stanislaus River are Pinecrest Lake and Lyon's Reservoir, both used for hydropower generation and owned by PG&E. The South Fork Stanislaus River is also used by Tuolumne Utilities District to provide water to much of Tuolumne County from Lyons Reservoir. The main canal that diverts water from Lyon's Reservoir by TUD includes a separate diversion to the Phoenix Powerhouse. Flows that pass through the Phoenix Powerhouse that are not diverted by users along the canal eventually end up crossing watersheds and end up in Don Pedro Reservoir in the Upper Tuolumne River watershed.

The Upper Stanislaus River ends at two manmade reservoirs: the 2,420,000 AF New Melones Lake, a rockfill dam which was completed in November 1978 and Tulloch Reservoir. New Melones Lake is owned and operated by the USBR and provides water for irrigation, municipal uses, and flood protection in the San Joaquin Valley. The 67,000 AF Tulloch Reservoir is downstream of New Melones Lake, and is owned by Tri-Dam. CCWD diverts water from Tulloch Reservoir to provide water for the Copper Cove and Copperopolis service areas.

2.7.3 Upper Rock Creek-French Camp Slough Watershed

The Upper Rock Creek-French Camp Slough watershed (shown in Figure 2-12), located entirely in Calaveras County, is located in the northwestern portion of the Region and drains approximately 110 square miles. The area of this watershed within the boundary contains the upper portion of the Rock Creek and Littlejohn's Creek sub-watersheds. The landscape of this watershed is similar to the westernmost, lower elevation portions of the Upper Tuolumne and Upper Stanislaus watersheds, with rolling hills covered by grasslands and chaparral eventually draining to the San Joaquin River through Rock Creek, Littlejohn's Creek, and French Camp Slough.

Salt Springs Valley Reservoir is the only major surface water body in the watershed. Salt Springs Valley Reservoir covers approximately 1.4 square miles. Releases from Salt Springs Valley Reservoir feed Rock Creek, which is a tributary to Littlejohn's Creek in San Joaquin County.

2.8 Ecological Processes and Environmental Resources

The lakes, creeks, meadows and other water features that form the Region provide key habitat for many of California's most important aquatic and terrestrial species, including many fish and wildlife species. Anadromous fish once migrated into the Region, using its waterways for spawning as far upstream as the waterfalls that did not allow further fish passage; fish passage is now to reaches below downstream dams. Over 50 special status species are found in the Region today, with many of which are federally or state listed species. Protection and restoration of these species is an important aspect of this IRWM program.

Figure 2-12: Upper Rock Creek-French Camp Slough Watershed

2.8.1 Aquatic Ecosystems and Fisheries

The wild and scenic river system, created by Congress in 1968, preserves selected rivers with remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values. The goal is to counterbalance dams and other construction in order to preserve these selected rivers/portions of rivers in their free-flowing condition to protect water quality and wildlife habitat for the benefit of future generations.

The Upper Tuolumne is the only Wild and Scenic river in the T-S Region as designated by Congress in 1984. The Clavey River is recommended for inclusion in the system, as well and a Value Review was conducted in 1997 which describes the status of the Clavey River's Wild and Scenic River values. A study conducted by the USFS preceding the Clavey River Review recommended the inclusion of the Clavey River, North Fork Stanislaus, Stanislaus, South Fork Tuolumne and five segments of the Middle Fork Stanislaus into the Wild and Scenic River System.

The Stanislaus and Tuolumne Rivers historically had strong runs of Chinook salmon. Now excluded above Goodwin Dam and La Grange Dams, respectively, which lie at the far downstream end of the Region, spring, fall and late winter runs of Chinook salmon are believed to have historically extended up to natural migration barriers on the Stanislaus River, Middle Fork Stanislaus and South Fork Stanislaus. These natural migration barriers prevented fish passage to the upper watershed areas.

Trout populations are a key species in both the Stanislaus and Tuolumne watersheds below the migration barriers. In the Stanislaus watershed, as in other Sierra Nevada watersheds, the California Department of Fish and Game has stocked fish for decades; the majority of the fish stocked in the past 30 years have been rainbow and brown trout. In the Tuolumne watershed, the Clavey River is designated by the California Department of Fish and Game as a Wild and Heritage Trout Water; this designation indicates that the stream supports a population of trout that best exemplifies indigenous strains of native trout within their historic drainage and domestic strains of trout of catchable-size trout are not to be planted in within the stream.

The Region has both native and non-native fish; the non-native fish are the result of fish plantings that occurred starting as early as 1877. Non-native fish in Yosemite National Park include bullgill, smallmouth bass, and 7 trout species including brook, brown, lahontan cutthroat, golden, rainbow and hybrid species. Some of the reservoirs are home to non-native species such as land-locked kokanee and Chinook salmon, black bass, catfish, crappie, carp, and blue gill; trout species are often stocked from California Fish and Game fish hatcheries. Non-native fish can impact native species through predation of threatened or endangered species such as the Sierra Nevada yellow-legged frog and provide competition for food resources by consuming invertebrates and zooplankton.

Other aquatic species of interest in the Region, including federally and state listed amphibian, reptile, and invertebrate species are listed in Table 2-11.

Figure 2-13: Groundwater Basin

2.8.2 Terrestrial Ecosystems

Native forest is the dominant vegetation in the Region, covering roughly two-thirds of the land area. Major tree species found in the lower elevation zones at about 1,800 feet foothill-woodland zone include manzanita, blue oak, interior live oak, and gray pine. The lower montane forest from around 3,000 feet elevation in the include California black oak, Ponderosa pine, white fir, and incense cedar. Two groves of giant Sequoias within Calaveras Big Trees State Park are also located within the Stanislaus River watershed in the lower montane forest zone. Upper montane forest begins at elevations near 6,000 feet and include trees such as red fir, lodgepole pine, Jeffrey pine, and western juniper. The subalpine forest, at elevations near 8,000 feet and above, includes species such as white pine, mountain hemlock and lodgepole pine.

Riparian areas found along the banks of the rivers and creeks are arguably the most productive and diverse part of the Region, and they serve an important water resource function in their ability to stabilize streambanks and provide filtering. Riparian vegetation in the lower portions of the Region is typically dense, with the overstory consisting of willows and Fremont cottonwoods, valley oaks, California sycamore, box elder, and Oregon ash. Upper watershed areas have species such as arroyo willow, red willow, shiny willow, dusky willow, narrow leaf willow and black cottonwood. Willows, cottonwood and valley oak are particularly important in that they provide habitat for a variety of birds including egrets, herons, osprey, ducks, and bald eagle. The understory consists of willows and herbaceous plants such as buttonbush, honeysuckle, elderberry, and gooseberry which are attractive to certain birds including sparrows and warblers. Smaller plants typically include poison oak, nettle, mule fat, wild grape, and longstemmed, shade-tolerant grasses. The dense understory provides habitat for rodents, deer and their predators. Historical riparian habitat in the Region has been lost due to land use management and flow regulation. Additionally native riparian plant species are facing competition from invasive species. As indicated in the invasive species discussion below, areas where soils have been disturbed are most susceptible to non-native invasion.

Montane meadows are another important habitat in the Region. Meadows are hydrologic convergence points in the watershed where topographic or geologic conditions lead to sediment deposition and high water tables. Meadows provide a number of water related benefits including filtering of sediments from flows from upland areas, serving as natural water storage reservoirs, promoting groundwater recharge/augmented baseflows and attenuating floods. Plant communities within meadows are biologically active and contribute a high proportion of forage for both wildlife and livestock grazing. Unfortunately, overgrazing has led to deterioration of meadows in some areas of the Region. Meadows that have been located within the Stanislaus National Forest are shown in Figure 2-14. Tuolumne Meadows, in Yosemite National Park is an example of a meadow that occurs in the subalpine forest zone while Happy Isles on the Valley Floor is an example of a fens, the wettest portion of a meadow. Approximately 3,000 meadows are located in the Park and cover about 3% or almost 23,000 acres of the entire park area in elevations from 3,000 to above 9,500 feet. These meadows represent a small area of the park but contain large proportions of species and are considered “islands” of high diversity. The meadows in Yosemite are believed to have been largely unchanged for the past 10,000 years, since near the last ice age.

Additional habitat types in the Region include grasslands, scattered woodlands and chaparral. General land cover types throughout the Region are shown in Figure 2-15.

Figure 2-14: USFS Meadow Sites

Figure 2-15: Land Cover

2.8.3 Endangered and Listed Species

This subsection presents a sampling of wildlife and plant species that occur or have been known to historically occur in the Region. Many of the species listed below have special status designations of endangered, threatened or species of concerns. Some species, while not federally or state listed, have been identified as management indicator species or of regional interest. A more comprehensive listing of special status species that occur or may occur in the Region is included as an appendix.

Table 2-11: Endangered and Listed Species

Common Name	Scientific Name	Status
Birds		
great gray owl	*Strix nebulosa*	CE, FSS, IS
Osprey	*Pandion haliaetus*	CSC
bald eagle	*Haliaeetus leucocephalus*	FT, CE, MIS
northern goshawk	*Accipiter gentilis*	FSC, CSC, FSS, MIS
American peregrine falcon	*Falco peregrinus anatum*	CE, FSS, MIS
California spotted owl	*Strix occidentalis occidentalis*	FSC, CSC, FSS, MIS
Pileated woodpecker	*Dryocopus pileatus*	MIS
Mountain quail	*Oreortyx picta*	MIS
Little willow flycatcher	*Empidonax traillii*	FSC, CE, FSS, MIS
American dipper		
Double crested cormorant	*Phalacrocorax auritus*	CSC
Harlequin duck	*Histrionicus histrionicus*	FSC, CSC
yellow warbler	*Dendroica petechia brewsteri*	CSC
Yellow-breasted chat	*Icteria virens*	CSC
Bank swallow	*Riparia riparia*	CT, FSV
Mammals		
California wolverine	*Gulo gulo*	FSC, CT, FSS
Sierra Nevada red fox	*Vulpes vulpes necator*	CT, FSC, FSS
American marten	*Martes americana*	FSS
Pacific fisher	*Martes pennanti (pacifica) DPS*	FSC, CSC, FSS
Mule deer		IS
Yuma myotis	*Myotis yumanensis*	FSC, CSC
Hoary bat	*Lasiurus cinereus*	FSV
Silver-haired bat	*Lasionycteris noctivagans*	FSV
Townsend's big-eared bat	*Corynorhinus townsendii*	FSC, CSC, FSS
Pallid bat	*Antrozous pallidus*	CSC, FSS
Western mastiff bat	*Eumops perotis*	FSC, CSC, FSV
River otter		
American mink		
Black bear	*Ursus americanus*	MIS

Common Name	Scientific Name	Status
Amphibians		
California red-legged frog	*Rana aurora draytonii*	FT, CSC
California tiger salamander	*Ambystoma californiense*	FPT
Yosemite toad	*Bufo canorus*	FSC, CSC, FSS
Foothill yellow-legged frog	*Rana boylii*	FSC, CSC, FSS
Mountain yellow-legged frog	*Rana muscosa*	
Reptiles		
Western pond turtle	*Clemmys marmorata*	FSC, CSC, FSS
Invertebrates		
Valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	FT
Hara's cave amphipod	*Stygobromus harai*	FSC, IS
Simply hydroporus diving beetle	*Hydroporus simplex*	FSC, IS
California floater	*Anodonta californiensis*	FSC, IS
Fish		
Chinook Salmon - spring run	*O. tshawytsha*	FT, CT, FSS
Chinook Salmon - winter run	*O. tshawytsha*	FE, CE
Chinook Salmon - late fall run	*O. tshawytsha*	FE, CSC, FSS
Pacific Lamprey	*Lampetra tridentata*	FSC
Hardhead	*Mylopharodon conocephalus*	CSC, FSS
Red Hills Roach	*H. s. spp. Lavinia*	CSC
San Joaquin Roach	*H.s. spp.*	CSC
Eagle Lake Rainbow Trout	*O. mykiss aquilarum*	FSC, CSC, FSS, MIS
Lahontan Cutthroat trout	*Oncorhynchus clarki henshawi*	FT (in home range but not native to region), MIS
Plants		
Sierra bolandra	*Bolandra californica*	FSW, CNPS-4
Mountain lady's slipper	*Cypripedium montanum*	FSS, CNPS-4
Stebbins' lomatium	*Lomatium stebbinsii*	CNPS-4
Cut-leaved monkeyflower	*Mimulus laciniatus*	FSC, FSS, CNPS-1B
Chinese Camp brodiaea	*Brodiaea pallida*	FT, CE, CNPS-1B
California vervain	*Verbena californica*	FT, CT, CNPS-1B
Ione manzanita	*Arctostaphylos myrtifolia*	FT, CNPS-1B
Greene's tuctoria	*Tuctoria greenei*	FE, CR, FSS, CNPS-1B
Layne's ragweed	*Senecio layneae*	FT, CR, FSS, CNPS-1B

CE	state listed endangered
CNPS 1B	rare, threatened or endangered in California and elsewhere
CNPS-4	limited distribution; a watch list
CSC	state species of concern

CT	state listed threatened
FPT	federally proposed threatened
FSC	federal species of concern
FSS	FS sensitive, Region 5
FSV	Sierra Nevada framework species of moderate to high vulnerability
FSW	FS Watch List
FT	federally listed threatened
IS	Indicator species
MIS	FS management indicator species

Sources: DEIS for Hydropower Licenses-Stanislaus River Projects; New Melones Lake Area Final RMP/EIS

2.8.4 Ecosystem Challenges

2.8.4.1 Invasive Species

Invasive species management in the Region is focused mainly on invasive plant species, which compete with native, often threatened/endangered, species for resources, alter wildlife habitat and threaten biological diversity, increase fire potential, and accelerate erosion and flooding. While the following discussion is limited to invasive plants, it should be noted that invasive fish predation is also a concern, as mentioned in the aquatic ecosystem and fisheries discussion.

The federal government and State of California have categorized some invasive species as “noxious weeds” mainly due to their threat to agriculture. Noxious weeds are found in higher abundance in the lower elevations of the Region and are less prevalent in the higher elevations. Areas where soils have been disturbed and transportation vectors exist are most susceptible to invasion. Noxious weed populations have been observed around roadways and other infrastructure and within riparian habitat, where vehicles, foot traffic and water serve as transportation vectors.

Invasive species management activities are generally prioritized based on the impact of the species on regional resources, the extent of the invasion and the potential to spread. The California State Department of Agriculture and California Exotic Pest Plan Council provide ratings of noxious weeds and other non-native plants that can help prioritize control activities.

Priority species for control in the Region include: cheat grass, Italian thistle, Spotted knapweed, yellow star-thistle, bull thistle, French broom, common velvet grass, perennial pepperweed and Himalayan blackberry. Yellow star-thistle, cheat grass and bull thistle are among the most widespread and prevalent species in the Region. In Yosemite National Park, it’s estimated that approximately 10 new non-native species are found each year.

A list of invasive species that are of concern for the Region is provided in Appendix 2-X.

2.8.4.2 Forest Management Issues

With over two-thirds of the Region’s land area located in either the Stanislaus National Forest or Yosemite National Park, forest management is an important component of Regional planning.

Challenge areas within the Region’s forest include mature forest, riparian habitat, fire and fuels maintenance, noxious weed prevention and control, hardwood ecosystem, trail and roadway maintenance and recreation management. Old forest ecosystems are not reaching the desired mature forest conditions because of overstocking; the high stand density minimizes individual tree growth and also presents a strong threat of mortality through the spread of insects, disease and fire. In aquatic and riparian ecosystems, riparian plant species are being suppressed due to increased conifer cover. Extensive accumulation of surface fuels increases the risk of fire, creating a threat to communities and wildlife. The extent and types of invasive species found in the forest land is increasing. Maintenance of hardwood ecosystems through regeneration of and recruitment of young hardwood trees to replace older trees ecosystems is necessary to maintain habitat. Road density and stream crossing are too high relative to desired conditions; some forest roads are built on highly erodible soils, and much of the road system drainage is directly connected to streams contributing sediments and impairing water quality. Aging infrastructure and lack of funding for upkeep of facilities affects recreational opportunities within the forest land.

The forest management issues with the strongest relation to water resources are the overstocking within old forest ecosystems, encroachment of conifer cover on riparian areas and hydrologic connectivity of roadways with streams. A forest area is considered overstocked when it has too many trees per acre, causing tree stress because it forces trees to compete with their neighbors for light, water and nutrients. Overstocking is a water resource concern because of its water supply implications. Less snow is able to accumulate in areas with increased tree cover, meaning that the available water supply for the Region is reduced with increased stand densities. In addition to reducing the amount of water entering the Region through reduced snowpack, overstocked areas represent an increase in water demand through plant transpiration, further reducing the water available for streamflow. Suppression of riparian plants affects wildlife, results in loss of the streambank stabilization provided by cottonwood and willows typically found along the streams and reduces the filtering of runoff provided by the normal understory species. The loss of riparian plants intensifies the issue of hydrologically connected segments of roadways, as sediments from the roadways may directly enter the stream instead of first passing through a riparian buffer.

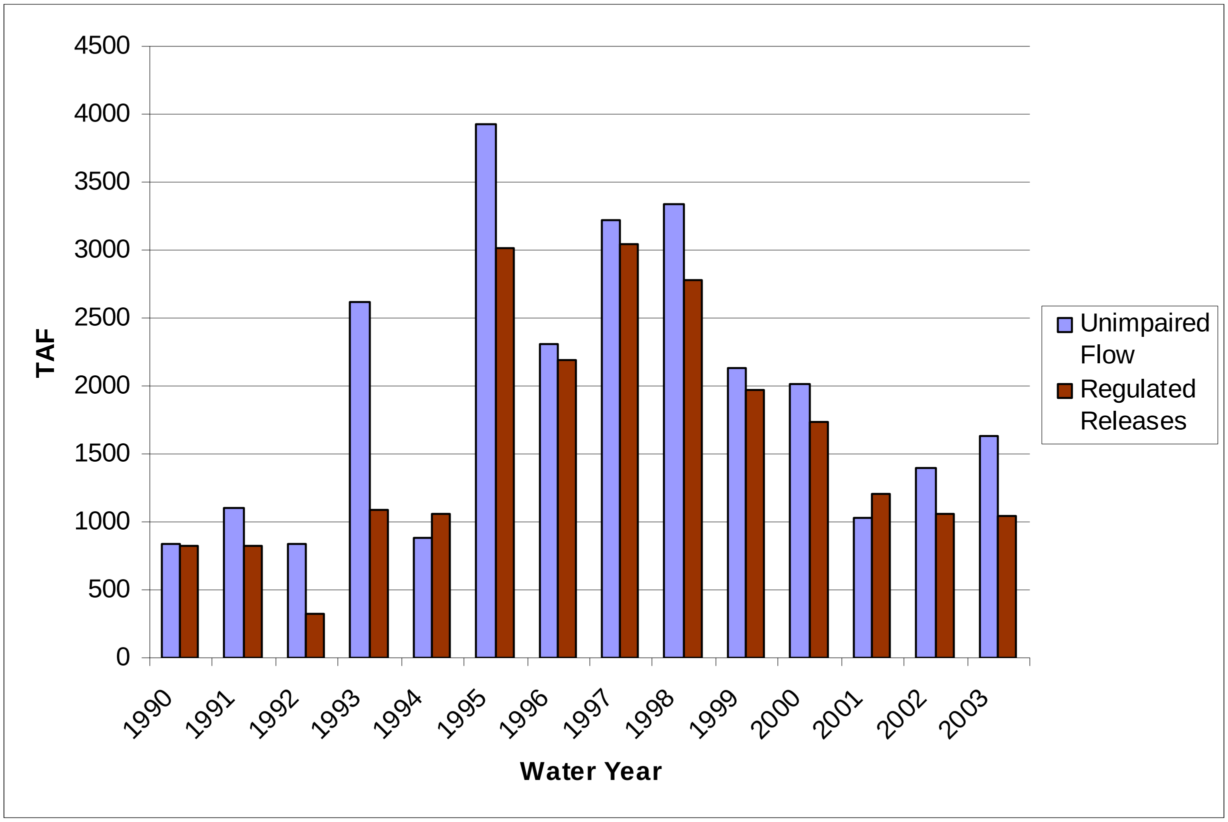
2.9 Water Resources

Water resources in the T-S Region are abundant; surface water from the Upper Tuolumne and Upper Stanislaus River watersheds provides essential water for users locally and throughout the state of California. Over 95% of the water supply is from surface water. This section describes the current and projected water supply conditions of surface water and groundwater, and projected water demands within the T-S Region.

2.9.1 Water Supply

2.9.1.1 Surface Water Sources

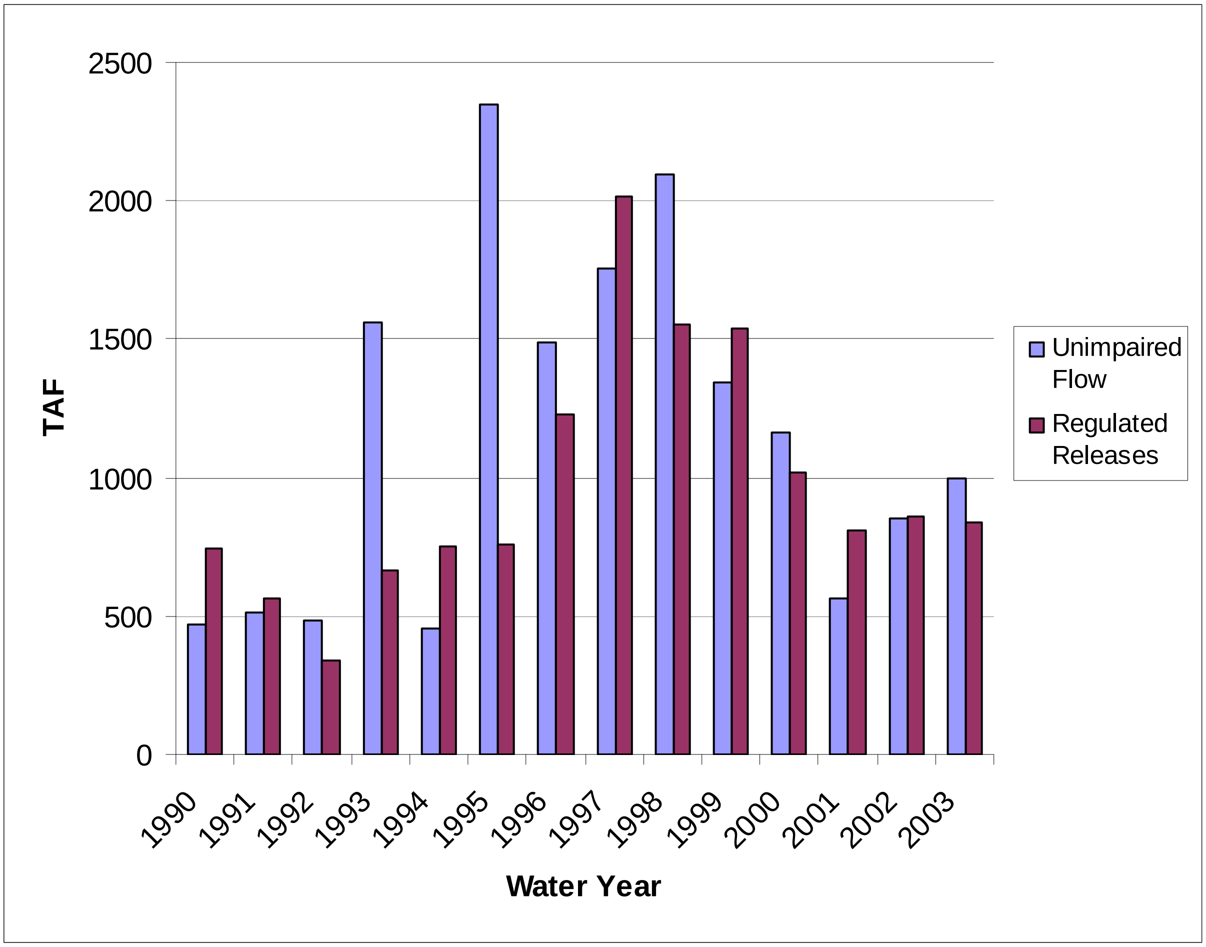
Runoff from the Tuolumne River is typified by early spring snowmelt, common amongst rivers in the Sierra Nevadas. Unimpaired runoff is the runoff from a watershed that would have occurred had man not altered the flow of water within the watershed. The average unimpaired flow from the Tuolumne River is 1.8 MAF per year (average, 1923 to 2009), although the annual flow can be highly variable dependent upon seasonal snowpack and precipitation totals. Figure 2-16 shows the annual unimpaired flow and historical regulated release flows (actual flows released from the manmade dams within the watershed) occurring between 1990 and 2003; the maximum historical estimated unimpaired flow was 3.9 MAF in 1995 and the minimum estimated unimpaired flow is 0.9 MAF in 1994. Average releases are lower than average unimpaired flow due primarily to water exported by SFPUC.



Sources: USGS Gage 11289651; California Central Valley Unimpaired Flow Data 4th Edition, 2007.

Figure 2-16: Upper Tuolumne River Watershed Unimpaired and Regulated Releases

Runoff feeding the Stanislaus River also peaks during early spring snowmelt. The average unimpaired runoff from the watershed is 1.1 MAF per year (average, 1923 to 2009), although the annual runoff can be highly variable dependent upon seasonal snowpack and precipitation totals. Figure 2-17 shows the annual unimpaired runoff and historical regulated flow occurring between 1990 and 2008 from the Stanislaus River; the maximum estimated unimpaired flow was 2.3 MAF in 1994 and the minimum estimated unimpaired flow was 0.4 MAF in 1994.



Sources: USGS Gage 11299200; California Central Valley Unimpaired Flow Data 4th Edition, 2007.

Figure 2-17: Upper Stanislaus River Watershed Unimpaired Flow and Regulated Releases

The Upper Rock Creek-French Camp Slough watershed is by far the smallest of the three drainages in the Region. Flows from Salt Springs Reservoir as well as flows within Littlejohns and Rock Creek are not well documented. There are presently no USGS or CDEC stations located within the portion of these creeks located within the Region. Water within this watershed generally drains to the Salt Springs Valley Reservoir where it is released to Rock Creek. Rock Creek is a tributary to Littlejohn's Creek in the lower watershed within San Joaquin County.

2.9.1.2 Groundwater Resources

The majority of available groundwater resources in the Region are contained within the Sierra Nevada Geomorphic province, where water is transient and found in fractured rock, volcanic, and metamorphic fissures. The T-S Region is located within the foothills and higher elevations of the Sierra Nevada where the subsurface material consists primarily of impermeable granitic and greenstone bedrock which often results in a low groundwater yield.

The only exception is a small area in the northwestern corner of the Region that is within the Eastern San Joaquin Groundwater subbasin, as shown on Figure 2-13. The 707,000 acre Eastern San Joaquin Groundwater Subbasin is a portion of the larger San Joaquin Groundwater Basin (as identified in Department of Water Resources Bulletin 118-80), which has been determined to be in an overdraft condition. This groundwater basin is defined by the areal extent of unconsolidated to semiconsolidated sedimentary deposits that are bounded by the Mokelumne River on the north and northwest; San Joaquin River on the west; Stanislaus River on the south; and consolidated bedrock on the east. CCWD has prepared a number of groundwater studies including a 2007 groundwater management plan update for the Camanche/Valley Springs area which includes a small portion of the Region around the community of Milton. However, there are no wells in the T-S Region portion of the Camanche/Valley Springs area and therefore limited data are available.

2.9.1.3 Groundwater Supply

Groundwater wells are used by many private property owners, especially in areas that are geographically isolated, and some water suppliers in the Region. Based on the population served by community water systems and the population of the Region, approximately 20,000 to 25,000 people in the Region may use groundwater as a potable supply. Due to the difficulty of predicting sustainable yield and storage capacity of the largely fractured bedrock groundwater storage that underlies the T-S Region, and lack of a regional level groundwater study, there is not sufficient data available at this time to quantify total available sustainable groundwater supply.

2.9.1.4 Regional Water Supplies

Water supply for use within the T-S Region is largely controlled by downstream senior water rights holders. For example, TUD, which provides water to many of the water users in the T-S Region, relies on an agreement with PG&E to obtain water from Lyon's Reservoir. Table 2-12 below provides a general summary of the water supply sources for the major water suppliers within the Region.

Table 2-12: Water Supply Sources

Water Supplier	Primary Supply Source	Water Rights Source
CCWD – Copper Cove/Copperopolis Area	North Fork Stanislaus River	CCWD Water Rights
CCWD – Ebbetts Pass Area	North Fork Stanislaus River	CCWD Water Rights
Utica Power Authority (provides water to City of Angels and Union Public Utilities District	North Fork Stanislaus River	UPA Water Rights and Agreement with CCWD for Water Rights
GCSD	Tuolumne River/Hetch Hetchy Reservoir	Agreement with SFPUC
TUD	South Fork Stanislaus River	Agreement with PG&E
LDPCSD	Groundwater – backup water supply agreement for surface water from Lake McClure.	not applicable

Calaveras County Water District

CCWD's Copper Cove/Copperopolis service area receives water from the North Fork of the Stanislaus River from the Tulloch Reservoir which is located just downstream of the New Melones Reservoir. The current water rights and permits that CCWD has obtained authorize a 6,000 AFY maximum diversion from Tulloch Reservoir for the Copper Cove/Copperopolis Area. When the demand approaches this supply, the District will request a higher diversion allowance. In addition, Copper Cove produces recycled water for use on local golf courses.

CCWD provides water to the Ebbetts Pass area from the North Fork of the Stanislaus River through the Collierville Tunnel, which is supplied by McKay's Point Reservoir. The current water rights and permits that CCWD has obtained allow for a 8,000 AFY diversion through the Collierville Tunnel. An additional 1,000 AFY may be diverted through an existing "cement slurry line" right to meet agricultural needs in the Ebbetts Pass area. In addition, recycled water from the Ebbetts Pass area is used on local golf courses and for pasture irrigation.

Groveland Community Services District

GCSD receives water primarily from water released from Hetch Hetchy Reservoir via the Hetch Hetchy Mountain Tunnel under a 1964 agreement with SFPUC. In addition to the tunnel, GCSD uses surface water from Pine Mountain Lake for potable use and recycled water for use on local golf courses.

Tuolumne Utilities District

TUD obtains water primarily from the South Fork of the Stanislaus River under TUD's Agreement with PG&E. This surface water is supplied to TUD from the South Fork of the Stanislaus River including the Lyons Reservoir and Pinecrest Lake and delivered through the Main Tuolumne Canal to the Phoenix Power House where TUD then delivers the water for Sonora, Jamestown, and Twain Harte. TUD also operates some groundwater wells for potable use and recycles wastewater for agricultural irrigation.

TUD is the largest water supplier in Tuolumne County and provides wholesale water supply to several municipal water companies and Twain Harte Community Services District.

Utica Power Authority

Utica Power Authority provides water from the North Fork Stanislaus River to the City of Angels Camp and UPUD, which supplies water to the Murphy's area along the Highway 4 corridor.

Regional Water Supply Projections

The T-S Regional water supply projections summarized in Table 2-13 are based on data obtained from 2010 UWMPs for CCWD, GCSD, and TUD. The projected supply availability for UPA was provided directly by UPA and is based on water rights allocations. Due to a lack of available data, quantifiable supply projections were not available for smaller community water systems, Lake Don Pedro CSD, or private domestic groundwater users in the T-S Region. However, it is estimated that from 20,000 to 25,000 persons in the T-S Region may be served by local fractured rock groundwater.

Table 2-13: Water Supply Projections

Agency	2015	2020	2025	2030	2035
CCWD - Copper Cove/Copperopolis	66,659	66,869	67,078	67,287	67,497
CCWD – Ebbetts Pass	9,294	9,324	9,353	9,383	9,410
GCSD	3,215	3,645	3,860	4,075	4,075
Lake Don Pedro CSD	n/a	n/a	n/a	n/a	n/a
UPA	2,998	3,278	3,641	4,011	4,510
TUD	26,993	27,084	27,182	27,284	27,372
Rural[4]	n/a	n/a	n/a	n/a	n/a
Total	109,159	110,200	111,114	112,040	112,864

Sources:
1. CCWD UWMP, 2010; GCSD UWMP, 2010; TUD UWMP, 2010.
2. GCSD does not have any water supply projections for the year 2035, because the contract with SFPUC ends in 2034, therefore it was assumed that the supply for 2030 is equal to the supply for 2035.
3. UPA did not provide supply projections. It was assumed that demand is supply is equal to demand.
4. Rural water supply within the Region is predominantly served by local groundwater wells. Groundwater quantity is variable within the Region, therefore no estimate of water supply is provided here.

2.9.1.5 Recycled Water

The Central Valley Regional Water Quality Control Board (CVRWQCB) regulates wastewater discharges from publicly operated treatment works (POTW) in the Region. The stringent discharge requirements have been established for many agencies to comply with the federal Clean Water Act and the Central Valley Basin Plan. As a result, land application of treated wastewater is strongly encouraged before discharges to surface water bodies are allowed. For these reasons, many of the agencies responsible for wastewater disposal in the Region have upgraded treatment processes, disposal infrastructure, and storage, or continue to seek improvements to upgrade their facilities to increase recycled water production and use. There is currently about 1,000 AFY in CCWD, 350 AFY in City of Angels, and 1,850 AFY in TUD for a total of about 3,200 AFY of secondary or tertiary quality recycled water used in the Region. Applications currently include mostly agricultural, landscape irrigation, and golf course irrigation systems. Agencies such as TUD, City of Angels, and CCWD continue to search for ways to expand and enhance their existing recycled water systems.

2.9.2 Water Demands

Water use in the T-S Region includes local municipal uses for residential, some industrial and commercial enterprises in addition to agricultural use, hydro power generation, the maintenance of minimum flow releases to meet downstream ecosystem needs, and major water exports by senior water rights holders. This section provides a summary of each of these demand categories.

2.9.2.1 Municipal and Agricultural Water Demands

In-Region water demands include predominantly municipal and agricultural uses. Water demand projections were derived from information provided by the various water agencies participating in development of this plan. Historic and projected water demands were taken from Urban Water Management Plans (UWMPs) and other current water planning documents wherever possible. Water demand projections for the three urban water suppliers, TUD, CCWD, and GCSD, include implementation of water use efficiency measures to comply with the statewide mandate for 20% per capita water use reduction by 2020 (Water Conservation Act of

2009). The specific per capita water use targets presented in Table 2-14 were determined by each agency and are discussed in detail in each respective UWMP. Each urban water suppliers have developed specific water conservation plans that must be implemented by 2020 in order to achieve the water use efficiency targets.

Table 2-14: 20x2020 Per Capita Water Use Targets

Urban Water Supplier	Baseline GPCD	2015 Target GPCD	2020 Compliance Target GPCD
TUD	187	176	165
CCWD	215	194	172
GCSD	n/a	n/a	n/a

* GCSD did not calculate a baseline or target per capita use in its UWMP.

In addition to these larger water purveyors, there are various small mutual water companies and private water systems that provide water within the T-S Region that were not captured within the local planning documents and thus cannot be broken into different water use categories, these are shown as rural water use in Table 2-15. Rural water usage was estimated using data from the 2010 U.S. Census to first approximate the population that resides outside of CCWD, GCSD, UPA, Lake Don Pedro CSD and TUD's service areas. Growth rates and per capita water demands were then assigned to the estimated population in each county based on: Calaveras County General Plan for rural populations in Calaveras County, and the 2010 TUD UWMP for rural populations located within Tuolumne County and Alpine County.

Water demands were divided into domestic, groundwater recharge, agricultural use, recycled water, water loss and other water uses, and wholesale demands. Table 2-15 provides a summary of projected water demands based on these water use categories for the major water agencies within the T-S Region. Rural water use is presented as a separate category to represent water use by the population not included in these agencies. This includes various small mutual water companies and private water systems located throughout the Region.

Table 2-15: Projected Water Demand Summary, AFY

Water Use Category	2010	2015	2020	2025	2030	2035
Domestic[1]	10,647	14,230	16,308	18,889	21,052	22,803
Groundwater Recharge	0	1,500	1,500	2,500	3,500	4,500
Agricultural	2,641	9,721	17,810	25,911	33,271	41,393
Recycled[2]	3,209	3,566	3,907	4,254	4,626	5,102
Water loss and other water uses[3]	6,591	7,873	8,659	9,540	10,522	11,094
Wholesale	709	1,014	1,072	1,132	1,185	1,241
Rural Water Use[4]	5,080	5,371	5,678	6,003	6,346	6,709
Total[1]	**28,876**	**43,275**	**54,934**	**68,228**	**80,502**	**92,842**

Source: CCWD, GCSD, TUD 2010 UWMP; UPA projections provided by UPA

1. GCSD: Assumed 4.5% growth between 2030 and 2035
2. GCSD: Assumed a 5 year 4.5% growth rate
3. GCSD: Assumed 14% Water Loss/Other Water Uses
4. See Table 2-2 for population growth rate assumptions by County

Currently, the largest demand within the T-S Region is for domestic (residential, commercial, and industrial uses) as shown in Table 2-15. Projections for 2035 show a large increase in agricultural water use within the T-S Region. A majority of this growth is projected in the Copper Cove/Copperopolis/Salt Springs area located in southwestern Calaveras County. Additionally, Calaveras County anticipates implementing groundwater recharge in this area in the future.

Currently the greatest demand within the Region is in the TUD service area, with approximately 15,000 AFY of water use. Future projections for CCWD however, project greater water use than TUD, with an increase from 4,400 to 54,000 AFY by 2035 (see Table 2-16). A majority of this water use is projected for agricultural development in the Copper Cove/Copperopolis/Salt Springs area. Current water use in areas outside of the major water purveyors is estimated to be approximately 15% of the total water use within the T-S Region.

Table 2-16: Projected Water Demand by Agency, AFY

Agency	2010	2015	2020	2025	2030	2035
CCWD	4,484	14,897	24,179	34,800	44,159	54,248
$GCSD_1$	1,038	1,090	1,140	1,193	1,244	1,300
Lake Don Pedro						
UPA	2,761	2,998	3,278	3,641	4,011	4,510
TUD	15,513	18,920	20,659	22,592	24,741	26,074
Tuolumne County-$Other_2$	4,179	4,409	4,653	4,909	5,180	5,466
Calaveras County-$Other_{3,4}$	876	935	997	1,064	1,135	1,211
Alpine County-$Other_5$	25	27	28	30	31	33
Total	**28,876**	**43,275**	**54,934**	**68,228**	**80,502**	**92,842**

Source: CCWD, GCSD, TUD 2010 UWMP; UPA projections provided by UPA
1. Assumed 4.5% growth between 2030 and 2035
2. Assumed a growth rate of 1.08% per year and a gpcd of 187 based on TUD 2010 UWMP
3. Assumed a growth rate of 1.3% per year based on 2030 General Plan Update Housing Element
4. Assumed a gpcd of 215 based on CCWD 2010 UWMP
5. Assumed a growth rate of 1.08% per year and a gpcd of 187 based on TUD 2010 UWMP

2.9.2.2 Non-Consumptive Demands – Hydropower Generation

Hydropower generation is one of the essential products in the T-S Region that have resulted from harnessing the natural energy potential of the Upper Stanislaus and Tuolumne Rivers. Hydroelectric power generation facilities are a significant user of water in the T-S Region. However, hydroelectric generation is also "non-consumptive", in that water used is generally returned to the natural water system downstream of the power production facilities.

With the significant number of reservoirs and diversions in the T-S Region, it is essential to maintain minimum flow releases from the reservoirs to support aquatic species both in the watershed as well as downstream in the San Joaquin River and the Sacramento-San Joaquin Delta. FERC hydropower licenses for the projects on the Upper Tuolumne and Stanislaus Rivers include requirements for maintaining minimum in-stream flows to provide protection for downstream fisheries and other aquatic species. Conditions including temperature, turbidity, and minimum flow often must be satisfied to ensure the releases are protective of the affected ecosystems.

Flows released from the O'Shaughnessy Dam at Hetch Hetchy Reservoir to the downstream Tuolumne River must meet the flow requirements outlined in the Raker Act, which was the 1913 state legislation that allowed the City of San Francisco to construct the dam and hydropower facilities.

The FERC licenses for Lake Don Pedro stipulate environmental in-stream flow requirements. The TID and MID are currently in the process of FERC relicensing for Don Pedro Dam which is set to expire in 2016. This process will reassess the required environmental in-stream flows and describe a required flow release schedule for the Don Pedro Dam.

New Melones is a federal project and does not require a FERC license, but currently operates under an Interim Plan of Operations (IPO), which prescribes minimum flow releases. The USBR is in the process of completing a Revised Plan of Operation (RPO) for New Melones Dam. This outlines how the USBR will maintain regulated flows while meeting export water needs.

2.9.2.3 Water Exports from the Region

Water exports for consumptive uses outside the Region comprise approximately 98% of the overall water deliveries from the Stanislaus and Tuolumne Rivers on an average annual basis. The actual exports that occur each year can vary significantly based on a number of factors including water year conditions, conjunctive water use operations, and climactic conditions. **The water storage and supply agreements can be very complex. For example ~~O~~, on the Stanislaus River, Oakdale Irrigation District~~ID~~ and South San Joaquin Irrigation District~~SSJID~~ have settlement agreements which entitle them up to the first 600,000 acre-feet of inflow to New Melones Reservoir. ~~B oth~~ Stockton East Water District~~EWD~~ and Central San Joaquin Water Conservation District~~CD~~ contracted with USBR in 1985 to receive up to 75,000 and 80,000 acre-feet per year respectively of New Melones water under the Central Valley Project. Likewise, Modesto Irrigation District (MID) and Turlock Irrigation District (TID) have senior water rights on the Tuolumne River and jointly own and operate Don Pedro Reservoir. San Francisco Public Utilities Commission (SFPUC) also has significant senior water rights and diverts water into the Hetch Hetchy aqueduct under the provisions of the Raker Act for use by customers in the San Francisco Bay Area.** ~~Table 2-17 provides a summary of typical, average year exports by agency and~~ Figure 2-18~~Figure 2-18~~ shows in-Region as compared to out-of-Region demands**, and Table** 2**-**17 **provides a summary of typical, average year exports by agency**.

Table 2-17: Summary of Water Exports

River/Agency	Primary Water Use	Average Water Exports (AFY)
Stanislaus River		
OID	Agricultural and Municipal	300,000
SSJID	Agricultural and Municipal	300,000
USBR	Varies	****
Subtotal, Stanislaus River		**600,000**
Tuolumne River		
MID	Agricultural and Municipal	310,000
TID	Agricultural and Municipal	575,000
SFPUC	Municipal	252,000
Subtotal, Tuolumne river		**1,137,000**
Total Average Water Exports from the T-S Region		**1,737,000**

Source: OID Water Resources Plan; SFPUC 2010 UWMP; www.mid.com

**** USBR has a range of operational parameters for New Melones Lake including a 450,000 acre-feet flood control reservation; 300,000 acre-feet minimum pool for power generation and recreation; and instream flow requirements that vary from 300 – 500 cubic feet per second to maintain fall-run Chinook salmon spawning.

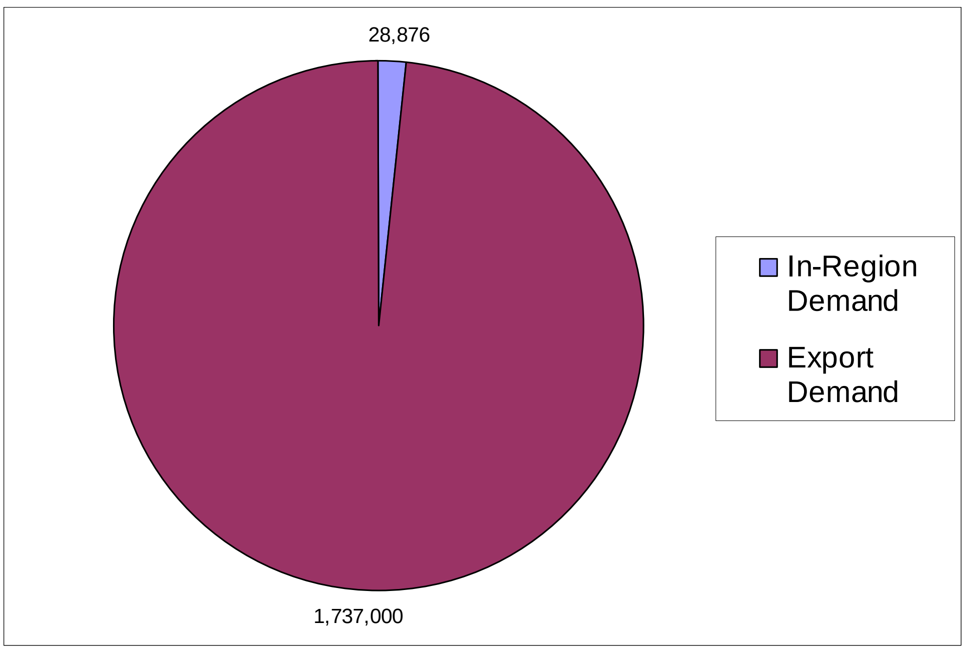


Figure 2-18: Water Demand (AFY)

Table 2-17: Summary of Water Exports

River/Agency	Primary Water Use	Average Water Exports (AFY)
Stanislaus River		
OID	**Agricultural and Municipal**	**300,000**
SSJID	**Agricultural and Municipal**	**300,000**
USBR	**Varies**	****
Subtotal, Stanislaus River		**600,000**
Tuolumne River		
MID	**Agricultural and Municipal**	**310,000**
TID	**Agricultural and Municipal**	**575,000**
SFPUC	**Municipal**	**252,000**
Subtotal, Tuolumne river		**1,137,000**
Total Average Water Exports from the T-S Region		**1,737,000**

Source: OID Water Resources Plan; SFPUC 2010 UWMP; www.mid.com

******** USBR has a range of operational parameters for New Melones Lake including a 450,000 acre-feet flood control reservation; 300,000 acre-feet minimum pool for power generation and recreation; and instream flow requirements that vary from 300 – 500 cubic feet per second to maintain fall-run Chinook salmon spawning.**

2.10 Water Related Infrastructure

2.10.1 Surface Water Infrastructure

Surface water originating from the Sierra Nevada mountain range is the primary source of water supply for the T-S Region, and a key regional export for water users outside the Region. The abundant surface water supply, combined with the natural elevation changes in the mountainous region have also resulted in the Region being ideal for hydroelectric power generation facilities. For these reasons, many upstream storage reservoirs have been constructed that provide water storage for M&I supply, flood protection, and renewable hydroelectric power generation. Water from these storage reservoirs is primarily conveyed to end users and water treatment facilities within the Region and downstream via an extensive network of ditches (unlined earth ditches and gunite lined), flumes, canals, and pipelines. Some of these conveyances were constructed in the late 1800s and early 1900s and have historic significance. Figure 2-19 depicts the major water storage, surface water conveyance, and hydroelectric infrastructure in the T-S Region.

Figure 2-19: Water Infrastructure

Water storage reservoirs located within the Stanislaus and Tuolumne River watersheds provide over 5.5 MAF of total storage as summarized in Table 2-18 below.

Table 2-18: Surface Water Storage Reservoirs

River	Reservoir	Storage Capacity (AF)	Owner	Primary Uses
North Fork Stanislaus	Lake Alpine	4,120	NCPA	Regulate flow for Downstream Power Generation
	Union Reservoir	3,130	NCPA	Regulate flow for Downstream Power Generation
	Utica Reservoir	2,330	NCPA	Regulate flow for Downstream Power Generation
	New Spicer Meadows Reservoir	189,000	NCPA (operated); CCWD (owned)	Regulate flow for Downstream Power Generation
	Hunters Reservoir	250	UPA	Municipal Use (CCWD, UPA); Power Generation (at Murphys)
	McKays Point Reservoir		NCPA	Power Generation
Middle Fork Stanislaus	Relief Reservoir	15,500	Tri-Dam	Power Generation
	Donnell Lake	64,300	Tri-Dam	Power Generation
	Beardsley Lake	97,800	Tri-Dam	Power Generation
South Fork Stanislaus	Pinecrest Reservoir	18,310	PG&E	Municipal Use (TUD); Power Generation; Recreation
	Lyons Reservoir	6,220	PG&E	Municipal Use (TUD); Power Generation
Stanislaus	New Melones Lake	2,420,000	USBR	Municipal-Agricultural Use/Flood Control / Power Generation/Recreation
	Tulloch Reservoir	67,000	Tri-Dam	Municipal Use (CCWD)/Power Generation
Tuolumne River	Lake Lloyd (Cherry Lake)	273,300	SFPUC	In Stream Flows/ Power Generation
	Lake Eleanor	27,000	SFPUC	In Stream Flows/ Power Generation
	Hetch Hetchy	360,000	SFPUC	Municipal Use for SFPUC and GCSD/Power Generation
	Don Pedro Reservoir	2,030,000	TID/MID	Agricultural Use/Flood Control/Power Generation/Recreation
Total Storage		5,577,960		

Sources: http://www.ncpahydro.com/about.htm; Draft Environmental Impact Statement for Hydropower Licenses-Stanislaus River Projects; 2010 TUD UWMP; 2010 SFPUC UWMP; http://tid.com/water/projects/don-pedro-reservoir

Table 2-19 provides a summary of the hydropower projects, power generating capacity in megawatts (MW), and rated flows in cubic feet per second (cfs).

Table 2-19: Hydropower Generation Projects

Docket Number	Project Name	Licensee	Waterway	Issue Date	Expiration Date	Authorized Capacity (MW)
2975	Sand Bar	Tri Dam	Stanislaus-Middle Fork	09/08/83	08/31/33	162.0
2130	Spring Gap-Stanislaus	PG&E	Stanislaus	04/24/09	03/31/47	90.8
2409	North Fork Stanislaus River	CCWD	Stanislaus-North Fork	02/08/82	01/31/32	258.7
1061	Phoenix	PG&E	Stanislaus-South Fork	09/30/92	08/31/22	1.8
2005	Beardsley/Donnells	OID/SSJD	Stanislaus-Middle Fork	01/30/06	12/31/46	82.5
2067	Tulloch	OID/SSJD	Stanislaus	02/16/06	12/31/46	24.1
2699	Angels	UPA	Angels Creek	09/03/03	08/31/33	1.4
2019	Utica	UPA	Silver Creek	09/03/03	08/31/33	4.5
11197	Collierville & Spicer Meadow T. L.	NCPA	Stanislaus-North Fork	02/12/92	01/31/32	0.0
2781	New Melones T.L.	PG&E	New Melones Reservoir	09/18/78	08/31/28	300.0
2299	New Don Pedro	TID	Tuolumne	03/10/64	04/30/16	168.0
11563	Upper Utica	NCPA	Silver Creek	09/03/03	08/31/33	0.0

Sources: Ferc eLibrary Issued Licenses; http://www.usbr.gov/projects/Powerplant.jsp?fac_Name=New+Melones+Powerplant (New Melones Capacity)

The majority of the surface water transmission infrastructure within the Region are owned and operated by TUD, CCWD, UPA, or PG&E. Much of the ditch systems constructed as part of the gold rush and mining operations in the 19th century are still in use today, delivering water to mines, ranches, farms, lumber mills, individual landowners, and drinking water treatment plants. The TUD owns and operates the most extensive system in the Region, with over 56 miles of canals and ditches that thread their way from high elevation to low, between forest, rural, urban, commercial and agricultural settings, and could be considered a cultural landscape. The canal and ditch system may provide a variety of social, economic and environmental benefits for the community of Tuolumne County as a whole. Among these are gravity-fed water, fire protection, wetlands, recreation, trails, living history, wildlife habitat, connectivity and migratory corridors, aesthetics, and community identity. However, many of these ditches/flumes provide a single source of water supply to their customers and are vulnerable to outages from fire, storm-related landslides and fallen trees, and other natural disasters.

2.10.2 Groundwater Infrastructure

As described previously, groundwater supply in the T-S Region is largely considered unreliable, but still provides as much as 30 percent of the water supply in Tuolumne County, and historically has been a significant water supply in southern Calaveras County. Groundwater wells constructed in fractured bedrock and metamorphic formations are owned and operated by private landowners, small public water systems (systems with less than 200 connections), and larger water utilities. For example, TUD maintains 26 wells, some of which are used to supply make-up water to replace reduced surface water availability during droughts and ditch outages.

Groundwater is the only water supply source for many of the small water systems in the T-S Region. The majority of the small water systems within Tuolumne County that are regulated by the County's Environmental Health Division rely exclusively on individual small capacity wells. A large portion of these small water systems are also disadvantaged communities, and are currently unable to afford needed infrastructure investments to procure a more reliable and long-term water source.

Groundwater has historically been a primary supply source in the Salt Springs Valley area of Calaveras County for agricultural uses, however due to overdraft and poor water quality conditions (including high salinity and nitrate concentrations), is no longer considered a reliable source of water for future users. The municipal use of groundwater in the Region has been delisted by the RWQCB as one of the beneficial uses.

2.10.3 Wastewater and Recycled Water Infrastructure

Wastewater collection and treatment throughout the T-S Region includes both sewered areas with wastewater treatment plants (WWTPs) operated by municipalities, and areas with onsite septic systems. Sewage collection systems, WWTPs, and onsite septic systems each present distinct water quality and resources management challenges.

There are a total of 12 wastewater collection and treatment systems within the T-S Region, including 5 systems owned and operated by CCWD, as well as systems owned and operated by TUD, Twain Hart Community Services District (THCSD), Jamestown Sanitary District, Murphy's Sanitary District, City of Angels, Groveland Community Services District, and Lake Don Pedro Sewer District, as summarized in Table 2-20 below. Each of these agencies is committed to managing their collection, treatment, and disposal systems in a manner that is protective of the environment and meets Clean Water Act requirements. Some sewered areas, such as CCWD's Copper Cove/Copperopolis system and Groveland CSD's system are located in very close proximity to surface water bodies. CCWD's Copper Cove/Copperopolis system, which serves over 1,700 connections, is located adjacent to Tulloch Reservoir, and in many cases is lower in elevation than the reservoir itself. For this reason, this area is particularly susceptible to contaminating Tulloch Reservoir if an unintended sanitary sewer overflow occurs.

Table 2-20: Wastewater Collection and Treatment Systems

Treatment System (owner)	Capacity (gpd)	Number of Connections	Treatment Level	Disposal Method
CCWD – Copper Cove	230,000 (secondary) 950,000 (tertiary)	1,741	Secondary and Tertiary	
CCWD – Indian Rock Vineyards	6,000	20	Secondary	
CCWD – Vallecito	65,000	254	Secondary	
CCWD – Forest Meadows	190,000	604	Secondary	
CCWD - Arnold	170,000	457	Secondary	
TUD	2,600,000	9,000	Secondary	Storage at Quartz Reservoir and agricultural irrigation
City of Angels	600,000	1,569	Tertiary	Irrigation for a golf course and pasture
Tuolumne Sanitary District	360,000	850		Spray evaporation ponds
Jamestown Sanitary District	280,000	1,250	Secondary	Storage at Quartz Reservoir and agricultural irrigation
GCSD	250,000	1,500	Secondary	Spray fields, evaporation ponds, irrigation for golf course
Murphy's Sanitary District	185,000	783	Secondary	Drip Irrigation
THCSD	N/A	1,500	Primary	Send to Regional TUD Wastewater Treatment Facility

Source: 2007 TUD MSR, 2011 Calaveras MSR, 2007 Foothill Watershed Assessment, 2007 GCSD MSR, 2007 THCSD MSR

GCSD operates a wastewater treatment plant that serves approximately 1,500 customers with a capacity of 250,000 gpd. The plant consists of primary and secondary treatment and disposes of its effluent by storing it in two storage ponds then sending it either to the Pine Mountain Lake Golf Course or to 14 acres of spray fields. GCSD's sewer system consists of 16 lift stations, 7 miles of force main and 35 miles of gravity lines.

The largest wastewater system is TUD's Regional WWTP, which receives flow from both the TUD and THCSD wastewater collection systems and has a design capacity of 2.6 million gallons per day (MGD). The Regional WWTP is a secondary level WWTP that utilizes screening, grit removal, primary clarification, trickling filtration, secondary clarification, effluent ponds, and disinfection. The secondary treated wastewater is comingled with secondary treated wastewater from Jamestown Sanitary District, and reused for agricultural applications (see Section 2.3.3.5). Occasionally, treated wastewater is discharged to Woods Creek during wet weather conditions when there is insufficient remaining capacity in the wastewater storage reservoir, Quartz Reservoir.

Individual, onsite septic systems are also very common within the T-S Region, as only a portion of the residents with community water service connections also have wastewater connections. Failed leaking onsite wastewater treatment systems are believed to be causing surface water and groundwater contamination issues.

2.10.4 Water Treatment and Distribution Infrastructure

Water treatment is required for all drinking water supplies from surface water in the Region, with the exception of Groveland CSD, which obtains water from SFPUC's Hetch-Hetchy water system and has obtained a treatment avoidance exemption from the USEPA. GCSD and the other water agencies that utilize surface water, including CCWD, TUD, City of Angels, UPUD, and LDPCSD, operate facilities that are compliant with the Safe Drinking Water Act and California drinking water standards codified under the Title 22 California Code of Regulations and regulated by the California Department of Public Health (CDPH). Due to the highly variable topography in the Region, it was originally not seen as practical to create large, interconnected distribution systems. For this reason, there are a significant number of water treatment plants, storage tanks and reservoirs, and satellite distribution systems relative to the population in the Region, as summarized below. This vast, aging infrastructure requires significant effort to maintain in reliable condition and keep it compliant with evolving drinking water quality regulations. A number of municipal groundwater wells also have wellhead treatment systems, primarily for iron and manganese.

- TUD – From Lyons Reservoir, water is conveyed through a series of open ditches, flumes and reservoirs prior to reaching its 14 surface WTPs. The WTPs range in capacity from 50 gpm (Brentwood) to 2,800 gpm (Sonora). TUD also maintains more than 80 treated water storage tanks and reservoirs.

- GCSD – From SFPUC's mountain tunnel, water is pumped into two (2) clearwells where it is chlorinated and the pH is lowered prior to pumping through two transmission mains to the system.

- CCWD – The Ebbetts Pass/Hwy 4 system receives water from the North Fork Stanislaus River through the Collierville Tunnel prior to conveyance to the Hunters Lake Water Treatment Plant with a capacity of 4 mgd. The distribution system contains 17 storage tanks. The Copper Cove/Copperopolis system receives water from the North Fork Stanislaus River through Tulloch Reservoir prior to conveyance to a 4.0 mgd water treatment plant. The distribution system contains one clear well and four storage tanks.

- City of Angels – The City of Angels receives water from the North Fork Stanislaus River through the Collierville Tunnel, Hunter's Reservoir, then via the UPA canal/flume system to Angels Creek/Angels Ditch and then into the 90 acre-feet Ross Reservoir which feeds the Angel's Water Treatment Plant. The distribution system contains a 2.5 million gallon treated water tank and 32 miles of distribution pipeline.

- Others – LDPCSD uses groundwater local groundwater although the LDPCSD is adjacent to New Don Pedro Reservoir. The LDPCSD does not have water rights or contracts for water from the lake.

2.11 Water Quality

There are many tools, whether regulatory, voluntary, or incentive based, currently available for preventing pollution. The US EPA, SWRCB, and Regional Water Quality Control Boards (RWQCBs) have permitting, enforcement, remediation, monitoring, and watershed-based programs to prevent pollution. Pollution can enter a water body from point sources like WWTPs and/or other industries that directly discharge to the river and from nonpoint sources over a broad area, such as runoff from a city and/or agricultural farmland or grazing areas located adjacent to stretches of the river reach. Some nonpoint source (NPS) contaminants are naturally occurring in local rocks and soil, such as heavy metals, (arsenic, chromium, selenium). Preventing pollution from most point sources relies on a combination of source control and treatment, while preventing NPS pollution generally involves the use of best management practices (BMPs), efficient water management practices, and source control. NPS pollution is not typically associated with discrete conveyances.

The Safe Drinking Water Act (SDWA) was originally passed by Congress in 1974 to protect public health by regulating the nation's public drinking water supply. SDWA applies to every public water system in the United States. SDWA authorizes the US EPA to set national health based standards for drinking water to protect against both naturally-occurring and man-made contaminants that may be found in drinking water. Originally, SDWA focused primarily on treatment as the means of providing safe drinking water at the tap and drinking water standards are based on health risk balanced by economic factors. Amendments in 1996 greatly enhanced the existing law by recognizing source water protection, operator training, funding for water system improvements, and public information as important components of safe drinking water. Under the SDWA, technical and financial aid is available for certain source water protection activities. In California, the California Department of Public Health regulates drinking water in community water systems.

The Federal Clean Water Act (CWA) contains two strategies for managing water quality including: (1) a technology-based approach that envisions requirements to maintain a minimum level of pollutant management using the best available technology; and (2) a water quality based approach that relies on evaluating the condition of surface waters and setting limitations on the amount of pollution that the water can be exposed to without adversely affecting the beneficial uses of those waters. Oftentimes, limits to water quality are based on the sensitivity of the ecosystem in the receiving water to contaminants, often at trace levels well below drinking water standards. Section 303(d) of the CWA bridges these two strategies. Section 303(d) requires that the States make a list of waters that are not attaining standards after the technology-based limits are put into place. For waters on this list (and where the US EPA administrator deems they are appropriate) the States are required to determine all the sources of the pollutants that caused the water to be listed including, contributions from point sources and non-point sources. Impaired water bodies within the T-S Region are listed in Table 2-21 and shown on Figure 2-20. This table identifies E.coli and mercury as the two major pollutants identified within the Region.

Table 2-21: Impaired Water Bodies

Water Body	Watershed	Affected Area	Unit	Pollutant	Final Listing Decision
Upper Tuolumne River					
Curtis Creek (Tuolumne County)	Upper Tuolumne River	12	Miles	Escherichia coli (E. coli)	List on 303(d) list (TMDL required list)
Don Pedro Lake	Upper Tuolumne River	11,056	Acres	Mercury	Do Not Delist from 303(d) list (TMDL required list)
Hetch Hetchy Reservoir	Upper Tuolumne River	1,840	Acres	Mercury	List on 303(d) list (TMDL required list)
Sullivan Creek (from Phoenix Reservoir to Don Pedro Lake, Tuolumne County)	Upper Tuolumne River	11	Miles	Escherichia coli (E. coli)	List on 303(d) list (TMDL required list)
Woods Creek (Tuolumne County)	Upper Tuolumne River	15	Miles	Escherichia coli (E. coli)	List on 303(d) list (TMDL required list)
Upper Stanislaus River					
New Melones Reservoir	Upper Stanislaus River	1,654	Acres	Mercury	List on 303(d) list (TMDL required list)
Tulloch Reservoir	Upper Stanislaus River	992	Acres	Mercury	List on 303(d) list (TMDL required list)
Rock Creek-French Camp Slough					
Littlejohns Creek	Rock Creek-French Camp Slough	68	Miles	Escherichia coli (E. coli)/ Unknown Toxicity	List on 303(d) list (TMDL required list)

1. Data based on combined 2010 303(d) Data.

Figure 2-20: 303(d) Impaired Water Bodies

The federal CWA, as well as the State Porter-Cologne Water Quality Control Act, requires water quality control plans to establish water quality standards which address beneficial uses of water sources. The CVRWQCB has established and adopted the Water Quality Control Plan for the Sacramento/San Joaquin (Basin Plan). The Basin Plan describes designated beneficial uses to be protected, water quality objectives to protect those uses, and a program of implementation needed for achieving the objectives. Beneficial uses, together with their corresponding water quality objectives, meet federal regulatory criteria for water quality standards. Hence, the Basin Plan serves as regulatory references for meeting both State and federal requirements for surface and groundwater water quality control in the Region.

2.11.1 Surface Water Quality

Surface water quality in the T-S Region is generally considered very good and compatible with most intended beneficial uses. For example, most of the water from the Tuolumne River is usable for human consumption with disinfection alone although SDWA regulations require more stringent treatment. Water quality based on environmental standards for fishes and other aquatic life is also good, although 303(d) impaired water bodies exist within the Region for seven (7) water bodies, with contamination of E*. coli* or mercury.

The majority of the surface water quality issues identified within the Region can be linked back to current or historical land use within the Region. Historical mining within the area largely affected the landscape and water quality within the Region. Gold mining within the Region has been linked to the 303(d) listing of four (4) of its water bodies for mercury contamination within the Region, spanning both the Stanislaus and Tuolumne River Watersheds.

Septic systems, grazing and water based recreation activities have been associated with to E. coli contamination within the Region. The 303(d) listed four (4) waterbodies within the Region for E. coli contamination. This contamination within the Region has led to the need for upgrades in some of the drinking water treatment plants within the Region to increase the removal of *Cryptosporidium*, *Giardia lamblia* and *E.coli* which may not be affectively removed using the conventional treatment methods previously used within the Region. Contamination of these waters from both manmade and natural sources occurs either in the source water or during transport through supply systems.

Additional water quality concerns limited to specific water diversion points include disinfection byproducts (DBPs) including halo-acetic acids and total trihalomethanes which have been detected above the MCL within the Stanislaus River Watershed at the Murphys Water Treatment Plant (WTP). DBP formation is usually linked to organic carbon in the source water. Overall water quality is good with generally low temperature readings, dissolved oxygen (DO) readings around 7.0 mg/L or greater, low concentrations of nutrients such as nitrate and phosphate and metals at undetectable levels. No persistently present constituents have been identified in the surface water requiring additional treatment processes, with the exception of *Cryptosporidium*, *Giardia lamblia* and *E.coli* which has been detected through Long Term 2 Enhanced Surface Water Treatment Rule (LT2) sampling. TUD is currently evaluating treatment options and is planning to upgrade treatment at three (3) existing water treatment plants including Columbia WTP, Monte Grande WTP and Ponderosa WTP to treat these microorganisms and to address the LT2 requirements.

Table 2-22: Surface Water Quality Constituents of Concern by Use

Constituent	End Use			
	Drinking Water	Irrigation	Environmental	Recreation
Bacteriological contamination (including e. coli, cryptosporidium, giardia)	*			
E. coli	X			X
Mercury			X	
Trihalomethanes	*			

X = Constituent on 303(d) list water quality regulations
* = Constituent identified by local stakeholders/local documents as source of impairment

2.11.2 Groundwater Quality

Groundwater basins within the Region generally consist of fractured bedrock. These basins are susceptible to infiltration and thus have variable water quality. Despite this, groundwater is still extensively used throughout the Region. Constituents naturally present that require treatment are primarily the naturally occurring constituents iron and manganese. The EPA Secondary Maximum Contaminant Limit (SMCL) for iron is 0.3 mg/L and the SMCL for manganese is 0.05 mg/L. These limits are not required treatment standards, but recommended standards for drinking water. TUD has a number of wells with high iron and manganese that they currently treat. Other constituents such as perchloroethylene, low pH and Freon have required treatment at one or more wells within the T-S Region. Perchlorethylene has been historically used in dry cleaning agents and freon has been used in refrigerants, propellants and solvents.

Other sources of groundwater contamination within the T-S Region are improperly placed and maintained septic systems as well as leaking underground storage tanks (LSTs). Many septic systems were installed prior to the requirement of a soil investigation and health study to demonstrate long term feasibility of the septic system prior to its installation; thus, the areas of most concern are generally associated with older residences where wells were drilled prior to the passing of these regulations. Septic system contamination leads to bacteriological contamination within groundwater wells that can become problematic for domestic use of local groundwater. LSTs are an issue throughout the United States due to their presence at nearly every gas station as well as in other locations. A report conducted in 1999, described 46 sites within Tuolumne County where groundwater contamination has been attributed to these leaking LSTs.

There are very small portions of DWR-defined Bulletin 118 groundwater basins in the Region. A small portion of the Eastern San Joaquin River Subbasin (Groundwater Basin Number 5-22.01) is located within the most eastern portion of Calaveras County located within the Region Boundary. An even smaller area of the Modesto Subbasin (Groundwater Basin Number 5-22.02) is located within the most eastern portion of Tuolumne County. Both are part of the larger San Joaquin Valley Basin. The San Joaquin Valley Basin has been historically overdrafted leading to poor water quality with issues such as high TDS. Because the areas within the Region are so small, little pumping from these basins occurs within the Region and data on these basins does not exist. As described earlier, CCWD overlies a portion of the Eastern San Joaquin River Subbasin and has begun to create a groundwater study to help manage the use of this water within their District.

2.11.3 Water from Storage

Water from storage can have variable water quality dependent on contaminant sources from non-point sources along the storage reservoir as well as the influent water quality. Most storage reservoirs within the T-S Region, such as Hetch Hetchy Reservoir, are considered to have pristine water quality, based on potable use standards. Hetch Hetchy Reservoir does not require filtration for potable use. However, Phoenix Lake, used as a water source for TUD, has been subject to variable water quality. Water quality within the lake is declining due to contamination, siltation and invasive exotic aquatic vegetation. Taste and odor complaints at downstream distribution systems to Phoenix Lake often attribute their water quality issues to the Lake.

Additionally, four (4) reservoirs in the Region have TMDLs for mercury. The levels present in these reservoirs, do not require treatment for potable use, but are considered a water quality issue for aquatic species. These reservoirs are Hetch Hetchy, Don Pedro, New Melones, and Tulloch Reservoirs.