Stanislaus River 2021 Watershed Sanitary Survey

Prepared for

California Department of Forestry and Fire Protection
Calaveras County Water District
City of Angels Camp
California Department of Corrections and Rehabilitation
Knights Ferry Community Services District
Pinecrest Permittees Association
South San Joaquin Irrigation District
Stockton East Water District
Tuolumne Utilities District
Union Public Utility District

WQTS
Water Quality & Treatment Solutions, Inc.
An environmental engineering and science consulting company

Karen E. Johnson
Water Resources Planning

June 2021

STANISLAUS RIVER

2021 WATERSHED SANITARY SURVEY

PREPARED FOR

California Department of Forestry and Fire Protection

Calaveras County Water District

City of Angels Camp

California Department of Corrections and Rehabilitation

Knights Ferry Community Services District

Pinecrest Permittees Association

South San Joaquin Irrigation District

Stockton East Water District

Tuolumne Utilities District

Union Public Utility District

June 2021

Prepared by

WQTS
Water Quality and Treatment Solutions, Inc.
An environmental engineering and science consulting company.

Karen E. Johnson
Water Resources Planning

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

When California adopted the federal Surface Water Treatment Rule, a requirement was included that public water systems conduct a watershed sanitary survey (WSS) and update it every five years. The Stanislaus River 2021 WSS covers the years 2016 to 2020 for the following members of the Stanislaus/Calaveras River Group (SCRG), a consortium of publicly owned utility drinking water purveyors utilizing Stanislaus River watershed water supplies.

- Baseline Conservation Camp (BCC) (California Department of Forestry and Fire Protection)
- Calaveras County Water District (CCWD)
- City of Angels Camp
- Sierra Conservation Center (SCC) (California Department of Corrections and Rehabilitation)
- Knights Ferry Community Services District (KFCSD)
- Pinecrest Permittees Association (PAA)
- South San Joaquin Irrigation District (SSJID)
- Stockton East Water District (SEWD)
- Tuolumne Utilities District (TUD)
- Union Public Utility District (UPUD)

The watershed includes all lands draining to the Stanislaus River and its tributaries upstream of the lowest intake at the Knights Ferry Community Services District secondary water treatment plant (WTP) intake. Two sub-watersheds are also included in the study area: Woodward Reservoir and its delivery system of South San Joaquin Main Canal for SSJID; and the New Melones Conveyance System, including Farmington Flood Control Basin and the Upper and Lower Farmington Canal for SEWD. The water supply reservoirs and lakes include Lake Alpine, Utica and Union reservoirs, New Spicer Meadow Reservoir, McKays Point Reservoir, Hunters Reservoir, Cadematori Reservoir, Ross Reservoir, Pinecrest Lake, Lyons Reservoir, New Melones Reservoir, Tulloch Reservoir, Goodwin Reservoir, Woodward Reservoir, and Farmington Flood Control Basin. There are 12 water treatment plants diverting water from the Stanislaus River and its tributaries that are addressed in this WSS.

The objectives of this WSS are to:

1. comply with California State Water Resources Control Board, Division of Drinking Water requirements,
2. prepare an inventory and assessment of potential contaminant sources,
3. review water quality data and evaluate ability to comply with drinking water regulations, and,
4. present findings and any recommendations to maintain and improve water quality.

The following groups of potential contaminant sources were reviewed and presented in this WSS.

- Forestry activities, such as timber clearing
- Irrigated agricultural lands and use of pesticides
- Livestock, dairies, and poultry
- Mining and legacy mine sites
- Public access recreation
- Solid and hazardous wastes

- Urban runoff and contaminant spills
- Wastewater operations (e.g., spray and leach fields)
- Wildfire events and resultant burned areas
- Wildlife and habitat trends

Most categories above present a low to medium risk to water quality in the Stanislaus River watershed. There is no direct correlation with adverse water quality impacts from most land uses and activities in the study period. However, there were elevated levels of total coliforms during dry years and elevated levels of *E. coli* and elevated turbidity levels during wet years particularly during rainfall events. Year 2016 was the last of five years of drought in California, one of the driest periods on record. 2017 on the other hand - particularly January - was one of the wettest winters on record.

Potential sources of microbial contamination may be associated with livestock grazing, recreation, failing septic systems, and or wildlife. Cattle graze throughout the watershed; primarily in the lower rolling foothills in the winter and in the higher elevations in the summer. Recreation with body contact in waterbodies occurs throughout the watershed. Most of the watershed is not connected to public sewer systems; as these on-site wastewater systems age, they tend to fail, particularly during rainfall events, with raw sewage potentially flowing to waterbodies unnoticed. In addition, Canada geese and other wildlife tend to congregate at streams and reservoirs during migration periods. In addition to the microbial risks, wildfires are considered a high risk to water quality in the watershed. Raw water quality to New Melones via the Middle Fork Stanislaus River will be experiencing impacts from the 2020 Donnell Fire, which burned over 36,400 acres, for years to come.

During 2016 to 2020, individual intakes for the SCRG participating agencies experienced challenging water quality conditions. These included periods of elevated levels of total coliforms, occasional elevated levels of *E. coli*, turbidity spikes, increases in TOC and the production of elevated DBPs. For some WTPs intakes the increase in total coliforms was especially noticeable during 2016. Several agencies completed the two-year monthly source water *Cryptosporidium* monitoring required under the Long Term 2 Enhanced Surface Water Treatment Rule. No increased risks from *Cryptosporidium* were identified.

During the study period, four of the participating agencies received compliance orders for not meeting the MCLs for THMs or HAA5. The fact that all of the systems within the watershed use free chlorine (sodium hypochlorite) for primary and secondary disinfection, combined with longer residence times in the distribution system (due to conservation measures) has led to an increase in the production of DBPs. With California likely entering another period of extended drought, these challenges are likely to continue during the foreseeable future.

RECOMMENDATIONS

The following recommendations reflect areas where SCRG member agencies have some ability to control source water quality within the Stanislaus River watershed along with other recommendations to improve water quality.

- Continually review data for the presences of pathogens associated with failing or leaking OWTSs. Continue working with Calaveras County and Tuolumne County Environmental Health departments, and to a lesser extent Alpine and Stanislaus counties, to be notified of any reports of spills or leakage. Work with the counties to solicit funding sources to cover the cost of additional monitoring, oversight, and replacement of aging wastewater systems near watershed waterbodies. Work with the counties to encourage homeowners to notify the County of any problems with their own OWTS or any leaking systems they may discover.

- Algae should continue to be monitored in Woodward Reservoir (and SSJID could consider increasing the frequency of monitoring) because of the risk of nutrient loading in runoff of agricultural lands (both livestock grazing and orchards) draining to the reservoir, nutrient loading upstream at Tulloch Reservoir from residential lands and grazing in the watershed, and/or Woodward Reservoir's location in the lower watershed with warmer weather and lack of year-round inflows. It is difficult to control agricultural land runoff because SSJID does not own the land. Additional monitoring of potential nutrient source contributions into Woodward Reservoir is also recommended to help define the problem.
- Options that SCRG agencies can consider for minimizing the formation of DBPs include installation of GAC filters for better TOC removal and converting the secondary disinfectant from free chlorine to chloramine. Each of these options has challenges: the expense of GAC and for chloramines there is the possibility that systems could experience nitrification in storage facilities or within low flow areas of the distribution system, that could lead to the loss of disinfectant residual.
- SSJID should increase the frequency of the annual holiday microbiological monitoring program in Woodward Reservoir and conduct the monitoring on a monthly basis at the same five locations to better understand the levels of total coliforms and *E. coli* during different times of the year.
- SSJID should add weekly microbiological monitoring one month before and one month after music festivals at Woodward Reservoir.
- SCRG participating agencies should consider developing a joint monitoring and communication plan with locations throughout the watershed to identify potential inputs of nutrients and the occurrence of algal blooms.
- Related to the above recommendation, in 2021 it is anticipated that DDW will issue Notification Levels for up to four cyanotoxins. SCRG agencies should consider developing a joint cyanotoxin monitoring and response plan for the entire watershed. Components of such a plan could include visual inspections for the presence of algal blooms, routine monitoring for algal cells and nutrients, and triggers to begin raw water monitoring for presence of algal toxins. Combined with developing these plans, agencies should evaluate the effectiveness of their current treatment processes to remove or destroy cyanotoxins.
- Maintaining water quality records is a critical activity for public water systems and takes time and resources. The maintenance of complete records for the participating SCRG agencies varied. SCRG agencies should consider establishing a shared centralized database that would incorporate sample locations and results from each agency. Each SCRG agency should commit to update the database with water quality data on a regular schedule (i.e., quarterly). The centralized database could be established to focus on key raw water quality parameters, including total coliforms, *E. coli*, turbidity, and TOC.
- One way to implement the above recommendation is to investigate available off the shelf data management packages. These may be a viable tool for the SCRG agencies to use as a centralized water quality database. Contract laboratories can upload water quality results directly into these software packages for each SCRG member's access and use.

SECTION 1 INTRODUCTION

This introduction section presents the regulatory requirements for a Watershed Sanitary Survey (WSS), survey methods, report organization, and abbreviations and acronyms.

REGULATORY REQUIREMENT FOR A WATERSHED SANITARY SURVEY

The federal Surface Water Treatment Rule (SWTR) promulgated by the U.S. Environmental Protection Agency (EPA) in 1989 includes a recommendation for all surface water systems to prepare watershed control plans. The State of California Title 22, Code of Regulations (CCR), Article 7, Section 64665, however, requires all water suppliers to conduct a watershed sanitary survey of their watersheds at least once every five years that evaluates potential contaminant sources within the watershed that may impact drinking water quality.

Title 22 of the California Code of Regulations requires that the initial WSS include a physical and hydrological description of the watershed, a summary of source water quality monitoring data, a description of activities and sources of contamination, a description of watershed control and management practices, an evaluation of a system's ability to meet requirements of Title 22, Chapter 17, Surface Water Filtration and Disinfection Treatment, and recommendations for corrective actions. Updates must include a description of any significant changes that have occurred since the last survey which could affect the quality of the source water. The first Stanislaus River WSS was completed in February 1996, and the most recent update was completed in 2016. This WSS is for the planning period of January 2016 through December 2020.

STANISLAUS/CALAVERAS RIVER GROUP

Numerous agencies divert drinking water from the Stanislaus River and its tributaries; these agencies have formed the Stanislaus/Calaveras River Group (SCRG) as a mechanism through which to prepare the WSS. The SCRG is composed of Stockton East Water District (SEWD), Calaveras County Water District (CCWD), Tuolumne Utilities District (TUD), Union Public Utility District (UPUD), South San Joaquin Irrigation District (SSJID), City of Angels Camp, Pinecrest Permittees Association[1], California Department of Forestry and Fire Protection (CALFIRE), California Department of Corrections and Rehabilitation (CDCR), and Knights Ferry Community Services District (KFCSD).

For the purposes of this report, the entire Stanislaus River watershed is included upstream of the community of Knights Ferry at the KFCSD secondary intake. Also included in this WSS are three subwatersheds that are on the Stanislaus River: Woodward Reservoir/South San Joaquin Main Canal, the New Melones Conveyance System, and the Utica Ditch. Woodward Reservoir and the New Melones Conveyance System receive water from the Stanislaus River as well as their own small watersheds.

---

[1] In the 2016 Stanislaus River Watershed Sanitary Survey the US Forest Service (USFS) participated as a member of the SCRG. In 2017 the USFS shut down their treatment plant and connected to the distribution system of the Pinecrest Permittees Association, who also use Pinecrest Lake as one of their sources of drinking water.

SURVEY METHODS

WQTS, Inc. and Karen Johnson Water Resources Planning prepared this watershed sanitary survey. A literature search consisted of collecting and reviewing reports, maps, aerial photographs, data, file documents, and other information from government agencies and others responsible for land uses and activities in the watershed. Telephone and email contacts were made with various entities for updated information and data. Because of the coronavirus pandemic during the development of this WSS, most telephone calls from public agencies, with the exception of water and sanitation districts, for data requests were not returned.

The project kick-off meeting was held February 24, 2021. Prior to the kick-off meeting the SCRG participating agencies were provided with a written data request. The requested data included: water quality data, modifications to intake and/or treatment facilities, changes in watershed management, etc. A field survey of selected locations in the watershed was conducted in April following all coronavirus protection protocols. A shared public Dropbox™ folder was set up to allow the easy exchange of large amounts of data and files. This 2021 WSS update brings forward some of details of existing land uses and other information presented in previous surveys, however, the focus is on updating relevant information and changes during the 5-year period 2016 through 2020.

REPORT ORGANIZATION

This report presents a description of the watershed, SCRG intake and treatment facilities, updated information on potential contaminant sources, and an analysis of water quality data. The content and organization of this WSS are consistent with the format recommended in the American Water Works Association California-Nevada Section Watershed Sanitary Survey Guidance Manual.

Report chapters are described below. Appendices provide supporting information and data tables.

SECTION 1 – INTRODUCTION. This section presents the purpose of the watershed sanitary survey, survey methods, report organization, and abbreviations and acronyms used in the report.

SECTION 2 – WATERSHED CHARACTERISTICS AND INFRASTRUCTURE. This chapter provides background information on the watershed study area and how the intakes and other surveys were used to establish the boundary. It describes natural physical and hydrologic characteristics. A summary is provided of the SCRG surface water supplies and primary infrastructure related to conveying raw water along with brief descriptions of the SCRG agency treatment facilities.

SECTION 3 – POTENTIAL CONTAMINANT SOURCES. This section provides a summary and update of potential contaminant sources by land use. Each primary land use is described in terms of significance for the potential to impact drinking water quality, potential contaminant sources in this watershed, and agencies with watershed water quality protection responsibility and their management activities.

SECTION 4 – WATER QUALITY REVIEW. Current drinking water regulations are summarized in this section, as well as the anticipated drinking water regulations within the next five years. Presented here are source water quality data from the watershed study area and treated water quality data from the various treatment facilities for the study period of 2016 through 2020.

SECTION 5 – CONCLUSIONS AND RECOMMENDATIONS. This section provides a summary of key findings and a list of recommendations.

APPENDICES –

ABBREVIATIONS AND ACRONYMS

ACH	aluminum chlorohydrate
AL	Action Level
BCC	Baseline Conservation Camp
BLM	Bureau of Land Management
BMP	Best Management Practices
BOF	Bureau of Forestry
BTEX	benzene, toluene, ethylbenzene, and xylene
BVWWTF	Bear Valley Wastewater Treatment Facilities
$CaCO_3$	calcium carbonate
CDFA	California Department of Food and Agriculture
Cal EPA	California Environmental Protection Agency
CAL FIRE	California Department of Forestry and Fire Protection
Cal OES	California Office of Emergency Services
CAWWTP	City of Angels Wastewater Treatment Plant
CCL	Contaminant Candidate List
CCR	Code of Regulations
CCWWRF	Copper Cove Wastewater Reclamation Facilities
CCWD	Calaveras County Water District
CDCR	California Department of Corrections and Rehabilitation
CDPR	California Department of Pesticide Regulation
CDFW	California Department of Fish and Wildlife
CFU	Colony Forming Units
CIWMB	California Integrated Waste Management Board
CUPA	Certified Unified Program Agency
CVRWQCB	Central Valley Regional Water Quality Control Board
DAF	dissolved air flotation
DBP	disinfection by-products
D/DBP	disinfectants/disinfection by-products
DDW	SWRCB Division of Drinking Water
DJW WTP	Dr. Joe Waidhofer Water Treatment Plant
DO	Dissolved Oxygen
CDOF	California Department of Finance
DWR	California Department of Water Resources
DQAP	Dairy Quality Assurance Program
E. coli	Escherichia coli
EMA	Emergency Management Agency

FCB	Farmington Flood Control Basin
FMWWRP	Forest Meadows Wastewater Reclamation Plant
GPD	gallons per day
GPM	gallons per minute
HAA	Haloacetic Acid
HAA5	Five Haloacetic Acids
IESWTR	Interim Enhanced Surface Water Treatment Rule
KFCSD	Knights Ferry Community Services District
L	liter
LRAA	Locational Running Annual average
LT1ESWTR	Long Term 1 Enhanced Surface Water Treatment Rule
LT2ESWTR	Long Term 2 Enhanced Surface Water Treatment Rule
LUST	Leaking Underground Storage Tank
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MG or mgal	million gallons
MGD	million gallons per day
mg/L	milligrams per liter
mL	milliliter
MPN	Most Probable Number
MS4	Municipal Separate Storm Sewer System
MSD	Murphys Sanitary District
MRDL	Maximum Residual Disinfectant Level
NL	Notification Level
NOM	natural organic matter
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NTU	Nephelometric Turbidity Units
OHV	Off-Highway Vehicle
PG&E	Pacific Gas and Electric
PSI	Pounds Per Square Inch
PWS	Public Water System
RAA	Running Annual average
RCD	Resource Conservation District
RWQCB	Regional Water Quality Control Board
SCC	Sierra Conservation Center
SCRG	Stanislaus/Calaveras River Group
SDWA	Safe Drinking Water Act
SEWD	Stockton East Water District
SMARA	Surface Mining and Reclamation Act
SOC	Synthetic Organic Chemicals
SPI	Sierra Pacific Industries
SSJID	South San Joaquin Irrigation District
SSO	sanitary sewer overflow
STEP	septic tank effluent pumping system

SUVA	Specific UV Absorbance
SWRCB	State Water Resources Control Board
SWTR	Surface Water Treatment Rule
TDS	Total Dissolved Solids
THMs	Trihalomethanes
THP	Timber Harvest Plan
Title 22	Division 4, Chapter 3, Title 22, California Code of Regulations
TMDL	Total Maximum Daily Load
TOC	Total Organic Carbon
TUD	Tuolumne Utilities District
UCMR	Unregulated Contaminant Monitoring Rule
µg/L	Micrograms Per Liter
UPUD	Union Public Utility District
USACOE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation
USDA	United States Department of Agriculture
USFS	United States Forest Service
US EPA	United States Environmental Protection Agency
UST	Underground Storage Tank
UV	ultraviolet
WDR	Waste Discharge Requirements
WFMP	Working Forest Management Plan
WTP	Water Treatment Plant
WWTF	Wastewater Treatment Facilities
WWTP	Wastewater Treatment Plant

SECTION 2 WATERSHED CHARACTERISTICS AND INFRASTRUCTURE

The Stanislaus River is a tributary of the San Joaquin River, extending from an extensive network of tributaries in the Sierra Nevada to its confluence with the San Joaquin River in the San Joaquin Valley south of Stockton. For the purpose of this study, the Stanislaus River watershed includes the entire watershed upstream of Knights Ferry Community Services District's secondary intake in the community of Knights Ferry. Figure 2-1 presents the Stanislaus River watershed boundary, primary tributaries, and larger communities. This section describes the participating agencies, study area characteristics, and water supply systems.

PARTICIPATING AGENCIES

The ten SCRG participating agencies operate 12 primary drinking water intakes and 11 surface water treatment plants (WTP). The WTPs included in this Stanislaus River WSS are described here.

- CCWD owns and operates two WTPs in the watershed: Copper Cove WTP, which has its intake on the Black Creek arm of Tulloch Reservoir, and Hunters WTP in the upper watershed, which has its primary intake from the Collierville Tunnel, diverted from McKays Reservoir on the North Fork Stanislaus River (with a backup intake at Hunters Reservoir). CCWD also owns the New Spicer Meadow Reservoir for water storage farther upstream along the Highland Creek tributary.
- The Pinecrest Permittees Association owns and operates an inline filtration plant with the intake located in Pinecrest Lake.
- TUD has a primary intake at Lyons Reservoir and a secondary intake at New Melones Reservoir. TUD operates 14 WTPs. For this WSS, raw and treated water quality data collected from the Upper Basin WTP was included.
- UPUD owns and operates a WTP in the Town of Murphys, with an intake on the Utica Ditch which diverts water from the North Fork of the Stanislaus River at Cadematori Reservoir.
- The City of Angels Camp owns and operates a WTP in Angels Camp. Water is diverted from Utica Ditch/Angels Creek to Ross Reservoir which serves as a storage reservoir. Water from Ross Reservoir travels through several miles of ditch to the Angels Forebay. The WTP is located adjacent to the Angels Forebay.
- CAL FIRE owns and operates the Baseline Conservation Camp WTP; the intake is located on the Stanislaus River approximately two miles downstream of New Melones Reservoir.
- CDCR owns and operates the Sierra Conservation Center WTP; the WTP intake is located 170 feet below the surface at the center of the bridge which crosses the narrow upstream portion of Tulloch Reservoir.
- SEWD owns and operates the Dr. Joe Waidhofer (DJW) WTP which has an intake from the Calaveras River at Bellota, and another diversion on the Stanislaus River at Goodwin Dam. The water diversion at Goodwin Dam serves as the beginning of the New Melones Conveyance System watershed.

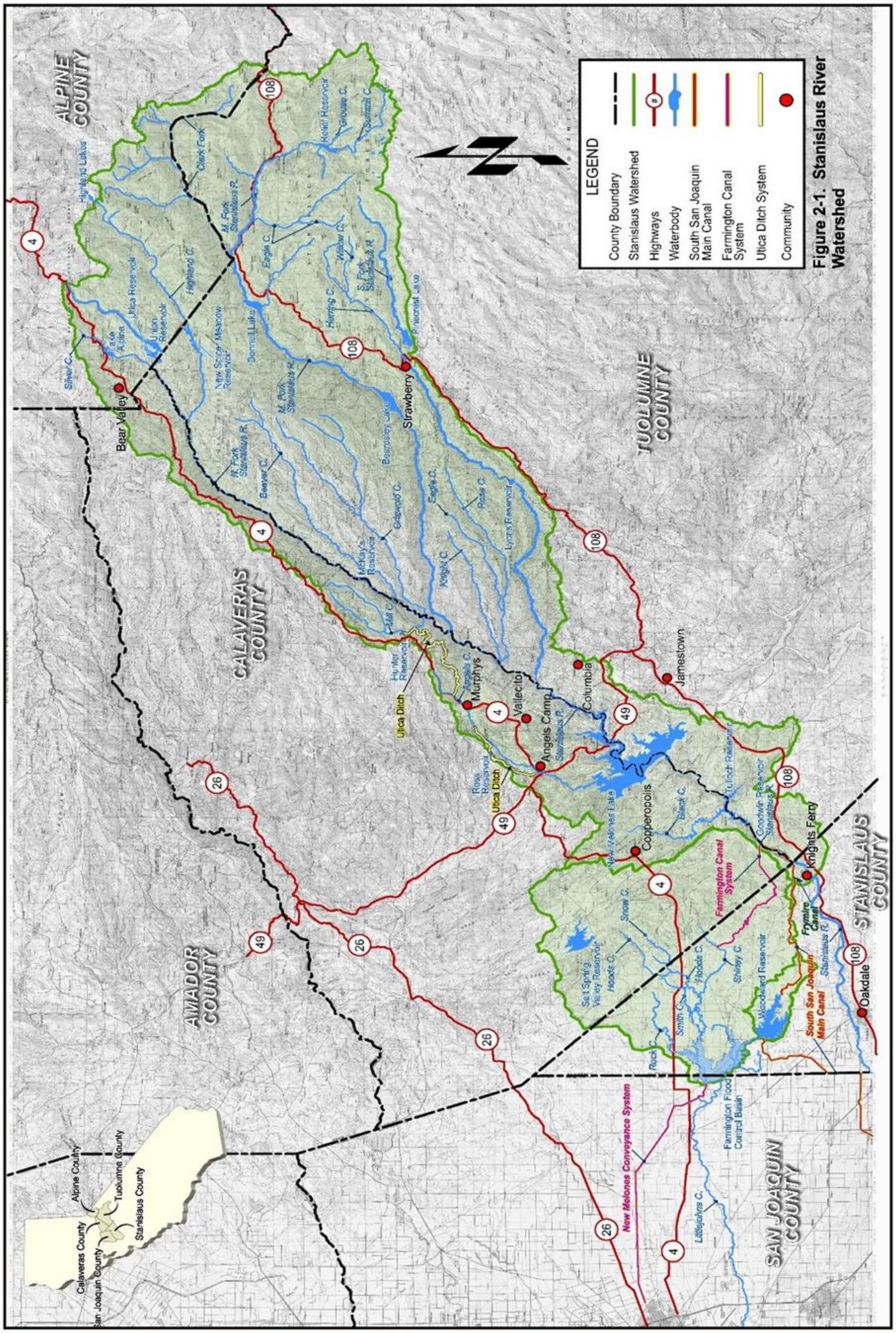


Figure 2-1. Stanislaus River Watershed

- SSJID diverts water at Goodwin Dam to the South San Joaquin Main Canal (SSJMC); the water is transported to Woodward Reservoir. SSJID has a primary (upper) and alternate (lower) intake from Woodward Reservoir to the Nick C. DeGroot (NCD) WTP.
- The Knights Ferry Community Services District (KFCSD) owns and operates the Knights Ferry WTP. Water is diverted at Goodwin Dam to SSJMC the diverted to Frymire Canal. The WTP intake is on the Frymire Canal. KFCSD has a secondary intake on the Stanislaus River in the community of Knights Ferry.

Figure 2-2 presents the location of the intakes and water treatment plants for the participating public water systems.

STANISLAUS RIVER WATERSHED STUDY AREA DESCRIPTION

The Stanislaus River watershed encompasses an approximately 990 square mile drainage basin. The watershed includes New Melones Reservoir as well as several smaller reservoirs. The Stanislaus River watershed is located primarily in Alpine, Calaveras, and Tuolumne counties, but also reaches into Stanislaus and San Joaquin counties downstream. The North Fork and Main Stem of Stanislaus River provides the demarcation between Calaveras County and Tuolumne County. To the west, the Woodward Reservoir sub-watershed, most of the New Melones Conveyance System, and a short segment of the Stanislaus River watershed upstream of Knights Ferry, lie in Stanislaus County. The western portion of the New Melones Conveyance System lies within San Joaquin County. The easternmost watershed lands of the North Fork and Middle Fork, extend into Alpine County.

The headwaters of the North, Middle, and South Forks of the Stanislaus River originate on the western slopes of the Sierra Nevada mountain range. The flows from New Melones Reservoir, Tulloch Reservoir, and other reservoirs are managed for various downstream uses, including hydropower generation, domestic and irrigation water supplies, and maintenance or enhancement of fishery habitat.

The water supply for Stanislaus River is rainfall and snowmelt runoff. The climate generally is Mediterranean, with moist cool winters and hot, dry summers. Prevailing winds are from the west to northwest, shifting to southerly flows following the approach of storms. The climate of the Stanislaus River watershed is dominated by a wet winter season and dry summer season. Flooding in the watershed is typically not a problem. Some flooding may occur along tributaries in the upper elevations in years when high spring rainfall coincides with snowmelt; however, because of the steep terrain, water flows quickly to the lower elevations. In the lower elevations where the topography is not as steep, high rainfall may contribute to flooding along tributaries to the river, although flooding along the main stem is unlikely because of the steep terrain. Operation of New Melones Reservoir for receiving flood water also greatly reduces the likelihood of river flooding in the lower watershed region.

As presented on Figure 2-3, rainfall varies greatly between the upper watershed as measured at Calaveras Big Trees State Park and in the lower watershed at New Melones Reservoir. This figure presents average monthly rainfall in inches for the five year study period. Typical patterns found in California and the study area that reflect this Mediterranean climate include the near absence of precipitation over five summer months. It is also important to note the high rainfall in January and February of 2017; storm events during this time are reflected in the water quality data as higher

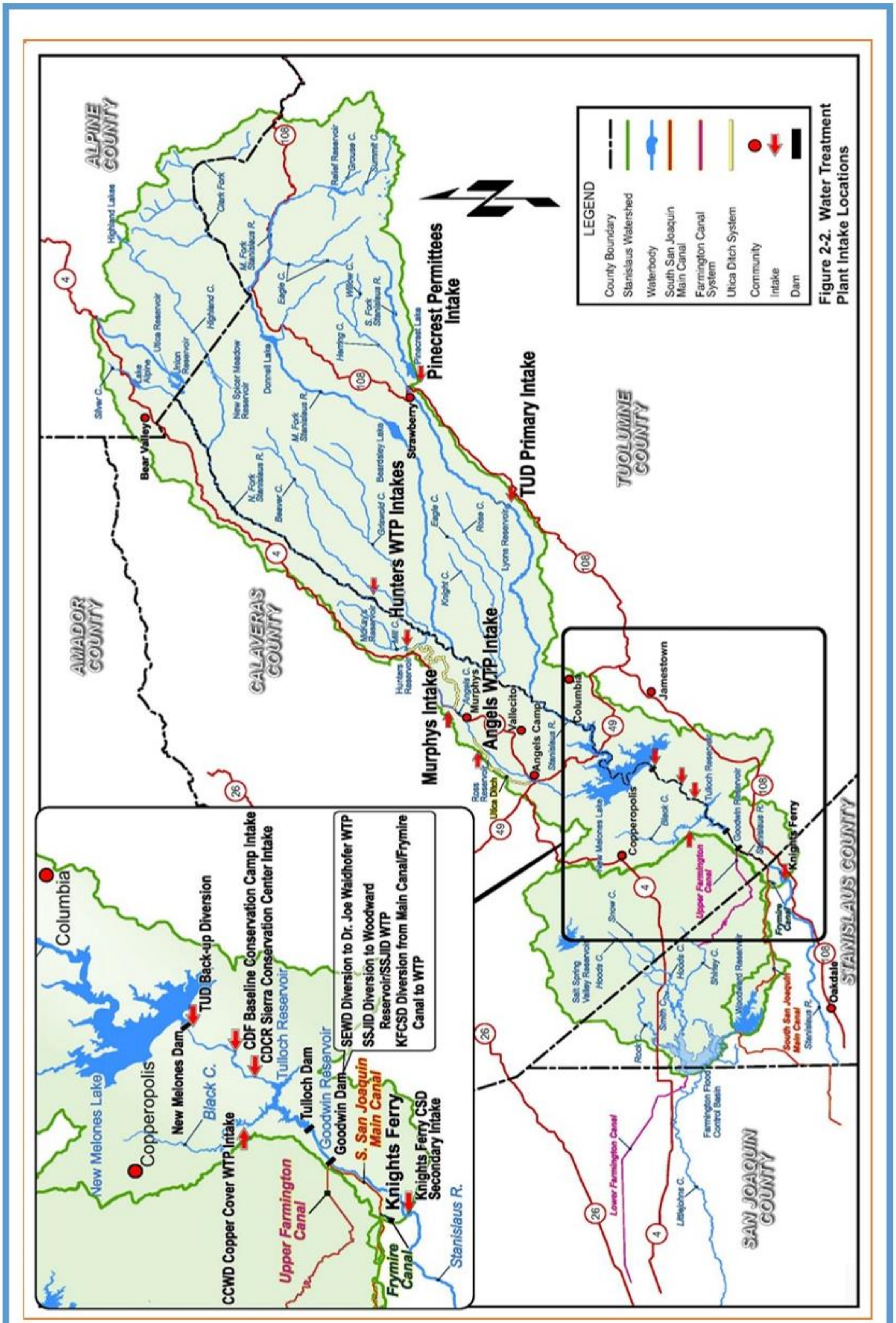


Figure 2-2. Water Treatment Plant Intake Locations

turbidity and *E. coli* levels. The last year of a five-year drought was 2016; this is also reflected in the water quality data as higher total coliform and total organic carbon levels.

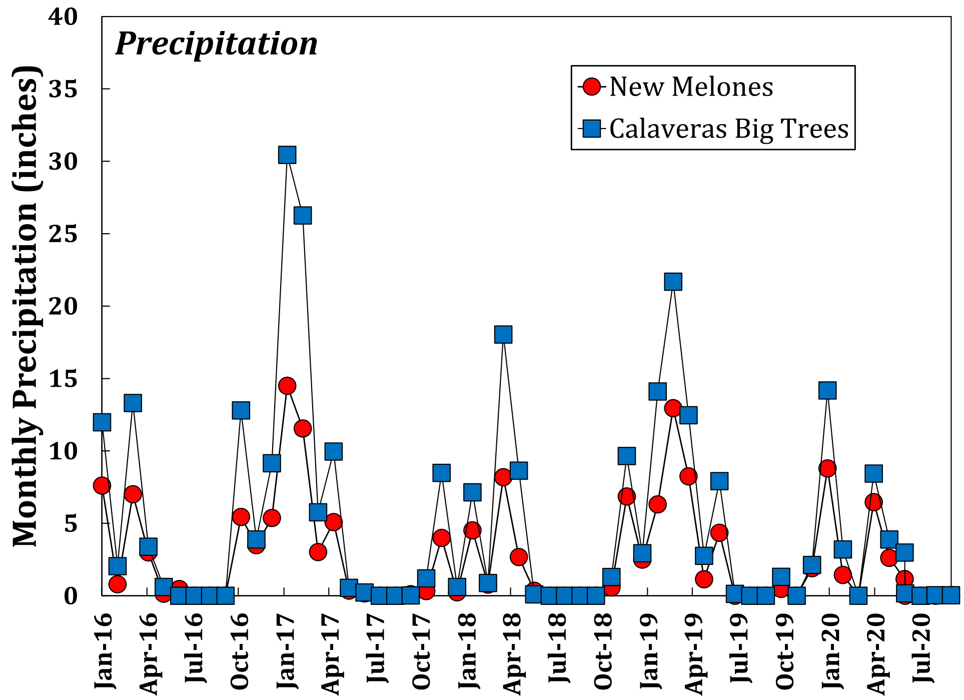


Figure 2-3 Monthly Precipitation
Source: NOAA, 2021

Flows on the Stanislaus River are heavily controlled by various dams and diversion structures. These control structures facilitate water use for hydropower generation, domestic and irrigation water supplies, and maintenance or enhancement of fishery habitat. The USGS maintains flow stations throughout the watershed.

Consistent with the majority of inland California, rainfall is primarily seen during the months of November through May. During the winter months, precipitation falls as snow in the higher elevations and as rain in the lower elevations. Runoff from the snow pack usually begins in the early spring and continues through much of June. Climate change appears to be changing the historical patterns resulting in less snowfall overall and earlier snowmelt.

Principal tributaries to the Stanislaus River include: Highland Creek, Bloods Creek, Beaver Creek, and Griswold Creek, all of which drain to the North Fork; Summit Creek, Deadmans Creek, Eagle Creek, Clark Fork, Niagara Creek, Mill Creek, Shoofly Creek, and Cow Creek, which flow to the Middle Fork; and Herring Creek and Deer Creek, which are tributaries of the South Fork. A number of other smaller tributaries also flow into the system.

Below Hunters Reservoir, drawing from an intake on the Collierville Tunnel from McKays Point Reservoir and from Mill Creek, water from Utica Water and Power Authority's (UWPA) Utica Ditch combines with water from Angels Creek for a short stretch and diverges at a dam downstream of the town of Murphys. Angels Creek continues to flow downstream along Murphys Grade Road, while some water is diverted into UWPA Angels system serving areas towards Angels Camp and for hydropower purposes.

SEWD's New Melones Conveyance System lies within the Farmington Flood Control Basin (FCB) subwatershed. Farmington FCB only fills when rainfall persists for several consecutive days, a circumstance that does not occur frequently. The U.S. Army Corps of Engineers (USACOE) controls the closure of the gate at Farmington Dam. With the exception of this somewhat annual event, the New Melones Conveyance System subwatershed consists of Shirley Creek, Hoods Creek and Rock Creek, which converge into Rock Creek just upstream of Farmington Dam. Salt Springs Valley Reservoir, a reservoir owned by Rock Creek Irrigation District with a recreation concession, is on Rock Creek. Littlejohns Creek is also part of the Farmington FCB, but has a passage separate from Rock Creek through the dam. Littlejohns Creek headwaters are adjacent to Rock Creek headwaters near Salt Spring Valley Reservoir; Littlejohns Creek travels by the Saddlecreek community before continuing parallel to the Stanislaus River then heading north to Farmington FCB. Downstream of the Farmington FCB dam, Rock Creek flows into Littlejohns Creek. However, at high flows, a cross canal allows Littlejohns Creek flows to enter Rock Creek.

Woodward Reservoir has no significant tributaries. The reservoir is filled by SSJMC but surrounding agricultural lands do drain to the reservoir; this is described in Section 3.

TOPOGRAPHY. The upper reaches of the Stanislaus River drainage in the Sierra Nevada are characterized by steep slopes that range from 5,000 to more than 10,000 feet in elevation. The Stanislaus River watershed basin narrows as the river's forks converge before they flow into New Melones Reservoir. The land elevation around New Melones Reservoir ranges from 700 to 1,700 feet. The elevation varies from 400 to 1,000 feet in the vicinity of Tulloch Reservoir, 500 feet near Goodwin Dam, 200 feet around Woodward Reservoir, and 184 feet at Knights Ferry.

The terrain varies from rugged mountains and wilderness in the eastern high Sierra region to more mild slopes and meadows in the western rolling foothills. Deep ravines and steep ridges are found in between these areas. The drainage is bounded by Gopher Ridge to the west and northwest; Summit Level Ridge and the Calaveras River watershed to the north; the Mokelumne River watershed and Mokelumne Wilderness Area to the northeast; Toiyabe National Forest lands and the Carson River East Fork watershed to the east; Dodge Ridge, Emigrant Wilderness, and Yosemite National Park and Wilderness Area to the southeast; and the Tuolumne River North Fork watershed to the south.

GEOLOGY. Underlying most of the forest lands are granitic rocks; granodiorite being the most common rock in the watershed and is especially evident at the higher elevations. Metamorphic rock is found in the western region of the forest lands. Volcanic rocks once covered much of the forest but have eroded away in many areas. The Dardanelles, which can be seen from Highway 108, and Table Mountain in the southwestern region of the watershed are remnants of these volcanic rocks. Glacial and alluvial deposits also occur. The US Forest Service (USFS) conducted an extensive soil survey in the Stanislaus

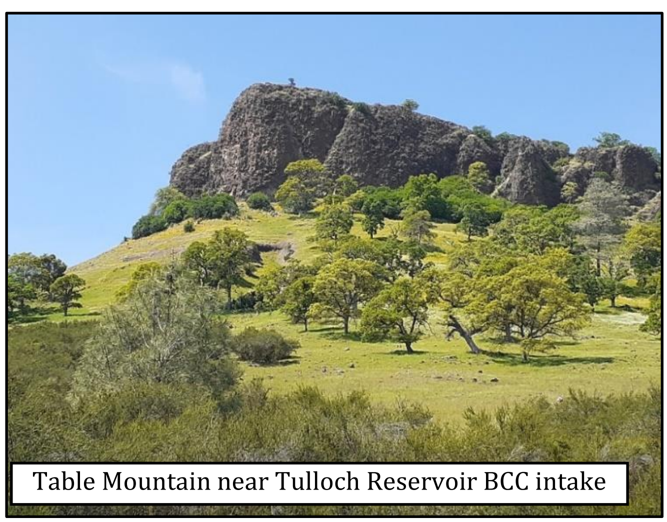


Table Mountain near Tulloch Reservoir BCC intake

National Forest in the early 1980s. The distribution of soils in areas below about 3,500 feet is influenced by topography. Soils on south- and southwest-facing slopes range from very shallow and undeveloped, with many rock outcroppings, to moderately deep and well-developed, with few types of gravel. Soils on north- and northeast-facing slopes in this zone generally are moderately deep to deep. Some shallow, stony soils occur where slopes are very steep, or parent rock is very hard.

In the range of 3,500 to 6,500 feet, soils on the south-facing slopes are quite variable, ranging from shallow and stony to deep and fine-textured. On north-facing slopes, soils are generally deep, medium and coarse-textured, and non-stony. Above 6,500 feet, large expanses of bare, glaciated rock occur and soils are mostly coarse-textured and shallow. The northwest-trending Sierra Foothills fault zone passes through the western portion of the watershed but does not pose a significant hazard.

In and adjacent to the Stanislaus River canyon below New Melones Reservoir, the SSJMC and tunnels were constructed in predominately fractured meta-volcanic rocks. Downstream from the canyon, SSJMC continues through the claystones, siltstones, sandstones and conglomerates.

VEGETATION. The Sierra Nevada foothills contain a mixture of agricultural lands, grasslands, scattered woodlands, chaparral, riparian habitats, and forested areas. Native grasses appear to survive best in narrow canyons, on steep slopes, or in rarely visited areas. Riparian vegetation is found along the banks of the rivers and creeks. It is typically dense, consisting of willows and Fremont cottonwoods, valley oaks, California sycamore, box elder, and Oregon ash. The underbrush consists of buttonbush, honeysuckle, elderberry, and gooseberry. Smaller plants typically include poison oak, nettle, mule fat, wild grape, and long-stemmed, shade-tolerant grasses.

Major tree species found in the Stanislaus National Forest include grey pine, live oak and black oak, Ponderosa pine, red fir, Douglas fir, white fir, lodgepole pine, incense cedar, and sugar pine. The Stanislaus National Forest includes older, mature conifer forest with stands predominantly 150 years or older, although some stands have trees 200 to 400 years old. Moderate to dense, multistoried canopy is usually associated with this habitat. Mature forests generally are considered to be large trees more than 100 years old that often provide habitat suitable for associated wildlife. Two groves of giant sequoias are within the Calaveras Big Trees State Park. The South Sequoia Grove and a portion of the North Grove are located within the Stanislaus River watershed.

The dominant vegetation of Woodward Reservoir and New Melones Conveyance System in the lower watershed consists of the common herbaceous annual, (mostly non-native) grassland, used extensively for cattle grazing. The bottomlands are also irrigated and farmed to produce almonds, grapes, alfalfa, and corn, among other various grains and fruits. Dominant tree species in the area include blue oak, interior live oak, and valley oak. These tree species mainly occur between the 300 to 400-foot (MSL) elevations, where the lower elevation grasslands give way to this more wooded environment.


South Fork Stanislaus River

LAND USE. Land use in the watershed can be identified as native forest, vegetation, rural developments, and communities. Tourism and recreation, forest products, mineral resources, and agricultural products make up significant elements of the area's economic base. The region is characterized by scattered rural residential land use with small urban and commercial centers concentrated at various locations along the major highways. Water-based recreation facilities are primarily located in the lower watershed at Tulloch and New Melones reservoirs and in the upper watershed at Lake Alpine, Union and Utica reservoirs, New Spicer Meadow Reservoir[1], and Pinecrest Lake. Swimming and other recreation uses also occur at Calaveras Big Trees State Park and at several other reservoirs and river and creek segments.

The downstream portion of the watershed is located in the lower foothills of the Sierra Nevada and is largely covered by native grassland vegetation. Cattle graze in small numbers throughout the watershed, primarily in the lower rolling foothills in the winter and in the higher elevations in the summer. Land immediately adjacent to Woodward Reservoir totaling approximately 3,300 acres (including the reservoir) is owned by SSJID and is covered by native grassland nut with agricultural used draining to the reservoir. Woodward Reservoir and SSJMC have been fenced to prevent cattle accessing waterbodies.

The majority of the watershed is sparsely populated, with several small towns located near historical mining or agricultural areas. As shown on Figure 2-1, in the Tuolumne County area of the watershed are the communities of Columbia and Strawberry/Pinecrest. In the watershed in Calaveras County are Angels Camp and Murphys, all along Highway 4, and Copperopolis and Copper Cove area, from Highway 4 to Lake Tulloch along O'Byrnes Ferry Road. Although most of Arnold is located in the Calaveras River watershed, residential areas straddle the watershed divide. The City of Angels or Angels Camp, with a population of 4,038 (CDOF, 2021), is the only incorporated city within the watershed. In the watershed within Alpine County, the highest concentration of homes is Bear Valley. Seasonal residences represent a significant portion of the population in the upper watershed in both counties. More information on population centers is found in Section 3.

STANISLAUS RIVER WATER SUPPLY SYSTEMS

The Stanislaus River system is a combination of natural and manmade waterways. The manmade elements of this river system include several reservoirs such as New Melones and Tulloch reservoirs. Additionally, several large diversion facilities direct water to hydroelectric and water treatment facilities. The eleven WTPs and associated facilities included in this WSS rely on the Stanislaus River for water supply. This section discusses the location, description, and water supply information pertaining to the following facilities.

- Pinecrest Permittees Association WTP
- Hunters WTP (CCWD Ebbetts Pass Service Area)
- Sierra Conservation Center WTP
- Copper Cove WTP (CCWD Copper Cove/Copperopolis Service Area)
- Dr. Joe Waidhofer WTP
- Knights Ferry CSD WTP

[1] Utica Reservoir, Union Reservoir, and Alpine Lake are all interconnected with New Spicer Meadow Reservoir through the North Fork Diversion Dam and tunnel.

- Murphys WTP
- Angels Camp WTP
- Baseline Conservation Camp WTP
- Nick C. DeGroot WTP
- Upper Basin WTP

The Dr. Joe Waidhofer WTP is not located within the watershed boundary but diverts water via the New Melones Conveyance System from Goodwin Dam (downstream of the New Melones and Tulloch reservoirs). The Nick C. DeGroot WTP is also outside of the watershed; it receives water from Goodwin Dam via the South San Joaquin Main Canal. Tuolumne Utilities District's Upper Basin WTP is not located within the watershed boundary; it diverts water from Lyons Reservoir located on the South Fork on the Stanislaus River.

SOUTH FORK STANISLAUS RIVER

The following paragraphs provide a description of the source waters of the South Fork of the Stanislaus River.

PINECREST LAKE. Pinecrest Lake is located at the upstream end of the South Fork of the Stanislaus River. The reservoir, owned and operated by Pacific Gas and Electric Company (PG&E), provides recreational benefits and supplies water for drinking and hydroelectric power generation. The water dedicated to power generation is released from Pinecrest Lake to the South Fork of the Stanislaus River to the diversion dam for the Spring Gap Power Plant on the Middle Fork of the Stanislaus River. Water is released from the reservoir for hydrogeneration in the fall then the reservoir refills as snow melts. The reservoir has a capacity of 18,312 acre-feet and is supplied by surface water runoff from a 26.5 square mile watershed. The water used for drinking is treated by the Pinecrest Permittees Association WTP.

PINECREST PERMITTEES ASSOCIATION WATER TREATMENT PLANT. The USFS and Pinecrest Permittees Association both use Pinecrest Lake as a source for drinking water. For the 2016 Stanislaus River WSS, the SCRG participant for Pinecrest Lake was the USFS. During 2017, the USFS shut down their treatment plant and physically connected to the Pinecrest Permittees Association distribution system. The Pinecrest Permittees Association owns and operate two treatment plants. The Pinecrest Lake WTP is an inline filtration plant with a production capacity of 140 gallons per minute (gpm). The filters are mixed media with anthracite. Disinfection is achieved with sodium hypochlorite applied downstream of the filters. Pinecrest Lake is not used year-round as a source of drinking water.

Pinecrest Reservoir drained in winter

Permittees are recreational residences constructed on USFS lands by permit. The association was formed in 1950 to provide utility services. The population served is approximately 3,000 people during the peak demand and 45 people during low demand.

LYONS RESERVOIR. Lyons Reservoir is located on the South Fork Stanislaus River, in the middle of the watershed. The reservoir is relatively small, with a capacity of 5,507 acre-feet, and drains a watershed of 67 square miles. The reservoir is owned and operated by PG&E and is used for hydroelectric power generation and as a water supply for Tuolumne Utilities District. No water recreation is allowed.

UPPER BASIN WATER TREATMENT PLANT. From the South Fork Stanislaus River at Lyons Dam, PG&E diverts water via the Tuolumne Main Canal. The water is conveyed out of the river canyon for roughly four miles to the TUD Section 4 diversion point. The Upper Basin WTP is located on the TUD Section 4 ditch about one half mile downstream of the Tuolumne Main Canal diversion point. Most of the Tuolumne Main Canal conveyance structure serving the Section 4 diversion is located in forested unpopulated and undeveloped lands. There are about 20 residential homes along Forest Service Road 4N01 in the last mile of the canal before reaching the Section 4 diversion point. There is about 20 residential homes located upstream of the Section 4 ditch situated along Quaker Lane along the one half mile segment of TUD ditch serving the Upper Basin WTP.

The raw water intake at the 1 MGD Upper Basin WTP consists of two channels located side-by-side in the Section 4 Ditch that allows water to continuously flow through and over screen inlets. The raw water flows through the up-flow clarifier. A vertical flocculator with a 1.5 horsepower adjustable drive unit is provided in the reaction chamber of the clarifier. Water flows by gravity from the clarifier into a concrete subsurface settled water sump. Water from the settled water sump is pumped through two horizontal pressure filters.

NORTH FORK STANISLAUS RIVER

NEW SPICER MEADOW RESERVOIR. New Spicer Meadow Reservoir is located on Highland Creek in the upper reaches of the North Fork Stanislaus watershed at an elevation of 6,621 feet. The reservoir has a capacity of 189,000 acre-feet and serves as the primary water storage feature for CCWD's Stanislaus River watershed services areas and for the North Fork Hydroelectric Development Project, diverted to the Collierville Tunnel and Powerhouse downstream. The reservoir and hydroelectric project is operated by the Northern California Power Agency. It is also used for recreation owing to its location in the Stanislaus National Forest.

MCKAYS POINT RESERVOIR. McKays Point Reservoir is located on the North Fork of the Stanislaus River. The reservoir has a drainage area of 166 square miles and a capacity of 1,785 acre-feet. The reservoir is owned by CCWD and operated by the Northern California Power Agency. The reservoir is used for fishery maintenance, drinking water supply, and hydroelectric power; it also facilitates the diversion of water into the Collierville Tunnel (primarily for hydropower generation purposes by North Fork Hydroelectric Development Project).

HUNTERS WATER TREATMENT PLANT. Hunters WTP, owned and operated by CCWD, provides water for 7,300 residents with 5,991 connections in several local communities and subdivisions, including Arnold and Dorrington/Camp Connell all within CCWD's Ebbetts Pass Service Area. CCWD also provides wholesale treated water from this facility to the Blue Lake Springs Mutual Water Company and Snowshoe Springs Homeowners Association.

Water for Hunters WTP is diverted through the Mill Creek Tap, off the Collierville Tunnel diverted from McKays Point Reservoir, through a 20-inch raw water pipeline to the WTP. Hunters WTP is an adsorption clarifier/filter package treatment plant with a capacity of 4 MGD. Treatment is initiated with the addition of sodium hypochlorite to the raw water. A polyaluminum chloride/ cationic polymer blend is added and followed by a static mixer. The water is filtered by gravity through a mixed media filter and chlorine is added for disinfection. Zinc orthophosphate is added for corrosion control. The WTP provided 1,407 acre-feet in 2020.

UTICA DITCH SYSTEM. The Utica Ditch is a 22-mile-long ditch system operated by Utica Power Authority. The Utica Ditch conveys surface water supply to the UPUD (Murphys WTP) and Angels Camp WTPs. It also supplies water for hydroelectric power generation and irrigation water via an interconnecting ditch system. The water is conveyed through an historic wooden or metal flume where the topography is too steep for construction of a canal. A few small intermittent drainages from the slopes above the ditch flow into the system. Most other drainage is routed over the ditch by either pipeline or wooden flume. From the Mill Creek Pressure Tap, the ditch runs east to west through a small northwestern portion of the watershed.

Flows that originate from the North Fork of the Stanislaus River and New Spicer Meadow Reservoir are diverted into the Collierville Tunnel at McKay's Point Reservoir and enters the canal at the Mill Creek Tap in the tunnel. A portion of the water in the Collierville Tunnel is delivered into the beginning of the Utica Ditch system and a portion is delivered to the Hunters WTP for treatment and distribution. The water remaining in the tunnel continues on to the Collierville Power Plant and eventually returns to the North Fork of the Stanislaus River.

From its origin at the Mill Creek Tap, water in the ditch flows into Hunter Reservoir; the ditch resumes below Hunter Reservoir and continues toward the Town of Murphys, where a portion of the flow is diverted into the Cadematori Reservoir. The flow there is combined with flows from Angels Creek.

The ditch flows through a penstock into the Utica Powerhouse where it is discharged into Murphys Forebay for water supply. The ditch begins again further downstream on Angels Creek, just below the Town of Murphys, where flow is diverted off the creek. Utica Ditch below Murphys is diverted toward Ross Reservoir through two miles of open ditch. This section of the ditch alternates between lined and unlined segments.

From Angels Creek, the ditch flows into Ross Reservoir, resumes at the opposite end of the reservoir, and continues to the Angels Camp WTP Forebay where it terminates. Approximately 1.5 miles north of the City of Angels Camp, water from the Utica Ditch is impounded for use at the Angels Power Plant, the Angels Camp WTP, and the Jupiter Ditch, which is used for irrigation. Water from the impoundment that is not treated for use continues down a hard-piped aqueduct to the Angels Power Plant; this flow is discharged directly into Angels Creek.

MURPHYS WATER TREATMENT PLANT. Water from the Utica Ditch flows through a 10-inch pipeline into Cadematori Reservoir; this is a 140 acre-foot reservoir that can be isolated from the Utica Ditch when water quality conditions (such as high turbidity) make the water in the ditch difficult to treat. The reservoir can provide 10 weeks of storage during summer high flow periods and 30 weeks of storage during the winter. Water is supplied to the WTP by gravity from Cadematori Reservoir through a 12-inch pipeline.

The Murphys WTP, owned and operated by UPUD, is a 2 MGD capacity in-line filtration plant. Water flowing from Cadematori Reservoir is treated with chlorine and polymer prior to a static mixer. Water flows from the static mixer into three dual-media pressure filter units. Water discharged from the filters is treated with additional chlorine, and caustic soda when necessary for pH control. Water from the filters is stored in a 250,000-gallon tank and a 2.0 MG clearwell. In response to elevated levels of trihalomethanes (THMs) the District installed and recently put into service (March 2021) an aeration system in the 2.0 MG clearwell.

ANGELS CAMP WATER TREATMENT PLANT[2]. The Angels Camp WTP, owned and operated by the City of Angels Camp, provides water to approximately 3,800 people. The Angels Camp WTP draws its water from Angels Creek/Utica Ditch and is stored in the Angels Forebay (owned by the Utica Power Authority). A 12-inch pipeline from Angels Forebay supplies the WTP by gravity. The intake provides a 900 gpm average daily flow. Alum is injected into the raw water as it enters the flocculation basin (paddle mixers) followed by a settling basin. In July 2015, the City of Angels Camp stopped injecting chlorine (sodium hypochlorite) simultaneously with the alum. Following sedimentation, the water is pumped into three pressure filters. Each pressure filter contains 46 inches of media consisting of gravel, sand, coal, and garnet. Each filter has a capacity of 720 gpm. One filter is designated as a backup, and DDW has rated the total plant capacity at 1,440 gpm (2.0 MGD). A 0.8 percent sodium hypochlorite solution is generated on-site and is added to the settled water. Caustic soda and orthophosphate are added to the treated water to adjust the pH and to provide corrosion control. The finished water is stored in a 2.5 MG tank.

NEW MELONES DAM AND RESERVOIR

New Melones Dam is a 625-foot-tall rock fill dam on the Stanislaus River and forms New Melones Reservoir with its capacity of 2,400,000 acre-feet. The reservoir, owned and operated by the US Bureau of Reclamation (USBR), as part of the Central Valley Project, is multipurpose, providing flood control, recreation, drinking water supply, irrigation supply, and hydroelectric power. During normal operations, USBR releases water through the hydropower facility located at the dam. The hydroelectric plant has a 300-MW generation capacity. TUD has a secondary intake at New Melones Reservoir.

BASELINE CONSERVATION CAMP WATER TREATMENT PLANT. Just downstream of New Melones Dam, Baseline Conservation Camp has an intake on the Stanislaus River. The plant intake is located 120 feet offshore in 40 to 45 feet of water. The three 10-horsepower intake pumps are located three feet above the bottom.

The WTP is owned by the State of California and is operated by the California Department of Forestry and Fire Protection staff at Baseline Conservation Camp. Treatment consists of sodium hypochlorite addition to the raw water, polymer addition, flash mix, and flocculation. Sedimentation is provided using tube settlers. The water is filtered by gravity through a mixed media filter. Sodium hypochlorite is added to the filtered water for final disinfection. The finished water is pumped to six storage tanks.

During preparation of the 2016 WSS, Baseline Conservation Camp was in the process of commissioning a new water treatment plant. The new facility is a Trident package conventional treatment plant and was not in service during the study period of 2016 through 2020 (BCC, 2021).

TULLOCH RESERVOIR. Tulloch Reservoir is located on the main stem Stanislaus River, about five miles downstream of New Melones Reservoir. Tulloch Reservoir has a storage capacity of 66,968 acre-feet

[2] In November 2020, the City of Angels Camp initiated a five-year project to implement a number of improvements at the WTP.

and a drainage area of 980 square miles, including the New Melones Reservoir drainage area and drainage from additional tributaries. TRI Dam owns and operates Tulloch Reservoir, which controls its operation for hydroelectric power and irrigation water supply. Hydroelectric power is generated at a power facility located on the dam.

SIERRA CONSERVATION CENTER WATER TREATMENT PLANT. The Sierra Conservation Center WTP obtains its water from Tulloch Reservoir. The State of California owns the WTP, but it is operated by the staff of the Sierra Conservation Center. The WTP intake is located 170 feet below the surface at the center of the bridge which crosses the narrow upstream portion of Tulloch Reservoir. The intake provides an average daily flow of 0.8 MGD.

Treatment consists of polymer and sodium hypochlorite addition to the raw water, rapid mix, sedimentation via an inverted cone clarifier, sodium hypochlorite addition prior to filtration. The filters are mixed media Microfloc filters with a 1.4-MGD capacity. Following filtration, the water is stored in two 10,000-gallon clearwells prior to distribution.

COPPER COVE WATER TREATMENT PLANT. CCWD's Copper Cove 4 MGD WTP obtains water from Tulloch Reservoir. The intakes are on the Black Creek arm of the reservoir. In 2015 the intake was extended approximately 110 feet and the depth of the intake was lowered from 30 feet below the reservoir level to approximately 88 feet below.

Water is delivered to approximately 5,200 residents with 2,664 connections in the communities of Copperopolis, Copper Cove, Lake Tulloch Shores, Connor Estates, and Saddle Creek. Treatment consists of pre-ozonation, filtration through approved alternative Microfloc filters and disinfection with sodium hypochlorite. Zinc orthophosphate is added for corrosion control. Successive 300,000-gallon and 700,000-gallon clearwells provide contact time prior to entering the distribution system. It provided 1,385 acre-feet in 2020.

GOODWIN RESERVOIR

Goodwin Dam, located downstream of Tulloch Reservoir, is designed to provide a relatively constant surface water elevation to Goodwin Reservoir. Three diversion structure inlets are located at the dam: New Melones Conveyance System, South San Joaquin Main Canal, and the Oakdale Irrigation District Canal.

NEW MELONES CONVEYANCE SYSTEM. The New Melones Conveyance System supplies water to the DJW WTP. The conveyance system consists of a diversion structure at Goodwin Reservoir (also known as Goodwin Tunnel Inlet), Goodwin Tunnel, Upper Farmington Canal, Shirley Creek, Hoods Creek, Rock Creek, Lower Farmington Canal, and Peters Pipeline to the existing 54-inch-diameter Bellota Pipeline, or to the 6-mile Peters Pipeline extension. The Goodwin Tunnel Inlet is a concrete intake located beneath the surface of the impoundment, with a single concrete intake pipe and gated ports. The tunnel is 14 feet in diameter and 3.5 miles long, bored through Table Top Mountain.

The Upper Farmington Canal consists of nine miles of an unlined channel extending from the Goodwin Tunnel outlet to a controlled release structure and into Shirley Gulch at the Shirley Gulch Weir. Conveyance capacity is 550 cubic feet per second (cfs). All local drainage is collected, channeled in ditches, and diverted in culverts over or under the canal, except in two locations where inverted siphons were constructed to route the canal under the larger drainage features.

A manmade channel extends about 100 yards from the Shirley Gulch Weir to Shirley Creek; the manmade channel is wide and shallow, facilitating flow from the canal to the natural creek. The natural waterways traverse privately owned grazing land and are heavily grazed; however, the Upper and Lower Farmington canals are fenced. Shirley Creek, Hoods Creek, and Rock Creek all flow from the upper reaches of the subwatershed to the Farmington (FCB) Dam converging into Rock Creek. These waterways total 16 miles of natural creek channels, improved where needed to provide protected crossings and erosion control and prevent the entry of potentially contaminated local surface water drainage.


Rock Creek

Farmington Dam impounds and regulates flow from the following ephemeral streams: Rock Creek, Hoods (Shirley) Creek, Littlejohns Creek, and Simon Creek, for flood control during heavy rain events. The Farmington Dam, operated by the USACOE for flood control purposes, is a concrete structure with two outlets to Littlejohn Creek and Rock Creek. Flow for SEWD is collected and controlled from Rock Creek at the Rock Creek Diversion Structure via flow control gates into the Lower Farmington Canal. The Lower Farmington Canal consists of 10 miles of an unlined channel from the diversion structure to Peters Pipeline; flow capacity is 250 cfs. The canal design is similar to the Upper Farmington Canal, with similar access, crossings, drainage, and protective features. Dairies are adjacent to the Lower Farmington Canal, with culverts diverting the runoff.

The 72-inch-diameter Peter's Pipeline extends three miles from the terminus of the Lower Farmington Canal with a connection to the existing 54-inch pipeline from Bellota to the WTP. Downstream of the Bellota Pipeline, Peter's Pipeline narrows to 66-inch and then to 60-inch paralleling the Bellota Pipeline until about two miles upstream the water treatment plant. The 72-inch pipeline is designed for a 100 cfs capacity. SEWD has facilitated the treatment of a greater percentage of the surface water that is available and benefitted the groundwater basin by banking water in-lieu of pumping it by the construction of the six mile extension to Peters Pipeline.

DR. JOE WAIDHOFER WATER TREATMENT PLANT (DJW WTP). Owned and operated by SEWD, the DJW WTP serves the City of Stockton and surrounding unincorporated areas. SEWD is a wholesaler of treated surface water. Maintenance and water quality management within the distribution system is the responsibility of the retailers: City of Stockton, California Water Service Company, and San Joaquin County. In 2020, the District provided 29,910 acre-feet to these retailers who serve a total of 363,722 residents (SEWD, 2021).

The DJW WTP has two water sources: the Calaveras River at Bellota and Goodwin Reservoir on the Stanislaus River (intake is located 14 feet below the water surface). Water is diverted at Goodwin Dam via the New Melones Conveyance System and flows by gravity to the WTP. Raw water can also be stored in five on-site reservoirs (the fifth on-site raw water storage reservoir was put into service in 2019). During high turbidity events, SEWD shuts down either or both raw water sources, and the WTP relies on the raw water reservoirs for both pre-sedimentation and water supply.

The DJW WTP has a rated capacity of 65 MGD. The water is lifted from the raw water reservoirs to the WTP influent. Water entering the WTP is first pre-chlorinated with chlorine gas for disinfection and alum and polymer for coagulation. The water then passes through a rapid mix, a flocculation basin, and sedimentation basin or plate settlers (depending on treatment train).

SEWD uses particle counts to demonstrate log removal for CT credit. Settled water is routed to dual-media (granular activated carbon [GAC] and sand) filters. Filter-aid polymer is added to the water prior to filtration. Filter backwash water flows to raw water reservoirs for groundwater recharge and reuse. Filter effluent flows through the finished water conduit, where sodium hydroxide is added to increase the pH level for distribution system corrosion control. Chlorine gas is added for final disinfection. The water then flows to two buried, finished water reservoirs, from which the water is pumped into the transmission mains and SEWD's retail customers.

SOUTH SAN JOAQUIN MAIN CANAL/FRYMIRE CANAL. The SSJMC diverts water from the northeastern bank of the Stanislaus River at Goodwin Dam. The water is used for irrigation by the Oakdale Irrigation District and the South San Joaquin Irrigation District, and for drinking water supply by the Knights Ferry WTP and the Nick C. DeGroot WTP. Water is diverted from SSJMC into the Frymire Canal, which flows to the Oakdale Irrigation District. The primary intake for the Knights Ferry WTP is located on the Frymire Lateral.

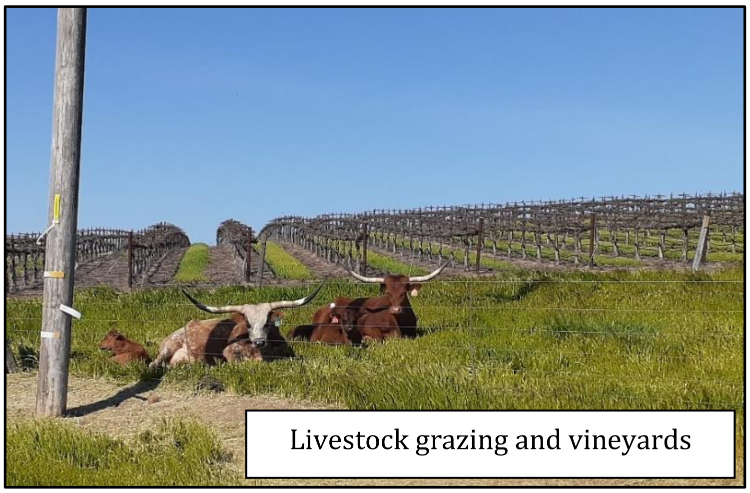
KNIGHTS FERRY CSD WATER TREATMENT PLANT (KFCSD WTP). The community of Knights Ferry obtains its water from the Stanislaus River through two routes. Water is diverted from the Frymire Canal and flows by gravity 3.5 miles after it is diverted from the SSJMC. Water is also pumped directly out of the Stanislaus River at the community of Knights Ferry and conveyed through a pipeline into a 5,000-gallon tank located just above the WTP.

The Knights Ferry WTP, a package plant built in 1973, is owned and operated by KFCSD. The WTP has a maximum capacity of 100 gpm and serves about 60 connections. Treatment starts with chlorine and alum, which are added before the WTP's upflow clarifier. The upflow clarifier provides flocculation and sedimentation. Chlorine is added to the settled water as it flows from the clarifier and into the two multimedia pressure filters. The filters discharge directly into a 30,000-gallon clearwell. The total detention time through the WTP and clearwell is about 6.5 hours in the summer and about 17 hours in the winter.

WOODWARD RESERVOIR. From the SSJMC, water is conveyed to Woodward Reservoir where the water is available for recreation, distribution to irrigation canals, and as supply for the Nick C. DeGroot WTP. Woodward Reservoir can store up to 36,000 acre-feet. Water releases from the reservoir, which are controlled by SSJID, occur seven or eight months of the year. Woodward Reservoir is kept at or near capacity during the summer months and is lowered during the winter for flood control; normally no releases occur during the winter months.

NICK C. DEGROOT WATER TREATMENT PLANT. The DeGroot WTP provides water to approximately 200,000 residents of south San Joaquin County. It draws water from two influent structures located in Woodward Reservoir, known as the Upper and Lower intakes. The Upper Intake is used during the summer months which allows for body contact downstream of the intake separated by a water quality wall. The Lower Intake is used during the winter months once flow into Woodward Reservoir and body contact has stopped for the season. Treatment begins with aluminum chlorohydrate (ACH) addition to the raw water as it enters the WTP. At this point in the process, if needed, SSJID can add sodium hypochlorite for disinfection/taste and odor control and sodium hydroxide to adjust pH. The

ACH dosed water passes through a series of baffles for mixing which allows for the formation of floc. The newly formed floc enters the Dissolved Air Floatation (DAF) basin and comes in contact with recirculated water that has been infused with air as it passes across a series of injection nozzles. The floc attaches to bubbles created by the infused air, and floats to the surface and forms a sludge blanket made up of organic and inorganic constituents. The sludge blanket is spilled over into the DAF residuals basins by overflowing the DAF basin. The waste is pumped to the waste drying beds, and ultimately, dried and hauled away. Supernatant from beneath the sludge blanket exits the DAF basin with an NTU target of 2.0 or less and enters the stabilization basin. In the stabilization basin where sodium hypochlorite for disinfection, lime to increase pH and alkalinity, and carbonic acid (CO_2) to decrease pH can be added. The water then enters the membrane train process. Each of the eight membrane trains contain six cassettes. The treated water exiting the membranes collects and passes through a combined permeate pipeline, at which point primary disinfection is performed with an additional sodium hypochlorite injection site and sodium hydroxide to adjust pH if needed. The treated water collects into two 3.0 MG treated water reservoirs. The treated water reservoirs allow for contact time before gravity feeding SSJID's retail customers.



Livestock grazing and vineyards

Section 3 Potential Contaminant Sources

This section begins with a description of the counties in relation to watershed boundaries. This is because some of the potential contaminant source data are available only by county. A discussion of water quality parameters of concern is then provided as a basis for understanding the risks or impacts of potential contaminant sources. Finally, the potential contaminant sources in the Stanislaus River watershed are summarized in the following format.

Concerns: Water quality concerns associated with the potential contaminant source.

Potential Contaminant Sources: Land use or activities specific to this watershed along with general locations.

Management Activities: Agencies responsible for managing the land use or activity and general practices employed to control the sources.

This chapter does not repeat background information provided in previous WSSs but does provide enough information necessary to ensure a stand-alone document.

Watershed Counties and Subwatersheds

For many of the land uses and activities in the watershed, information is only available by county. The Stanislaus River watershed lies partially within five counties, but the counties of Alpine, San Joaquin, and Stanislaus contain only small areas of the watershed. Therefore, information available by county is often presented for Calaveras and Tuolumne counties.

Alpine County watershed lands contain the community and ski resort of Bear Valley with the majority of lands within the Stanislaus National Forest; recreational and forestry uses are described here. San Joaquin County watershed lands contain the Farmington Flood Control Basin dam and a small area of land and water immediately adjacent to and behind the dam, as well as the Lower Farmington Canal. Watershed lands within Stanislaus County include the community of Knights Ferry, Woodward Reservoir and Main Canal and its watershed, and Farmington Flood Control Basin and its immediate watershed.

Although the majority of watershed lands are in Tuolumne County, Tuolumne County contains no incorporated cities within the watershed. The majority of Tuolumne County watershed lands are in the mountains and are designated for timber production and public lands. The largest watershed community in Tuolumne County is Columbia; small communities include Strawberry, Pinecrest, and Tuttletown. Countywide data of urban activities is usually not applicable for the Tuolumne County portion of the watershed because most communities are outside of this watershed.

The Stanislaus River watershed has one incorporated city: Angels Camp, located in Calaveras County. Calaveras County also contains the foothill communities of Murphys and Copperopolis; and the mountain communities of Arnold, Forest Meadows, Dorrington, Camp Connell, and Avery straddling the watershed divide between the Calaveras and Stanislaus River watershed along State Highway 4.

Figure 3-1 and Figure 3-2 provides a schematic of the upper watershed and lower watershed water system facilities, respectively. These schematics identify the water treatment plant (WTP) subwatersheds: intakes and reservoirs in relation to the Stanislaus River and its tributaries. They do not contain all of the drinking water related facilities (e.g., Union/Utica, New Spicer Meadow, and Beardsley reservoirs), only those proximate to the treatment plant intakes. When discussing potential contaminate sources, the WTP intakes or receiving waterbodies were often identified in this chapter to aid in understanding correlations between contaminant sources and the water quality data presented in Chapter 4. However, the reservoirs without direct intakes are also of importance as water supply storage reservoirs.

WATER QUALITY PARAMETERS OF CONCERN

Water quality parameters of greatest concern in the watershed from a drinking water perspective include the following.

- Microorganisms
- Disinfection by-product precursors
- Turbidity (particulates)
- Synthetic organic chemicals (SOCs), volatile organic chemicals (VOCs), herbicides, and metals

These four groupings are described briefly below. A more thorough discussion as they relate to Stanislaus River watershed water quality over the five year study period is provided in Section 4, Source Water Quality.

MICROORGANISMS. Microbiological organisms of concern as agents of waterborne outbreaks of infectious disease or indicators of potential contamination in drinking water include gross bacterial measurements (total coliform, e. coli, HPCs), viruses, and specific pathogens (such as *Cryptosporidium* and *Giardia*). *Cryptosporidium* and *Giardia* are currently the water quality parameters of greatest concern due to the health risks and the difficulty of treatment. For example, *Cryptosporidium* strongly resists chlorine disinfection. Also, there is no maximum contaminant level (MCL) for *Cryptosporidium* and *Giardia*. Utilities demonstrate compliance with drinking water regulations for these two organisms by meeting specific treatment technique requirements established by the US Environmental Protection Agency (US EPA) and DDW.

DISINFECTION BY-PRODUCT PRECURSORS. When chlorine is added in the treatment disinfection process, many chlorinated organic compounds are formed as the chlorine reacts with the naturally occurring organic matter (NOM) present in the water. Some of these compounds, referred to as disinfection by-products (DBPs), are suspected of causing cancer in humans. Trihalomethanes (THMs) and haloacetic acids (HAAs) are regulated. One important strategy for reducing DBPs is to reduce the amount of NOM present in the water, if possible. Watershed management to reduce erosion (which carries organic material from the land into water bodies) and control aquatic plant and algae growth (which generate organic matter) can provide significant reductions in NOM, and therefore DBP formation. Because NOM cannot be measured directly, total organic carbon (TOC) present in the water is typically used as a surrogate measurement. Bromide in the source waters is of concern. It can react with ozone in the treatment disinfection process to produce bromate (regulated in the Stage 1 D/DBP Rule).

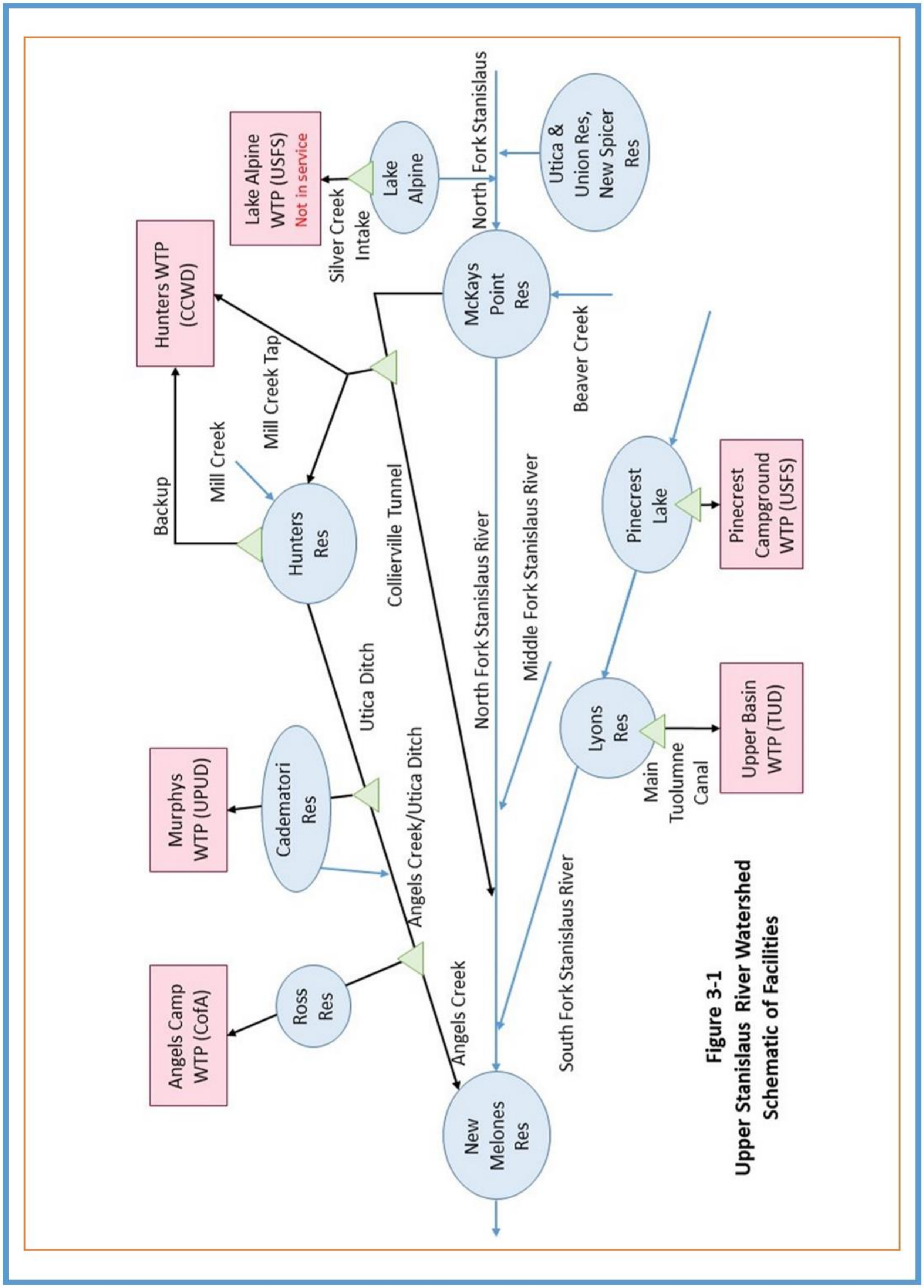


Figure 3-1
Upper Stanislaus River Watershed Schematic of Facilities

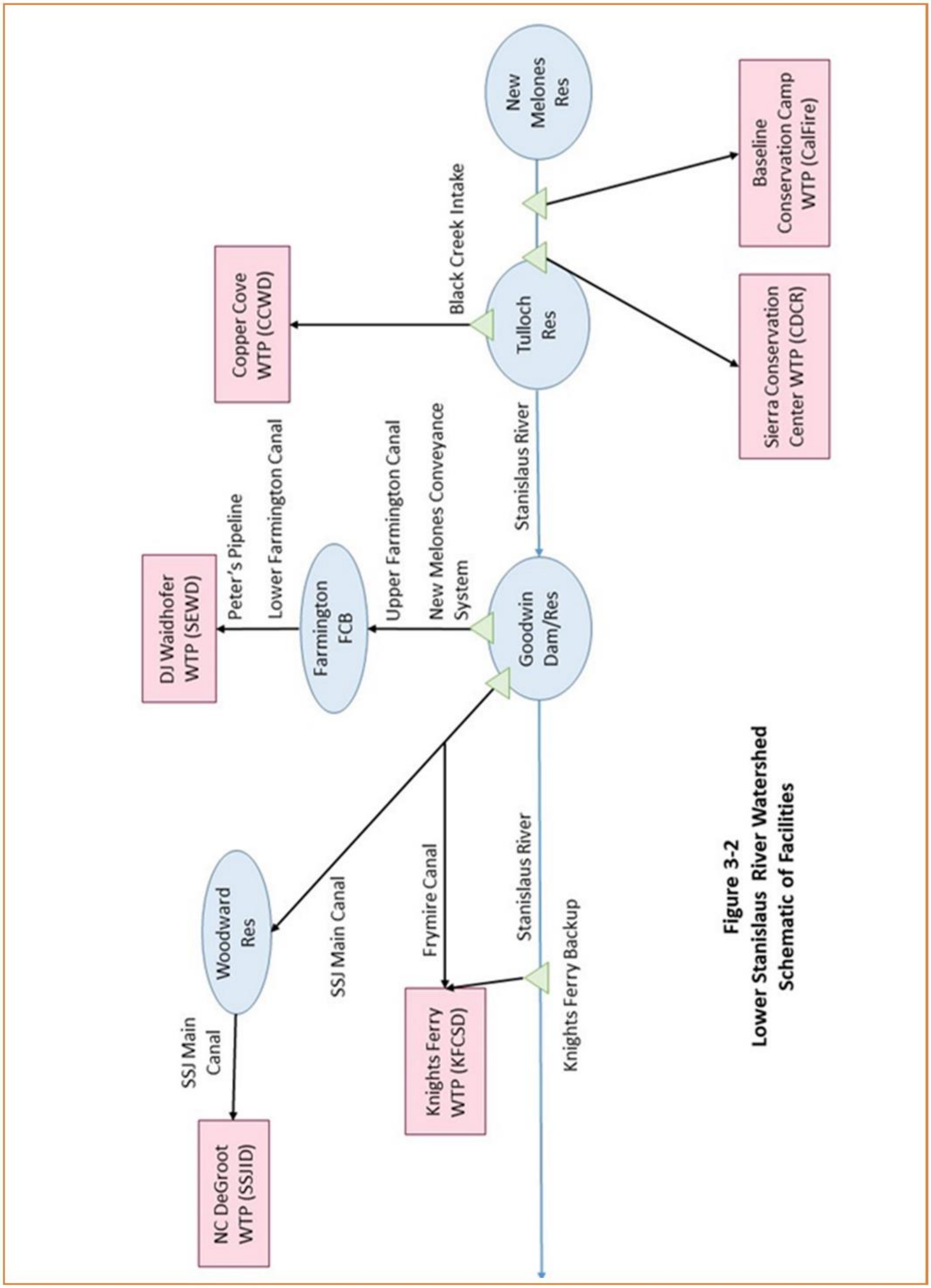


Figure 3-2
Lower Stanislaus River Watershed
Schematic of Facilities

TURBIDITY. Turbidity is a nonspecific measure of suspended matter such as clay, silt, organic particulates, plankton, and microorganisms. Turbidity is not a specific public health concern, but other constituents that are of concern can adhere or adsorb onto the surfaces or into the pores of the particulates. Microorganisms in particular have been known to survive disinfection during treatment by essentially hiding within the pores of particulates. The presence of turbidity is a general indicator of surface erosion and runoff into waterbodies, resuspension of sediment material, or biological productivity. Following major storms, water quality is degraded by inorganic and organic solids and associated adsorbed contaminants (e.g., metals, nutrients, and agricultural chemicals) that are resuspended or introduced in runoff.

Turbidity is of concern from a watershed protection perspective primarily because it reduces the efficiency of disinfection by shielding microorganisms and other contaminants, and it acts as a vehicle for the transport of contaminants. An increase in raw water turbidity at the treatment plant increases treatment operations (e.g., higher chemical doses, more frequent filter backwashing, higher disinfectant dosages), increases the likelihood of THMs and other DBPs generated, and can result in a greater level of risk of pathogens slipping through the treatment process.

SOCS, VOCS, HERBICIDES, PESTICIDES, AND METALS. SOCs and VOCs represent the largest group of water quality parameters currently regulated. Many VOCs and some SOCs are formulated for or are the result of industrial processes. Pesticides and herbicides are specifically formulated for their toxic effects on animals and plants. From a public health perspective, these organics are identified as being or are suspected of being carcinogens, mutagens, or teratogens. Heavy metals, originating primarily from rocks, minerals, and municipal and industrial wastes, can have toxic effects on human health if of high enough concentration in the water or if found in fish consumed by humans.

Table 3-1 provides an overview of the relationship between these water quality parameter groups and potential contaminant sources in the Stanislaus River watershed. The objective of this table is to provide a basic understanding of the water quality concerns associated with the land uses and activities.

Table 3-1: Relationship Between Contaminant Sources and Water Quality Concerns

Watershed Activities	Micro-organisms	DBP Precursors	Turbidity	SOCs, VOCs, & Metals
Forestry Activities		●	●	●
Irrigated Agriculture and Pesticides		●	●	●
Livestock, Dairies, and Poultry	●	●	●	
Mining			●	●
Recreation	●	●	●	●
Solid and Hazardous Waste	●			●
Urban Runoff and Spills	●	●	●	●
Wastewater	●	●	●	●
Wildfires		●	●	●
Wildlife	●	●	●	

FORESTRY ACTIVITIES

Forestry activities are focused here on timber harvesting. Livestock grazing, off-road vehicles, and wildfires associated with forest lands are addressed in other sections.

CONCERN

Timber harvest operations have the potential to dramatically impact water quality, especially on pristine lands. Logging and associated road construction may increase the rate of soil erosion, thereby impacting waterways by increasing turbidity and nutrient loading. Applied herbicides can contribute SOCs. In addition, flow volumes from the watershed can be significantly altered and may show dramatic increases immediately following logging, slowly returning to normal over a period of years.

POTENTIAL CONTAMINANT SOURCES

Jedidiah Smith made the first recorded crossing of the Sierras by white men in early spring 1827 at the Stanislaus River in what is now known as the Stanislaus National Forest. The 900,000 acre Stanislaus National Forest is one of the oldest national forests in the United States, formed in 1905. Timber harvest occurs in the higher elevations of the watershed where the United States Forest Service (Forest Service) manages sales to maintain forest health and fire protection.

Tuolumne County reports 83,978 acres of land in timber preserves. Timber production in Tuolumne County was 50,367 thousand board feet in 2019. Within Tuolumne County, Forest Service owns 605,803 acres while the Bureau of Land Management owns 47,352 acres. Sierra Pacific Industries (SPI) is the largest private landowner in Tuolumne County with approximately 80,000 acres of forest in the Stanislaus National Forest. Forested lands are generally in the upper watershed above New Melones Reservoir.

Timber production in Calaveras County is primarily found on Stanislaus National Forest lands or on private lands within a designated timber production zone. Calaveras County reports 77,500 acres of land in timber preserves (a 50 percent decrease since 2013). The forested watershed upstream of Murphy's within Calaveras County is a small area (relative to land within Tuolumne County) mainly between the Highway 4 watershed divide and the County line along the Stanislaus River. A small portion of the timber preserves and board feet produced is from this part of Calaveras County. The Calaveras County Dept of Agriculture notes in their annual crop report that timber production ramped up in 2016 to 57,873 million board feet because of salvage operations for the 2015 Butte fire and for bark beetle timber.

Table 3-2 lists the most recent timber harvesting plans (THP) and non-industrial timber management plans that have been initiated in the Stanislaus River watershed. These THP requests provided by the State Department of Forestry and Fire Protection (CAL FIRE) are in Tuolumne and Calaveras counties. A THP is the environmental review document outlining what timber is requested to be harvested, how it will be harvested, and steps taken to prevent damage to the environment. The landowner must replant the area according to the Forest Practice Rules requirements. Figure 3-3 provides an overview of the lands in the watershed which have had a THP over time. This figure provides an overview of the extent of THPs that have occurred over time.

Some areas within the watershed are naturally more susceptible to erosion due to slope, soils, and vegetative cover. This is of concern in the vicinity of McKays Point Reservoir where erosion has impacted Collierville Tunnel and the Hunters WTP/UWPA diversion. Timber harvesting would exacerbate erosion from these areas without proper controls.

Table 3-2: New Timber Harvesting Plans in the Stanislaus River Watershed

Year Filed by CAL FIRE	Timber Harvest Plan No.	Subwatershed	Acreage
11/5/20	4-20-0185-TUO	Upper Beaver Creek (North Fork Stanislaus Ri)	455
11/25/20	4-20NTMP-00007-CAL	Love Creek (North Fork Stanislaus Ri)	280

Source: CAL FIRE, 2021.

Source: USFS

Stanislaus River Watershed Sanitary Survey
Figure 3-3
Timber Harvest Plan Areas in Stanislaus River Watershed

WATERSHED MANAGEMENT

The Forest Service manages timber harvest lands within the Stanislaus National Forest portion of the watershed. Most timber on Stanislaus National Forest land is harvested on general forest land, with only small amounts and much more restrictive logging occurring in areas with wilderness, near natural wildlife, and wild and scenic river designations. The Forest Service harvests timber for several purposes including thinning of trees to reduce risk or extent of insect or disease infestation.

The Board of Forestry and Fire Protection implements the Z'berg-Nejedly Forest Practice Act of 1973 by developing forest practice rules and policy applicable to timber management on state and private timberlands. CAL FIRE monitors logging activities and enforces laws that regulate logging on privately lands. Together the Board of Forestry and CAL FIRE work to protect and enhance resources that are not under federal jurisdiction, including: major commercial and non-commercial stands of timber, areas reserved for parks and recreation, and lands in private and state ownership that are a part of California's forests.

Timber harvests of 2 to 1,000 acres are regularly permitted by CAL FIRE. CAL FIRE stipulates conditions under which timber harvest can occur including mitigation for potential water quality impacts such as providing buffer zones near streams, and implementation of BMPs. Once a timber harvest plan is approved, the landowners are required to implement erosion control practices. CAL FIRE continues to monitor timber harvest areas for one to three years to assure that erosion control practices are still in place. Timber harvesting that occurs near waterbodies containing anadromous fish populations is monitored for erosion control practices for three years. All owners of private timberland in California must obtain an approved THP before harvesting of commercial timber species is allowed. This requirement applies to all lands that contain commercial timber species, regardless of zoning.

The State Water Resources Control Board (SWRCB) worked with the Board of Forestry and Central Valley Regional Water Quality Control Board (CVRWQCB) to update Waste Discharge Requirements for federal and non-federal lands to provide a General Order for timberland management activities. It waives the requirements to submit a report of waste discharge and obtain waste discharge requirements. On October 8, 2013, amendments to Public Resources Code went into effect and established a new type of timber harvesting permit: Working Forest Management Plan (WFMP). This new permit allows non-federal non-industrial landowners of 10,000 acres or less to harvest timber via a non-expiring permit. After litigation, the Board of Forestry amended the adopted 2017 regulations to reduce the acreage to 10,000 acres or less and address the need for information regarding erosion control in the plan. Amended regulations passed in February 2019. The first WEFP has been submitted and is under review by CAL FIRE and other state agencies.

IRRIGATED AGRICULTURE AND PESTICIDES

CONCERN

The potential risks to water quality associated with agricultural cultivation are increased erosion, loss of top soil, and use of fertilizers, pesticides, and herbicides. Pesticide and herbicide use within the study area is primarily for landscaping, rights of way, forest lands, and agricultural activities.

IRRIGATED AGRICULTURE. The pervious surfaces of agricultural lands absorb contaminants and runoff during precipitation events. However, when soils are saturated or the surface is impervious, storm events result in runoff from these lands conveyed as sheetflow or concentrated flows eroding the ground surface and stream banks. Soils with poor drainage characteristics may have higher runoff potential than more permeable soils. Plowing and grading fields, particularly on windy days, can cause the suspension of particles with atmospheric transport into waterbodies. High loadings of suspended solids into waterbodies result in high turbidity levels containing pesticides and herbicides, and DBP precursors.

Water quality contamination associated with illegal marijuana farming is typically found in rural mountainous or foothill areas. Concerns with illegal farms are associated with grading and other earth moving that can cause erosion, liberal use of banned rodenticides for workers sleeping on-site to protect the high value crops, dumped trash and discarded vehicles, human waste entering waterbodies, excessive use of pesticides and herbicides, and illegal diverting of surface waters. The concern is primarily with illegal cannabis farms growing in the ground subject to runoff that are not permitted. Legal crops require farmers to report chemical usage to the county as with other crops, and permits are issued to ensure compliance with waste discharge requirements etc. Illegal operations result in SOCs, hydrocarbons, herbicides, and pesticides, and microorganisms making their way to waterbodies through direct deposition and runoff.

PESTICIDES AND HERBICIDES. When herbicides and pesticides are applied to agricultural lands, they can enter waterbodies by runoff from the land due to stormwater flows or flood irrigation, overspray, or wind transport during application. These chemicals are also applied aerially by crop dusters. Improper use and over-application of pesticides, as well as over-irrigating, also can cause runoff of sediment and pesticides into surface waters or can seep into groundwater. Sediment, pesticides, and excess nutrients can also affect aquatic habitats by causing eutrophication, turbidity, temperature increases, toxicity, and decreased oxygen.

Pesticide/herbicide use is categorized by season of application, with application occurring either during the irrigation or dormant season. During the dormant season, organophosphate pesticides are carried to surface water by stormwater runoff. Pesticide residues deposited on trees and on the ground migrate with runoff water during rain events. Although practices are available to minimize pesticide drift, once pesticides enter the atmosphere through volatilization, only natural degradation limits their movement and fallout during rainstorms. Pesticides applied during the dormant season, from December through February, are periodically washed off fields by storms large enough to generate runoff. For the San Joaquin River Basin, studies have shown that the amount of pesticide washed off is usually a very small fraction of the amount applied, ranging between 0.05 and 0.13 percent for diazinon and 0.06 to 0.08 percent for chlorpyrifos, but it is sufficient to cause toxicity to aquatic invertebrates.

In addition to the pounds of pesticide applied, other factors affect the amount of pesticide in storm runoff and pesticide loading. Soils with poor drainage characteristics may have higher runoff potential than more permeable soils, and field slope, the presence and type of cover crop, and antecedent moisture conditions also affect transport mechanisms. Irrigation methods affect the magnitude of pesticide loading to a river or ditch. With furrow or flood irrigation, tailwater drains from the end of the field and is usually discharged to a drainage channel that leads to a stream or pond. In some cases, systems are in place to recycle tailwater to another field, or to blend it with fresh irrigation water and reapply it to another field. Tailwater return flows from flood and furrow irrigation generate the largest loads because large volumes of water are discharged directly to waterbodies. Relative to flood and furrow irrigation, sprinkler irrigation is likely to increase pesticide wash-off from foliage but will generate less tailwater if used appropriately. Drip irrigation systems typically generate little or no runoff. If well managed, drip irrigation minimizes irrigation seasonal pesticide runoff from treated sites.

Agricultural ponds can be a source of pesticides, organic matter, and as discussed with livestock, microorganisms. Runoff from agricultural lands concentrated in ponds can be spilled during rainfall events resulting in loading of contaminants to waterbodies.

Almond orchard drainage to Woodward Reservoir

POTENTIAL CONTAMINANT SOURCES

IRRIGATED AGRICULTURE. Vineyards and orchards can be found throughout the Stanislaus River watershed. The small to mid-sized vineyard operations are mostly concentrated near Murphys and Angels Camp.

Agricultural land use in the lower elevations is predominantly rangeland; cattle grazing is discussed under Livestock. There appears to be a trend to convert grazing lands to orchards, particularly almond orchards in the lands draining to Woodward Reservoir and Farmington Flood Control Basin. This was evident during the project site visit. The Stanislaus County Agricultural Commissioner stated in its annual reports that an additional 8,496 harvested almond acres were added to the county in 2018 and 20,000 new acres in 2019 reflecting a trend for this permanent high value crop across the region. It is the top agricultural commodity in Stanislaus County. The report further states that as dairies close, many silage acres are being transitioned to almond orchards (Stanislaus County, 2018).

The latest crop reports for Tuolumne and Calaveras counties indicate that the demand and prices for agricultural crops have remained strong. According to the 2019 crop reports, miscellaneous field crops are the top commodity after livestock and poultry, and timber harvested in Tuolumne County. Wine grapes, walnuts, and almonds are the top commodities after timber and livestock in Calaveras County. Table 3-3 presents crop acreages for Calaveras, Tuolumne, and Stanislaus counties from the most recent crop reports. Although data are for the entire counties, the trend of increasing almond orchards in Calaveras and Stanislaus counties is apparent.

Table 3-3: Crop Production Acreage

	Calaveras County		Tuolumne County		Stanislaus County	
Crop	**2018**	**2019**	**2018**	**2019**	**2018**	**2019**
Grapes	711	711	-	-	9,655	9,226
Hay	227	250	560	560	35,871	38,430
Walnuts	794	811	775	788	37,468	37,044
Almonds	50	180	-	-	196,496	216,265
Tree, Vine, and Vegetable Crops	-	-	218	236	-	-
Vegetable Crops	-	-	-	-	28,097	28,223

Source: Agricultural Commissioners for Calaveras County, 2020, Tuolumne County, 2020 and Stanislaus County 2020.
Note: acreages are for each entire county. Counties report acreages using different categories.

The region is crossed with irrigation canals providing Stanislaus River water to irrigated farmlands. The Farmington and Woodward Reservoir subwatersheds have crop farming in the vicinity of Littlejohns, Salt, and Hood creeks, and adjacent lands draining to Woodward Reservoir. Vineyards and almond orchards were the predominant crops observed, with a range of apparent ages and many recent plantings observed. The Woodward Reservoir/South San Joaquin Main Canal subwatershed in Stanislaus County has nut orchards lining the Main Canal before it flows into the reservoir. In previous surveys, it was noted that along both the Upper and Lower Farmington canals, runoff currently enters the canals in several areas; improved drainage would prevent agricultural runoff from entering the canals. The Chapter 4 discussion on water quality indicates elevated TOC levels in Woodward Reservoir which may be from cropland runoff of fertilizers and other chemicals or from agricultural ponds overflowing.

Agriculture is anticipated to continue to expand into grazing and natural resources lands, particularly in areas around Salt Spring Valley and the Highway 4 corridor up to Murphys.

PESTICIDES AND HERBICIDES. Reports of controlled pesticide and herbicide use are submitted to the California Agricultural Commissioner monthly providing chemical use, quantities, etc. Statewide, farmers have reduced pesticide use over time. This shift has been influenced by more stringent regulations from the California Department of Pesticide Regulation (CDPR). Other contributors to the shift towards reduced pesticide use include increased pesticide costs, choices made by the farmers to make economical and safety decisions, a small shift towards organic farming, and efforts made by the local resource conservation districts.

Table 3-4 presents overall pounds of pesticides used in Tuolumne and Calaveras counties from 2011 to 2019. Pesticide usage varies year to year depending on pest problems, weather, acreage and types of crops planted, economics, and other factors. The extended data in Table 3-4 shows the influence that weather has on pesticide usage. The driest years were 2012 and 2013 with a low usage, and the wettest years were 2011 and 2017 with higher usage.

Table 3-4: Pesticide Quantities (pounds applied)

	2011	2012	2013	2014	2015	2016	2017	2018	2019
Calaveras County	78,513	43,814	33,524	61,992	52,834	49,025	52,986	73,868	61,220
Tuolumne County	71,138	28,527	28,382	83,339	50,296	46,678	50,502	39,976	40,999

Source: CDPR, 2021. Note: Quantities include adjuvants and are for the entire counties.

The top five pesticides used in Calaveras and Tuolumne counties, pounds applied, and acres are presented in Table 3-5. Glyphosate is the most commonly used herbicide in the United States; it is the primary ingredient in products such as Round-up. Banning this chemical was considered by the US EPA but it could not be proved that it was harmful to humans, however it has been proven to kill bees which are important to crop production.

Of the chemicals listed in Table 3-5, many cities in the United States have restricted or banned the use of glyphosates on city facilities. Methylated soybean oil is an adjuvant, a substance added to improve herbicidal activity. Sulfur is the primary chemical used for wine grapes; it is applied as a fungicide against powdery mildew. Dimethylamine salt, or 2,4-D, is designed to kill broad-leaf weeds. Pendimethalin is an herbicide used to control grassy and broadleaf weeds in a number of crop and noncrop areas.

Table 3-5: Top Five Pesticides Used - 2018

Pesticide	Commodity	Calaveras County		Tuolumne County	
		Pounds	Acres	Pounds	Acres
Glyphosate, Isopropylamine Salt	Landscape Maintenance	22,968	0	2,022	1
	Rights of Way	3,698	9	1,861	3
	Forest, Timberland	1,912	602	3,141	917
	Grape, Wine	73	28	21	21
	Walnut	235	175	-	-
	Regulatory Pest Control	-	-	35	0
	Total	28,886	814	7,080	942
Methylated Soybean Oil	Forest, Timberland	6,884	1,639	5,990	3,393
	Rights of Way	273	15	233	0
	Landscape Maintenance	219	0	79	0
	Uncultivated Ag	17	28	17	4
	Pastureland	33	30	-	-
	Total	7,426	1,712	6,319	3,397
Glyphosate, Dimethylamine Salt	Forest, Timberland	3,937	1,002	8,960	2,530
	Rights of Way	10	10	-	-
	Uncultivated Non-Ag	-	-	13	4
	Total	3,947	1,012	8,973	2,534
Sulfur	Grape, Wine	7,980	1,586	0	0
	Total	7,980	1,586	0	0
Pendimethalin	Landscape Maintenance	-	-	2,774	0
	Rights of Way	-	-	59	0
	Structural Pest Control	-	-	<1	0
	Total	0	0	2,833	0
Glyphosate, Potassium Salt	Landscape Maintenance	1,572	0	1,139	0
	Right of Way	208	70	379	0
	Rangeland	133	22	-	-
	Grape, Wine	583	322	-	-
	Walnut	55	40		
	Total	2,551	454	1,518	0
Total Pesticide Usage		**50,790**	**5,578**	**26,723**	**6,873**

Source: CDPR, 2021. Top five pesticides by pounds.

Because of the increasing acreage trend and proximity of almond orchards in the lower watershed to Woodward Reservoir and New Melones Conveyance System in particular, with other lands draining to the Stanislaus River at Knights Ferry, pesticides used on almond orchards are identified here. According to CDPR, almond orchards are often treated with insecticides such as Abamectin, petroleum and mineral oils, methoxyfenozide, chlorantraniliprole, and bifenthrinwith with a steady increase in acreage treated with the top chemical Abamectin over the years; it is most used in May. Fenazaquin is a relatively new foliar miticide starting use on almond acreage in 2016 with a rapid increase over time. The biopesticide *Burkholderia* spp. strain A396 is used; bioinsecticides *Bacillus thuringiensis* and *Chromobacterium subtsugae*s strain PRAA4-1 are used; and biofungicide *Bacillus amyloliquefaciens* strain D747 is used, doubling in use between 2017 and 2018. The top five herbicides used in 2018 on almond orchards include glyphosate, oxyfluorfen, glufosinate-ammonium, paraquat dichloride, and saflufenacil. The top five fungicides include fluopyram, azoxystrobin, trifloxystrobin, propiconazole, and copper. The top five fumigants were aluminum phosphide, 1,3-dichloropropene, chloropicrin, methyl bromide, and sulfuryl fluoride. The trending of use of these pesticides in California on almond orchards is graphically depicted in Figure 3-4 (CDPR, 2020).

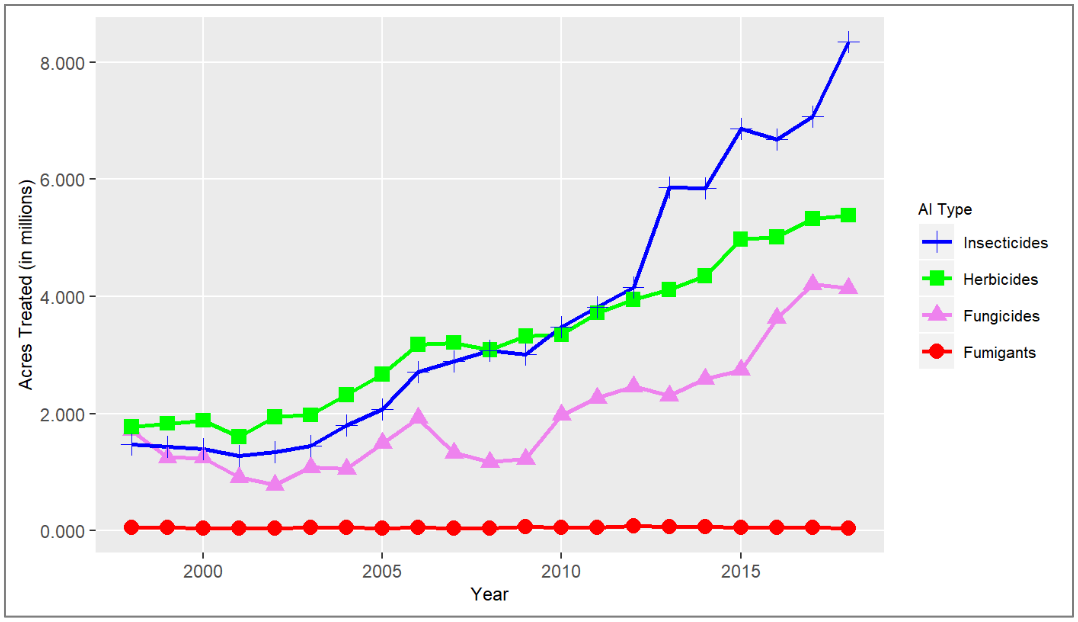


Figure 3-4: Acres of Almond Treated by All Active Ingredients in the Major Types of Pesticides (1998 to 2018)

The Forest Service uses glyphosate on watershed lands if hand pulling does not eradicate noxious weeds. SSJID controls weed growth around dam locations with herbicides such as Round-up and Clearcast (active ingredient: ammonium salt of imazamox). SEWD was able to establish no fly zones for crop dusters to prevent chemicals being directly applied to waterbodies. The crop dusters must receive clearance before applications if they are in the vicinity. SEWD applies pesticides along canal roads approximately two times a year at a proximity of no less than 50 feet.

WATERSHED MANAGEMENT

Programs established to control nonpoint source pollution from agriculture include joint efforts by local, state, and federal agencies. The SWRCB oversees the statewide nonpoint source program, with assistance from CDPR for pesticide usage. As described under Livestock, the SWRCB regulates agricultural runoff through its nonpoint source program. CDPR protects human health and the environment by regulating pesticide sales and use and by fostering reduced-risk pest management. CDPR requires full use reporting of all agricultural pesticide use and structural pesticides applied by professional applicators. CDPR works closely with California's county agricultural commissioners, who serve as the primary enforcement agents for state pesticide laws and regulations. County agricultural commissioners regulate pesticide use to prevent misapplication or drift, and possible contamination of people or the environment. County agricultural commissioner staff also enforce regulations to protect groundwater and surface water from pesticide contamination.

Farmers must obtain site-specific permits from their county agricultural commissioner to purchase and use many agricultural chemicals. The commissioner must evaluate the proposed application to determine whether it is near a sensitive area, such as wetlands, residential neighborhoods, schools, or organic fields. State law requires commissioners to ensure that applicators take precautions to protect people and the environment. Based on this evaluation, the county agricultural commissioner may deny the permit or require specific use practices to mitigate any hazards. For example, a permit may be contingent upon the method of application, time of day, weather conditions, and use of buffer zones. Part of the commissioner's duty in issuing a permit is to decide the need for a particular pesticide and whether a safer pesticide or better method of application can be used and still prove effective.

Local governments such as the county Department of Agriculture and local resource conservation districts play an active role in influencing practices of agricultural activities. The USDA Natural Resources Conservation Service (NRCS) and the University of California Cooperative Extension Service provide technical and financial services for farmers. NRCS provides conservation assistance through a nationwide network of resource conservation districts (RCD) and local offices. The Tuolumne RCD provides guidance, training, and technical assistance.

The NRCS works through the local RCDs and others to help landowners, as well as federal, state, tribal, and local governments, and community groups, conserve natural resources on private land. The NRCS has three strategies to implement their goals of high quality, productive soils; clean and abundant water; healthy plant and animal communities; clean air; an adequate energy supply; and working farms and ranchlands.

- Cooperative conservation: seeking and promoting cooperative efforts to achieve conservation goals.
- Watershed approach: providing information and assistance to encourage and enable locally-led, watershed-scale conservation.
- Market-based approach: facilitating the growth of market-based opportunities that encourage the private sector to invest in conservation on private lands.

In 2016, Calaveras County began the process of establishing requirements to regulate the growing of medical marijuana/cannabis and approved a temporary ordinance. The Calaveras County Board of Supervisors adopted an ordinance regulating cannabis cultivation on July 28, 2020 (Chapter 17.95). These regulations allow for limited regulated cannabis cultivation and require applicants to comply with SWRCB's 2019 General Waste Discharge Requirements for Discharges of Waste associated with Cannabis Cultivation Activities (Resolution No. 2019-0001- DWQ).

LIVESTOCK, DAIRIES, AND POULTRY

CONCERN

Rangeland cattle, dairy cattle, and poultry are addressed together because of the risk of microbial contaminants. Livestock can contribute microbial contaminants to a waterbody when feces are deposited directly into the water or when runoff carries feces into the water; calves younger than six months appear to be the most likely to shed *Cryptosporidium* oocysts. Pathogens are more difficult to treat than pesticides and herbicides and there is a public health risk associated with pathogens. Within the Stanislaus River watershed, the Copper Cove WTP uses ozone as a primary disinfectant which significantly lowers the risk of a *Cryptosporidium* outbreak.

Animal waste includes ammonia, nitrates, salts, pathogens, and pharmaceuticals such as ceftiofur, penicillin, and sulfa drugs (CDFA, 2015). Nitrogen and phosphorous can contribute to the eutrophication of waterbodies and excessive algal growth; increased nutrient levels also increase treatment costs.

DAIRIES AND POULTRY. Concentrated animal facilities, such as dairies, tend to have stockpiled manure which contains pathogens and nutrients and are of concern during continuous or intense precipitation events. Generally, loadings are a function of animal density and infection rates among the herd. Because dairies are concentrated animal feeding operations, the presence of calves year-round in dairies greatly increases the risks of spreading infection, more so than rangeland cattle. Runoff from dairies and poultry operations is prohibited and may occur with dairies during more severe storms that overload the waste management systems. Poultry are usually housed. Poultry includes chickens, turkeys, ducks, geese, guinea fowl, pheasant, pigeons, and ostrich.

RANGELAND GRAZING. Rangeland cattle typically include raising cows for breeding and raising steers for sale. In addition to microbial contamination, livestock can increase erosion causing particulate, turbidity, and DBP precursor problems if they are allowed to overgraze an area and remove the vegetative cover, compact soils, or are given direct access to a waterbody. Reduced vegetative cover and compaction from animal trails can reduce stormwater infiltration resulting in increased runoff, which increases soil erosion. Increased sedimentation can cause high turbidity reaching treatment plants. Suspended soil particles can absorb and transport other pollutant to the intakes.

Rangeland grazing drainage to Farmington FCB

Contamination risks of rangeland grazing are associated with two primary activities: cattle concentrating at waterbodies and storm events delivering runoff to waterbodies. Livestock with access to waterbodies can directly deposit manure and its associated contaminants in the streams and can disturb the shoreline and riparian vegetation resulting in erosion during precipitation events. Cattle access streams and reservoirs when there are no water improvements to encourage them to drink elsewhere; water stations can be expensive to provide in rangelands with limited water access. Thus, the risk of contamination is greater without water provisions.

Risks of loading viable *Cryptosporidium parvum* oocysts into waterbodies from rangeland cattle are greatest during storm events because sheet flow from grazed areas transports sediment, along with organic matter, nutrients, and pathogenic microorganisms from the manure. Check dams on small water courses create watering spots for grazing cattle which can overflow during rainfall events, releasing pathogens to waterbodies. In addition, if irrigated pasture is not properly managed, irrigation water could run off the site and into waterways.

POTENTIAL CONTAMINANT SOURCES

There are no dairies in the study area watershed, however several dairies are proximate to the Lower Farmington Canal in San Joaquin County. The lower Farmington Canal, as shown on Figure 2-2, does not have lands draining directly to it but there are drainages piped over the canal as described below. Watershed lands within Calaveras and Tuolumne counties are primarily rural residential and open space lands with many farms and ranches throughout the watershed. Larger scale commercial poultry operations are only found in the lower watershed. Grazing animals can be found throughout the watershed but are more prevalent in the lower foothill elevations. In addition to rangeland grazing, residential development in communities such as Copper Cove have ranchettes with livestock.

DAIRIES AND POULTRY. California has been the nation's leading dairy state since 1993 with Stanislaus County currently the fourth highest milk producing county in California. Dairies have decreased in Stanislaus County from 232 in 2011 to 185 in 2017, the last year of available data. Milk cows in the county decreased from 180,416 head in 2011 to 171,473 in 2016, then increased to 185,000 in 2019, an eight percent increase since 2016 (CDFA, 2021). Data for Stanislaus County are provided as an indicator of trends in the region.

As presented on Figure 3-5, there are two dairies adjacent to the Lower Farmington Canal (below Farmington Flood Control Basin) and one nearby. The two proximate dairies are Armelim Amaral Dairy on Groves Road and River Oak Dairy on Highway 4 north of the dam. River Oak Dairy has a ditch that collects runoff from fields and reuses it; the runoff is piped across the Lower Farmington Canal in three places. The risk is associated with leaking pipelines where they cross the canal. SEWD is aware of this potential contaminant source and monitors the pipeline crossings.

Dairies typically have a milking parlor, animal housing areas, feed and manure storage areas, liquid storage pond with pond liners, and land used for application of manure. Manure is handled either in a wet form through a liquid/slurry system or a drier form (solids from corrals or a separator/ basin).

The SWRCB began registering poultry operations in 2016. Calaveras County has two facilities listed; they are out of the watershed. Tuolumne County has six facilities registered; one located on Highway 108 draining to Tulloch Reservoir. According to the CVRWQCB, it is recognized that there are more facilities in the region but the new program has relied on voluntary registration. Poultry operations observed within the watershed during the development of this survey that are not registered include one on Woodward Lake Drive draining to Woodward Reservoir; and five draining to Rock Creek in the Farmington Flood Control Basin: two on Dunton Road, two on Hwy 4, and one on Milton Road.

RANGELAND GRAZING. Cattle production is one of the largest agricultural industries in both Calaveras and Tuolumne County. Livestock grazing in the upper watershed began in the area around the 1850's after the gold rush caused in a boom in the cattle industry. Ranchers established summer ranges on meadow lands in the high Sierras. These cattlemen used the low country open range during winter, and mid and higher country had ideal pasture and meadows for grazing during the summer. The pattern of rotating cattle up and down throughout the seasons persists to this day (Tuolumne County, 2021). The Stanislaus National Forest Reserve was established in 1905 and with it came leased allotments. Cattle graze in low densities, depending on the terrain and vegetation, throughout the watershed on Stanislaus National Forest lands and private lands including that owned by Sierra Pacific Industries (SPI). Ranchers protect grazing areas to maintain permit status, the long-term health of their herd, and the availability of a healthy grazing environment.

Stanislaus River Watershed Sanitary Survey
Figure 3-5
Dairies in Vicinity of Lower Farmington Canal

Table 3-6 presents acreages of land used for rangeland grazing in the three counties. 2015 is provided to indicate trends. Total acres have not changed for Calaveras and Tuolumne counties since 2015 but 500 acres of Stanislaus County rangelands were replaced with almond orchards and other high value crops as discussed earlier.

Table 3-6: Rangeland by County

	Rangeland Acres		
	2015	**2018**	**2019**
Calaveras County	197,805	197,805	197,805
Tuolumne County	200,000	200,000	200,000
Stanislaus County	421,949	421,449	421,449

Source: Agricultural Commissioners for each county, 2016 and 2020.

Runoff from grazed lands drain to the Stanislaus River reservoirs of New Melones and Tulloch. Lands proximate to Utica Ditch below Murphys, both above and below Ross Reservoir (Angels Camp WTP) are used for grazing with limited fencing of the ditch. Land proximate to and upstream of Copper Cove WTP is grazed with drainage to Black Creek. Grazing is also found along the Stanislaus River near the Baseline Conservation Camp and Sierra Conservation Center WTP intakes. Woodward Reservoir and the South San Joaquin Main Canal have been fenced to prevent cattle grazing, but runoff from rangelands drain to these facilities (supplies for NCD WTP and DJW WTP, respectively). SSJID conducts routine inspections of the fencing surrounding Woodward Reservoir and provides DDW with an annual update on the number of repairs conducted during the previous year.

According to the 2006 WSS, all local drainage in the vicinity of New Melones Conveyance System's Shirley Gulch Weir is collected, channeled in ditches, and diverted in culverts over or under the canal. However, a canal extends from Shirley Gulch Weir to Shirley Creek conveying canal flow to the natural creek. The natural creek crosses privately owned grazing land and is heavily grazed. Water which could contain contaminated runoff is then conveyed to the Farmington Flood Control Basin (DJW WTP supply).

As presented in Table 3-7, cattle numbers in Calaveras, Stanislaus, and Tuolumne counties vary each year, likely related to prices, weather, and market conditions. There was a significant decline in cattle numbers starting in 2013 and ending in 2017; this appears to be associated with the 2012 to 2016 drought. Data in Table 3-7 for the study period represent the entire county, not just the study area watershed.

Table 3-7: Cattle by County [1]

	2016	2017	2018	2019	2020
Calaveras	7,800	8,500	10,600	10,300	10,500
Tuolumne	4,800	5,200	5,300	NA	NA
Stanislaus	26,500	29,000	25,500	24,500	25,500

Source: CDFA, 2020. [1] Beef cows

WATERSHED MANAGEMENT

DAIRIES AND POULTRY. Dairies are required to retain on site all waste, washwater, and runoff that has contact with animal waste. In October 2013, the CVRWQCB adopted *Reissued Waste Discharge Requirements General Order for Existing Milk Cow Dairies, Order No. R5-2013-0122*, which replaced the original Dairy General Order R5-2007-0035 adopted in May 2007. This order serves as general waste discharge requirements for discharges of waste from existing milk cow dairies of all sizes. It includes requirements for corrals, production areas, and land application areas and requires each dairy to fully implement a Waste Management Plan and a Nutrient Management Plan.

UC Cooperative Extension partners with the dairy industry and regulatory agencies for the California Dairy Quality Assurance Program (DQAP) providing certification in Environmental Stewardship. This successful certification program requires education in water and air quality requirements, on-farm planning to verify regulatory documentation is up to date and visual analyses are conducted, and third party evaluation be performed. The DQAP has been incorporated into the Regional Water Quality Control Board (RWQCB) permitting process by reducing the fees if certified.

The River Oak Dairy is adjacent to the Lower Farmington Canal. According to SEWD, it does not drain into the canal. Facilities collect runoff from the fields and convey it over and under the canal to a storage pond where the water is reused, and around the canal. SEWD closely monitors the pipelines crossing the canal for leakage (SEWD, 2016).

As of 2016, commercial poultry operations are regulated under the RWQCB's Confined Animal Facilities program and are also subject to waste discharge requirements. The Poultry General Order regulates wastes generated by poultry facilities but includes manure, wash water, and stormwater runoff that has contact with feed or manure. The Poultry General Order regulates commercial operations involving more than 2,000 pounds of live poultry for more than 12 weeks in any 12 month period. Backyard and other small operations are not included. The order has two tiers of requirements based on the potential threat to water quality. Facilities that primarily conduct their operations indoors, do not generate process wastewater, and do not store uncovered manure outdoors are considered Low Threat Operations. Some pasture poultry operations may also be considered Low Threat Operations. Facilities that generate wastewater or that have a significant amount of manure exposed to the elements are considered Full Coverage Operations and must comply with the full range of requirements in the Poultry General Order. Low Threat Operations have significantly fewer monitoring and reporting requirements.

According to the CVRWQCB, there have been no complaints or problems associated with poultry raising facilities in Calaveras or Tuolumne counties. In general, poultry operations are a lower risk than other livestock for water quality conditions because the animals do not generate the same volume of waste as with livestock at dairies or feedlots and are housed.

RANGELAND GRAZING. Runoff from grazed land is considered a non-point source of pollution and requires compliance with the SWRCB's Non-Point Source Program, a program under the Porter-Cologne Water Quality Control Act requiring permits for anyone discharging waste that could affect water quality in the State. Typical best management practices (BMP) to keep cattle from waterbodies include the provision of salt licks located away from waterbodies, dedicated watering containers with a water source, and fencing of streams (which can be problematic for wildlife). Grazing provides the benefit of reducing fire fuels; fuels management can greatly reduce the impact of wildland fires in the watershed.

Grazing is extensive on federal lands owned by Forest Service and U. S. Bureau of Land Management. Regulations for allotments address the density of cattle, minimum grass height in meadows, seasons for grazing, provision of water and salt licks away from waterbodies, and fencing sensitive areas. Grazing on federal lands is governed by the Water Quality Management Plan for National Forest System Lands in California. This plan utilizes range management BMPs including range analysis and planning, grazing permits, and rangeland improvements.

Forest Service initiated a water quality monitoring pilot program in response to concerns regarding cattle grazing and water quality. The Forest Service study investigated microbial contamination, nutrients, and temperature, as well as overall livestock impacts, such as streambank alteration. In the first year of the study, 2010, the focus was on the Stanislaus River. Forest Service monitored creeks upstream and downstream of recreation sites and cattle grazing sites. The 2010 study found that the coliform data were below EPA and CVRWQCB standards in all the recreation sites. The conclusions were that cattle grazing, recreation, and provisioning of clean water can be compatible goals on national forest lands.

The Rangeland Water Quality Management Program developed by UC Cooperative Extension, Cattlemen's Association, and U. S. Department of Agriculture (USDA) Natural Resources Conservation Service, continues to be used as a voluntary management program for private grazing lands. Similar to the program for dairies, the training supports ranchers to develop and implement water quality management plans and BMPs on their lands.

Grazing has historically taken place along the South San Joaquin Main Canal. SSJID provides fencing and inspections along the canal up to Goodwin Dam, and for Woodward Reservoir. The inspections are weekly around Woodward Reservoir and periodically, weather permitting, along the canal (SSJID, 2021). Appendix B presents the records of fencing inspections required of SSJID by DDW. According to the 2006 WSS, all local drainage in the vicinity of New Melones Conveyance System's Shirley Gulch Weir is collected, channeled in ditches, and diverted in culverts over or under the canal.

MINING

CONCERN

Active, inactive, abandoned, and unknown mining operations can contribute elevated levels of mercury, arsenic, copper, and other metals to waterbodies. Instream suction dredge mining is currently prohibited and is not discussed here. The risk with active mines is associated with accidental discharges. Sand and gravel resource extraction can result in elevated levels of turbidity and sedimentation if berms separating mining activities from waterbodies are breached or if fuels from equipment leak.

Abandoned mines pose the greatest risk to water quality by contributing high levels of metals from exposed soils and tailings transported through runoff. Abandoned mines are not only hazards to the public, but if accessed by the public typically have extensive trash left behind, including cans and flashlight and lantern batteries.

There is little known about the capability and risks of unknown mines to contribute contaminated runoff and sediment. Historical mines and mining operations can contribute contaminants to watershed waterbodies without being a known source. Historical mining operations had little regard for environmental impacts and the sites did not require reclamation plans when operations ceased as they do presently.

POTENTIAL CONTAMINANT SOURCES

Current mining operations in the watershed are limited to quarry or rock pit operations. Active mines currently produce limestone, dolomite, and various forms of crushed rock, gravel, and sand products. Most of the mines within the watershed are inactive historic gold and other mines in the foothills and higher elevations. There are unknown mines continually being discovered throughout the region.

The State Department of Conservation, Office of Mine Reclamation periodically publishes a list of mines regulated under the Surface Mining and Reclamation Act of 1975 that meet provisions set forth under California's Public Resources Code. Active, idle, and closed mines are identified on an interactive map available from the Department of Conservation. All active and idle mines within the Stanislaus River watershed are listed in Table 3-8. Most are in Calaveras County. Tulloch Reservoir is listed as an impaired water body for mercury on the 303(d) list of impaired waterbodies. No total maximum daily loads (TMDL) have been developed for Tulloch Reservoir.

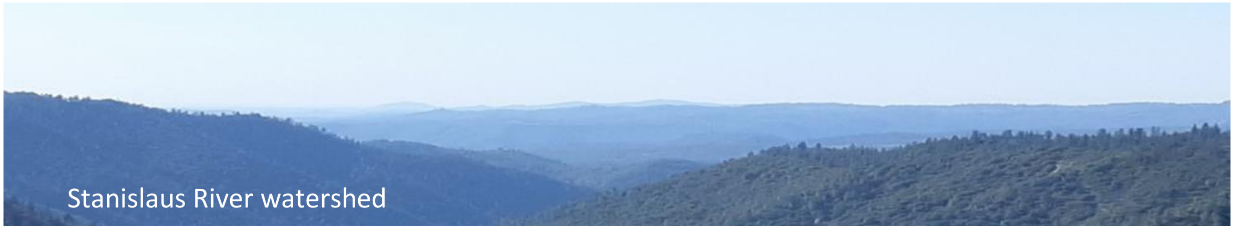


Table 3-8: Active Mines - Stanislaus River Watershed

Mine Name	Commodity	Proximate Waterbody
Table Mountain Quarry	Stone	Mountain Pass Creek to Tulloch Reservoir
Carson Hill Rock Products	Rock	New Melones
Blue Mountain Minerals	Limestone	New Melones
Cataract Limestone Quarry (Idle)	Limestone	North Fork Stanislaus
McCarty Pit	Sand & Gravel	Douglas Flat to New Melones

Source: CDOC, 2021. Proximity to waterbodies approximated by author.

WATERSHED MANAGEMENT

ACTIVE AND INACTIVE MINES. In Calaveras County, all mineral extraction operations require mining use permit approval prior to commencement of operations. Calaveras County then examines project specific impacts from the operation. Active mines are usually allowed only inert or nonhazardous waste releases; mining operations can meet these conditions by controlling the acidity of their discharges and by implementing other management practices. Tuolumne County adopted Title 8.20 of Tuolumne County Zoning Ordinance regarding land use regulation and reclamation for mining operations.

The Surface Mining and Reclamation Act of 1975 (SMARA) regulates surface mining operations to minimize environmental impacts and ensure that mined lands are reclaimed to a usable condition. Annual reporting is required of all mines under the State Mining and Geology Board's authority.

The CVRWQCB Mining Program oversees discharge of mining waste from active and inactive mines. The only mine in the watershed with a permit (i.e., Waste Discharge Requirements) is Red Hill Mine near Vallecito in Calaveras County, which drains to New Melones Reservoir. The unpermitted mine sites are Carson Hill Gold Mine, located on Highway 49 draining to New Melones Reservoir, and Juniper Uranium Mine, located in the Stanislaus National Forest draining to the Middle Fork of the Stanislaus River. Discharges from active mines are regulated through the issuance of waste discharge requirements and will usually include all surface impoundments, tailing ponds, and waste piles. Regulations have prescriptive and performance standards for waste containment, monitoring, and closure. Inactive and abandoned mines that are threatening or impacting surface and groundwater are regulated by the SWRCB laws and regulations for closure of mine sites and cleanup.

METHYL MERCURY. In 2010, SWRCB began a process to develop a statewide mercury control program for reservoirs. The three main goals of the program are as follows.

1. Reduce fish methyl mercury concentrations in reservoirs determined to be mercury-impaired
2. Have a control program in place for reservoirs in the future determined to be mercury impaired.
3. Protect reservoirs not currently mercury impaired from becoming mercury impaired.

Each reservoir listed as mercury impaired will eventually have its own plan with the SWRCB focusing first on the greatest contributors of mercury to waterbodies within the State. An update to this process since the last WSS update is the adoption of a resolution identifying three new beneficial uses associated with tribal and subsistence fishing and mercury provisions for fish tissue water quality objectives. It was noted that the mercury water quality objectives in the California Toxics Rule do not protect wildlife or people that consume fish contaminated with methylmercury. The resolution was approved in 2017 as titled: *Part 2 of the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California – Tribal and Subsistence Fishing Beneficial Uses and Mercury Provisions*. The provisions include, in addition to many other items, the change from directly measuring mercury in surface waters to assess the accumulation of the mercury found in the tissue of fish living in the water.

New Melones, Tulloch, and Woodward reservoirs were all listed under Clean Water Act Section 303(d) as mercury impaired reservoirs. These reservoirs are listed in SWRCB's draft Phase I program to address mercury in reservoirs. Phase I will include pilot tests to manage water chemistry in reservoirs (e.g., oxidant addition to reservoir bottom waters, sediment removal or encapsulation, etc.) and to manage fishers to reduce bioaccumulation (e.g., intensive fishing, changes to fish stocking practices). The mercury control program is also intended to address the cleanup of mine sites upstream of mercury-impaired reservoirs, and work with California Air Resources Board to reduce atmospheric deposition of mercury.

RECREATION

CONCERN

Recreational use of a waterbody poses a wide range of water quality risks, depending on the specific activity, proximity to intakes, and loadings. For example, body contact activities introduce microorganisms. Microorganisms from houseboat waste are of concern because of the potential for accidental release of large volumes of waste directly into a waterbody. Power boating contributes VOCs and allows boaters to access remote areas of a reservoir without restroom facilities. Shoreline access to reservoirs and rivers can increase erosion, causing turbidity, particulate contributions, and DBP precursors. Marinas can have accidental discharges into waterbodies as a result of resort and marina operations; these loadings would likely be much greater than for individual boats, but less frequent. Activities such as the refueling of boats, storage of fuel, pumping houseboat wastes, launching of boats, and maintenance of facilities (including cleaning and washing of boats) can result in pollutants being discharged to a waterbody.

Illegal dumping could include food waste, and hazardous and other materials. Illegal camping generally results in the improper disposal of fecal waste.

POTENTIAL CONTAMINANT SOURCES

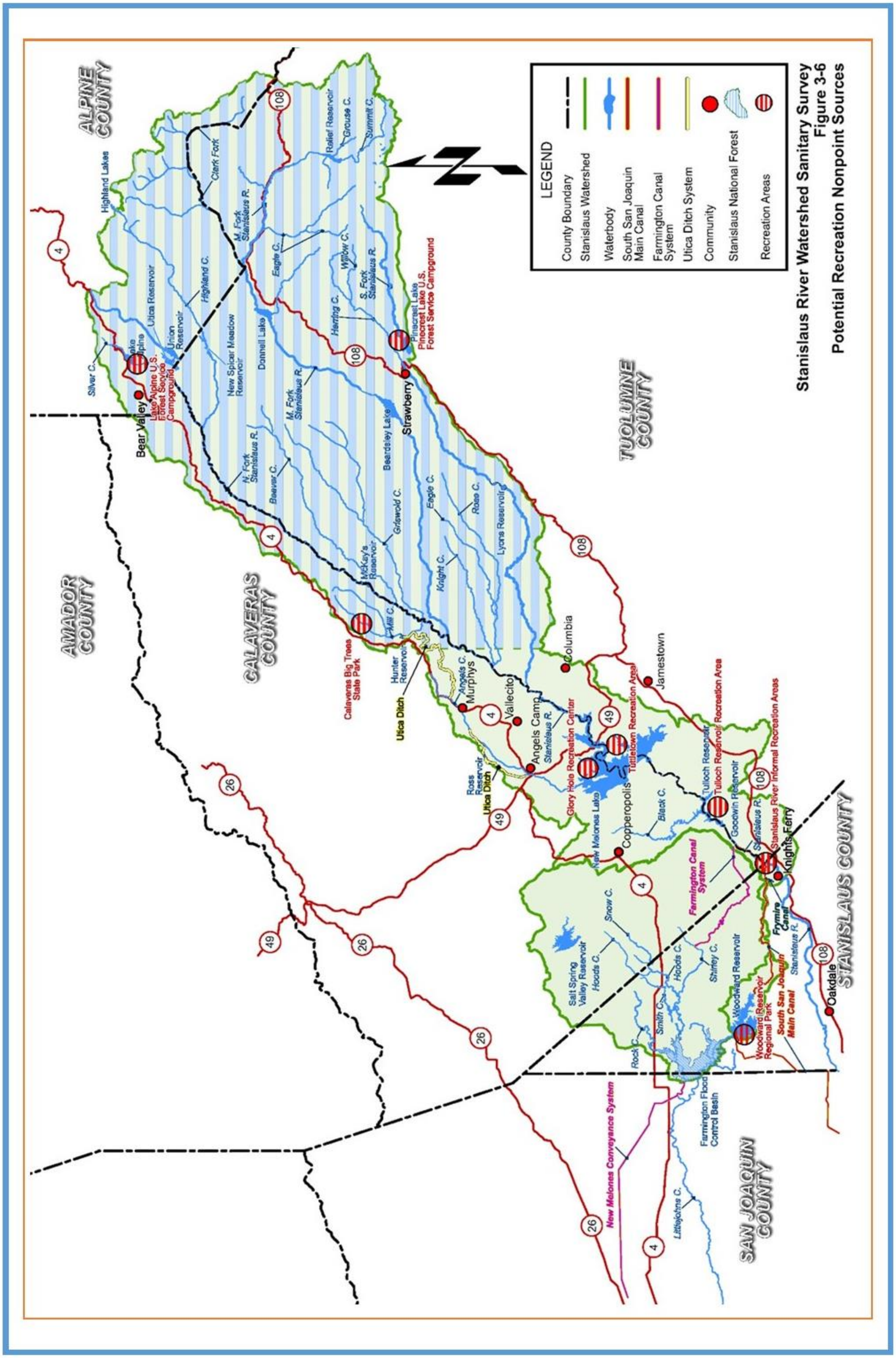
Recreation is a significant activity in the Stanislaus River watershed which includes access to Stanislaus National Forest and Calaveras Big Trees State Park. Recreational opportunities throughout the watershed include swimming, boating, houseboating, fishing, waterskiing, whitewater rafting, and non-water contact activities such as camping, hiking, picnicking, wine tasting, off-highway motor vehicle (OHV) use, and sightseeing. There are numerous public and private owned reservoirs with substantial body contact (e.g., New Melones, Pinecrest, New Spicer Meadow, Tulloch, Union/Utica, and Woodward reservoirs, and Lake Alpine). Recreational use of the Stanislaus River, including body contact, occurs throughout the river, concentrated at access points (e.g., between Goodwin Dam and Knights Ferry, Beaver Creek within Calaveras Big Trees State Park, Boards Crossing, etc.). Private campgrounds are also present throughout the watershed (e.g., Camp Wolfeboro, a Bay Area Boy Scout Camp located on the North Fork Stanislaus River downstream of Utica Reservoir) in addition to public campgrounds. The Stanisalus National Forest overlaps with the Carson-Iceberg and Emigrant wilderness areas.

A discussion of recreational activities associated with specific sites in the watershed is provided along with a discussion of unauthorized activities. Recreational areas that are of significant size, popular use, or of risk to water quality are located on Figure 3-6.

STANISLAUS NATIONAL FOREST. The Stanislaus National Forest provides opportunities for a wide and varied range of formal and dispersed recreation activities. It ranges in elevation from 1,200 feet to almost 12,000 feet at the watershed divide. All of the formal 49 campgrounds provide vault or flush toilets. Dispersed recreation includes activities that occur on Forest Service lands outside of developed sites such as scenic driving, camping at undeveloped campsites, hiking, boating, Nordic skiing, horseback riding, hunting, fishing, OHV, and Over Snow Vehicle Use (OSV). Users are encouraged to bury human waste in a six-inch hole away from water. The Forest Service allows dispersed camping almost anywhere within the forest. Dispersed camping, fishing, boating, and swimming occur within or adjacent to undeveloped lakes such as Herring Creek and Beardsley. Streamside camping used to occur with recreational mining activities in the lower South and Middle Forks of the Stanislaus River near New Melones Reservoir before suction dredging permits were placed on hold. The Forest Service has identified unmanaged recreation, especially impacts from motor vehicles, as one of the key threats facing the nation's forests today. In addition, OHV impacts have created unplanned roads and trails, caused erosion and watershed habitat degradation, and impacted cultural resources sites.

Lake Alpine recreation

LAKE ALPINE. Lake Alpine is a small, scenic reservoir located just east of the community of Bear Valley on State Highway 4, at the head of the North Fork Stanislaus River in Alpine County. At an elevation of 7,350 feet, it is the central attraction of the Lake Alpine Recreation Complex on the Calaveras Ranger District of the Stanislaus National Forest.


Stanislaus River Watershed Sanitary Survey
Figure 3-6
Potential Recreation Nonpoint Sources
LEGEND
County Boundary
Stanislaus Watershed
Waterbody
South San Joaquin Main Canal
Farmington Canal System
Utica Ditch System
Community
Stanislaus National Forest
Recreation Areas
ALPINE COUNTY
AMADOR COUNTY
CALAVERAS COUNTY
TUOLUMNE COUNTY
STANISLAUS COUNTY
SAN JOAQUIN COUNTY
Bear Valley
Strawberry
Columbia
Jamestown
Murphys
Vallecito
Angels Camp
Copperopolis
Knights Ferry
Oakdale
Lake Alpine U.S. Forest Service Campground
Pinecrest Lake U.S. Forest Service Campground
Calaveras Big Trees State Park
Glory Hole Recreation Center
Tuttletown Recreation Area
Tulloch Reservoir Recreation Area
Stanislaus River Informal Recreation Areas
Woodward Reservoir Regional Park
New Melones Lake
Tulloch Reservoir
Goodwin Reservoir
Woodward Reservoir
Beardsley Lake
Donnell Lake
New Spicer Meadow Reservoir
Union Reservoir
Utica Reservoir
Highland Lakes
Lyons Reservoir
Relief Reservoir
McKay's Reservoir
Hunter Reservoir
Ross Reservoir
Salt Spring Valley Reservoir
Utica Ditch
Farmington Canal System
South San Joaquin Main Canal
Frymire Canal
New Melones Conveyance System
Farmington Flood Control Basin
N. Fork Stanislaus R.
M. Fork Stanislaus R.
S. Fork Stanislaus R.
Stanislaus R.
Clark Fork
Highland C.
Silver C.
Eagle C.
Willow C.
Herring C.
Grouse C.
Summit C.
Beaver C.
Griswold C.
Knight C.
Rose C.
Mill C.
Angels C.
Black C.
Snow C.
Hoods C.
Shirley C.
Smith C.
Rock C.
Littlejohns C.

UNION/UTICA RESERVOIRS. These connected twin reservoirs are located between State Highway 4 and New Spicer Meadow Reservoir in Alpine County (except for a portion of Utica Reservoir in Tuolumne County). These reservoirs are more remote and rustic than other recreational facilities with access requiring a few miles of unpaved road between Spicer Reservoir Road and the reservoirs. Utica Reservoir is managed for non-motorized boating (e.g., canoes and kayaks) while Union Reservoir has a primitive boat launch and a 5 mile per hour boating speed limit. Both include dispersed tent camping and day use recreational areas. These areas within the Stanislaus National Forest are popular for fishing, camping, and boating. Vault toilets are provided.

NEW SPICER MEADOW RESERVOIR. New Spicer Meadow Reservoir is located on Spicer Reservoir Road at approximately 6,600 feet elevation in the Stanislaus National Forest. It has a surface area of 2,000 acres when full, allowing boating, fishing, and other recreational water uses. At or near the reservoir, camping, hiking, and horseback riding is also available. Vault toilets are at various points within the recreation area. A Wilderness Permit is required for shoreline camping in the eastern portion of the reservoir. The upper portion of the reservoir, surrounded by Carson-Iceberg Wilderness, is managed for non-motorized uses only. The trailhead at Spicer Dam provides access to the Carson-Iceberg Wilderness.

Lake Alpine, Union/Utica reservoirs, and New Spicer Meadow Reservoir are collectively referred to as "Upper Reservoirs". Although Union/Utica reservoirs and New Spicer Meadow Reservoir do not have a direct WTP intake like Lake Alpine, they are a primary water supply source for CCWD and UWPA. Swimming, boating, hiking, camping, fishing, picnicking, ATV and 4 wheel driving, and mountain biking are available for summer visitors to the Upper Reservoirs. There are developed campgrounds at Lake Alpine. Campsites have flush or pit/vault toilets. Developed day use areas include picnic sites and public boat launching ramps (except Utica Reservoir). Lake Alpine is planted with trout from Memorial Day through Labor Day. Lake Alpine Lodge, a full-service summer resort, offers cabin rentals, restaurant, public showers, laundromat, boat/canoe/kayak rentals, and bike rentals, and a general store. The Bear Valley Adventure Company offers boat and bike rentals, kayak lessons and guided paddle tours. A known OHV trail can be found connecting Alpine Lake with Utica Lake.

Winter visitors can use a snow park located at the Highway 4 or Spicer Reservoir Road winter closure gates. Groomed or marked trails are maintained throughout these areas. Recommended activities include cross country skiing, dog sledding, snow play, and snowmobiling. Near Lake Alpine is the Bear Valley ski resort with Mt. Reba forming the watershed divide between the Mokelumne River and Stanislaus River watersheds. The Mt. Reba Ski Bowl complex first opened for skiing in winter of 1967-68. The area now known as Bear Valley Village has homes, tennis courts, sewer system, and an air strip. The residential development, Bear Lake, and the southern ski area is within the Stanislaus River watershed. Further west along Highway 4, Big Meadow campground has camping with small and group sites. Sand Flat Campground is near Big Meadow but on the North Fork Stanislaus.

CALAVERAS BIG TREES STATE PARK. Calaveras Big Trees State Park, operated by the California State Department of Parks and Recreation, is located between Arnold and Dorrington, within both the Stanislaus River and Calaveras River watersheds. The park has several campgrounds within the Stanislaus River watershed. One mile southeast of North Grove which is in the Calaveras River watershed, is Oak Hollow with 55 campsites for tents and RVs and a group campsite; this is open May to October. South Grove has day use and tent campsites on Beaver Creek and Big Trees Creek. Big

Trees Creek flows to White Pines Lake, a mostly recreational reservoir in the Arnold area, tributary to the Calaveras River. Beaver Creek flows are diverted downstream at CCWD's Beaver Creek Diversion Dam to McKays Point Reservoir, meant to supplement hydropower flows in the North Fork Stanislaus Hydroelectric Development Project. Other activities available at the park include hiking, cross country skiing, and snowshoeing.

Oak Hollow campground has three septic tanks which discharge to a leachfield. The park also has vault toilets. There are six pit toilets available in the environmental (tent) campsites. An RV sanitation station is located near the park entrance.

Visitors have access to the North Fork Stanislaus River and Beaver Creek within the State Park. Public access to the North Fork is upstream of McKays Point Reservoir, the intake for Hunters WTP and Utica Ditch – McKays Point Reservoir and the Beaver Creek Diversion Dam are not publicly accessible. Public access to Beaver and Big Trees creeks is available just upstream of the diversion facilities.

COLUMBIA STATE PARK. Columbia State Park is in Tuolumne County east of New Melones Reservoir off Parrots Ferry Road, north of Highway 49. Downtown Columbia is the historic town, now a heavily visited State Park; a small airport is also found in the watershed, the community college is outside of the watershed. The area drains to Dead Man's Gulch and Mormon Creek, tributaries of New Melones Reservoir.

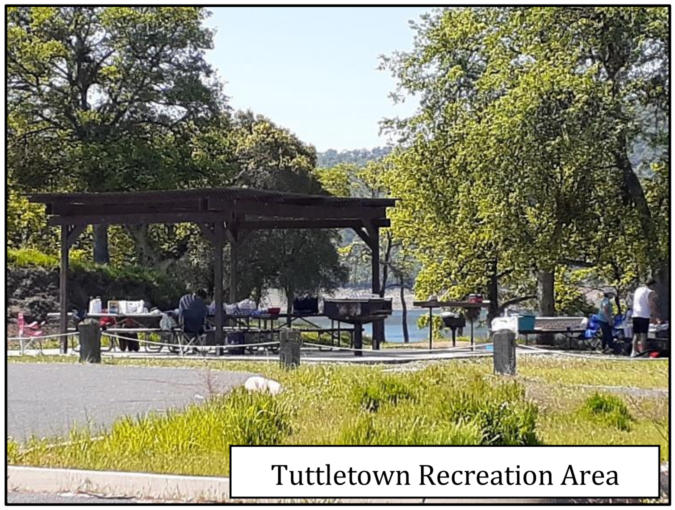
KNIGHTS FERRY. The Army Corps of Engineers manages the Stanislaus River Parks which includes Goodwin Canyon and Knights Ferry Recreation Area. Recreation activities include visiting the covered bridge, four miles of white water rafting for experienced rafters between Goodwin Dam and Knights Ferry, fishing except during Chinook salmon run, picnicking facilities with restrooms and river access, hiking, swimming, and canoeing. There is no motor boating between Goodwin Dam and Knights Ferry. Camping is available downstream of the Knights Ferry CSD secondary Intake.

NEW MELONES RESERVOIR. New Melones Dam and Reservoir is part of the Central Valley Project - New Melones Unit, operated by the U.S. Bureau of Reclamation (USBR). Located in the foothills of the study area, the reservoir has a capacity of 2.4 million acre feet with 100 miles of shoreline, and a water surface area of 12,500 acres when at capacity. It is the fourth largest reservoir in California. Allowed uses include fishing, boating, house boating, waterskiing, swimming, and camping, with a visitor center and museum. New Melones Reservoir has year-round fishing for both cold and warm water species, and heavy use by boaters. There are numerous trails for hikers and mountain bikers in the surrounding woodland areas. Dogs are allowed but must be on a leash at all times.

The USBR, which owns 17,000 acres of land immediately surrounding the reservoir, operates two recreational areas: Glory Hole on the northern, Calaveras County side and Tuttletown on the southern, Tuolumne County side of the reservoir, and five day use parks. Campsites in both recreation areas are served by flush toilets. Other toilets at the site are vault. There are no septic tank systems.

Gloryhole Recreation Area has two campgrounds (Big Oak and Ironhorse) with 144 campsites, three day use areas, 30 miles of hiking/biking trails, a fish cleaning station, a swim beach, and 2 boat launch ramps with parking lots. A full service marina and store complete with fuel and boat rentals are available. Launch ramps are located towards the end of the Gloryhole access road. Both campgrounds have full service restrooms with showers, water taps, barbecue/fire pits, fish cleaning station, sewage dump station, and launch ramps. There are no RV hook-ups.

Tuttletown Recreation Area has three campgrounds (Acorn, Chamise, and Manzanita) with 161 campsites, two day use areas, a boat launch ramp with parking lot, an RV dump station, and fish cleaning station. Two group campgrounds are available by reservation only. The campgrounds have full service restrooms with showers, picnic tables and no RV hook-ups. Launch ramps are located at the end of the Tuttletown access road. Until the coronavirus pandemic in 2020, the facilities had approximately 600,000 visitors per year.


Tuttletown Recreation Area

Because New Melones Project releases water to meet water quality objectives (i.e., TDS and DO) at Vernalis just downstream of the confluence with the San Joaquin River and its supply commitments, its water levels fluctuate more severely than other large reservoirs. Accessing the reservoir during low water levels can be difficult with existing and new hazards emerging as the water level fluctuates below its average range. Recreational visitors at the reservoir decline or increase as reservoir levels decline or increase.

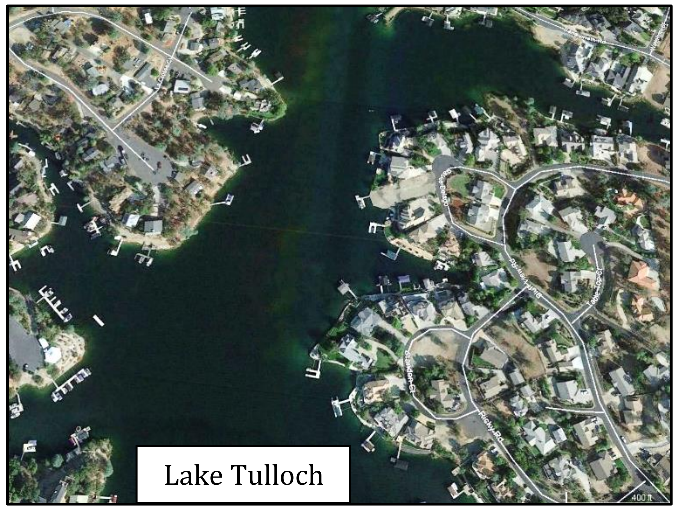
PINECREST LAKE. Pinecrest Lake is located 30 miles east of Sonora on State Highway 108 near the head of the South Fork Stanislaus River. The Forest Service's Pinecrest Campground WTP intake is at the reservoir. The reservoir lies in a timbered setting at an elevation of 5,600 feet. The California Department of Fish and Game regularly stocks Pinecrest Lake with rainbow trout. Pinecrest summer visitors swim, boat, hike, camp, fish, picnic, ride bicycles, and participate in interpretive programs.

Pinecrest Campground and Meadowview Campground have flush toilets; the three group sites have vault toilets; and the day use area located adjacent to the boat launch has flush toilets. An RV dump station is located across Highway 108 from the Pinecrest Basin Recreation Area.

One large day use area with 50 sites and three Forest Service campgrounds are located around the reservoir: Pioneer Trail Group Camp, Pinecrest, and Meadowview, which include three group campsites and 300 individual campsites. There is a designated swim area and fishing dock on opposite ends of the western shoreline. No dogs are allowed in the day use area and they are not allowed to be left unattended within the campgrounds. According to the Forest Service, Pinecrest and Meadowview campgrounds are typically 80 to 100 percent occupied from Memorial Day through Labor Day.

Pinecrest National Recreation Trail is a four mile hiking trail around the reservoir; paved pathways connect points of interest for a portion of the four mile hike leading to less developed foot trails along the northern side of the reservoir. In winter, the reservoir is drained by Pacific Gas and Electric Company (PG&E) with no water related activities available. During the winter, the area is frequented by cross country skiers and day users sledding on the reservoir slopes and picnic areas. Groomed or marked trails are maintained for winter recreation throughout the area.

TULLOCH RESERVOIR. Formed by Tulloch Dam on the Stanislaus River below New Melones Reservoir, Tulloch Reservoir has 55 miles of shoreline. Recreation such as swimming, waterskiing, fishing, picnicking, and boating are allowed. Tulloch Reservoir is home to several year-round communities; most are located on the Calaveras County side of the river.



Each homeowner's association (HOA) has a boat ramp, for a total of five boat ramps. Lake Tulloch RV Campground and Marina is on the southern shore (Tuolumne County), with 130 sites on over a mile of waterfront. These include lakefront hook-ups with space to keep a boat, and lakefront cabins with dock and full hookup RV sites, water, and sewer. Many tent sites with water, picnic table and fire pits are also available.

Property ownership at Tulloch Reservoir is private with waterfront homes lining the reservoir. There is unlimited access to the reservoir, including body contact, for those with private docks as well as HOA private launch ramps and parks. There is no one single responsible party for controlling recreational access as the lands are private and there are several HOAs. The concerns associated with recreation at drinking water reservoirs are summarized above in "Concerns". Lake Tulloch has a high risk of microbial and other contamination from recreation due to the high concentration of residences adjacent and with lands draining to the reservoir.

WOODWARD RESERVOIR. At Woodward Reservoir, a water quality control structure separates the open reservoir with body contact recreation and boats from the controlled access area where the upper intake structure for NCDWTP is located. The structure has been designed to confine flow through Woodward Reservoir in a way that maintains a positive velocity through the structure from the controlled access side to the lower impoundment. SSJID typically uses the upper intake during the summer season (mid-March through mid-October) which is also the irrigation season, then uses the lower (alternate) intake near the dam during winter season when body contact is not permitted (mid-October through mid-March). When the irrigation season ends and Main Canal flow stops, SSJID provides the County with a no body contact order.

Woodward Reservoir Regional Park is managed by Stanislaus County Recreation and Parks Department. Recreation is allowed along the western and southeastern shores and includes camping, picnicking, fishing, boating, swimming, and duck hunting. Total visitors to the regional park during the planning period are provided in Appendix C. There was a significant decrease in visitors in 2020 due to restricted access because of the coronavirus pandemic. For example, there were 45,584 day use vehicle permits in 2019 and 26,315 in 2020. Camping permits declined from 35,857 permits in 2019 to 289 permits in 2020.

There are many different day and overnight camping areas including boat ramps and picnic areas. Most of the campsites are adjacent to the water. A marina, boat launching facilities, fueling station, and fuel tank are located along the reservoir's western side, along with numerous dumpsters to encourage their use. The eastern side has a boat launch and day use area, with numerous dumpsters throughout. OHV use is not allowed at Woodward Reservoir and users are stopped at the recreation area entrance station.

Dogs and horses are allowed in the park, but not in the reservoir; dogs are required to be leashed in the park. Annual permits for dogs averaged 16,637 during the planning period while permits issued for horses averaged 841 per year. Camping and picnicking is also allowed in designated areas of the park. Developed campgrounds have designated campsites in addition to flush toilets and showers. Undeveloped campsites do not have designated campsites and are served only by portable toilets. Recreational vehicles are allowed in designated spots. RV hookups are available at T-Island and Hackberry/Muir Point campsites. The flush toilets are connected to a small wastewater treatment plant located onsite. Sewage is conveyed via several booster pump stations located throughout the park. The undeveloped campsites with vault toilets are pumped out one to two times per week in the summer.

Music festival at Woodward Reservoir
Photo courtesy of symbiosisgathering.com

Stanislaus County Parks allows music festivals at Woodward Reservoir along the camping peninsula. The Symbiosis festival was held September 17 - 20, 2015 and September 22 - 25, 2016 with 15,000 attendees each. The Serenity Gathering and Music Festival was held April 27-29, 2018 and April 26-28, 2019; there were approximately 5,000 attendees at each event. Plans were to repeat it in 2020 were cancelled due to the coronavirus pandemic.

Additional water quality samples are drawn following summer holiday weekends indicating worst case conditions for bacteria concentrations. Coliform and *E. coli* levels and spikes are quite high, as discussed in Chapter 4. Even though the reservoir is used in the winter months to convey water to the WTP, the lower intake near the dam had higher concentrations of *E.coli* than the upper intake. Sources could be from body contact from recreational activity in the summer resuspended during winter months, Canada geese, pets or runoff from cattle grazing nearby. The intake in the upper reservoir had high concentrations of coliform levels; sources could be from swallows nesting on the bridge, Canada geese, pets, or runoff into the canal or reservoir.

LESS FORMAL RECREATION AREAS. There are access points all along the Stanislaus River allowing public access to the water and some areas with developed but limited recreational facilities. The Forest Service provides camping facilities and vault toilets at several river locations such as Sourgrass Recreation Area which includes Wakaluu Hep Yoo campground at Boards Crossing on the North Fork outside of Dorrington. Day use river access is also provided at the Stanislaus River day use area on Spicer Road and Highland Creek at the end of Spicer Road below the dam.

Class IV whitewater rafting is available on the North Fork Stanislaus River from Sourgrass Bridge put-in to Calaveras Big Trees State Park take-out. Whitewater rafting and kayaking can also take place with some difficulty on the North Fork Stanislaus River when the New Melones Reservoir water levels are low, with the put-in at Camp Nine and take-out at Parrot's Ferry.

Hiking trails crisscross the watershed with regional trails such as the Pacific Crest Trail on the eastern watershed divide and Mokelumne Coast to Crest Trail on the northeastern divide; the two trails cross at Ebbetts Pass. Most of the trails in the watershed are at high elevations (above 6,000 feet) limiting access to summer and early fall months. The Arnold Rim Trail by White Pines is open year round.

The Bureau of Land Management manages land along the river between where the South Fork merges with the North Fork up to and across Camp Nine Road's crossing of the North Fork. The USBR manages lands surrounding the reservoir as well as the Peoria Wildlife Management Area downstream of New Melones Dam (near the Sierra Conservation Camp [SCC] and Baseline Conservation Camp [BCC] intakes) with trails to the reservoir. There are numerous trails surrounding New Melones Reservoir.

UNAUTHORIZED USES. Unauthorized activities that may be potential contaminant sources include: illegal dumping, illegal drug manufacture and manufacturing waste disposal, vandalism, unauthorized discharge into a surface water, and most likely to occur unsanctioned recreational activities (e.g., off-road vehicle use, illegal camping).

Within the Stanislaus National Forest, OHVs are the greatest problem. Vehicles that stray off the authorized roads are easily apprehended. Within Calaveras Big Trees State Park occasional dumping of trash does occur and is cleaned up by park maintenance staff. OHV use is not allowed and these vehicles are prevented from entering the State Park at the three entrance stations. Occasionally an unauthorized woodcutter is encountered. The rangers patrol all areas of the park frequently.

Because of its remote location and extensive land holdings around the USBR's New Melones Reservoir, dumping of trash occurs, particularly along the remote Camp Nine Road. It usually consists of non-hazardous household waste. At Tulloch Reservoir, it is more difficult to identify and prevent unauthorized activities because of the lack of a single land ownership and lack of controlled access points. But the high density of residential development and uncontrolled access along this drinking water reservoir puts it at risk for unauthorized uses that contribute contaminants to the drinking water supply.

Occasional dumping of household trash at Woodward Reservoir can be quickly cleaned up by maintenance staff. SEWD installed an alarm system with camera at Lower Farmington Canal. UPUD's Cadematori Reservoir is fenced to prevent access. SSJID had 25 fence repairs in 2016 and 21 fence repairs in 2017.

WATERSHED MANAGEMENT

RECREATIONAL FACILITIES. Stanislaus National Forest, managed by the Forest Service, encompasses 989,099 acres ranging from 1,200 feet in elevation to almost 12,000 feet on the western slope of the Sierra Nevada between the Mokelumne River and beyond the lower reaches of the Tuolumne River. Servicing the Stanislaus River watershed, ranger district offices are located in Pinecrest and Hathaway Pines. Portions of the Stanislaus National Forest Land and Resource Management Plan, originally approved in 1991, are periodically updated to manage the land and resources in a changing environment. Resource management actions are continually enacted to better manage these federal lands.

Forest Service will soon determine how to manage Over Snow Vehicle Use (OSV). System roads, trails, and areas where OSV use will be allowed or prohibited have been identified and are anticipated to be approved in the near future. As planned, the proposed action will allow groomed snowmobile trails connecting Highway 4 with New Spicer Meadow Reservoir, Union and Utica reservoirs, and Lake Alpine. Another OSV designated trail follows the general alignment of Highway 108 and the Middle Fork Stanislaus River from north of Strawberry to the watershed divide; with trails on lands between Donnell Lake and Dardanelle; and north of the Middle Fork Stanislaus River along the Clark Fork (Forest Service, 2021).

Recently, day and time restrictions were temporarily placed on Candy Rock Quarry Shooting Restriction Area, located near Hathaway Pines downstream of McKays Point Reservoir, to limit the use of firearms to more restrictive daytime hours and eliminate use on Sundays, and prohibit the use of explosives in the area. This was required due to the noise to nearby residences and fire risk from explosives. There is still the potential for lead contamination to waterbodies with its continued use (Forest Service, 2021).

Lake Alpine, on Silver Creek, and Union and Utica reservoirs on the North Fork Stanislaus River are owned and operated by Northern California Power Agency for hydroelectric power generation in the North Fork Stanislaus Hydroelectric Development Project. Additionally, some flows from these reservoirs are used to meet in-stream environmental flow requirements. The Forest Service manages recreational uses for these facilities.

Calaveras Big Trees State Park is managed by the California State Parks. Management of New Melones Reservoir and surrounding lands is the responsibility of the USBR. The USBR has operations and maintenance staff throughout the federally-owned lands managing the recreational activities; the entrance gates are closed at night to minimize vandalism of the facilities.

Salt Spring Valley Reservoir, located north of Copperopolis on Rock Creek is owned by Rock Creek Irrigation District with underlying and adjacent lands owned by several private entities. Rock Creek drains to the Farmington Flood Control Basin. Recreational facilities include an 80 acre campground, day use picnic areas, and fishing and boating lake, all managed by a concessionaire. The facility has events during the year such as a Bass Tournament in April.

Pinecrest Reservoir is owned and operated by PG&E. It is managed for power generation through releases to the South Fork Stanislaus River to the diversion dam for the Spring Gap Power Plant on the Middle Fork Stanislaus. The reservoir is drained for power generation annually and refilled with spring runoff. PG&E also owns and manages Lyons Reservoir; no water recreation is allowed at Lyons Reservoir.

Tulloch Reservoir is owned and operated by Tri-Dam which manages the reservoir for hydroelectric power and water supply. There are five different homeowners' associations and Lake Tulloch Resort along the lakefront. With no cohesive single entity patrolling and managing lands around the reservoir for water quality protection there are greater risks of contamination.

Stanislaus River Parks, which includes Goodwin Canyon and Knights Ferry Recreation Area, are managed by the Army Corps of Engineers. Restroom facilities are available at the day use area; swimming and other body contact in the river are popular recreational activities.

Woodward Reservoir Regional Park is managed by Stanislaus County Department of Parks and Recreation. SSJID issues no body contact notices to the county each year in the late summer. Woodward Reservoir is owned by SSJID and is used to supply water to the NCDWTP; it is managed for recreation by the County of Stanislaus. SSJID maintains the reservoir water level at or near capacity during the summer months when possible and lower during the winter for flood control.

SSJID uses the upper intake when there is water being conveyed in the South San Joaquin Main Canal and uses the lower intake at the dam during other times. The eastern end of the reservoir is walled off to watercraft at all times to minimize risk to water quality. When the lower intake is in use, recreational activities in the reservoir are limited. To control unauthorized activities, SSJID operates cameras at the upper intake, buoys, and turnouts.

QUAGGA AND ZEBRA MUSSEL PREVENTION PLAN. The California Fish and Game Code, Section 2302, requires that owners/operators of publicly owned and available reservoirs where recreation, boating or fishing is permitted must do the following:

1. Assess the vulnerability of the reservoir to introduction of nonnative mussels (including quagga and zebra mussels), and
2. Develop and implement a program designed to prevent the introduction of nonnative mussel species.

In October 2014 a consortium of agencies published the "North Central Valley Consortium Quagga and Zebra Mussel Prevention Plan." Agencies involved in the prevention plan included Don Pedro Recreation Agency, Turlock Irrigation District, Merced Irrigation District, San Francisco Public Utilities Commission, Stanislaus County Parks, Modesto Irrigation District, Tri-Dam Project, South San Joaquin Irrigation District, Oakdale Irrigation District, U.S. Forest Service, and U.S. Bureau of Reclamation.

Relevant to the Stanislaus River Watershed Sanitary Survey, the following reservoirs are included in the quagga and zebra mussel prevention plan: New Melones Reservoir, Tulloch Reservoir, and Woodward Reservoir. The initial step in the plan is a vulnerability assessment to assess the likelihood of mussels being introduced. The prevention plan includes public education, monitoring programs and management efforts.

New Melones, Tulloch, and Woodward reservoirs are considered at high risk of introduction. Because of that assessment, monthly surface surveys (visual and tactile search for mussels) and monthly artificial substrate monitoring are conducted. Management steps require the implementation of self-inspection permits for the public to certify that their vessels are clean, drained and dry. At Woodward Reservoir, quagga prevention activities include public outreach via informational posters, signage brochures, and use of a third party to conduct boat inspections.

SOLID AND HAZARDOUS WASTE

CONCERN

Waste disposal facilities may result in groundwater contamination (which may seep to surface water) even after a site has been closed. Therefore, both open and closed waste disposal facilities were investigated.

Authorized municipal solid waste disposal sites are permitted and monitored and are unlikely to be a significant source of contamination under normal operation. However, improper maintenance, negligent operation, or natural disasters, such as a fire followed by rainfall, may lead to the release of leachate containing bacteria, pathogens, metals, or other contaminants. Solid waste from the treatment dewatering process (filter wash water and sludge lagoons) at water treatment plants and wastewater treatment plants is stored in ponds adjacent to the treatment facilities for off-site disposal or land application. These lagoons are designed to have adequate capacity; capacity exceedance is infrequent and associated with extreme precipitation events. Runoff from composting facilities composting green waste can contain nutrients and TOC associated with stored materials in stages of decomposition. Stormwater permits are required for composting facilities.

Underground storage tanks (UST) and other spills, leaks, investigations and cleanup sites all pose a threat to water quality. While the majority of gasoline and chemical spills will usually be of greatest concern for groundwater quality, runoff and groundwater plumes from contaminated sites can also impact surface waters. Precipitation may wash superficial surface spills into nearby drainages, which may eventually flow into larger streams, rivers, reservoirs, etc. Moreover, contaminated groundwater plumes may flow to lower elevations (from the spill site) and re-emerge, contributing contaminated water to large waterbodies such as reservoirs.

POTENTIAL CONTAMINANT SOURCES

LANDFILLS. Two permitted waste disposal facilities operate within the Stanislaus River watershed: Rock Creek Landfill in Milton and California Asbestos Monofill. The watershed has one closed facility, Red Hill Landfill. All of these facilities are located in the Calaveras County part of the watershed. No landfill facilities currently operate in the Tuolumne County part of the watershed.

Rock Creek Solid Waste Facility, a Class II Landfill, owned and operated by Calaveras County, is located in the upper reaches of Rock Creek. It has a landfill and a transfer station; the transfer station building is a waste recovery and transfer center with a permanent household hazardous waste facility. It accepts household trash and recyclables, motor vehicles and vessels, tires, etc. In accordance with recent solid waste management regulations, the site is designed to prevent any runoff to surface water. Water that comes into contact with any waste is treated as leachate and sent to an evaporation pond. This landfill is in the New Melones Conveyance System subwatershed and could impact DJWWTP.

The California Asbestos Monofill is located just downstream of New Melones Dam outside of Copperopolis. It was operated as an asbestos mine from 1962 to 1987 leaving a pit size of 16 million cubic yards. The existing open pit mine is being reclaimed by filling it with asbestos-containing waste and cover material; the tailings are used for cover. It is the first asbestos-only disposal site in California although the site now also accepts and stores used tires. The mine pit has low permeability with its serpentine rock base. Both groundwater and surface water monitoring programs are in place. Drainage is to French Creek and Rogers Creek on the northern half of the site, draining to the Stanislaus River above the Baseline Conservation Camp WTP intake; drainage to Long Canyon Creek crosses the southwest corner of the property, draining to the Stanislaus River above the Sierra Conservation Center WTP intake and Tulloch Reservoir. The facility is in compliance with its waste discharge requirements. Water that comes into contact with waste is treated as leachate and sent to an evaporation pond.

The Red Hill Landfill near Vallecito closed in 1990. Results from groundwater and stormwater monitoring conducted at the landfill since closure indicate no groundwater contamination has occurred, and the facility is in compliance with its closure requirements. Water that comes into contact with waste is treated as leachate and sent to an evaporation pond.

The Copperopolis, Avery, and Red Hill transfer stations are all located in the northwestern portion of the watershed area. They are used for the consolidation of waste before transfer to solid waste disposal sites located outside Calaveras County.

UNDERGROUND STORAGE TANKS. The Forest Service has replaced its underground storage tanks (UST) with aboveground tanks. The replacement process included testing the nearby soil and filling the tanks with slurry after closing. The above ground tanks are double-walled concrete tanks with steel liners.

There is only one leaking underground storage tank (LUST) open and active clean-up site in the watershed; there were five in 2016. The number of closed LUSTs as well as open (active and inactive) within the Stanislaus River watershed are presented in Table 3-9. Open cases include site assessment, remediation, and monitoring.

WATERSHED MANAGEMENT

The California Integrated Waste Management Board (CIWMB), under the California Environmental Protection Agency, manages landfills within California. The CIWMB is the state agency designated to oversee, manage, and track California's 92 million tons of waste generated each year. Landfills are also subject to CVRWQCB waste discharge requirements. The CIWMB provides funds to clean up solid waste disposal sites and co-disposal sites (those accepting both hazardous waste substances and nonhazardous waste). These funds are available where the responsible party cannot be identified or is unable or unwilling to pay for a timely remediation, and where cleanup is needed to protect public health and safety or the environment.

Table 3-9: Leaking Underground Storage Sites in the Stanislaus River Watershed

Town	Open/Active	Open/Inactive	Closed
Angels Camp	0	0	20
Arnold	0	0	17
Avery	0	0	1
Bear Valley	0	0	7
Columbia	0	0	7
Copperopolis	1	0	7
Murphys	0	0	8
Pinecrest	0	0	2
Strawberry	0	0	1
Tulloch (SCC)	0	0	1
Vallecito	0	0	1

Source: SWRCB, 2021b.

Underground storage tanks are permitted and regulated by the environmental health departments for Calaveras County and Tuolumne County. The CVRWQCB typically handles cases in which a leaking storage tank is involved. Cases are monitored closely for remediation activities and are not closed until the leak is properly remediated.

The CVRWQCB requires a permit to install an UST. BMPs should be in place by the UST owners to ensure the safety of the tank. Such BMPs include secondary containment devices, monitoring wells and proper maintenance. Many of these sites are former industrial facilities and dry cleaners, where chlorinated solvents were spilled, or have leaked into the soil or groundwater.

The Certified Unified Program Agency (CUPA) was established by the State to improve the coordination of hazardous materials management. The following agencies are identified as the representative CUPA in the watershed.

- Calaveras County Environmental Health Department
- San Joaquin County Environmental Health Department
- Stanislaus County Environmental Resources
- Tuolumne County Environmental Health Department

The county CUPAs consolidates, coordinates, and makes consistent the administrative requirements for the following hazardous waste and hazardous materials programs.

- Hazardous Materials Disclosure
- California Accidental Release Prevention Program
- Underground Storage Tank Program
- Aboveground Petroleum Storage Tanks
- Hazardous Waste Generator

URBAN RUNOFF AND SPILLS

CONCERN

Stormwater runoff from paved highways and streets, vehicle emissions, vehicle maintenance wastes, outdoor washing, and parking lots contain many pollutants associated with automobiles such as hydrocarbons, heavy metals (e.g., lead, cadmium, and copper), asbestos, and rubber. Urban runoff from landscaped areas and impervious surfaces contribute pesticides, herbicides, and nutrients; sediment; trash; bacteria and pathogens; and metals such as copper, zinc, and nickel. Runoff drains into storm drains, which convey untreated water into a local stream, eventually making its way to the Stanislaus River or reservoirs.

Sources of fecal contamination in urban runoff include domestic and wild animals, in addition to human sources from illegal camping, illicit connections, or dumping to the storm drain system, septic system leaks, or sewage spills. Since fecal coliforms are used as indicators of fecal contamination, their presence (as evidenced by those communities that monitor runoff) indicates that urban runoff typically carries a significant amount of fecal material into waterbodies. The actual amount of pathogens (or risk to human health) from urban runoff cannot be extrapolated from indicator organism data.

Automobile, truck, watercraft, and marina accidents can result in spilled cargo content or vehicle fuel spills to waterbodies. Leaked or spilled hazardous materials, petroleum products (gasoline, motor oil), or other fluids can introduce SOCs, heavy metals, and hydrocarbons into a waterbody from runoff, vehicles driving into waterbodies, watercraft malfunctioning or sinking, etc. Hazardous waste spills pose a direct or potentially direct threat to water quality. Sewage spills from sewer overflows and “milk trucks” result in pathogen contamination, including bacteria, viruses, and protozoa. Transported hazardous materials could include fuel, pesticides, solvents, and a variety of other materials.

POTENTIAL CONTAMINANT SOURCES

Drainage directly to the Stanislaus River, reservoirs, and tributaries is of greatest concern near intakes because of the lack of blending and time to dilute before the contaminants reach the WTPs. Runoff concerns, spills, and accidental releases are discussed here.

STORMWATER RUNOFF. National Pollutant Discharge Elimination System (NPDES) stormwater permittees must comply with NPDES stormwater discharge permits issued individually to each facility. Permittees include wineries in Calaveras County, utilities such as telephone communications, local trucking, rock materials, and refuse systems. Several are located in the lower watershed of Copperopolis, which drains to Tulloch Reservoir, and Vallecito, which drains to New Melones Reservoir, while the remainder are scattered throughout the watershed. NPDES permits are discussed under Watershed Management.

SPILLS. Hazardous materials spills include sewer overflows, fuel spills from vehicle and boating accidents, and other spills reported to the State Office of Emergency Services. Numerous highways pass through the watershed: Highway 49, Highway 4, and Highway 108 where it is coterminous with Highway 120. While these highways are major thoroughfares through the Sierra Nevada, they are considered to be minor arterials, primarily serving inter- and intra-county traffic. Highway 4 and 108, both west to east alignments, are closed in the winter during inclement weather along the summits of Ebbetts Pass and Sonora Pass, respectively. Highway 4 is not plowed east of the Mount Reba turnoff near Alpine Lake and is closed often from November through April.

From the west, Highway 4 passes through the Farmington Flood Control Basin, crossing Rock, Smith, and Hoods creeks, before following much of the northern watershed divide between Stanislaus River and Calaveras River/Mokelumne River watersheds, running parallel to the North Fork and Main Stem Stanislaus River, as shown on Figure 2-1. It passes through Copperopolis and Angels Camp, Murphys, Arnold, Dorrington, and Bear Valley. Depending on where a spill occurs, the spill on Highway 4 could impact any of the Stanislaus River tributaries or drain to the north out of the watershed.

From the west, Highway 108/120 travels along the Stanislaus River at Knights Ferry; Highway 120 then turns south at Yosemite Junction where O'Byrnes Ferry Road ends. Highway 108 continues northeast until it leaves the watershed in Jamestown and reenters near the south fork of the Stanislaus River following the watershed divide between the Stanislaus River and Tuolumne River watersheds until Strawberry. At Strawberry, Highway 108 remains in the watershed until the summit. Highway 49 travels north to south entering the watershed at the intersection of Highway 4 in Angels Camp, crossing New Melones Reservoir, and then exiting the watershed in Columbia.

Most of the hazardous materials spills reported are on local streets. Spills are reported to the California Emergency Management Agency (Cal EMA) which records the spill type, quantity, and location, and whether a waterbody was affected. Table 3-10 provides the number of reported hazardous material spills in Calaveras County and Tuolumne County within the Stanislaus River watershed during the previous five years. There were no spills reported within the watershed in Stanislaus County.

Most of the spills in Table 3-10 were caused by roots causing blockage in sewers and septic systems. There were several power outages causing overflows, infrequent spills associated with traffic accidents, and unauthorized activities such as dumping unknown substances into creeks. There were a few spills associated with boat launching, a houseboat fire, a sunken vessel, and other incidents in New Melones and Tulloch reservoirs.

Table 3-10: Hazardous Material Spills within the Stanislaus River Watershed

Year	Calaveras County	Tuolumne County
2016	9	0
2017	19	0
2018	9	0
2019	12	1
2020	6	0
Average	**0**	**0**

Source: COES, 2021.

WATERSHED MANAGEMENT

STORMWATER RUNOFF. Stormwater and dry weather runoff in the Stanislaus River watershed is regulated through the NPDES federal and state stormwater permitting process. The NPDES program is mandated by the Federal Clean Water Act and administered and enforced in California by the SWRCB through the various RWQCBs. The NPDES stormwater program regulates some stormwater discharges from three potential sources: municipal separate storm sewer systems (MS4s), construction activities, and industrial activities.

The SWRCB Municipal Storm Water Permitting Program regulates storm water discharges from municipal separate storm sewer systems (MS4) that discharge into waters of the United States. The RWQCB issues Waste Discharge Requirements (WDR) and NPDES permits for the discharge of stormwater runoff from MS4s. The permits are reissued approximately every five years.

The NPDES permits require large and medium municipalities to develop stormwater management plans and conduct monitoring of stormwater discharges and receiving waters. Since 2003, small communities have been required to develop stormwater management plans, but do not have to conduct monitoring. Small communities are defined as having a population of at least 10,000, a population density of at least 1,000 persons per square mile, and lying within an urbanized area.

The NPDES stormwater permit for industrial activities was effective in 2015. Features include electronic filing requirements, implementation of stormwater pollution prevention plan structural and nonstructural BMPs, design storm standards, monitoring requirements, exceedance response action process. In 2020, the SWRCB modified the Industrial Stormwater General Permit to provide additional guidance for compliance and allow stormwater dischargers in areas identified in an emergency proclamation that are impacted by wildfires to document that the facilities may include higher levels of a pollutant in the stormwater discharges that are unrelated to the facility's industrial activities. The Construction permit was also modified to provide additional guidance for compliance and document higher pollutant levels in stormwater discharges unrelated to construction activities.

Tuolumne County is not subject to NPDES stormwater regulations because the population of each incorporated town is less than 10,000. However, Tuolumne County has taken a proactive approach to address water quality issues and prepared a Water Quality Plan in 2007 consistent with requirements for small MS4s. It provides a framework for implementation of stormwater management practices for discharges entering drainage conveyance systems. In addition, Tuolumne

County requires stormwater permits for new developments, and also requires some level of treatment using subsurface or onsite detention/retention facilities. The Water Quality Plan focuses on the principal non-point sources: pathogens and nutrients, urban contaminants, and erosion and sedimentation.

Tuolumne County and the Tuolumne County RCD are spearheading efforts to promote community and stewardship-based programs to maintain and improve surface water quality county-wide. The current and planned public involvement and participation activities are focused on maintaining and improving runoff water quality from urbanized and rural land uses. The primary goal is to identify water quality control measures that the public can implement "in their own backyards."

The CVRWQCB determined that within Calaveras County, selected community areas were designated as regulated MS4s and Calaveras County is required to comply with the statewide General Permit that was adopted by the SWRCB for "Storm Water Discharges from Small Municipal Separate Storm Sewer Systems." The MS4s include publicly-owned and maintained roadside ditches, culverts, channels, and related systems for the collection and conveyance of stormwater runoff. Consistent with these requirements, Calaveras County prepared a Stormwater Management Plan that identifies potential sources of stormwater pollution from within the county and includes a comprehensive program to reduce identified pollutant discharges. This program includes plans for the implementation of BMPs designed to reduce the discharge of pollutants to the maximum extent practicable.

SPILLS. Typically, water treatment plant operators are notified of hazardous materials spills or other significant events by the State Office of Emergency Services Spill Prevention and Response, or County health services, public works department, or office of emergency services. A county may be notified by the sheriff's dispatch center, California Department of Fish and Wildlife, Caltrans, or by its own road maintenance or flood control staff. As discussed under Solid and Hazardous Waste, the CUPA for each county is responsible for coordinating the accidental release prevention program and is contacted if there is a spill.

At Woodward Reservoir Regional Park, the spill contact communication plan is to notify the following entities.

- SSJID
- Nick DeGroot WTP
- Stanislaus County Environmental Resources
- County's Safety Officer

SSJID has a Safety and Emergency Response Plan. Emergency response in the event of a spill or release includes notification to various agencies of the following information: exact location, name of person reporting, quantity of hazardous material, and potential hazards. In addition, the following agencies are notified of all spills.

- Stanislaus County Environmental Resources
- Stanislaus County Hazardous Materials Team
- Oakdale Rural Fire Department
- Chemtrec Emergency Response Information Service
- Stanislaus County EMA
- San Joaquin County EMA

- Cal EMA
- National Response Center

At Calaveras Big Trees State Park, if a spill occurs on Highway 4, the fire department is contacted. If there is a spill in the park, the following agencies are contacted.

- California Emergency Management Agency
- Calaveras County Environmental Health Department
- CVRWQCB

At Pinecrest Lake, the spill contact communication plan is to notify the following agencies.

- National Response Center
- Cal EMA
- Tuolumne County Environmental Health Department
- CVRWQCB
- California Department of Transportation
- California Highway Patrol
- Local Fire Department
- California Department of Fish and Wildlife Toxic Substance (contacted by Cal EMA)
- Local Air Quality Management District

As the owner and operator of Lyons Reservoir, PG&E has an emergency spill notification procedure. In the event of an emergency spill, the following agencies will be notified.

- National Response Center
- California Office of Emergency Management Agency
- California Department of Fish and Game
- Regional Water Quality Control Board
- Department of Transportation
- California Highway Patrol
- Fire Department

The Angels Camp WTP has an Emergency/Disaster Response Plan effective 2003. According to the plan, the following agencies will be notified in the event of a spill.

- California Department of Public Health
- Calaveras County Department of Environmental Health
- KNGT Radio
- Calaveras Enterprise
- Calaveras County Emergency Management Agency

The North Fork Stanislaus River Hydroelectric Development Project (a joint development project between CCWD and Northern California Power Agency) has a hazardous materials communication plan with communication protocols in the case of spills. This plan covers the upper watershed reservoirs downstream to below the Collierville Powerhouse.

WASTEWATER

CONCERN

Sanitation facilities collect, treat, and dispose of human waste and can pose a variety of water quality risks when they fail. Failures of treatment plants and onsite wastewater treatment (OWTS) systems (e.g., septic tank/leachfield systems) may result in the introduction of disease-causing pathogenic organisms such as bacteria, parasitic cysts, and viruses (directly or indirectly through soils) to the Stanislaus River, its tributaries, and reservoirs. Also of concern is the risk of increased nutrient loading, particularly nitrogen, to the waterbodies which can contribute to DBP production. Sanitary sewer overflows often contain high levels of suspended solids, pathogenic organisms, nutrients, oxygen demanding organic compounds, oil and grease, and other wastes.

OWTSs can contribute to the contamination of groundwater. However, a greater risk in the Stanislaus River watershed is improperly located, designed, constructed, or maintained systems proximate to surface waters. In addition to the pathogenic organisms and nutrient loading discussed above, improperly functioning systems may contribute metals, pesticides, herbicides, SOCs, and organic matter from leachfields due to improper disposal of household chemicals.

POTENTIAL CONTAMINANT SOURCES

Wastewater discharges are typically considered a "point source" discharge, permitted by CVRWQCB. Generally, if the effluent is discharged to surface water, the facility is subject to a NPDES permit. If the effluent is discharged to land via ponds or sprayfields, it is regulated by WDR. Onsite wastewater treatment systems, which are located throughout the watershed, are regulated by the CVRWQCB and the county environmental health departments, as discussed in this section under Watershed Management.

Four WWTPs hold NPDES permits to discharge to surface water as well as WDR for land applications; these are listed in Table 3-11 and discussed below followed by a discussion of wastewater facilities subject to only WDR. Sanitary Sewer Overflows are discussed after land application dischargers with OWTS discussed last.

Table 3-11: NPDES Permits in Stanislaus River Watershed for Wastewater Treatment Facilities

Facility Name	Owner	NPDES No.
Bear Valley WWTP	Bear Valley Water District	CA0085146
Copper Cove Wastewater Reclamation Facility	Calaveras County Water District	CA0084620
City of Angels WWTP	City of Angels	CA0085201
Forest Meadows WWTP	CCWD	CA0085278

Source: CVRWQCB, 2021a

BEAR VALLEY WASTEWATER TREATMENT FACILITY (BVWWTF). Bear Valley Water District (BVWD) owns and operates BVWWTF. Located in Alpine County's Bear Valley, the BVWWTF serves a permanent population of 175 residents distributed throughout the communities of Bear Valley, Bear Valley Ski Resort, and USFS Lake Alpine resort and campgrounds, and over 500 connections in total.

The average monthly application rates during the peak disposal months range from approximately 128,000 to 222,000 gallons per day (gpd). The treatment system consists of a 40 acre-foot aeration pond followed by chlorination, a 106 million gallon (mgal) effluent storage pond/polishing basin, and land disposal. Spray irrigation is permitted on 80 acres of private land and Forest Service land during summer months. During wet winters with heavy snowfall, effluent may be discharged to Bloods Creek, a tributary of the North Fork Stanislaus, under the NPDES permit; discharge to surface water is only allowed from January 1 to June 30 and sodium bisulfite is used to remove chlorine residual prior to discharge.

BVWWTF had five violations within the past five years. The violations were primarily related to compliance with monitoring requirements and coliform exceedances (CVRWQCB, 2021a).

COPPER COVE WASTEWATER RECLAMATION FACILITY. CCWD owns and operates the Copper Cove Wastewater Reclamation Facility, located west of Tulloch Reservoir, which serves 1,679 residential connections, 26 commercial connections, and a population of around 4,500. It serves the communities of Copper Cove, Conner Estates, Copper Meadows, Saddle Creek, and Lake Tulloch. Average dry weather flows are approximately 0.17 mgd (CCWD, 2018).

The secondary and tertiary treatment facilities includes headworks/flow diverter, two aerated ponds, non-aerated ponds, storage ponds, and irrigation spraying fields. Reclaimed water undergoes coagulation-flocculation, two-stage filtration, and UV disinfection before it is used by the Saddle Creek Golf Course which is a co-discharger. Undisinfected secondary treated wastewater is stored onsite in an unlined storage reservoir (Pond 6) which may then be land applied, after disinfection, via spray irrigation on CCWD's 25 acres of spray irrigation fields.

The collection system, secondary treatment and storage facilities, and on-site irrigation are covered under separate WDR Order R5-2013-0072. During the summer, wastewater from Pond 6 is further treated to tertiary levels using tertiary filtration and ultraviolet light (UV) disinfection. The Title 22 tertiary treated effluent is collected in a reclaimed water storage tank and then discharged to Pond NC-2D to be used for golf course irrigation or to provide makeup water for the wetland system. The 404 permit for the wetlands requires that all ponds and wetland areas have a continuous supply of water to maintain minimum levels. During severe wet weather events some of the ponds may overflow to Mitchell Lake and Littlejohns Creek, although the amount reaching Littlejohns Creek is minimal according to the CVRWQCB. Littlejohns Creek drains to the Farmington Flood Control Basin.

In the past five years, 39 violations were recorded by the CVRWQCB. Violations were for exceedances of coliform, nitrogen, BOD, manganese, iron, color, and odor, and disinfection process violations. Heavy precipitation in January and February 2017 resulted in spray field discharge exceedances and sand filters bypassed. Some violations of late reporting (CVRWQCB, 2021a).

CITY OF ANGELS WASTEWATER TREATMENT PLANT. The City of Angels WWTP (CAWWTP), located in the City of Angels Camp, is owned and operated by the city. The WWTP discharges tertiary effluent that is mostly land applied under the regulation of WDR Order R5-2012-0088. CAWWTP provides UV to meet Title 22 criteria for recycled water. Facilities include influent flow equalization, mechanical screening, grit removal, nitrification/denitrification, chemical addition, sedimentation, and UV disinfection. Holman Reservoir provides CAWWTP with an effluent storage capacity of 60 mgal. The CAWWTP treatment capacity is 600,000 gpd (average monthly, dry weather). Treated effluent has three alternative methods of disposal depending on the weather. During a dry year, effluent is primarily disposed of at approximately 110 acres at the Greenhorn Creek Golf Course with a minor amount through spray irrigation of pasture with approximately 60 acres available. During a wet year, land disposal is used as much as possible, and is discharged to Angels Creek only when there is no other available disposal method.

Criteria that must be met before any discharges into Angels Creek include an average daily flow in the creek of at least 12 million gallons per day (MGD) to achieve a minimum downstream flow ratio of 20:1 (creek flow:effluent). Discharge to Angels Creek is prohibited when the storage reservoir has more than 20 mgal of unused effluent storage capacity. Only tertiary UV disinfected effluent is allowed for discharge to Angels Creek. Under the NPDES permit, CAWWTP is allowed to discharge into Angels Creek from November 15 through May 15.

In the past five years, 12 violations were recorded by the CVRWQCB. Most violations were associated with late reporting but some indicated vegetation and other debris accumulating at a storage pond, lack of monitoring of EC, hardness, and TDS, and thermometers not calibrated. Severe rain events in January 2017 caused overload of WWTP resulting in blending of influent and effluent waters (CVRWQCB, 2021a).

FOREST MEADOWS WASTEWATER RECLAMATION PLANT. CCWD owns and operates Forest Meadows Wastewater Reclamation Plant (FMWWRP), located near Murphys. Under WDR Order R5-2014-0011, CCWD is allowed to treat up to 0.28 MGD municipal wastewater from the community of Forest Meadows. The FMWWRP includes a rotary strainer, complete mixed basin, sludge-settling storage basin, two dissolved air flotation thickeners, two continuous backwash sand filters, and UV light disinfection system. The FMWWRP has on-site leachfields and an emergency storage pond. Treatment and land application to the leachfield, storage pond, and Forest Meadows Golf Course irrigation are regulated by the Order with CCWD and Sierra Golf Management Corporation as co-dischargers. The treatment process and the effluent must comply with Title 22 requirements because of the use of effluent as an irrigation supply.

The surface drainage systems at both FMWWRP and the golf course discharge into Angels Creek. FMWWRP is allowed to discharge up to 0.89 MGD of tertiary treated effluent into the Collierville (tunnel) powerhouse effluent channel which drains to Angels Creek. Under the NPDES permit, discharge to the Collierville tunnel is only allowed from December 1 through May 15 and only when the storage pond does not meet the requirements prescribed under the permit. The plant does not make use of its NPDES permit because it does not have the infrastructure to connect to the tunnel. CCWD does not anticipate a need to discharge into Angels Creek and does not have plans to construct a pipeline connecting to the Collierville tunnel in the near future.

In the past five years, one violation was recorded by the CVRWQCB. The violation was due to odors from the effluent storage pond caused by an algae bloom.

WASTEWATER TREATMENT DISCHARGERS – LAND DISPOSAL. Wastewater treatment plants that do not dispose of the effluent to waterbodies typically use land disposal methods. These include spraying fields, leachfields, holding ponds, and the reuse of tertiary treated wastewater in irrigation systems, particularly golf courses. These facilities are required to comply with WDR and do not need NPDES point discharge permits. The Stanislaus River watershed WWTPs with WDR are listed in Table 3-12; these facilities were described in previous WSSs. Most violations during the past five years were associated with the high precipitation events in January and February 2017.

Table 3-12: Land Disposal Dischargers in the Stanislaus River Watershed

Facility Name	Owner	Community/ County	WDR Order
Angels Camp RV & Camping	M&T Rentals	Angels Camp, Calaveras	92-011
Arnold WWTP	CCWD	Arnold, Calaveras	2014-0153-DWQ
Baseline Conservation Camp	CAL FIRE and Ca Dept. of Corrections & Rehabilitation	Jamestown, Tuolumne	97-010 DWQ
Big Trees County Houses WWTP	CCWD	Camp Connell	R5-1994-0357
Calaveras Big Trees State Park	Ca Dept Parks & Recreation	Arnold, Calaveras	R5-2006-0043
Camp Connell Maintenance Sta. WWTF	Ca Dept of Transportation	Camp Connell	90-297
Douglas Flat/Vallecito WWTP	CCWD	Douglas Flat, Calaveras	R5-2013-0009
Forest Meadows WWTP & RP	CCWD	Forest Meadows, Calaveras	5-00-066
Glory Hole Recreation Area	USBR	New Melones Reservoir, Calaveras	02-125
Indian Rock Vineyards WWTP	CCWD	Murphys, Calaveras	90-259
Leland Meadow WWTP	Leland Meadow Water District	Strawberry, Tuolumne	97-010-DWQ
Mi-Wuk Village WW System	Tuolumne Utilities District	Mi Wuk, Tuolumne	97-010-DWQ
Murphys WWTF	Murphys Sanitary District	Murphys, Calaveras	5-00-264
Pinecrest WWTP	Forest Service	Pinecrest, Tuolumne	5-01-061
Rawhide Mobile Home Park	Rawhide Investment Co.	Jamestown, Tuolumne	97-010-DWQ
Roll-in Mobile Home Park	David and Maria Glenos	Columbia, Tuolumne	R5-2002-0069
Sequoia Woods Condominiums & Mountain Retreat Resort	CCWD	Arnold, Calaveras	R5-1995-0069
Sierra Conservation Camp	Ca Dept. of Corrections & Rehabilitation	Jamestown, Tuolumne	95-063
Tanwood Mobile Home Park	RHJ Estates Investment	Avery, Calaveras	95-223
Tuttletown Recreation Area	USBR	New Melones Reservoir, Tuolumne	87-084
Vallecito Conservation Camp	CAL FIRE and Ca Dept. of Corrections & Rehabilitation	Douglas Flat, Calaveras	94-314

Source: CVRWQCB, 2021a.

SANITARY SEWER OVERFLOWS. Potential causes of sanitary sewer overflows (SSO) include grease, root, and debris blockages, sewer line flood damage, manhole structure failures, vandalism, pump station mechanical failures, power outages, storm or groundwater inflow/infiltration, lack of capacity, and/or contractor causes blockages.

A record of SSOs is maintained by the SWRCB. Overflows listed in each individual SSO report contain data related on each specific incident where sewage is discharged from the sanitary sewer system due to a failure (e.g., sewer pipe blockage or pump failure). Table 3-13 provides a summary of SSOs within the watershed from 2016 to 2020.

Table 3-13: Sanitary Sewer Overflows in Collection Systems (2016 to 2020)

Agency/Collection System	Total Number of SSO Locations	Total Volume of SSOs (gal)	Total Volume Recovered (gal)
CCWD/Copper Cover Collection System (CS)	3	352,700	10,000
CCWD/Douglas Flat & Vallecito CS	1	250	250
CCWD/ Forest Meadows CS	0	0	0
CDPR/ Calaveras Big Trees State Park CS	1	200	0
City of Angels/Angels Camp CS	18	72,884	974
Murphys Sanitation District/Murphys CS	16	5,659	1,115
Sierra Conservation Camp/SCC CS	1	12,000	12,000
Tuolumne Utility District/Columbia CS	26	7,519	5,057
USBR/Tuttletown Recreation Area CS	0	0	0

Source: CVRWQCB, 2021a.

ONSITE WASTEWATER TREATMENT SYSTEMS. Outside of the wastewater collection and treatment systems described above, most of the residential and commercial uses in the watershed are on onsite wastewater treatment systems (OWTS), commonly called septic systems, with leachfields and/or septic tanks. Engineered systems pump the liquids to an area with better drainage. As septic systems age, they tend to fail more frequently. Properly operated systems can experience problems during prolonged precipitation events. Of more concern is a plugged leachfield or tank or nonworking pump which can send untreated sewage directly into a waterbody. Septic system siting can be problematic, particularly in the higher elevations because there is less soil depth and less separation to groundwater. Limestone and volcanic mudflow subsurface formations are problematic because of the difficulty percolating.

The county environmental health departments permit individual on-site sewage disposal systems on parcels that have the area, soils, and other characteristics that permit installation of such disposal facilities without threatening surface or groundwater quality. These are only permitted where community sewer services are not available and cannot be provided. There are currently no plans to replace septic systems with sewage collection service in the watershed in the near future.

Tuolumne County has over 17,800 OWTS. One of the larger Tuolumne County communities in the watershed is Columbia, which is served by both sewer and septic systems. The outlying areas to the west within the watershed are served by septic systems. The outlying areas of Jamestown and Tuttletown near New Melones Reservoir, which drain to Stanislaus River tributaries, are also served by septic systems. Residences of Tuttletown are generally on three acre lots; a minimum of two acres is required to use both well water and a septic system. There are few homes at Tulloch Reservoir that lie in Tuolumne County; these homes have large lots and use septic systems. The community of Strawberry is served wholly by septic systems.

Within Calaveras County, smaller communities served by OWTS include Carson Hill, Hathaway Pines, and Avery. The communities of Vallecito and Six Mile Village are served by Septic Tank Effluent Pumping (STEP) systems. STEP systems use septic tanks as settling devices, then send the liquid wastewater to a WWTP, and solids are pumped out. Vallecito's wastewater is collected in a 2-inch-diameter pipeline that discharges to CCWD facilities. These communities arrange to pump solids accumulated in septic tanks every three to four years. Six Mile Village's STEP system has 68 connections and is primarily composed of a series of septic tanks that allow solids to settle. Wastewater from the tanks is collected in a 2-inch pipeline that discharges into the lift station where it is pumped to the Angels Camp WWTP to undergo further treatment.

WATERSHED MANAGEMENT

Federal and state laws protect water quality from wastewater discharges, as well as the point and nonpoint sources. All treated wastewater in California that is reclaimed for reuse as recycled water must comply with Title 22. On-site wastewater treatment systems are regulated by the SWRCB as well as each county.

FEDERAL AND STATE LAWS FOR POINT AND NONPOINT WASTEWATER DISCHARGES. As discussed under stormwater, the federal Clean Water Act requires states to adopt water quality standards and to submit those standards for approval by the United States Environmental Protection Agency (US EPA). The Porter-Cologne Water Quality Control Act is the principal state law governing water quality regulation in California. The Porter-Cologne Act established a comprehensive program to protect water quality and the beneficial uses of water. It established the SWRCB and nine RWQCBs which are charged with implementing its provisions, and which have primary responsibility for protecting water quality in California. The SWRCB provides program guidance and oversight, allocates funds, and reviews RWQCB decisions. The RWQCBs have primary responsibility for individual permitting, inspection, and enforcement actions within each of nine hydrologic regions. The Stanislaus River watershed falls under the jurisdiction of the CVRWQCB.

The SWRCB and the RWQCBs preserve and enhance the quality of the State's waters through the development of water quality control plans and the issuance of waste discharge requirements. The RWQCBs regulate point source discharges (i.e., discharges from a discrete conveyance) primarily through issuance of NPDES and waste discharge requirement permits. NPDES permits serve as waste discharge requirements for surface water discharges. Anyone discharging or proposing to discharge materials to land in a manner that allows infiltration into soil and percolation to groundwater (other than to a community sanitary sewer system regulated by an NPDES permit) must file a report of waste discharge to the local RWQCB (or receive a waiver). Following receipt of a report of waste discharge, the RWQCB issues WDRs that prescribe how the discharge is to be managed.

An NPDES permit is required for municipal, industrial, and construction discharges of wastes to surface waters. Typically, NPDES permits are issued for a five-year term, and they are generally issued by the RWQCBs. An individual permit (i.e., covering one facility) is tailored for a specific discharge, based on information contained in the application (e.g., type of activity, nature of discharge, and receiving water quality). A general permit is developed and issued to cover multiple facilities within a specific category.

The beneficial uses and receiving water objectives to protect those uses are established in the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins, known as the Basin Plan. The CVRWQCB establishes effluent limitations for wastewater dischargers based on the beneficial uses and the receiving waterbody's water quality objectives. Effluent limitations are specific to each discharge and vary throughout the Central Valley. If a discharge is to an ephemeral stream or a stream that the CVRWQCB determines does not have any assimilative capacity for a contaminant, the discharger's effluent must meet the receiving water quality objectives. If the receiving water has dilution capacity available, the CVRWQCB establishes effluent limitations that allow for a mixing zone and effluent dilution in the receiving water. The CVRWQCB establishes effluent limits for several contaminants in waste discharge permits. However, the Basin Plan does not contain water quality objectives for key drinking water constituents of concern (e.g., disinfection byproduct precursors, pathogens, and nutrients) or the current objectives are not based on drinking water concerns (salinity, chloride). Therefore, current reporting provides limited effluent quality data for many such constituents because the dischargers are not required to conduct monitoring.

STATE AND LOCAL REGULATIONS FOR ON-SITE WASTEWATER TREATMENT SYSTEMS. The SWRCB adopted Resolution 2012-0032 setting policy for the siting, design, operation, and maintenance of OWTS (AB 885). The OWTS Policy sets standards for OWTS that are constructed or replaced, that are subject to a major repair, that pool or discharge waste to the surface of the ground, and that have affected, or will affect, groundwater or surface water to a degree that makes it unfit for drinking water or other uses, or cause a health or other public nuisance condition. The OWTS Policy also includes minimum operating requirements for OWTS that may include siting, construction, and performance requirements; requirements for OWTS near certain waters listed as impaired under Section 303(d) of the Clean Water Act; requirements authorizing local agency implementation of the requirements; corrective action requirements; minimum monitoring requirements; exemption criteria; requirements for determining when an existing OWTS is subject to major repair, and a conditional waiver of waste discharge requirements (SWRCB, 2016d). The regulations allow local control over managing the systems. If the current OWTS is in good operating condition and is not near an "impaired water body", the policy has little effect on property owners.

Tuolumne County requires a 250 foot setback of a septic system to a drinking water source. Residences are allowed to be less than 250 feet from a reservoir; however, leachfields must be more than 250 feet. The Environmental Health Department is responsible for establishing permit requirements and compliance. Failed OWTSs are typically discovered through complaints. The County has a maintenance and monitoring program that requires inspection of all engineered or experimental septic systems twice a year by a third party. The goal is to repair systems before they leak. Older non-engineered systems are not routinely inspected. Non-engineered systems are inspected only if the homeowner or a neighbor notifies the County of a problem. The most problematic systems are generally located in older communities with high septic system densities and lots with an inadequate leachfield area. Some of these subdivisions were developed primarily for use as vacation cabins but now have a high rate of year-round occupancy.

Most of the septic systems were installed prior to the adoption of current regulations which now require a health review and soils investigation to demonstrate feasibility and long-term operation prior to approval. Additionally, the County notes that some systems were installed in fractured rock and are potentially a threat to groundwater quality and local water wells. Those wells of most concern are generally associated with older residences drilled prior to the adoption of the local well construction ordinance in 1986 which mandates minimum separation between leachfields and other sources of pollution.

The Calaveras County General Plan specifies new development of one dwelling unit per one acre-plus (no denser) can have an OWTS, if feasible. Higher densities must be connected to public sewage collection systems. Calaveras County does not require that a septic system be inspected during the sale of a property. However, most lending institutions require that a septic system be pumped out and inspected to obtain a mortgage.

WILDFIRES

CONCERN

Wildfires result in a loss of surface cover and forest duff, such as needles and small branches, which exposes soil to the direct impact of raindrops, which then reduces the infiltration capacity of the soils, increasing runoff. With the loss of vegetation, rainfall does not collect and run off along established depressions, but it dissipates rapidly as sheet flow. In addition, fires in chaparral vegetation can produce hydrophobic soils. Hydrophobic soils decrease permeability of soils and increase runoff. Wildfires can contribute to increased sediment and organic matter in surface runoff to waterbodies during precipitation events in years following the fire. Sediment is a major carrier and catalyst for pesticides, organic residues, nutrients, and pathogenic organisms. Fire derived ash can increase pH, alkalinity, and nutrients. The increase in turbidity at the treatment plants from fine particles which have not settled to the bottom of waterways during transport result in increased treatment operations (e.g., more filter backwashing, higher disinfectant dosages), increased likelihood of THMs and other DBPs generated, and a greater level of risk of pathogens slipping through the treatment process. Nutrient loads into water bodies, particularly phosphorus and nitrogen, have also been reported to increase after wildfires.

In addition, water yields, peak flows, and flow duration can be drastically impacted post-fire. Immediately following large fire events, runoff peaks can increase significantly and can occur much earlier. Future overall yields can be lower, depending on the nature of the fire and watershed characteristics. At moderately high altitudes, this occurs because snowmelt is greatly accelerated due to the removal or reduction of shade. It is released too rapidly to be stored in the soil, meadows, or in reservoirs. Post fire logging practices can impact water quality through the application of herbicides to control brush and log removal increasing erosion.

POTENTIAL CONTAMINANT SOURCES

According to CAL FIRE, the area features a range of challenging topography, fuels, and weather. The grasslands of the rolling western plains routinely experience extreme summer heat, and significant wind events during spring and fall months. The brush fields lay over broad expanses of steep hillsides and atop narrow ridgelines between deepening river canyons, with topography making access difficult. The brush transitions into mixed oak and conifer zones as the elevation increases and the canyon depth and width increase with high hazard brush and timber fuels. This mid-elevation area also experiences high summer temperatures and is most affected by normal diurnal winds associated with the canyon topography. The higher elevation zone features dense stands of conifer timber, with accumulations of ground and ladder fuels. Temperatures are routinely moderated due to the elevation, however, wind events in the fall can contribute to challenging fire conditions. Most of the watershed lands in Calaveras and Tuolumne counties are designated as having a very high to high fire risk rating.

Another fire concern is the increase in tree mortality rates due in part to more frequent droughts and bark beetle infestation. Dead and dying trees, in particular, Ponderosa, Pinyon, and sugar pines, raise the risk of faster moving and more intense forest fires.

Table 3-14 lists fires from CAL FIRE incident reports that have occurred in the watershed in the last five years. The tributary or reservoir downstream of the fire burn area is estimated. The most significant fire was the Donnell Fire of 2018 which burned over 36,000 acres, almost entirely within the Stanislaus River upper watershed near the Dardanelles. This fire, started from an unattended campfire outside of a developed campground, burned for over five months and destroyed 54 structures. The heat perimeter, or the outer edge of a fire, is shown on Figure 3-7.

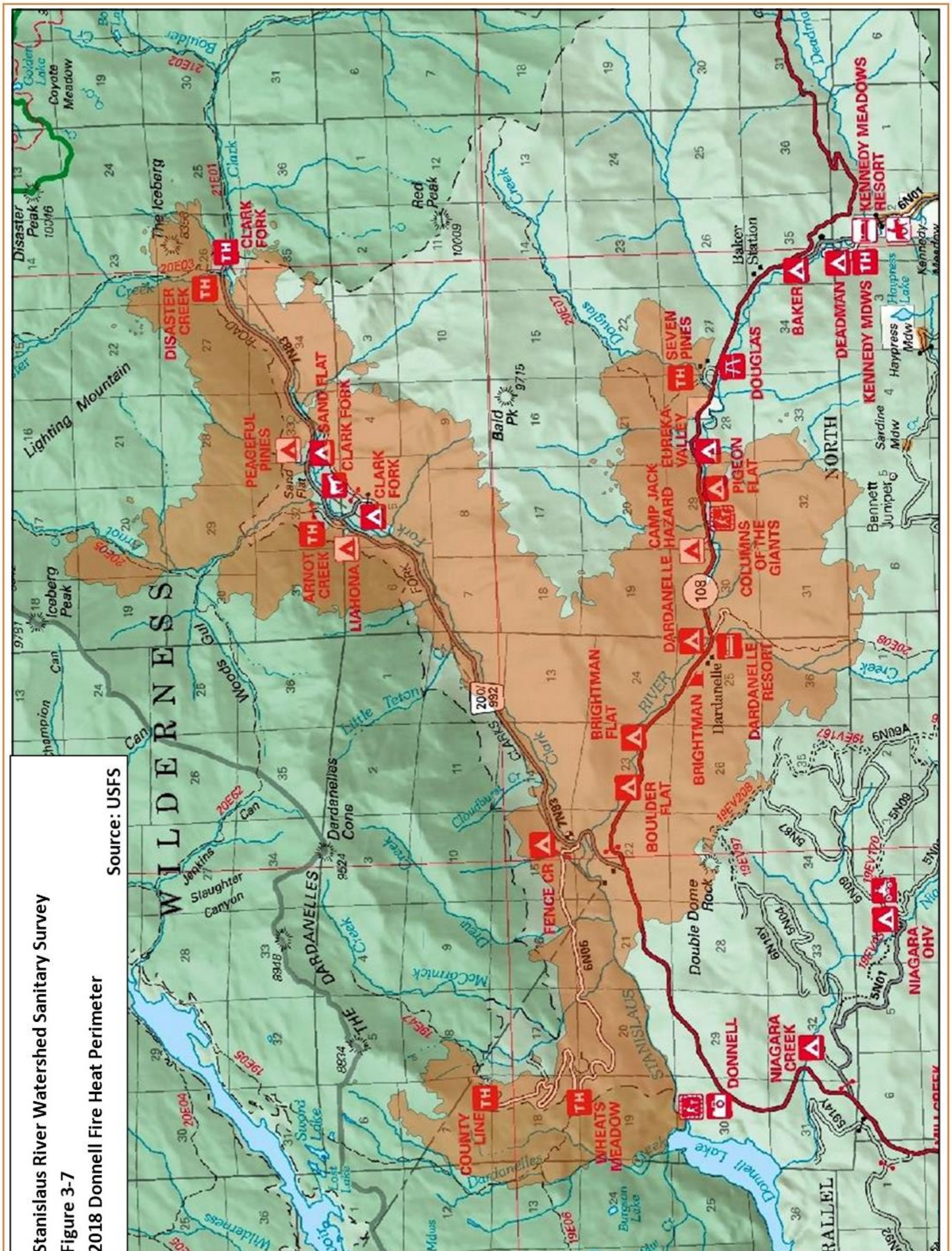
Table 3-14: Fires in Stanislaus River Watershed (2016 to 2020)

Year	Fire Name	Tributary/Reservoir	Started	Acres
2020	Diamond Fire	Sawmill Cr/Tulloch	October 13	21
2020	Flint Fire	Rock Cr/Farmington FCB	August 19	55
2020	Salt Fire	Rock Cr/Farmington FCB	August 18	1,789
2020	Quarter Fire	South Fork Stanislaus/New Melones	June 21	10
2020	Walker Fire	Rock Cr/Farmington FCB	June 16	1,000
2019	Milton Fire	Rock Cr/Farmington FCB	July 15	202
2018	Parrots Fire	Coyote Cr/New Melones	August 5	136
2018	Donnell Fire	Middle Fork Stanislaus/New Melones	August 1	36,450
2018	Horse Fire	McCarty Creek/Farmington FCB	June 24	80
2017	Milton Fire	Littlejohns Cr/Farmington FCB	October 18	13
2017	Table Fire	Peoria Cr/BCC Intake/Tulloch	September 19	39
2017	Summit Complex	South Fork Stanislaus/Pinecrest	July 31	5,247
2017	Willms Fire	Stanislaus Ri/Knights Ferry Intake	July 18	19
2017	Orange Fire	Main Canal	June 21	65
2016	Stagecoach Fire	McCarty Creek/Farmington FCB	July 12	35
2016	Baker Fire	Copper Cr/Tulloch	July 12	57
2016	Appaloosa Fire	Nassau Cr/New Hogan	July 2	310
2016	Tulloch Fire	Peoria Cr/BCC Intake/Tulloch	May 30	85

Source: CAL FIRE, 2021. Tributary/reservoirs were identified by author and are approximate.

WATERSHED MANAGEMENT

Areas of the state are designed as State Responsibility Areas (CAL FIRE is the primary responder for nonstructural fires outside of Forest Service land), Federal Responsibility Areas (Forest Service has primary jurisdiction for fires in the Stanislaus National Forest), or Local Responsibility Areas (county or city fire departments have primary jurisdiction). Forest Service manages fuel breaks to protect



Stanislaus River Watershed Sanitary Survey
Figure 3-7
2018 Donnell Fire Heat Perimeter
Source: USFS

private property. Fuel breaks are created by thinning, cutting surface and ladder fuels, pruning residual trees, piling, and burning.

Eleven fire protection districts, a public utility district, one city fire department, and the Calaveras County Fire Department are organized to fight fires in the county. Calaveras County has agreements with seven of the fire protection districts in which an exchange of services, emergency response, and financial support is delineated. Calaveras County Fire and Emergency Services is the primary responder for structure fires, unless a community has a fire agency. The Calaveras County Fire and

Emergency Services has primary jurisdiction for structure fires unless a community has a fire agency such as the City of Angels Camp Fire Department. The remaining lands are located in either State or Federal responsibility areas.

In Tuolumne County, the County is the primary responder for structure fires, including the Calaveras Big Trees State Park, unless a community has a fire agency. Several agencies provide fire protection services within Tuolumne County, representing federal, state, and local jurisdictions, with the assistance of the county's citizens serving as volunteer firefighters. Fire protection missions are broken into two categories: life and property fire protection and wildland fire protection. Most of Tuolumne County outside of the Stanislaus National Forest and the City of Sonora is a State Responsibility Area as defined by Sections 4126-4127 of the Public Resources Code. Therefore, CAL FIRE is responsible for wildland fire protection in these areas.

CAL FIRE Tuolumne-Calaveras Unit has updated its Pre-Fire Management Plan. The report includes assessment summaries of each battalion in the region including a discussion of assets at risk, fuels and weather, and management activities undertaken by the unit to prevent fire damage to the area. The CAL FIRE Emergency Watershed Protection and the Forest Service Burn Area Emergency Rehabilitation teams begin rehabilitation evaluations once a fire is contained. The teams review both the suppression impacts, such as the fire lines constructed by hand crews and dozers, and the fire impacts to determine the extent of repair and rehabilitation needed. After a wildland fire, CAL FIRE assists with hydroseeding, mulching, and other slope stabilization techniques. CAL FIRE attempts to restore the disturbed area. Erosion mitigation response conducted after a wildfire depends on how much vegetation was removed, soil type, steepness of slope, and other factors.

Five of the six largest fires in modern history burned at the same time during the 2020 fire season. A consortium of state agencies released: “California’s Wildfire and Forest Resilience Action Plan”, in January 2021 to address the increased size and intensity of wildfires throughout the state. This plan is intended to accelerate efforts to restore the health and resilience of forests, grasslands, and natural places, improve fire safety of communities, and sustain the economic vitality of rural forested areas. Actions to achieve these goals include increased forest management, expanded use of prescribed fires, create economic opportunities for the use of forest materials that store carbon and reduce emissions, streamline permitting for vegetation treatment, scale up forest thinning, and promote sustainable land use, among other items.

Consistent with this action plan, the Stanislaus National Forest is conducting prescribed burns for lands within the South Fork Stanislaus watershed north of Mi Wuk Village within the Mi-Wok Ranger District. Up to 218 acres total will be burned over a two month period in 2021. The purpose of this prescribed burn and others planned for the future is to reduce the build-up of flammable forest fuels and reduce the impacts of large uncontrolled wildland fires (USFS, 2021).

WILDLIFE

CONCERN

Wild animal populations are a threat to water quality because they may contribute pathogenic organisms such as *Giardia* and *Cryptosporidium*, bacteria, and viruses to the water supply. Wild animals congregate near bodies of water, similar to domestic animals, and can contribute to increased nutrients (nitrogen and phosphorous), microorganisms (bacteria, viruses, and protozoa), and increased erosion of sediment from compaction and disturbance of soils. Birds, in particular, can be a significant source of pathogens to waterbodies because of the direct nature of their deposits, and a tendency to roost in large numbers on water surfaces, and if there is a large year-round population as opposed to migratory population. The more expensive testing required to determine whether detected coliform levels are from human or animal sources is not typically conducted.

POTENTIAL CONTAMINANT SOURCES

The grasslands of the watershed provide productive habitat for hundreds of vertebrate and invertebrate species while the woodland vegetation supports a wide variety of game species. Common bird species include acorn woodpeckers, common crows, California quail, doves, hawks, and eagles. Mammals include bats, gray foxes, coyotes, deer, raccoons, and rodents. Squirrels, deer mice, voles and pocket gophers can be found in the grasslands.

Mammals include foxes, coyotes, deer, raccoons, bear, mountain lion, bobcat, wild boar, squirrel, and rabbit. Deer are the most prevalent large mammal. In Calaveras County there are resident deer and migratory deer that move from its winter range in central Calaveras County to its summer range in Alpine County. Raccoons, skunks, opossums, weasels, muskrats and black-tailed deer favor the riparian corridors. In the forested lands of the upper watershed, habitat supports wildlife such as bears, martens, gray foxes, mountain lions, weasels, coyotes, spotted skunks, flying and gray squirrels, opossums, ringtail cats, and other species.

Visitors to Calaveras Big Trees State Park have observed raccoon, fox, porcupine, chipmunk, flying squirrel, black bear, bobcat, and coyote. The southernmost part of the park is the Calaveras South Grove Natural Preserve.

New Melones Reservoir has abundant wildlife including the above plus ospreys, bald eagles, egrets, and herons. Black tail deer, fox, river otter, and raccoons are common as the reservoir provides a source of water. The Peoria Wildlife Area, immediately south of New Melones Reservoir above the intakes for SCC WTP and BCC WTP, provides a protected habitat with direct access to a water source. The wildlife area encompasses 2,500 acres accessible only on foot, horseback, or by bike.

Waterfowl along the South San Joaquin Main Canal and at Woodward Reservoir is of particular concern. Migratory waterfowl access the canal and Canada geese are becoming resident (non-migratory). A single goose can defecate up to 1.5 pounds per day; their fecal matter may contribute pathogens and nutrients.

Swallow nests on bridges crossing waterbodies were observed at Woodward Reservoir and along Littlejohns Creek. Boating on Woodward Reservoir and seasonal mixing can stir up settled fecal deposits.

WATERSHED MANAGEMENT

Watershed management of wild animals occurs through the California Department of Fish and Wildlife, county animal control officers, and Forest Service. The presence of wildlife is a high risk to water quality because they difficult to manage to prevent contamination of drinking water supplies.

Managing Canada geese is difficult because there are federal protections. Border collies are effective in chasing geese as a management control but are not a practical solution. Signage discouraging people from feeding them aids in educating the public about the problem. Replanting grass areas with tall fescue or ground covers reduces their food source while studies have shown that geese were less likely to walk to food that was placed beyond 39 yards from the water line. In addition, increasing bank slope or placing large stones around the banks reduces the attraction (ICWDM, 2015).

GROWTH AND URBANIZATION

The majority of the Stanislaus River watershed is sparsely populated, with several small towns established during the Gold Rush period of early California located along historic routes of Highways 49, 12, 4, and 108. Both Tuolumne and Calaveras counties have a relatively flat rate of population growth, however, agriculture in Calaveras County is anticipated to continue to increase, particularly in areas around Salt Spring Valley and along the Highway 4 corridor east to Murphys. Population estimates for the counties for the previous five years are provided in Table 3-15. The California Department of Finance estimates the population of Calaveras County as approximately 44,286, a 1.1 percent decrease from 2016, and Tuolumne County as approximately 52,353, a 1.8 percent decrease since 2016. There are 2.13 people per household in Tuolumne County and 2.38 people per household in Calaveras County. The vacancy rate in Tuolumne County is over 30 percent, reflecting the numerous vacation homes and recreational rental units (Tuolumne County, 2018).

The only incorporated city in the watershed, Angels Camp (City of Angels), has a population in 2020 of 4,123. Although it is difficult to obtain precise population estimates for the unincorporated areas, various sources provided the following: the largest unincorporated community in the watershed is Arnold with an estimate of 3,843 residents followed by Copperopolis with a population of 3,675, Murphys at 2,213, and Forest Meadows at 1,249.

Table 3-15: Population by County

	2016	2017	2018	2019	2020	Percent Change 2016 to 2020
Calaveras	44,763	44,656	44,572	44,403	44,286	-1.1
Tuolumne	53,291	52,862	52,843	52,557	52,353	-1.8

Source: DOF, 2021
Note: This is for entire counties. Stanislaus and Alpine Counties are not included because of the limited extent within the watershed; population in those two counties is sparse with the exception of Bear Valley in Alpine County with its seasonal population.

Within the watershed in Calaveras County, newer developments around Murphys, Angels Camp, and greater Copperopolis have higher density development than the remainder of the rural county, more similar to suburban densities. Copper Cove and vicinity, which drains to Littlejohns Creek, has homes with larger lots with small farming operations. Smaller communities in the Calaveras County part of the watershed include: Knights Ferry, Tulloch Reservoir, Vallecito, Douglas Flat, Forest Meadows, Hathaway Pines, Avery, Dorrington, and Bear Valley. Many of these mountain communities have a great number of vacation homes. Calaveras County General Plan indicates that its population is expected to increase to 48,038 by 2040. According to the recently adopted general plan, this may require the addition of 1,012 residential units in the county (Calaveras County, 2020).

The Tuolumne County General Plan was updated in 2018. It focused the majority of new development within community plan areas. Western Columbia, and the western region outside of Jamestown near New Melones Reservoir are the only community plan areas within the watershed. Communities in Tuolumne County that are in the watershed include Columbia, Tuttletown area, Pinecrest, and Strawberry.

Tulloch Reservoir in Copperopolis has the greatest risk of urban land uses contaminating water supplies due to the high density of homes along the waterfront and in the immediate drainage area. The communities are sewered but contamination of the water supply could be from human waste associated with recreational activities, stormwater flows with road and landscaping contaminants, unauthorized disposal of oil and other contaminants, for example. Water treatment plants receiving this water include Sierra Conservation Center WTP, Copper Cove WTP, Knights Ferry WTP, DJ Waidhofer WTP, and NC DeGroot WTP.

SECTION 4 WATER QUALITY

This section presents a review of available water quality data for the study period of 2016 through 2020. Section 4 is organized as follows:

- Review of drinking water regulations with a focus on the SWTR, Interim Enhanced Surface Water Treatment Rule (IESWTR), and the LT2ESWTR.
- Water quality data for the study period 2016 through 2020 are presented for each of the participating public water systems.

DRINKING WATER REGULATIONS

The Safe Drinking Water Act (SDWA) was enacted by the United States Congress in 1974. The SDWA authorized the United States Environmental Protection Agency (EPA) to set standards for contaminants in drinking water supplies. The SDWA was0 amended in 1986 and again in 1996. Under the SDWA, states are given primacy to adopt and implement drinking water regulations that are no less stringent than the federal regulations and to enforce those regulations. For California, the DDW is the primacy agency in with this authority.

SURFACE WATER TREATMENT REQUIREMENTS. The SWTR was promulgated in 1989 to control the levels of turbidity, *Giardia lamblia*, viruses, *Legionella*, and heterotrophic plate count (HPC) bacteria. Compliance with the SWTR is demonstrated by meeting specific turbidity and disinfection performance requirements. Surface water treatment plants are required to achieve 3-log (99.9 percent) reduction of *Giardia* and 4-log (99.99 percent) reduction of viruses. A conventional filtration plant in compliance with the turbidity performance standards is given credit for physical removal of 2.5 logs *Giardia* and 2.0 log virus. The additional 0.5-log *Giardia* reduction and 2-log virus reduction must be achieved through disinfection. A direct filtration plant in compliance with the turbidity performance standards is given credit for physical removal of 2 logs *Giardia* and 1 log virus. The additional 1 log *Giardia* reduction and 3-log virus reduction must be achieved through disinfection. Compliance with the disinfection requirements is demonstrated by monitoring CT where C is the concentration of disinfectant and T is the contact time for the disinfectant, and CT is the product of the two. The calculated CT is compared to CT values required to achieve a certain log inactivation credit.

Beyond the minimum SWTR requirements described above, DDW staff can impose additional treatment requirements (via permit) when the quality of the raw water poses higher microbial risk according (based on monthly total coliform results) to the criteria presented in Table 4-1.

EPA promulgated the Interim Enhanced Surface Water Treatment Rule (IESWTR) in 1998 (effective in California in January 2008). The IESWTR applied to surface water systems (and groundwater under the direct influence of surface water) serving greater than 10,000 population. The IESWTR lowered the turbidity performance requirement in the 1989 SWTR for the combined filter effluent from 0.5 NTU to 0.3 NTU for conventional and direct filtration plants and required that utilities monitor and record the turbidity for individual filters. In addition, the IESWTR added (1) a requirement that utilities achieve 2-log removal of *Cryptosporidium*, with compliance demonstrated by meeting the turbidity performance requirement, (2) requirements for disinfection profiling and benchmarking, and (3) a requirement that all new finished water storage facilities be covered.

Table 4-1. Coliform Triggers for Increased *Giardia* and Virus Reduction[1]

Median Monthly Total Coliform (MPN/100 mL)	*Giardia* Cyst (Log reduction required)	Virus (Log reduction required)
<1000	3	4
>1000 – 10,000	4	5
>10,000 – 100,000	5	6

In January 2002 EPA published the final Long-term 1 ESWTR (LT1ESWTR). The LT1ESWTR applied the requirements of the IESWTR to systems serving less than 10,000 population. The LT1ESWTR went into effect in California in July 2013.

The Long term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) was promulgated in January 2006 and was effective in California in July 2013. The LT2ESWTR required 2 years of monthly source water monitoring for *Cryptosporidium*. Depending upon the concentration of *Cryptosporidium*, utilities were placed into one of four bins, which corresponded to levels of risk. Table 4-2 presents the schedule for the first and second round of monthly source water *Cryptosporidium* monitoring.

Table 4-2. LT2ESWTR Source Water Monitoring Schedule

	Population Served			
	≥ 100,000	**50,000 to 99,999**	**10,000 to 49,999**	**< 10,000***
Begin first round of source water monitoring	Oct 2006	Apr 2007	Apr 2008	Oct 2008
Submit Bin Classification	Mar 2009	Sept 2009	Sept 2010	Sept 2012
Begin second round of source water monitoring	Apr 2015	Oct 2015	Oct 2016	Apr 2019

*Required to monitor every two weeks for *E. coli*, results may trigger *Cryptosporidium* monitoring.

Table 4-3 presents the various bin classifications adopted in the LT2ESWTR. If the monitoring results indicated placement in Bin 1, no additional treatment for *Cryptosporidium* was required beyond the 2-log removal credit given to plants that meet the turbidity removal requirements. Placement in Bins 2 through 4 required increasing levels of *Cryptosporidium* reduction. EPA developed a microbial toolbox that assigned credit for *Cryptosporidium* reduction for various treatment options.

[1] *Surface Water Treatment Staff Guidance Manual*, Office of Drinking Water, Department of Health Services, Appendix B, Tables B-1, and B-2. May 15, 1991.

Table 4-3. LT2ESWTR Bin Classification

Cryptosporidium (oocysts/L)	Bin	Additional Treatment Required for Conventional Filtration Plant
<0.075	1	No additional treatment
>0.075 and <1.0	2	1 log treatment*
>1.0 and <3.0	3	2 log treatment**
>3.0	4	2.5 log treatment**

*Using any technology or combination of technologies from microbial toolbox.
** At least 1 log must be achieved using ozone, chlorine dioxide, UV light, membranes, bag/cartridge filters, or bank filtration.

The second round of source water monitoring for systems serving >100,000 population began in April 2015. A system is exempt from the source water *Cryptosporidium* monitoring if it provides at least 5.5 log *Cryptosporidium* treatment.

REGULATION OF DISINFECTION BY-PRODUCTS (DBPS). DBPs have been regulated since the adoption of the 1979 total trihalomethane (TTHM) standard. In 1998, EPA promulgated the Stage 1 Disinfectants/Disinfection By-Products (D/DBP) Rule, which lowered the MCL for TTHMs from 0.10 mg/L to 0.080 mg/L and established new MCLs for haloacetic acids (HAA) at 0.060 mg/L, bromate at 0.010 mg/L (for systems using ozone), and chlorite at 1.0 mg/L (for systems using chlorine dioxide). The Stage 1 D/DBP Rule also established Maximum Residual Disinfectant Levels (MRDLs) for disinfectants including chlorine, chloramines, and chlorine dioxide, and included requirements for "enhanced coagulation" for the removal of natural organic matter in surface water filtration plants that use conventional treatment. Compliance with the enhanced coagulation requirement is met by achieving specific levels of Total Organic Carbon (TOC) removal for a given raw water quality.

To determine compliance with the enhanced coagulation requirements, each monthly set of paired TOC samples (raw water and combined filter effluent) is used to determine the removal percentage achieved, as follows:

$$\text{TOC Removal Achieved} = \left[\frac{\text{Raw Water TOC - Treated Water TOC}}{\text{Raw Water TOC}} \right] \times 100$$

The required TOC removal varies with the quality of the source water, as shown in Table 4-4.

After determining the TOC removal achieved and finding the Step 1 TOC removal required from Table 4-4, the compliance ratio is calculated as follows:

$$\text{Compliance Ratio} = \frac{\text{TOC Removal Achieved}}{\text{TOC Removal Required}}$$

Each month, a compliance ratio is determined. Each month's compliance ratio is averaged with the compliance ratios for the previous 11 months to calculate a rolling 12-month average. If the rolling

12-month average of compliance ratios is 1.0 or greater, the requirement is met. This calculation must be done each quarter.

Table 4-4. Step 1 TOC Removal Requirements

Source Water TOC (mg/L)	Source Water Alkalinity (mg/L as $CaCO_3$)		
	0 to 60	**>60 to 120**	**>120**
>2.0 to 4.0	35%	25%	15%
>4.0 to 8.0	45%	35%	25%
>8.0	50%	40%	30%

There are "alternative compliance criteria" which can be used to exempt a system from the DBP precursor treatment technique requirements. In any month that one or more of the following six conditions are met, a monthly compliance ratio value of 1.0 can be assigned (in lieu of the value calculated above) when determining compliance.

1. The source water TOC is <2.0 mg/L.
2. The treated water TOC is <2.0 mg/L.
3. The source water Specific UV Absorbance (SUVA), prior to any treatment, is ≤2.0 L/mg-m.
4. The treated water SUVA is ≤2.0 L/mg-m.
5. The raw water TOC is <4.0 mg/L, the raw water alkalinity is >60 mg/L (as $CaCO_3$), the TTHMs are <40 µg/L and the HAA5 is <30 µg/L.
6. The TTHMs are <40 µg/L and the HAA5 is <30 µg/L with only chlorine for disinfection.

Both source water and treated water SUVA must be measured upstream of any oxidant addition, including chlorine. Further, both UV-254 and Dissolved Organic Carbon (DOC) used in the SUVA calculation are measured after the water has been filtered through 0.45-µm filter paper.

If the system cannot meet the Step 1 TOC removal levels, the system can apply to DDW for a "Step 2" alternative TOC removal requirement. The Step 2 application must be made within three (3) months of determining that Step 1 removals cannot be achieved.

In its application for the "Step 2" alternate TOC removal, the system must provide data from bench or pilot testing. The Step 2 removal requirements are determined as follows:

1. Bench- or pilot-scale testing of enhanced coagulation is conducted using representative water samples and adding 10 mg/L increments of alum (or 5.4 mg/L of ferric chloride) until the pH is reduced to a level less than or equal to the Step 2 target pH values shown in Table 4-5.

Table 4-5. Step 2 Enhanced Coagulation Target pH Values

Raw Water Alkalinity (mg/L as $CaCO_3$)	Target pH
0 to 60	5.5
>60 to 120	6.3
>120 to 240	7.0
>240	7.5

2. The "Step 2" dose is the least of the following two doses:
    a. The dose resulting in the Step 2 target pH value shown in Table 4-5, or
    b. The dose above which the next higher dose results in less than 0.3 mg/L of additional TOC removal (this is called the Point of Diminishing Returns).
3. The percent TOC removal achieved with the "Step 2" dose is then defined as the minimum TOC removal required by the plant.
4. Once approved by DDW, this Step 2 TOC removal requirement supersedes the minimum TOC removal requirement (Step 1) shown in Table 4-4.
5. If no incremental increase of 10 mg/L alum (or 5.4 mg/L ferric chloride) results in greater than 0.3 mg/L incremental TOC removal, then the water is deemed to contain TOC not amenable to enhanced coagulation. Under those conditions, the system may apply to DDW for a waiver of enhanced coagulation requirements.

On January 4, 2006, EPA promulgated the Stage 2 D/DBP Rule (effective in California in June 2012). The Stage 2 D/DBP Rule did not change the MCLs, the MRDLs, or the enhanced coagulation requirements from the Stage 1 D/DBP Rule. However, it did change the manner in which compliance with the MCLs for TTHMs and HAA5 is determined, requiring compliance at each sampling location rather than across the entire distribution system (referred to as a Locational Running Annual Average or LRAA). The Rule contained a new requirement where systems conducted an Initial Distribution System Evaluation that would be used to identify sample locations anticipated to produce higher levels of DBPs.

ADDITIONAL DRINKING WATER REGULATIONS. In addition to the regulations described above, EPA and DDW have established health-based regulations for a number of inorganic chemicals (metals, minerals), organic chemicals (volatile and synthetic organic chemicals), radionuclides (man-made and naturally occurring), and non-health based secondary standards for constituents that can impact the taste, odor, and/or color of drinking water.

FUTURE DRINKING WATER REGULATIONS

The following presents a discussion of potential future drinking water regulations anticipated within the next five-year period.

CONTAMINANT CANDIDATE LIST. Every five years, EPA is required to publish a list of currently unregulated contaminants that "are not subject to any proposed or promulgated NPDWRs [National Primary Drinking Water Regulation], are known or anticipated to occur in public water systems and may require regulation under the SDWA" (referred to as the Contaminant Candidate List or CCL). Every five years, EPA is also required to determine whether or not to regulate at least five contaminants from the CCL.

The fourth CCL (CCL4)[2] was published in November 2016 and contained two Per- and polyfluoroalkyl substances (PFAS): PFOA and PFOS. In March 2020, EPA published for a 60-day public comment period a proposed Regulatory Determination to establish drinking water regulations for PFOA and

[2] On October 4, 2018 EPA published a request for nominations for microbials and chemicals to include in CCL5. In a legal settlement with the Waterkeeper Alliance and others, EPA is expected to publish the final CCL5 by July 18, 2022.

PFOS. EPA indicated there was sufficient occurrence data and health effects information to develop regulations for these two constituents. Public comments were due by June 10, 2020. As of the end of December 2020, EPA's Regulatory Determination was at the Office of Management and Budget (OMB), and the final Regulatory Determination had not been published in the *Federal Register*.[3]

Under the SDWA, once the final Regulatory Determination is published in the *Federal Register*, EPA will have 24 months to propose a Maximum Contaminant Level Goal (MCLG) and a National Primary Drinking Water Regulation (NPDWR) for public review and comment. Following that deadline, EPA will then have 18 months to publish the final MCLG and NPDWR.

UNREGULATED CONTAMINANT MONITORING RULE (UCMR). The UCMR monitoring program develops occurrence information for unregulated contaminants (from the CCLs) that may require regulation in the future. The final UCMR4 was published in the *Federal Register* on December 20, 2016. Included in the UCMR4 were cyanotoxins, metals, pesticides, brominated haloacetic acids, alcohols, and semivolatile organic chemicals. Monitoring was conducted between 2018 and 2020.

On July 16, 2019 EPA held a public meeting on development of the UCMR5. At that time, EPA anticipated proposing the UCMR5 in the summer of 2020 and publishing the final UCMR5 in late 2021. Monitoring would occur during 2023 through 2025. [4]

Under existing EPA regulations, all systems serving more than 10,000 people must participate in the UCMR monitoring program, while only a representative number of systems serving a population of 10,000 or fewer persons must monitor. The 2018 American Water Infrastructure Act (AWIA) amended this requirement and subject to the availability of appropriations and sufficient laboratory capacity, UCMR monitoring programs will now include all systems serving between 3,300 and 10,000 persons and include a representative number of systems serving a population less than 3,300.

CYANOBACTERIA. Cyanobacteria (also known as blue green algae) occur throughout the world. Some species of cyanobacteria can produce toxins. Factors that affect cyanobacteria blooms include light intensity, sunlight duration, nutrient availability, water temperature, pH, and water stability.

In June 2015 EPA issued 10-day Health Advisories (HA) for two cyanotoxins: microcystin and cylindrospermopsin presented in Table 4-6.

[3] The final Regulatory Determination was signed for publication by the EPA Administrator on January 15, 2021. When the new Biden Administration took office on January 20, 2021 a Regulatory Freeze was issued that included regulations signed but not yet published in the *Federal Register*. On March 3, 2021, the final Regulatory Determination to regulate PFOA and PFOS was published in the *Federal Register*.

[4] The proposed Unregulated Contaminant Monitoring Rule 5 (UCMR5) was published March 11, 2021 in the *Federal Register*. Public comments were due by May 10, 2021. The proposed monitoring includes 29 PFAS and lithium. EPA proposed that PFAS would be measured using EPA Methods 533 and 537.1. EPA anticipates the monitoring would occur during 2023 to 2025. Monitoring would be one year of quarterly monitoring for surface water and groundwater under the direct influence of surface water systems, and two samples (5 to 7 months apart) in a 12-month period for groundwater systems.

Table 4-6. EPA 10-day Cyanotoxin HA Values (µg/L)[5]

Algal Toxin	10-Day HA <6 years of Age	10-Day HA >6 Years of Age	Health Effect
Microcystin	0.3	1.6	Liver Toxicity
Cylindrospermopsin	0.7	3	Liver & Kidney Toxicity

Also, in June 2015 EPA released a "Health Effects Support Document" for anatoxin-a. The HA documents include the following information:

- Information on sources, occurrence, and environmental fate
- Summary of available health effects information
- Calculation of the Health Advisories
- Recommended analytical methods
- Review of treatment technology

EPA staff described the 10-day HAs as the "concentration in drinking at or below which no adverse non-carcinogenic effects are expected for a ten-day exposure."

SIX-YEAR REVIEW OF REGULATIONS. The SDWA requires that every six years, EPA review primary drinking water regulations to determine whether they should be revised. In January 2017 EPA published the results from the third six-year review of contaminants. The outcome of that review was that EPA considered eight National Primary Drinking Water Regulations as candidates for regulatory revision (chlorite, *Cryptosporidium*, haloacetic acids, heterotrophic bacteria, *Giardia lamblia*, *Legionella*, total trihalomethanes, and viruses). These constituents are currently regulated under the Long-term 2 Enhanced Surface Water Treatment Rule and the Stage 2 Disinfection Byproduct Rule and are referred to as Microbial/Disinfection Byproduct (M/DBP) regulations. The January 2017 *Federal Register* publication did not propose specific revisions to any current regulation, but rather began the process.

On October 14th and 15th, 2020, EPA held a public meeting to obtain input on possible revisions to the eight M/DBP regulations. Additional public meetings will be held during 2021.[6]

REVIEW OF WATER QUALITY DATA

There are ten public water agencies participating in this update of the Stanislaus River Watershed Sanitary Survey Update. In general, the water quality data for the various monitoring points indicate a soft water, with a low alkalinity, low hardness, and low TDS. During 2016 through 2020, several SCRG treatment plants experienced water quality challenges including elevated total coliform levels,

[5] On February 4, 2021 DDW submitted a formal request to the Office of Environmental Health Hazard Assessment (OEHHA) to develop recommended Notification Levels for microcystins, cylindrospermopsin, anatoxin-a, and saxitoxin. On May 3, 2021 OEHHA submitted recommended NLs to the SWRCB DDW.

[6] During 2021 EPA intends to continue to seek input on potential rule revisions through a series of seven (7) public meetings. The first two public meetings are in May and June as follows: May 20, 2021 – topic "Disinfectant Residual Levels and Opportunistic Pathogens (including *Legionella*), June 24, 2021 – topic "Regulated and Unregulated Disinfection Byproducts." Additional tentative dates in 2021 are July 14th, August 10th, September 1st, September 29th, and November 9th.

turbidity spikes, and increased levels of THMs and HAA5 (several MCL Notice of Violations were issued by DDW for THM and HAA5 MCL violations).

A couple of intakes had iron and manganese concentrations above the secondary MCL in the raw water (all finished water iron and manganese results were ND or below the secondary MCL). Several intakes also reported elevated levels of color. Available treated water results indicated that color concentrations were reduced below the secondary MCL. The following sections present and discuss the available raw and treated water quality data for each of the nine public water systems during the study period 2016-2020.

CALAVERAS COUNTY WATER DISTRICT – HUNTERS WTP (EBBETTS PASS)
Water for the Hunters WTP is diverted through the Mill Creek Tap off the Collierville Tunnel, rediverted from McKays Point Reservoir downstream of the New Spicer Meadow Reservoir. The Hunters WTP is an adsorption clarifier/filter package treatment plant with a capacity of 4 MGD. Sodium hypochlorite is added to the raw water, followed by addition of a polyaluminum chloride/cationic polymer blend. Mixing is accomplished through a static mixer and the water is filtered through a mixed media filter. Sodium hypochlorite is added for final disinfection and residual maintenance. Zinc orthophosphate is added for corrosion control.

HUNTERS WTP RAW WATER QUALITY.[7] Figure 4-1 presents the total coliform counts measured weekly in the influent to the Hunters WTP. The results ranged from ND to >2,419 MPN/100 mL, with an average of 384 MPN/100 mL. During the summer and fall of 2016 there were several weekly samples with elevated total coliform counts. This is consistent with the 2015 results. Figure 4-2 presents the *E. coli* results which ranged from ND to 870 MPN/100 mL, with an average of 7 MPN/100 mL. The majority of the *E. coli* results were ND. Other than the single sample result of 870 MPN/100 mL, these results were consistent with the 2011 through 2015 results.

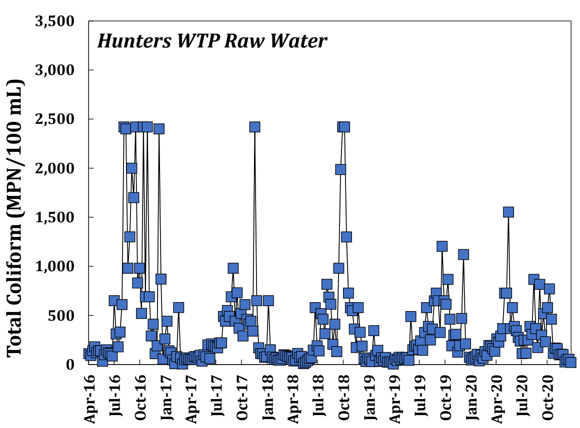


Figure 4-1 Hunters WTP Total Coliforms (2016 to 2020)

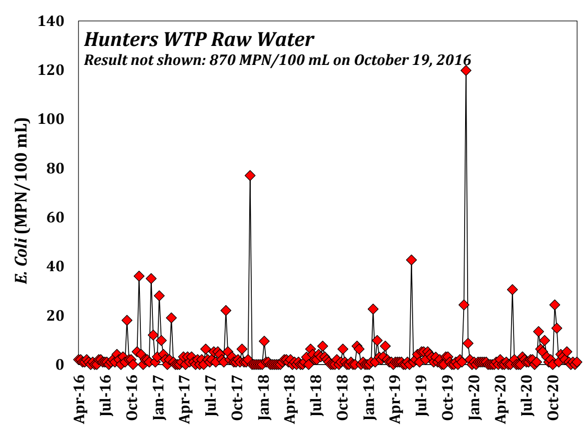


Figure 4-2 Hunters WTP *E. coli* (2016 to 2020)

CCWD conducted the second round of monthly source water *Cryptosporidium* monitoring from October 2016 through December 2018 (samples were frozen during January, February and

[7] During UCMR4 monitoring, all cyanotoxin toxin results for the Hunters WTP were ND.

November 2017 and were unable to be tested). No *Cryptosporidium* oocysts were detected and the results indicated a Bin 1 classification, no addition treatment required for *Cryptosporidium*.

Figure 4-3 presents the daily raw water turbidity at the influent to the treatment plant. The turbidity ranged from 0.4 NTU to 38.9 NTU, with an average of approximately 0.4 NTU. During January 2019 there was one week with several elevated turbidity results. Figure 4-4 presents the daily pH during 2016 to 2020; the pH ranged from 5.8 to 8.3, with an average pH of 6.9.

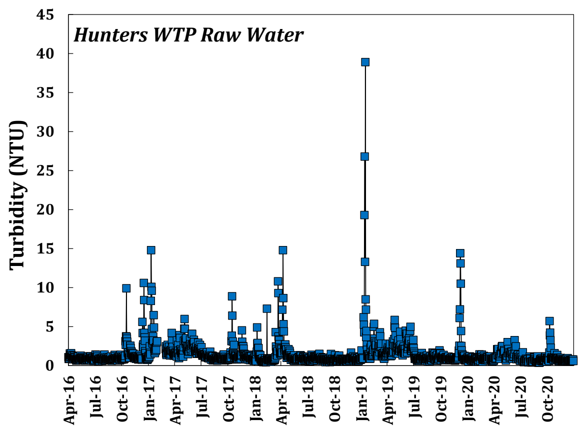


Figure 4-3 Hunters WTP Daily Turbidity (2016 to 2020)

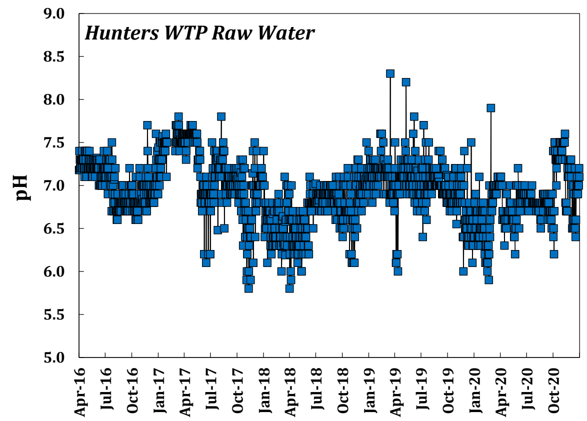


Figure 4-4 Hunters WTP Daily pH (2016 to 2020)

HUNTERS WTP TREATED WATER QUALITY. Figure 4-5 presents the quarterly THM results for the Hunters WTP. Quarterly THM samples are collected at four distribution system locations. Figure 4-6 presents the LRAA at each of the four sample locations. The individual quarterly results ranged from a minimum of 17 µg/L to a maximum of 127 µg/L. The LRAAs ranged from 33 µg/L to 79 µg/L (recorded in April 2020).

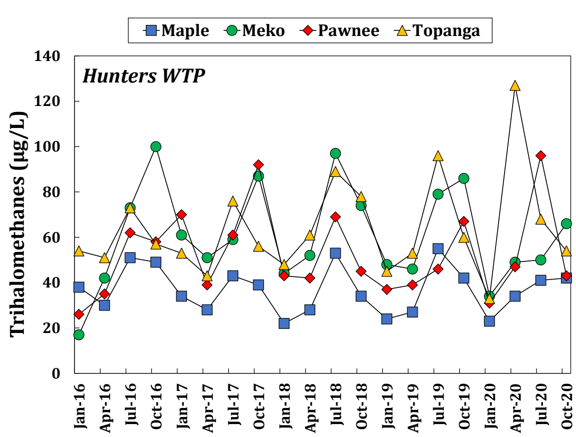


Figure 4-5 Hunters WTP Quarterly THMs (2016 to 2020)

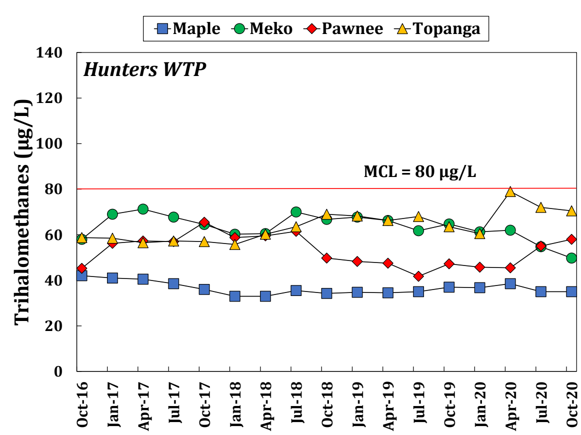


Figure 4-6 Hunters WTP THM LRAAs (2016 to 2020)

Figures 4-7 and 4-8 present the quarterly and HAA5 LRAA results, respectively. The quarterly HAA5 results ranged from 17 µg/L to 71 µg/L. The individual LRAA values ranged from 29 µg/L to 65 µg/L (one location exceeded the MCL during the third and four quarters of 2020 and a Notice of Violation was issued by DDW).

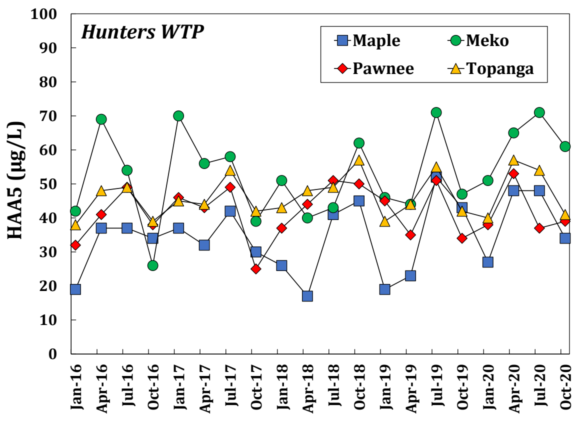


Figure 4-7 Hunters WTP Quarterly HAA5 (2016 to 2020)

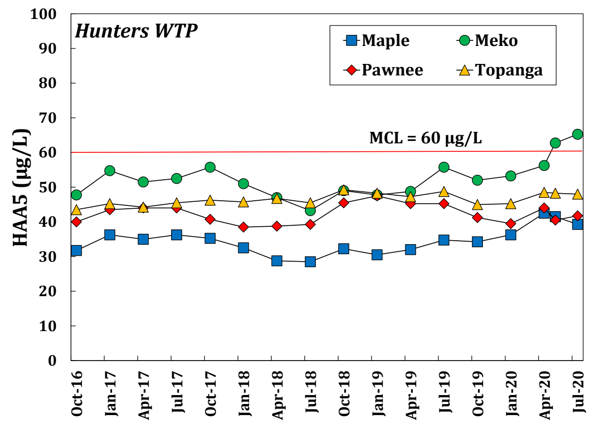


Figure 4-8 Hunters WTP HAA5 LRAAs (2016 to 2020)

Figure 4-9 presents the monthly raw and treated water TOC results for the Hunters WTP. The raw water TOC ranged from 1.1 mg/L to 5.6 mg/L with an average of 2 mg/L. The treated water TOC ranged from 0.7 mg/L to 2.8 mg/L, with an average of 1.4 mg/L.

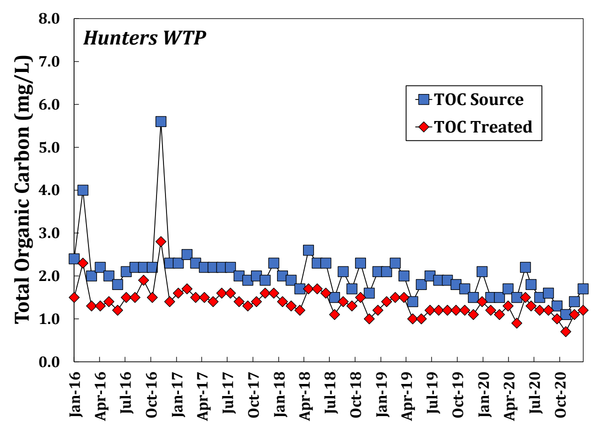


Figure 4-9 Hunters WTP TOC (2016 to 2020)

HUNTERS WTP Title 22. Title 22 monitoring results for McKays Point Dam and for the treated water are presented in Appendix D, Tables D-1 and D-2. All VOC and SOC results were ND. Low levels of aluminum and nitrate were detected in raw water, well below their respective MCLs. Color results for McKays Point Dam ranged from ND to 35 color units, with an average of approximately 5 color units. Treated water TON results ranged from ND to 1 and color results were all ND. Threshold odor Number (TON) results for McKays Point Dam ranged from ND to 4, with an average less than 1. The raw water has an average pH of approximately 7.4 and has a low alkalinity and low hardness of 7.6 mg/L.

UNION PUBLIC UTILITY DISTRICT (UPUD) MURPHYS WTP

Water from the Utica Ditch flows through a 10-inch-diameter pipeline into Cadematori Reservoir. The Cadematori Reservoir is a 140 AF reservoir that can be isolated from the Utica Ditch when water quality conditions (such as high turbidity) make the water in the ditch difficult to treat. Typically, the reservoir can provide 10 weeks of storage during summer high-flow periods and 30 weeks of storage during the winter. Water is supplied to the Murphys WTP by gravity flow from the Cadematori Reservoir.

The Murphys WTP, owned and operated by UPUD, is a 2.0 MGD capacity in-line filtration plant. Water flowing from Cadematori Reservoir is treated with chlorine and polymer prior to a static mixer. Water flows from the static mixer into three dual-media pressure filter units. Water discharged from the filters is treated with additional chlorine and caustic soda as needed for pH adjustment. Water from the filters is stored in a 250,000-gallon tank and a 2.0 MG clearwell.

MURPHYS WTP RAW WATER QUALITY. Figure 4-10 presents the results for weekly (UPUD switched from biweekly samples to weekly samples in October 2016) total coliforms in the raw water to the Murphys WTP. The total coliform counts ranged from 7.5 MPN/100 mL to >2,419 MPN/100 mL, with an average of 1,295 MPN/100 mL. Out of a total of 235 total coliform samples, nearly half were reported as 2,419/100 mL or >2,419/100 mL (beginning in 2015 the Murphys raw water began experiencing elevated levels of total coliforms, a pattern that continued during 2016 through 2020). Figure 4-11 presents the biweekly results for *E. coli*. The *E. coli* counts ranged from ND to 185 MPN/100 mL, with an average of 2.4 MPN/100 mL. In general, the *E. coli* results were low and do not provide a strong indication of fecal contamination.

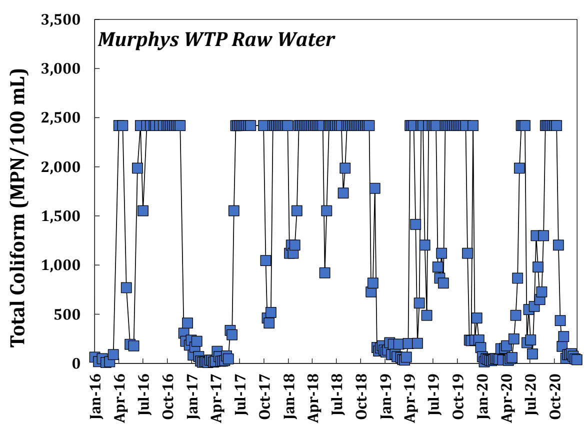


Figure 4-10 Murphys WTP Total Coliforms (2016 to 2020)

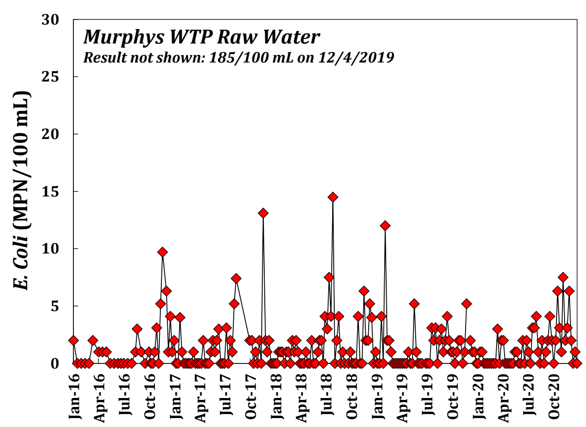


Figure 4-11 Murphys WTP *E. Coli* (2016 to 2020)

Figure 4-12 presents the daily raw water turbidity at the influent to the WTP. During the study period, raw water turbidity ranged from 0.7 NTU to 4.6 NTU, with an average of 1.4 NTU. In general the raw water turbidity was fairly consistent, while during the winter of 2017 there were weeks with the daily turbidity above 3 NTU. A review of monthly precipitation data for the Calaveras Big Trees location showed approximately 9 inches, 30 inches and 26 inches of precipitation during December 2016, January 2017, and February 2017, respectively, when the maximum raw water turbidity values were recorded. The majority of the turbidity results were less than 3 NTU. Figure 4-13 presents the daily raw water pH results that ranged from 6.2 to 7.8, with an average of 6.9.

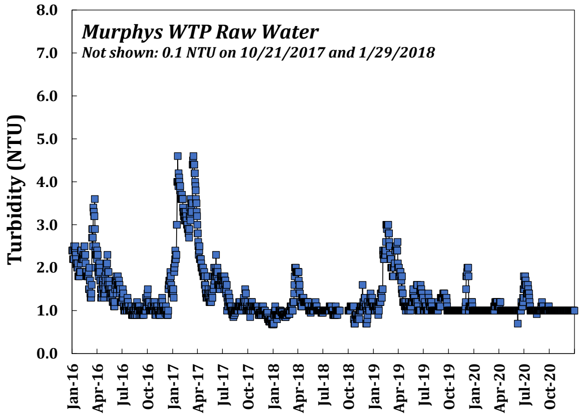


Figure 4-12 Murphys WTP Daily Turbidity (2016 to 2020)

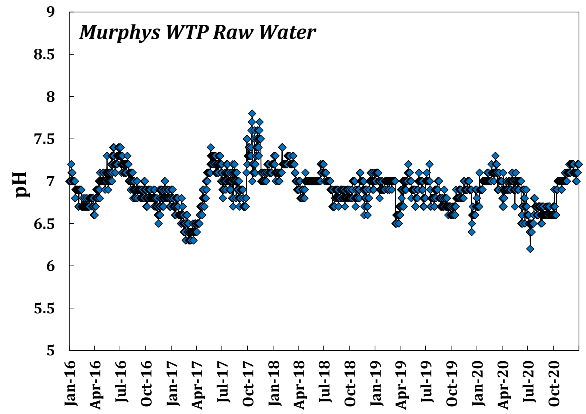


Figure 4-13 Murphys WTP pH (2016 to 2020)

MURPHYS WTP TREATED WATER QUALITY. Figure 4-14 presents the quarterly THM results for the Murphys WTP. The individual quarterly results ranged from 26 µg/L to 109 µg/L. From 2016 through the end of 2020, the general trend is towards increasing levels of THMs. Figure 4-15 presents the LRAA for each sample location. The individual LRAA values ranged from 54 µg/L to 93 µg/L. The quarterly LRAAs exceeded the THM MCL at both sample locations during the third and fourth quarters of 2020 (the Red Hill Road sample location also exceeded the THM MCL during the second quarter of 2020 while the Six Mile Rd sample location was just under the MCL during the second quarter of 2020). DDW issued Notice of Violations for the THM LRAAs. In response to the elevated level of THMs the District installed and recently put into service (March 2021) an aeration system in the 2 MG clearwell.

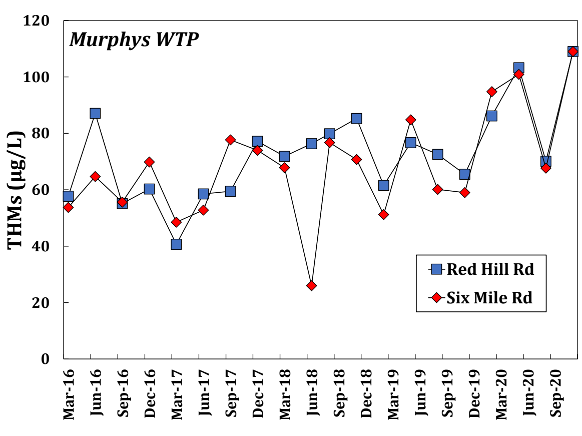


Figure 4-14 Murphys WTP Quarterly THMs (2016 to 2020)

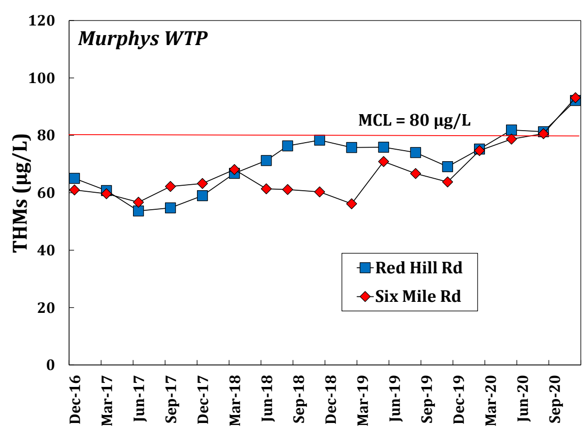


Figure 4-15 Murphys WTP THM LRAAs (2016 to 2020)

Figure 4-16 presents the quarterly HAA5 results for the study period. The individual quarterly HAA5 results ranged from 4 µg/L to 38 µg/L. Figure 4-17 presents the HAA5 LRAAs. Individual LRAAs ranged from 7 µg/L to 30 µg/L, well below the MCL.

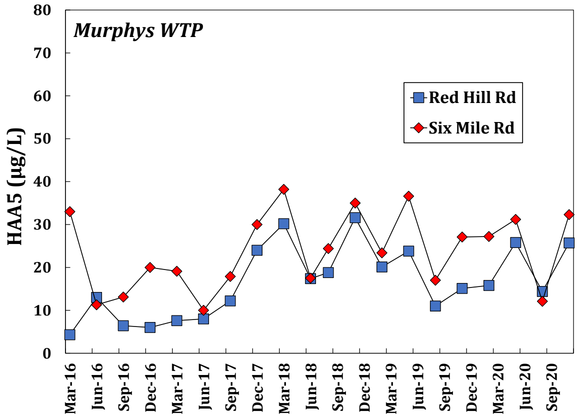


Figure 4-16 Murphys WTP Quarterly HAA5 (2016 to 2020)

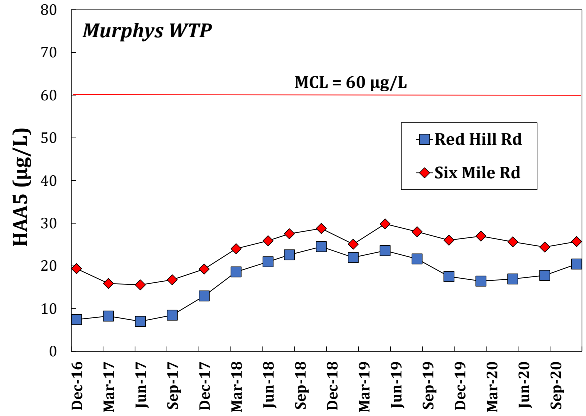


Figure 4-17 Murphys WTP HAA5 LRAAs (2016 to 2020)

MURPHYS WTP TITLE 22. Title 22 monitoring for the Murphys WTP raw water is presented in Appendix D, Table D-3. Table D-4 presents treated water results for aluminum, perchlorate, specific conductance, and iron. All VOCs and SOCs were ND. Low levels of aluminum were detected in the raw water, well below the MCL (results for all other regulated IOCs were ND). In the treated water, color results ranged from 5 to 12 color units with an average of 9.4, and TON results ranged from ND to 5.6, with an average of 1.1.

ANGELS CAMP WTP

The Angels Camp WTP, owned and operated by the City of Angels Camp, provides water to about 3,800 people. The Angels Camp WTP draws its water from Angels Creek/Utica Ditch that is stored in the Angels Forebay (owned by the Utica Power Authority, UPA). A 12-inch diameter pipeline from Angels Forebay supplies the WTP by gravity. Alum is injected into the raw water, which then flows into the flocculation basin (paddle mixers) followed by a settling basin. Chlorine (sodium hypochlorite) was previously injected simultaneously with the alum but was ceased on July 30, 2015. Following sedimentation, the water is pumped into three pressure filters. Each pressure filter contains 46 inches of gravel, sand, coal, and garnet. Each filter has a capacity of 720 gpm. One filter is designated as a backup, and DDW has rated the total plant capacity at 1,440 gpm (2.0 MGD). A 0.8 percent sodium hypochlorite solution is generated on-site. Caustic soda and orthophosphate are added to the treated water to adjust the pH and to provide corrosion control. Finished water is stored in a 2.5 MG tank.

ANGELS CAMP WTP RAW WATER QUALITY. Figure 4-18 presents the weekly raw water total coliform results. The total coliform results ranged from 4 MPN/100 mL to >2,419 MPN/100 mL, with an average of 783 MPN/100 mL. During 2016 through 2020, out of the total of 247 reported results, 69 samples had a result of 1,000 MPN/100 mL or greater and 30 samples had a result >2,419 MPN/100 mL. The total coliform results, on average were higher than experienced during 2011 through 2015. Figure 4-19 presents the weekly *E. coli* results. The *E. coli* results ranged from 4 MPN/100 mL to >1,600 MPN/100 mL, with an average of 129 MPN/100 mL. During 2016 through 2020 out of the total of 246 weekly results, 8 samples had an *E. coli* result greater than 500 MPN/100 mL and 5 samples had an *E. coli* result greater than 1,000 MPN/100 mL.

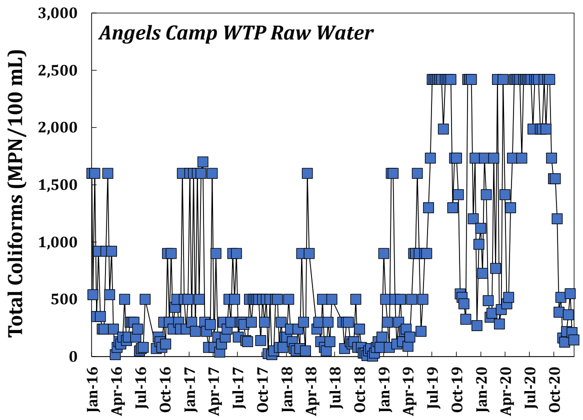


Figure 4-18 Angels Camp WTP Total Coliforms (2016 to 2020)

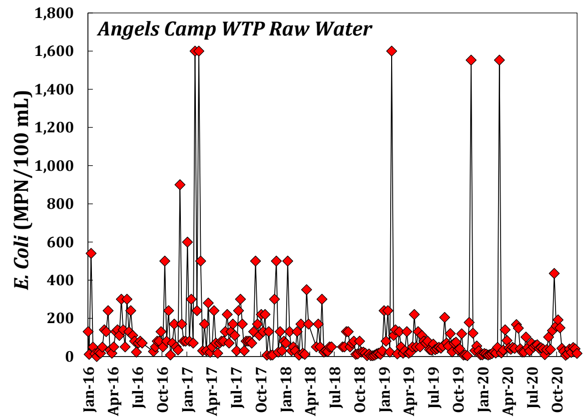


Figure 4-19 Angels Camp WTP *E. coli* (2016 to 2020)

Figure 4-20 presents the daily raw water turbidity for Angels Camp WTP. During 2016 to 2020, turbidity ranged from 0.1 NTU to 55 NTU, with an average of 2.3 NTU. The raw water turbidity alarm is set at 40 NTU. During high turbidity events, operations staff will contact Utica Power Authority staff and request that they regulate flows to provide a longer detention time in the WTP forebay. Depending upon conditions, staff may shut down the plant during periods of high turbidity. Figure 4-21 presents the daily raw water pH values. During 2016 to 2020, the pH ranged from 7.1 to 8.5, with an average pH of 7.8.

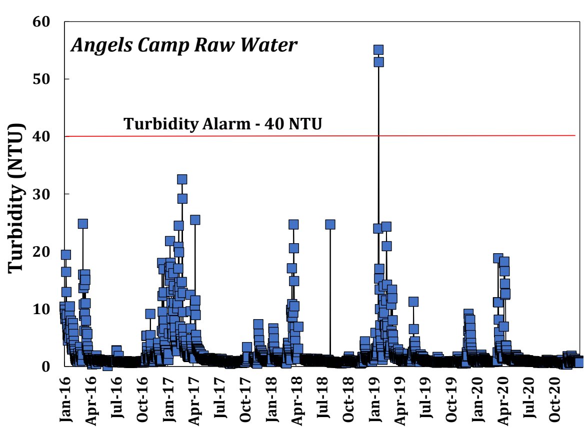


Figure 4-20 Angels Camp WTP Daily Turbidity (2016 to 2020)

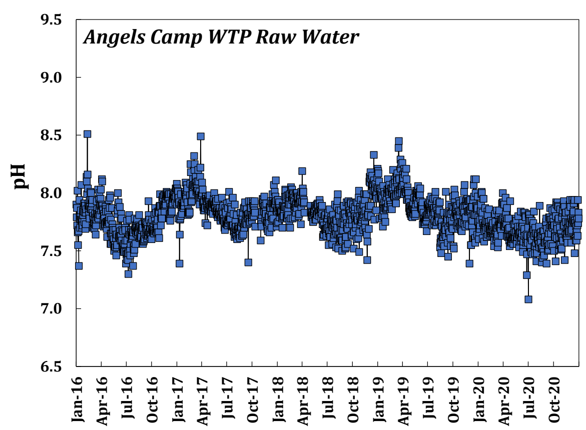


Figure 4-21 Angels Camp WTP Daily pH (2016 to 2020)

Figure 4-22 presents the monthly paired raw and treated water TOC results from 2016 through 2020. The raw water TOC results ranged from 1.1 mg/L to 6.1 mg/L, with an average of 2.4 mg/L. The treated water TOC ranged from 0.4 mg/L to 1.9 mg/L, with an average of 1.2 mg/L. The percent removal of TOC ranged from approximately 30 percent to 73 percent, with an average of approximately 50 percent. Figure 4-23 presents the monthly raw water alkalinity. The alkalinity ranged from 12 mg/L to 35 mg/L as $CaCO_3$, with an average of approximately 19 mg/L as $CaCO_3$. From the files provided, Angels Camp complied with the enhanced coagulation requirements through a combination of meeting the required TOC reduction and use of one of the alternate compliance criteria.[8]

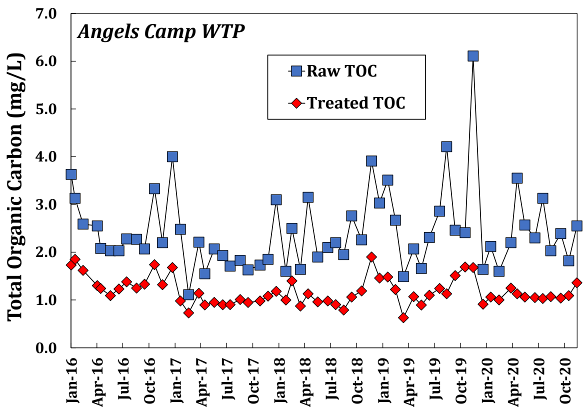


Figure 4-22 Angels Camp WTP Monthly Raw and Treated TOC (2016 to 2020)

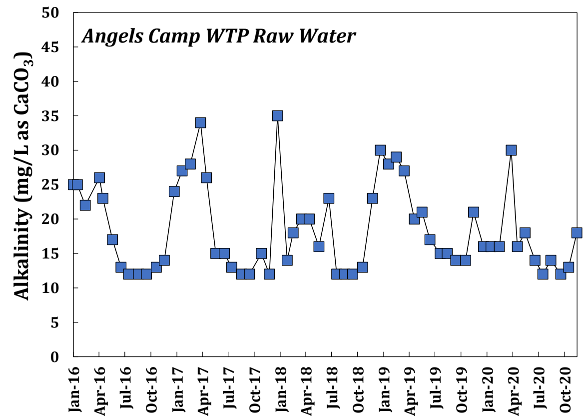


Figure 4-23 Angels Camp WTP Alkalinity (2016 to 2020)

ANGELS CAMP WTP TREATED WATER QUALITY. Figures 4-24 and 4-25 presents the 2016 through 2020 quarterly and LRAA THM results, respectively. During the study period, the individual quarterly THM results ranged from 14 µg/L to 61 µg/L. The LRAAs ranged from a minimum of 22 µg/L to 45 µg/L.

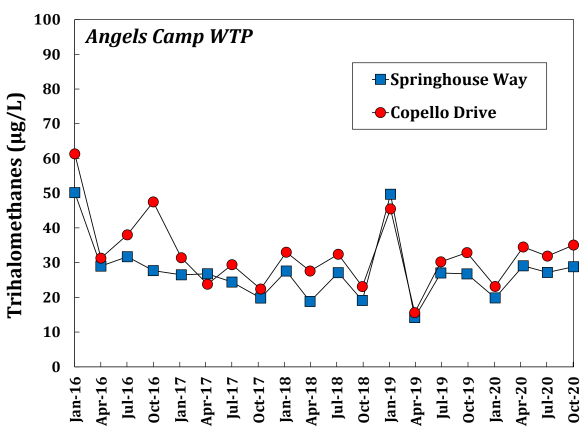


Figure 4-24 Angels Camp WTP Quarterly THMs (2016 to 2020)

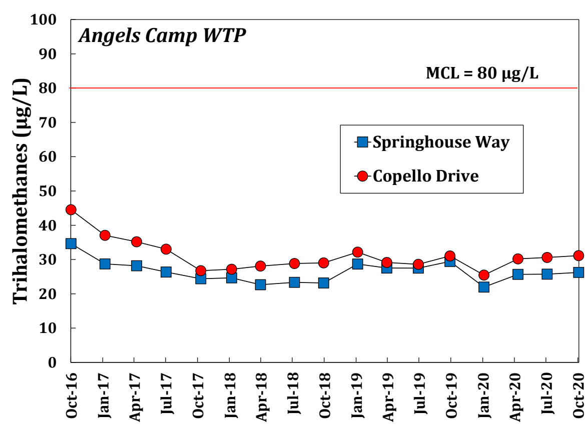


Figure 4-25 Angels Camp WTP THM LRAAs (2016 to 2020)[9]

Figures 4-26 and 4-27 present the individual quarterly and the LRAAs for HAA5s, respectively. The individual quarter HAA5 results ranged from 7 µg/L to 32 µg/L. The LRAAs ranged from 14 µg/L to 21 µg/L.

[8] According to SDWIS, Angels Camp received a Notice of Violation in 2016 for failing to comply with the enclosed coagulation requirements.

[9] The LRAA is calculated using only results collected during January 2016 through December 2020. According to SDWIS, Angels Camp received a notice of violation for the THM LRAA in 2016.

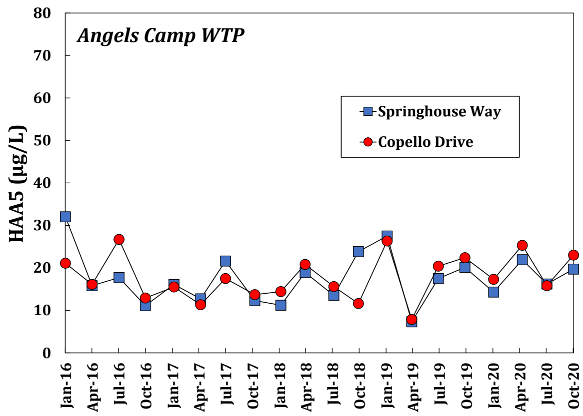


Figure 4-26 Angels Camp WTP Quarterly HAA5 (2016 to 2020)

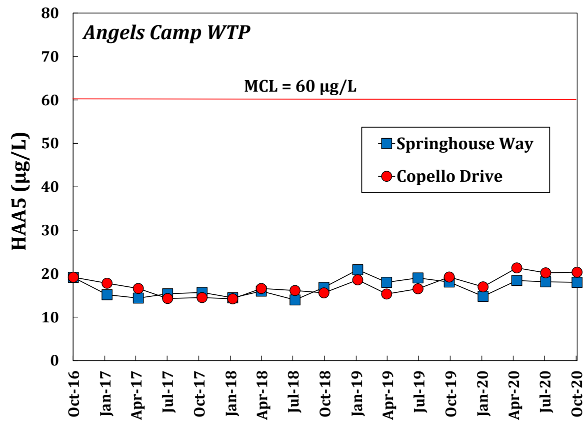


Figure 4-27 Angels Camp WTP HAA5 LRAAs (2016 to 2020)

ANGELS CAMP WTP TITLE 22. Title 22 monitoring results are presented in Appendix D, Tables D-5 and D-6. One sample detected MTBE in the raw water at 0.71 µg/L (well below the MCL of 13 µg/L). All other results for VOCs and SOCs were ND. Low levels of aluminum, fluoride and nitrate were detected in the raw water, well below their respective MCLs. Raw water iron results ranged from ND to 540 µg/L, with an average of 221 µg/L. The raw water has a low alkalinity (average of 19 mg/L as $CaCO_3$), is a soft water (average hardness of 17 mg/L). The color results in the raw water ranged from 10 to 40 color units with an average of approximately 24 color units. One treated water sample had a color result 7 color units (secondary MCL is 15 color units).

PINECREST PERMITTEES ASSOCIATION

Pinecrest Lake is located at the upstream end of the South Fork of the Stanislaus River. The reservoir is owned and operated by Pacific Gas and Electric Company (PG&E). The reservoir provides recreational benefits, is used for hydroelectric power generation, and is a drinking water supply for Pinecrest Permittees Association. The reservoir has a capacity of 18,312 acre-feet and is supplied by surface water runoff from a 26.5-square-mile watershed.

The USFS and Pinecrest Permittees Association have both used Pinecrest Lake as a source for drinking water. For the 2016 Stanislaus River WSS, the SCRG participant for Pinecrest Lake was the USFS. During 2017, the USFS shut down their treatment plant and physically connected to the Pinecrest Permittees Association distribution system. The Pinecrest Permittees own and operate two treatment plants. The Pinecrest Lake treatment plant is an inline filtration plant with a production capacity of 140 gpm. The filters are mixed media with anthracite. Disinfection is achieved with sodium hypochlorite applied downstream of the filters. Pinecrest Lake is not used year-round as a source of drinking water. The population served is approximately 3,000 people during the peak demand and 45 people during low demand.

PINECREST PERMITTEES ASSOCIATION RAW WATER QUALITY. Figures 4-28 and 4-29 present the raw water monitoring results for total coliform and *E. coil*, respectively. The total coliform results ranged from ND to 30 MPN/100 mL, with an average of 4 MPN/100 mL. All of the *E. coli* results were ND, with the exception of a single sample in October 2020 with a result of 4 MPN/100 mL.

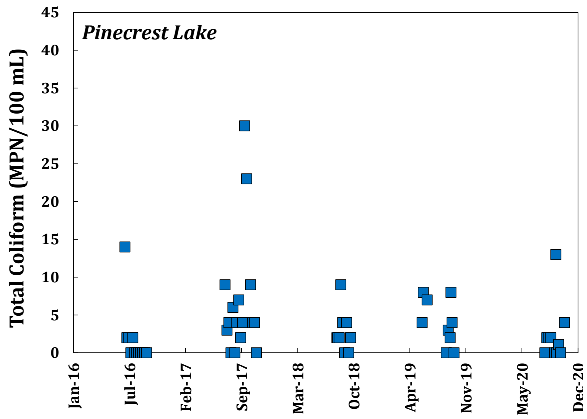


Figure 4-28 Pinecrest Lake Total Coliforms (2016 to 2020)

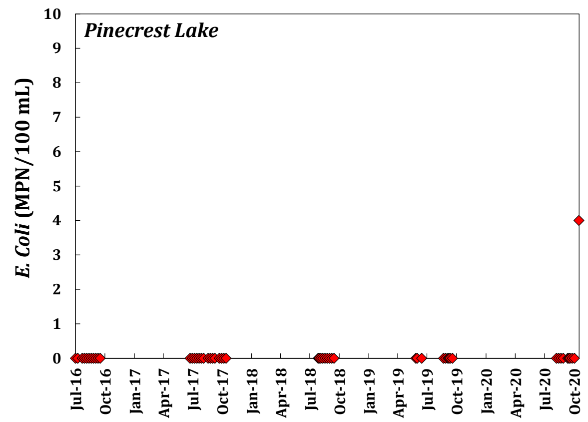


Figure 4-29 Pinecrest Lake *E. Coli* (2016 to 2020)

Figure 4-30 presents the daily peak raw water turbidity during periods when the WTP was in operation. The daily peak turbidity ranged from 0.4 to 7.0 NTU, with an average of 1.2 NTU.

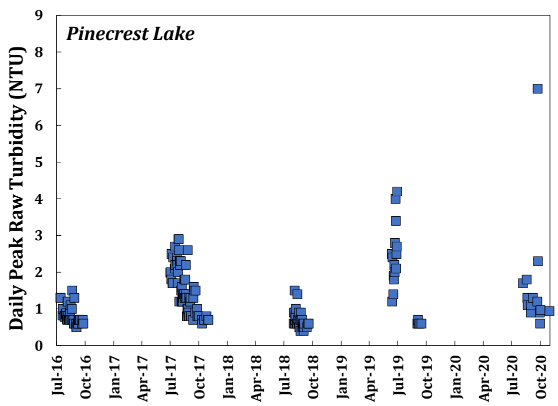


Figure 4-30 Pinecrest Lake Turbidity (2016 to 2020)

PINECREST PERMITTEES ASSOCIATION TREATED WATER QUALITY. Figures 4-31 and 4-32 presents the results for THMs and HAA5, respectively. The THMs ranged from ND to 35 µg/L. The HAA5 results ranged from ND to 55 µg/L.

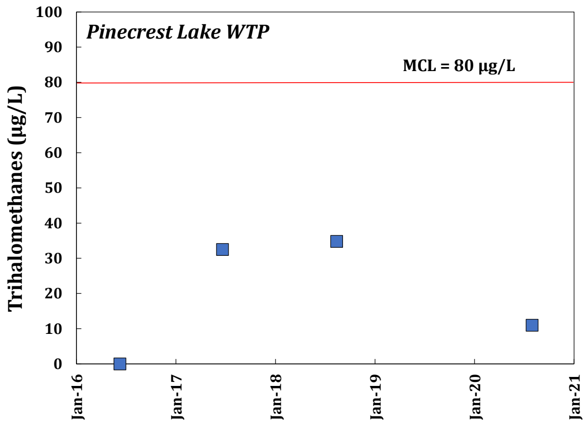


Figure 4-31 Pinecrest Lake WTP THMs (2016 to 2020)

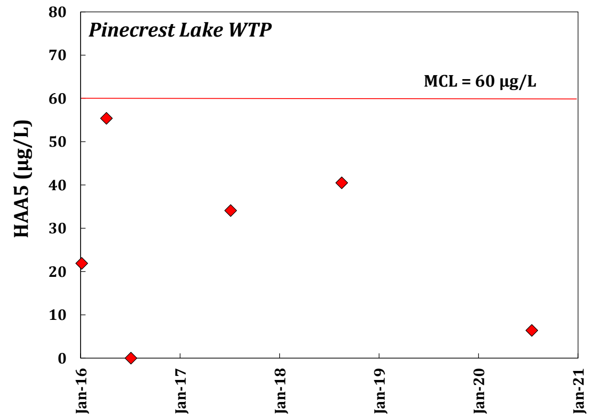


Figure 4-32 Pinecrest Lake WTP HAA5 (2016 to 2020)

PINECREST PERMITTEES ASSOCIATION TITLE 22. Title 22 monitoring results are presented in Appendix D, Table D-7. In 2017 dichloromethane was detected at approximately 3.2 µg/L (MCL is 5 µg/L) and MTBE was detected at 1.5 µg/L (MCL is 13 µg/L). No results after 2017 are available in the DDW water quality database. The potential sources of these two compounds is unknown. All other results for VOCs and SOCs were ND. Low levels of aluminum, fluoride and nitrate were detected in the raw water, well below their respective MCLs. Average pH in the raw water was approximately 6.7. The raw water has a low alkalinity and reported results for hardness were ND.

TUOLUMNE UTILITIES DISTRICT - UPPER BASIN WTP

Lyons Reservoir receives drainage from the watersheds of Herring Creek and South Fork of the Stanislaus River and supplemental stored water from Pinecrest Lake from Labor Day until the end of the calendar year, conveyed in the South Fork to Lyons Reservoir. PG&E then diverts water from Lyons Dam and conveys it out of the river canyon via the Tuolumne Main Canal for 4.2 miles to the TUD Section 4 diversion point. The Upper Basin WTP is located on the TUD Section 4 ditch about one half mile downstream of the Tuolumne Main Canal diversion point.

The raw water intake for the 1 MGD Upper Basin WTP consists of two channels located side-by-side in the Section 4 Ditch. The water flows through and over Coanda screen inlets. The raw water then flows through an up-flow clarifier. A vertical flocculator is located in the reaction chamber of the clarifier. Water flows by gravity from the clarifier into a concrete subsurface settled water sump. Water from the settled water sump is pumped through two horizontal pressure filters. The filter media consists of gravel, sand, and GAC.

UPPER BASIN WTP RAW WATER QUALITY. Figure 4-33 presents the monthly raw water total coliform results. The coliform results ranged from 2 MPN/100 mL to 500 MPN/100 mL, with an average of approximately 61 MPN/100 mL. Figure 4-34 presents the monthly *E. coli* results. The results ranged from <2 MPN/100 mL to 110 MPN/100 mL, with an average of approximately 16 MPN/100 mL. The total coliform and *E. Coli* results were consistent with the 2011 through 2015 results.

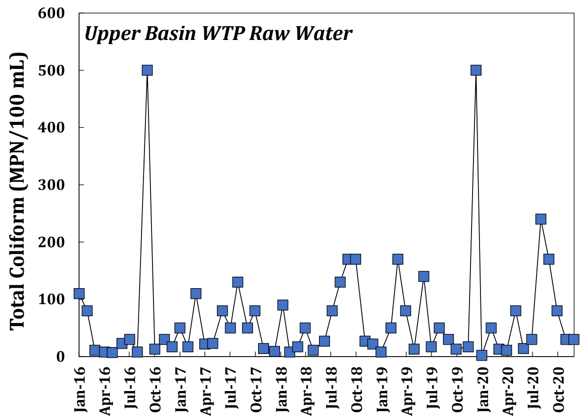


Figure 4-33 Upper Basin WTP Total Coliforms (2016 to 2020)

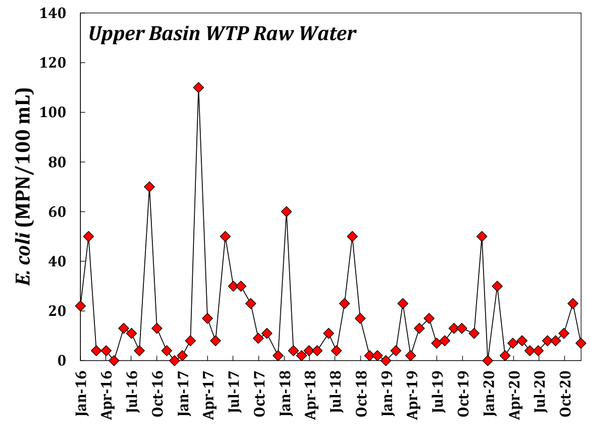


Figure 4-34 Upper Basin WTP *E. Coli* (2016 to 2020)

For the preparation of the 2021 WSS Update, TUD provided the low, high, and average turbidity measurement for each month. Figure 4-35 presents the monthly low, high, and average raw water turbidity. The monthly minimum turbidity was 0.9 NTU and the maximum monthly turbidity was 55 NTU. The monthly average turbidity ranged from 2.4 NTU to approximately 15 NTU. The raw water turbidity alarm is set at 20 NTU. If that value is exceeded the plant will automatically shut down until the turbidity goes below that value. If an operator is present and treated water is needed to fill the clearwell, they can adjust the turbidity alarm to allow raw water to flow into the plant, lower the flow rate and monitor the filtered water turbidity.

Figure 4-36 presents monthly raw and treated water TOC results. The raw water TOC results ranged from 1.2 mg/L to 4.3 mg/L with an average of 2 mg/L. Treated water TOC ranged from 0.4 mg/L to 1.8 mg/L, with an average of 1.1 mg/L. The percent reduction ranged from 14 to 75 percent, with an average of approximately 45 percent. During the five-year study period, TUD complied with the enhanced coagulation requirements for the Upper Basin WTP through a combination of achieving the required percent removal of TOC and using one of the alternate compliance criteria.

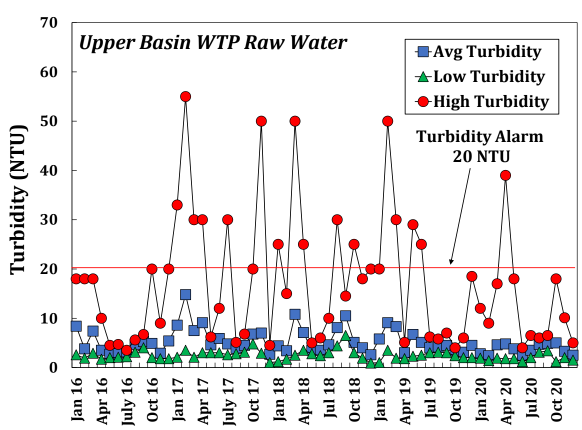


Figure 4-35 Upper WTP Basin Turbidity (2016 to 2020)

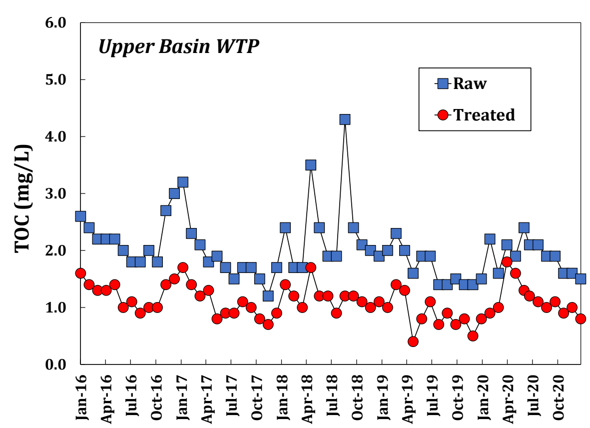


Figure 4-36 Upper Basin WTP TOC (2016 to 2020)

UPPER BASIN WTP TREATED WATER QUALITY. Figure 4-37 presents the quarterly THM sample results for the Upper Basin WTP. The quarterly THM results ranged from 13 to 60 µg/L. Figure 4-38 presents the THM LRAAs. The LRAAs ranged from approximately 18 to 46 µg/L.

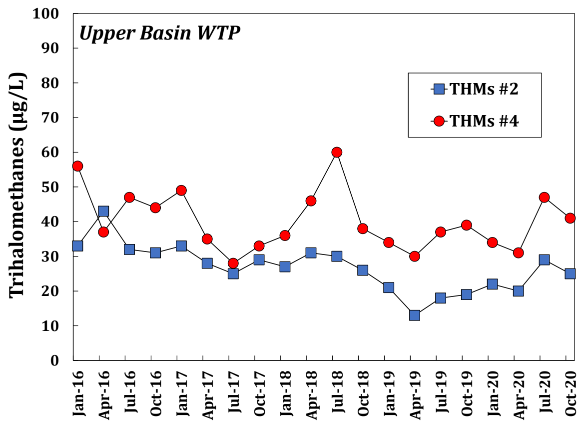


Figure 4-37 Upper Basin WTP Quarterly THMs (2016 to 2020)

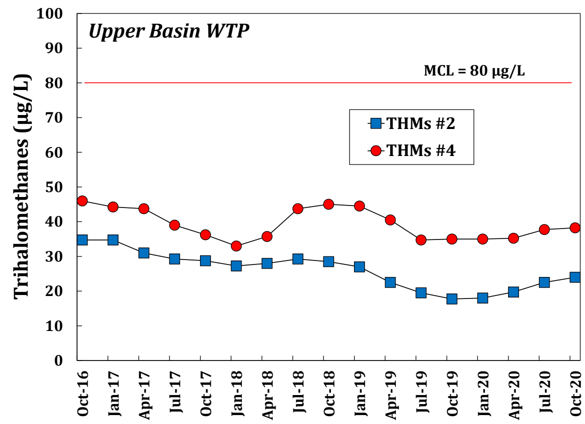


Figure 4-38 Upper Basin WTP THM LRAAs (2016 to 2020)

Figures 4-39 and 4-40 present the individual quarterly and the LRAAs for the HAA5 results, respectively. The individual quarterly results ranged from approximately 15 to 66 µg/L. The LRAAs ranged from approximately 18 to 49 µg/L.

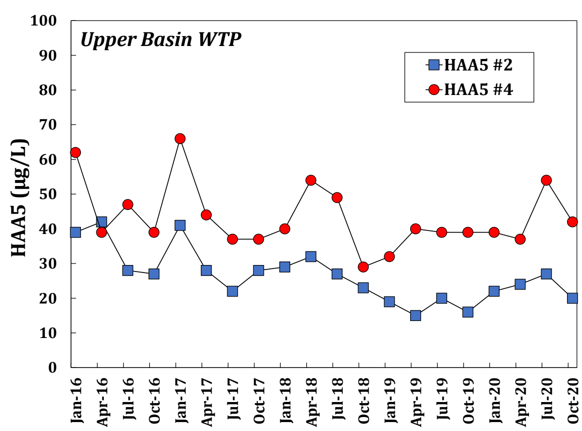


Figure 4-39 Upper Basin WTP Quarterly HAA5s (2016 to 2020)

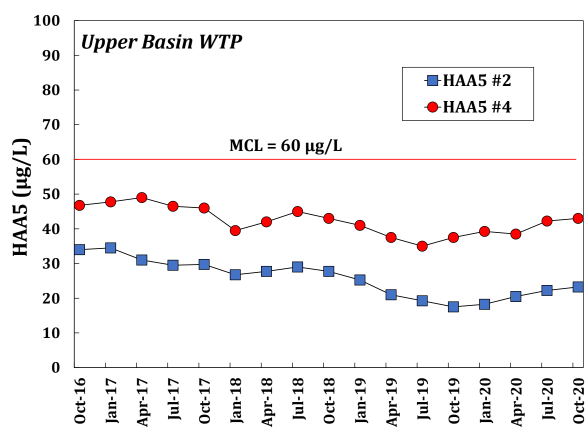


Figure 4-40 Upper Basin WTP HAA5 LRAAs (2016 to 2020)

UPPER BASIN TITLE 22. Title 22 results are presented in Appendix D, Tables D-8 (raw water) and D-9 (treated water). A sample collected in 2018 reported a low-level detection of toluene (0.62 µg/L well below the MCL of 150 µg/L). Toluene was not detected in any other samples in previous years. All other results for VOCs and SOCs were ND. Low levels of aluminum were detected in the raw water, all other results for IOCs were ND. Raw water iron results ranged from 201 µg/L to 710 ug/L, with an average of 440 µg/L. Raw water manganese ranged from 38 µg/L to 100 µg/L, with an average of approximately 65 µg/L. The average color in the raw water was 19 color units. The average alkalinity was approximately 12 mg/L as $CaCO_3$ and the average hardness was approximately 8.7 mg/L. Average color results for the treated water were approximately 1.3 color units. Finished water iron and manganese levels were ND.

CAL FIRE BASELINE CONSERVATION CAMP

The Baseline Conservation Camp obtains water from Tulloch Reservoir, approximately two miles downstream of New Melones Dam. Tulloch Reservoir can store up to 64,040 acre-feet of water. The Baseline Conservation Camp WTP is owned by the State of California and is operated by the California Department of Forestry and Fire Protection staff. The intake for the WTP is located 120 feet offshore in 40 to 45 feet of water. Three 10 hp intake pumps are located three feet above the bottom. Sodium hypochlorite is added to the raw water followed by polymer addition. The water flows to a flash mix stage and then to single-stage flocculation. Sedimentation is provided using tube settlers. The water is filtered by gravity through a mixed media filter and sodium hypochlorite is added to the filtered water.

The WTP has provided drinking water up to approximately 120 staff and inmates. During preparation of the 2016 WSS Update, Baseline Conservation Camp was in the process of commissioning a new water treatment plant. That facility is a Trident package conventional treatment plant but is currently not in operation (BCC, 2021).

BASELINE CONSERVATION CAMP RAW WATER QUALITY. Figures 4-41 and 4-42 presents the raw water turbidity and pH data, respectively (data was available for 2017, 2018, and 2020). For the available data, the raw water turbidity ranged from 0.2 to 8.8 NTU, with an average of 1.4 NTU. The pH ranged from 6.4 to 7.9, with an average of 6.8.

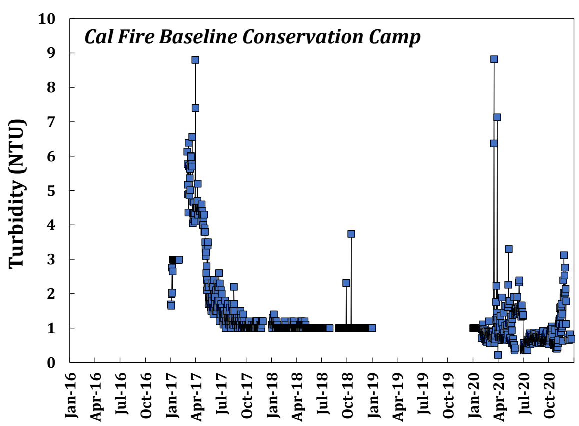


Figure 4-41 Baseline Conservation Camp Raw Water Turbidity (2016 to 2020)

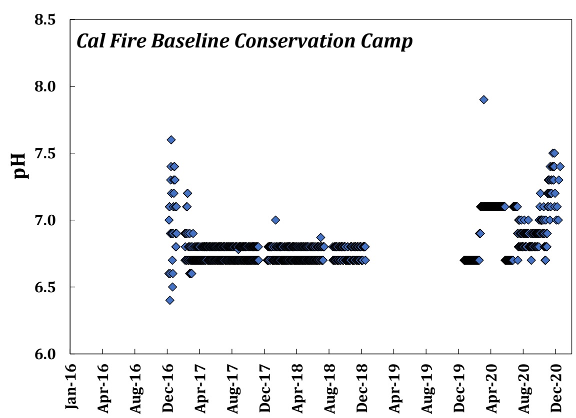


Figure 4-42 Baseline Conservation Camp Raw Water pH (2016 to 2020)

Raw and treated water TOC was available for 2017 and 2018 and are presented in Figure 4-43. The source water TOC ranged from 1.4 to 3.2 mg/L, and the treated water TOC ranged from ND to 2.1 mg/L. For the two years of TOC data, the raw water alkalinity ranged from 20 to 48 mg/L as $CaCO_3$, with an average of 26 mg/L as $CaCO_3$.

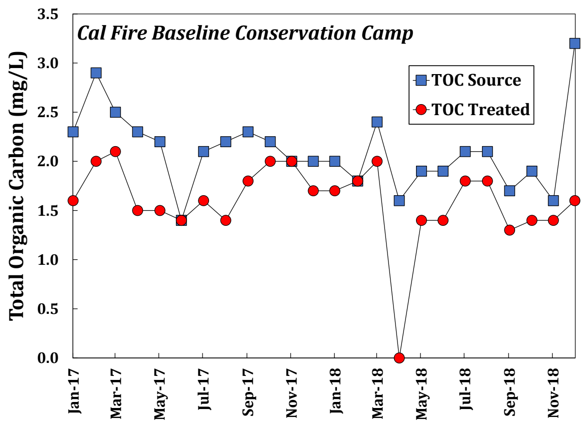


Figure 4-43 Baseline Conservation Camp TOC (2016 to 2020)

BASELINE CONSERVATION CAMP TREATED WATER QUALITY. Figures 4-44 and 4-45 present the available results for THMs and HAA5, respectively. The THMs ranged from 48 to 87 µg/L. The HAA5s ranged from ND to 152 µg/L. While only limited data was available for preparation of the 2021 WSS Update, Cal Fire has reported both THM and HAA5 results above their respective MCLs (information in SDWIS indicates DDW issued Notice of Violations for monitoring and MCL violations of the HAA5 standard and monitoring violation for THMs).

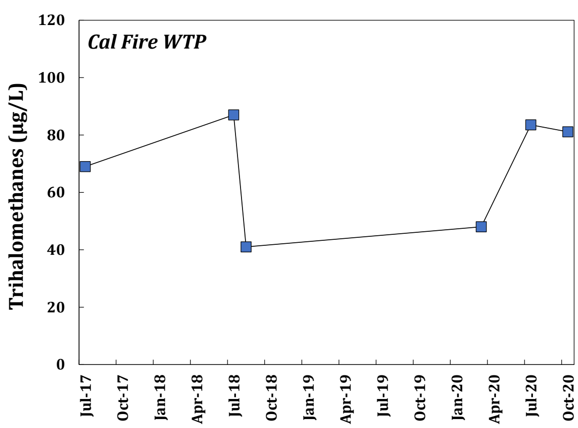


Figure 4-44 Baseline Conservation Camp WTP THMs (2017 to 2020)

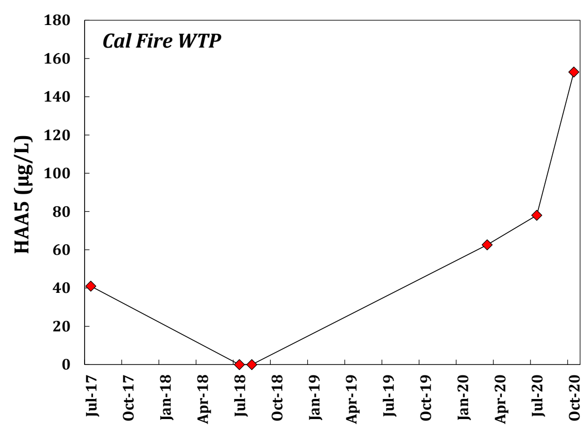


Figure 4-45 Baseline Conservation Camp WTP HAA5 (2017 to 2020)

BASELINE CONSERVATION CAMP TITLE 22. Title 22 monitoring results are presented in Table D-10. All results for IOCs, SOC, and VOCs were ND. The average iron and manganese results in the raw water were 153 µg/L and 28 µg/L, respectively. The average alkalinity was 26 mg/L as $CaCO_3$, and the average hardness was 23 mg/L. During the study period the Baseline Conservation Camp received a number of violations from DDW including for the HAA5 MCL and monitoring violations for THMs, nitrate, coliforms, and 1,2,3-trichloropropane.

CALIFORNIA DEPARTMENT OF CORRECTIONS SIERRA CONSERVATION CENTER

Raw water for the Sierra Conservation Center WTP comes from Tulloch Reservoir where the Stanislaus River enters. The intake is located 170 feet below the surface at the center of the bridge which crosses Tulloch Reservoir. Treatment processes consist of flash mix, inverted cone clarifier and Microfloc filters. Chemical addition includes polymer and sodium hypochlorite.

SIERRA CONSERVATION CENTER RAW WATER QUALITY. Figures 4-46 and 4-47 present the weekly raw water total coliform and *E. coli* results, respectively. The total coliform results ranged from ND to >2,419 MPN/100 mL, with an average of 466 MPN/100 mL. The *E. Coli* results ranged from ND to 579 MPN/100 mL, with an average of 11 MPN/100 mL.

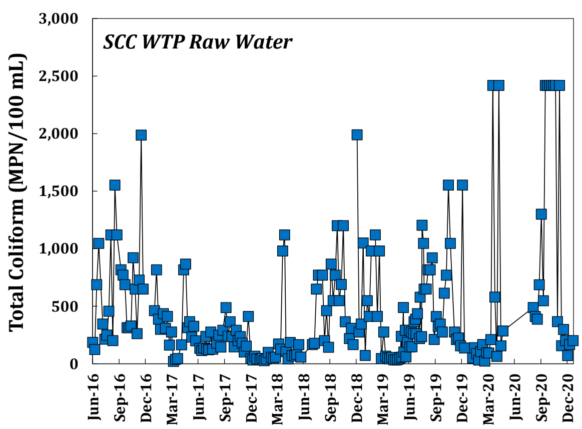


Figure 4-46 SCC WTP Raw Water Total Coliforms (2016 to 2020)

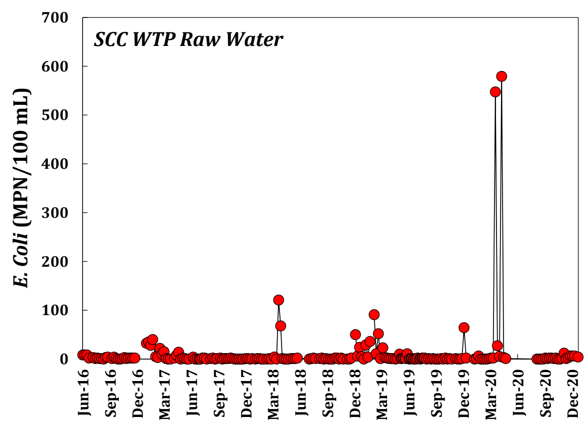


Figure 4-47 SCC WTP Raw Water *E. Coli* (2016 to 2020)

Scanned copies of the monthly Surface Water Treatment reports were reviewed for daily peak turbidity values. The monthly average of the daily peak turbidity values ranged from 0.3 NTU to 2.8 NTU. The maximum daily peak turbidity value was 4.4 NTU in January 2017.

Figure 4-48 presents the monthly raw and treated water TOC results. The raw water TOC results ranged from 1.0 to 4.6 mg/L, with an average of 2.1 mg/L. The treated water TOC ranged from 0.9 to 4.7 mg/L, with an average of 1.8 mg/L. Figure 4-49 presents the monthly raw water alkalinity. During the study period, the alkalinity ranged from 20 to 70 mg/L as $CaCO_3$, with an average of approximately 29 mg/L as $CaCO_3$. Sierra Conservation Center complied with the enhanced coagulation requirements through a combination of achieving the required TOC removal and use of one of alternate compliance criteria.

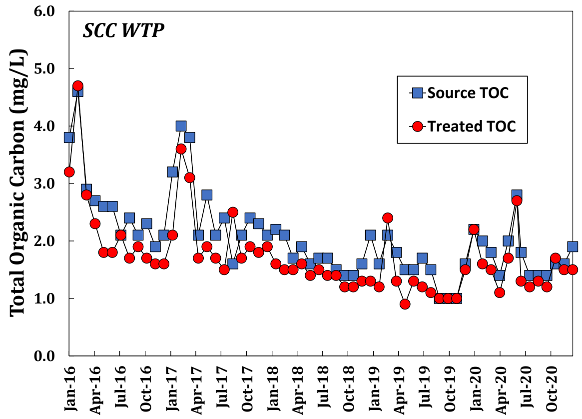


Figure 4-48 SCC WTP Monthly TOC (2016 to 2020)

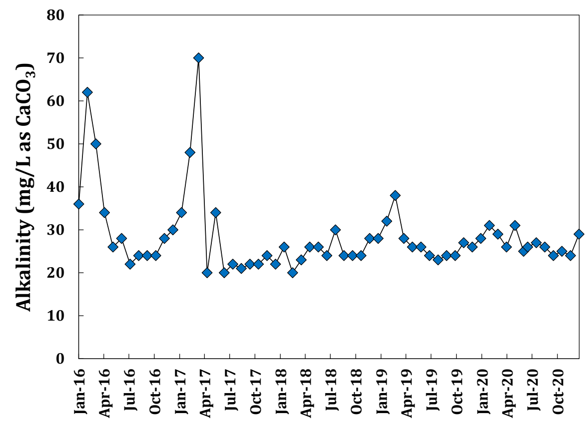


Figure 4-49 SCC WTP Monthly Raw Water Alkalinity (2016 to 2020)

SIERRA CONSERVATION CENTER TREATED WATER QUALITY. Figures 4-50 and 4-51 present the individual quarterly and LRAA THM results, respectively. The quarterly THM results ranged from 13 µg/L to 91 µg/L. The THM LRAAs ranged from approximately 21 µg/L to approximately 76 µg/L.

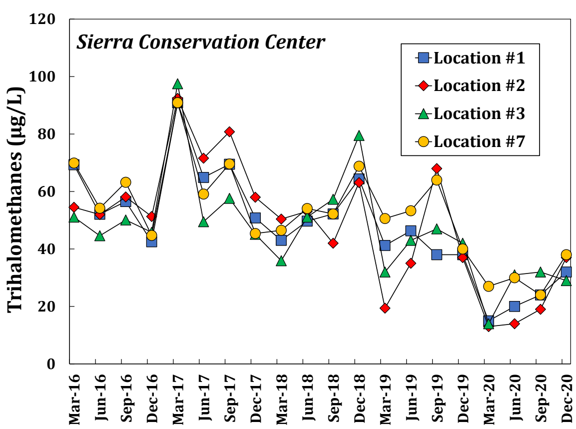


Figure 4-50 SCC WTP Quarterly THMs (2016 to 2020)

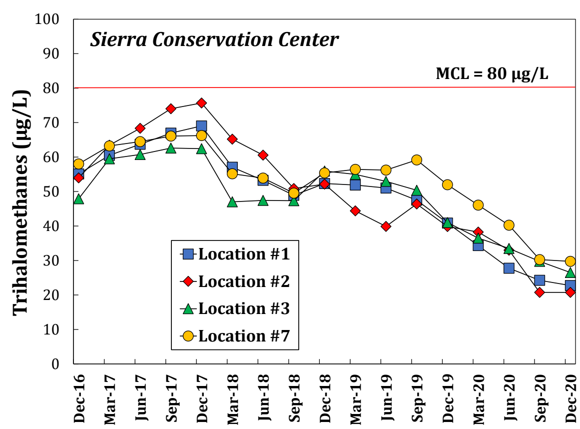


Figure 4-51 SCC WTP THM LRAAs (2016 to 2020)

Figures 4-52 and 4-53 present the individual quarterly and LRAA HAA5 results, respectively. The quarterly HAA5 results ranged from ND to 84 µg/L. The HAA5 LRAAs ranged from 15 µg/L to 66 µg/L (DDW issued several Notice of Violations to the Sierra Conservation Center for the HAA5 LRAA results in 2018 and 2019).

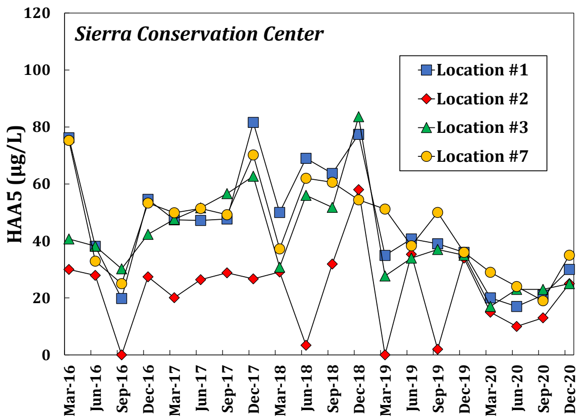


Figure 4-52 SCC WTP Quarterly HAA5 (2016 to 2020)

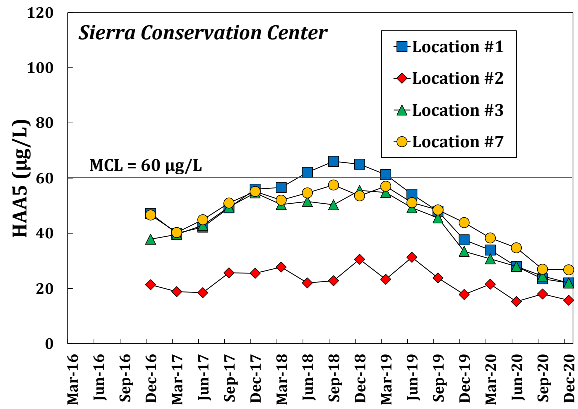


Figure 4-53 SCC WTP HAA5 LRAAs (2016 to 2020)

SIERRA CONSERVATION CENTER TITLE 22. Raw water Title 22 monitoring results are presented in Appendix D, Tables D-11. All VOC and SOC results were ND. For the IOCs, low levels of aluminum, barium and nitrate were detected in raw water, well below their respective MCLs. Low levels of iron and manganese were detected in the raw below their respective secondary MCLs. Color results for the raw water ranged from ND to 15 color units, with an average of approximately 6 color units. The raw water has a low alkalinity (average 22 mg/L as $CaCO_3$) and is a soft water (average hardness of 22 mg/L).

CALAVERAS COUNTY WATER DISTRICT COPPER COVE WTP

The raw water supply for the Copper Cove WTP comes from CCWD's North Fork Stanislaus River water rights, rediverted from Tulloch Reservoir downstream of New Melones. The intake is located on the Black Creek arm of the reservoir. The WTP is rated at a capacity of 4 MGD. Treatment consists of pre-ozonation, coagulant feed consisting of a polyaluminum chloride followed by a static mixer followed by filtration through Microfloc filters. After filtration, the water enters a 300,000-gallon clearwell. Disinfection is with sodium hypochlorite. Zinc orthophosphate is added to the filtered water for corrosion control.

COPPER COVE WTP RAW WATER QUALITY[10]. Figure 4-54 presents the weekly raw water total coliform results for the Copper Cove WTP. The results ranged from ND to >2,419 MPN/100 mL, with an average of 267 MPN/100 mL. The average total coliform count was higher than observed during the previous five-year study. The results during 2016 and 2017 appear to have continued a trend of occasional elevated results that was observed during 2015. Figure 4-55 presents the weekly *E. coli* results for the Copper Cove WTP raw water supply. The *E. coli* results ranged from ND to 921 MPN/100 mL, with an average of 15 MPN/100 mL. The majority of *E. coli* results were ND. During December 2018 and January 2019 there were a few weeks with elevated levels of total coliform and *E. coli*. The *E. coli* results were similar to the results observed during the previous five-year study.

[10] During UCMR4 monitoring, all cyanotoxin results for the Copper Cove WTP were ND.

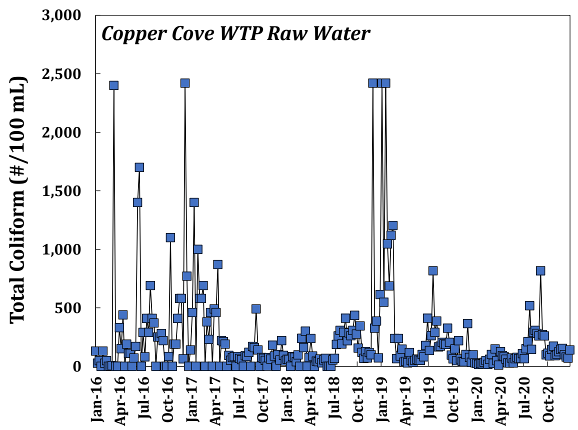


Figure 4-54 Copper Cove WTP Total Coliforms (2016 to 2020)

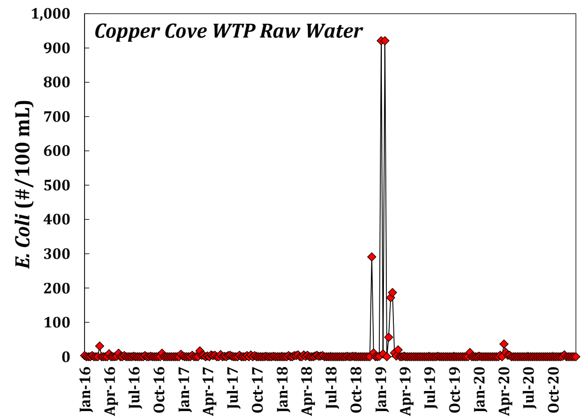


Figure 4-55 Copper Cove WTP *E. Coli* (2016 to 2020)

CCWD conducted the second round of source water LT2ESWTR monitoring beginning October 2017. Raw water samples were collected from the Tulloch Reservoir pump station every two weeks and analyzed for *E. Coli*. The 12-month mean did not exceed the 10 *E. Coli*/100 mL trigger for reservoirs and source water *Cryptosporidium* monitoring was not required.

Figure 4-56 presents the daily raw water turbidity results. The turbidity ranged from 0.2 NTU to 39.2 NTU, with an average of 1.3 NTU. The majority of the turbidity results were less than 2 NTU. The elevated turbidity values during early December 2018 are associated with elevated total coliform and *E. coli* counts in Figures 4-54 and 4-55. The elevated turbidity results for December 2017 are associated with elevated total coliform results at the same time, but no increase in *E. coli* were observed at that same time. Figure 4-57 presents raw water daily pH values. The pH ranged from 5.6 to 7.7, with an average of 6.6.

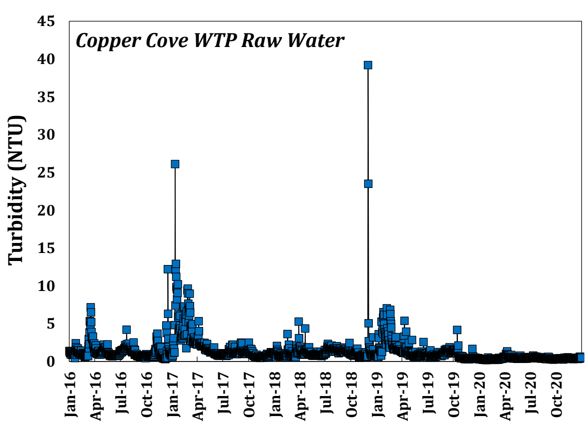


Figure 4-56 Copper Cove WTP Turbidity (2016 to 2020)

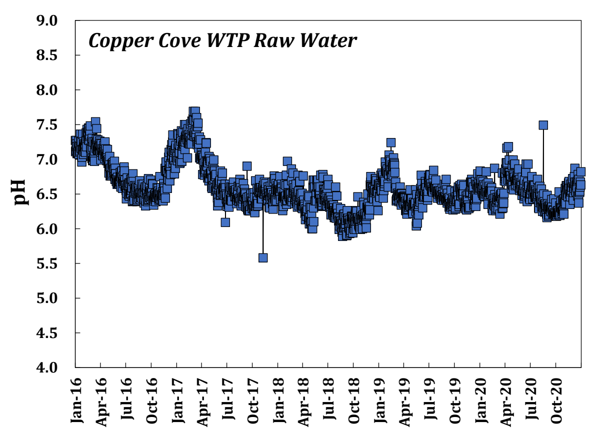


Figure 4-57 Copper Cove WTP pH (2016 to 2020)

Figure 4-58 presents the monthly raw and treated water TOC results. The source water TOC ranged from 1.3 mg/L to 5.9 mg/L, with an average of approximately 2.3 mg/L. The treated water TOC ranged from 0.9 to 2.8 mg/L with an average of 2.5 mg/L. The monthly percent TOC removal ranged from 12 percent to 55 percent, with an average of 33 percent. In winter 2016 and 2018 there were a few monthly TOC results that were elevated, but in general, the source water TOC results were consistent with the results during the previous five-year study. During 2016 through 2020 the Copper Cove WTP complied with the enhanced coagulation requirements through a combination of meeting the required TOC removal each month or using one of the alternative compliance criteria.

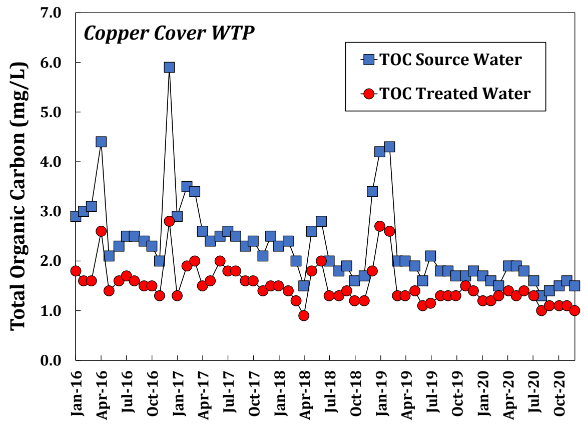


Figure 4-58 Copper Cove TOC (2016 to 2020)

COPPER COVE WTP TREATED WATER QUALITY. Figures 4-59 and 4-60 present the THM quarterly results and LRAAs, respectively, for Copper Cove's distribution system locations. The individual quarterly THM results ranged from 23 to 91 µg/L. The LRAAs are based on data collected during the study period and ranged from 38 to 68 µg/L.

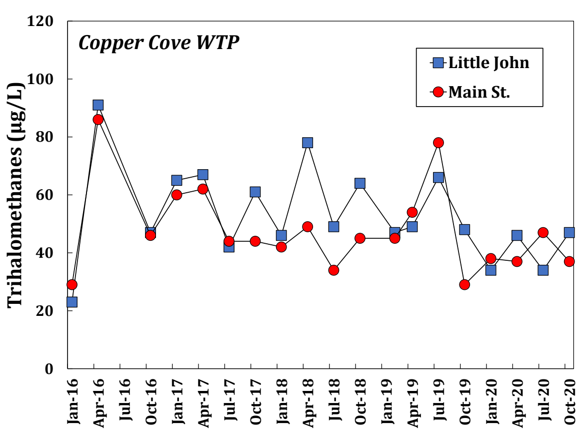


Figure 4-59 Copper Cove WTP Quarterly THMs (2016 to 2020)

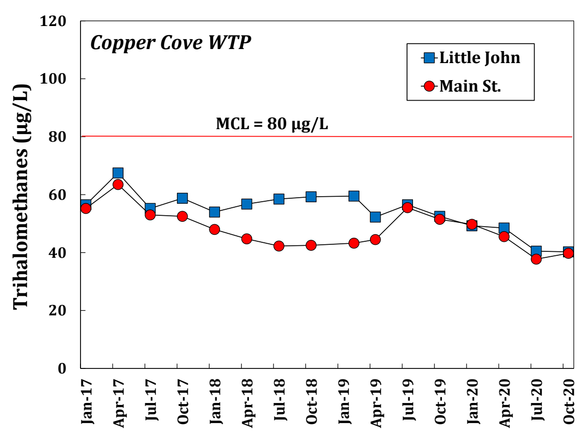


Figure 4-60 Copper Cove WTP THM LRAAs (2016 to 2020)

Figures 4-61 and 4-62 present the quarterly and LRAAs for HAA5s for the two sample locations. The individual quarterly HAA5 results ranged from 15 to 94 µg/L. The HAA5 LRAAs ranged from 21 to 57 µg/L.

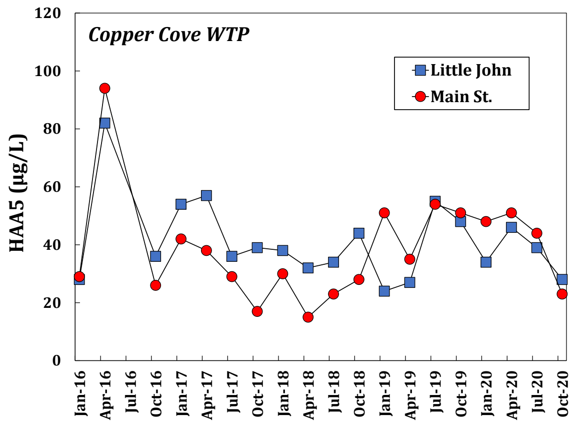


Figure 4-61 Copper Cove WTP HAA5 Quarterly (2016 to 2020)

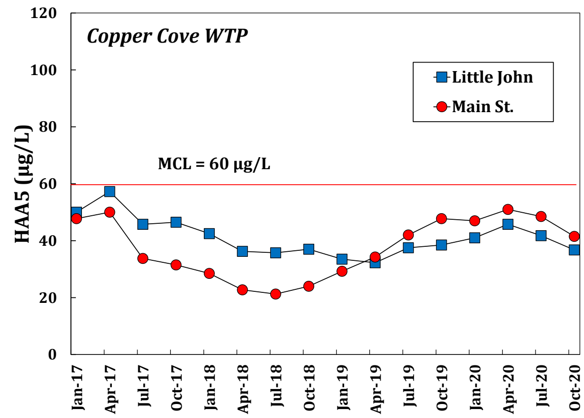


Figure 4-62 Copper Cove WTP HAA5 LRAAs (2016-2020)

Because the Copper Cove WTP uses ozone, bromate must be monitored at the treatment plant effluent on a monthly basis. Compliance with the bromate MCL of 10 µg/L is based on a running 12-month average, calculated quarterly. Figure 4-63 presents the monthly bromate results for the Copper Cove WTP. During the study period, the monthly bromate results ranged from ND to a maximum of 3.6 µg/L. The majority of the results were ND.

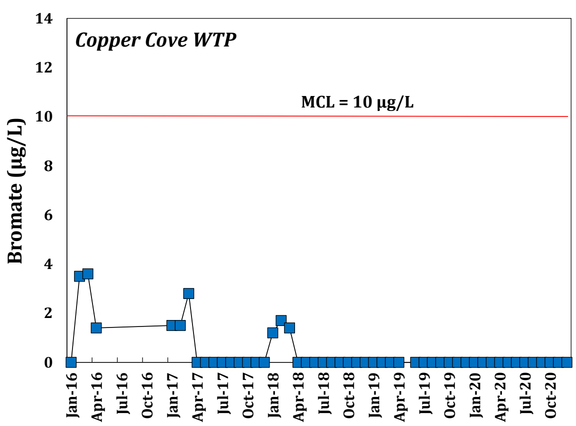


Figure 4-63 Copper Cove WTP Monthly Bromate (2016 to 2020)

COPPER COVE WTP TITLE 22. Title 22 monitoring results are presented in Appendix D, Tables D-12 (raw water) and D-13 (treated water). All results for VOCs and SOCs were ND. Low levels of aluminum, asbestos, and nitrate were detected in the raw water (well below their respective MCLs), the results for all other IOCs were ND. Raw water color results ranged from ND to 35 color units, with an average of approximately 7.3 color units. Treated water color results were ND. The raw water has a low alkalinity (average of approximately 31 mg/L as CaCO3) and is a soft water (average of approximately 38 mg/L).

STOCKTON EAST WATER DISTRICT DJW WTP

SEWD provides treated surface water from the DJW WTP which has two water sources, Calaveras River at Bellota Weir Intake and Stanislaus River at Goodwin Tunnel Inlet, downstream of Tulloch Reservoir. During 2016 through 2020, source supply data were available for 58 out of the 60 months. The Calaveras River provided 100 percent of the supply from September 2016 through April 2017, and again during February 2019 and November 2020. During other months, the raw water supply was either 100 percent Stanislaus River (26 months) or a blend of Stanislaus River, Calaveras River, and groundwater (22 months).

In 2019 SEWD put a new 120 MG raw water reservoir into service on site at the WTP. Raw water can be stored in the five on-site reservoirs (total storage capacity of 240 MG) and during high turbidity events, the WTP can rely on the raw water reservoirs for both pre-sedimentation and water supply. The DJW WTP has a rated capacity of 65 MGD. The water is lifted from the raw water reservoirs to the WTP influent. Water entering the WTP is first pre-chlorinated with chlorine gas for disinfection and alum and polymer are added to the raw water. The water then passes through a rapid mix, a flocculation basin, and sedimentation basin or plate settlers (depending on treatment train). Settled water is routed to dual-media (GAC and sand) filters. Filter-aid polymer is added to the water prior to filtration. Filter backwash water flows to raw water reservoirs for groundwater recharge and reuse. Filter effluent flows through the finished water conduit, where sodium hydroxide is added to increase the pH level for distribution system corrosion control. Chlorine gas is added again at this point for final disinfection. The water then flows to two buried, finished water reservoirs, from which the water is pumped into the distribution system.

DJW WTP RAW WATER QUALITY. In December 2015 SEWD increased microbial monitoring of the raw water from weekly to five days per week. Figure 4-64 presents the raw water total coliform results from January 2016 through December 2020. Total coliform counts ranged from 20 MPN/100 mL to 19,863 MPN/100 mL, with an average of 991 MPN/100 mL and a median of 727 MPN/100 mL. The average and median total coliform results are consistent with the results from the previous five-year WSS, however, during 2016 through 2020 there were a handful of elevated results. Figure 4-65 presents the total coliform results from 2016 through 2020 without ten (10) results that were greater than 6,000 MPN/100 mL. From this figure, there appears to be a consistent increase in total coliforms during the summer months of each year (the increase was much less pronounced during 2020).

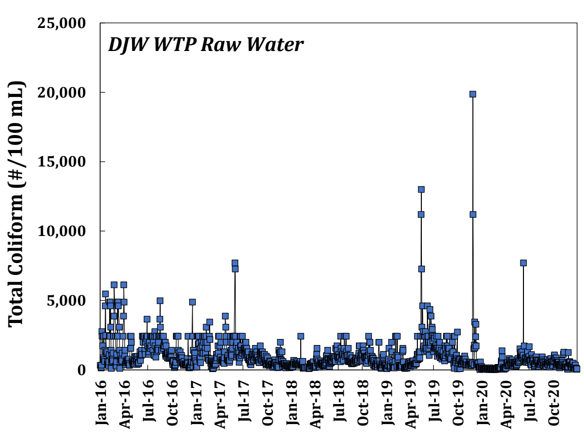


Figure 4-64 DJW WTP Total Coliforms (2016 to 2020)

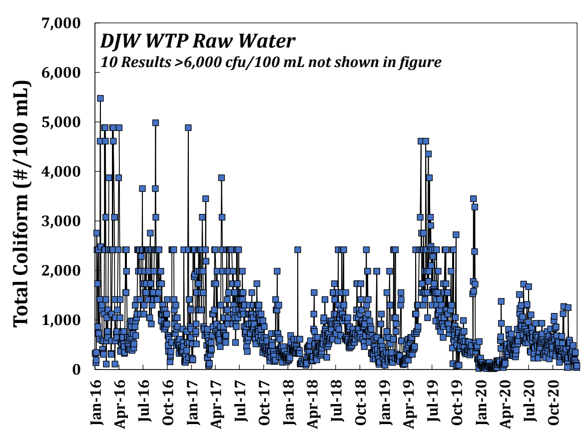


Figure 4-65 DJW WTP Total Coliforms Without Ten Elevated Counts (2016 to 2020)

Figure 4-66 presents the weekly *E. coli* results for 2016 through 2020. The *E. coli* results do not indicate the same pattern as the total coliform results. The *E. coli* results are fairly consistent throughout the study period with occasional elevated counts (typically in January and February). The *E.coli* results ranged from ND to 770 MPN/100 mL, with an average of 23 MPN/100 mL. The total coliform and *E. coli* results are consistent with the results during the previous five-year WSS.

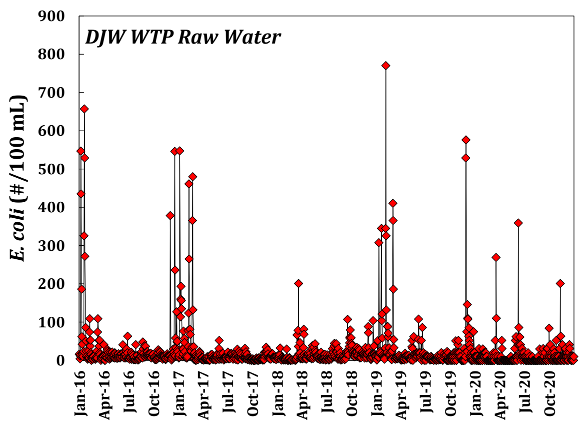


Figure 4-66 DJW WTP *E. Coli*
(2016 to 2020)

SEWD conducted the first round of source water *Cryptosporidium* monitoring from October 2006 through September 2008. USEPA used the results from the plant influent sample location and calculated an average of 0.075 oocysts/L, placing the DJW WTP in Bin 2. Placement in Bin 2 required 1 additional log reduction of *Cryptosporidium*. SEWD achieves the required 1 additional log credit for *Cryptosporidium* by meeting the individual filter turbidity requirement of less than 0.1 NTU in 95 percent of the daily maximum daily values for each filter in each month. DDW included the following language in SEWD's Permit Amendment No. 03-10-11PA-005:

> *"SEWD shall continue to review monthly IFE [individual filter effluent] turbidity data to determine compliance with the <0.1 NTU requirement in at least 95% of the maximum daily readings and watch for any upward trends. If any filter shows increasing values, diagnose the filter and the instrumentation to determine the cause of the unusual results and implement corrective actions to assure continuous compliance with the criteria that allow the SEWD to claim the additional log of Cryptosporidium treatment..."*

SEWD conducted the second round of monthly source water *Cryptosporidium* monitoring from April 2015 through March 2017. A single *Cryptosporidium* oocyst was detected during one month of the monitoring, all other results were ND. The highest 12-month average of *Cryptosporidium* detected was 0.008/L, corresponding to Bin 1, and no additional *Cryptosporidium* treatment is required. However, DDW indicated that the DJW WTP should remain in Bin 2 (Justin Hopkins, personal communication, April 27, 2020).

Figure 4-67 presents daily raw water turbidity. Between January 2016 and December 2020, the raw water turbidity ranged from 0.8 NTU to 25 NTU with an average of 4.5 NTU. Figure 4-68 presents the daily raw water hardness. The raw water hardness ranged from 13 mg/L to 115 mg/L, with an average of 44 mg/L. The increases in hardness presented in Figure 4-68 appears to be closely related to periods when the Calaveras River was the only source supplying the WTP or was a significant amount of the blend of source waters.

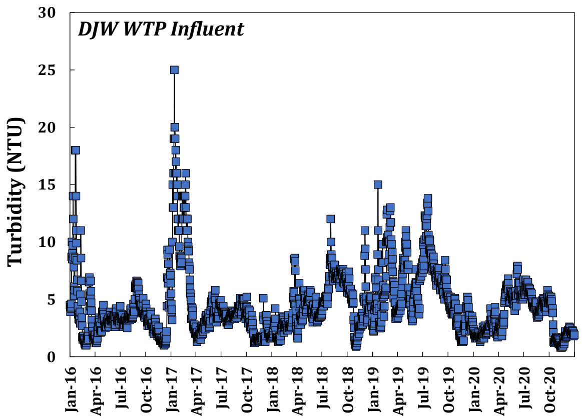


Figure 4-67 DJW WTP Turbidity (2016 to 2020)

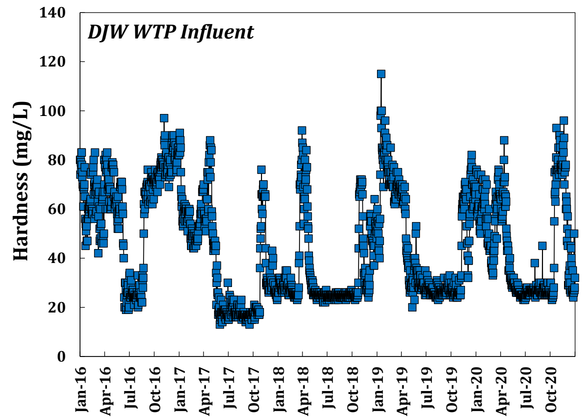


Figure 4-68 DJW WTP Hardness (2016 to 2020)

Figure 4-69 presents the daily temperature in the raw water to the DJW WTP. The temperature readings ranged from 9.0 to 27 °C, with an average of approximately 18 °C. During the previous five-year study, there was a slight increase over time in the maximum temperature recorded in the DJW WTP influent. During 2016 through 2020, the maximum temperature was consistent with the maximum temperature measured during 2015. Figure 4-70 presents the daily raw water color measurements. The color results ranged from 10 to 110 color units, with an average of approximately 31 color units during the study period. As can be seen in Figure 4-70 the raw water to the DJW WTP experienced periods of elevated color during the winter/spring period of all five years (although, the increase in color was much less during 2020). Color in raw water can be due to metals, organic matter, or algae.

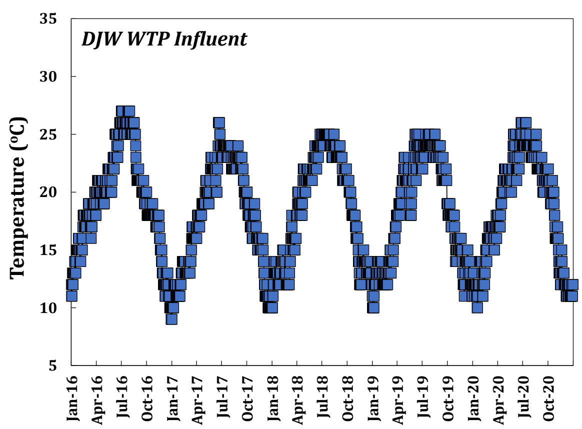


Figure 4-69 DJW WTP Temperature (2016 to 2020)

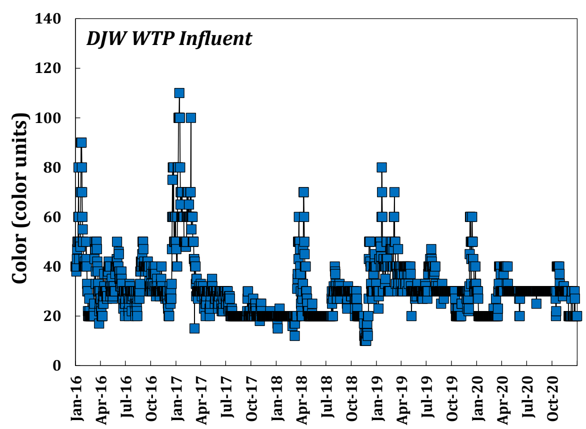


Figure 4-70 DJW WTP Color (2016 to 2020)

Figure 4-71 present the monthly raw and treated water TOC results. During the study period the source water TOC ranged from 1.4 mg/L to 7.8 mg/L, with an average of 3.1 mg/L. The treated water

TOC ranged from 0.6 to 3.6 mg/L, with an average of 1.7 mg/L. Figure 4-72 presents the raw water monthly alkalinity. The alkalinity ranged from 20 to 90 mg/L as $CaCO_3$.

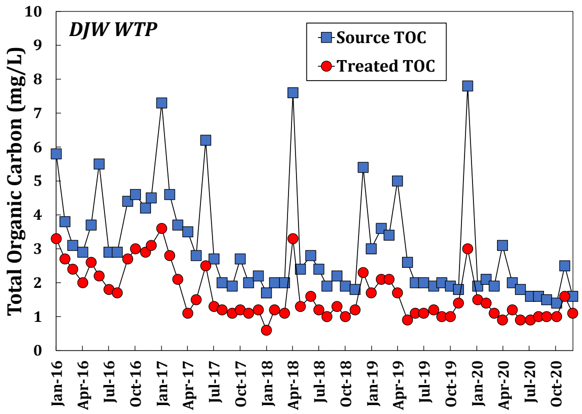


Figure 4-71 DJW WTP TOC (2016 to 2020)

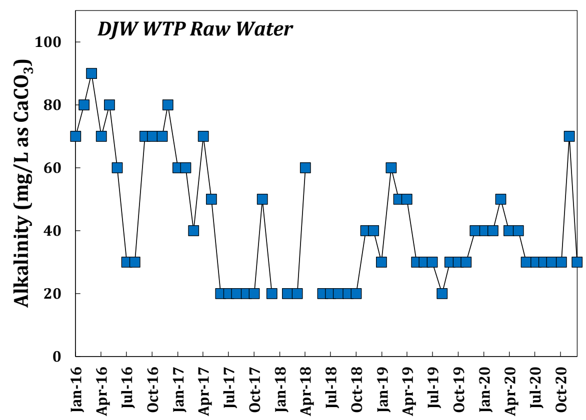


Figure 4-72 DJW WTP Alkalinity (2016 to 2020)

DJW WTP TREATED WATER QUALITY. SEWD collects quarterly THM and HAA5 samples from the treated water effluent at the DJW WTP. Figures 4-73 and 4-74 present the THM and HAA5 results, respectively. The results presented in these figures are the individual quarterly results as well as the LRAAs. Based on the quarterly THM results during the study period, the LRAAs ranged from 31 µg/L to 43 µg/L. Based on the quarterly HAA5 results collected during the study period, the HAA5 LRAAs ranged from 10 µg/L to 26 µg/L.

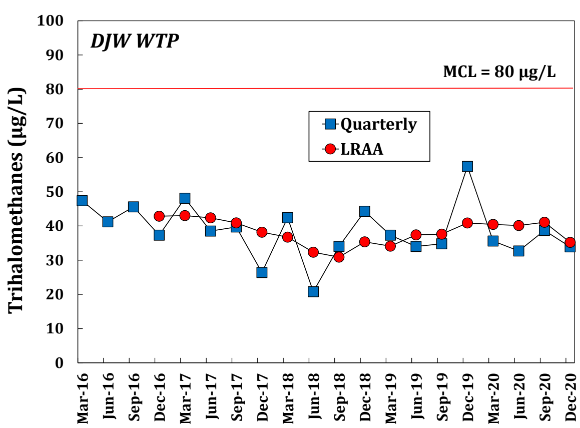


Figure 4-73 DJW WTP THM Quarterly and LRAA (2016 to 2020)

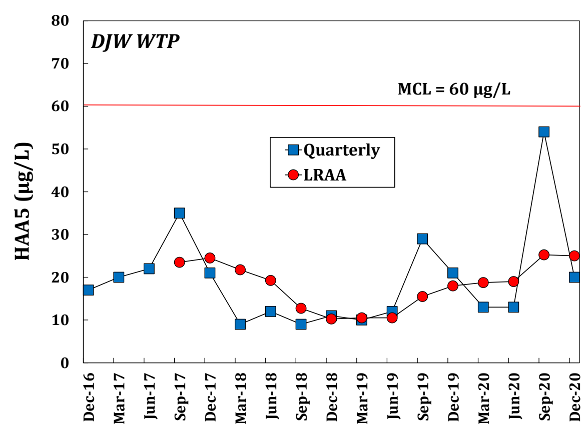


Figure 4-74 DJW WTP HAA5 Quarterly and LRAA (2016 to 2020)

DJW WTP TITLE 22. Title 22 monitoring results for the Stanislaus River source water are presented in Appendix D, Table D-14. Table D-15 presents finished water Title 22 monitoring results which can reflect both Stanislaus River and Calaveras River supplies. Raw water results for all VOCs and SOCs were ND. Low levels of aluminum, barium and nitrate were detected in the raw water (well below their respective MCLs). The results for all other IOCs were ND. Raw water results indicated levels of iron that ranged from 110 µg/L to 240 µg/L, with an average of 192 µg/L. Raw water manganese ranged from ND to 20 µg/L, with an average of 8 µg/L. All finished water iron and manganese results were ND. Raw water color results ranged from 5 to 55 color units, with an average of 15 color units. Treated water color results were ND. The raw water has a low alkalinity (average of 26 mg/L as $CaCO_3$) and is a soft water (average hardness of 27 mg/L).

SOUTH SAN JOAQUIN IRRIGATION DISTRICT NCD WTP

Woodward Reservoir, owned and operated by SSJID, receives water from Goodwin Dam via the 26-mile long SSJMC. Woodward Reservoir can store up to 36,000 AF of water and in addition to a drinking water supply, the reservoir provides irrigation water and is used to generate hydroelectric energy. Stanislaus County Parks and Recreation leases Woodward Reservoir from SSJID for recreational purposes. SSJID installed a "Water Quality Control Structure" to separate the portion of reservoir where body contact recreation is allowed from the portion of the reservoir from where raw water is diverted to the WTP. This protected area of Woodward Reservoir is referred as the "Upper Impoundment." The water intake screens are located within the upper impoundment approximately 12,000 linear feet upstream from the existing dam. The control structure provides a physical separation that inhibits the passage of boaters or swimmers to the upper impoundment.

SSJID can divert water to the DeGroot WTP from either the Upper Intake or from the Lower (Alternate) Intake. The Upper Intake is SSJID's primary source during irrigation season. When the Upper Intake is supplying the WTP, body contact recreation is allowed in Woodward Reservoir (generally mid-March through mid-October). The Lower Intake is SSJID's winter source after the irrigation season and flow stops in the SSJMC. When the Lower Intake is used to supply the WTP, body contact recreation is not allowed in Woodward Reservoir. Table 4-7 presents the periods of time when each intake was being used during 2016 through 2020.

Table 4-7: SSJID Dates When Upper and Lower Intake Were Used

Upper (SSJMC) Intake	Lower (Alternate) Intake
	1/1/2016 - 04/06/2016
04/07/2016 - 10/27/2016	
	10/28/2016 - 05/03/2017
05/04/2017 - 10/17/17	
	10/18/17 - 04/03/2018
04/04/2018 - 10/03/2018	
	10/04/2018 - 04/16/19
04/17/19 - 10/03/2019	
	10/04/2019 - 04/26/20
04/27/20 - 11/02/20	
	11/03/20 - 12/31/2020

Treatment at the NCD WTP includes the following: pre-oxidation as needed (sodium hypochlorite); coagulation and dissolved air flotation for removal of solids and dissolved materials; chemical stabilization with lime and carbon dioxide; followed by membrane filtration and chlorine (sodium hypochlorite) addition.

DEGROOT WTP RAW WATER QUALITY. Water quality data from both the Upper and Lower intakes is collected by SSJID and is presented in this section. Figures 4-75 and 4-76 present the weekly total coliform results for the Upper and Lower Intakes, respectively. For the Upper Intake the total coliform results ranged from 129 MPN/100 mL to 4,106 MPN/100 mL, with an average of 1,033 MPN/100 mL. For the Lower Intake the total coliforms ranged from 8 MPN/100 mL to 1,986 MPN/100 mL, with an average of 209 MPN/100 mL.

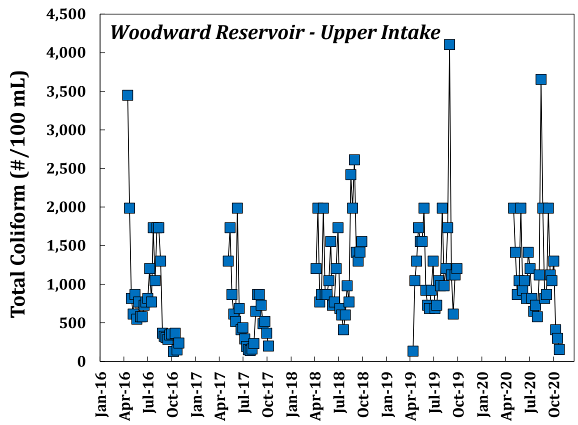


Figure 4-75 Woodward Reservoir Total Coliforms Upper Intake (2016 to 2020)

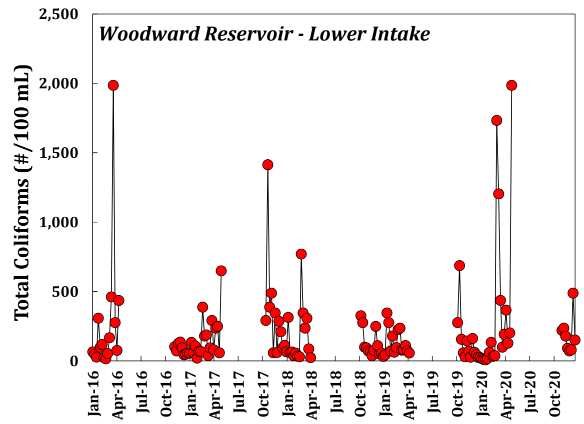


Figure 4-76 Woodward Reservoir Total Coliforms Lower Intake (2016 to 2020)

Figures 4-77 and 4-78 present the weekly *E. coli* results for the Upper and Lower Intakes, respectively. For the Upper Intake, the *E. coli* results ranged from ND to 96 MPN/100 mL, with an average of 14 MPN/100 mL. For the Lower Intake the *E. coli* results ranged from ND to 154 MPN/100 mL, with an average of 21 MPN/100 mL.

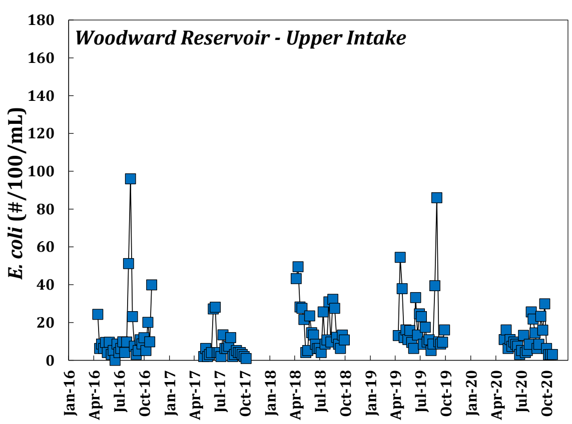


Figure 4-77 Woodward Reservoir *E. Coli* Upper Intake (2016 to 2020)

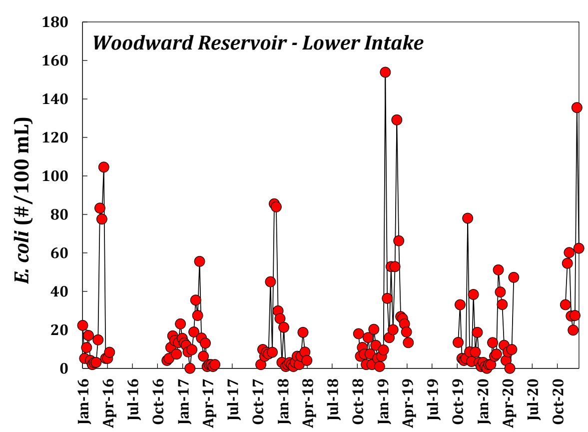


Figure 4-78 Woodward Reservoir *E. Coli* Lower Intake (2016 to 2020)

Figures 4-79 and 4-80 presents the results for total coliform and *E. coli* results from both the Lower and Upper Intakes, respectively.

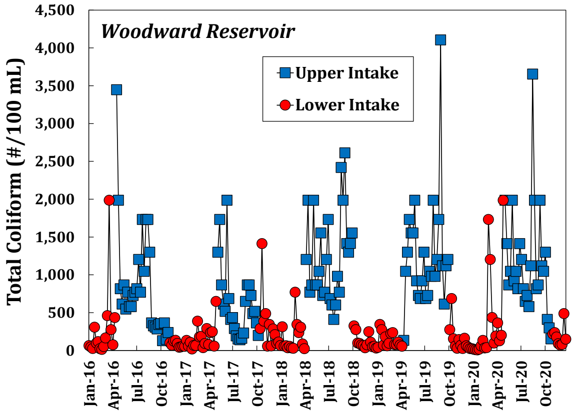


Figure 4-79 Woodward Reservoir Total Coliforms Upper & Lower Intakes (2016 to 2020)

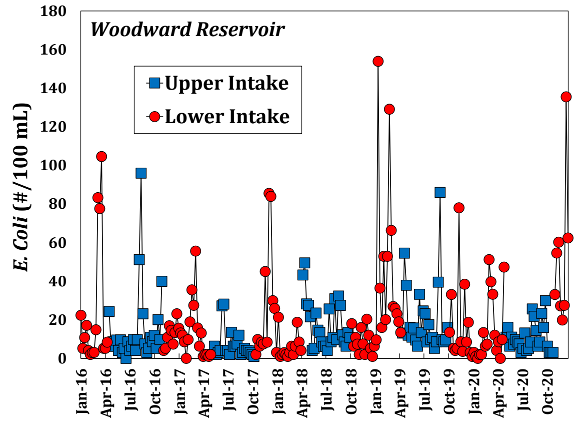


Figure 4-80 Woodward Reservoir *E. coli* Upper & Lower Intakes (2016 to 2020)

SSJID conducts monitoring for total coliforms and *E. coli* at five locations around Woodward reservoir on the day after the following holidays: Memorial Day, Fourth of July, and Labor Day. Samples are collected at the following five locations: Water Quality Control Structure, Bayview Point, Marina, Lower (Alternate) Intake and the Upper (Canal) Intake. The intent is to capture the worst case situation for bacterial concentrations when recreational use peaks in Woodward Reservoir. When the holiday samples are collected, SSJID takes water from the Upper Intake and not from the Lower (Alternate) Intake when body contact recreation is allowed. Figures 4-81 and 4-82 present the results from the special holiday monitoring during the five-year study period. The reservoir was closed for Memorial Day 2020 (due to the pandemic) and no samples were collected. During 2017, 2018 and 2019 elevated total coliform sample results were observed following Labor Day. The results at the Upper Intake were not impacted to the same extent as at the other locations.

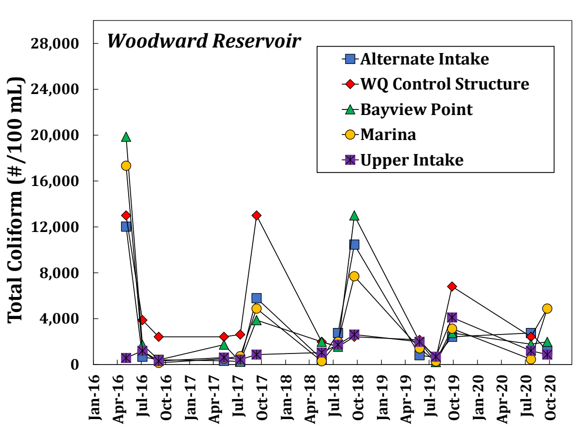


Figure 4-81 SSJID Holiday Monitoring Total Coliforms (2016 to 2020)

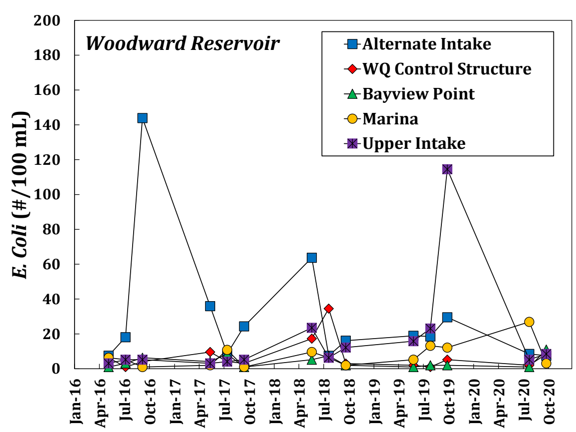


Figure 4-82 SSJID Holiday Monitoring *E. Coli* (2016 to 2020)

SSJID conducted the initial 24 months of source water *Cryptosporidium* monitoring (Woodward Reservoir) from January 2007 through December 2008. Based on those results, SSJID was classified in Bin 1 and no additional treatment for *Cryptosporidium* was required. The second round of monthly *Cryptosporidium* monitoring was conducted between October 2015 and September 2017 and no *Cryptosporidium* oocysts were detected.

Figures 4-83 and 4-84 present algae counts for the Upper and Lower Intakes, respectively. For the Upper Intake, the algae counts ranged from 360/100 mL to 167,500/100 mL. For the Lower Intake, the algae counts ranged from 320/100 mL to 9,120/100 mL.

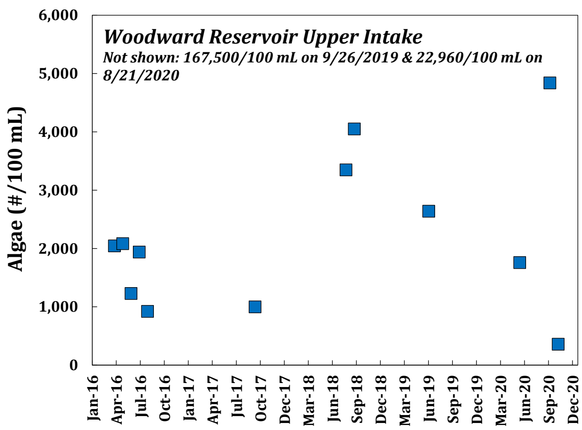


Figure 4-83 Woodward Reservoir Algae Counts Upper Intake (2016 to 2020)

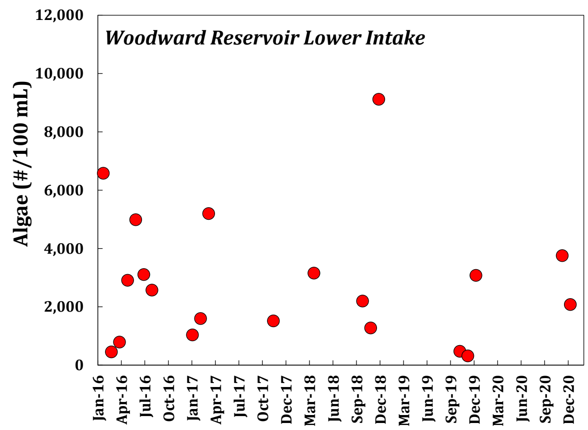


Figure 4-84 Woodward Reservoir Algae Counts Lower Intake (2016 to 2020)

During the five-year study period, there were three music festivals held at Woodward Reservoir: the Symbiosis festival was held September 22 - 25, 2016 with 15,000 attendees. The Serenity Gathering and Music Festival was held April 27-29, 2018 and again during April 26-28, 2019; there were approximately 5,000 attendees during each Serenity music festival. Plans to repeat the Serenity Gathering in 2020 were cancelled due to the coronavirus pandemic.

SSJID conducts daily monitoring for total coliform and *E. coli* shortly before, during and after the music festivals. Figures 4-85 and 4-86 present the total coliform and *E. coli* results, respectively, during each of the three music festivals. Samples are collected at three locations approximately 20 feet from the shoreline. At the same time the samples are collected near the music festivals, SSJID collects daily samples for total coliform and *E. coli* from the Upper Intake that would be supplying the WTP (the Upper Intake sample results are the blue squares in the figures). The results indicate elevated total coliform counts near the music festivals and there were several elevated *E. coli* results during the 2019 music festival. The results at the Upper Intake, do not appear to indicate an influence from the music festivals.

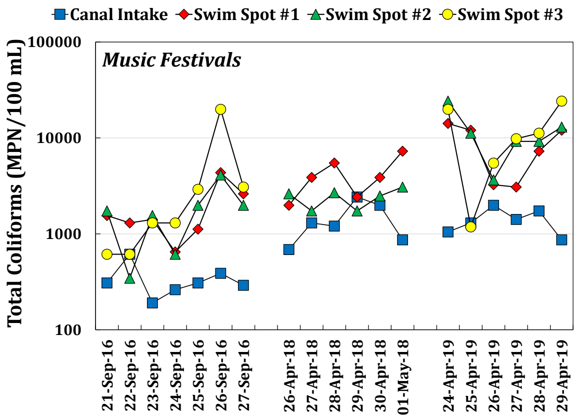


Figure 4-85 Woodward Reservoir Music Festivals Total Coliform (2016 to 2020)

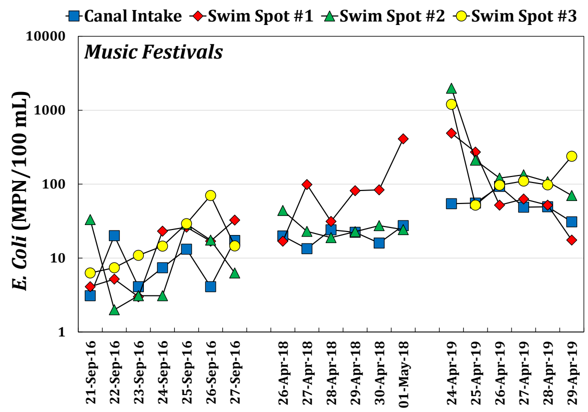


Figure 4-86 Woodward Reservoir Music Festivals *E. Coli* (2016 to 2020)

Figures 4-87 and 4-88 present the daily raw water turbidity at the Woodward Reservoir Upper and Lower Intakes, respectively (note that there are different scales on the y-axis). The turbidity in the Upper Intake ranged from 0.8 to 9.3 NTU, with an average of 2.3 NTU. The turbidity for the Lower Intake ranged from 1.3 to 56 NTU, with an average of 8.6 NTU. The highest turbidity levels are observed in the Lower Intake in the winter/spring months each year.

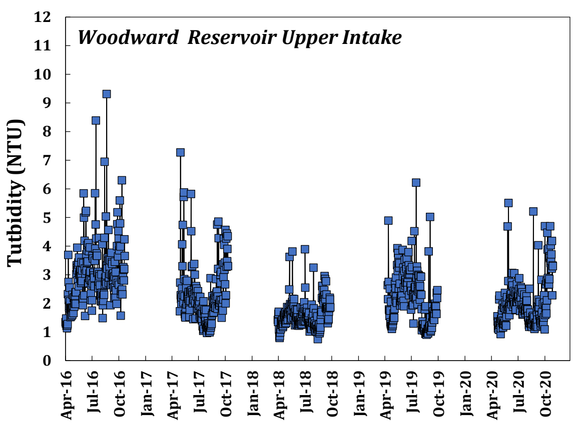


Figure 4-87 Woodward Reservoir Upper Intake Turbidity (2016 to 2020)

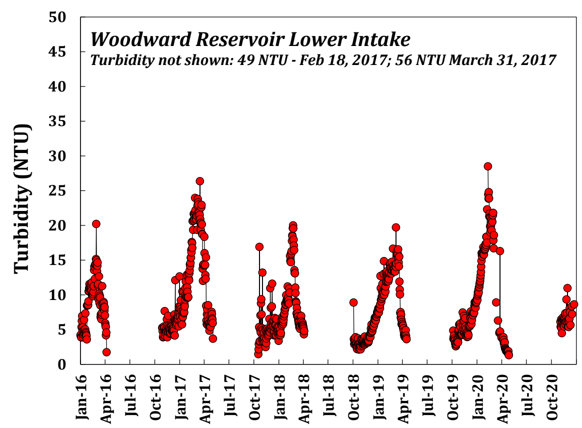


Figure 4-88 Woodward Reservoir Lower Intake Turbidity (2016 to 2020)

Figure 4-89 presents the daily turbidity from both the Upper and Lower intakes.

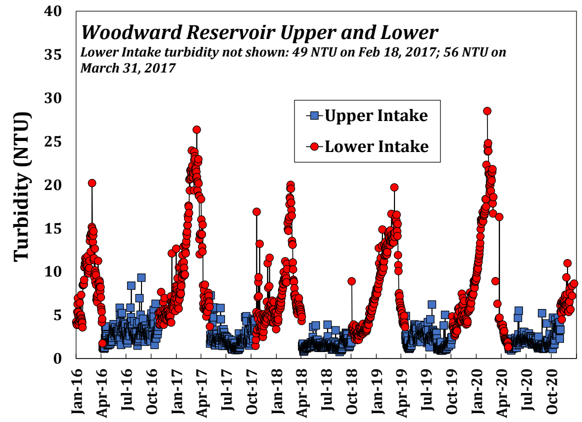


Figure 4-89 Woodward Reservoir Turbidity (2016 to 2020)

Daily pH samples are collected from either the Upper Intake or the Lower Intake, depending upon which intake was supplying water to the WTP at the time of sample collection. Figure 4-90 presents the daily raw water pH. During the five-year study period, the raw water pH ranged from 6.3 to 7.8, with an average of 7.2. Figure 4-91 presents daily raw water temperature results from the Upper and Lower intakes. The recorded temperature for the five-year study period ranged from 11 to 23 °C, with an average of approximately 17 °C. For the Lower intake, the temperature ranged from 10.6 °C to 21.1 °C, with an average of 15.3 °C. For the Upper intake, the temperature ranged from 15 °C to 22.8 °C, with an average of 19.3 °C.

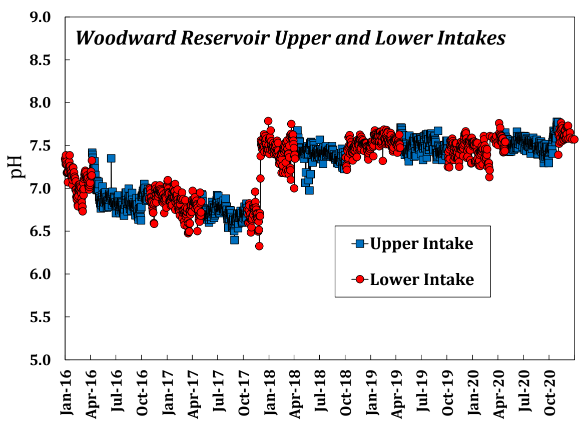


Figure 4-90 Woodward Reservoir pH (2016 to 2020)

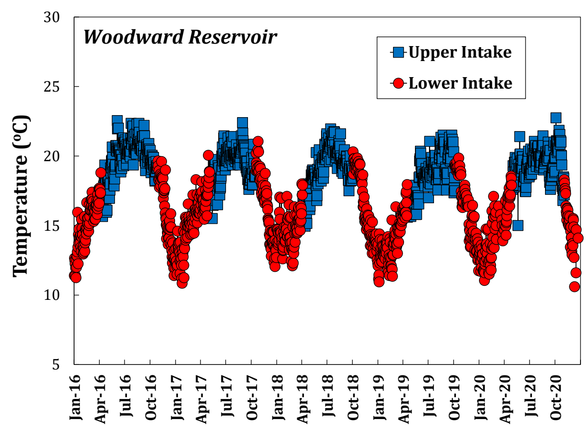


Figure 4-91 Woodward Reservoir Temperature (2016 to 2020)

SSJID collects monthly paired source and treated water TOC. The results are presented in Figure 4-92. During 2016 through 2020, the source water TOC ranged from 1.3 mg/L to 13.9 mg/L, with an average of 3.4 mg/L. The treated water TOC ranged from 0.72 to 10.4 mg/L, with an average of 2.1 mg/L. The Nick DeGroot WTP is not a conventional treatment plant and therefore the enhanced coagulation requirements of the Stage 1 D/DBP Rule do not apply.

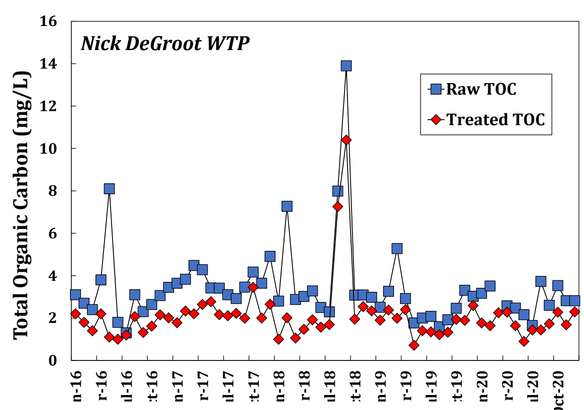


Figure 4-92 DeGroot WTP TOC (2016 to 2020)

DEGROOT WTP FINISHED WATER QUALITY. Figures 4-93 and 4-94, present the quarterly and LRAAs for THMs, respectively, measured at the effluent of the treated water reservoir and at three distribution system locations (Manteca turnout, Lathrop turnout, and the Tracy pump station).

At the treated water reservoir sample location, the individual quarterly THM results ranged from 19 µg/L to 61 µg/L, with an average THM concentration of 34 µg/L. For the three distribution system locations, the quarterly TTHM results ranged from 30 µg/L to 73 µg/L. The LRAAs ranged from 27 µg/L to 61 µg/L.

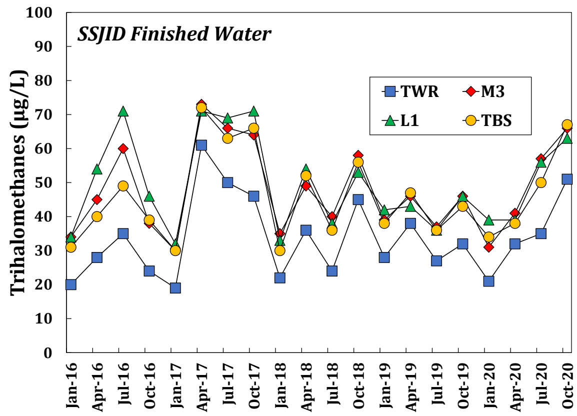


Figure 4-93 DeGroot WTP Quarterly THMs (2016 to 2020)

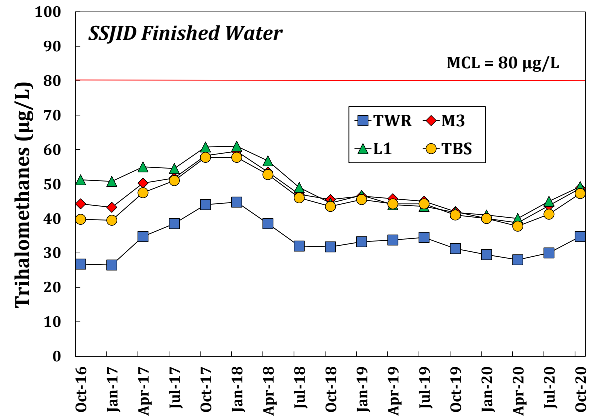


Figure 4-94 DeGroot WTP THM LRAAs (2016 to 2020)

Figures 4-95 and 4-96 present the individual quarterly and the LRAAs for HAA5s, respectively. The individual quarterly HAA5 results ranged from ND to 56 µg/L. The LRAAs ranged from 15 µg/L to 41 µg/L.

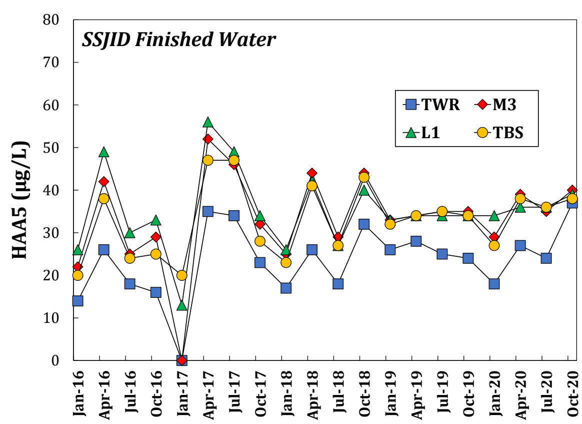


Figure 4-95 DeGroot WTP Quarterly HAA5s (2016 to 2020)

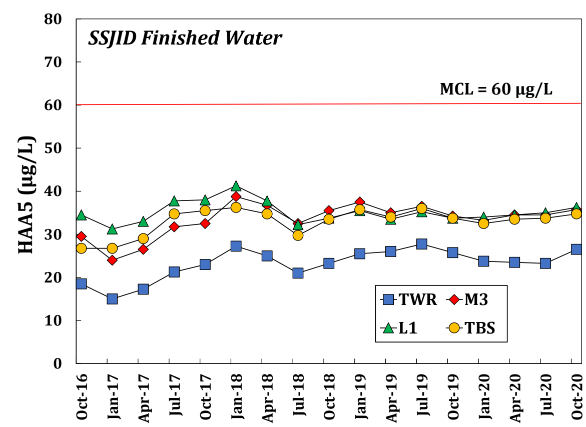


Figure 4-96 DeGroot WTP HAA5 LRAAs (2016 to 2020)

DEGROOT WTP TITLE 22. Title 22 results are presented in Appendix D, Tables D-16 (raw water) and D-17 (treated water). All results for VOCs and SOCs were ND. Low levels of aluminum, fluoride, and nitrate were detected in raw water. Color results in the raw water ranged from 3 to 20 color units, with an average of 11.6 color units. The average raw water alkalinity was approximately 34 mg/L as $CaCO_3$, and the average hardness was 49 mg/L. Color units recorded in the treated water ranged from ND to 10, with an average of 1.2 color units.

KNIGHTS FERRY COMMUNITY SERVICES DISTRICT WTP

The community of Knights Ferry obtains its water from the Stanislaus River from Frymire Canal, 3.5 miles after it is diverted from SSJMC. When this intake is not used, water can be pumped directly from the Stanislaus River at Knights Ferry through a pipeline and into a 5,000-gallon tank located just above the WTP.

During the study period, the source water for the Knights Ferry WTP was predominantly from the Frymire Canal. During 44 of the 60 months from 2016 through 2020 SSJMC/Frymire was the source of supply while for the remaining 16 months the source was either the river intake or a blend of both.

The Knights Ferry WTP is a package plant that uses an upflow clarifier. The WTP has a maximum capacity of 100 gpm and serves about 60 connections. Sodium hypochlorite and alum are added to the raw water prior to the upflow clarifier. The upflow clarifier provides flocculation and sedimentation. Sodium hypochlorite is added to the settled water as it flows from the clarifier and into two dual media pressure filters. The filters discharge into a 30,000-gallon clearwell. The total detention time through the WTP and clearwell is about 6.5 hours in the summer and about 17 hours in the winter.

KNIGHTS FERRY CSD WTP RAW WATER QUALITY: Figures 4-97 and 4-98 present the monthly total coliform and *E. coli* results, respectively. The total coliform results ranged from 34 MPN/100 mL to >2,419 MPN/100 mL, with an average of 697 MPN/100 mL. The *E. coli* results ranged from 1 MPN/100 mL to 579 MPN/100 mL, with an average of 37 MPN/100 mL.

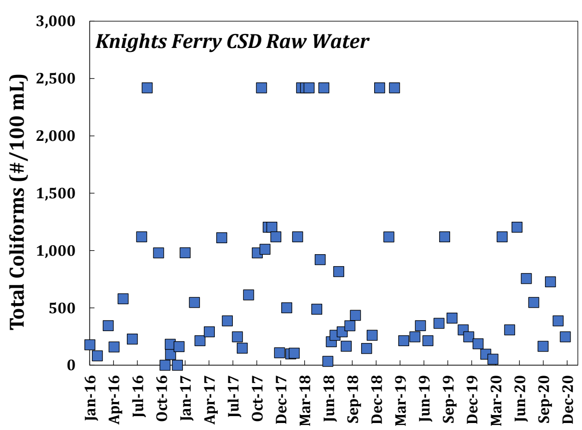


Figure 4-97 Knights Ferry CSD Total Coliforms (2016 to 2020)

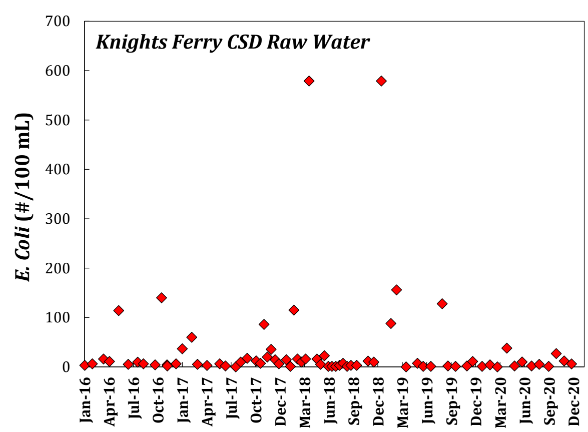


Figure 4-98 Knights Ferry CSD *E. Coli* (2016 to 2020)

Figure 4-99 presents the daily raw water turbidity. During the study period, the turbidity ranged from 0.5 to 100 NTU, with an average of 4.7 NTU. The raw water turbidity alarm is typically set at 30 to 35 NTU. If the raw water alarm is triggered, that will automatically shut down the treatment plant and staff allow the high turbidity water to pass by the treatment plant. If supplies get low, staff will use an onsite sedimentation basin to settle out the high turbidity prior to the treatment plant influent.

Figure 4-100 presents the weekly raw water pH values for the treatment plant. During 2016 to 2020 the raw water pH ranged from approximately 6.4 to 9.6, with an average of 7.6. It is not clear what might have caused the significant decrease in pH in early 2018. Weekly raw water temperature measurements ranged from 7.8 to 27.7 °C, with an average of 17.8 °C.

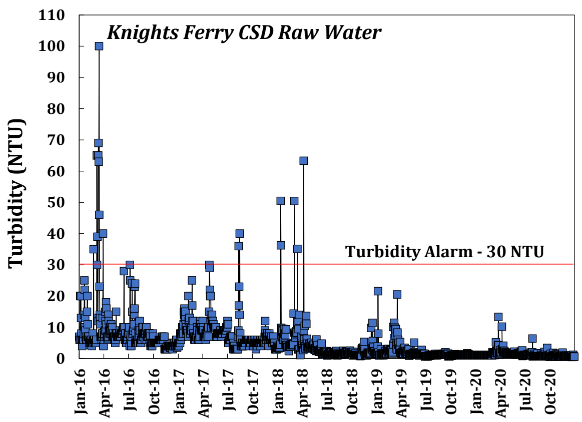


Figure 4-99 Knights Ferry WTP Turbidity (2016 to 2020)

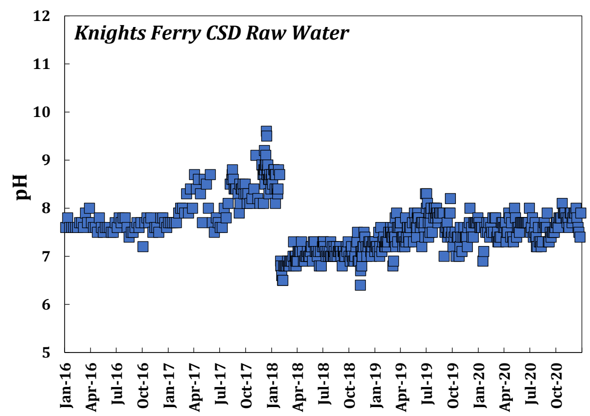


Figure 4-100 Knights Ferry WTP pH (2016 to 2020)

Figure 4-101 presents the monthly source and treated water TOC for the Knights Ferry WTP. The source water TOC ranged from 1.4 to 11 mg/L, with an average of 2.5 mg/L. The treated water TOC ranged from 1.1 to 2.7 mg/L, with an average of 1.6 mg/L. The source water alkalinity ranged from 22 to 67 mg/L as $CaCO_3$, with an average of 30 mg/L as $CaCO_3$. The monthly percentage of TOC removed ranged from 11 to 88 percent, with an average of 31 percent.

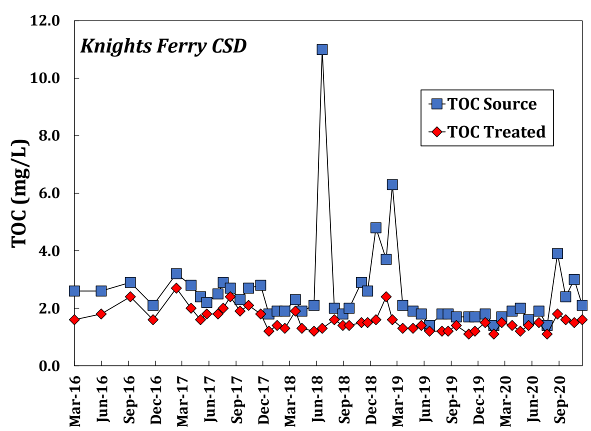


Figure 4-101 Knights Ferry Raw and Treated TOC (2016 to 2020)

KNIGHTS FERRY TREATED WATER QUALITY. Figures 4-102 and 4-103 present the quarterly and LRAA for the THM and HAA5 results, respectively. The quarterly THM results ranged from 22 µg/L to 150 µg/L. Using the quarterly THM results during the study period the THM LRAA ranged from 46 to 102 µg/L. During several quarters in 2016 and 2017 the THM LRAA was above the MCL (and several Notice of Violations were issued by DDW). The quarterly HAA5 results ranged from 8 µg/L to 69 µg/L. The HAA5 LRAA results ranged from 21 µg/L to 48 µg/L.

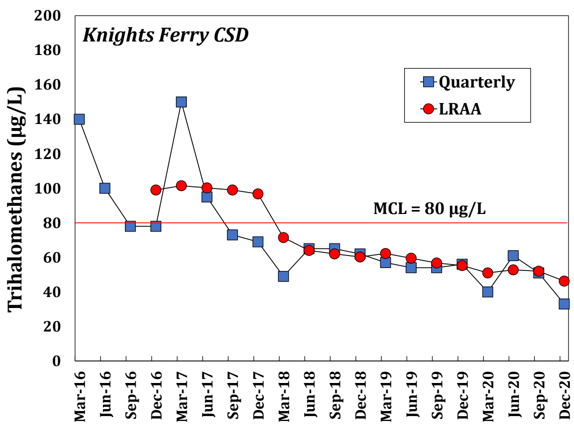


Figure 4-102 Knights Ferry WTP THMs (2016-2020)

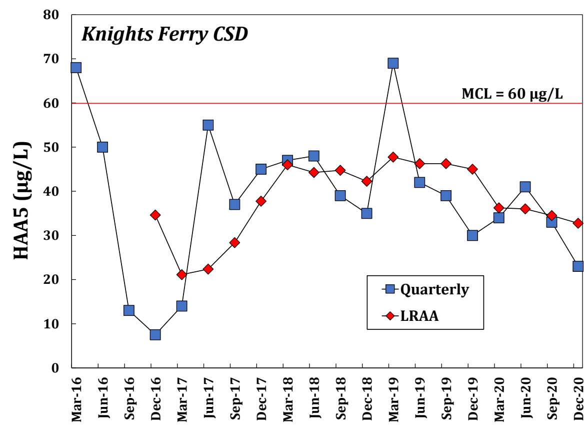


Figure 4-103 Knights Ferry WTP HAA5 (2016-2020)

KNIGHTS FERRY CSD TITLE 22. Title 22 monitoring results for Knights Ferry CSD are presented in Appendix D, Table D-18. All results for VOCs and SOCs were ND. Low levels of aluminum and nitrate were detected in raw water. Levels well above the secondary MCLs for iron and manganese were detected in raw water. While treated water results were not available for this WSS, iron, and manganese would not be expected above the secondary MCL in treated water.

Section 5 Conclusions And Recommendations

Public water systems using surface water supplies maintain multiple barriers in order to provide safe drinking water to their customers. Protecting source waters is the initial barrier. The second barrier is the provision of adequate treatment designed to handle and treat raw water to provide safe drinking water. A WSS provides the opportunity every five years to conduct an assessment of these barriers and to make course corrections, if needed. This section presents a summary of key conclusions from the analysis, and a list of recommendations.

Potential Contaminant Sources

Based on the analysis of potential contaminant sources presented in Section 3, the potential risk to Stanislaus River water quality is provided in Table 5-1.

Table 5-1 Risk Associated with Contaminant Sources

Watershed Activities	Potential Risk
Dairies and Livestock	Medium
Forestry Activities	Low
Irrigated Agriculture and Pesticides	Medium
Mining	Medium
Recreation	Medium
Solid and Hazardous Waste	Low
Urban Runoff and Spills	Low
Wastewater	Medium
Wildfires	High
Wildlife	High

Level of potential risk associated with observed land uses and activities. Risk primarily based on treatability concerns (e.g., pathogens being a higher risk than particulates) as well as the potential for the contaminant to enter waterbodies.

A brief overview is provided of potential contaminant sources in the Stanislaus River watershed. The most significant contaminant sources are those associated with pathogens.

Cattle Grazing: Grazing is throughout the watershed except in forested areas but is of greater concern when proximate to WTP intakes. Lands near the Utica Ditch below Murphys, and above and below Ross Reservoir (Angels Camp WTP) are heavily used for grazing with limited fencing of the ditch. Land proximate to and upstream of Copper Cove WTP is grazed with drainage to Black Creek. Runoff from grazed lands also drain to the Stanislaus River reservoirs of New Melones and Tulloch (BCC WTP and SCC WTP), and to Salt Spring Valley reservoir on Rock Creek that drains to Farmington FCB (DJW WTP). Woodward Reservoir and South San Joaquin Main Canal have been fenced to prevent cattle accessing the canal, but runoff from rangelands drain to these facilities (e.g., NCD WTP); SSJID conducts routine inspections of the fencing surrounding Woodward Reservoir and provides DDW with an annual update on the number of repairs conducted during the previous year

(Appendix B). Livestock grazing is considered a medium risk due to the proximity of the intakes and the potential presence of pathogens.

FORESTRY ACTIVITIES: Logging increases the rate of soil erosion into waterbodies, however, forestry activities are considered a low risk due to minimal pathogen contributions.

IRRIGATED AGRICULTURE AND PESTICIDE USE: This risk has increased as more lands in the lower and middle watershed are converted to vineyards and orchards, particularly almond orchards. However, monitoring data do not indicate adverse impacts to water quality associated with irrigated agriculture and pesticide usage. Runoff from orchards draining to Woodward Reservoir was observed during the site visit.

MINING: Tulloch, Woodward, and New Melones reservoirs are listed under Clean Water Act section 303(d) as mercury impaired, thus the medium risk rating. SWRCB is continuing to develop a program to address mercury impaired reservoirs.

RECREATION: Recreation is a significant activity throughout the Stanislaus River watershed. There is body contact recreation in all of the major reservoirs and along the river at formal and informal access locations. Risk is moderate due to accessibility and pathogen potential. The music festivals at Woodward Reservoir are heavily attended with thousands of people for a long weekend with reservoir body contact placing this water body at a high risk of pathogen contamination. Boating and seasonal mixing can stir up settled fecal deposits. The upper more protected reservoir has lower turbidity levels but higher total coliform levels compared with the lower reservoir. The lower reservoir with its recreational uses, however, has higher *E. coli* levels. Tulloch Reservoir is also of concern primarily due to body contact accessibility to the reservoir by residents and visitors from the homes lining the shore.

SOLID AND HAZARDOUS WASTES: Two permitted waste disposal facilities are located within the Stanislaus River watershed (Rock Creek and the California Asbestos Monofill). Programs are in place at both facilities to minimize risk of contaminated runoff to surface water.

URBAN RUNOFF AND SPILLS: Although pets and small agricultural operations at homes can contribute microorganisms to waterbodies during storm events, urban runoff and spills is otherwise considered a low risk. There are a number of highways that pass through the Stanislaus River watershed, however, they are not major arterials. Tulloch Reservoir is of concern because of the density of residential land uses draining directly to the reservoir which provides water to five WTPs.

WASTEWATER: There is a medium risk to surface water associated with sanitary system overflows in Murphys and Angels Camp and with the extensive and aging on-site wastewater treatment systems. The majority of reported spills were manhole overflows, septic system blockages, or accidental damage to a sewer line during construction. It is difficult to determine water quality impacts from aging OWTSs but increased precipitation events may cause leaking systems to fail, resulting in increased total coliform and *E. coli* levels to waterbodies.

WILDFIRES: During the study period there were 18 recorded fires within the watershed. The Donnell fire of 2018 burned over 36,000 acres, directly impacting the Middle Fork. The Stanislaus River watershed has an increasingly higher risk to water quality from wildfires due to more frequent and longer dry periods. Fire aftermath can result in large loadings of sediment and organic matter in surface water runoff, particularly during "first flush" rain events, leading to increased turbidity, total coliform, *E.coli*, and TOC levels. Wildfire events and resultant sediment (ash) runoff remain some of the largest risks to water supply quality in the upper portions of the Stanislaus River watershed.

WILDLIFE: Waterfowl along the SSJMC and Woodward Reservoir are a concern as Canada Geese have become non-migratory and tend to deposit a high volume of waste near waterbodies. Wildlife is rated a medium risk to surface water supplies in the watershed due to the presence of Canada Geese, swallows nesting on bridges over waterbodies, and the difficulty in managing this contaminant source. As mentioned above under recreation, the upper more protected and natural reservoir has higher total coliform levels while the lower reservoir with its recreational uses, has higher *E. coli* levels.

GROWTH AND URBANIZATION: According to the California Department of Finance, population has remained stable (with a negligible decrease) in both Calaveras and Tuolumne counties during the study period. It is too early to determine changes in occupancy of seasonal homes in the foothills and mountains due to the coronavirus pandemic in 2020, although it is anticipated that occupancy increased. Growth is rated a low risk to water quality at this time due to the stable population numbers.

WATER QUALITY FINDINGS

The water quality data for the various monitoring points along the Stanislaus River indicate a soft water, with a low alkalinity, low hardness, and low TDS. In general, such waters can be difficult to treat.

During 2016 through 2020, several SCRG treatment plants continued to experience water quality challenges including elevated total coliform levels, turbidity spikes following rain events, and increased levels of THMs and HAA5s. Several of the participating agencies received Notice of Violations for exceeding THM and HAA5 MCLs. Dealing with elevated levels of DBPs can be challenging for these waters. One agency has addressed elevated levels of THMs by installing an aeration system in the finished water reservoir to volatilize chloroform.

Several agencies conducted the two years of monthly monitoring for *Cryptosporidium* as required under the LT2ESWTR. No increased risks were identified.

Title 22 monitoring for regulated IOCs, SOCs, and VOCs did not indicate any issues (note that one sample from Pinecrest Lake detected the presence of dichloromethane (previous sample results had been ND). Several intakes had iron and manganese concentrations above the secondary MCL in the raw water (all finished water iron and manganese results that were available for review indicated that results were ND or below the secondary MCL).

California may be entering another period of extended drought. If those conditions occur, it is likely that the challenging water quality conditions will continue and may be exacerbated as customers are asked to conserve water, leading to longer residence times for treated water in storage (and thus potentially leading to increased production of DBPs).

RECOMMENDATIONS

The following recommendations reflect areas where SCRG member agencies have some ability to control source water quality within the Stanislaus River watershed along with other recommendations to improve water quality.

- Continually review data for the presences of pathogens associated with failing or leaking OWTSs. Continue working with Calaveras County and Tuolumne County Environmental Health departments to be notified of any reports of spills or leakage. Work with the County to solicit funding sources to cover the cost of additional monitoring, oversight, and replacement of aging wastewater systems near watershed waterbodies. Work with the County to encourage homeowners to notify the County of any problems with their own OWTS or any leaking systems they may discover.
- Algae should be monitored in Woodward Reservoir because of the risk of nutrient loading in runoff of agricultural lands (both livestock grazing and orchards) draining to the reservoir, nutrient loading upstream at Tulloch Reservoir from residential lands and grazing in the watershed, and/or Woodward Reservoir's location in the lower watershed with warmer weather and lack of year-round inflows. It is difficult to control agricultural land runoff because SSJID does not own the land. Additional monitoring of potential nutrient source contributions into Woodward Reservoir is also recommended to help define the problem.
- Options that SCRG agencies can consider for minimizing the formation of DBPs include installation of GAC filters for better TOC removal and converting the secondary disinfectant from free chlorine to chloramine. Each of these options has challenges: the expense of GAC and for chloramines there is the possibility that systems could experience nitrification in storage facilities or within the distribution system, that could lead to the loss of disinfectant residual.
- SSJID should increase the frequency of the annual holiday microbiological monitoring program in Woodward Reservoir and conduct the monitoring on a monthly basis at the same five locations to better understand the levels of total coliforms and *E. coli* during different times of the year.
- SSJID should add weekly microbiological monitoring one month before and one month after music festival held at Woodward Reservoir, to better understand impacts of the large crowds on water quality in the reservoir.
- SCRG participating agencies should consider developing a joint monitoring and communication plan with locations throughout the watershed to identify potential inputs of nutrients and the occurrence of algal blooms.
- Related to the above recommendation, in 2021 it is anticipated that DDW will issue Notification Levels for up to four cyanotoxins. SCRG agencies should consider developing a joint cyanotoxin monitoring and response plan for the entire watershed. Components of such a plan could include visual inspections for the presence of algal blooms, routine monitoring for algal cells and nutrients, and triggers to begin raw water monitoring for presence of algal toxins. Combined with developing these plans, agencies should evaluate the effectiveness of their current treatment processes to remove or destroy cyanotoxins.
- Maintaining water quality records is a critical activity for public water systems and takes time and resources. The maintenance of complete records for the participating SCRG agencies varied. SCRG agencies should consider establishing a shared centralized database that would incorporate sample locations and results from each agency. Each SCRG agency should commit to update the database with water quality data on a regular schedule (i.e., quarterly). The centralized database could be established to focus on key raw water quality parameters, including total coliforms, *E. coli*, turbidity, and TOC.

- One way to implement the above recommendation is to investigate available off the shelf data management packages. These may be a viable tool for the SCRG agencies to use as a centralized water quality database. Contract laboratories can upload water quality results directly into these software packages for each SCRG member's access and use.

APPENDICES

APPENDIX A

REFERENCES

APPENDIX A REFERENCES

BBC, 2021. Information provided by Brian West, Operations Manager for Baseline Conservation Camp. April 2021.

BVWD, 2021. *Wastewater System: Collection, Treatment, and Disposal*, Bear Valley Water District. Website accessed May 2021.

Calaveras County, 2020. *Calaveras County Crop Reports for 2016 through 2019*, prepared by Calaveras County Department of Agriculture. Obtained March 2021.

_____, 2021. *Calaveras County 2014 Pesticide Use,* prepared by Calaveras County Department of Agriculture. Website accessed April and May 2021.

_____, 2020. *Calaveras County General Plan Land Use Element*, prepared by Calaveras County Planning Department. October 2020.

CCWD, 2021. *2020 Urban Water Management Plan*, prepared by Woodward & Curran for Calaveras County Water District. Public Draft April 2021.

_____, 2018. *Copper Cove Wastewater System Master Plan*, Calaveras County Water District, prepared by Lee & Ro. June 2018.

CAL FIRE, 2021a. *Timber Harvesting Plans*, provided by CAL FIRE. Website accessed March 2021.

_____, 2021b. *Incident Information* prepared by CAL FIRE for historical fires. Website accessed May 2021.

CDFA, 2020. *California Agricultural Statistics Review*, prepared by California Department of Food and Agriculture for years 2016 through 2019.

CDOC, 2021. *AB 3098 List*, published by California Department of Conservation Office of Mine Reclamation.

CDOF, 2021. *County Population Estimates with Annual Percent Change*, prepared by California Department of Finance. May 2021.

CDPR, 2021. *Top Five Pesticides Used* in Each County, prepared by California Department of Pesticide Regulation from the *Pesticide Use Report* obtained for years 2016 through 2020.

_____, 2020. *Summary of Pesticide Use Report Data – 2018, Trends in Pesticide Use for Select Commodities*. Prepared by California Department of Pesticide Regulation. Information on almonds was excerp of the backyard ted. November 2020.

COES, 2021. *Historical HazMat Spill Notifications,* prepared by California Office of Emergency Services. 2016 through 2020.

CVRWQCB, 2021a. *NPDES and WDR for Wastewater Treatment Facilities*, Central Valley Regional Water Quality Control Board. Website accessed March and April 2021.

_____, 2021b. Conversation with Girma Getachew, CVRWQCB regarding Poultry General Order and registered operations. March 2021.

_____, 2016a. *Waste Discharge Requirements General Order for Poultry Operations*, CVRWQCB. 2016.

DDW, 2021. Safe Drinking Water Information System. Accessed at https://sdwis.waterboards.ca.gov/PDWW/

ICWDM, 2016. *Canada Geese Damage Management Control Techniques*, prepared by Internet Center for Wildlife Damage Management. 2015.

Jacobson, John, 2021. Information provided by John (Jake) Jacobson, Water Treatment Operator with Sierra Sunrise Water Treatment, Inc. for Knights Ferry CSD. March 2021.

MSD, 2021. Information provided by Dan Murphy, Operations Manager of Murphys Sanitation District, regarding wastewater treatment facilities. Website accessed. May 2021.

Roche, Leslie et al, 2013. *Water Quality Conditions Associated with Cattle Grazing and Recreation on National Forest Lands*, prepared by Roche, Lea Kromschroeder, Edward Atwill, Randy Dahlgren, and Kenneth Tate of UC Davis. 2013.

State Parks, 2015. *Calaveras Big Trees State Park North Grove and Oak Hollow Campgrounds*, prepared by California State Parks. February 2015.

SEWD, 2021. Information provided by Stockton East Water District regarding pesticide usage and security. March 2021.

_____, 2021. *2020 Urban Water Management Plan*, prepared by Provost & Pritchard Consulting Group for Stockton East Water District. June 2021.

SSJID, 2021. Information provided by Charles Galea, Chief Plant Operator, and James Gallegos of South San Joaquin Irrigation District regarding Woodward Reservoir intakes. March 2021.

_____, 2020. *Annual Response on Permit Condition No 29*, Ed Erisman, Treatment Plant Manager correspondence with SWRCB. 2016 through 2020.

SWRCB, 2021a. *California Integrated Water Quality System Project*. State Water Resources Control Board. Database accessed April and May 2021.

_____, 2021b. *Geotracker*, environmental data for regulated hazardous substance facilities, State Water Resources Control Board. Website accessed April 2021.

_____, 2021c. *Project Facility at a Glance Report*, prepared by California Integrated Water Quality System for stormwater permittees. Website accessed April 2021.

_____, 2021d. *Regulated Facility Report*, data available from State Water Resources Control Board. Website accessed May 2021.

_____, 2017. *Final Part 2 of the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California – Tribal and Subsistence Fishing Beneficial Uses and Mercury Provisions*. Resolution adopted by State Water Resources Control Board. May 2, 2017

_____, 2016. *Water Quality Control Policy for Siting, Operation, and Maintenance of Onsite Wastewater Treatment Systems*, information prepared by the State Water Resources Control Board. Website accessed May 2016.

_____, 2013. *Waste Discharge Requirement for Murphys Sanitary District Murphys Wastewater Treatment Plant, Calaveras County*. Order No. 5-00-254-002. May 31, 2013.

Tuolumne County, 2020. *Tuolumne County Crop and Livestock Reports*, for years 2016 through 2019, prepared by County of Tuolumne Agricultural Commissioner. Obtained March 2021.

_____, 2018. *Tuolumne County General Plan Update,* prepared by Ascent Environmental Inc. for Tuolumne County. December 2018.

University of Montana, 2019. *Timber Harvest for Calaveras and Tuolumne Counties, California*, prepared by Forest Industry Research Program, University of Montana. Data accessed 2021.

UPUD, 2021. Information provided by Union Public Utility District regarding security. March 2021.

USDA, 2021. *National Agricultural Statistics Service* data provided by U.S. Department of Agriculture. Researched poultry operations with inventory. Website accessed March 2021.

USFS, 2021. *Stanislaus National Forest Plans Prescribed Burning on Mi Wok Ranger District for Resource and Public Benefit*, U.S. Forest Service. May 7, 2021.

APPENDIX B

SSJID DOCUMENTATION
FENCE INSPECTIONS

SOUTH SAN JOAQUIN IRRIGATION DISTRICT

January 27, 2017

State Water Resource Control Board – Drinking Water Division
Tahir Mansoor – District Engineer
Waterboards
31 East Channel Street, Room 270
Stockton, CA 95202

Subject: 2016 Annual Response on Permit Condition No. 29

Permit Condition No. 29 of SSJID potable water permit requires that SSJID provide an annual report to Waterboards – Stockton office summarizing the following:

1. No grass fires occurred around Woodward Reservoir in 2016. No sewage spills or sanitary hazards occurred around Woodward other than the fires during 2016.

2. No cattle were allowed to graze within the fence boundaries along the canal or surrounding Woodward Reservoir.

3. There were no dead cattle in the canal in 2016.

4. In 2016 the irrigation season started on March 25th and ended on October 14th. Water flows into the Woodward Reservoir were estimated to be 183,005 acre feet and the flows out of the Woodward Reservoir were estimated to be 150,917.92 acre feet for irrigation and 15,939 acre feet used at the water treatment plant; for a total of 166,856.92 acre feet.

5. Fence repairs surrounding Woodward reservoir – There were 25 repairs made during the months of March, April, May, June, July, August, September, October and November.

Should you have any questions, I can be reached at 209-844-1506.

Regards,

Ed Erisman
Nick C. DeGroot Water Treatment Plant Manager

FOR BOTH, MAILING ADDRESS
PO Box 747
Ripon, CA 95366
www.ssjid.com

OFFICE
11011 E. Highway 120
Manteca, CA 95336
tel 209.249.4600

NICK C. DEGROOT WATER TREATMENT PLANT
5585 Dodds Road
Oakdale, CA 95361
tel 209.844.1500

SOUTH SAN JOAQUIN
IRRIGATION DISTRICT

January 15, 2018

State Water Resource Control Board – Drinking Water Division
Tahir Mansoor – District Engineer
Waterboards
31 East Channel Street, Room 270
Stockton, CA 95202

Subject: 2017 Annual Response on Permit Condition No. 29

Permit Condition No. 29 of SSJID potable water permit requires that SSJID provide an annual report to Waterboards – Stockton office summarizing the following:

1. No grass fires occurred around Woodward Reservoir in 2017. No sewage spills or sanitary hazards occurred around Woodward other than the fires during 2017.

2. No cattle were allowed to graze within the fence boundaries along the canal or surrounding Woodward Reservoir.

3. There were no dead cattle in the canal in 2017.

4. In 2017 the irrigation season started on March 19th and ended on October 20th. Water flows into the Woodward Reservoir were estimated to be 202,196 acre feet and the flows out of the Woodward Reservoir were estimated to be 177,674.88 acre feet for irrigation and 20,123.78 acre feet used at the water treatment plant; for a total of 197,798.66 acre feet.

5. Fence repairs surrounding Woodward reservoir – There were 21 repairs made during the months of Feb, March, April, May, June, July, August, September, October and November.

Should you have any questions, I can be reached at 209-844-1506.

Regards,

Ed Erisman
Nick C. DeGroot Water Treatment Plant Manager

FOR BOTH, MAILING ADDRESS
PO Box 747
Ripon, CA 95366
www.ssjid.com

OFFICE
11011 E. Highway 120
Manteca, CA 95336
tel 209.249.4600

NICK C. DEGROOT WATER TREATMENT PLANT
5585 Dodds Road
Oakdale, CA 95361
tel 209.844.1500

SSJID

SOUTH SAN JOAQUIN
IRRIGATION DISTRICT

January 21, 2019

State Water Resource Control Board – Drinking Water Division
Tahir Mansoor – District Engineer
Waterboards
31 East Channel Street, Room 270
Stockton, CA 95202

Subject: 2018 Annual Response on Permit Condition No. 29

Permit Condition No. 29 of SSJID potable water permit requires that SSJID provide an annual report to Waterboards – Stockton office summarizing the following:

1. No grass fires occurred around Woodward Reservoir in 2018. There were no recorded or reported sewage spills or violations of any sanitary nature in 2018.

2. No cattle grazed within the fence boundaries along the canal or surrounding Woodward Reservoir.

3. In 2018, the irrigation season started on February 27th, stopped on March 23rd due to rain, continued on April 3rd and ended on October 19th. Water flows into the Woodward Reservoir were estimated to be 220,517-acre feet and the flows out of the Woodward Reservoir were estimated to be 196,881.01-acre feet for irrigation and 21,710-acre feet used at the water treatment plant; for a total of 218591.01-acre feet.

4. Fence repairs surrounding Woodward reservoir – There were 7 repairs made during the months of Feb, July, October, November and December.

Should you have any questions, I can be reached at 209-844-1506.

Regards,

Ed Erisman
Nick C. DeGroot Water Treatment Plant Manager

MAIN OFFICE:
11011 E. Highway 120
Manteca, CA 95336
tel 209.249.4600

NICK C. DEGROOT
WATER TREATMENT PLANT:
5855 Dodds Road
Oakdale, CA 95361
tel 209.844.1500

FOR BOTH, MAILING ADDRESS:
PO Box 747
Ripon, CA 95366

www.ssjid.com

SSJID

SOUTH SAN JOAQUIN
IRRIGATION DISTRICT

January 20, 2020

State Water Resource Control Board – Drinking Water Division
Tahir Mansoor – District Engineer
Waterboards
31 East Channel Street, Room 270
Stockton, CA 95202

Subject: 2019 Annual Response on Permit Condition No. 29

Permit Condition No. 29 of SSJID potable water permit requires that SSJID provide an annual report to Waterboards – Stockton office summarizing the following:

1. No grass fires occurred around Woodward Reservoir in 2019. There were no recorded or reported sewage spills or violations of any sanitary nature in 2019.

2. No cattle grazed within the fence boundaries along the canal or surrounding Woodward Reservoir.

3. In 2019, the irrigation season started on March 18th and ended on October 24th. Water flows into the Woodward Reservoir are estimated to be 218,714-acre feet and the flows out of the Woodward Reservoir are estimated to be 168,011.41-acre feet for irrigation and 21,689.48-acre feet used at the water treatment plant; for a total of 189,700.89-acre feet.

4. Fence repairs surrounding Woodward reservoir – There were 2 repairs made during the months of April and October.

Should you have any questions, I can be reached at 209-844-1506.

Regards,

Ed Erisman
Nick C. DeGroot Water Treatment Plant Manager

MAIN OFFICE:
11011 E. Highway 120
Manteca, CA 95336
tel 209.249.4600

NICK C. DEGROOT
WATER TREATMENT PLANT:
5855 Dodds Road
Oakdale, CA 95361
tel 209.844.1500

FOR BOTH, MAILING ADDRESS:
PO Box 747
Ripon, CA 95366

www.ssjid.com

SOUTH SAN JOAQUIN
IRRIGATION DISTRICT

January 28, 2020

State Water Resource Control Board, Drinking Water Division
Tahir Mansoor, District Engineer, Water Boards
31 East Channel Street, Room 270
Stockton, CA 95202

Subject: 2020 Annual Response on Permit Condition No. 29

Dear Tahir,
Permit Condition No. 29 of SSJID potable water permit requires that SSJID provide an annual report to the Stockton Water Boards office summarizing the following:

1. No grass fires occurred around the water line of Woodward Reservoir in 2020. There were no recorded or reported sewage spills or violations of any sanitary nature in 2020.

2. No cattle grazed within the fence boundaries along the canal or surrounding Woodward Reservoir.

3. In 2020, the irrigation season started on **March 3** and ended on **October 15**. Estimated 2020 Water flows into the Woodward Reservoir were **249,804-acre feet,** and estimated flows out of the Woodward Reservoir were **185,323.97-acre-feet** for irrigation, and **23,984.22-acre-feet** used at the water treatment plant, for a total of **209,308.19-acre-feet**.

4. Fence repairs surrounding Woodward reservoir: There were (3) repairs made during the months of August, September and December.

Should you have any questions, feel free to contact me at 209-844-1506.

Regards,

Ed Erisman
Plant Manager
Nick C. DeGroot Water Treatment Plant Manager

P.O. Box 747, Ripon, CA 95366-0747 (Mailing)
11011 E. Highway 120, Manteca, CA 95336-9750
(209) 249-4600

APPENDIX C

WOODWARD RESERVOIR VISITOR COUNTS (2016 TO 2020)

Woodward Reservoir Visitor Counts

Use Description	Year				
	2016	2017	2018	2019	2020
Annual 2nd Boat Permit	2	1	8	2	0
Annual 2nd Jet Ski Permit	9	10	3	6	4
Annual 2nd Vehicle Permit	4	6	0	6	2
Annual Boat Permit	26	31	25	26	5
Annual Disabled Boat Permit	2	8	7	5	4
Annual Disabled Jet Ski Permit	9	6	11	10	2
Annual Disabled Vehicle Permit	13	25	39	30	18
Annual Jet Ski Permit	11	14	16	13	4
Annual Replacement Permit	10	14	9	12	6
Annual Senior Boat Permit	20	22	29	29	13
Annual Senior Jet Ski	7	14	13	18	7
Annual Senior Vehicle Permit	47	94	102	119	82
Annual Vet Boat Permit	5	6	5	4	1
Annual Vet Vehicle Permit	7	16	26	20	10
Camping	40451	37932	36178	35857	289
Camping 2nd Vehicle	226	200	243	235	2402
Camping Disabled	321	449	463	459	28
Camping Senior	2459	2764	3216	3011	108
Camping Senior 2nd Vehicle	180	66	0	0	0
Disabled Vet/POW Hookup Site	12	18	15	257	1518
Disabled Vet/POW Camping	1460	1345	1316	1208	39
Hookup 2nd Vehicle (1 per site)	1218	1571	1533	1426	319
Hookup Site	1401	1811	1435	1424	1954
Hookup Site Disabled	392	892	1060	1084	159
Hookup Site Senior	836	1819	2142	2253	1401
Vet Camp Hookup	255	687	833	259	87
Vet Camp Special	60	90	54	52	28
Vet Camp Vehicle	640	714	806	742	10
Ann Vehicle Permit	107	133	141	149	85
Boat	4977	4970	4516	4326	2404
Day Use Vehicle	33048	29688	40375	45584	26315
Disabled Boat	244	279	307	275	137
Disabled Day Use Vehicle	1129	1402	1328	1319	776
Disabled Jet Ski	225	222	277	192	105
Disabled Vet/POW Day Use Vehicle	1	0	0	0	557
Disabled Veteran/POW Boat	50	82	65	56	131

Disabled Veteran/POW Jet Ski	153	258	336	233	54
Fireworks Show (Per Vehicle)	1501	1027	1453	1071	0
Jet Ski	7201	6546	6442	7116	2567
Senior Boat	538	630	774	811	444
Senior Day Use Vehicle	3090	3671	4164	3985	2633
Senior Jet Ski	400	432	390	453	218
Discount Rate for Stan County Residents	11462	17429	4838	0	0
Vet Boat Day Use	131	157	153	210	22
Vet Vehicle Day Use	691	970	1180	1219	215
Waterfowl Ann Vehicle Permit	11	3	7	11	7
Waterfowl Ann Vessel Permit	7	3	4	4	5
Waterfowl Blind Permit Fee	16	15	13	14	14
Waterfowl Refundable Blind Dep	16	15	13	14	14
Holiday Surcharge (Vehicle Day)	966	762	752	764	1312
Holiday Weekend Surcharge (Camp)	15793	10654	10568	7620	150
Late Exit Fee	42	244	230	129	0
Mooring Fee - (Per Month)	0	0	3	3	0
Picnic Shelter Reservoirs	30	30	38	27	4
Dog Ann Commercial	0	0	0	4	5
Dog Ann Private	4	17	21	14	12
Dog Per Day	13276	19143	20765	19663	10336
Horse Ann	6	12	17	21	20
Horse Ann Additional	7	5	10	15	14
Horse Per Day	749	871	990	955	639
Reservation Fee (Non-Refundable)	26	27	33	27	4

Source: SSJID, March 2021

APPENDIX D

TITLE 22 MONITORING RESULTS (2016 TO 2020)

Table D-1: Title 22 Analysis of Raw Water for the Hunters Treatment Plant (McKays Point Dam Source).

INORGANICS			HUNTERS WATER TREATMENT PLANT - RAW WATER MCKAYS POINT DAM SOURCE						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	1000	µg/L	5	50.2	ND	70	Apr. 2016	-	Apr. 2020
Antimony	6	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Arsenic	10	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Asbestos	7	MFL	1	ND	ND	ND	Jan. 2017		
Barium	1000	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Beryllium	4	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Cadmium	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Fluoride (Source)	2	mg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Mercury	2	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Nickel	100	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Nitrate (As N)	10	mg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Nitrate + Nitrite (As N)	10000	µg/L	5	0.04	ND	0.2	Apr. 2016	-	Apr. 2020
Nitrite (As N)	1000	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Perchlorate	6	µg/L	5	ND	ND	ND	Oct. 2016	-	Jun. 2020
Selenium	50	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Thallium	2	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Total Chromium	50	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020

VOLATILE ORGANIC CHEMICALS (VOCs)			HUNTERS WATER TREATMENT PLANT - RAW WATER MCKAYS POINT DAM SOURCE						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
1,1,1-Trichloroethane	200	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
1,1,2,2-Tetrachloroethane	1	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
1,1,2-Trichloroethane	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
1,1-Dichloroethane	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
1,1-Dichloroethylene	6	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
1,2,3-Trichlorobenzene	0.005	µg/L	4	ND	ND	ND	Apr. 2017	-	Apr. 2020
1,2,4-Trichlorobenzene	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
1,2-Dichlorobenzene	600	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
1,2-Dichloroethane	0.5	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
1,2-Dichloropropane	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
1,3-Dichloropropene (Total)	0.5	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
1,4-Dichlorobenzene	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Benzene	1	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Carbon Tetrachloride	0.5	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Cis-1,2-Dichloroethylene	6	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Dichloromethane	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Ethylbenzene	300	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Methyl tert-Butyl Ether	13	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Monochlorobenzene	70	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Styrene	100	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Tetrachloroethylene	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Toluene	150	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Trans-1,2-Dichloroethylene	10	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Trichloroethylene	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Trichlorofluoroethane (Freon 113)	1200	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Trichlorofluoromethane	150	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Vinyl Chloride	0.5	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Xylenes	1750	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020

NON-VOLATILE SYNTHETIC ORGANIC CHEMICALS (SOCS)			HUNTERS WATER TREATMENT PLANT - RAW WATER MCKAYS POINT DAM SOURCE						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
1,2,3-Trichloropropane	0.005	µg/L	5	ND	ND	ND	Jan. 2018	-	Dec. 2018
Glyphosate	700	µg/L	4	ND	ND	ND	Mar. 2018	-	Jun. 2019

SECONDARY STANDARDS			HUNTERS WATER TREATMENT PLANT - RAW WATER MCKAYS POINT DAM SOURCE						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	200	µg/L	5	50.2	ND	70	Apr-2016	-	Apr-2020
Chloride	250	mg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Color	15	Units	185	5	ND	35	Jan. 2016	-	Dec. 2020
Copper	1000	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Iron	300	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Manganese	50	µg/L	5	4.6	ND	23	Apr. 2016	-	Apr. 2020
MBAS	0.5	mg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Methyl tert-Butyl Ether	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Odor	3	TON	109	0.95	ND	4	Jan. 2016	-	Dec. 2020
Silver	100	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Specific Conductance	900	µS/cm	5	26	25	27	Apr. 2016	-	Apr. 2020
Sulfate	250	mg/L	5	0.28	ND	0.9	Apr. 2016	-	Apr. 2020
Total Dissolved Solids	500	mg/L	5	18	ND	32	Apr. 2016	-	Apr. 2020
Turbidity	5	NTU	5	0.576	0.5	0.67	Apr. 2016	-	Apr. 2020
Zinc	5000	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
MONITORING ASSOCIATED WITH SECONDARY STANDARDS			**HUNTERS WATER TREATMENT PLANT - RAW WATER MCKAYS POINT DAM SOURCE**						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Bicarbonate Alkalinity	-	mg/L	37	12.6	ND	30	Apr. 2016	-	Dec. 2020
Calcium	-	mg/L	5	2.44	2	3	Apr. 2016	-	Apr. 2020
Carbonate Alkalinity	-	mg/L	37	ND	ND	ND	Apr. 2016	-	Dec. 2020
Hydroxide Alkalinity	-	mg/L	37	ND	ND	ND	Apr. 2016	-	Dec. 2020
Magnesium	-	mg/L	5	0.37	ND	0.64	Apr. 2016	-	Apr. 2020
pH	-	-	4	7.38	7.30	7.60	Apr. 2016	-	Apr. 2019
Sodium	-	mg/L	5	1.98	ND	5	Apr. 2016	-	Apr. 2020
Total Alkalinity	-	mg/L	57	9.61	ND	30	Jan. 2016	-	Dec. 2020
Total Hardness	-	mg/L	5	7.60	4.99	9.1	Apr. 2016	-	Apr. 2020

Table D-2: Title 22 Analysis of Treated Water for the Hunters Treatment Plant

INORGANICS			HUNTERS WATER TREATMENT PLANT TREATED WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	1000	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Antimony	6	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Arsenic	10	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Barium	1000	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Beryllium	4	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Cadmium	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Fluoride (Source)	2	mg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Mercury	2	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Nickel	100	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Nitrate (As N)	10	mg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Nitrate + Nitrite (As N)	10000	µg/L	5	0.04	ND	0.2	Apr. 2016	-	Apr. 2020
Nitrite (As N)	1000	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Selenium	50	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Thallium	2	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Total Chromium	50	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020

VOLATILE ORGANIC CHEMICALS (VOCs)			HUNTERS WATER TREATMENT PLANT TREATED WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
1,1,1-Trichloroethane	200	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2018
1,1,2,2-Tetrachloroethane	1	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2018
1,1,2-Trichloroethane	5	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2018
1,1-Dichloroethane	5	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2018
1,1-Dichloroethylene	6	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2018
1,2,3-Trichlorobenzene	0.005	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2018
1,2,4-Trichlorobenzene	5	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2018
1,2-Dichlorobenzene	600	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2018
1,2-Dichloroethane	0.5	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2018
1,2-Dichloropropane	5	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2018
1,3-Dichloropropene (Total)	0.5	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2018
1,4-Dichlorobenzene	5	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2018
Benzene	1	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2018
Carbon Tetrachloride	0.5	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2018
Cis-1,2-Dichloroethylene	6	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2018
Dichloromethane	5	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2018
Ethylbenzene	300	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2018
Methyl tert-Butyl Ether	13	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2018
Monochlorobenzene	70	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2018
Styrene	100	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2018
Tetrachloroethylene	5	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2018
Toluene	150	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2018
Trans-1,2-Dichloroethylene	10	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2018
Trichloroethylene	5	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2018
Trichlorofluoroethane (Freon 113)	1200	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2018
Trichlorofluoromethane	150	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2018
Vinyl Chloride	0.5	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2018
Xylenes	1750	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2018

SECONDARY STANDARDS			HUNTERS WATER TREATMENT PLANT TREATED WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	200	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Chloride	250	mg/L	5	2.68	2.2	3.0	Apr. 2016	-	Apr. 2020
Color	15	Units	7	ND	ND	ND	Jan. 2016	-	Apr. 2020
Copper	1000	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Iron	300	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Manganese	50	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
MBAS	0.5	mg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Methyl tert-Butyl Ether	5	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2018
Odor	3	TON	5	0.2	ND	1	Feb. 2016	-	Apr. 2020
Silver	100	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Specific Conductance	900	µS/cm	5	34.4	33	35	Apr. 2016	-	Apr. 2020
Sulfate	250	mg/L	5	0.56	ND	1.00	Apr. 2016	-	Apr. 2020
Total Dissolved Solids	500	mg/L	5	19	ND	35	Apr. 2016	-	Apr. 2020
Turbidity	5	NTU	5	0.11	ND	0.20	Apr. 2016	-	Apr. 2020
Zinc	5000	µg/L	5	140	100	170	Apr. 2016	-	Apr. 2020
MONITORING ASSOCIATED WITH SECONDARY STANDARDS			**HUNTERS WATER TREATMENT PLANT TREATED WATER**						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Bicarbonate Alkalinity	-	mg/L	36	11.9	ND	30	Apr. 2016	-	Dec. 2020
Calcium	-	mg/L	5	2.44	2.0	3.0	Apr. 2016	-	Apr. 2020
Carbonate Alkalinity	-	mg/L	36	ND	ND	ND	Apr. 2016	-	Dec. 2020
Hydroxide Alkalinity	-	mg/L	36	ND	ND	ND	Apr. 2016	-	Dec. 2020
Magnesium	-	mg/L	5	0.37	ND	0.62	Apr. 2016	-	Apr. 2020
pH	-	-	4	7.40	7.30	7.70	Apr. 2016	-	Apr. 2019
Sodium	-	mg/L	5	4.1	3.0	7.0	Apr. 2016	-	Apr. 2020
Total Alkalinity	-	mg/L	42	8.0	ND	20	Jan. 2016	-	Dec. 2020
Total Hardness	-	mg/L	5	7.60	4.99	8.8	Apr. 2016	-	Apr. 2020

Table D-3: Title 22 Analysis of Raw Water for Murphys Water Treatment Plant

INORGANICS			MURPHYS WATER TREATMENT PLANT - RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	1000	µg/L	5	22	ND	110	Jan. 2016	-	Jan. 2020
Antimony	6	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Arsenic	10	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Asbestos	7	MFL	1	ND	ND	ND	Mar. 2016		
Barium	1000	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Beryllium	4	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Cadmium	5	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Fluoride (Source)	2	mg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Mercury	2	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Nickel	100	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Nitrate (As N)	10	mg/L	6	ND	ND	ND	Jan. 2016	-	Jan. 2020
Nitrate + Nitrite (As N)	10000	µg/L	3	ND	ND	ND	Jan. 2018	-	Jan. 2020
Nitrite (As N)	1000	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Perchlorate	6	µg/L	5	ND	ND	ND	Jun. 2016	-	Jun. 2020
Selenium	50	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Thallium	2	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Total Chromium	50	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
RADIOACTIVITY			**MURPHYS WATER TREATMENT PLANT - RAW WATER**						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Gross Alpha	15	pCi/L	1	0.66	0.66	0.66	Oct. 2016		

VOLATILE ORGANIC CHEMICALS (VOCs)			MURPHYS WATER TREATMENT PLANT - RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
1,1,1-Trichloroethane	200	µg/L	2	ND	ND	ND	Mar. 2016	-	Jan. 2018
1,1,2,2-Tetrachloroethane	1	µg/L	2	ND	ND	ND	Mar. 2016	-	Jan. 2018
1,1,2-Trichloroethane	5	µg/L	2	ND	ND	ND	Mar. 2016	-	Jan. 2018
1,1-Dichloroethane	5	µg/L	2	ND	ND	ND	Mar. 2016	-	Jan. 2018
1,1-Dichloroethylene	6	µg/L	2	ND	ND	ND	Mar. 2016	-	Jan. 2018
1,2,4-Trichlorobenzene	5	µg/L	2	ND	ND	ND	Mar. 2016	-	Jan. 2018
1,2-Dichlorobenzene	600	µg/L	2	ND	ND	ND	Mar. 2016	-	Jan. 2018
1,2-Dichloroethane	0.5	µg/L	2	ND	ND	ND	Mar. 2016	-	Jan. 2018
1,2-Dichloropropane	5	µg/L	2	ND	ND	ND	Mar. 2016	-	Jan. 2018
1,3-Dichloropropene (Total)	0.5	µg/L	2	ND	ND	ND	Mar. 2016	-	Jan. 2018
1,4-Dichlorobenzene	5	µg/L	2	ND	ND	ND	Mar. 2016	-	Jan. 2018
Benzene	1	µg/L	2	ND	ND	ND	Mar. 2016	-	Jan. 2018
Carbon Tetrachloride	0.5	µg/L	2	ND	ND	ND	Mar. 2016	-	Jan. 2018
Cis-1,2-Dichloroethylene	6	µg/L	2	ND	ND	ND	Mar. 2016	-	Jan. 2018
Dichloromethane	5	µg/L	2	ND	ND	ND	Mar. 2016	-	Jan. 2018
Ethylbenzene	300	µg/L	2	ND	ND	ND	Mar. 2016	-	Jan. 2018
Methyl tert-Butyl Ether	13	µg/L	2	ND	ND	ND	Mar. 2016	-	Jan. 2018
Monochlorobenzene	70	µg/L	2	ND	ND	ND	Mar. 2016	-	Jan. 2018
Styrene	100	µg/L	2	ND	ND	ND	Mar. 2016	-	Jan. 2018
Tetrachloroethylene	5	µg/L	2	ND	ND	ND	Mar. 2016	-	Jan. 2018
Toluene	150	µg/L	2	ND	ND	ND	Mar. 2016	-	Jan. 2018
Trans-1,2-Dichloroethylene	10	µg/L	2	ND	ND	ND	Mar. 2016	-	Jan. 2018
Trichloroethylene	5	µg/L	2	ND	ND	ND	Mar. 2016	-	Jan. 2018
Trichlorofluoroethane (Freon 113)	1200	µg/L	2	ND	ND	ND	Mar. 2016	-	Jan. 2018
Trichlorofluoromethane	150	µg/L	2	ND	ND	ND	Mar. 2016	-	Jan. 2018
Vinyl Chloride	0.5	µg/L	2	ND	ND	ND	Mar. 2016	-	Jan. 2018
Xylenes	1750	µg/L	2	ND	ND	ND	Mar. 2016	-	Jan. 2018

SYNTHETIC ORGANIC CHEMICALS (SOCs)			MURPHYS WATER TREATMENT PLANT - RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
1,2,3-Trichloropropane	0.005	µg/L	4	ND	ND	ND	Jan. 2018	-	Nov. 2018
Glyphosate	700	µg/L	4	ND	ND	ND	Mar. 2018	-	Jun. 2019

SECONDARY STANDARDS			MURPHYS WATER TREATMENT PLANT - RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	1000	µg/L	5	22	ND	110	Jan. 2016	-	Jan. 2020
Chloride	250	mg/L	5	0.89	0.55	1.2	Jan. 2016	-	Jan. 2020
Color	15	Units	5	9.4	5	12	Jan. 2016	-	Jan. 2020
Copper	1000	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Iron	300	µg/L	5	72	ND	140	Jan. 2016	-	Jan. 2020
Manganese	50	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Methyl tert-Butyl Ether	13	µg/L	2	ND	ND	ND	Mar. 2016	-	Jan. 2018
MBAS	0.5	mg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Odor	3	TON	5	1.12	ND	5.6	Jan. 2016	-	Jan. 2020
Silver	100	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Specific Conductance	900	µS/cm	10	35	28	44	Jan. 2016	-	Jun. 2020
Sulfate	250	mg/L	5	0.82	0.64	1	Jan. 2016	-	Jan. 2020
Total Dissolved Solids	500	mg/L	5	30	25	39	Jan. 2016	-	Jan. 2020
Turbidity	5	NTU	5	1.05	0.57	1.8	Jan. 2016	-	Jan. 2020
Zinc	5000	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020

MONITORING ASSOCIATED WITH SECONDARY STANDARDS			MURPHYS WATER TREATMENT PLANT - RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Bicarbonate Alkalinity	-	mg/L	5	14.8	9	20	Jan. 2016	-	Jan. 2020
Calcium	-	mg/L	5	3.1	2.6	3.8	Jan. 2016	-	Jan. 2020
Carbonate Alkalinity	-	mg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Hydroxide Alkalinity	-	mg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Magnesium	-	mg/L	5	0.22	ND	1.1	Jan. 2016	-	Jan. 2020
pH	-	-	5	6.50	6.08	6.73	Jan. 2016	-	Jan. 2020
Sodium	-	mg/L	5	1.68	1.3	2.1	Jan. 2016	-	Jan. 2020
Total Alkalinity	-	mg/L	5	13.4	9	17	Jan. 2016	-	Jan. 2020
Total Hardness	-	mg/L	5	11.2	9	14	Jan. 2016	-	Jan. 2020

Table D-4: Title 22 Analysis of Treated Water for Murphy's Water Treatment Plant

INORGANICS			MURPHYS WATER TREATMENT PLANT - TREATED WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	1000	µg/L	4	ND	ND	ND	Jan. 2016	-	Jan. 2020
Perchlorate	6	µg/L	1	ND	ND	ND	Jun. 2019		
SECONDARY STANDARDS			**MURPHYS WATER TREATMENT PLANT - TREATED WATER**						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	200	µg/L	4	ND	ND	ND	Jan. 2016	-	Jan. 2020
Iron	300	µg/L	4	ND	ND	ND	Jan. 2016	-	Jan. 2020
Specific Conductance	900	µS/cm	1	40	40	40	Jun. 2019		

Table D-5: Title 22 Analysis of Raw Water for Angels Camp Water Treatment Plant

INORGANICS			ANGELS CAMP WATER TREATMENT PLANT - RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	1000	µg/L	5	199.2	ND	660	Jan. 2016	-	Jan. 2020
Antimony	6	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Arsenic	10	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Asbestos	7	MFL	1	ND	ND	ND	Aug. 2017		
Barium	1000	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Beryllium	4	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Cadmium	5	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Fluoride (Source)	2	mg/L	5	0.11	ND	0.43	Jan. 2016	-	Jan. 2020
Hexavalent Chromium	10	µg/L	2	ND	ND	ND	Jan. 2016	-	Aug. 2017
Mercury	2	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Nickel	100	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Nitrate (As N)	10	mg/L	5	0.74	ND	3.1	Jan. 2016	-	Jan. 2020
Nitrate + Nitrite (As N)	10000	µg/L	2	0.30	ND	0.61	Jan. 2016	-	Jan. 2017
Nitrite (As N)	1000	µg/L	4	ND	ND	ND	Jan. 2016	-	Jan. 2019
Perchlorate	6	µg/L	6	ND	ND	ND	May. 2016	-	Jun. 2020
Selenium	50	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Thallium	2	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Total Chromium	50	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
RADIOACTIVITY			**ANGELS CAMP WATER TREATMENT PLANT - RAW WATER**						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Gross Alpha	15	pCi/L	2	1.50	0.50	2.5	Mar. 2016	-	Apr. 2020

VOLATILE ORGANIC CHEMICALS (VOCs)			ANGELS CAMP WATER TREATMENT PLANT - RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
1,1,1-Trichloroethane	200	µg/L	2	ND	ND	ND	Jan. 2018	-	Jul. 2018
1,1,2,2-Tetrachloroethane	1	µg/L	2	ND	ND	ND	Jan. 2018	-	Jul. 2018
1,1,2-Trichloroethane	5	µg/L	2	ND	ND	ND	Jan. 2018	-	Jul. 2018
1,1-Dichloroethane	5	µg/L	2	ND	ND	ND	Jan. 2018	-	Jul. 2018
1,1-Dichloroethylene	6	µg/L	2	ND	ND	ND	Jan. 2018	-	Jul. 2018
1,2,3-Trichlorobenzene	0.005	µg/L	1	ND	ND	ND	Jan. 2018		
1,2,4-Trichlorobenzene	5	µg/L	2	ND	ND	ND	Jan. 2018	-	Jul. 2018
1,2-Dichlorobenzene	600	µg/L	2	ND	ND	ND	Jan. 2018	-	Jul. 2018
1,2-Dichloroethane	0.5	µg/L	2	ND	ND	ND	Jan. 2018	-	Jul. 2018
1,2-Dichloropropane	5	µg/L	2	ND	ND	ND	Jan. 2018	-	Jul. 2018
1,3-Dichloropropene (Total)	0.5	µg/L	2	ND	ND	ND	Jan. 2018	-	Jul. 2018
1,4-Dichlorobenzene	5	µg/L	2	ND	ND	ND	Jan. 2018	-	Jul. 2018
Benzene	1	µg/L	2	ND	ND	ND	Jan. 2018	-	Jul. 2018
Carbon Tetrachloride	0.5	µg/L	2	ND	ND	ND	Jan. 2018	-	Jul. 2018
Cis-1,2-Dichloroethylene	6	µg/L	2	ND	ND	ND	Jan. 2018	-	Jul. 2018
Dichloromethane	5	µg/L	2	ND	ND	ND	Jan. 2018	-	Jul. 2018
Ethylbenzene	300	µg/L	2	ND	ND	ND	Jan. 2018	-	Jul. 2018
Methyl tert-Butyl Ether	13	µg/L	2	0.36	ND	0.71	Jan. 2018	-	Jul. 2018
Monochlorobenzene	70	µg/L	2	ND	ND	ND	Jan. 2018	-	Jul. 2018
Styrene	100	µg/L	2	ND	ND	ND	Jan. 2018	-	Jul. 2018
Tetrachloroethylene	5	µg/L	2	ND	ND	ND	Jan. 2018	-	Jul. 2018
Toluene	150	µg/L	2	ND	ND	ND	Jan. 2018	-	Jul. 2018
Trans-1,2-Dichloroethylene	10	µg/L	2	ND	ND	ND	Jan. 2018	-	Jul. 2018
Trichloroethylene	5	µg/L	2	ND	ND	ND	Jan. 2018	-	Jul. 2018
Trichlorofluoroethane (Freon 113)	1200	µg/L	2	ND	ND	ND	Jan. 2018	-	Jul. 2018
Trichlorofluoromethane	150	µg/L	2	ND	ND	ND	Jan. 2018	-	Jul. 2018
Vinyl Chloride	0.5	µg/L	2	ND	ND	ND	Jan. 2018	-	Jul. 2018
Xylenes	1750	µg/L	2	ND	ND	ND	Jan. 2018	-	Jul. 2018

NON-VOLATILE SYNTHETIC ORGANIC CHEMICALS (SOCS)			ANGELS CAMP WATER TREATMENT PLANT - RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
1,2,3-Trichloropropane	0.005	µg/L	7	ND	ND	ND	Jan. 2018	-	Nov. 2019
Alachlor	2	µg/L	1	ND	ND	ND	Jul. 2018		
Atrazine	1	µg/L	1	ND	ND	ND	Jul. 2018		
Dibromochloropropane (DBCP)	0.2	µg/L	2	ND	ND	ND	Jan. 2018	-	Jul. 2018
Ethylene Dibromide	0.05	µg/L	2	ND	ND	ND	Jan. 2018	-	Jul. 2018
Glyphosate	700	µg/L	1	ND	ND	ND	Jun. 2019		
Molinate	20	µg/L	1	ND	ND	ND	Jul. 2018		
Simazine	4	µg/L	1	ND	ND	ND	Jul. 2018		
Thiobencarb	70	µg/L	1	ND	ND	ND	Jul. 2018		

SECONDARY STANDARDS			ANGELS CAMP WATER TREATMENT PLANT - RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	200	µg/L	5	199.2	ND	660	Jan. 2016	-	Jan. 2020
Chloride	250	mg/L	5	5.51	0.80	21.1	Jan. 2016	-	Jan. 2020
Color	15	Units	5	23.6	10	40	Jan. 2016	-	Jan. 2020
Copper	1000	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Iron	300	µg/L	5	221.2	ND	540	Jan. 2016	-	Jan. 2020
Manganese	50	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Methyl tert-Butyl Ether	5	µg/L	2	0.36	ND	0.71	Jan. 2018	-	Jul. 2018
MBAS	0.5	mg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Odor	3	TON	5	5	ND	17	Jan. 2016	-	Jan. 2020
Silver	100	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Specific Conductance	900	µS/cm	6	59.7	35	80	Jan. 2016	-	Jan. 2020
Sulfate	250	mg/L	5	2.70	0.88	4.4	Jan. 2016	-	Jan. 2020
Total Dissolved Solids	500	mg/L	5	51.2	18	130	Jan. 2016	-	Jan. 2020
Turbidity	5	NTU	5	4.26	1.37	8.3	Jan. 2016	-	Jan. 2020
Zinc	5000	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020

MONITORING ASSOCIATED WITH SECONDARY STANDARDS			ANGELS CAMP WATER TREATMENT PLANT - RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Bicarbonate Alkalinity	-	mg/L	25	19.6	12	38	Jan. 2016	-	Dec. 2020
Calcium	-	mg/L	5	4.37	ND	7.43	Jan. 2016	-	Jan. 2020
Carbonate Alkalinity	-	mg/L	25	ND	ND	ND	Jan. 2016	-	Dec. 2020
Hydroxide Alkalinity	-	mg/L	25	ND	ND	ND	Jan. 2016	-	Dec. 2020
Magnesium	-	mg/L	5	1.56	1	2.3	Jan. 2016	-	Jan. 2020
pH	-	-	6	7.37	6.64	7.86	Jan. 2016	-	Jan. 2020
Sodium	-	mg/L	5	2.49	1.8	3.8	Jan. 2016	-	Jan. 2020
Total Alkalinity	-	mg/L	61	19.2	12	38	Jan. 2016	-	Dec. 2020
Total Hardness	-	mg/L	5	17.4	4.9	28	Jan. 2016	-	Jan. 2020

Table D-6: Title 22 Analysis of Treated Water for Angels Camp Water Treatment Plant

INORGANICS			ANGELS CAMP WATER TREATMENT PLANT TREATED WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	1000	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Antimony	6	µg/L	1	ND	ND	ND	Jan. 2016		
Arsenic	10	µg/L	1	ND	ND	ND	Jan. 2016		
Barium	1000	µg/L	1	ND	ND	ND	Jan. 2016		
Beryllium	4	µg/L	1	ND	ND	ND	Jan. 2016		
Cadmium	5	µg/L	1	ND	ND	ND	Jan. 2016		
Fluoride (Source)	2	mg/L	4	0.074	ND	0.18	Jan. 2016	-	Jan. 2019
Mercury	2	µg/L	1	ND	ND	ND	Jan. 2016		
Nickel	100	µg/L	1	ND	ND	ND	Jan. 2016		
Nitrate (As N)	10	mg/L	4	0.26	ND	0.84	Jan. 2016	-	Jan. 2019
Nitrate + Nitrite (As N)	10000	µg/L	2	0.42	ND	0.84	Jan. 2016	-	Jan. 2017
Nitrite (As N)	1000	µg/L	4	ND	ND	ND	Jan. 2016	-	Jan. 2019
Selenium	50	µg/L	1	ND	ND	ND	Jan. 2016		
Thallium	2	µg/L	1	ND	ND	ND	Jan. 2016		
Total Chromium	50	µg/L	1	ND	ND	ND	Jan. 2016		

SECONDARY STANDARDS			ANGELS CAMP WATER TREATMENT PLANT TREATED WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	200	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Chloride	250, 500, 600*	mg/L	4	5.39	2.56	8.5	Jan. 2016	-	Jan. 2019
Color	15	Units	1	7	7	7	Jan. 2016		
Copper	1000	µg/L	1	ND	ND	ND	Jan. 2016		
Iron	300	µg/L	5	ND	ND	ND	Jan. 2016	-	Jan. 2020
Manganese	50	µg/L	4	5.25	ND	21	Jan. 2016	-	Jan. 2019
MBAS	0.5	mg/L	2	ND	ND	ND	Jan. 2016	-	Jan. 2017
Odor	3	TON	1	ND	ND	ND	Jan. 2016		
Silver	100	µg/L	1	ND	ND	ND	Jan. 2016		
Specific Conductance	900, 1600, 2200*	µS/cm	5	69.8	50	93	Jan. 2016	-	Jan. 2020
Sulfate	250, 500, 600*	mg/L	4	2.72	1.3	4.3	Jan. 2016	-	Jan. 2019
Total Dissolved Solids	500, 1000, 1500*	mg/L	5	49	28	80	Jan. 2016	-	Jan. 2020
Turbidity	5	NTU	1	0.24	0.24	0.24	Jan. 2016		
Zinc	5000	µg/L	1	360	360	360	Jan. 2016		
MONITORING ASSOCIATED WITH SECONDARY STANDARDS			**ANGELS CAMP WATER TREATMENT PLANT TREATED WATER**						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Bicarbonate Alkalinity	-	mg/L	4	51.8	26	103	Jan. 2016	-	Jan. 2019
Calcium	-	mg/L	4	4.17	ND	7.37	Jan. 2016	-	Jan. 2019
Carbonate Alkalinity	-	mg/L	4	ND	ND	ND	Jan. 2016	-	Jan. 2019
Hydroxide Alkalinity	-	mg/L	4	ND	ND	ND	Jan. 2016	-	Jan. 2019
Magnesium	-	mg/L	4	1.61	0.83	2.3	Jan. 2016	-	Jan. 2019
pH	-	-	4	7.44	7.19	7.66	Jan. 2016	-	Jan. 2019
Sodium	-	mg/L	4	6.3	4.6	7.9	Jan. 2016	-	Jan. 2019
Total Alkalinity	-	mg/L	4	50.3	26	103	Jan. 2016	-	Jan. 2019
Total Hardness	-	mg/L	4	17.1	5.5	28	Jan. 2016	-	Jan. 2019

Table D-7: Title 22 Analysis of Raw Water for Pinecrest Permittees Water Treatment Plant

INORGANICS			PINECREST CAMPGROUND WTP - RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	1000	µg/L	5	1.89	ND	9.43	Jul. 2016	-	Oct. 2020
Antimony	6	µg/L	5	ND	ND	ND	Jul. 2016	-	Oct. 2020
Arsenic	10	µg/L	5	ND	ND	ND	Jul. 2016	-	Oct. 2020
Barium	1000	µg/L	5	ND	ND	ND	Jul. 2016	-	Oct. 2020
Beryllium	4	µg/L	5	ND	ND	ND	Jul. 2016	-	Oct. 2020
Cadmium	5	µg/L	5	ND	ND	ND	Jul. 2016	-	Oct. 2020
Fluoride (Source)	2	mg/L	5	0.10	ND	0.31	Jul. 2016	-	Oct. 2020
Mercury	2	µg/L	5	ND	ND	ND	Jul. 2016	-	Oct. 2020
Nickel	100	µg/L	5	ND	ND	ND	Jul. 2016	-	Oct. 2020
Nitrate (As N)	10	mg/L	5	0.12	ND	0.61	Jul. 2016	-	Oct. 2020
Nitrate + Nitrite (As N)	10000	µg/L	1	0.61	0.61	0.61	Jul. 2016		
Nitrite (As N)	1000	µg/L	5	ND	ND	ND	Jul. 2016	-	Oct. 2020
Perchlorate	6	µg/L	5	ND	ND	ND	Jul. 2016	-	Oct. 2020
Selenium	50	µg/L	5	ND	ND	ND	Jul. 2016	-	Oct. 2020
Thallium	2	µg/L	5	ND	ND	ND	Jul. 2016	-	Oct. 2020
Total Chromium	50	µg/L	5	ND	ND	ND	Jul. 2016	-	Oct. 2020
RADIOACTIVITY			**PINECREST CAMPGROUND WTP - RAW WATER**						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Gross Alpha	15	pCi/L	1	0.04	0.04	0.04	Jul. 2016		
Radium 228	-	pCi/L	2	ND	ND	ND	Dec. 2016	-	Oct. 2017

VOLATILE ORGANIC CHEMICALS (VOCs)			PINECREST CAMPGROUND WTP - RAW WATER				
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**
1,1,1-Trichloroethane	200	µg/L	1	ND	ND	ND	Oct. 2017
1,1,2,2-Tetrachloroethane	1	µg/L	1	ND	ND	ND	Oct. 2017
1,1,2-Trichloroethane	5	µg/L	1	ND	ND	ND	Oct. 2017
1,1-Dichloroethane	5	µg/L	1	ND	ND	ND	Oct. 2017
1,1-Dichloroethylene	6	µg/L	1	ND	ND	ND	Oct. 2017
1,2,3-Trichlorobenzene	0.005	µg/L	1	ND	ND	ND	Oct. 2017
1,2,4-Trichlorobenzene	5	µg/L	1	ND	ND	ND	Oct. 2017
1,2-Dichlorobenzene	600	µg/L	1	ND	ND	ND	Oct. 2017
1,2-Dichloroethane	0.5	µg/L	1	ND	ND	ND	Oct. 2017
1,2-Dichloropropane	5	µg/L	1	ND	ND	ND	Oct. 2017
1,3-Dichloropropene (Total)	0.5	µg/L	1	ND	ND	ND	Oct. 2017
1,4-Dichlorobenzene	5	µg/L	1	ND	ND	ND	Oct. 2017
Benzene	1	µg/L	1	ND	ND	ND	Oct. 2017
Carbon Tetrachloride	0.5	µg/L	1	ND	ND	ND	Oct. 2017
Cis-1,2-Dichloroethylene	6	µg/L	1	ND	ND	ND	Oct. 2017
Dichloromethane	5	µg/L	1	3.19	3.19	3.19	Oct. 2017
Ethylbenzene	300	µg/L	1	ND	ND	ND	Oct. 2017
Methyl tert-Butyl Ether	13	µg/L	1	1.46	1.46	1.46	Oct. 2017
Monochlorobenzene	70	µg/L	1	ND	ND	ND	Oct. 2017
Styrene	100	µg/L	1	ND	ND	ND	Oct. 2017
Tetrachloroethylene	5	µg/L	1	ND	ND	ND	Oct. 2017
Toluene	150	µg/L	1	ND	ND	ND	Oct. 2017
Trans-1,2-Dichloroethylene	10	µg/L	1	ND	ND	ND	Oct. 2017
Trichloroethylene	5	µg/L	1	ND	ND	ND	Oct. 2017
Trichlorofluoroethane (Freon 113)	1200	µg/L	1	ND	ND	ND	Oct. 2017
Trichlorofluoromethane	150	µg/L	1	ND	ND	ND	Oct. 2017
Vinyl Chloride	0.5	µg/L	1	ND	ND	ND	Oct. 2017
Xylenes	1750	µg/L	1	ND	ND	ND	Oct. 2017

NON-VOLATILE SYNTHETIC ORGANIC CHEMICALS (SOCS)			PINECREST CAMPGROUND WTP - RAW WATER				
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**
1,2,3-Trichloropropane	0.005	µg/L	5	ND	ND	ND	Oct. 2017 - Nov. 2018
Alachlor	2	µg/L	1	ND	ND	ND	Aug. 2018
Atrazine	1	µg/L	1	ND	ND	ND	Aug. 2018
Dibromochloropropane (DBCP)	0.2	µg/L	1	ND	ND	ND	Oct. 2017
Ethylene Dibromide	0.05	µg/L	1	ND	ND	ND	Oct. 2017
Molinate	20	µg/L	1	ND	ND	ND	Aug. 2018
Simazine	4	µg/L	1	ND	ND	ND	Aug. 2018
Thiobencarb	70	µg/L	1	ND	ND	ND	Aug. 2018

SECONDARY STANDARDS			PINECREST CAMPGROUND WTP - RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**		**Date**	
Aluminum	200	µg/L	5	1.89	ND	9.43	Jul. 2016	-	Oct. 2020
Chloride	250	mg/L	5	0.19	ND	0.96	Jul. 2016	-	Oct. 2020
Color	15	Units	5	4	ND	6	Jul. 2016	-	Oct. 2020
Copper	1000	µg/L	5	ND	ND	ND	Jul. 2016	-	Oct. 2020
Iron	300	µg/L	5	ND	ND	ND	Jul. 2016	-	Oct. 2020
Manganese	50	µg/L	5	ND	ND	ND	Jul. 2016	-	Oct. 2020
MBAS	0.5	mg/L	5	ND	ND	ND	Jul. 2016	-	Oct. 2020
Methyl tert-Butyl Ether	5	µg/L	1	1.46	1.46	1.46	Oct. 2017		
Odor	3	TON	5	1.48	1	3	Jul. 2016	-	Oct. 2020
Silver	100	µg/L	5	ND	ND	ND	Jul. 2016	-	Oct. 2020
Specific Conductance	900	µS/cm	5	14.8	13	19.7	Jul. 2016	-	Oct. 2020
Sulfate	250	mg/L	5	1.37	ND	4.14	Jul. 2016	-	Oct. 2020
Total Dissolved Solids	500	mg/L	5	9	6	13	Jul. 2016	-	Oct. 2020
Turbidity	5	NTU	5	0.39	0.062	0.54	Jul. 2016	-	Oct. 2020
Zinc	5000	µg/L	5	17.2	ND	86	Jul. 2016	-	Oct. 2020
MONITORING ASSOCIATED WITH SECONDARY STANDARDS			**PINECREST CAMPGROUND WTP - RAW WATER**						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**		**Date**	
Bicarbonate Alkalinity	-	mg/L	5	11.2	8	19	Jul. 2016	-	Oct. 2020
Calcium	-	mg/L	5	0.97	ND	1.75	Jul. 2016	-	Oct. 2020
Carbonate Alkalinity	-	mg/L	5	ND	ND	ND	Jul. 2016	-	Oct. 2020
Hydroxide Alkalinity	-	mg/L	5	ND	ND	ND	Jul. 2016	-	Oct. 2020
Magnesium	-	mg/L	5	ND	ND	ND	Jul. 2016	-	Oct. 2020
pH	-	-	5	6.66	6.13	7.23	Jul. 2016	-	Oct. 2020
Sodium	-	mg/L	5	0.23	ND	1.14	Jul. 2016	-	Oct. 2020
Total Alkalinity	-	mg/L	5	11.2	8	19	Jul. 2016	-	Oct. 2020
Total Hardness	-	mg/L	5	ND	ND	ND	Jul. 2016	-	Oct. 2020

Table D-8: Title 22 Analysis of Raw Water for Upper Basin Water Treatment Plant

INORGANICS			UPPER BASIN WATER TREATMENT PLANT - RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	1000	µg/L	5	98.2	66	150	Aug. 2016	-	Aug. 2020
Antimony	6	µg/L	5	ND	ND	ND	Aug. 2016	-	Aug. 2020
Arsenic	10	µg/L	5	ND	ND	ND	Aug. 2016	-	Aug. 2020
Barium	1000	µg/L	5	ND	ND	ND	Aug. 2016	-	Aug. 2020
Beryllium	4	µg/L	5	ND	ND	ND	Aug. 2016	-	Aug. 2020
Cadmium	5	µg/L	5	ND	ND	ND	Aug. 2016	-	Aug. 2020
Fluoride (Source)	2	mg/L	5	ND	ND	ND	Aug. 2016	-	Aug. 2020
Mercury	2	µg/L	5	ND	ND	ND	Aug. 2016	-	Aug. 2020
Nickel	100	µg/L	5	ND	ND	ND	Aug. 2016	-	Aug. 2020
Nitrate (As N)	10	mg/L	5	ND	ND	ND	Aug. 2016	-	Aug. 2020
Nitrate + Nitrite (As N)	10000	µg/L	4	ND	ND	ND	Aug. 2017	-	Aug. 2020
Nitrite (As N)	1000	µg/L	5	ND	ND	ND	Aug. 2016	-	Aug. 2020
Perchlorate	6	µg/L	5	ND	ND	ND	Aug. 2016	-	Aug. 2020
Selenium	50	µg/L	5	ND	ND	ND	Aug. 2016	-	Aug. 2020
Thallium	2	µg/L	5	ND	ND	ND	Aug. 2016	-	Aug. 2020
Total Chromium	50	µg/L	5	ND	ND	ND	Aug. 2016	-	Aug. 2020

VOLATILE ORGANIC CHEMICALS (VOCS)			UPPER BASIN WATER TREATMENT PLANT - RAW WATER				
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**
1,1,1-Trichloroethane	200	µg/L	1	ND	ND	ND	Aug. 2018
1,1,2,2-Tetrachloroethane	1	µg/L	1	ND	ND	ND	Aug. 2018
1,1,2-Trichloroethane	5	µg/L	1	ND	ND	ND	Aug. 2018
1,1-Dichloroethane	5	µg/L	1	ND	ND	ND	Aug. 2018
1,1-Dichloroethylene	6	µg/L	1	ND	ND	ND	Aug. 2018
1,2,3-Trichlorobenzene	0.005	µg/L	1	ND	ND	ND	Aug. 2018
1,2,4-Trichlorobenzene	5	µg/L	1	ND	ND	ND	Aug. 2018
1,2-Dichlorobenzene	600	µg/L	1	ND	ND	ND	Aug. 2018
1,2-Dichloroethane	0.5	µg/L	1	ND	ND	ND	Aug. 2018
1,2-Dichloropropane	5	µg/L	1	ND	ND	ND	Aug. 2018
1,3-Dichloropropene (Total)	0.5	µg/L	1	ND	ND	ND	Aug. 2018
1,4-Dichlorobenzene	5	µg/L	1	ND	ND	ND	Aug. 2018
Benzene	1	µg/L	1	ND	ND	ND	Aug. 2018
Carbon Tetrachloride	0.5	µg/L	1	ND	ND	ND	Aug. 2018
Cis-1,2-Dichloroethylene	6	µg/L	1	ND	ND	ND	Aug. 2018
Dichloromethane	5	µg/L	1	ND	ND	ND	Aug. 2018
Ethylbenzene	300	µg/L	1	ND	ND	ND	Aug. 2018
Methyl tert-Butyl Ether	13	µg/L	1	ND	ND	ND	Aug. 2018
Monochlorobenzene	70	µg/L	1	ND	ND	ND	Aug. 2018
Styrene	100	µg/L	1	ND	ND	ND	Aug. 2018
Tetrachloroethylene	5	µg/L	1	ND	ND	ND	Aug. 2018
Toluene	150	µg/L	1	0.62	0.62	0.62	Aug. 2018
Trans-1,2-Dichloroethylene	10	µg/L	1	ND	ND	ND	Aug. 2018
Trichloroethylene	5	µg/L	1	ND	ND	ND	Aug. 2018
Trichlorofluoroethane (Freon 113)	1200	µg/L	1	ND	ND	ND	Aug. 2018
Trichlorofluoromethane	150	µg/L	1	ND	ND	ND	Aug. 2018
Vinyl Chloride	0.5	µg/L	1	ND	ND	ND	Aug. 2018
Xylenes	1750	µg/L	1	ND	ND	ND	Aug. 2018

NON-VOLATILE SYNTHETIC ORGANIC CHEMICALS (SOCS)			UPPER BASIN WATER TREATMENT PLANT - RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
1,2,3-Trichloropropane	0.005	µg/L	4	ND	ND	ND	Feb. 2018	-	Dec. 2018
Atrazine	1	µg/L	1	ND	ND	ND	Jul. 2019		
Simazine	4	µg/L	1	ND	ND	ND	Jul. 2019		

SECONDARY STANDARDS			UPPER BASIN WATER TREATMENT PLANT - RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	200	µg/L	5	98.2	66	150	Aug. 2016	-	Aug. 2020
Chloride	250	mg/L	5	ND	ND	ND	Aug. 2016	-	Aug. 2020
Color	15	Units	5	19	ND	25	Aug. 2016	-	Aug. 2020
Copper	1000	µg/L	5	ND	ND	ND	Aug. 2016	-	Aug. 2020
Iron	300	µg/L	5	440	210	710	Aug. 2016	-	Aug. 2020
Manganese	50	µg/L	5	64.6	38	100	Aug. 2016	-	Aug. 2020
MBAS	0.5	mg/L	5	ND	ND	ND	Aug. 2016	-	Aug. 2020
Methyl tert-Butyl Ether	5	µg/L	1	ND	ND	ND	Aug. 2018		
Odor	3	TON	5	0.3	ND	1.5	Aug. 2016	-	Aug. 2020
Silver	100	µg/L	5	ND	ND	ND	Aug. 2016	-	Aug. 2020
Specific Conductance	900	µS/cm	5	26.2	20	32	Aug. 2016	-	Aug. 2020
Sulfate	250	mg/L	5	ND	ND	ND	Aug. 2016	-	Aug. 2020
Total Dissolved Solids	500	mg/L	5	22.6	18	34	Aug. 2016	-	Aug. 2020
Turbidity	5	NTU	5	2.06	1.4	2.9	Aug. 2016	-	Aug. 2020
Zinc	5000	µg/L	5	ND	ND	ND	Aug. 2016	-	Aug. 2020
MONITORING ASSOCIATED WITH SECONDARY STANDARDS			**UPPER BASIN WATER TREATMENT PLANT - RAW WATER**						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Bicarbonate Alkalinity	-	mg/L	62	14.5	9.6	25	Jan. 2016	-	Dec. 2020
Calcium	-	mg/L	5	2.38	1.8	3	Aug. 2016	-	Aug. 2020
Carbonate Alkalinity	-	mg/L	62	ND	ND	ND	Jan. 2016	-	Dec. 2020
Hydroxide Alkalinity	-	mg/L	62	ND	ND	ND	Jan. 2016	-	Dec. 2020
Magnesium	-	mg/L	5	0.68	0.51	0.88	Aug. 2016	-	Aug. 2020
pH	-	-	5	7.32	7.2	7.4	Aug. 2016	-	Aug. 2020
Sodium	-	mg/L	5	1.06	ND	1.5	Aug. 2016	-	Aug. 2020
Total Alkalinity	-	mg/L	62	11.9	7.9	20	Jan. 2016	-	Dec. 2020
Total Hardness	-	mg/L	5	8.68	6.6	11	Aug. 2016	-	Aug. 2020

Table D-9: Title 22 Analysis of Treated Water for Upper Basin Water Treatment Plant

INORGANICS			UPPER BASIN WATER TREATMENT PLANT TREATED WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	1000	µg/L	4	ND	ND	ND	Aug. 2017	-	Aug. 2020
Antimony	6	µg/L	4	ND	ND	ND	Aug. 2017	-	Aug. 2020
Arsenic	10	µg/L	4	ND	ND	ND	Aug. 2017	-	Aug. 2020
Barium	1000	µg/L	4	ND	ND	ND	Aug. 2017	-	Aug. 2020
Beryllium	4	µg/L	4	ND	ND	ND	Aug. 2017	-	Aug. 2020
Cadmium	5	µg/L	4	ND	ND	ND	Aug. 2017	-	Aug. 2020
Fluoride (Source)	2	mg/L	4	ND	ND	ND	Aug. 2017	-	Aug. 2020
Mercury	2	µg/L	4	ND	ND	ND	Aug. 2017	-	Aug. 2020
Nickel	100	µg/L	4	ND	ND	ND	Aug. 2017	-	Aug. 2020
Nitrate (As N)	10	mg/L	4	ND	ND	ND	Aug. 2017	-	Aug. 2020
Nitrate + Nitrite (As N)	10000	µg/L	4	ND	ND	ND	Aug. 2017	-	Aug. 2020
Nitrite (As N)	1000	µg/L	4	ND	ND	ND	Aug. 2017	-	Aug. 2020
Perchlorate	6	µg/L	4	ND	ND	ND	Aug. 2017	-	Aug. 2020
Selenium	50	µg/L	4	ND	ND	ND	Aug. 2017	-	Aug. 2020
Thallium	2	µg/L	4	ND	ND	ND	Aug. 2017	-	Aug. 2020
Total Chromium	50	µg/L	4	ND	ND	ND	Aug. 2017	-	Aug. 2020

SECONDARY STANDARDS			UPPER BASIN WATER TREATMENT PLANT TREATED WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	200	µg/L	4	ND	ND	ND	Aug. 2017	-	Aug. 2020
Chloride	250	mg/L	4	2.38	2.2	2.5	Aug. 2017	-	Aug. 2020
Color	15	Units	4	1.25	ND	5	Aug. 2017	-	Aug. 2020
Copper	1000	µg/L	4	ND	ND	ND	Aug. 2017	-	Aug. 2020
Iron	300	µg/L	4	ND	ND	ND	Aug. 2017	-	Aug. 2020
Manganese	50	µg/L	4	ND	ND	ND	Aug. 2017	-	Aug. 2020
MBAS	0.5	mg/L	4	ND	ND	ND	Aug. 2017	-	Aug. 2020
Odor	3	TON	4	1.25	1	1.5	Aug. 2017	-	Aug. 2020
Silver	100	µg/L	4	ND	ND	ND	Aug. 2017	-	Aug. 2020
Specific Conductance	900	µS/cm	4	39.5	32	44	Aug. 2017	-	Aug. 2020
Sulfate	250	mg/L	4	ND	ND	ND	Aug. 2017	-	Aug. 2020
Total Dissolved Solids	500	mg/L	4	29	23	38	Aug. 2017	-	Aug. 2020
Turbidity	5	NTU	4	0.16	0.13	0.19	Aug. 2017	-	Aug. 2020
Zinc	5000	µg/L	4	ND	ND	ND	Aug. 2017	-	Aug. 2020
MONITORING ASSOCIATED WITH SECONDARY STANDARDS			**UPPER BASIN WATER TREATMENT PLANT TREATED WATER**						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Bicarbonate Alkalinity	-	mg/L	4	16	11	19	Aug. 2017	-	Aug. 2020
Calcium	-	mg/L	4	2.35	1.8	3	Aug. 2017	-	Aug. 2020
Carbonate Alkalinity	-	mg/L	4	ND	ND	ND	Aug. 2017	-	Aug. 2020
Hydroxide Alkalinity	-	mg/L	4	ND	ND	ND	Aug. 2017	-	Aug. 2020
Magnesium	-	mg/L	4	0.69	0.52	0.9	Aug. 2017	-	Aug. 2020
pH	-	-	4	7.28	7.2	7.3	Aug. 2017	-	Aug. 2020
Sodium	-	mg/L	4	4.03	3.3	4.8	Aug. 2017	-	Aug. 2020
Total Alkalinity	-	mg/L	4	13.1	9.3	15	Aug. 2017	-	Aug. 2020
Total Hardness	-	mg/L	4	8.65	6.7	11	Aug. 2017	-	Aug. 2020

Table D-10: Title 22 Analysis of Raw Water for the Baseline Conservation Camp Water Treatment Plant

INORGANICS			BASELINE CONSERVATION CAMP WTP RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	1000	µg/L	2	ND	ND	ND	Oct. 2017	-	Mar. 2020
Antimony	6	µg/L	2	ND	ND	ND	Oct. 2017	-	Mar. 2020
Arsenic	10	µg/L	2	ND	ND	ND	Oct. 2017	-	Mar. 2020
Barium	1000	µg/L	2	ND	ND	ND	Oct. 2017	-	Mar. 2020
Beryllium	4	µg/L	2	ND	ND	ND	Oct. 2017	-	Mar. 2020
Cadmium	5	µg/L	2	ND	ND	ND	Oct. 2017	-	Mar. 2020
Fluoride (Source)	2	mg/L	2	ND	ND	ND	Oct. 2017	-	Mar. 2020
Mercury	2	µg/L	2	ND	ND	ND	Oct. 2017	-	Mar. 2020
Nickel	100	µg/L	2	ND	ND	ND	Oct. 2017	-	Mar. 2020
Nitrate (As N)	10	mg/L	4	ND	ND	ND	Apr. 2016	-	Mar. 2020
Nitrate + Nitrite (As N)	10000	µg/L	1	ND	ND	ND	Oct. 2017		
Nitrite (As N)	1000	µg/L	3	ND	ND	ND	Apr. 2016	-	Mar. 2019
Perchlorate	6	µg/L	2	ND	ND	ND	Oct. 2017	-	Mar. 2020
Selenium	50	µg/L	2	ND	ND	ND	Oct. 2017	-	Mar. 2020
Thallium	2	µg/L	2	ND	ND	ND	Oct. 2017	-	Mar. 2020
Total Chromium	50	µg/L	2	ND	ND	ND	Oct. 2017	-	Mar. 2020
RADIOACTIVITY			**BASELINE CONSERVATION CAMP WTP RAW WATER**						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Gross Alpha	15	pCi/L	1	0.982	0.982	0.982	Mar. 2020		

VOLATILE ORGANIC CHEMICALS (VOCs)			BASELINE CONSERVATION CAMP WTP RAW WATER				
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**
1,1,1-Trichloroethane	200	µg/L	1	ND	ND	ND	Mar. 2020
1,1,2,2-Tetrachloroethane	1	µg/L	1	ND	ND	ND	Mar. 2020
1,1,2-Trichloroethane	5	µg/L	1	ND	ND	ND	Mar. 2020
1,1-Dichloroethane	5	µg/L	1	ND	ND	ND	Mar. 2020
1,1-Dichloroethylene	6	µg/L	1	ND	ND	ND	Mar. 2020
1,2,4-Trichlorobenzene	5	µg/L	1	ND	ND	ND	Mar. 2020
1,2-Dichlorobenzene	600	µg/L	1	ND	ND	ND	Mar. 2020
1,2-Dichloroethane	0.5	µg/L	1	ND	ND	ND	Mar. 2020
1,2-Dichloropropane	5	µg/L	1	ND	ND	ND	Mar. 2020
1,3-Dichloropropene (Total)	0.5	µg/L	1	ND	ND	ND	Mar. 2020
1,4-Dichlorobenzene	5	µg/L	1	ND	ND	ND	Mar. 2020
Benzene	1	µg/L	1	ND	ND	ND	Mar. 2020
Carbon Tetrachloride	0.5	µg/L	1	ND	ND	ND	Mar. 2020
Cis-1,2-Dichloroethylene	6	µg/L	1	ND	ND	ND	Mar. 2020
Dichloromethane	5	µg/L	1	ND	ND	ND	Mar. 2020
Ethylbenzene	300	µg/L	1	ND	ND	ND	Mar. 2020
Methyl tert-Butyl Ether	13	µg/L	1	ND	ND	ND	Mar. 2020
Monochlorobenzene	70	µg/L	1	ND	ND	ND	Mar. 2020
Styrene	100	µg/L	1	ND	ND	ND	Mar. 2020
Tetrachloroethylene	5	µg/L	1	ND	ND	ND	Mar. 2020
Toluene	150	µg/L	1	ND	ND	ND	Mar. 2020
Trans-1,2-Dichloroethylene	10	µg/L	1	ND	ND	ND	Mar. 2020
Trichloroethylene	5	µg/L	1	ND	ND	ND	Mar. 2020
Trichlorofluoroethane (Freon 113)	1200	µg/L	1	ND	ND	ND	Mar. 2020
Trichlorofluoromethane	150	µg/L	1	ND	ND	ND	Mar. 2020
Vinyl Chloride	0.5	µg/L	1	ND	ND	ND	Mar. 2020
Xylenes	1750	µg/L	1	ND	ND	ND	Mar. 2020

NON-VOLATILE SYNTHETIC ORGANIC CHEMICALS (SOCS)			BASELINE CONSERVATION CAMP WTP RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
1,2,3-Trichloropropane	0.005	µg/L	4	ND	ND	ND	May. 2018	-	Mar. 2020
Alachlor	2	µg/L	1	ND	ND	ND	Mar. 2020		
Atrazine	1	µg/L	1	ND	ND	ND	Mar. 2020		
Molinate	20	µg/L	1	ND	ND	ND	Mar. 2020		
Simazine	4	µg/L	1	ND	ND	ND	Mar. 2020		
Thiobencarb	70	µg/L	1	ND	ND	ND	Mar. 2020		

SECONDARY STANDARDS			BASELINE CONSERVATION CAMP WTP RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	200	µg/L	2	ND	ND	ND	Oct. 2017	-	Mar. 2020
Chloride	250	mg/L	3	0.6	ND	1.2	Apr. 2016	-	Mar. 2020
Color	15	Units	2	7.5	5	10	Oct. 2017	-	Mar. 2020
Copper	1000	µg/L	3	ND	ND	ND	Apr. 2016	-	Mar. 2020
Iron	300	µg/L	3	153.3	ND	460	Apr. 2016	-	Mar. 2020
Manganese	50	µg/L	3	28.3	ND	85	Apr. 2016	-	Mar. 2020
MBAS	0.5	mg/L	3	ND	ND	ND	Apr. 2016	-	Mar. 2020
Methyl tert-Butyl Ether	5	µg/L	1	ND	ND	ND	Mar. 2020		
Odor	3	TON	1	1.6	1.6	1.6	Mar. 2020		
Silver	100	µg/L	3	ND	ND	ND	Apr. 2016	-	Mar. 2020
Specific Conductance	900	µS/cm	3	61.3	53	77	Apr. 2016	-	Mar. 2020
Sulfate	250	mg/L	3	2.23	1.5	3.3	Apr. 2016	-	Mar. 2020
Total Dissolved Solids	500	mg/L	3	50	41	63	Apr. 2016	-	Mar. 2020
Turbidity	5	NTU	2	0.32	0.14	0.49	Oct. 2017	-	Mar. 2020
Zinc	5000	µg/L	3	ND	ND	ND	Apr. 2016	-	Mar. 2020

MONITORING ASSOCIATED WITH SECONDARY STANDARDS			BASELINE CONSERVATION CAMP WTP RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Bicarbonate Alkalinity	-	mg/L	3	31.7	27	38	Apr. 2016	-	Mar. 2020
Calcium	-	mg/L	3	6.0	5	7.2	Apr. 2016	-	Mar. 2020
Carbonate Alkalinity	-	mg/L	3	ND	ND	ND	Apr. 2016	-	Mar. 2020
Hydroxide Alkalinity	-	mg/L	3	ND	ND	ND	Apr. 2016	-	Mar. 2020
Magnesium	-	mg/L	3	1.97	1.4	2.9	Apr. 2016	-	Mar. 2020
pH	-	-	3	7.20	6.89	7.60	Apr. 2016	-	Mar. 2020
Sodium	-	mg/L	3	2.3	2	2.7	Apr. 2016	-	Mar. 2020
Total Alkalinity	-	mg/L	3	26	22	31	Apr. 2016	-	Mar. 2020
Total Hardness	-	mg/L	3	23	18	30	Apr. 2016	-	Mar. 2020

Table D-11: Title 22 Analysis of Raw Water for the Sierra Conservation Center Water Treatment Plant

INORGANICS			SIERRA CONSERVATION CENTER WTP RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	1000	µg/L	5	36.2	ND	80	Jul. 2016	-	Jul. 2020
Antimony	6	µg/L	6	ND	ND	ND	Jul. 2016	-	Jul. 2020
Arsenic	10	µg/L	6	ND	ND	ND	Jul. 2016	-	Jul. 2020
Asbestos	7	MFL	1	ND	ND	ND	Aug. 2017		
Barium	1000	µg/L	5	8.14	ND	14.7	Jul. 2016	-	Jul. 2020
Beryllium	4	µg/L	5	ND	ND	ND	Jul. 2016	-	Jul. 2020
Cadmium	5	µg/L	5	ND	ND	ND	Jul. 2016	-	Jul. 2020
Fluoride (Source)	2	mg/L	5	ND	ND	ND	Jul. 2016	-	Jul. 2020
Mercury	2	µg/L	5	ND	ND	ND	Jul. 2016	-	Jul. 2020
Nickel	100	µg/L	5	ND	ND	ND	Jul. 2016	-	Jul. 2020
Nitrate (As N)	10	mg/L	5	0.076	ND	0.15	Jul. 2016	-	Jul. 2020
Nitrate + Nitrite (As N)	10000	µg/L	2	0.13	0.11	0.15	Jul. 2016	-	Aug. 2017
Nitrite (As N)	1000	µg/L	4	ND	ND	ND	Jul. 2016	-	Jul. 2020
Perchlorate	6	µg/L	5	ND	ND	ND	Jul. 2016	-	Jul. 2020
Selenium	50	µg/L	6	ND	ND	ND	Jul. 2016	-	Jul. 2020
Thallium	2	µg/L	5	ND	ND	ND	Jul. 2016	-	Jul. 2020
Total Chromium	50	µg/L	5	ND	ND	ND	Jul. 2016	-	Jul. 2020
RADIOACTIVITY			**SIERRA CONSERVATION CENTER WTP RAW WATER**						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Gross Alpha	15	pCi/L	1	ND	ND	ND	Jul. 2016		

VOLATILE ORGANIC CHEMICALS (VOCs)			SIERRA CONSERVATION CENTER WTP RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
1,1,1-Trichloroethane	200	µg/L	3	ND	ND	ND	Jul. 2016	-	Jul. 2019
1,1,2,2-Tetrachloroethane	1	µg/L	3	ND	ND	ND	Jul. 2016	-	Jul. 2019
1,1,2-Trichloroethane	5	µg/L	3	ND	ND	ND	Jul. 2016	-	Jul. 2019
1,1-Dichloroethane	5	µg/L	3	ND	ND	ND	Jul. 2016	-	Jul. 2019
1,1-Dichloroethylene	6	µg/L	3	ND	ND	ND	Jul. 2016	-	Jul. 2019
1,2,3-Trichlorobenzene	0.005	µg/L	1	ND	ND	ND	Jul. 2016		
1,2,4-Trichlorobenzene	5	µg/L	3	ND	ND	ND	Jul. 2016	-	Jul. 2019
1,2-Dichlorobenzene	600	µg/L	3	ND	ND	ND	Jul. 2016	-	Jul. 2019
1,2-Dichloroethane	0.5	µg/L	3	ND	ND	ND	Jul. 2016	-	Jul. 2019
1,2-Dichloropropane	5	µg/L	3	ND	ND	ND	Jul. 2016	-	Jul. 2019
1,3-Dichloropropene (Total)	0.5	µg/L	3	ND	ND	ND	Jul. 2016	-	Jul. 2019
1,4-Dichlorobenzene	5	µg/L	3	ND	ND	ND	Jul. 2016	-	Jul. 2019
Benzene	1	µg/L	3	ND	ND	ND	Jul. 2016	-	Jul. 2019
Carbon Tetrachloride	0.5	µg/L	3	ND	ND	ND	Jul. 2016	-	Jul. 2019
Cis-1,2-Dichloroethylene	6	µg/L	3	ND	ND	ND	Jul. 2016	-	Jul. 2019
Dichloromethane	5	µg/L	3	ND	ND	ND	Jul. 2016	-	Jul. 2019
Ethylbenzene	300	µg/L	3	ND	ND	ND	Jul. 2016	-	Jul. 2019
Methyl tert-Butyl Ether	13	µg/L	2	ND	ND	ND	Aug. 2017	-	Jul. 2019
Monochlorobenzene	70	µg/L	3	ND	ND	ND	Jul. 2016	-	Jul. 2019
Styrene	100	µg/L	2	ND	ND	ND	Aug. 2017	-	Jul. 2019
Tetrachloroethylene	5	µg/L	3	ND	ND	ND	Jul. 2016	-	Jul. 2019
Toluene	150	µg/L	3	ND	ND	ND	Jul. 2016	-	Jul. 2019
Trans-1,2-Dichloroethylene	10	µg/L	3	ND	ND	ND	Jul. 2016	-	Jul. 2019
Trichloroethylene	5	µg/L	3	ND	ND	ND	Jul. 2016	-	Jul. 2019
Trichlorofluoroethane (Freon 113)	1200	µg/L	3	ND	ND	ND	Jul. 2016	-	Jul. 2019
Trichlorofluoromethane	150	µg/L	3	ND	ND	ND	Jul. 2016	-	Jul. 2019
Vinyl Chloride	0.5	µg/L	2	ND	ND	ND	Aug. 2017	-	Jul. 2019
Xylenes	1750	µg/L	3	ND	ND	ND	Jul. 2016	-	Jul. 2019

NON-VOLATILE SYNTHETIC ORGANIC CHEMICALS (SOCS)			SIERRA CONSERVATION CENTER WTP RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
1,2,3-Trichloropropane	0.005	µg/L	5	ND	ND	ND	Jul. 2016	-	Jul. 2019
Alachlor	2	µg/L	1	ND	ND	ND	Jul. 2019		
Atrazine	1	µg/L	2	ND	ND	ND	Feb. 2019	-	Jul. 2019
Benzo(a)pyrene	0.2	µg/L	1	ND	ND	ND	Jul. 2019		
Di(2-ethylhexyl)adipate	400	µg/L	1	ND	ND	ND	Jul. 2019		
Di(2-ethylhexyl)phthalate	4	µg/L	1	ND	ND	ND	Jul. 2019		
Dibromochloropropane (DBCP)	0.2	µg/L	1	ND	ND	ND	Jul. 2016		
Ethylene Dibromide	0.05	µg/L	1	ND	ND	ND	Jul. 2016		
Hexachlorobenzene	1	µg/L	1	ND	ND	ND	Jul. 2019		
Hexachlorocyclopentadiene	50	µg/L	1	ND	ND	ND	Jul. 2019		
Molinate	20	µg/L	1	ND	ND	ND	Jul. 2019		
Simazine	4	µg/L	2	ND	ND	ND	Feb. 2019	-	Jul. 2019
Thiobencarb	70	µg/L	1	ND	ND	ND	Jul. 2019		

SECONDARY STANDARDS			SIERRA CONSERVATION CENTER WTP RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	200	µg/L	5	36.2	ND	80	Jul. 2016	-	Jul. 2020
Chloride	250	mg/L	5	0.82	0.6	0.9	Jul. 2016	-	Jul. 2020
Color	15	Units	5	6.4	ND	15	Jul. 2016	-	Jul. 2020
Copper	1000	µg/L	6	3.63	ND	5.5	Jul. 2016	-	Jul. 2020
Iron	300	µg/L	5	22.9	ND	64	Jul. 2016	-	Jul. 2020
Manganese	50	µg/L	5	5.34	ND	12.4	Jul. 2016	-	Jul. 2020
MBAS	0.5	mg/L	5	ND	ND	ND	Jul. 2016	-	Jul. 2020
Methyl tert-Butyl Ether	5	µg/L	2	ND	ND	ND	Aug. 2017	-	Jul. 2019
Odor	3	TON	5	0.8	ND	4	Jul. 2016	-	Jul. 2020
Silver	100	µg/L	6	ND	ND	ND	Jul. 2016	-	Jul. 2020
Specific Conductance	900	µS/cm	5	51.0	42.6	54.4	Jul. 2016	-	Jul. 2020
Sulfate	250	mg/L	5	1.78	1.1	2.7	Jul. 2016	-	Jul. 2020
Total Dissolved Solids	500	mg/L	5	38.6	29	46	Jul. 2016	-	Jul. 2020
Turbidity	5	NTU	5	0.92	0.4	1.1	Jul. 2016	-	Jul. 2020
Zinc	5000	µg/L	5	ND	ND	ND	Jul. 2016	-	Jul. 2020
MONITORING ASSOCIATED WITH SECONDARY STANDARDS			**SIERRA CONSERVATION CENTER WTP RAW WATER**						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Bicarbonate Alkalinity	-	mg/L	5	24	20	26	Jul. 2016	-	Jul. 2020
Calcium	-	mg/L	5	2206	5.9	5510	Jul. 2016	-	Jul. 2020
Carbonate Alkalinity	-	mg/L	5	ND	ND	ND	Jul. 2016	-	Jul. 2020
Hydroxide Alkalinity	-	mg/L	5	ND	ND	ND	Jul. 2016	-	Jul. 2020
Magnesium	-	mg/L	5	637.1	1.6	1590	Jul. 2016	-	Jul. 2020
pH	-	-	5	7.22	7.10	7.53	Jul. 2016	-	Jul. 2020
Sodium	-	mg/L	5	709.3	2	1930	Jul. 2016	-	Jul. 2020
Total Alkalinity	-	mg/L	5	22.8	20	26	Jul. 2016	-	Jul. 2020
Total Hardness	-	mg/L	5	22.1	20	25	Jul. 2016	-	Jul. 2020

Table D-12: Title 22 Analysis of Raw Water for the Copper Cove Water Treatment Plant.

INORGANICS			COPPER COVE WATER TREATMENT PLANT - RAW WATER						
Constituents	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	1000	µg/L	5	68.4	ND	180	Apr. 2016	-	Apr. 2020
Antimony	6	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Arsenic	10	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Asbestos	7	MFL	1	0.19	0.19	0.19	Jan. 2017		
Barium	1000	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Beryllium	4	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Cadmium	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Fluoride (Source)	2	mg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Mercury	2	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Nickel	100	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Nitrate (As N)	10	mg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Nitrate + Nitrite (As N)	10000	µg/L	5	0.06	ND	0.3	Apr. 2016	-	Apr. 2020
Nitrite (As N)	1000	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Perchlorate	6	µg/L	5	ND	ND	ND	Apr. 2016	-	Jun. 2020
Selenium	50	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Thallium	2	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Total Chromium	50	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020

VOLATILE ORGANIC CHEMICALS (VOCs)			COPPER COVE WATER TREATMENT PLANT - RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
1,1,1-Trichloroethane	200	µg/L	6	ND	ND	ND	Apr. 2016	-	May. 2020
1,1,2,2-Tetrachloroethane	1	µg/L	6	ND	ND	ND	Apr. 2016	-	May. 2020
1,1,2-Trichloroethane	5	µg/L	6	ND	ND	ND	Apr. 2016	-	May. 2020
1,1-Dichloroethane	5	µg/L	6	ND	ND	ND	Apr. 2016	-	May. 2020
1,1-Dichloroethylene	6	µg/L	6	ND	ND	ND	Apr. 2016	-	May. 2020
1,2,3-Trichlorobenzene	0.005	µg/L	6	ND	ND	ND	Apr. 2016	-	May. 2020
1,2,4-Trichlorobenzene	5	µg/L	6	ND	ND	ND	Apr. 2016	-	May. 2020
1,2-Dichlorobenzene	600	µg/L	6	ND	ND	ND	Apr. 2016	-	May. 2020
1,2-Dichloroethane	0.5	µg/L	6	ND	ND	ND	Apr. 2016	-	May. 2020
1,2-Dichloropropane	5	µg/L	6	ND	ND	ND	Apr. 2016	-	May. 2020
1,3-Dichloropropene (Total)	0.5	µg/L	6	ND	ND	ND	Apr. 2016	-	May. 2020
1,4-Dichlorobenzene	5	µg/L	6	ND	ND	ND	Apr. 2016	-	May. 2020
Benzene	1	µg/L	6	ND	ND	ND	Apr. 2016	-	May. 2020
Carbon Tetrachloride	0.5	µg/L	6	ND	ND	ND	Apr. 2016	-	May. 2020
Cis-1,2-Dichloroethylene	6	µg/L	6	ND	ND	ND	Apr. 2016	-	May. 2020
Dichloromethane	5	µg/L	6	ND	ND	ND	Apr. 2016	-	May. 2020
Ethylbenzene	300	µg/L	6	ND	ND	ND	Apr. 2016	-	May. 2020
Methyl tert-Butyl Ether	13	µg/L	6	ND	ND	ND	Apr. 2016	-	May. 2020
Monochlorobenzene	70	µg/L	6	ND	ND	ND	Apr. 2016	-	May. 2020
Styrene	100	µg/L	6	ND	ND	ND	Apr. 2016	-	May. 2020
Tetrachloroethylene	5	µg/L	6	ND	ND	ND	Apr. 2016	-	May. 2020
Toluene	150	µg/L	6	ND	ND	ND	Apr. 2016	-	May. 2020
Trans-1,2-Dichloroethylene	10	µg/L	6	ND	ND	ND	Apr. 2016	-	May. 2020
Trichloroethylene	5	µg/L	6	ND	ND	ND	Apr. 2016	-	May. 2020
Trichlorofluoroethane (Freon 113)	1200	µg/L	6	ND	ND	ND	Apr. 2016	-	May. 2020
Trichlorofluoromethane	150	µg/L	6	ND	ND	ND	Apr. 2016	-	May. 2020
Vinyl Chloride	0.5	µg/L	6	ND	ND	ND	Apr. 2016	-	May. 2020
Xylenes	1750	µg/L	6	ND	ND	ND	Apr. 2016	-	May. 2020

NON-VOLATILE SYNTHETIC ORGANIC CHEMICALS (SOCS)			COPPER COVE WATER TREATMENT PLANT - RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
1,2,3-Trichloropropane	0.005	µg/L	4	ND	ND	ND	Jan. 2018	-	Oct. 2018
Glyphosate	700	µg/L	4	ND	ND	ND	Mar. 2018	-	Jun. 2019

SECONDARY STANDARDS			COPPER COVE WATER TREATMENT PLANT - RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	200	µg/L	5	68.4	ND	180	Apr. 2016	-	Apr. 2020
Chloride	250	mg/L	5	1.32	ND	2.3	Apr. 2016	-	Apr. 2020
Color	15	Units	179	7.32	ND	35	Jan. 2016	-	Dec. 2020
Copper	1000	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Iron	300	µg/L	5	62	ND	180	Apr. 2016	-	Apr. 2020
Manganese	50	µg/L	13	46	ND	190	Apr. 2016	-	May. 2020
Methyl tert-Butyl Ether	5	µg/L	6	ND	ND	ND	Apr. 2016	-	May. 2020
MBAS	0.5	mg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Odor	3	TON	80	1.23	ND	4	Jan. 2016	-	Dec. 2020
Silver	100	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Specific Conductance	900	µS/cm	5	90.4	60	130	Apr. 2016	-	Apr. 2020
Sulfate	250	mg/L	5	4.58	2.0	7.5	Apr. 2016	-	Apr. 2020
Total Dissolved Solids	500	mg/L	5	64.2	40	94	Apr. 2016	-	Apr. 2020
Turbidity	5	NTU	7	1.68	0.78	2.5	Apr. 2016	-	Apr. 2020
Zinc	5000	µg/L	5	13.2	ND	66	Apr. 2016	-	Apr. 2020

MONITORING ASSOCIATED WITH SECONDARY STANDARDS			COPPER COVE WATER TREATMENT PLANT - RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Bicarbonate Alkalinity	-	mg/L	37	35.5	20	70	Apr. 2016	-	Dec. 2020
Calcium	-	mg/L	5	7.28	6.0	9.0	Apr. 2016	-	Apr. 2020
Carbonate Alkalinity	-	mg/L	37	ND	ND	ND	Apr. 2016	-	Dec. 2020
Hydroxide Alkalinity	-	mg/L	37	ND	ND	ND	Apr. 2016	-	Dec. 2020
Magnesium	-	mg/L	5	4.72	2.0	8.3	Apr. 2016	-	Apr. 2020
pH	-	-	6	7.30	6.80	7.70	Apr. 2016	-	Apr. 2020
Sodium	-	mg/L	5	4.42	2.0	8.0	Apr. 2016	-	Apr. 2020
Total Alkalinity	-	mg/L	61	30.9	20	84	Jan. 2016	-	Dec. 2020
Total Hardness	-	mg/L	5	37.6	23.2	57	Apr. 2016	-	Apr. 2020

Table D-13: Title 22 Analysis of Treated Water for the Copper Cove Water Treatment Plant.

INORGANICS			COPPER COVE WATER TREATMENT PLANT TREATED WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	1000	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Antimony	6	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Arsenic	10	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Barium	1000	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Beryllium	4	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Cadmium	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Fluoride (Source)	2	mg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Mercury	2	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Nickel	100	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Nitrate (As N)	10	mg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Nitrate + Nitrite (As N)	10000	µg/L	5	0.06	ND	0.3	Apr. 2016	-	Apr. 2020
Nitrite (As N)	1000	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Selenium	50	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Thallium	2	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Total Chromium	50	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020

SECONDARY STANDARDS			COPPER COVE WATER TREATMENT PLANT TREATED WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	200	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Chloride	250	mg/L	5	4.52	3	6.3	Apr. 2016	-	Apr. 2020
Color	15	Units	9	ND	ND	ND	Jan. 2017	-	Apr. 2020
Copper	1000	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Iron	300	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Manganese	50	µg/L	13	9.31	ND	40	Apr. 2016	-	Oct. 2020
MBAS	0.5	mg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Odor	3	TON	6	0.33	ND	2.0	Mar. 2017	-	Apr. 2020
Silver	100	µg/L	5	ND	ND	ND	Apr. 2016	-	Apr. 2020
Specific Conductance	900	µS/cm	5	104.6	69	150	Apr. 2016	-	Apr. 2020
Sulfate	250	mg/L	5	4.9	2.2	7.8	Apr. 2016	-	Apr. 2020
Total Dissolved Solids	500	mg/L	5	59.6	ND	100	Apr. 2016	-	Apr. 2020
Turbidity	5	NTU	7	0.06	ND	0.21	Apr. 2016	-	Apr. 2020
Zinc	5000	µg/L	5	100.8	53	160	Apr. 2016	-	Apr. 2020
MONITORING ASSOCIATED WITH SECONDARY STANDARDS			**COPPER COVE WATER TREATMENT PLANT TREATED WATER**						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Bicarbonate Alkalinity	-	mg/L	38	38.6	20	170	Apr. 2016	-	Dec. 2020
Calcium	-	mg/L	5	7.56	6.0	9.6	Apr. 2016	-	Apr. 2020
Carbonate Alkalinity	-	mg/L	38	ND	ND	ND	Apr. 2016	-	Dec. 2020
Hydroxide Alkalinity	-	mg/L	38	ND	ND	ND	Apr. 2016	-	Dec. 2020
Magnesium	-	mg/L	5	4.98	2.0	8.9	Apr. 2016	-	Apr. 2020
pH	-	-	6	7.41	7.17	7.70	Apr. 2016	-	Apr. 2020
Sodium	-	mg/L	5	6.96	4.0	10	Apr. 2016	-	Apr. 2020
Total Alkalinity	-	mg/L	61	31.6	10	140	Jan. 2016	-	Dec. 2020
Total Hardness	-	mg/L	5	39.4	23.2	61	Apr. 2016	-	Apr. 2020

Table D-14: Title 22 Analysis of Raw Water (Stanislaus River) for the Dr. Joe Waidhofer Water Treatment Plant.

INORGANICS			DR. JOE WAIDHOFER TREATMENT PLANT - RAW WATER STANISLAUS RIVER				
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**
Aluminum	1000	µg/L	5	114	ND	170	Jun. 2016 - Jun. 2020
Antimony	6	µg/L	5	ND	ND	ND	Jun. 2016 - Jun. 2020
Arsenic	10	µg/L	5	ND	ND	ND	Jun. 2016 - Jun. 2020
Barium	1000	µg/L	5	8.88	ND	44.4	Jun. 2016 - Jun. 2020
Beryllium	4	µg/L	5	ND	ND	ND	Jun. 2016 - Jun. 2020
Cadmium	5	µg/L	5	ND	ND	ND	Jun. 2016 - Jun. 2020
Fluoride (Source)	2	mg/L	5	ND	ND	ND	Jun. 2016 - Jun. 2020
Mercury	2	µg/L	5	ND	ND	ND	Jun. 2016 - Jun. 2020
Nickel	100	µg/L	5	ND	ND	ND	Jun. 2016 - Jun. 2020
Nitrate (As N)	10	mg/L	5	ND	ND	ND	Jun. 2016 - Jun. 2020
Nitrate + Nitrite (As N)	10000	µg/L	5	0.04	ND	0.2	Jun. 2016 - Jun. 2020
Nitrite (As N)	1000	µg/L	5	ND	ND	ND	Jun. 2016 - Jun. 2020
Perchlorate	6	µg/L	5	ND	ND	ND	Jun. 2016 - Jul. 2020
Selenium	50	µg/L	5	ND	ND	ND	Jun. 2016 - Jun. 2020
Thallium	2	µg/L	5	ND	ND	ND	Jun. 2016 - Jun. 2020
Total Chromium	50	µg/L	5	ND	ND	ND	Jun. 2016 - Jun. 2020
RADIOACTIVITY			**DR. JOE WAIDHOFER TREATMENT PLANT - RAW WATER STANISLAUS RIVER**				
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**
Gross Alpha	15	pCi/L	1	0.691	0.691	0.691	Oct. 2019

VOLATILE ORGANIC CHEMICALS (VOCs)			DR. JOE WAIDHOFFER TREATMENT PLANT - RAW WATER STANISLAUS RIVER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
1,1,1-Trichloroethane	200	µg/L	5	ND	ND	ND	Jun. 2016	-	Aug. 2020
1,1,2,2-Tetrachloroethane	1	µg/L	5	ND	ND	ND	Jun. 2016	-	Aug. 2020
1,1,2-Trichloroethane	5	µg/L	5	ND	ND	ND	Jun. 2016	-	Aug. 2020
1,1-Dichloroethane	5	µg/L	5	ND	ND	ND	Jun. 2016	-	Aug. 2020
1,1-Dichloroethylene	6	µg/L	5	ND	ND	ND	Jun. 2016	-	Aug. 2020
1,2,3-Trichlorobenzene	0.005	µg/L	5	ND	ND	ND	Jun. 2016	-	Aug. 2020
1,2,4-Trichlorobenzene	5	µg/L	5	ND	ND	ND	Jun. 2016	-	Aug. 2020
1,2-Dichlorobenzene	600	µg/L	5	ND	ND	ND	Jun. 2016	-	Aug. 2020
1,2-Dichloroethane	0.5	µg/L	5	ND	ND	ND	Jun. 2016	-	Aug. 2020
1,2-Dichloropropane	5	µg/L	5	ND	ND	ND	Jun. 2016	-	Aug. 2020
1,3-Dichloropropene (Total)	0.5	µg/L	5	ND	ND	ND	Jun. 2016	-	Aug. 2020
1,4-Dichlorobenzene	5	µg/L	5	ND	ND	ND	Jun. 2016	-	Aug. 2020
Benzene	1	µg/L	5	ND	ND	ND	Jun. 2016	-	Aug. 2020
Carbon Tetrachloride	0.5	µg/L	5	ND	ND	ND	Jun. 2016	-	Aug. 2020
Cis-1,2-Dichloroethylene	6	µg/L	5	ND	ND	ND	Jun. 2016	-	Aug. 2020
Dichloromethane	5	µg/L	5	ND	ND	ND	Jun. 2016	-	Aug. 2020
Methyl tert-Butyl Ether	13	µg/L	5	ND	ND	ND	Jun. 2016	-	Aug. 2020
Monochlorobenzene	70	µg/L	5	ND	ND	ND	Jun. 2016	-	Aug. 2020
Styrene	100	µg/L	5	ND	ND	ND	Jun. 2016	-	Aug. 2020
Tetrachloroethylene	5	µg/L	5	ND	ND	ND	Jun. 2016	-	Aug. 2020
Toluene	150	µg/L	5	ND	ND	ND	Jun. 2016	-	Aug. 2020
Trans-1,2-Dichloroethylene	10	µg/L	5	ND	ND	ND	Jun. 2016	-	Aug. 2020
Trichloroethylene	5	µg/L	5	ND	ND	ND	Jun. 2016	-	Aug. 2020
Vinyl Chloride	0.5	µg/L	5	ND	ND	ND	Jun. 2016	-	Aug. 2020
Xylenes	1750	µg/L	5	ND	ND	ND	Jun. 2016	-	Aug. 2020
Ethylbenzene	300	µg/L	5	ND	ND	ND	Jun. 2016	-	Aug. 2020
Trichlorofluoromethane	150	µg/L	5	ND	ND	ND	Jun. 2016	-	Aug. 2020
Trichlorofluoroethane (Freon 113)	1200	µg/L	5	ND	ND	ND	Jun. 2016	-	Aug. 2020

NON-VOLATILE SYNTHETIC ORGANIC CHEMICALS (SOCS)			DR. JOE WAIDHOFER TREATMENT PLANT - RAW WATER STANISLAUS RIVER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
2,4,5-TP (Silvex)	50	µg/L	2	ND	ND	ND	Jun. 2016	-	Aug. 2019
2,4-D	70	µg/L	2	ND	ND	ND	Jun. 2016	-	Aug. 2019
Bentazon	18	µg/L	2	ND	ND	ND	Jun. 2016	-	Aug. 2019
Carbofuran	18	µg/L	2	ND	ND	ND	Jun. 2016	-	Aug. 2019
Dalapon	200	µg/L	2	ND	ND	ND	Jun. 2016	-	Aug. 2019
Dibromochloropropane (DBCP)	0.2	µg/L	2	ND	ND	ND	Jun. 2016	-	Aug. 2019
Dinoseb	7	µg/L	2	ND	ND	ND	Jun. 2016	-	Aug. 2019
Diquat	20	µg/L	2	ND	ND	ND	Jun. 2016	-	Aug. 2019
Endothall	100	µg/L	2	ND	ND	ND	Jun. 2016	-	Aug. 2019
Ethylene Dibromide	0.05	µg/L	2	ND	ND	ND	Jun. 2016	-	Aug. 2019
Glyphosate	700	µg/L	2	ND	ND	ND	Jun. 2016	-	Aug. 2019
Oxamyl	50	µg/L	2	ND	ND	ND	Jun. 2016	-	Aug. 2019
Pentachlorophenol	1	µg/L	2	ND	ND	ND	Jun. 2016	-	Aug. 2019
Picloram	500	µg/L	2	ND	ND	ND	Jun. 2016	-	Aug. 2019
1,2,3-Trichloropropane	0.005	µg/L	4	ND	ND	ND	Jan. 2018	-	Oct. 2018

SECONDARY STANDARDS			DR. JOE WAIDHOFER TREATMENT PLANT - RAW WATER STANISLAUS RIVER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	200	µg/L	5	114	ND	170	Jun. 2016	-	Jun. 2020
Chloride	250	mg/L	5	0.4	ND	1	Jun. 2016	-	Jun. 2020
Color	15	Units	5	15	5	25	Jun. 2016	-	Jun. 2020
Copper	1000	µg/L	5	ND	ND	ND	Jun. 2016	-	Jun. 2020
Iron	300	µg/L	5	192	110	240	Jun. 2016	-	Jun. 2020
Manganese	50	µg/L	5	8	ND	20	Jun. 2016	-	Jun. 2020
Methyl tert-Butyl Ether	5	µg/L	5	ND	ND	ND	Jun. 2016	-	Aug. 2020
MBAS	0.5	mg/L	5	ND	ND	ND	Jun. 2016	-	Jun. 2020
Odor	3	TON	5	2.4	1	4	Jun. 2016	-	Jun. 2020
Silver	100	µg/L	5	ND	ND	ND	Jun. 2016	-	Jun. 2020
Specific Conductance	900	µS/cm	5	64	55	75	Jun. 2016	-	Jun. 2020
Sulfate	250	mg/L	5	2.44	1.6	4	Jun. 2016	-	Jun. 2020
Total Dissolved Solids	500	mg/L	5	40	ND	60	Jun. 2016	-	Jun. 2020
Turbidity	5	NTU	5	4.6	2.8	8.9	Jun. 2016	-	Jun. 2020
Zinc	5000	µg/L	5	ND	ND	ND	Jun. 2016	-	Jun. 2020
MONITORING ASSOCIATED WITH SECONDARY STANDARDS			**DR. JOE WAIDHOFER TREATMENT PLANT - RAW WATER STANISLAUS RIVER**						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Bicarbonate Alkalinity	-	mg/L	5	32	30	40	Jun. 2016	-	Jun. 2020
Calcium	-	mg/L	5	6	5	7	Jun. 2016	-	Jun. 2020
Carbonate Alkalinity	-	mg/L	5	ND	ND	ND	Jun. 2016	-	Jun. 2020
Hydroxide Alkalinity	-	mg/L	5	ND	ND	ND	Jun. 2016	-	Jun. 2020
Magnesium	-	mg/L	5	2.2	2	3	Jun. 2016	-	Jun. 2020
pH	-	-	5	7.34	6.8	7.7	Jun. 2016	-	Jun. 2020
Sodium	-	mg/L	5	2.4	2	3	Jun. 2016	-	Jun. 2020
Total Alkalinity	-	mg/L	5	26	20	30	Jun. 2016	-	Jun. 2020
Total Hardness	-	mg/L	5	24.02	20.7	29.8	Jun. 2016	-	Jun. 2020

Table D-15: Title 22 Analysis of Treated Water for the Dr. Joe Waidhofer Water Treatment Plant.

INORGANICS			DR. JOE WAIDHOFER TREATMENT PLANT - TREATED WATER						
Name	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	1000	µg/L	5	4	ND	20	Jun. 2016	-	Jun. 2020
Antimony	6	µg/L	5	ND	ND	ND	Jun. 2016	-	Jun. 2020
Arsenic	10	µg/L	5	ND	ND	ND	Jun. 2016	-	Jun. 2020
Barium	1000	µg/L	5	8.3	ND	41.5	Jun. 2016	-	Jun. 2020
Beryllium	4	µg/L	5	ND	ND	ND	Jun. 2016	-	Jun. 2020
Cadmium	5	µg/L	5	ND	ND	ND	Jun. 2016	-	Jun. 2020
Fluoride (Source)	2	mg/L	5	ND	ND	ND	Jun. 2016	-	Jun. 2020
Mercury	2	µg/L	5	ND	ND	ND	Jun. 2016	-	Jun. 2020
Nickel	100	µg/L	5	ND	ND	ND	Jun. 2016	-	Jun. 2020
Nitrate (As N)	10	mg/L	5	ND	ND	ND	Jun. 2016	-	Jun. 2020
Nitrate + Nitrite (As N)	10000	µg/L	5	ND	ND	ND	Jun. 2016	-	Jun. 2020
Nitrite (As N)	1000	µg/L	5	ND	ND	ND	Jun. 2016	-	Jun. 2020
Selenium	50	µg/L	5	ND	ND	ND	Jun. 2016	-	Jun. 2020
Thallium	2	µg/L	5	ND	ND	ND	Jun. 2016	-	Jun. 2020
Total Chromium	50	µg/L	5	ND	ND	ND	Jun. 2016	-	Jun. 2020

SECONDARY STANDARDS			DR. JOE WAIDHOFER WTP - TREATED WATER						
Name	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	200	µg/L	5	4	ND	20	Jun. 2016	-	Jun. 2020
Chloride	250	mg/L	5	3.2	3	4	Jun. 2016	-	Jun. 2020
Color	15	Units	5	ND	ND	ND	Jun. 2016	-	Jun. 2020
Copper	1000	µg/L	5	ND	ND	ND	Jun. 2016	-	Jun. 2020
Iron	300	µg/L	5	ND	ND	ND	Jun. 2016	-	Jun. 2020
Manganese	50	µg/L	5	ND	ND	ND	Jun. 2016	-	Jun. 2020
MBAS	0.5	mg/L	5	ND	ND	ND	Jun. 2016	-	Jun. 2020
Odor	3	TON	8	1.6	ND	4	Jun. 2016	-	Dec. 2020
Silver	100	µg/L	5	ND	ND	ND	Jun. 2016	-	Jun. 2020
Specific Conductance	900	µS/cm	5	97.8	81	120	Jun. 2016	-	Jun. 2020
Sulfate	250	mg/L	5	12.0	9.4	15	Jun. 2016	-	Jun. 2020
Total Dissolved Solids	500	mg/L	5	66	50	80	Jun. 2016	-	Jun. 2020
Turbidity	5	NTU	5	0.12	ND	0.4	Jun. 2016	-	Jun. 2020
Zinc	5000	µg/L	5	ND	ND	ND	Jun. 2016	-	Jun. 2020

MONITORING ASSOCIATED WITH SECONDARY STANDARDS			DR. JOE WAIDHOFER WTP - TREATED WATER						
Name	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Bicarbonate Alkalinity	-	mg/L	5	32	30	40	Jun. 2016	-	Jun. 2020
Calcium	-	mg/L	5	6.6	5	8	Jun. 2016	-	Jun. 2020
Carbonate Alkalinity	-	mg/L	5	ND	ND	ND	Jun. 2016	-	Jun. 2020
Hydroxide Alkalinity	-	mg/L	5	ND	ND	ND	Jun. 2016	-	Jun. 2020
Magnesium	-	mg/L	5	2.6	2	3	Jun. 2016	-	Jun. 2020
pH	-	-	5	7.80	6.80	8.10	Jun. 2016	-	Jun. 2020
Sodium	-	mg/L	5	7.4	6	9	Jun. 2016	-	Jun. 2020
Total Alkalinity	-	mg/L	5	26	20	30	Jun. 2016	-	Jun. 2020
Total Hardness	-	mg/L	5	27.16	20.7	32.3	Jun. 2016	-	Jun. 2020

Table D-16: Title 22 Analysis of Raw Water for the NC DeGroot Water Treatment Plant.

INORGANICS			NC DEGROOT WATER TREATMENT PLANT - RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	1000	µg/L	5	126.8	ND	380	Apr. 2016	-	Jul. 2020
Antimony	6	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Arsenic	10	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Barium	1000	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Beryllium	4	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Cadmium	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Fluoride (Source)	2	mg/L	5	0.04	ND	0.2	Apr. 2016	-	Jul. 2020
Mercury	2	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Nickel	100	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Nitrate (As N)	10	mg/L	5	0.2	ND	1	Apr. 2016	-	Jul. 2020
Nitrate + Nitrite (As N)	10000	µg/L	4	0.25	ND	1	Apr. 2017	-	Jul. 2020
Nitrite (As N)	1000	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Perchlorate	6	µg/L	5	ND	ND	ND	Jun. 2016	-	Jul. 2020
Selenium	50	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Thallium	2	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Total Chromium	50	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020

VOLATILE ORGANIC CHEMICALS (VOCs)			NC DEGROOT WATER TREATMENT PLANT - RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
1,1,1-Trichloroethane	200	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
1,1,2,2-Tetrachloroethane	1	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
1,1,2-Trichloroethane	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
1,1-Dichloroethane	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
1,1-Dichloroethylene	6	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
1,2,3-Trichlorobenzene	0.005	µg/L	2	ND	ND	ND	Apr. 2016	-	Apr. 2017
1,2,4-Trichlorobenzene	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
1,2-Dichlorobenzene	600	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
1,2-Dichloroethane	0.5	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
1,2-Dichloropropane	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
1,3-Dichloropropene (Total)	0.5	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
1,4-Dichlorobenzene	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Benzene	1	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Carbon Tetrachloride	0.5	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Cis-1,2-Dichloroethylene	6	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Dichloromethane	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Methyl tert-Butyl Ether	13	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Monochlorobenzene	70	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Styrene	100	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Tetrachloroethylene	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Toluene	150	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Trans-1,2-Dichloroethylene	10	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Trichloroethylene	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Trichlorofluoroethane (Freon 113)	1200	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Vinyl Chloride	0.5	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Xylenes	1750	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Ethylbenzene	300	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Trichlorofluoromethane	150	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020

NON-VOLATILE SYNTHETIC ORGANIC CHEMICALS (SOCS)			NC DEGROOT WATER TREATMENT PLANT - RAW WATER						
Name	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
1,2,3-Trichloropropane	0.005	µg/L	4	ND	ND	ND	Jan. 2018	-	Oct. 2018
2,4,5-TP (Silvex)	50	µg/L	1	ND	ND	ND	Apr. 2016		
2,4-D	70	µg/L	1	ND	ND	ND	Apr. 2016		
Alachlor	2	µg/L	3	ND	ND	ND	Apr. 2016	-	Apr. 2020
Atrazine	1	µg/L	3	ND	ND	ND	Apr. 2016	-	Apr. 2020
Bentazon	18	µg/L	1	ND	ND	ND	Apr. 2016		
Benzo(a)pyrene	0.2	µg/L	1	ND	ND	ND	Apr. 2016		
Carbofuran	18	µg/L	1	ND	ND	ND	Apr. 2016		
Chlordane	0.1	µg/L	1	ND	ND	ND	Apr. 2016		
Dalapon	200	µg/L	1	ND	ND	ND	Apr. 2016		
Di(2-ethylhexyl)adipate	400	µg/L	1	ND	ND	ND	Apr. 2016		
Di(2-ethylhexyl)phthalate	4	µg/L	1	ND	ND	ND	Apr. 2016		
Dinoseb	7	µg/L	1	ND	ND	ND	Apr. 2016		
Diquat	20	µg/L	1	ND	ND	ND	Apr. 2016		
Endothall	100	µg/L	1	ND	ND	ND	Apr. 2016		
Endrin	2	µg/L	1	ND	ND	ND	Apr. 2016		
Glyphosate	700	µg/L	4	ND	ND	ND	Apr. 2016	-	Jul. 2019
Heptachlor	0.01	µg/L	1	ND	ND	ND	Apr. 2016		
Heptachlor Epoxide	0.01	µg/L	1	ND	ND	ND	Apr. 2016		
Hexachlorobenzene	1	µg/L	1	ND	ND	ND	Apr. 2016		
Hexachlorocyclopentadiene	50	µg/L	1	ND	ND	ND	Apr. 2016		
Lindane	0.2	µg/L	1	ND	ND	ND	Apr. 2016		
Methoxychlor	30	µg/L	1	ND	ND	ND	Apr. 2016		
Molinate	20	µg/L	1	ND	ND	ND	Apr. 2016		
Oxamyl	50	µg/L	1	ND	ND	ND	Apr. 2016		
Pentachlorophenol	1	µg/L	1	ND	ND	ND	Apr. 2016		
Picloram	500	µg/L	1	ND	ND	ND	Apr. 2016		
Simazine	4	µg/L	3	ND	ND	ND	Apr. 2016	-	Apr. 2020
Thiobencarb	70	µg/L	1	ND	ND	ND	Apr. 2016		
Total Polychlorinated Biphenyls (PCBs)	0.5	µg/L	1	ND	ND	ND	Apr. 2016		
Toxaphene	3	µg/L	1	ND	ND	ND	Apr. 2016		

SECONDARY STANDARDS			NC DEGROOT WATER TREATMENT PLANT - RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	200	µg/L	5	126.8	ND	380	Apr. 2016	-	Jul. 2020
Chloride	250	mg/L	5	1.32	ND	5	Apr. 2016	-	Jul. 2020
Color	15	Units	11	11.6	3	20	Apr. 2016	-	Oct. 2020
Copper	1000	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Iron	300	µg/L	13	290	ND	1100	Apr. 2016	-	Oct. 2020
Manganese	50	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
MBAS	0.5	mg/L	5	0.017	ND	0.085	Apr. 2016	-	Jul. 2020
Methyl tert-Butyl Ether	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Odor	3	TON	11	0.09	ND	1	Apr. 2016	-	Oct. 2020
Silver	100	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Specific Conductance	900	µS/cm	7	64	51	86	Apr. 2016	-	Jul. 2020
Sulfate	250	mg/L	5	3	1.3	6.5	Apr. 2016	-	Jul. 2020
Total Dissolved Solids	500	mg/L	5	40.4	36	47	Apr. 2016	-	Jul. 2020
Turbidity	5	NTU	8	3.99	1.5	11	Apr. 2016	-	Oct. 2020
Zinc	5000	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020

MONITORING ASSOCIATED WITH SECONDARY STANDARDS			NC DEGROOT WATER TREATMENT PLANT - RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Bicarbonate Alkalinity	-	mg/L	5	41.22	30	64.1	Apr. 2016	-	Jul. 2020
Calcium	-	mg/L	5	7.12	4.4	13.1	Apr. 2016	-	Jul. 2020
Carbonate Alkalinity	-	mg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Hydroxide Alkalinity	-	mg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Magnesium	-	mg/L	5	2.38	1.6	3.5	Apr. 2016	-	Jul. 2020
pH	-	-	7	7.27	6.4	7.7	Apr. 2016	-	Jul. 2020
Sodium	-	mg/L	5	3.72	2	8.7	Apr. 2016	-	Jul. 2020
Total Alkalinity	-	mg/L	5	33.9	25	52.5	Apr. 2016	-	Jul. 2020
Total Hardness	-	mg/L	6	49.0	21	111	Apr. 2016	-	Jul. 2020

Table D-17: Title 22 Analysis of Treated Water for the NC DeGroot Water Treatment Plant.

INORGANICS			NC DEGROOT WATER TREATMENT PLANT TREATED WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	1000	µg/L	6	ND	ND	ND	Apr. 2016	-	Jul. 2020
Antimony	6	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Arsenic	10	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Barium	1000	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Beryllium	4	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Cadmium	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Fluoride (Source)	2	mg/L	5	0.02	ND	0.1	Apr. 2016	-	Jul. 2020
Mercury	2	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Nickel	100	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Nitrate (As N)	10	mg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Nitrate + Nitrite (As N)	10000	µg/L	4	ND	ND	ND	Apr. 2017	-	Jul. 2020
Nitrite (As N)	1000	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Perchlorate	6	µg/L	5	ND	ND	ND	Jun. 2016	-	Jul. 2020
Selenium	50	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Thallium	2	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Total Chromium	50	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020

VOLATILE ORGANIC CHEMICALS (VOCs)			NC DEGROOT WATER TREATMENT PLANT TREATED WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
1,1,1-Trichloroethane	200	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
1,1,2,2-Tetrachloroethane	1	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
1,1,2-Trichloroethane	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
1,1-Dichloroethane	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
1,1-Dichloroethylene	6	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
1,2,3-Trichlorobenzene	0.005	µg/L	2	ND	ND	ND	Apr. 2016	-	Apr. 2017
1,2,4-Trichlorobenzene	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
1,2-Dichlorobenzene	600	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
1,2-Dichloroethane	0.5	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
1,2-Dichloropropane	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
1,3-Dichloropropene (Total)	0.5	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
1,4-Dichlorobenzene	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Benzene	1	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Carbon Tetrachloride	0.5	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Cis-1,2-Dichloroethylene	6	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Dichloromethane	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Methyl tert-Butyl Ether	13	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Monochlorobenzene	70	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Styrene	100	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Tetrachloroethylene	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Toluene	150	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Trans-1,2-Dichloroethylene	10	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Trichloroethylene	5	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Trichlorofluoroethane (Freon 113)	1200	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Vinyl Chloride	0.5	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Xylenes	1750	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Ethylbenzene	300	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020
Trichlorofluoromethane	150	µg/L	5	ND	ND	ND	Apr. 2016	-	Jul. 2020

NON-VOLATILE SYNTHETIC ORGANIC CHEMICALS (SOCS)			NC DEGROOT WATER TREATMENT PLANT - TREATED WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Alachlor	2	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2020
Atrazine	1	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2020
Glyphosate	700	µg/L	2	ND	ND	ND	Jul. 2018	-	Jul. 2019
Simazine	4	µg/L	2	ND	ND	ND	Apr. 2017	-	Apr. 2020

SECONDARY STANDARDS			NC DEGROOT WATER TREATMENT PLANT TREATED WATER				
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**
Chloride	250	mg/L	5	3.66	2.6	6.7	Apr. 2016 - Jul. 2020
Color	15	Units	11	1.18	ND	10	Apr. 2016 - Oct. 2020
Copper	1000	µg/L	5	ND	ND	ND	Apr. 2016 - Jul. 2020
Iron	300	µg/L	13	ND	ND	ND	Apr. 2016 - Oct. 2020
Manganese	50	µg/L	5	ND	ND	ND	Apr. 2016 - Jul. 2020
MBAS	0.5	mg/L	5	ND	ND	ND	Apr. 2016 - Jul. 2020
Odor	3	TON	11	0.75	ND	4	Apr. 2016 - Oct. 2020
Silver	100	µg/L	5	ND	ND	ND	Apr. 2016 - Jul. 2020
Specific Conductance	900	µS/cm	7	103.6	90	120	Apr. 2016 - Jul. 2020
Sulfate	250	mg/L	5	2.46	1.2	4.1	Apr. 2016 - Jul. 2020
Total Dissolved Solids	500	mg/L	5	49.6	30	64	Apr. 2016 - Jul. 2020
Turbidity	5	NTU	8	0.09	ND	0.24	Apr. 2016 - Oct. 2020
Zinc	5000	µg/L	5	ND	ND	ND	Apr. 2016 - Jul. 2020
MONITORING ASSOCIATED WITH SECONDARY STANDARDS			**NC DEGROOT WATER TREATMENT PLANT TREATED WATER**				
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**
Bicarbonate Alkalinity	-	mg/L	5	57.2	50	75.6	Apr. 2016 - Jul. 2020
Calcium	-	mg/L	5	14.4	11	21.9	Apr. 2016 - Jul. 2020
Carbonate Alkalinity	-	mg/L	5	ND	ND	ND	Apr. 2016 - Jul. 2020
Hydroxide Alkalinity	-	mg/L	5	ND	ND	ND	Apr. 2016 - Jul. 2020
Magnesium	-	mg/L	5	2.36	1.6	3.4	Apr. 2016 - Jul. 2020
pH	-	-	7	7.71	7.2	8	Apr. 2016 - Jul. 2020
Sodium	-	mg/L	5	5.22	3.7	8.3	Apr. 2016 - Jul. 2020
Total Alkalinity	-	mg/L	5	46.78	41	61.9	Apr. 2016 - Jul. 2020
Total Hardness	-	mg/L	6	63.8	37	109.2	Apr. 2016 - Jul. 2020

Table D-18: Title 22 Analysis of Raw Water for Knights Ferry

INORGANICS			KNIGHTS FERRY RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	1000	µg/L	4	35	ND	140	Oct. 2017	-	Oct. 2020
Antimony	6	µg/L	4	ND	ND	ND	Oct. 2017	-	Oct. 2020
Arsenic	10	µg/L	4	ND	ND	ND	Oct. 2017	-	Oct. 2020
Asbestos	7	MFL	1	ND	ND	ND	Jun. 2020		
Barium	1000	µg/L	4	ND	ND	ND	Oct. 2017	-	Oct. 2020
Beryllium	4	µg/L	4	ND	ND	ND	Oct. 2017	-	Oct. 2020
Cadmium	5	µg/L	4	ND	ND	ND	Oct. 2017	-	Oct. 2020
Fluoride (Source)	2	mg/L	4	ND	ND	ND	Oct. 2017	-	Oct. 2020
Mercury	2	µg/L	4	ND	ND	ND	Oct. 2017	-	Oct. 2020
Nickel	100	µg/L	4	ND	ND	ND	Oct. 2017	-	Oct. 2020
Nitrate (As N)	10	mg/L	9	0.2	ND	0.8	Jan. 2016	-	Oct. 2020
Nitrate + Nitrite (As N)	10000	µg/L	7	0.2	ND	0.8	Jan. 2016	-	Oct. 2020
Nitrite (As N)	1000	µg/L	6	ND	ND	ND	Jan. 2017	-	Oct. 2020
Perchlorate	6	µg/L	5	ND	ND	ND	Mar. 2016	-	Sep. 2019
Selenium	50	µg/L	4	ND	ND	ND	Oct. 2017	-	Oct. 2020
Thallium	2	µg/L	4	ND	ND	ND	Oct. 2017	-	Oct. 2020
Total Chromium	50	µg/L	4	ND	ND	ND	Oct. 2017	-	Oct. 2020
RADIOACTIVITY			**KNIGHTS FERRY RAW WATER**						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Gross Alpha	15	pCi/L	2	0.96	ND	1.92	Jul. 2016	-	Jul. 2020

VOLATILE ORGANIC CHEMICALS (VOCs)			KNIGHTS FERRY RAW WATER				
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**
1,1,1-Trichloroethane	200	µg/L	1	ND	ND	ND	Oct. 2017
1,1,2,2-Tetrachloroethane	1	µg/L	1	ND	ND	ND	Oct. 2017
1,1,2-Trichloroethane	5	µg/L	1	ND	ND	ND	Oct. 2017
1,1-Dichloroethane	5	µg/L	1	ND	ND	ND	Oct. 2017
1,1-Dichloroethylene	6	µg/L	1	ND	ND	ND	Oct. 2017
1,2,3-Trichlorobenzene	0.005	µg/L	1	ND	ND	ND	Oct. 2017
1,2,4-Trichlorobenzene	5	µg/L	1	ND	ND	ND	Oct. 2017
1,2-Dichlorobenzene	600	µg/L	1	ND	ND	ND	Oct. 2017
1,2-Dichloroethane	0.5	µg/L	1	ND	ND	ND	Oct. 2017
1,2-Dichloropropane	5	µg/L	1	ND	ND	ND	Oct. 2017
1,3-Dichloropropene (Total)	0.5	µg/L	1	ND	ND	ND	Oct. 2017
1,4-Dichlorobenzene	5	µg/L	1	ND	ND	ND	Oct. 2017
Benzene	1	µg/L	1	ND	ND	ND	Oct. 2017
Carbon Tetrachloride	0.5	µg/L	1	ND	ND	ND	Oct. 2017
Cis-1,2-Dichloroethylene	6	µg/L	1	ND	ND	ND	Oct. 2017
Dichloromethane	5	µg/L	1	ND	ND	ND	Oct. 2017
Ethylbenzene	300	µg/L	1	ND	ND	ND	Oct. 2017
Methyl tert-Butyl Ether	13	µg/L	2	ND	ND	ND	Oct. 2017 - Oct. 2020
Monochlorobenzene	70	µg/L	1	ND	ND	ND	Oct. 2017
Styrene	100	µg/L	1	ND	ND	ND	Oct. 2017
Tetrachloroethylene	5	µg/L	1	ND	ND	ND	Oct. 2017
Toluene	150	µg/L	1	ND	ND	ND	Oct. 2017
Trans-1,2-Dichloroethylene	10	µg/L	1	ND	ND	ND	Oct. 2017
Trichloroethylene	5	µg/L	1	ND	ND	ND	Oct. 2017
Trichlorofluoroethane (Freon 113)	1200	µg/L	1	ND	ND	ND	Oct. 2017
Trichlorofluoromethane	150	µg/L	1	ND	ND	ND	Oct. 2017
Vinyl Chloride	0.5	µg/L	1	ND	ND	ND	Oct. 2017
Xylenes	1750	µg/L	1	ND	ND	ND	Oct. 2017

NON-VOLATILE SYNTHETIC ORGANIC CHEMICALS (SOCS)			KNIGHTS FERRY RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
1,2,3-Trichloropropane	0.005	µg/L	4	ND	ND	ND	Feb. 2018	-	Nov. 2018
2,4,5-TP (Silvex)	50	µg/L	1	ND	ND	ND	Oct. 2017		
2,4-D	70	µg/L	1	ND	ND	ND	Oct. 2017		
Alachlor	2	µg/L	1	ND	ND	ND	Oct. 2017		
Atrazine	1	µg/L	1	ND	ND	ND	Oct. 2017		
Bentazon	18	µg/L	1	ND	ND	ND	Oct. 2017		
Benzo(a)pyrene	0.2	µg/L	1	ND	ND	ND	Oct. 2017		
Carbofuran	18	µg/L	1	ND	ND	ND	Oct. 2017		
Dalapon	200	µg/L	1	ND	ND	ND	Oct. 2017		
Di(2-ethylhexyl)adipate	400	µg/L	1	ND	ND	ND	Oct. 2017		
Di(2-ethylhexyl)phthalate	4	µg/L	1	ND	ND	ND	Oct. 2017		
Dibromochloropropane (DBCP)	0.2	µg/L	1	ND	ND	ND	Oct. 2017		
Dinoseb	7	µg/L	1	ND	ND	ND	Oct. 2017		
Diquat	20	µg/L	1	ND	ND	ND	Oct. 2017		
Endothall	100	µg/L	1	ND	ND	ND	Oct. 2017		
Ethylene Dibromide	0.05	µg/L	1	ND	ND	ND	Oct. 2017		
Glyphosate	700	µg/L	1	ND	ND	ND	Oct. 2017		
Molinate	20	µg/L	1	ND	ND	ND	Oct. 2017		
Oxamyl	50	µg/L	1	ND	ND	ND	Oct. 2017		
Pentachlorophenol	1	µg/L	1	ND	ND	ND	Oct. 2017		
Picloram	500	µg/L	1	ND	ND	ND	Oct. 2017		
Simazine	4	µg/L	1	ND	ND	ND	Oct. 2017		
Thiobencarb	70	µg/L	1	ND	ND	ND	Oct. 2017		

SECONDARY STANDARDS			KNIGHTS FERRY RAW WATER						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Aluminum	200	μg/L	4	35	ND	140	Oct. 2017	-	Oct. 2020
Chloride	250	mg/L	3	1.83	1.3	2.6	Apr. 2018	-	Apr. 2020
Color	15	Units	3	20	20	20	Apr. 2018	-	Apr. 2020
Copper	1000	μg/L	3	ND	ND	ND	Apr. 2018	-	Apr. 2020
Iron	300	μg/L	3	426.7	200	690	Apr. 2018	-	Apr. 2020
Manganese	50	μg/L	3	68.7	27	130	Apr. 2018	-	Apr. 2020
MBAS	0.5	mg/L	3	ND	ND	ND	Apr. 2018	-	Apr. 2020
Methyl tert-Butyl Ether	5	μg/L	2	ND	ND	ND	Oct. 2017	-	Oct. 2020
Odor	3	TON	3	ND	ND	ND	Apr. 2018	-	Apr. 2020
Silver	100	μg/L	5	ND	ND	ND	Oct. 2017	-	Oct. 2020
Specific Conductance	900	μS/cm	8	68.4	52	110	Mar. 2016	-	Apr. 2020
Sulfate	250	mg/L	3	1.93	1.9	2	Apr. 2018	-	Apr. 2020
Total Dissolved Solids	500	mg/L	3	51.7	43	62	Apr. 2018	-	Apr. 2020
Turbidity	5	NTU	3	4.83	3	8	Apr. 2018	-	Apr. 2020
Zinc	5000	μg/L	3	ND	ND	ND	Apr. 2018	-	Apr. 2020
MONITORING ASSOCIATED WITH SECONDARY STANDARDS			**KNIGHTS FERRY RAW WATER**						
Constituent	**MCL**	**Units**	**Samples**	**Average**	**Min**	**Max**	**Date**		
Bicarbonate Alkalinity	-	mg/L	50	35.6	26.9	82	Mar. 2016	-	Dec. 2020
Calcium	-	mg/L	3	6.5	6.4	6.6	Apr. 2018	-	Apr. 2020
Carbonate Alkalinity	-	mg/L	49	ND	ND	ND	Mar. 2016	-	Dec. 2020
Hydroxide Alkalinity	-	mg/L	49	ND	ND	ND	Mar. 2016	-	Dec. 2020
Magnesium	-	mg/L	3	2.73	2.4	3.4	Apr. 2018	-	Apr. 2020
pH	-	-	4	7.58	7.2	8.2	Apr. 2018	-	Apr. 2020
Sodium	-	mg/L	3	2.73	2.6	3	Apr. 2018	-	Apr. 2020
Total Alkalinity	-	mg/L	50	29.2	22	67.2	Mar. 2016	-	Dec. 2020
Total Hardness	-	mg/L	3	27.3	26	30	Apr. 2018	-	Apr. 2020