

## 7.2 Water Resources

### 7.2.1 Overview

This section discusses water resources in the vicinity of Yuba County Water Agency’s (YCWA or Licensee) Yuba River Development Project (Project).<sup>1</sup> This section is divided into nine subsections, including this overview (Section 7.2.1). Section 7.2.2 provides drainage area information for the Yuba River sub-basins and at major Project facilities. Section 7.2.3 provides information such as length and gradient of stream reaches potentially affected by the Project. Section 7.2.4 provides morphometric information regarding Project reservoirs. Section 7.2.5 describes the hydrology in the Project Vicinity. Sections 7.2.6 and 7.2.7 list the existing instream flow designated beneficial uses and applicable water quality standards, respectively, for stream reaches and reservoirs potentially affected by the Project. Section 7.2.8 provides the existing and proposed water rights potentially affected by the Project. Section 7.2.9 describes existing, relevant, and reasonably available water quality information upstream, within, and downstream of the Project, including water temperature, water chemistry, and mercury in fish.

### 7.2.2 Drainage Areas of Yuba River Sub-basins

Section 3.1.1 provided an overview of the seven major drainages in the Yuba River basin, and included a map (Figure 3.1-1) showing each sub-basin. The total drainage area of each sub-basin, including the portion of the drainage area upstream and downstream of the Project, is provided in Table 7.2.2-1.

**Table 7.2.2-1. Drainage areas of Yuba River sub-basins.**

Sub-Basin	Most Upstream Project Facility or Feature	Drainage Area			
		Upstream of Project Facilities	Downstream of Project Facilities		Total
		(square miles)	(square miles)	% of Total	(square miles)
North Yuba River	New Bullards Bar Reservoir Normal Maximum Water Surface Elevation	419.6	71.1	14	490.7
Middle Yuba River	Our House Diversion Dam <sup>1</sup>	144.5	30.4	17%	174.9
Oregon Creek <sup>2</sup>	Log Cabin Diversion Dam <sup>1</sup>	29.1	6.1	17	35.2
South Yuba River	None	351.6	0	0%	351.6
Deer Creek	None	89.4	0	0%	89.4
Dry Creek	None	108.0	0	0%	108
Yuba River <sup>3,4</sup>	New Colgate Powerhouse	14.6	80.1	85%	94.7
<b>Total</b>		<b>1,156.8</b>	<b>187.7</b>	<b>14%</b>	<b>1,344.5</b>

<sup>1</sup> Since the impoundments formed by Our House and Log Cabin diversion dams are so minor, the drainage area is given at the dam rather than at the normal maximum water surface elevation formed by the dam.

<sup>2</sup> Oregon Creek, on which the Project’s Log Cabin Diversion Dam is located, is a tributary to the Middle Yuba River. For the purpose of the above table, Oregon Creek is considered a separate sub-basin and its drainage area is not included in the Middle Yuba River drainage area.

<sup>3</sup> While New Colgate Powerhouse is the most upstream Project facility on the Yuba River, the Yuba River originates at the confluence of the North and Middle Yuba rivers. Project facilities on the North and Middle Yuba rivers result in the entire drainage area of the Yuba River being affected by the Project.

<sup>4</sup> Ninety-nine percent of the drainage area in the Yuba River is located upstream of United States Army Corps of Engineers’ (USACE) Daguerre Point Dam, and the remaining 1 percent is downstream of the dam.

<sup>1</sup> For the purpose of the Relicensing, the Project Vicinity is defined as the area surrounding the Project on the order of a United States Geological Survey (USGS) 1:24,000 topographic quadrangle.

### 7.2.3 Stream Reaches Affected by the Project

The eight stream reaches directly, indirectly, and cumulatively affected by the Project were described in Section 3.2. A summary description of each reach is provided in Table 7.2.3-1.

**Table 7.2.3-1. Stream reaches affected by the Project by sub-basin.<sup>1</sup>**

Reach Name	Upstream Terminus	Downstream Terminus	Length (mi)	Gradient (%)
<b>NORTH YUBA RIVER</b>				
New Bullards Bar Dam Reach	Base of New Bullards Bar Dam (RM 2.3, Elev 1,320 ft)	North Yuba River Confluence with Middle Yuba River (RM 0.0, Elev 1,124 ft)	2.3	2.2
<b>OREGON CREEK, A TRIBUTARY TO THE MIDDLE YUBA RIVER</b>				
Log Cabin Diversion Dam Reach	Base of Log Cabin Diversion Dam (RM 4.1, Elev 1,965 ft)	Oregon Creek Confluence with Middle Yuba River (RM 0.0, Elev 1,442 ft)	4.1	2.5
<b>MIDDLE YUBA RIVER</b>				
Our House Diversion Dam Reach	Base of Our House Diversion Dam (RM 12.0, Elev 1,970 ft)	Middle Yuba River Confluence with Oregon Creek (RM 4.5, Elev 1,442 ft)	7.5	1.4
Oregon Creek Reach	Middle Yuba River Confluence with Oregon Creek (RM 4.5, Elev 1,442 ft)	Middle Yuba River Confluence with North Yuba River (RM 0.0, Elev 1,124 ft)	4.5	1.3
<b>YUBA RIVER</b>				
Middle/North Yuba River Reach	Confluence of North and Middle Yuba rivers (RM 39.7, Elev 1,124 ft)	New Colgate Powerhouse (RM 33.9, Elev 543 ft)	5.8	1.9
New Colgate Powerhouse Reach	New Colgate Powerhouse (RM 33.9, Elev 543 ft)	USACE's <sup>2</sup> Englebright Reservoir Normal Maximum (RM 32.2, Elev 542 ft)	1.7	0.1
Narrows 2 Powerhouse Reach	Narrows 2 Powerhouse (RM 24.0, Elev 307 ft)	USACE's <sup>2</sup> Daguerre Point Dam Normal Maximum (RM 11.5, Elev 124 ft)	12.5	0.3
USACE's <sup>2</sup> Daguerre Point Dam Reach	USACE's <sup>2</sup> Daguerre Point Dam (RM 11.4, Elev 124 ft)	Yuba River Confluence with the Feather River (RM 0.0, Elev 48 ft)	11.4	0.1

Note: Elevation datum: NAVD 88

<sup>1</sup> Stream reaches impounded by Project and non-Project dams are not included in this table. See Section 3.2.2.

<sup>2</sup> USACE: United States Army Corps of Engineers

### 7.2.4 Morphometric Data for Existing Project Reservoirs

Table 7.2.4-1 summarizes relevant data related to New Bullards Bar Reservoir, the Project's only storage reservoir, including water surface elevation, gross storage, usable storage, surface area, volume, estimated maximum depths, and shoreline length.

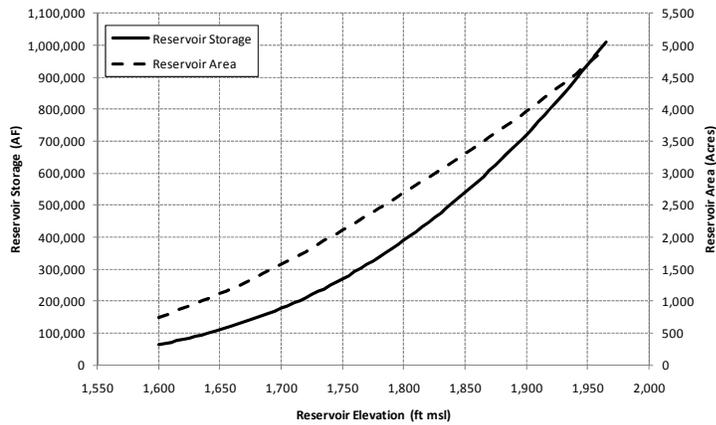
**Table 7.2.4-1. Morphometric information regarding Project reservoirs.**

Project Reservoir	Upstream Drainage Area (sq mi)	Usable Storage Capacity (ac-ft)	Normal Maximum WSEL <sup>1</sup> (ft)	Surface Area (ac)	Shoreline Length (mi)	Maximum Length (mi)	Estimated Maximum Depth (ft)
New Bullards Bar Reservoir	488.6	966,103	1,956	4,790	71.9	8.5	645

WSEL = Water Surface Elevation

The average hydraulic retention time of usable storage within New Bullards Bar Reservoir is approximately 6 months, based on long-term averages of storage and flow through the reservoir.

Figure 7.2.4-1 shows the storage-area-elevation curves for New Bullards Bar Reservoir from United States Army Corps of Engineers' (USACE) 1972 New Bullards Bar Reservoir Regulation for Flood Control Manual.



**Figure 7.2.4-1. New Bullards Bar storage-area-elevation curves.**

## 7.2.5 Streamflow, Gage Data, and Flow Statistics

For the purpose of this Pre-Application Document (PAD), Licensee’s hydrologic period of record extends from water year (WY) 1970 through WY 2008. This period includes both the driest and wettest periods for the Project Vicinity. Further, for the purpose of this PAD, “regulated” hydrology refers to hydrologic conditions with both Project and non-Project facilities in the watershed, “unimpaired” hydrology refers to flows that would have occurred in the basin during the period of record if no Project or non-Project facilities were present, and “non-Project” hydrology refers to flows that would have occurred if the Project had not been developed, but all non-Project facilities were present.

All regulated, unimpaired, and non-Project hydrology (mean daily values) as well as Licensee’s methods used to estimate each flow condition are provided in Appendix F. Regulated hydrology was synthesized by Licensee from measured reservoir elevations and stream flows and is reported by the United States Department of Interior (USDOI) United States Geological Survey (USGS) in annual reports, while unimpaired and non-Project hydrology were calculated using area-weighted flow, mass balance, and statistical regression methodologies. Appendix F also includes flow exceedance charts for all gage locations discussed in this section.

### 7.2.5.1 Streamflow and Other Gages in the Project Vicinity

Flow and reservoir elevation/storage data for the Project Vicinity comes from USGS and Licensee-maintained gages within the Yuba River Basin. Table 7.2.5-1 identifies the main gages that provide either flow or reservoir level data.

**Table 7.2.5-1. Streamflow gages and Project tunnel, powerhouse, and reservoir gages.**

USGS Gage Number	Name	Elevation (ft msl)	Drainage (sq mi)	Period of Record	
				Start	End
<b>STREAMFLOW GAGES</b>					
11408850	Middle Yuba River Near Camptonville	NA <sup>1</sup>	136	8/1/1967	9/30/1989
11408880 <sup>2</sup>	Middle Yuba River Below Our House Diversion Dam, Near Camptonville	1,957.51	145	10/1/1968	Present
11409300	Oregon Creek At Camptonville	2,230	23	10/1/1967	9/30/2000

**Table 7.2.5-1. Streamflow gages and Project tunnel, powerhouse, and reservoir gages.**

USGS Gage Number	Name	Elevation (ft msl)	Drainage (sq mi)	Period of Record	
				Start	End
11409400 <sup>2</sup>	Oregon Creek below Log Cabin Diversion Dam, Near Camptonville	1,912.73	29.1	9/1 1968	Present
11413000	North Yuba River below Goodyears Bar	2,453	250	10/1/1930	Present
11413300	Slate Creek Below Diversion Dam, Near Strawberry Valley	3,570	49.4	10/1/1960	Present
11413520 <sup>1</sup>	North Yuba River Below New Bullards Bar Dam, Near North San Juan	1,350	490	8/13/1966	9/30/2004
11417500	South Yuba River At Jones Bar, Near Grass Valley	1,060	308	10/1/1940	Present
11418000 <sup>1</sup>	Yuba River Below USACE's Englebright Dam, Near Smartville	278.68	1,108	10/1/1941	Present
11418500	Deer Creek Near Smartville	630	84.6	10/1/1935	Present
11421000 <sup>1</sup>	Yuba River Near Marysville	-2.95	1,339	10/1/1943	Present
11420700	Dry Creek near Browns Valley	NA	87	8/1/1964	10/03/1980
<b>TUNNEL FLOW GAGES</b>					
11408870	Lohman Ridge Diversion Tunnel At Intake, Near Camptonville	2,014.77	NA	10/1/1988	Present
11409350	Camptonville Diversion Tunnel At Intake, Near Camptonville	1,952.00	NA	10/1/1988	Present
<b>POWERHOUSE FLOW GAGES</b>					
11417980	Narrows Powerhouse No. 2 Below USACE's Englebright Dam	NA	NA	10/1/1970	9/30/2006
11413510	New Colgate Powerplant Near French Corral	NA	NA	10/1/1966	Present
11413517 <sup>1</sup>	North Yuba River Low Flow Release Below New Bullards Bar Dam	NA	NA	10/1/2003	Present
11417970	Narrows No. 1 Powerhouse at USACE's Englebright Dam (PG&E)	NA	NA	10/01/1974	9/30/2006
<b>RESERVOIR STORAGE GAGES</b>					
11413515	New Bullards Bar Reservoir Near North San Juan	1,965	489	1/1/1969	Present

Notes: Elevation per NGVD 1929. Elevation and drainage per USGS records.  
NA: Not available  
msl: mean sea level

<sup>1</sup> These gages are used by Licensee to document compliance with the minimum flow requirements in the existing Federal Energy Regulatory Commission (FERC) license.

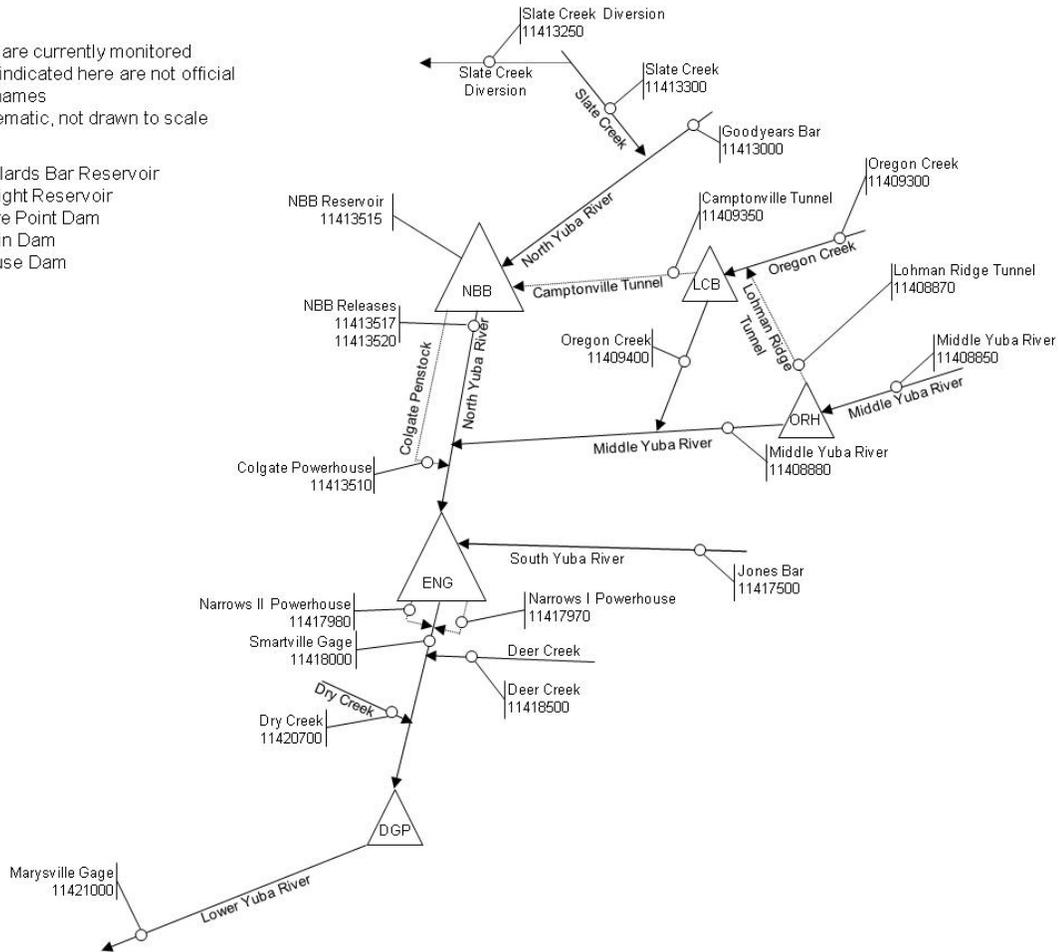
Figure 7.2.5-1 provides a schematic view of Project facilities and gages in the Project Vicinity.

**Notes:**

- Not all gages are currently monitored
- Gage names indicated here are not official USGS gage names
- Figure is schematic, not drawn to scale

**Key:**

- NBB = New Bullards Bar Reservoir
- ENG = Englebright Reservoir
- DGP = Daguerre Point Dam
- LCB = Log Cabin Dam
- ORH = Our House Dam



**Figure 7.2.5-1. Schematic of the Project Vicinity, including USGS gage identification numbers.**

**7.2.5.2 Regulated Hydrology Data for Project Facilities and Potentially Affected Sections of the Yuba River and Tributaries**

This section summarizes hydrology data available for sections of the Yuba River and its tributaries that provide inflow to the Project Area<sup>2</sup>, the area immediately downstream of Project facilities, powerhouses, and other points of interest, (e.g., USGS gage locations). Data are generally presented by sub-basin as outlined in Section 7.2.2 above, and in an upstream-to-downstream order. Licensee’s synthesized flow data for these points of interest are included with the complete hydrology data for both regulated and unimpaired flows in Appendix F.

Flow data shown in this section include average monthly gage flows, historical mean daily

<sup>2</sup> For the purposes of this document, the Project Area is defined as the area within the Federal Energy Regulatory Commission (FERC) Project Boundary and the land immediately surrounding the FERC Project Boundary (i.e., within about 0.25-mile of the FERC Project Boundary) and includes Project-affected reaches between facilities and downstream to the next major water controlling feature or structure.

streamflows per year, and flow exceedance curves by tributary or facility within the Project Vicinity. Most of the figures are based on an analysis of regulated USGS gage flow data for the period of record (i.e., WY 1970 through 2008). There are some exceptions due to new or discontinued gages, in which case the data were either synthesized based on a combination of data from several gages or a limited data set was used for analysis. Average monthly streamflows are shown as bar charts with end-point bars to represent minimum and maximum monthly flow values. Regulated mean daily flow figures help characterize daily trends and flow variability throughout the year. The flow exceedance curves represent the percentage of time a specified flow is equaled or exceeded throughout the period of record. See Appendix F for more detailed flow exceedance curves by month. The combination of the three figures for each tributary or facility provides a general description of gaged flow behaviors of these features within the Project Area.

#### 7.2.5.2.1 Historic Overview

Construction and operation of the Project have altered the flow regime of the lower Yuba River below USACE's Englebright Dam and flow regimes in the reaches below New Bullards Bar Dam, Log Cabin Diversion Dam and Our House Diversion Dam. Little streamflow information is available for pre-Project time periods for the reaches directly below the three Project dams, but two gaging stations located on the lower Yuba River have been operated since well before the Project was constructed. These gaging stations provide lower Yuba River hydrology for the pre-Project time period to compare to the Project hydrology. From 1903 through 1943, USGS Gage 11419000 measured flows on the Yuba River near Smartsville,<sup>3</sup> just below Deer Creek. Since 1943, both the Smartville Gage, USGS Gage Number 11418000, located at river mile 23 and the Marysville Gage, USGS Gage Number 11421000, at river mile 5.6, have been in operation.

Pre-Project hydrology can be compared with Project hydrology on a long term basis by comparing the exceedance probabilities of mean daily flows for various time periods. Three periods of interest are used for the comparison. The period of 1903 to 1941 is used for pre-project-condition hydrology at the Smartville Gage. This period was before the construction of USACE's Englebright Dam. The period of 1944 to 1969 is used for pre-project-condition flows with USACE's Englebright Dam and Pacific Gas and Electric Company (PG&E's) Narrows I Powerhouse in place, and the period of 1969 to 2008 is used for the Project-condition period of record flows.

#### 7.2.5.2.2 Time Period Setting

During the pre-Project time period of 1903 to 1941, no Project facilities were in place, USACE's Englebright Dam was not in place, although it was under construction for the last few years of this period, and development of the upper Yuba River watershed was taking place. Most of the dams and diversions that were used primarily for gold mining were already in place during this period, but they were being re-built, replaced or removed. Debris dams were also in place, being

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<sup>3</sup> In 2008, the people of this community petitioned to have the name changed to Smartsville, with an 's' in the middle of the name. However, the USGS gage refers to the former spelling of the community name. Therefore in this document, the community is referred to as such

re-built or being added at several locations throughout the middle to lower elevations of the watershed. During the 1903 to 1941 time period, three notable dams were constructed. The original Bullards Bar Dam (several brush, timber, and rock structures were constructed at Bullards Bar in the mid to late 1800s), a 175-foot-high dam creating 31,500 acre-ft of storage capacity, was constructed in the early 1920s at a location 2 miles upstream of the location of New Bullards Bar Dam. USACE's Englebright Dam was constructed by the California Debris Commission, a unit of USACE, in the late 1930s and early 1940s and is now owned by USACE. Lastly, USACE's Daguerre Point Dam was constructed in 1906 by the California Debris Commission and has been rebuilt several times in the same general vicinity since then.

For the lower Yuba River, the pre-Project time period of 1944 to 1969 is characterized by the construction and operation of USACE's Englebright Dam and the Narrows 1 Powerhouse. The Narrows 1 Powerhouse has a maximum rated release capacity of 730 cubic feet per second (cfs). USACE's Englebright Dam has an uncontrolled spillway crest; inflows to USACE's Englebright Reservoir at rates greater than the Narrows 1 Powerhouse release capacity, and that lasted for any significant duration, resulted in uncontrolled spilling at the dam. Upper Yuba River watershed development on the Middle and South Yuba rivers was mostly in place during this time period with the major South Yuba River dam, Spaulding Dam, having been constructed in 1913.

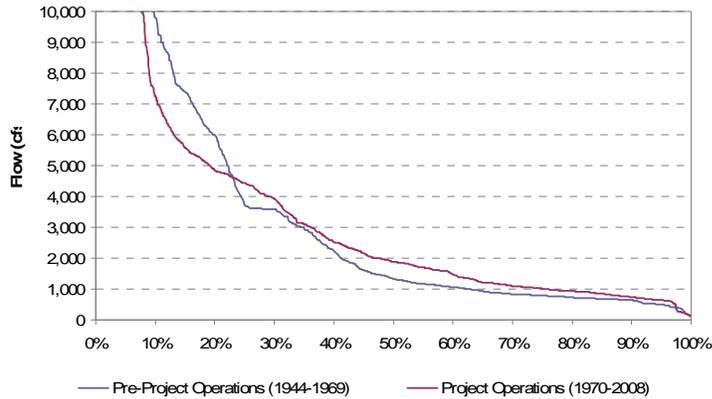
The Project time period of 1970 to 2008 includes the operation of New Bullards Bar Dam and the New Colgate and Narrows 2 powerhouses. During this time period, there were a range of operational procedures and constraints on the project affecting downstream hydrology. These procedures and constraints are detailed in Section 6.0. During the Project time period, three sets of instream flow requirements governed Project operations and resulted in varied hydrologies. Also during the Project time period, the use of Yuba River water, primarily through diversions at USACE's Daguerre Point Dam, increased with the expansion of irrigation systems within Yuba County.

#### 7.2.5.2.3 Comparison of Hydrologies

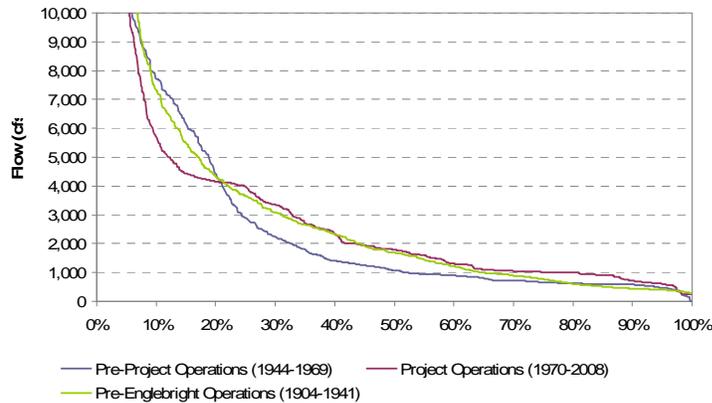
Figures 7.2.5-2 and 7.2.5-3 below show exceedance probabilities of mean daily flow in January for the two gaged locations, Marysville and Smartsville, respectively. The Marysville gage figure includes two time periods for comparison, the pre-Project time period of 1944 through 1969, and the Project time period of 1970 through 2008. The Smartsville gage figures include three time periods for comparison, the pre-Project and Pre-Englebright Dam time period of 1904 through 1941, the pre-Project time period of 1944 through 1969, and the Project time period of 1970 through 2008. Exceedance probability figures show the percentage of occurrences, in this case the percentage of days that a flow occurred, at or above a specific level. For example, in the figure for the Marysville gage mean daily flow exceedance for the month of January, the mean daily flows were at or above 2,000 cfs 40 percent of days for the pre-Project time period and 50 percent of days for the Project time period. Several of the exceedance charts are shown in the following pages. The full set of exceedance charts is in Appendix F – Hydrology CD.

The charts for both Marysville and Smartsville gages show little difference in pre-Project and Project flow exceedance percentages for the months gages of January. The Yuba River runoff

volume is substantially greater than the storage of Project facilities or USACE’s Englebright Reservoir. Even though New Bullards Bar Reservoir is typically filling during these months, the effect of filling may not significantly affect the frequency and volume of flow in the lower Yuba River on a long term basis.

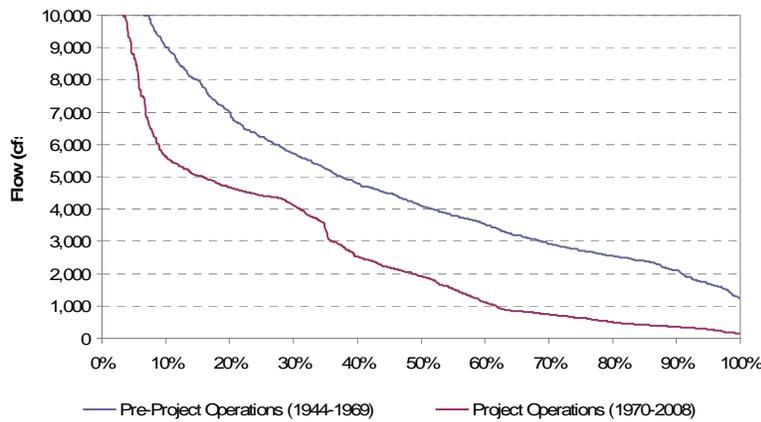


**Figure 7.2.5-2. Flow exceedance of historical mean daily streamflow at Marysville gage for January.**

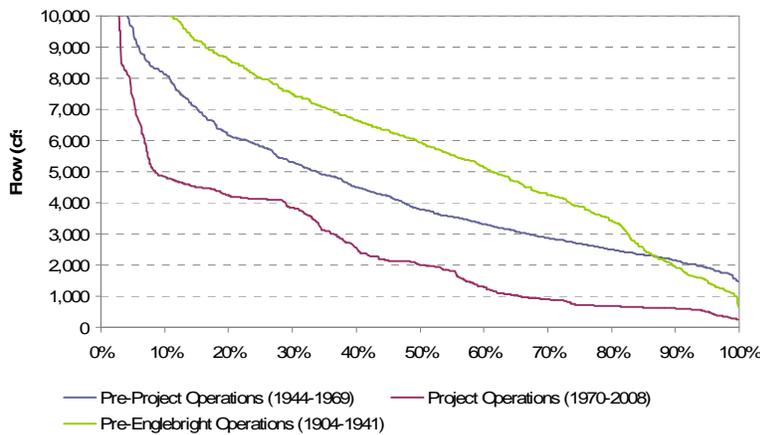


**Figure 7.2.5-3. Flow exceedance of historical mean daily streamflow at Smartville gage for January.**

As examples of flow conditions during the snowmelt period, figures 7.2.5-4 and 7.2.5-5 show the exceedance probabilities of mean daily flows for Marysville and Smartville gages for the month of April, respectively. These figures show that the Project period flows in April are consistently lower than flows during either the Pre-Englebright period or the Pre-Project period. The lower flows of the Project period are due to New Bullards Bar Reservoir capturing much of the snowmelt runoff. The months of March and May also show this trend, although with reduced differences in mean daily flow exceedances.



**Figure 7.2.5-4. Flow exceedance of historical mean daily streamflow at Marysville gage for April.**



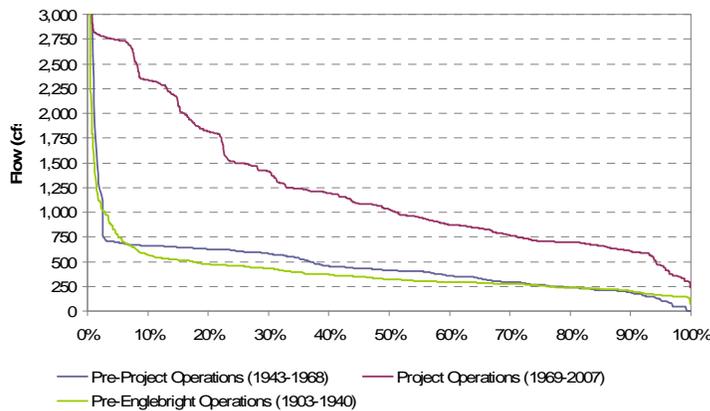
**Figure 7.2.5-5. Flow exceedance of historical mean daily streamflow at Smartville gage for April.**

Differences in mean daily flow exceedances are not solely related to Project operations; some of the differences in mean daily flow exceedances for March through May between the Project and pre-Project periods are due to hydrologic differences for the two periods. Unimpaired flow in the driest third of years averaged 400,000 acre-feet (ac-ft) less in the Project period than in the pre-Project period.

Comparisons of the pre-Project and Project flows for the months of July through November show substantially higher flows during the Project time period as compared to the pre-Englebright and pre-Project periods at both locations for all five months. Figures 7.2.5-6 and 7.2.5-7 show exceedance probabilities for the Marysville and Smartville gages for the month of October, respectively. The Marysville gage figure indicates 90 percent of the mean daily flow for the Project period is at least 400 cfs while the flow for the same month during the pre-Project period is only 44 cfs. Figure 7.2.5-7 shows mean daily flows at the Smartville gage are at least 600 cfs for 90 percent of days during the Project period, while flows in both the pre-Project and pre-Englebright periods exceed 195 cfs 90 percent of days. Other months of the July to November period have even greater differences between the Project and pre-Project flow exceedance probabilities (see Appendix F).

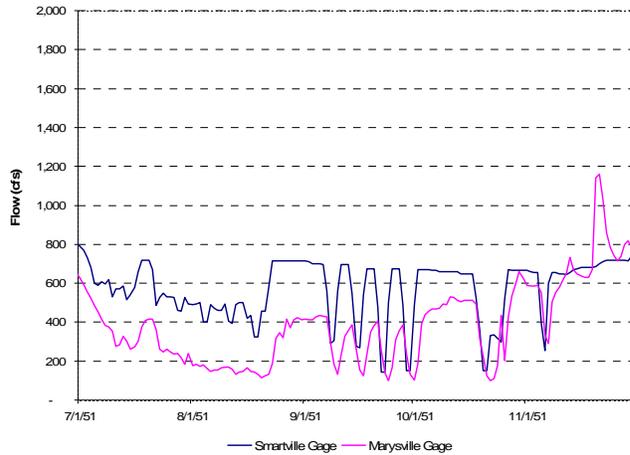


**Figure 7.2.5-6. Flow exceedance of historical mean daily streamflow at Marysville gage for October.**

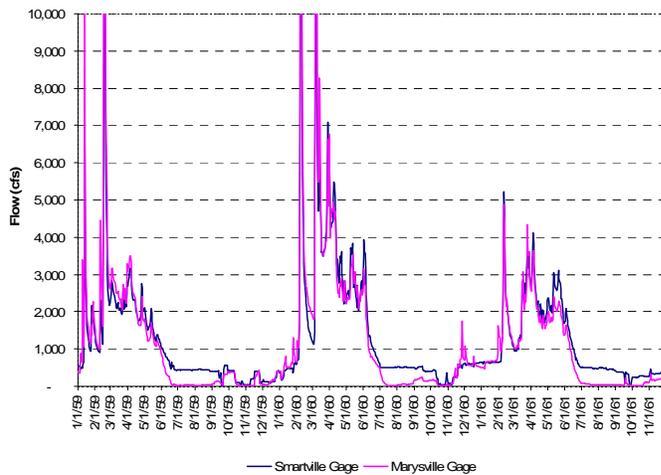


**Figure 7.2.5-7. Flow exceedance of historical mean daily streamflow at Smartville gage for October.**

While the exceedance probability figures provide a good reference for recurrence of flow, they do not provide any context to flow variability or how these flows occur. The mean daily pre-Project flows are characterized by low (as low as 20 cfs) flows at Marysville for July through November in many years irrespective of hydrology, and similarly low fall flows at Smartville with highly varied flows from day to day. For example, Figure 7.2.5-8 is a chart of mean daily flows for the months of July through November of 1951. As water was released from the Narrows 1 Powerhouse, mean daily flows at Smartville for the pre-Project period varied from 700 cfs to 150 cfs with a mid-week power generation peaking schedule for most of this period. Mean daily flows in September and parts of October averaged around 700 cfs on weekdays and dropped to about 150 cfs on weekends. Figure 7.2.5-9 shows mean daily flows for the years 1959 through 1961. For this pre-Project time period, flows at Marysville ranged from 15 cfs to 50 cfs for most of the summer, increased in the early fall for about a week or two to 150 cfs or more, and then dropped back to around 50 cfs for October and into November. For the Yuba Accord, summer flows are required to be above 400 cfs at Marysville gage for 95 percent of all years and would be above 350 cfs for the remaining percentage of years, except years classified as conference years, which is the one percent chance driest year.



**Figure 7.2.5-8. Mean daily streamflow on the lower Yuba River for July through November of 1951.**



**Figure 7.2.5-9. Mean daily streamflow on the lower Yuba River for 1959 through 1961.**

### 7.2.5.2.3 Project Conditions

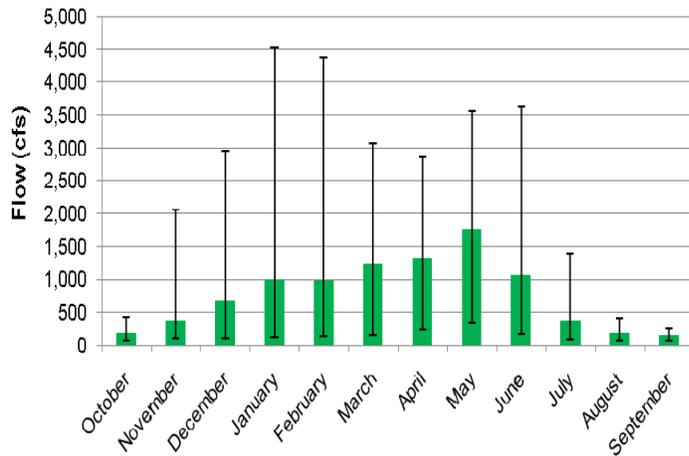
This section describes flow conditions at various facilities, beginning upstream of the Project and continuing through the Project and downstream to Marysville.

#### **North Yuba River**

The three primary tributaries of the North Yuba River are Canyon Creek, Slate Creek, and Deadwood Creek. There are no major projects on the mainstem of the North Yuba River upstream of New Bullards Bar that significantly affect the flow of the river. On its tributaries, however, there are two developments of note: one is the Deadwood Creek Power Plant, which is a small hydropower plant on Deadwood Creek; the other is the Slate Creek Diversion Dam on Slate Creek, operated by South Feather Water and Power Agency (SFWPA), which diverts water into the Feather River basin.

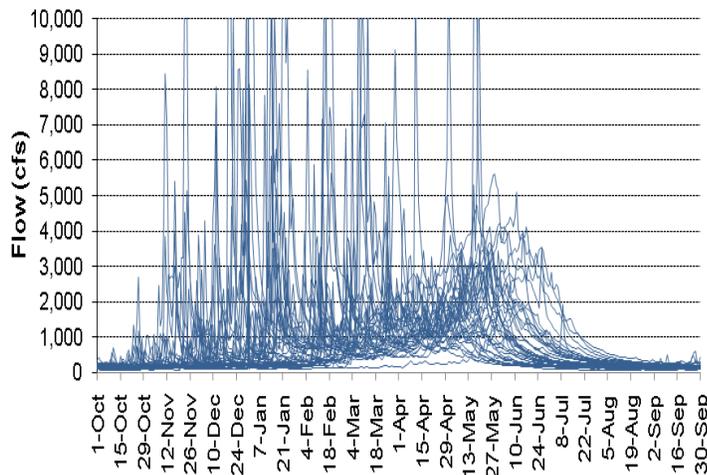
North Yuba River Upstream of New Bullards Bar Reservoir

The hydrology of the North Yuba River is predominantly snowmelt driven, with rain and snowmelt peak flows occurring from March through May. The record of daily data from the primary gage in the watershed upstream of the Project, North Yuba River below Goodyears Bar (USGS 11413000), has a period of record from October 1930 through the present. The Goodyears Bar gage is located at an elevation of approximately 2,453 feet, and includes a watershed area of approximately 250 square miles. Figure 7.2.5-10 shows average monthly streamflow for the North Yuba River at Goodyears Bar. During most months, the maximum monthly flows are significantly higher than the monthly average, representing significant precipitation events or outliers. The maximum average monthly streamflow of 4,526 cfs and daily maximum streamflow of 29,600 cfs were recorded during the height of an extreme flood in January 1997.



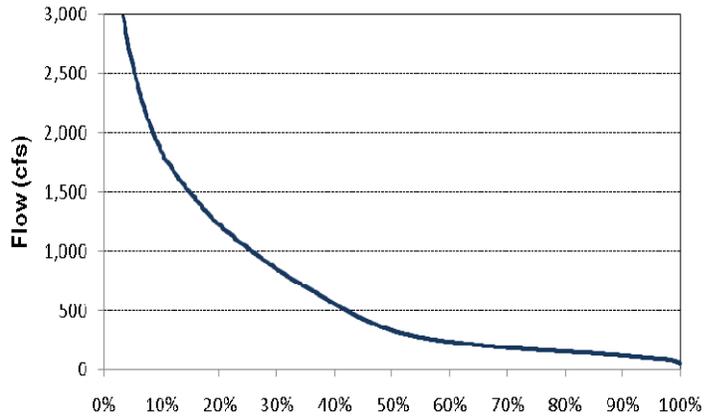
**Figure 7.2.5-10. Average monthly streamflow for the North Yuba River below Goodyears Bar gage (USGS 11413000) from WY 1970 through WY 2008.**

Historical mean daily streamflows per year in the North Yuba River are shown in Figure 7.2.5-11.



**Figure 7.2.5-11. Historical mean daily streamflow each year for the North Yuba River below Goodyears Bar gage (USGS Gage 11413000) from WY 1970 through WY 2008.**

A flow exceedance curve of historical mean daily average flow on the North Yuba River at Goodyears Bar gage is shown in Figure 7.2.5-12. Only 10 percent of daily average flows during the period of record exceed 2,000 cfs. Fifty percent of daily average flows exceed 360 cfs, and 90 percent of daily average flows exceed 140 cfs.



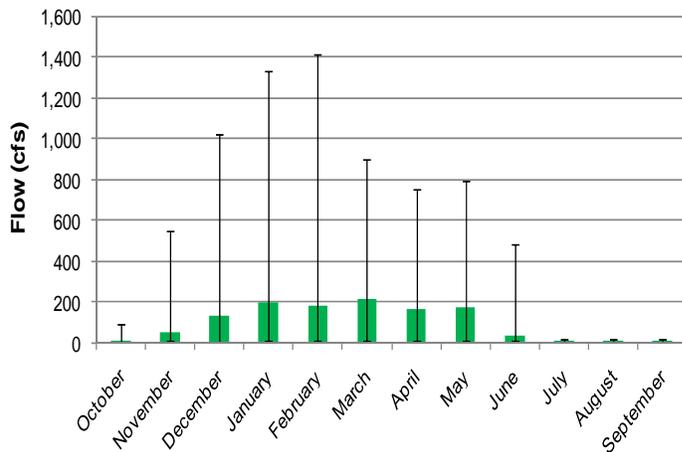
**Figure 7.2.5-12. Flow exceedance of historical mean daily streamflow for the North Yuba River below Goodyears Bar gage (USGS Gage 11413000) from WY 1970 through WY 2008.**

#### Slate Creek, Tributary to North Yuba River Upstream of New Bullards Bar Reservoir

Slate Creek is one of the larger tributaries to the North Yuba River upstream of New Bullards Bar Reservoir. It originates near the town of La Porte in the northern portion of the Yuba River watershed and joins the North Yuba River approximately 0.5 mile upstream of the upper reaches of New Bullards Bar Reservoir at an elevation of approximately 1,980 feet. The Slate Creek watershed is approximately 61 square miles.

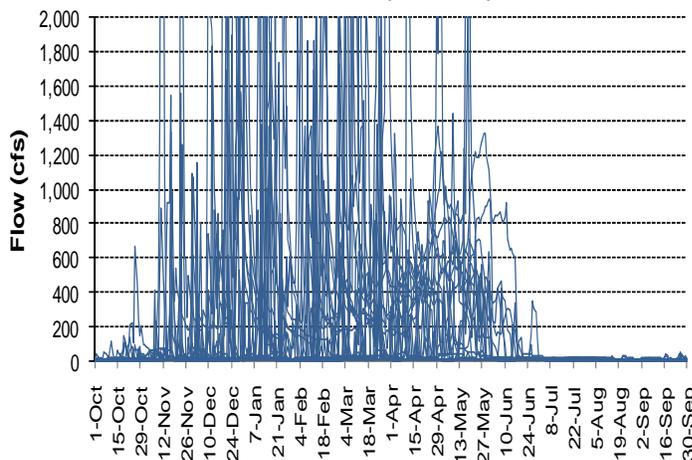
SFWPA diverts water from Slate Creek into the Feather River basin near Strawberry Valley via the Slate Creek Tunnel at approximately 3,500 feet, nearly 9 miles above Slate Creek's confluence with the North Yuba River. For a discussion of these diversions, refer to Section 7.2.8.1. Approximately 49 square miles of the Slate Creek watershed are upstream of the Slate Creek Diversion Dam; the other 12 square miles of the watershed are below the diversion dam. The average gradient of Slate Creek below the Slate Creek Diversion Dam is 3.3 percent.

Slate Creek inflows to the North Yuba River have been continuously gaged below the Slate Creek Tunnel by USGS Gage 11413300 since October 1960. Figure 7.2.5-13 shows average monthly streamflow for Slate Creek below the Slate Creek Diversion Dam. The maximum daily average streamflow of approximately 12,200 cfs was recorded during the height of the extreme flood in January 1997.



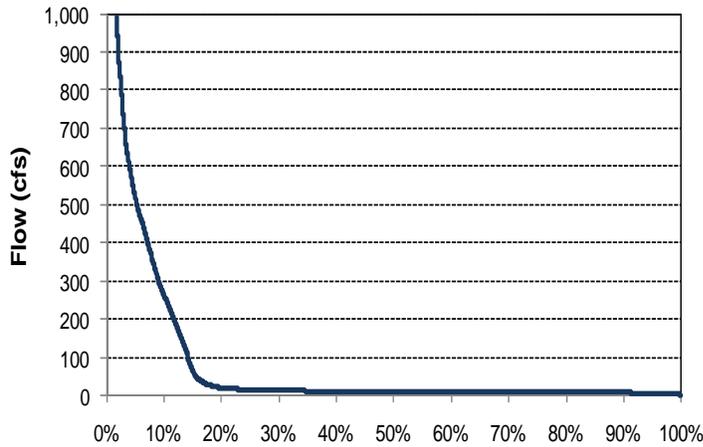
**Figure 7.2.5-13. Average monthly streamflow for Slate Creek below SFWPA's Slate Creek Diversion Dam (USGS Gage 11413300) from WY 1970 through WY 2008.**

Historical mean daily streamflows per year in Slate Creek below the Slate Creek Diversion Dam are shown in Figure 7.2.5-14.



**Figure 7.2.5-14. Historical mean daily streamflow each year for Slate Creek below SFWPA's Slate Creek Diversion Dam (USGS Gage 11413300) from WY 1970 through WY 2008.**

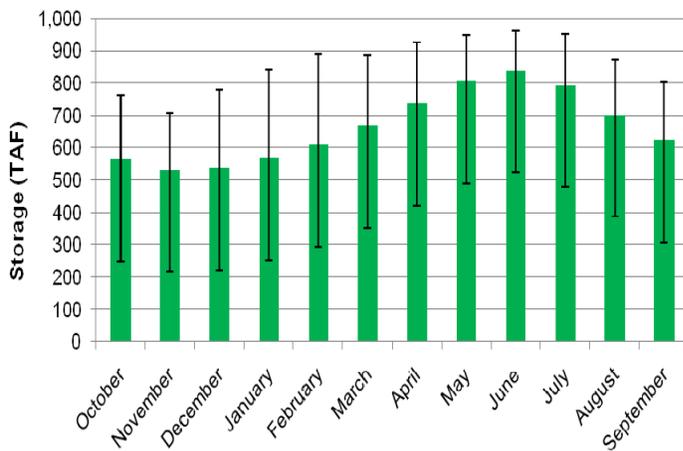
A flow exceedance curve for Slate Creek below SFWPA's Slate Creek Diversion Dam is shown in Figure 7.2.5-15. Only 10 percent of mean daily flows during the period of record exceed 300 cfs. Fifty percent of mean daily flows exceed 13 cfs, and 90 percent of mean daily flows exceed 2 cfs.



**Figure 7.2.5-15. Flow exceedance of historical mean daily streamflow for Slate Creek below SFWPA's Slate Creek Diversion Dam (USGS Gage 11413300) from WY 1970 through WY 2008.**

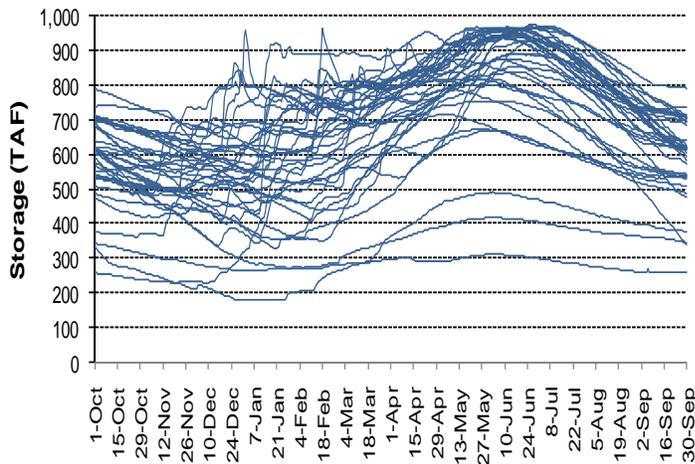
New Bullards Bar Reservoir

New Bullards Bar Reservoir has an estimated useable storage capacity of 966,103 ac-ft at gross pool and has been measured daily at USGS Gage 11413515 from October 1969 to the present. Figure 7.2.5-16 shows average monthly storage for the New Bullards Bar Reservoir. The maximum average monthly storage volume of approximately 960,000 ac-ft was recorded in June of 1996.



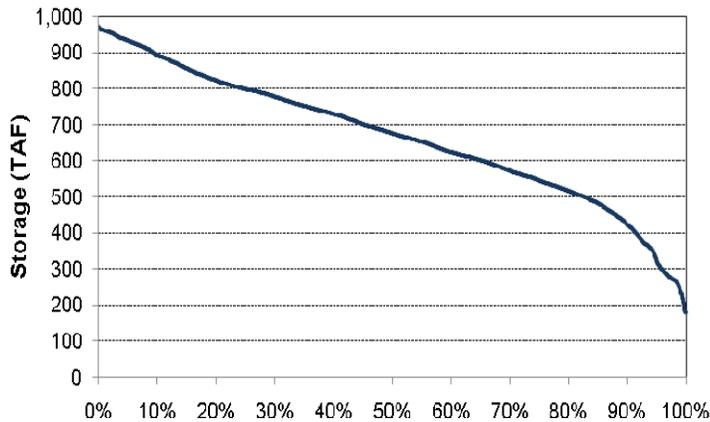
**Figure 7.2.5-16. Average monthly storage for New Bullards Bar Reservoir (USGS Gage 11413515) from WY 1970 through WY 2008.**

Historical daily storage for the reservoir is shown per year in Figure 7.2.5-17. The reservoir storage is typically at its highest in May and June, and at its lowest in December and January. The lowest storage since the reservoir first filled, 178,230 ac-ft, occurred on December 29, 1981. The lowest maximum daily storage for the May and June time period, 289,454 ac-ft, occurred on May 2, 1977.



**Figure 7.2.5-17. Historical daily storage each year for New Bullards Bar Reservoir (USGS Gage 11413515) from WY 1970 through WY 2008. WY 1977 represents the lowest peak storage during the period of record.**

A storage exceedance curve for daily New Bullards Bar Reservoir storage is shown in Figure 7.2.5-18. Daily storage exceeds 895,000 ac-ft 10 percent of the time during the period of record. Daily storage exceeds 675,000 ac-ft 50 percent of the time and exceeds 415,000 ac-ft 90 percent of the time.



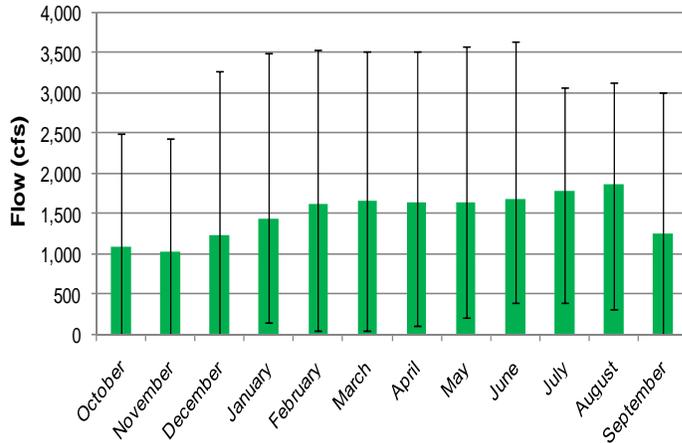
**Figure 7.2.5-18. Storage exceedance of historical daily storage for New Bullards Bar Reservoir (USGS Gage 11413515) from WY 1970 through WY 2008.**

New Colgate Power Tunnel and Powerhouse - Diversion from North Yuba River to Yuba River

The New Colgate Powerhouse Power Tunnel and Penstock, with a capacity of 3,500 cfs, conveys water from New Bullards Bar Reservoir on the North Yuba River to the New Colgate Powerhouse on the Yuba River. The power tunnel and penstock include 5.2 miles of tunnel and 2,809 feet of a 14.5-ft diameter steel pipe. The New Colgate Powerhouse is an above-ground, steel-reinforced concrete powerhouse that houses two Voith Siemens Pelton-type turbines with a combined capacity of 340 megawatts (MW) under a design head of 1,306 feet and a maximum release rate of 3,430 cfs.

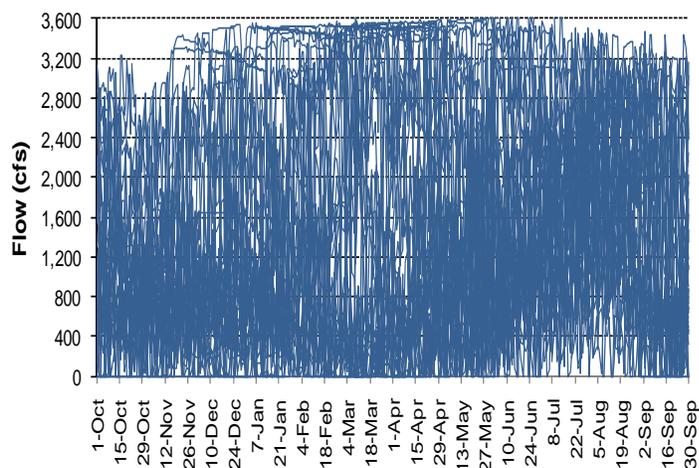
Flows in the power tunnel are measured by USGS Gage 11413510 at the New Colgate Powerhouse. This gage has measured flows since the New Colgate Powerhouse became active in 1969. Figure 7.2.5-19 shows the monthly average New Colgate Powerhouse Tunnel flow; the

maximum monthly average flow at full release capacity has occurred several times, always during very wet periods when the powerhouse was run at full capacity for the entire month. While the reported flows have exceeded 3,500 cfs on occasion, this is likely due to gage error.



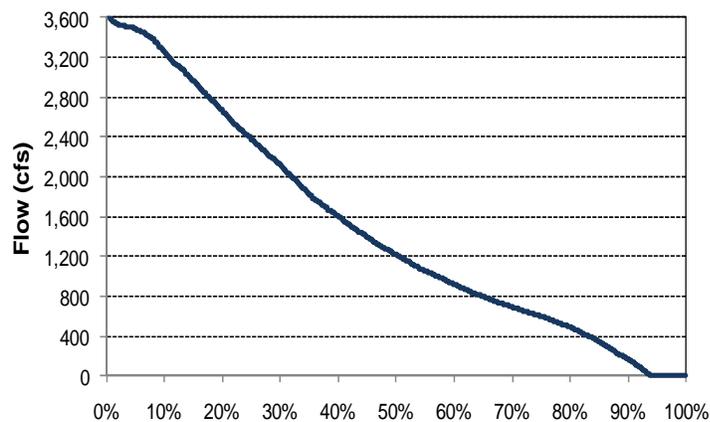
**Figure 7.2.5-19. Historical monthly average flow through the New Colgate Powerhouse Tunnel (USGS Gage 11413510) from WY 1970 through WY 2008.**

Figure 7.2.5-20 shows the historical mean daily flow through the New Colgate Powerhouse Tunnel. Since the New Colgate Powerhouse Tunnel nearly always has access to water due to the large amount of storage in New Bullards Bar Reservoir, releases do not generally follow a typical hydrological pattern of high releases during the winter and low releases in the summer and fall. For most of the year, New Colgate Powerhouse is operated as a peaking facility, or to provide ancillary services such as spinning reserves or regulation. Under peaking operations, releases through the powerhouse are concentrated to hours of the day when power is most valuable or when power is needed most (such as weekdays from mid-morning through early evening, largely corresponding to warmer times of the day and/or peak workday hours). Under ancillary services operations, the generating station may be ramped upwards or downwards quickly, to respond to power system load changes on a near-real-time basis. Under ancillary services operations, generating station output and flows may vary substantially minute-to-minute. The New Colgate Powerhouse also often operates under a combined peaking/ancillary service protocol, with one unit operating in peaking mode and the other unit responding to ancillary service requirements. During some of the late 1990s and early 2000s, New Colgate Powerhouse operations were focused on weekday peak generation. More recently, power generation has shifted to a schedule driven by a balance of peak period generation and providing ancillary services to the region.



**Figure 7.2.5-20. Historical mean daily flow each year for the New Colgate Powerhouse Tunnel (USGS Gage 11413510) from WY 1970 through WY 2008.**

The exceedance chart in Figure 7.2.5-21 shows the range and relative recurrence of mean daily flows throughout the period of record. This figure indicates the mean daily flows exceeded 3,200 cfs approximately 10 percent of the time, 1,200 cfs 50 percent of the time, and 200 cfs 90 percent of the time.

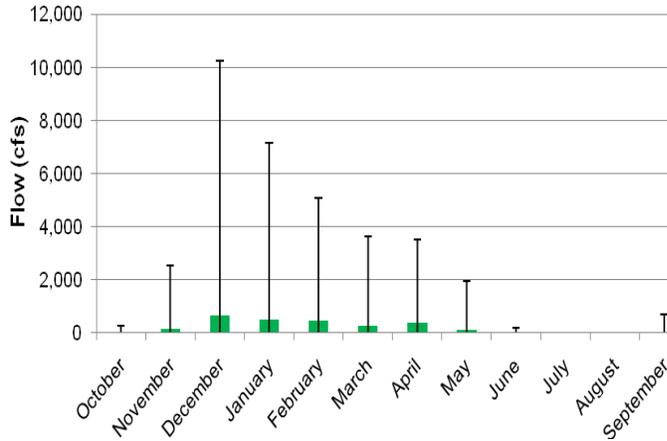


**Figure 7.2.5-21. Flow exceedances of historical mean daily flows in the New Colgate Powerhouse Tunnel (USGS Gage 11413510) from WY 1970 through WY 2008.**

North Yuba River Downstream of New Bullards Bar Dam

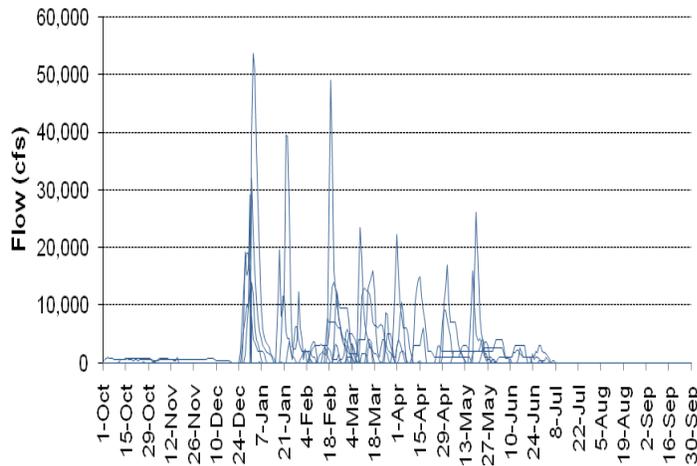
In the 2-mile-long reach of the North Yuba River below New Bullards Bar Dam, flow can come from one of three sources: releases from the New Bullards Bar Minimum Flow Powerhouse, releases from the New Bullards Bar Hollow Jet Valve, or spills from New Bullards Bar Dam spillway. The New Bullards Bar Minimum Flow Powerhouse constantly releases at about 6 cfs to meet the required 5 cfs minimum flow below New Bullards Bar Dam. The Hollow Jet Valve is used infrequently, generally when outages preclude releases to the New Colgate Powerhouse. Spills, while relatively infrequent, are a notable contributor to flows in the North Yuba River below New Bullards Bar Dam when they occur. Data for historical mean daily flows below New Bullards Bar Dam are from historical Licensee records and USGS gages 11413517 and 11413520, and are provided as Figures 7.2.5-22 through 7.2.5-24. While these figures do not

show any flows in July, August, or September, North Yuba River flows below New Bullards Bar Dam have historically been maintained at or above the minimum required flow throughout the period of record. The scale of the figures obscures the low flows generally occurring in those months.



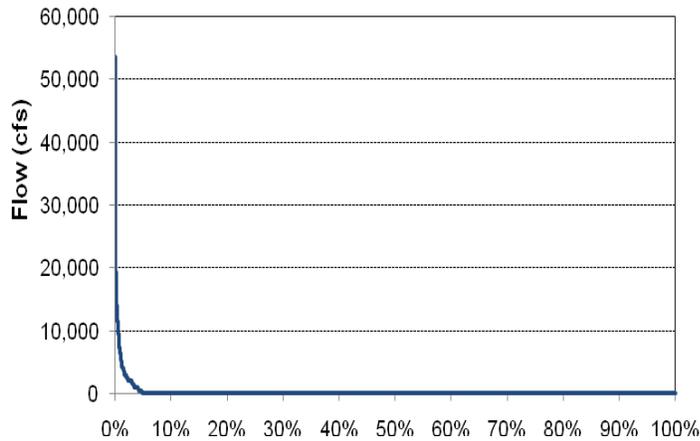
**Figure 7.2.5-22. Historical monthly average releases from New Bullards Bar Reservoir from WY 1970 through WY 2008.**

Spills from New Bullards Bar Dam typically occur between December and May, with some rare spills in June. Historically, the largest spills have occurred in late-December through mid-February, with the greatest mean daily spill of 53,633 cfs occurring on January 2, 1997.



**Figure 7.2.5-23. Historical mean daily average releases from New Bullards Bar Reservoir from WY 1970 through WY 2008.**

As shown in Figure 7.2.5-24, New Bullards Bar Dam spills have occurred on approximately 5 percent of days within the period of record. Spills of over 10,000 cfs have occurred on approximately 1 percent of days within the record.



**Figure 7.2.5-24. Flow exceedance of historical mean daily New Bullards Bar Dam releases from WY 1970 through WY 2008.**

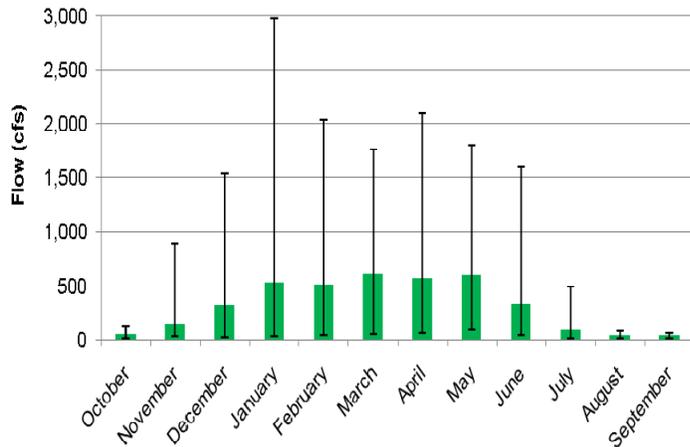
### **Middle Yuba River**

The Middle Yuba River Sub-basin covers approximately 210 square miles. This includes the area of the Oregon Creek watershed, which is discussed separately below. River flows vary greatly throughout the year due to the narrow, steep canyons along the banks of the river. Flows in the Middle Yuba River primarily originate from snow runoff and rainwater gathered at Jackson Meadows Reservoir in Sierra County. Other inflows to the Project-affected basin are provided by two tributaries: Oregon Creek and Grizzly Creek.

#### Middle Yuba River Upstream of Our House Diversion Dam

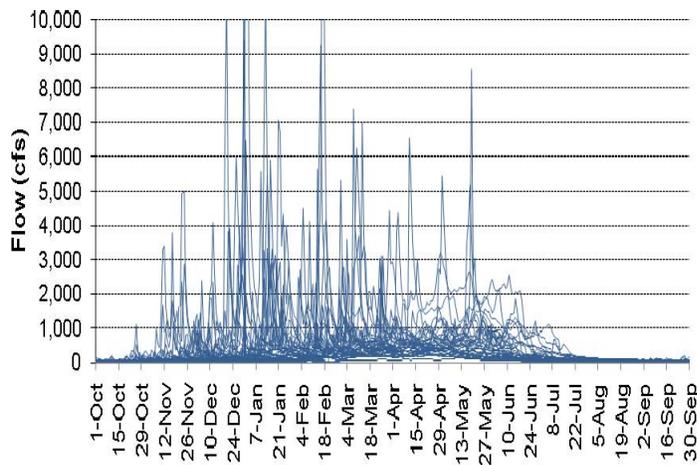
Nevada Irrigation District (NID) affects flow upstream of Our House Diversion Dam by storing water in Jackson Meadows Reservoir and diverting water to the South Yuba River at the Milton Diversion Dam. For a discussion of these storages and diversions, refer to Section 7.2.8.1.

Inflows to Our House Diversion Dam from the Middle Yuba River have been determined from three gages. Prior to 1989, USGS Gage 11408850 recorded Middle Yuba River flows near Camptonville. Since 1989, Middle Yuba River inflows to the Our House Diversion Dam are computed by adding the flow below Our House Diversion Dam, as measured at USGS Gage number 11408880 and flows in the Lohman Ridge Diversion Tunnel, as measured at USGS Gage 11408870. Figure 7.2.5-25 shows average monthly streamflow for Middle Yuba River based on the synthesized flows described above. The maximum monthly average streamflow, approximately 3,000 cfs, and maximum daily average stream flow of approximately 21,000 cfs, were recorded during the height of the extreme flood in January 1997.



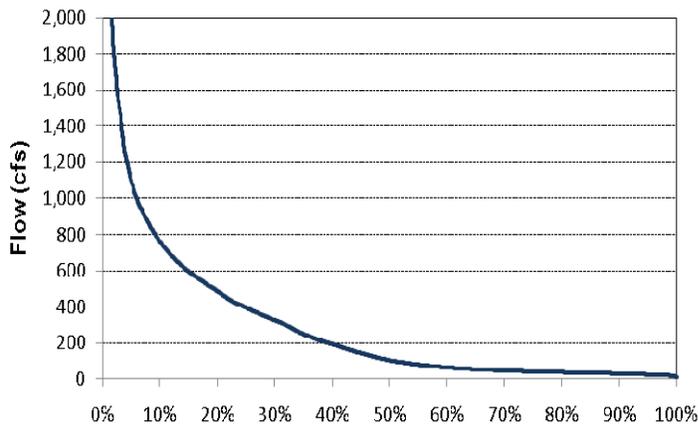
**Figure 7.2.5-25. Average monthly Middle Yuba River inflow to Our House Diversion Dam from WY 1970 through WY 2008.**

Historical mean daily streamflows per year in the Middle Yuba River are shown in Figure 7.2.5-26.



**Figure 7.2.5-26. Historical mean daily Middle Yuba River inflow to Our House Diversion Dam from WY 1970 through WY 2008.**

A flow exceedance curve for mean daily flows on the Middle Yuba River into Our House Diversion Dam is shown in Figure 7.2.5-27. Only 10 percent of mean daily flows during the period of record exceed 800 cfs. Fifty percent of mean daily flows exceed 115 cfs and 90 percent of mean daily flows exceed 30 cfs. These results indicate that the Middle Yuba River has generally lower flows than the North Yuba River.



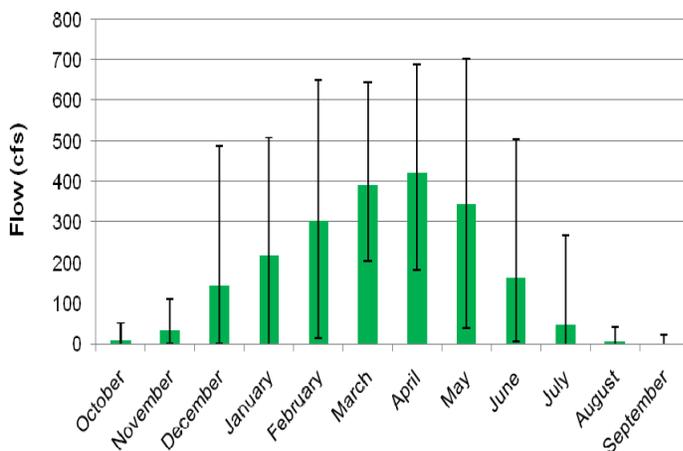
**Figure 7.2.5-27. Flow exceedance of historical mean daily Middle Yuba River inflow to Our House Diversion Dam from WY 1970 through WY 2008.**

Our House Diversion Dam Impoundment

Our House Diversion Dam is a 130-ft radius double curvature concrete arch dam located on the Middle Yuba River 12 miles upstream of its confluence with the North Yuba River, and has a drainage area of 144.8 square miles. The dam is 70 feet high with a crest length of 368 feet, a crest elevation of 2,049 feet, and has a maximum spillway capacity of 60,000 cfs. While there is no storage behind Our House Dam, the dam creates a headwater for diversion to the Project’s Lohman Ridge Tunnel and for releases to the Middle Yuba River.

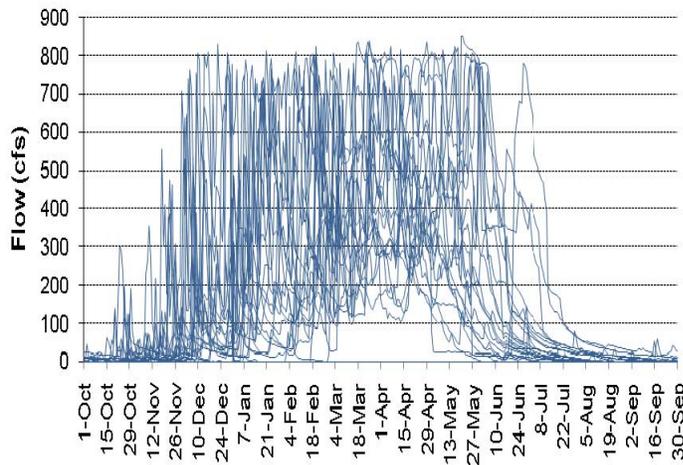
Lohman Ridge Diversion Tunnel – Diversion from Middle Yuba River to Oregon Creek

The Lohman Ridge Diversion Tunnel diverts flow from the Middle Yuba River at the Our House Diversion Dam impoundment to Oregon Creek. Tunnel flows have been measured at USGS Gage 11408870 since October 1988. The Lohman Ridge Diversion Tunnel is 12.5 feet high by 12.5 feet wide and diverts a maximum flow of 860 cfs through its 19,410- foot (90% unlined and 10% lined) length to Oregon Creek, approximately 1,000 feet upstream of Log Cabin Diversion Dam. Figure 7.2.5-28 shows average monthly flow for Lohman Ridge Diversion Tunnel diversions. The maximum monthly average flow, approximately 700 cfs, was recorded in May of 1996, a wet year.



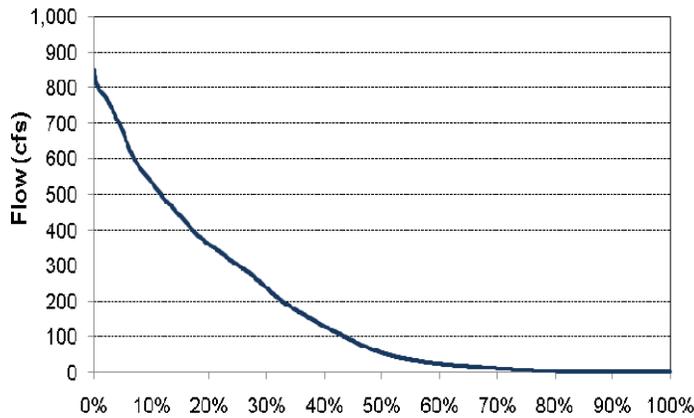
**Figure 7.2.5-28. Average monthly flow for the Lohman Ridge Diversion Tunnel (USGS Gage 11408870) from WY 1989 through WY 2008.**

Historical mean daily flows per year for the Lohman Ridge Diversion Tunnel are shown in Figure 7.2.5-29.



**Figure 7.2.5-29. Historical mean daily flow each year for the Lohman Ridge Diversion Tunnel (USGS Gage 11408870) from WY 1989 through WY 2008.**

A flow exceedance curve for mean daily flows in the Lohman Ridge Diversion Tunnel is shown in Figure 7.2.5-30. Only 10 percent of mean daily flows during the period of record (WY 1989-2008) exceed 525 cfs. Fifty percent of mean daily flows exceed 52 cfs; mean daily flows exceed 0 cfs 90 percent of days.

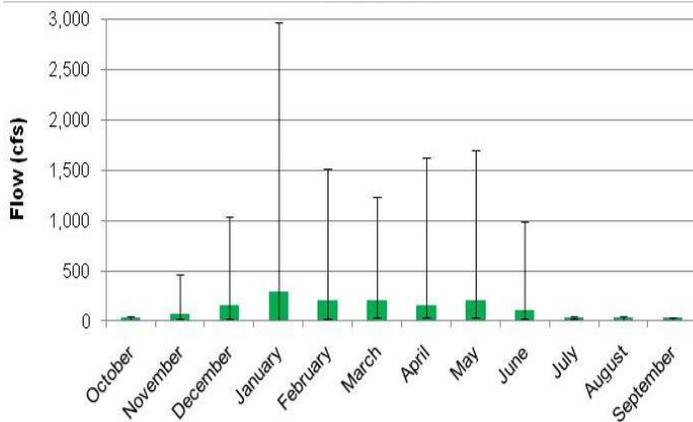


**Figure 7.2.5-30. Flow exceedance of historical mean daily flow for the Lohman Ridge Diversion Tunnel (USGS Gage 11408870) from WY 1989 through WY 2008.**

Middle Yuba River Downstream of Our House Diversion Dam

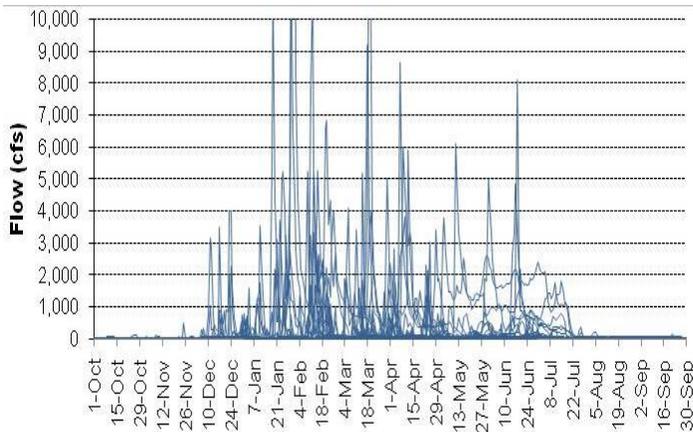
Our House Diversion Dam has two outlets: a 5-ft diameter steel pipe controlled by a slide gate on the upstream face of the dam diverts flows into the Lohman Ridge Diversion Tunnel, and a 24-inch pipe for releases to the Middle Yuba River. The outlet centerline of the 5-ft diameter steel pipe is at an elevation of 1,990 feet, and has a maximum capacity of 800 cfs. Flow to the 24-inch pipe is controlled by a hand-operated downstream gate valve and has a maximum capacity of 60 cfs.

Flows on the Middle Yuba River below Our House Diversion Dam have been measured since 1970 by the USGS gage 11408880. Figure 7.2.5-31 shows average monthly flow in the Middle Yuba River below Our House Diversion Dam for water year 1970 through water year 2008. The maximum monthly average Middle Yuba River flow below Our House Dam of 2,973 cfs and the maximum mean daily flow of 21,000 cfs were both recorded during the height of the extreme flood in January 1997.



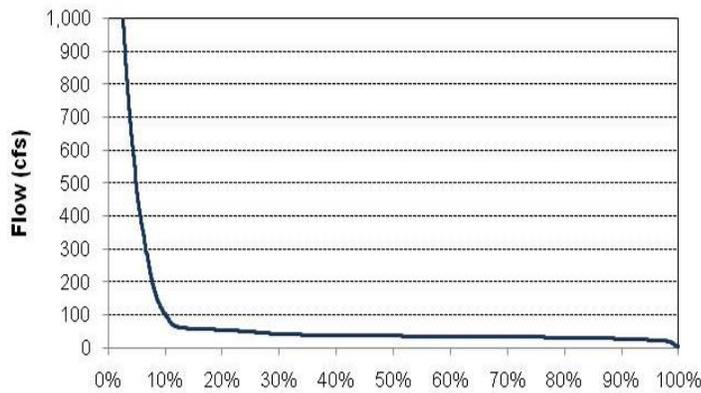
**Figure 7.2.5-31. Average monthly Middle Yuba River flow below Our House Dam from WY 1970 through WY 2008.**

Historical mean daily flows in the Middle Yuba River below Our House Dam are shown in Figure 7.2.5-32.



**Figure 7.2.5-32. Historical mean daily Middle Yuba River flow below Our House Dam from WY 1970 through WY 2008.**

An exceedance curve of mean daily flows in the Middle Yuba River below Our House Dam is shown in Figure 7.2.5-33. Only 10 percent of mean daily flows during the period of record (1969-2008) exceed 102 cfs. Fifty percent of mean daily flows exceed 36 cfs, and mean daily flows exceed 27 cfs on 90 percent of days.

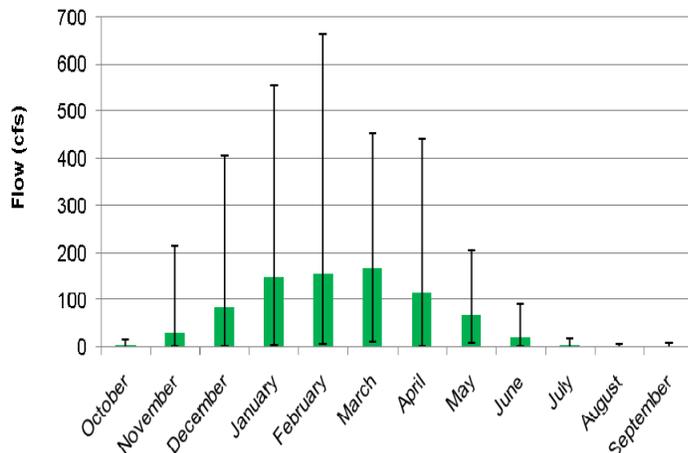


**Figure 7.2.5-33. Flow exceedance of historical mean daily Middle Yuba River flow below Our House Dam from WY 1970 through WY 2008.**

Oregon Creek, Tributary to the Middle Yuba River, Upstream of the Project

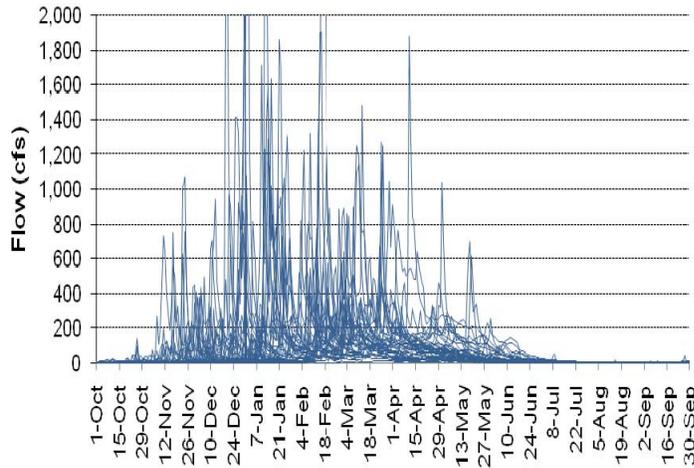
Oregon Creek is entirely contained within the Middle Yuba River watershed and originates near an elevation of approximately 4,455 feet. Oregon Creek flow above Log Cabin Diversion Dam is a combination of flow from the Lohman Ridge Diversion Tunnel, originating at Our House Diversion Dam on the Middle Yuba River, and Oregon Creek flows. Above the outfall of the Lohman Ridge Diversion Tunnel, Oregon Creek is free of development. Approximately 6 square miles of the 35-square mile Oregon Creek watershed lie below Log Cabin Diversion Dam.

Between October 1968 and September 2000, Oregon Creek flows to Log Cabin Diversion Dam were gaged by the USGS Gage 11409300 at Camptonville. Since then, inflows to Log Cabin Diversion Dam can be calculated by combining flows below Log Cabin Diversion Dam, as measured by USGS Gage 11409400, with flows in the Camptonville Diversion Tunnel, as measured by USGS Gage 11409350, and subtracting flows from the Lohman Ridge Diversion Tunnel, as measured at USGS Gage 11408870. Figure 7.2.5-34 shows average monthly streamflow for Oregon Creek based on a combination of historical and synthesized flows, as described above. The maximum monthly average streamflow, approximately 664 cfs, was recorded during a flood event in February of 1986, and the maximum daily average stream flow of approximately 3,730 cfs, was recorded during the height of the extreme flood in January 1997.



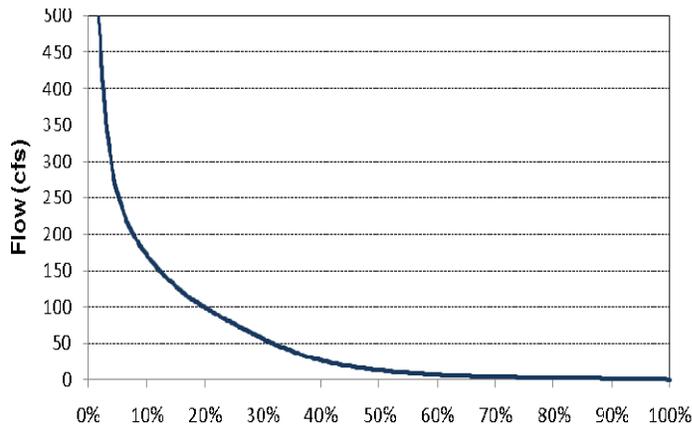
**Figure 7.2.5-34. Average monthly Oregon Creek flow above the Lohman Ridge Tunnel outfall from WY 1970 through WY 2008.**

Historical mean daily streamflows per year in Oregon Creek are shown in Figure 7.2.5-35.



**Figure 7.2.5-35 Historical mean daily Oregon Creek flow above the Lohman Ridge Tunnel outfall from WY 1970 through WY 2008.**

A flow exceedance curve of mean daily flows to Oregon Creek is shown in Figure 7.2.5-36. Only 10 percent of mean daily flows during the period of record exceed 140 cfs. Fifty percent of mean daily flows exceed 15 cfs, and mean daily flows exceed 2 cfs on 90 percent of days.



**Figure 7.2.5-36. Flow exceedance of historical mean daily Oregon Creek flow above the Lohman Ridge Tunnel outfall from WY 1970 through WY 2008.**

Log Cabin Diversion Dam Impoundment

The 55-ft high Log Cabin Diversion Dam diverts flows from Oregon Creek to New Bullards Bar Reservoir via the Camptonville Diversion Tunnel. Log Cabin Diversion Dam is approximately 4 miles upstream of Oregon Creek’s confluence with the Middle Yuba River. Similar to Our House Diversion Dam, Log Cabin Diversion Dam does not have any storage; the dam creates a headwater for diversions into the Project’s Camptonville Tunnel and for releases to Oregon Creek.

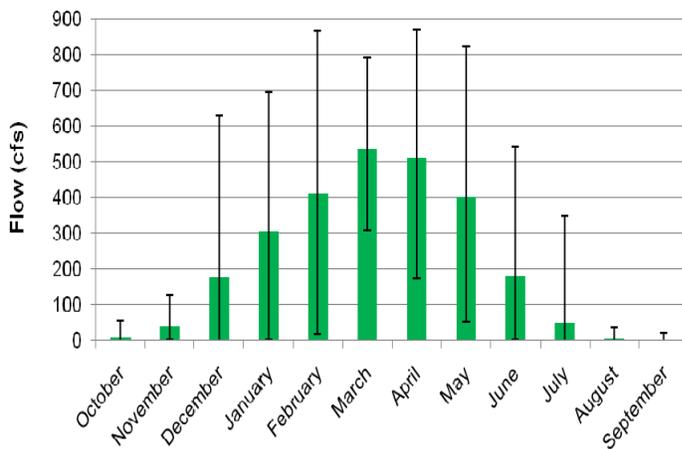
Camptonville Diversion Tunnel – Diversions from Oregon Creek to North Yuba River

Flow to the Camptonville Diversion Tunnel is controlled by a slide gate just upstream of the dam. The outlet centerline is at an elevation of 1,938 feet and the pipe’s maximum capacity is

1,100 cfs. Releases to Oregon Creek are made through an 18-inch diameter steel pipe controlled by a hand-operated gate valve downstream. The pipe's maximum capacity is 13 cfs.

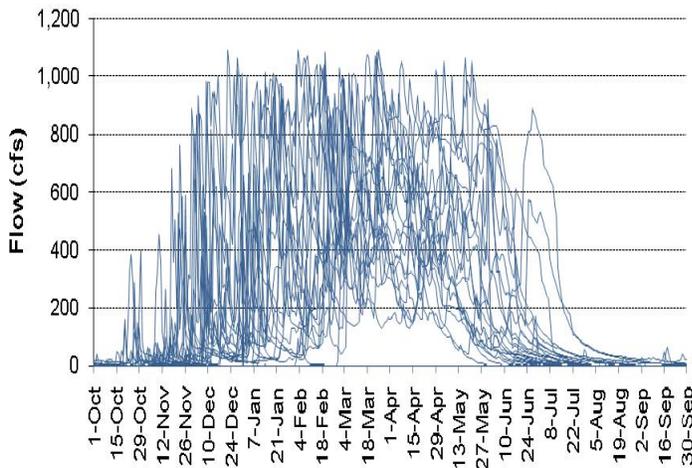
The Camptonville Diversion Tunnel is 6,107 feet long and has the capacity to convey 1,100 cfs to New Bullards Bar Reservoir on the North Yuba River. The first 4,275 feet of the conduit is an unlined horseshoe shaped tunnel 14.5 feet wide by 14.5 feet high, and the remaining 1,832 feet of the tunnel is a lined horseshoe shaped tunnel 11 feet 7 inches wide by 13 feet high.

The Camptonville Diversion Tunnel has the capacity to divert up to 1,100 cfs to New Bullards Bar Reservoir. The tunnel has been measured at USGS Gage 11408870 from October 1988 to the present. Figure 7.2.5-37 shows average monthly flow for Camptonville Diversion Tunnel diversions. The maximum average monthly flow, approximately 870 cfs, was recorded in April 1995, a wet year.



**Figure 7.2.5-37. Average monthly streamflow in the Camptonville Diversion Tunnel (USGS Gage 11408870) from WY 1989 through WY 2008.**

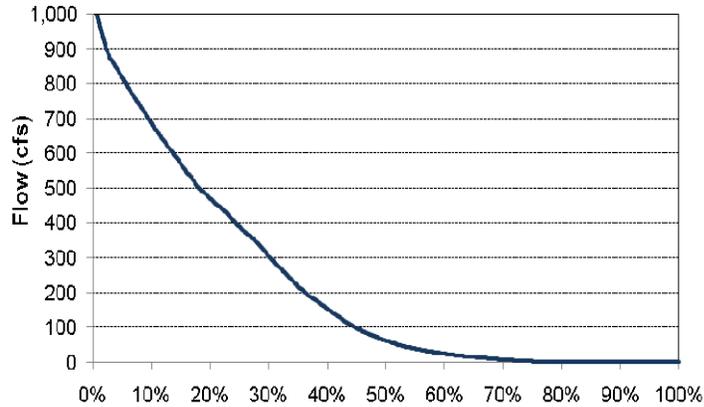
Historical mean daily flows for the Camptonville Diversion Tunnel are shown in Figure 7.2.5-38.



**Figure 7.2.5-38. Historical mean daily streamflow each year in the Camptonville Diversion Tunnel (USGS Gage 11408870) from WY 1989 through WY 2008.**

A flow exceedance curve for the Camptonville Diversion Tunnel is shown in Figure 7.2.5-39. Only 10 percent of mean daily flows during the period of record exceed 670 cfs, indicating that

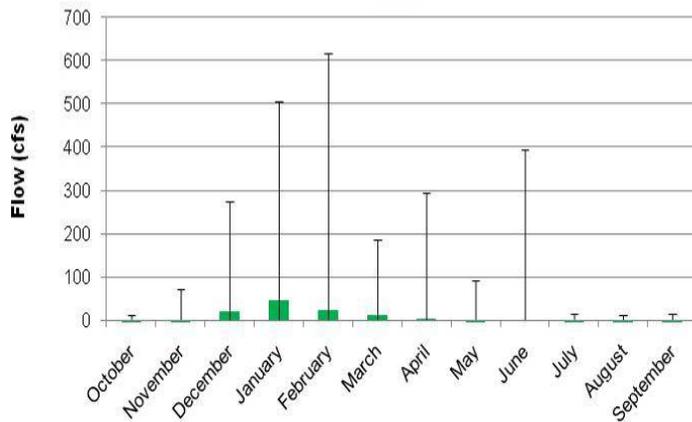
the majority of flows are much lower. Fifty percent of mean daily flows exceed 63 cfs, and mean daily flows exceed 0 cfs 90 percent of days.



**Figure 7.2.5-39. Flow exceedance of historical mean daily streamflow in the Camptonville Diversion Tunnel (USGS Gage 11408870) from WY 1989 through WY 2008.**

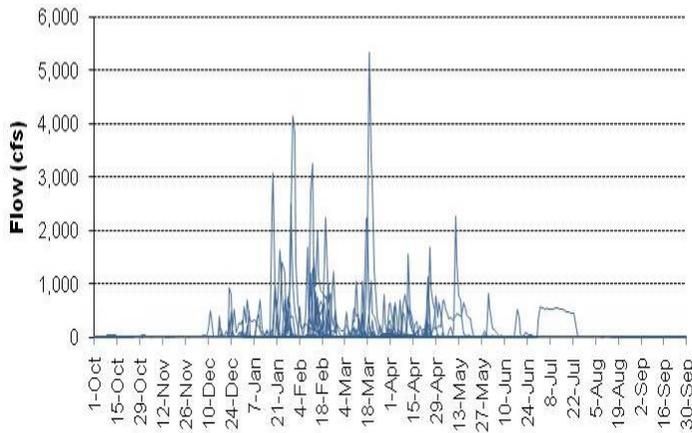
Oregon Creek Downstream of Log Cabin Diversion Dam

Flows in Oregon Creek below Log Cabin Diversion Dam have been monitored since 1970 by the USGS gage 11409400. Figure 7.2.5-40 shows average monthly flow in Oregon Creek below Log Cabin Diversion Dam for water year 1970 through water year 2008. The maximum monthly average flow in Oregon Creek below Log Cabin Diversion Dam of 617 cfs, and the maximum mean daily flow of 5,340 cfs, were recorded in February and March 1986, respectively.



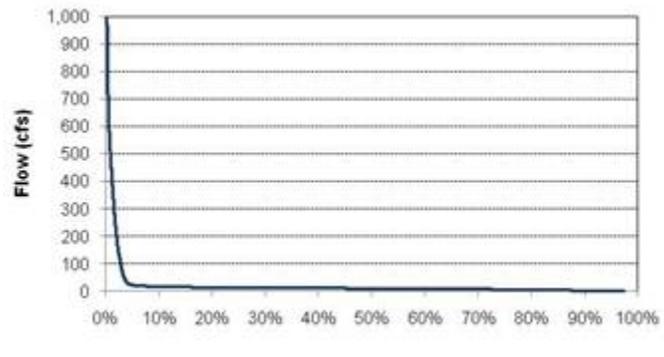
**Figure 7.2.5-40. Average monthly Oregon Creek flow below Log Cabin Diversion Dam from WY 1970 through WY 2008.**

Historical mean daily flows in Oregon Creek below the Log Cabin Diversion Dam are shown in Figure 7.2.5-41.



**Figure 7.2.5-41. Historical mean daily Oregon Creek flow below Log Cabin Diversion Dam from WY 1970 through WY 2008.**

A flow exceedance curve of mean daily flows in Oregon Creek below the Log Cabin Diversion Dam is shown in Figure 7.2.5-42. Only 10 percent of mean daily flows during the period of record exceed 17 cfs. Fifty percent of mean daily flows exceed 10 cfs, and mean daily flows exceed 3 cfs on 90 percent of days.



**Figure 7.2.5-42. Flow exceedance of historical mean daily streamflow in Oregon Creek below the Log Cabin Diversion Dam (USGS 11409400) from WY 1970 through WY 2008.**

## South Yuba River

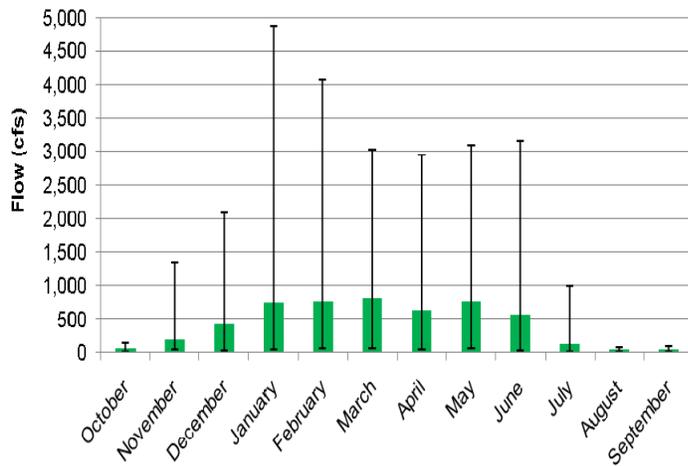
The headwaters of the South Yuba River begin at an elevation of 9,000 feet in Placer County near Castle Peak and Donner Summit. The South Yuba River watershed covers approximately 352 square miles. The South Yuba River joins the Yuba River at USACE’s Englebright Reservoir at an elevation of approximately 525 feet, after flowing for 42 miles with an average gradient of 2 percent.

### South Yuba River Upstream of the Project

The upper portion of the South Yuba River watershed (above 5,000 ft elevation) is primarily snowmelt-runoff driven, while the lower portion is rainfall-runoff driven. Inflows to the basin are attributed to natural runoff in the basins.

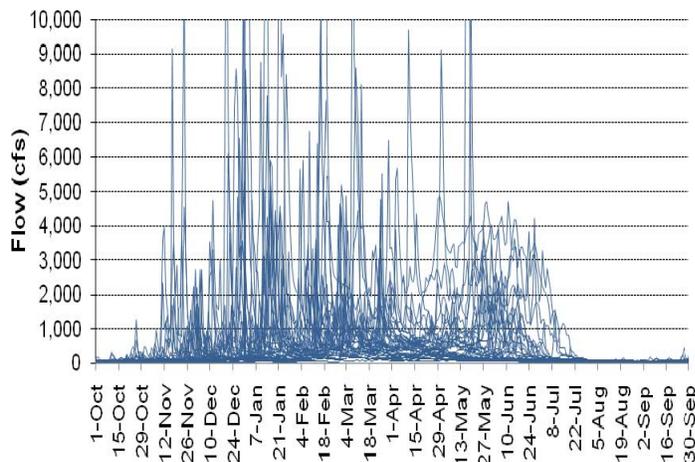
NID's Yuba-Bear Hydroelectric Project and PG&E's Drum-Spaulding Project affect runoff into the Project by storing water in upstream reservoirs and diverting water to the Bear River at Spaulding Dam. For a discussion of these storages and diversions, refer to Section 7.2.8.1.

Flows on the lower South Yuba River have been continuously measured at the Jones Bar gage (USGS 11417500), approximately 7 miles upstream of its confluence with the Yuba River, since April 1959. Figure 7.2.5-43 shows average monthly streamflow for the South Yuba River at the Jones Bar gage. As with the North and Middle Yuba rivers, maximum monthly flows in the South Yuba River are significantly higher than monthly averages because they typically represent significant precipitation events or outliers. The maximum monthly average streamflow, approximately 4,865 cfs, and the maximum daily average streamflow of approximately 30,300 cfs, were recorded during the height of the extreme flood in January 1997.



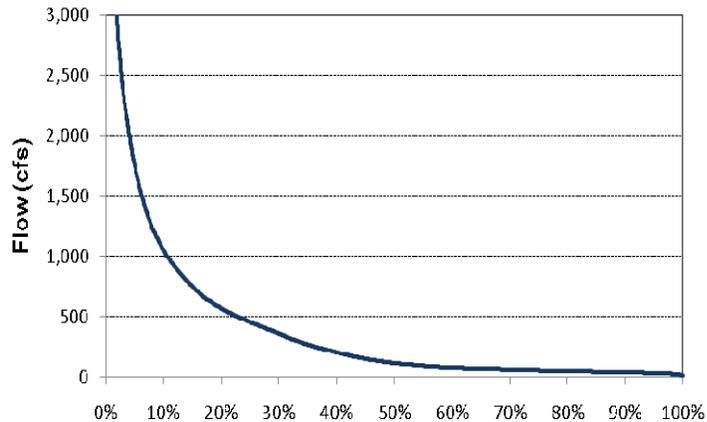
**Figure 7.2.5-43. Average monthly streamflow for the South Yuba River near Jones Bar gage (USGS Gage 11417500) from WY 1970 through WY 2008.**

Figure 7.2.5-44 shows the historical mean daily streamflows on the South Yuba River near Jones Bar.



**Figure 7.2.5-44. Historical mean daily streamflow each year for the South Yuba River near Jones Bar gage from WY 1970 through WY 2008.**

A flow exceedance curve for the South Yuba River is shown in Figure 7.2.5-45. Only 10 percent of mean daily flows during the period of record exceed 1,000 cfs, indicating that the majority of flows are much lower. Fifty percent of mean daily flows exceed 125 cfs, and 90 percent of mean daily flows exceed 40 cfs. Generally, these results indicate that the South Yuba River has mean daily flows similar to the mean flows in the Middle Yuba River.



**Figure 7.2.5-45. Flow exceedance of historical mean daily streamflow for the South Yuba River near Jones Bar gage from WY 1970 through WY 2008.**

## Yuba River

The Yuba River begins at the confluence of the North and Middle Yuba rivers, approximately 16 miles upstream of USACE's Englebright Dam, at an elevation of approximately 1,124 feet. The river then extends approximately 24 miles below USACE's Englebright Dam to the Feather River in Marysville for a combined total of 63 miles. The Yuba River sub-basin covers approximately 95 square miles.

The majority of the Yuba River sub-basin is rainwater driven since it is located at relatively low elevations. In addition to the North and Middle Yuba rivers, inflows to the basin are attributed to the South Yuba River, Deer Creek, and Dry Creek. There are several developments along the Yuba River between the confluence of the North and Middle Yuba rivers and its confluence with the Feather River. The two largest developments are USACE's Englebright and Daguerre Point dams as well as the Narrows 1 and 2 powerhouses. There is also a pumpline diversion located approximately 1 mile upstream from USACE's Daguerre Point Dam. The only Project facility along the lower Yuba River is the Narrows 2 Powerhouse.

### Yuba River Upstream of New Colgate Powerhouse

Flow in the Yuba River at the confluence of the North and Middle Yuba rivers consists primarily of flows from the North Yuba River that are releases and spills from New Bullards Bar Dam plus accretion, releases and spills from Our House Dam on the Middle Yuba River plus accretion, and releases and spills from Log Cabin Dam on Oregon Creek plus accretions. No stream gage information is available for the upper reach of the Yuba River between the head of the Yuba River at the confluence of the North and Middle Yuba rivers and the New Colgate Powerhouse. Figures 7.2.5-24, 7.2.5-33, and 7.2.5-42, show flows in the North Yuba River below New Bullards Bar Dam, in the Middle Yuba River below Our House Dam, and in Oregon Creek

below Log Cabin Dam, respectively. With the exception of periods of high flows resulting from reservoir spills, flows in this reach are primarily driven by releases to meet minimum flow requirements below each of the three dams.

#### Yuba River Downstream of New Colgate Powerhouse to USACE's Englebright Reservoir

While no stream gage information is available for this reach, Yuba River flows below the New Colgate Powerhouse above USACE's Englebright Reservoir are largely a reflection of releases from the New Colgate Powerhouse. As previously described, flows in the Yuba River above the New Colgate Powerhouse are generally composed of releases from New Bullards Bar Dam, Our House Dam, and Log Cabin Dam to meet minimum flow requirements below the respective dams. As described previously in this section, New Colgate Powerhouse releases are typically a function of power generation needs on an hour and daily timeframe and yearly hydrologic conditions and New Bullards Bar Reservoir storage on a seasonal and annual timeframe. As shown in figures 7.2.5-20 and 7.2.5-21, during most of the year, powerhouse releases are typically much greater than the combined flows from the three tributary dams. As a result, flows in the Yuba River downstream of New Colgate Powerhouse typically have large hourly and daily fluctuations in flow, reflecting power generation operations of the New Colgate Powerhouse.

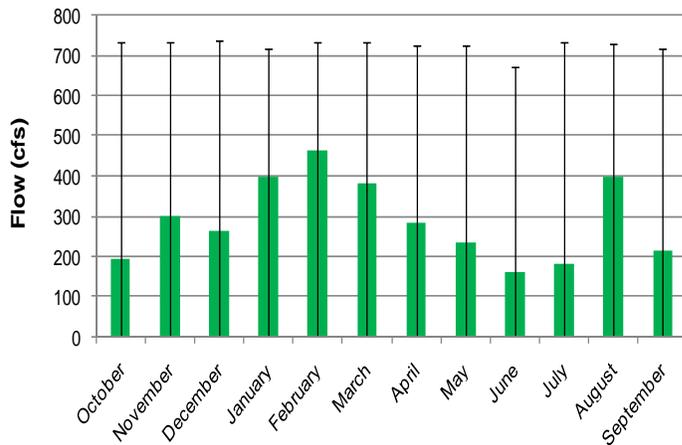
#### USACE's Englebright Reservoir

USACE's Englebright Dam was constructed from 1938 to 1941 to capture sediment produced by upstream hydraulic mining activities. The reservoir is situated downstream of New Bullards Bar Dam at the confluence of the mainstem Yuba River and the South Yuba River. The average annual inflow to USACE's Englebright Reservoir, excluding releases from New Bullards Bar Reservoir, is approximately 400,000 ac-ft. USACE's Englebright Reservoir has a total storage capacity of approximately 70,000 ac-ft. However, only about the upper 10% of this storage is exercised. PG&E holds an appropriative water right license for the storage of up to 45,000 ac-ft in USACE's Englebright Reservoir. The reservoir storage capacity is used primarily to attenuate power peaking releases from New Colgate Powerhouse and to capture storm runoff from the upstream watershed. USACE's Englebright Reservoir is used extensively for recreation.

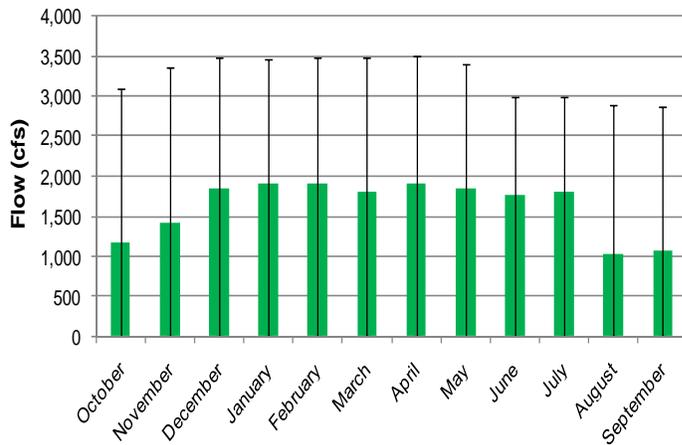
USACE's Englebright Dam has no low-level outlet; water from the reservoir is released for power generation at the PG&E Narrows 1 Powerhouse and the Narrows 2 Powerhouse or spills over the top of the dam during high flow conditions.

#### Yuba River Downstream of Narrows 2 Powerhouse

Controlled releases from USACE's Englebright Dam are made through the Narrows 1 and 2 powerhouses. The Narrows 1 Powerhouse, owned and operated by PG&E, has a 730-cfs capacity and diverts water from USACE's Englebright Reservoir on its southern shore, near the dam. The Narrows 1 Powerhouse is located approximately a quarter mile below USACE's Englebright Dam. The Narrows 2 Powerhouse is owned and operated by Licensee. The Narrows 2 Powerhouse diverts up to 3,400 cfs from USACE's Englebright Reservoir from its intake on the northern shore. The Narrows 2 Powerhouse is located on the northern bank of the Yuba River, about 600 feet below USACE's Englebright Dam. Data for historical Narrows 1 and 2 releases are from historical Licensee records. Figures 7.2.5-46 and 7.2.5-47 show the historical monthly average flows through each powerhouse.

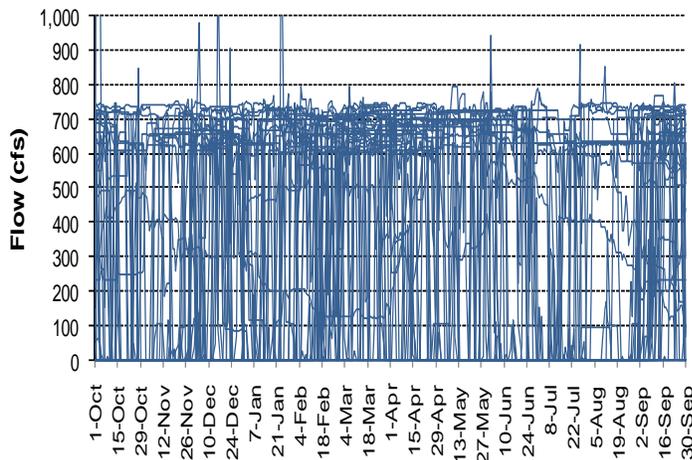


**Figure 7.2.5-46. Average monthly flow for PG&E's Narrows 1 Powerhouse releases from WY 1970 through WY 2008.**

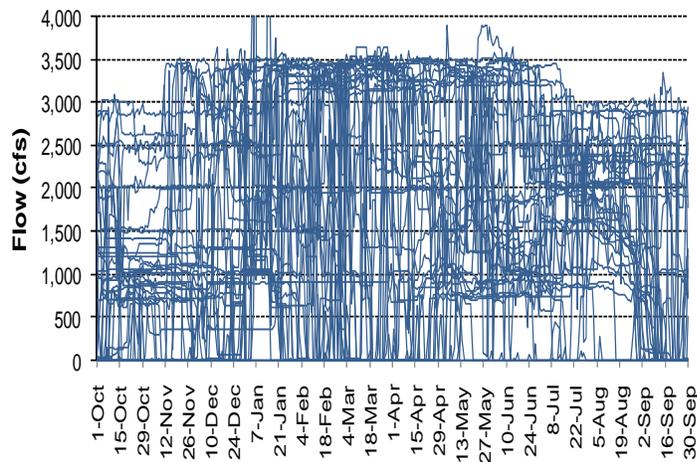


**Figure 7.2.5-47. Average monthly flow for Narrows 2 Powerhouse releases from WY 1970 through WY 2008.**

Figure 7.2.5-48 shows historical mean daily releases through the Narrows 1 Powerhouse. Occasional points exceeding 730 cfs are a reflection of a gaging error. Similarly, Figure 7.2.5-49 shows historical mean daily releases through the Narrows 2 Powerhouse. Releases range from 0 cfs to the maximum powerhouse capacity of 3,400 cfs.

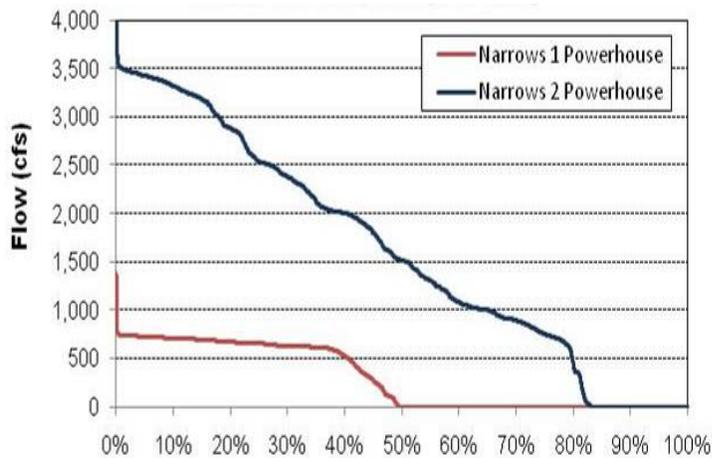


**Figure 7.2.5-48. Historical mean daily releases each year for PG&E's Narrows I Powerhouse from WY 1970 through WY 2008.**



**Figure 7.2.5-49. Historical mean daily outflows each year for the Narrows 2 Powerhouse from WY 1970 through WY 2008.**

Figure 7.2.5-50 shows the exceedance probability of releases through the Narrows 1 and Narrows 2 powerhouses. Fifty percent of the time, there are no releases through the Narrows 1 Powerhouse; 10 percent of the time, releases through the Narrows 1 Powerhouse exceed 709 cfs. Narrows 2 Powerhouse releases exceed 0 cfs 90 percent of the time, exceed 1,514 cfs 50 percent of the time, and exceed 3,315 cfs 10 percent of the time.



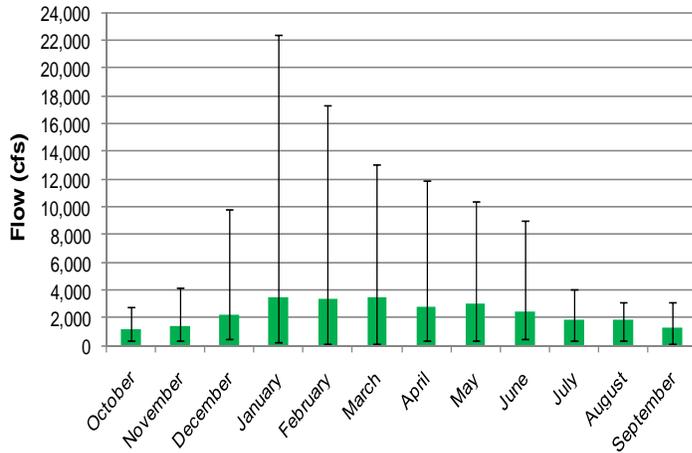
**Figure 7.2.5-50. Flow exceedance of historical mean daily releases through the Narrows 1 and Narrows 2 powerhouses from WY 1970 through WY 2008.**

Yuba River at Smartville Gage

Flows on the Yuba River below USACE’s Englebright Dam are characterized by flows at two gaging stations. At the upper end of this reach, the Smartville gage (USGS 11418000) is located just below USACE’s Englebright Dam, and reflects releases from Engelbright Reservoir through the Narrows 1 and 2 powerhouses and spills over USACE’s Englebright Dam. The Smartville gage has been in active operation since October 1941. The Smartville gage is a compliance measurement point for license-required minimum streamflows and water-right streamflow compliance, as well as for Yuba Accord required minimum streamflows.

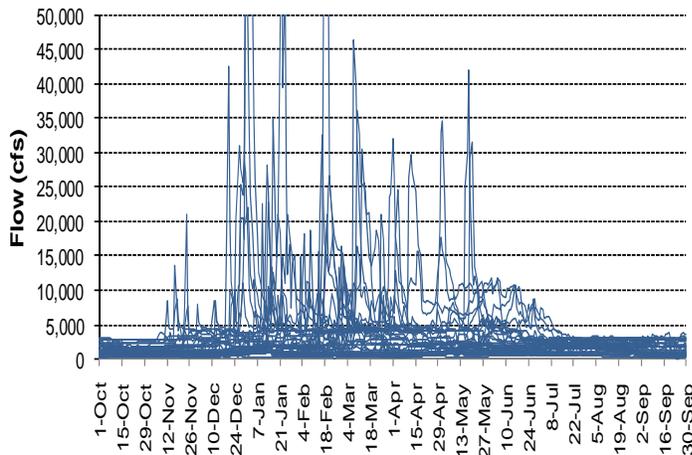
Figure 7.2.5-51 shows average monthly streamflow for the Yuba River at Smartville. The maximum monthly average streamflow, approximately 22,000 cfs, and the maximum daily

average streamflow of approximately 134,000, were recorded during the height of the extreme flood in January 1997.



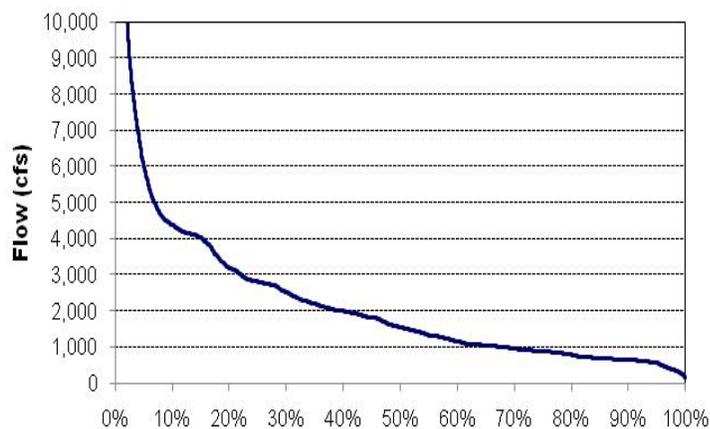
**Figure 7.2.5-51. Average monthly Yuba River flow at the Smartville gage (USGS 11418000) from WY 1970 through WY 2008.**

Historical mean daily streamflows per year in the Yuba River at Smartville are shown in Figure 7.2.5-52.



**Figure 7.2.5-52. Historical mean daily streamflow each year for the Yuba River at Smartville (USGS 11418000) from WY 1970 through WY 2008.**

A flow exceedance curve for the Yuba River at Smartville is shown in Figure 7.2.5-53. Only 10 percent of mean daily flows during the period of record (WY 1970-2008) exceed 4,400 cfs. Fifty percent of mean daily flows exceed 1,500 cfs, and 90 percent of mean daily flows exceed 600 cfs.



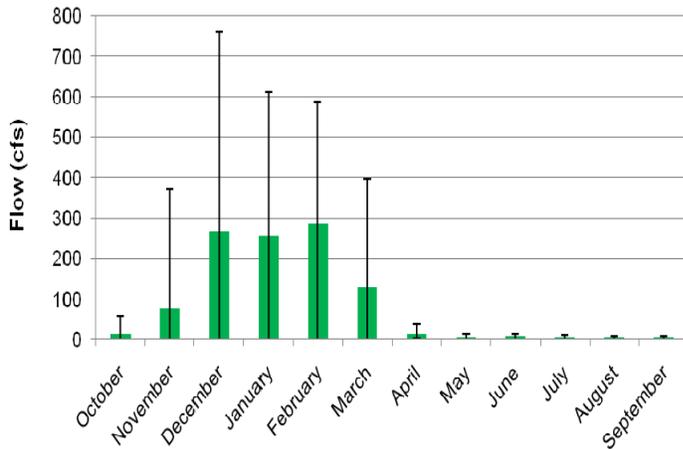
**Figure 7.2.5-53. Flow exceedance of historical mean daily streamflow for the Yuba River at Smartville from WY 1970 through WY 2008.**

### Dry Creek, Tributary to Yuba River

Dry Creek, flowing near the western edge of Yuba County, has a watershed area of approximately 108 square miles, with its headwaters near the town of Challenge at an elevation of approximately 3,155 feet. Dry Creek flows generally southward and its flows are captured by Merle Collins Reservoir, a 57,000-ac-ft reservoir at an elevation of approximately 1,160 feet, owned and operated by Browns Valley Irrigation District (BVID). Flowing approximately 12 miles before meeting the Yuba River, Dry Creek releases from Merle Collins Reservoir are augmented by accretions from local runoff and agricultural return flows, reaching the Yuba River approximately 10 miles below USACE's Englebright Dam at an elevation of approximately 147 feet.

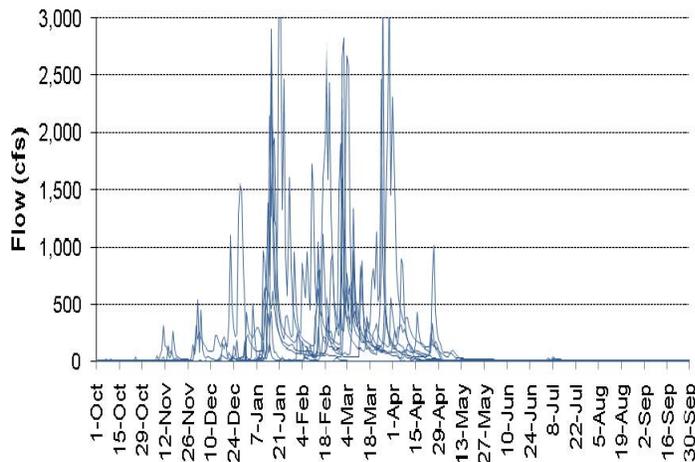
As shown in Table 7.2.2-1, Dry Creek is not affected by the Project because none of the facilities or diversion structures on Dry Creek are part of the Project; Dry Creek is a tributary to the Yuba River and flows into the Project Area.

Dry Creek flows near Browns Valley (below Merle Collins Reservoir) were measured by USGS Gage 11420700, approximately 5 miles upstream of Dry Creek's confluence with the Yuba River, from August 1964 through October 1980, but no records exist for flows after October 1980. Figure 7.2.5-54 shows average monthly streamflow for Dry Creek near Browns Valley. The maximum streamflow, approximately 760 cfs, was recorded in December of 1970, a wet year.



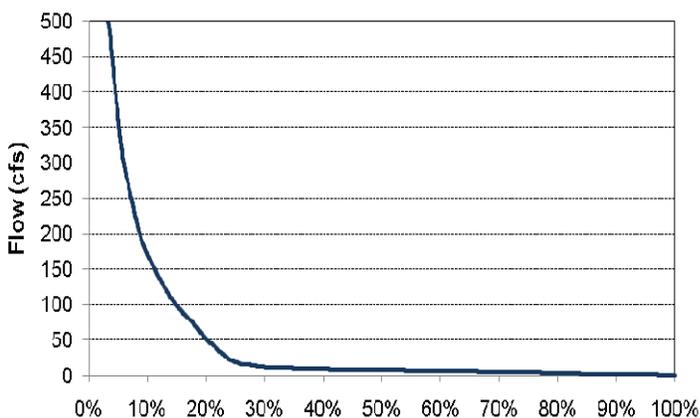
**Figure 7.2.5-54. Average monthly streamflow for Dry Creek from WY 1964 through WY 1980.**

Historical mean daily streamflows per year in Dry Creek are shown in Figure 7.2.5-55.



**Figure 7.2.5-55. Historical mean daily streamflow each year for Dry Creek from WY 1964 through WY 1980.**

A flow exceedance curve for Dry Creek near Browns Valley is shown in Figure 7.2.5-56. Only 10 percent of mean daily flows during the period of record (1964-1980) exceed 170 cfs, fifty percent of mean daily flows exceed 8 cfs, and 90 percent of mean daily flows exceed 2 cfs.



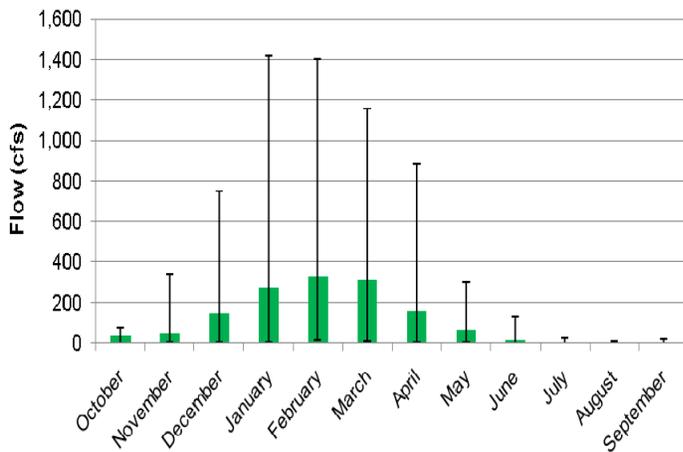
**Figure 7.2.5-56. Flow exceedance of historical mean daily streamflow for Dry Creek from WY 1964 through WY 1980.**

Deer Creek, Tributary to Yuba River

Deer Creek originates in Nevada County and, in addition to its own natural runoff, receives water from the Middle and South Yuba River watersheds through PG&E’s Drum-Spaulding Project (via the South Yuba Canal). The approximately 89-square mile Deer Creek watershed is primarily rainfall-runoff driven. Before it flows into the Yuba River near Smartsville below USACE’s Englebright Reservoir, Deer Creek is subject to impoundment at NID’s Scotts Flat Reservoir and in Lake Wildwood. Several canals divert water from Deer Creek into the Bear River watershed.

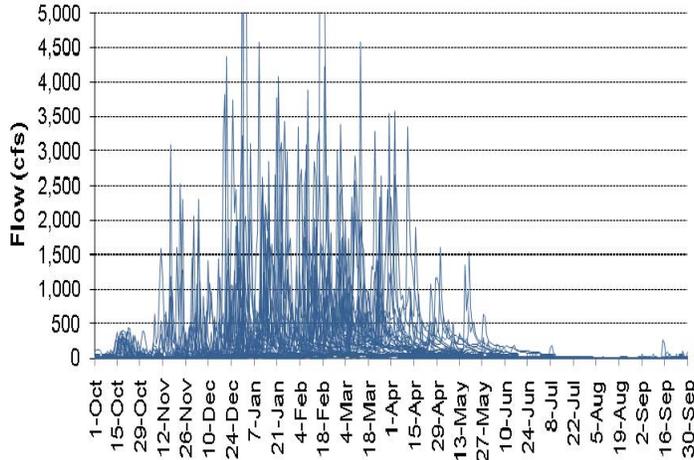
As shown in Table 7.2.2-1, Deer Creek is not affected by the Project because none of the facilities or diversion structures on Deer Creek are part of the Project; Deer Creek is a tributary to the Yuba River and flows into the Project Area.

Historical Deer Creek flows near Smartsville have been measured at the USGS Gage 11418500, approximately 1 mile upstream of Deer Creek’s confluence with the Yuba River, since October 1935. The watershed contributing to Deer Creek flow below the Deer Creek gage is approximately 5 square miles. Figure 7.2.5-57 shows average monthly streamflow for Deer Creek near Smartville. The maximum streamflow, approximately 1,400 cfs, was recorded during the height of the extreme flood in January 1997.



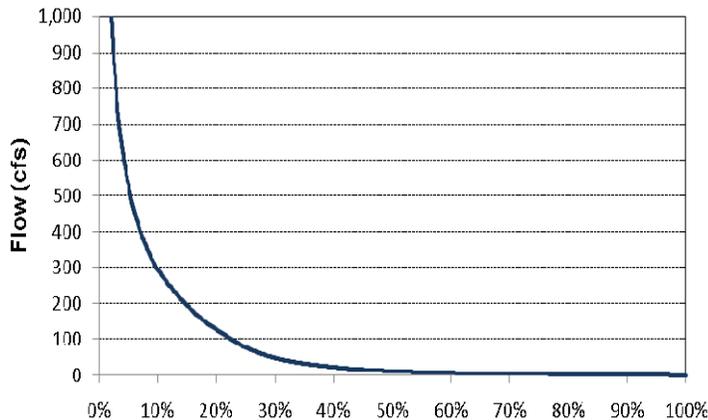
**Figure 7.2.5-57. Average monthly streamflow for Deer Creek at Smartville (USGS Gage 11418500) from WY 1970 through WY 2008.**

Historical mean daily streamflows per year in Deer Creek are shown in Figure 7.2.5-58.



**Figure 7.2.5-58. Historical mean daily streamflow each year for Deer Creek at Smartville (USGS Gage 11418500) from WY 1970 through WY 2008.**

A flow exceedance curve of mean daily flows on Deer Creek at Smartville is shown in Figure 7.2.5-59. Only 10 percent of mean daily flows during the period of analysis (1970-2008) exceed 305 cfs. Fifty percent of mean daily flows exceed 12 cfs, and 90 percent of mean daily flows exceed 3 cfs. In general, these results indicate that flows at 50 percent exceedance and above, or low flow trends, in Deer Creek are similar to those of Dry Creek.



**Figure 7.2.5-59. Flow exceedance of historical mean daily streamflow for Deer Creek at Smartville (USGS Gage 11418500) from WY 1970 through WY 2008.**

USACE’s Daguerre Point Dam

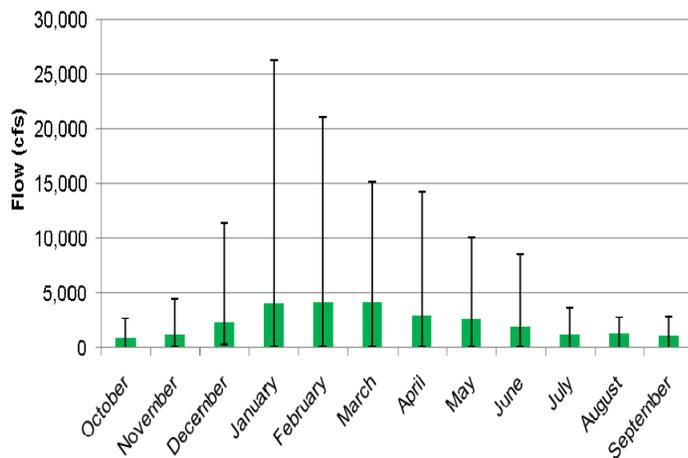
Similar to USACE’s Eglebright Dam, USACE’s Daguerre Point Dam was constructed by the California Debris Commission to prevent hydraulic mining debris from the Yuba River watershed from flowing into the Feather and Sacramento rivers. The 30-foot high dam, which was constructed in 1906 and rebuilt in 1964 following damage from floods, has no appreciable storage capacity. USACE’s Daguerre Point Dam has two fish ladders, one on the north bank and one on the south bank of the river, and two diversions, one on the north bank and one on the south bank. These two diversions provide water to YCWA’s Member Units (a group of eight water users with water rights as explained in Section 7.2.8.3) for irrigation of farms within the Member Units. Some of the water diverted to the north is diverted under YCWA’s water rights and some is diverted under Member Units’ water rights. Water diverted to the south is all diverted under YCWA’s water rights. Diversions and water deliveries from the lower Yuba

River are discussed in more detail in Section 7.2.8.3. USACE’s Daguerre Point Dam also creates important groundwater recharge to the North and South Yuba groundwater basins.

Yuba River Downstream of USACE’s Daguerre Point Dam to the Feather River

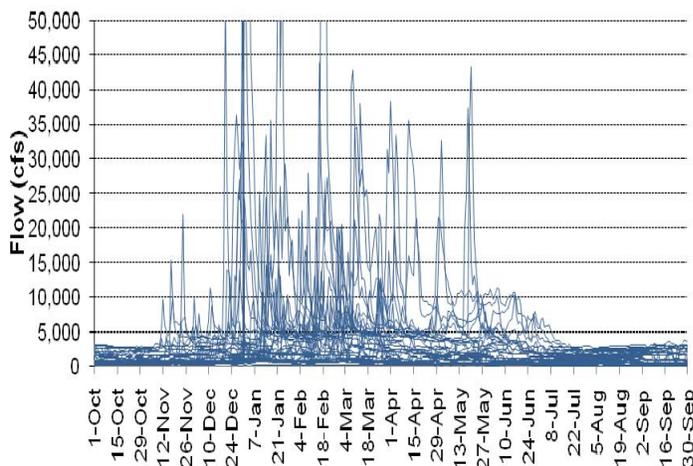
At the lower end of the Yuba River, the Marysville Gage (USGS 11421000) has measured Yuba River flows approximately 6 miles upstream of its confluence with the Feather River since October 1943. Flows at Marysville reflect upstream (Smartville) flows, agricultural diversions at USACE’s Daguerre Point Dam, inflows at Deer and Dry creeks, and accretions or depletions that occur along the lower Yuba River.

Figure 7.2.5-60 shows average monthly streamflow for the Yuba River at Marysville. The maximum monthly average streamflow, approximately 26,000 cfs, and the maximum daily average streamflow of approximately 140,000 cfs, were recorded during the height of the extreme flood in January 1997.



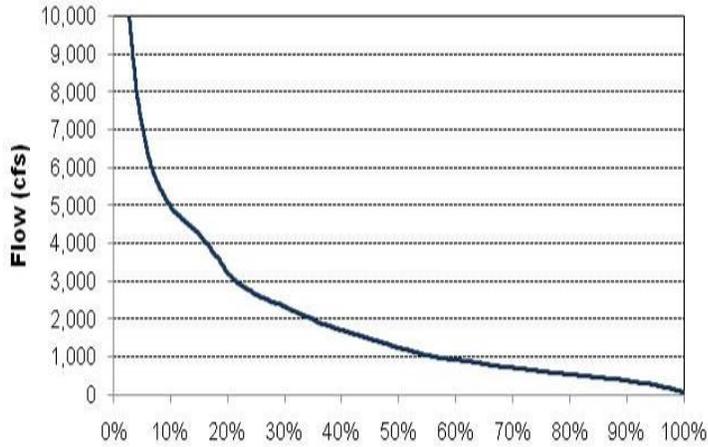
**Figure 7.2.5-60. Average monthly streamflow for the Yuba River at Marysville (USGS Gage 11421000) from WY 1970 through WY 2008.**

Historical mean daily streamflows per year in the Yuba River at Marysville are shown in Figure 7.2.5-61. The average daily flow variability between the minimum and maximum flows at the Marysville gage is 33,300 cfs, with the greatest monthly flow variability at both locations occurring in January and February.



**Figure 7.2.5-61. Historical mean daily streamflow each year for the Yuba River at Marysville (USGS Gage 11421000) from WY 1970 through WY 2008.**

A flow exceedance curve for the Yuba River at Marysville is shown in Figure 7.2.5-62. Only 10 percent of mean daily flows during the period of record exceed 5,000 cfs. Fifty percent of mean daily flows exceed 1,300 cfs, and 90 percent of mean daily flows exceed 400 cfs.



**Figure 7.2.5-62. Flow exceedance of historical mean daily streamflow for the Yuba River at Marysville from WY 1970 through WY 2008.**

## 7.2.6 Existing Instream Flow Designated Beneficial Uses

Section 4.1.9 described the designated beneficial uses of water in the Project Vicinity, as specified in the State Water Resources Control Board’s (SWRCB) Basin Plan. These beneficial uses include: 1) municipal and domestic water supply; 2) agricultural water supply (irrigation); 3) industrial service supply (power generation); 4) water contact recreation; 5) non-water contact recreation; 6) warm freshwater habitat; 7) cold freshwater habitat; and 8) wildlife habitat. Refer to Table 4.1.9-1 for detailed description of the designated beneficial uses.

## 7.2.7 Applicable Water Quality Standards

As described in Section 4.1.9, water quality standards “*consist of the designated uses of the navigable waters involved and the water quality criteria for such waters based upon such uses.*” [33 USC § 1313(C) (2) (A)]. Table 7.2.7-1, below, lists water quality objectives described in the Basin Plan related to the designated beneficial uses. This list is not exhaustive and can be modified by the SWRCB to reflect site-specific information.

**Table 7.2.7-1. Water quality objectives to support designated beneficial uses in the Project Vicinity.**

Water Quality Objective	Description
Bacteria	In terms of fecal coliform. Less than a geometric average of 200/100 ml on five samples collected in any 30-day period and less than 400/100 ml on ten percent of all samples taken in a 30-day period.
Biostimulatory Substances	Water shall not contain biostimulatory substances that promote aquatic growth in concentrations that cause nuisance or adversely affect beneficial uses.

**Table 7.2.7-1. (continued)**

Water Quality Objective	Description
Chemical Constituents	Waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses. Specific trace element levels are given for certain surface waters, none of which include the waters in the vicinity of the Project. Electrical conductivity (at 77 °F) shall not exceed 150 micromhos (µmhos)/cm (90 percentile) in well-mixed waters of the Feather River from the Fish Barrier Dam at Oroville to Sacramento River. Other limits for organic, inorganic and trace metals are provided for surface waters that are designated for domestic or municipal water supply. In addition, waters designated for municipal or domestic use must comply with portions of Title 22 of the California Code of Regulations. For protection of aquatic life, surface water in California must also comply with the California Toxics Rule (40 CFR Part 131).
Color	Water shall be free of discoloration that causes a nuisance or adversely affects beneficial uses.
Dissolved Oxygen (DO)	Monthly median of the average daily dissolved oxygen concentration shall not fall below 85 percent of saturation in the main water mass, and the 95 percent concentration shall not fall below 75 percent of saturation. Minimum level of 7 mg/L. Specific DO water quality objectives below Oroville dam are 8.0 mg/L from September 1 to May 31, for Feather River from Fish Barrier Dam at Oroville to Honcut Creek (surface water body #40). When natural conditions lower dissolved oxygen below this level, the concentrations shall be maintained at or above 95 percent of saturation.
Floating Material	Water shall not contain floating material in amounts that cause a nuisance or adversely affect beneficial uses.
Oil & Grease	Water shall not contain oils, greases, waxes or other material in concentrations that cause a nuisance, result in visible film or coating on the surface of the water or on objects in the water, or otherwise adversely affect beneficial uses.
PH	The pH of surface waters will remain between 6.5 and 8.5, and cause changes of less than 0.5 in receiving water bodies.
Pesticides	Waters shall not contain pesticides or a combination of pesticides in concentrations that adversely affect beneficial uses. Other limits established as well.
Radioactivity	Radionuclides shall not be present in concentrations that are harmful to human, plant, animal or aquatic life nor that result in the accumulation of radionuclides in the food web to an extent that presents a hazard to human, plant, animal or aquatic life.
Sediment	The suspended sediment load and suspended-sediment discharge rate of surface waters shall not be altered in such a manner as to cause a nuisance or adversely affect beneficial uses.
Settleable Material	Waters shall not contain substances in concentrations that result in the deposition of material that causes a nuisance or adversely affects beneficial uses.
Suspended Material	Waters shall not contain suspended material in concentrations that cause a nuisance or adversely affect beneficial uses.
Tastes and Odor	Water shall not contain taste- or odor-producing substances in concentrations that impart undesirable tastes and odors to domestic or municipal water supplies or to fish flesh or other edible products of aquatic origin, or that cause nuisance, or otherwise adversely affect beneficial uses.
Temperature	The natural receiving water temperature of interstate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Water Quality Control Board that such alteration in temperature does not adversely affect beneficial uses. Increases in water temperatures must be less than 5 °F above natural receiving-water temperature.
Toxicity	All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life. Compliance with this objective will be determined by analyses of indicator organisms, species diversity, population density, growth anomalies, and biotoxicity tests as specified by the Regional Water Quality Control Board.
Turbidity	In terms of changes in turbidity (NTU) in the receiving water body: where natural turbidity is 0 to 5 NTUs, increases shall not exceed 1 NTU; where 5 to 50 NTUs, increases shall not exceed 20 percent; where 50 to 100 NTUs, increases shall not exceed 10 NTUs; and where natural turbidity is greater than 100 NTUs, increase shall not exceed 10 percent.

Source: Central Valley Water Quality Control Board (CVRWQCB) 1998.

Section 303(d) of the Clean Water Act (CWA) requires that every two years each State submit to the United States Environmental Protection Agency (EPA) a list of rivers, lakes and reservoirs in the State for which pollution control or requirements have failed to provide for water quality. The Central Valley Regional Water Quality Control Board (CVRWQCB) and SWRCB work together to research and update the list for the Central Valley region of California. Based on a review of this list and its associated Total Maximum Daily Load (TMDL) Priority Schedule, in

the Project Vicinity, USACE's Englebright Reservoir has been identified by the SWRCB as CWA §303(d) State Impaired for mercury; and Deer Creek, a tributary to the Yuba River, has been identified as impaired for pH (SWRCB 2006). However, there are currently no approved TMDL plans for the Yuba River.

In 2009, the CVRWQCB recommended including additional surface waters in the Project Area to the 303(d) list as impaired for mercury: New Bullards Bar Reservoir, the Middle Yuba River, the North Fork Yuba River from New Bullards Bar Dam to Englebright Reservoir, the South Yuba River from Lake Spaulding to USACE's Englebright Reservoir, and the Lower Yuba River from USACE's Englebright Reservoir to the Feather (CVRWQCB 2009). The CVRWQCB is also recommending that the lower Yuba River be added to the 303(d) list as impaired for iron (CVRWQCB 2009). These recommendations considered and adopted by the SWRCB at the August 3, 2010 Board meeting and were advanced forward for approval by the United States EPA at that time (Azimi-Gaylon, pers. comm., 2010).

## **7.2.8 Existing and Proposed Water Rights Potentially Affecting or Affected by the Project**

Section 6.3.1.3 provides a list of water rights held by Licensee for power generation. Provided below is a description of other existing or proposed water rights potentially affecting or affected by the Project.

### **7.2.8.1 Water Rights Upstream of the Project Area That Affect the Project**

Numerous water rights holders divert and store waters upstream of the Project Area. The upstream projects with significant impacts on inflows to the Project include SFWPA's South Feather Power Project, NID's Yuba-Bear Hydroelectric Project, and PG&E's Drum-Spaulding Project. Each of these project's diversions are summarized below.

#### **7.2.8.1.1 South Feather Power Project**

SFWPA diverts water from Slate Creek, a tributary to the North Yuba River upstream of New Bullards Bar Reservoir at the Slate Creek Diversion Dam. This diversion diverts up to a maximum flow of 848 cfs of water out of Slate Creek to Sly Creek Reservoir on Lost Creek, a tributary to the South Fork Feather River. SFWPA's water rights limit Slate Creek diversions to 600 cfs and at times diversions are physically limited to 500 cfs due to high water elevations in Sly Creek Reservoir.

Table 7.2.8-1 shows the average diversions in cfs and total annual diversions in ac-ft at the Slate Creek Diversion Dam as measured at USGS Gage 11413250, for three water years representative of dry, normal, and wet conditions.

**Table 7.2.8-1. North Yuba River sub-basin diversions by SFWPA South Feather Power Project - Slate Creek diversions for representative water year types.**

Year Type	Representative Water Year	Average Diversion (cfs)	Annual Diversion (ac-ft)
Dry	2001	68	48,995
Normal	2003	141	102,108
Wet	1995	209	151,075

Source: USGS Gage 11413250, Slate C Tunnel Nr Strawberry Valley CA. [http://waterdata.usgs.gov/nwis/dv/?referred\\_module=sw](http://waterdata.usgs.gov/nwis/dv/?referred_module=sw)

#### 7.2.8.1.2 Yuba-Bear Hydroelectric Project

NID diverts and regulates flows in the Middle and South Yuba river watersheds. On the Middle Yuba River, NID’s Jackson Meadows Reservoir (RM 45.6) and Milton Diversion Dam (RM 43.4) affect flows entering the Yuba River Development Project. Jackson Meadows Reservoir can store 67,435 ac-ft of water and the Milton Diversion Dam, which has no associated storage, can divert up to 450 cfs from the Middle Yuba River to Bowman Lake on Canyon Creek, a tributary to the South Yuba River. Table 7.2.8-2 shows the average diversions in cfs and total annual diversions in ac-ft at the Milton Diversion Dam for water years representative of dry, normal, and wet conditions.

**Table 7.2.8-2. Middle Yuba River sub-basin diversions by NID’s Yuba-Bear Hydroelectric Project – Milton Diversion Dam diversions for representative water year types.**

Year Type	Representative Water Year	Average Diversion (cfs)	Annual Diversion (ac-ft)
Dry	2001	40	28,682
Normal	2003	97	70,527
Wet	1995	87	62,991

Source: USGS Gage 11408000, Milton-Bowman Tunnel Outlet Nr Graniteville CA. [http://waterdata.usgs.gov/nwis/dv/?referred\\_module=sw](http://waterdata.usgs.gov/nwis/dv/?referred_module=sw) .

Note: These values should be considered estimates, as tunnel gage statistics do not take into account changes in upstream storage.

On the South Yuba River, NID’s Canyon Creek reservoir system affects South Yuba River flows. The Canyon Creek reservoir system includes the French, Faucherie, Sawmill, Jackson Meadows and Bowman reservoirs with a combined gross storage of roughly 90,647 ac-ft. Bowman-Spaulding Diversion Dam can divert up to 300 cfs from Canyon Creek to PG&E’s Lake Spaulding on the South Yuba River. Bowman-Spaulding Diversion Conduit also captures the majority of flows from several feeder streams, all tributary to the South Yuba River, between Bowman Lake and Lake Spaulding. These waters are then subsequently diverted out of South Yuba River basin into the Deer Creek and Bear River drainages by PG&E. Table 7.2.8-3 shows the average diversions in cfs and total annual diversions in ac-ft at NID diversion facilities tributary to the South Yuba River for water years representative of dry, normal, and wet conditions.

**Table 7.2.8-3. South Yuba River sub-basin diversions by NID’s Yuba-Bear Hydroelectric Project – Bowman-Spaulling Diversion Dam and Conduit diversions for representative water year types.**

Year Type	Representative Water Year	Average Diversion (cfs)	Annual Diversion (ac-ft)
Dry	2001	48	35,004
Normal	2003	102	73,934
Wet	1995	141	102,257

Source: USGS Gage 11417500 – South Yuba River at Jones Bar CA. [http://waterdata.usgs.gov/nwis/dv/?referred\\_module=sw](http://waterdata.usgs.gov/nwis/dv/?referred_module=sw). Note: These values should be considered estimates, as tunnel gage statistics do not take into account changes in upstream storage.

### 7.2.8.1.3 Drum-Spaulling Project

PG&E diverts and regulates flows in the South Yuba River watershed. Several upstream storage reservoirs, including Spaulling and Fordyce, with a combined gross storage of 125,815 ac-ft, affect South Yuba River flows. Water is diverted at Spaulling Dam, where the Spaulling Tunnel can divert up to 1,200 cfs to the South Yuba and Drum canals. These canals transfer diverted flows into the Deer Creek and Bear River drainages, respectively. Table 7.2.8-4 shows the average diversions in cfs and total annual diversions in ac-ft at PG&E diversion facilities tributary to the South Yuba River for water years representative of dry, normal, and wet conditions.

**Table 7.2.8-4. South Yuba River sub-basin diversions by PG&E’s Drum-Spaulling Project – Spaulling Dam diversions for representative water year types.**

Year Type	Representative Water Year	Average Diversion (cfs)	Annual Diversion (ac-ft)
Dry	2001	289	208,511
Normal	2003	525	378,140
Wet	1995	583	419,962

Source: USGS Gage 11417500 – South Yuba River at Jones Bar CA. [http://waterdata.usgs.gov/nwis/dv/?referred\\_module=sw](http://waterdata.usgs.gov/nwis/dv/?referred_module=sw). Note: These values should be considered estimates, as tunnel gage statistics do not take into account changes in upstream storage.

Table 7.2.8-5 shows the cumulative annual average diversions in cfs and ac-ft from the South Yuba River upstream of the Project due to NID and PG&E’s combined operations.

**Table 7.2.8-5. Cumulative South Yuba River sub-basin diversions by PG&E’s Drum-Spaulling Project and NID’s Yuba-Bear Hydroelectric Project – diversions for representative water year types.**

	Representative Water Year	Average Diversion (cfs)	Annual Diversion (ac-ft)
Dry	2001	337	243,514
Normal	2003	627	452,074
Wet	1995	724	522,219

Source: USGS Gage 11417500 – South Yuba River at Jones Bar CA. [http://waterdata.usgs.gov/nwis/dv/?referred\\_module=sw](http://waterdata.usgs.gov/nwis/dv/?referred_module=sw). Note: These values should be considered estimates, as tunnel gage statistics do not take into account changes in upstream storage.

### 7.2.8.2 Water Rights within the Project Area

YCWA pumps some water directly from New Bullards Bar Reservoir to supply water to the Cottage Creek Water Treatment Plant for domestic use associated with the recreation facilities adjacent to the reservoir. The amount of this pumping averages approximately 6 ac-ft per year.

### 7.2.8.3 Water Rights Downstream of the Project Area Affected by the Project

Downstream of the Project, water is diverted under consumptive-use water-right permits to eight water users, which are collectively referred to as the YCWA Member Units. YCWA also makes surface water available to the City of Marysville for the city's diversion to and use at Lake Ellis. The place of water delivery to YCWA's Member Units and the City of Marysville are listed in Table 7.2.8-6. The YCWA Member Unit service areas are shown in Figure 7.2.8-1.

**Table 7.2.8-6. Yuba County Water Agency's annual contract amounts and place of delivery.**

Member Unit	Base Contract (ac-ft)	Supplemental Contract (ac-ft)	Total Contract (ac-ft)	Member Unit Water Rights (ac-ft)	Total Contract and Water Rights (ac-ft)
<b>BROWNS VALLEY IRRIGATION DISTRICT PUMPLINE DIVERSION FACILITY</b>					
Browns Valley Irrigation District (BVID) <sup>1</sup>	9,500	--	9,500	24,462 <sup>1</sup>	33,962
<b>SOUTH CANAL<sup>2</sup></b>					
Brophy Water District (BWD)	43,470	32,177	75,647	--	75,647
South Yuba Water District (SYWD)	25,487	18,843	44,330	--	44,330
Dry Creek Mutual Water Company (DCMWC) <sup>2</sup>	13,682	3,061	16,743	--	16,743
Wheatland Water District (WWD) <sup>3</sup>	23,092	17,138	40,230	--	40,230
<b>NORTH CANAL<sup>4</sup></b>					
Cordia Irrigation District (CID)	12,000	--	12,000	60,000	72,000
Hallwood Irrigation Company (HIC)	--	--	--	78,000	78,000
Ramirez Water District (RWD)	14,790	10,311	25,101	--	25,101
<b>MARYSVILLE<sup>5</sup></b>					
City of Marysville	--	2,500	2,500	--	2,500
<b>Total</b>	<b>142,021</b>	<b>84,030</b>	<b>226,051</b>	<b>162,462</b>	<b>388,513</b>

<sup>1</sup> BVID receives water at the Pumpline Diversion Facility, located 1 mile upstream from USACE's Daguerre Point Dam.

<sup>2</sup> BWD, SYWD, DCMWC and WWD receive water from the South Yuba Canal (South Canal), which begins on the south side of the Yuba River slightly upstream of the south abutment of USACE's Daguerre Point Dam.

<sup>3</sup> Includes both Phase 1 and Phase 2 of the Wheatland Project.

<sup>4</sup> CID, HIC, and RWD receive water through the Hallwood-Cordia Canal (North Canal), located on the north abutment of USACE's Daguerre Point Dam.

<sup>5</sup> The City of Marysville diverts water from the Yuba River near Marysville.

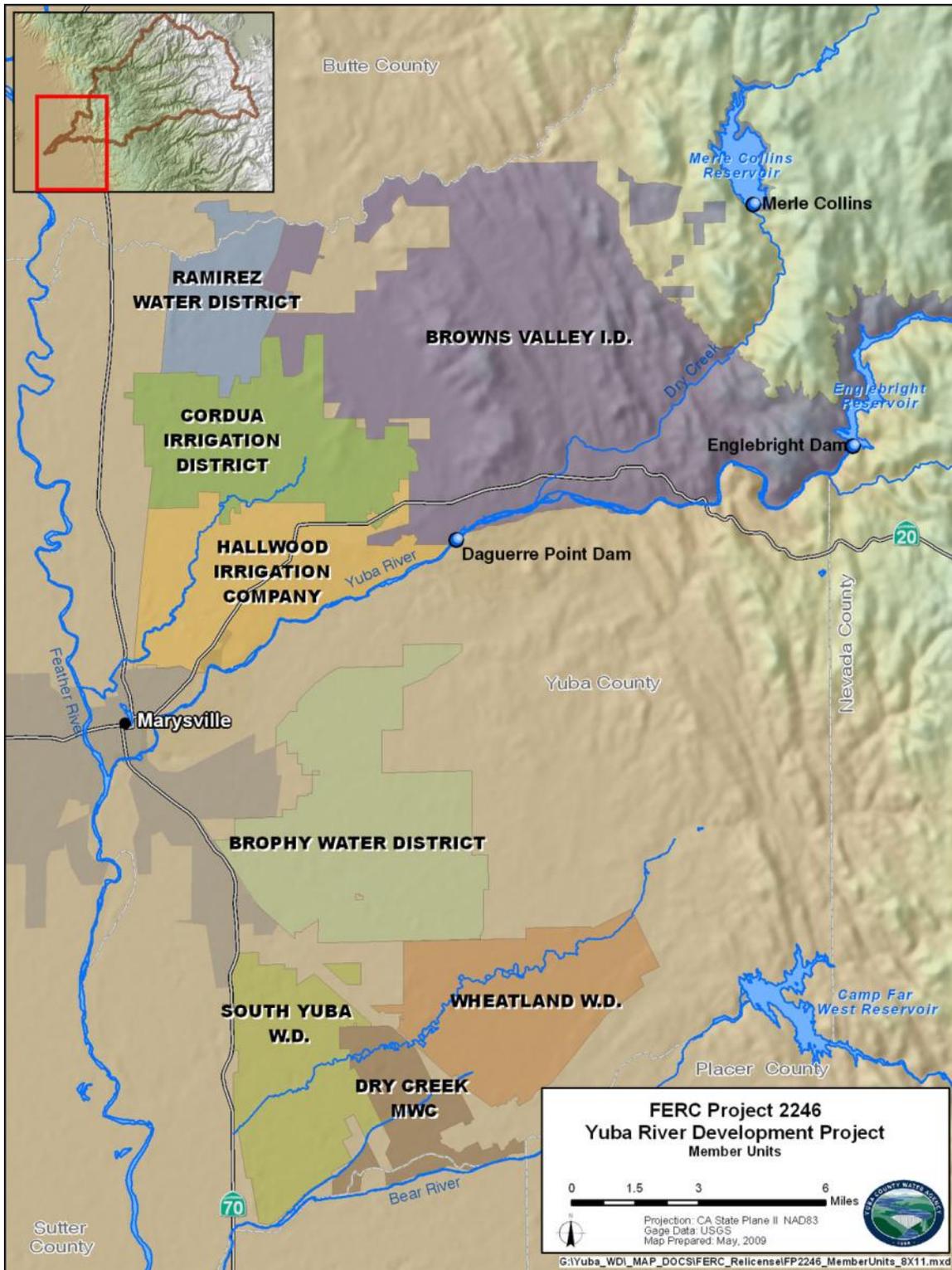


Figure 7.2.8-1. Yuba County Water Agency Member Unit service areas.

BVID, Cordua Irrigation District (CID), and Hallwood Irrigation Company (HIC) have their own water rights on the lower Yuba River (Table 7.2.8-6). Under settlement contracts with YCWA, CID and HIC receive surface water supplies as part of Project operations. Dry year deficiency criteria in these contracts are different from the deficiency criteria in YCWA’s contracts with other member units. Provisions in YCWA’s water right settlement contracts preclude deficiencies in water right settlement deliveries unless the California Department of Water Resources (CDWR) April forecast of unimpaired runoff as measured at the Smartville Gage is less than 40 percent of average. No deficiencies in such deliveries may be imposed on BVID. Contract shortage provisions are presented in Table 7.2.8-7.

**Table 7.2.8-7. Yuba County Water Agency water supply contract shortage provisions.**

Category	Unimpaired Runoff Forecast (f) <sup>a</sup>	Percentage of Settlement/ Contract Allocation Available
<b>PRE-1914 RIGHTS SETTLEMENTS</b>		
Base Project Water	$f > 85\%$	100%
	$50\% < f \leq 85\%$	85%
	$40\% \leq f \leq 50\%$	70%
	$f < 40\%$	50%
Browns Valley Irrigation District	All	100%
Cordua Irrigation District	$f \geq 40\%$	100%
Hallwood Irrigation Company	$f < 40\%$	80%
<b>YCWA SUPPLY CONTRACTS</b>		
Supplemental Water	All forecasts	Determined annually by Licensee in its reasonable discretion considering forecasted runoff and operational conditions.

Note: *f* -

<sup>a</sup> April 1 CDWR forecast of unimpaired Yuba River runoff near Smartville, in percentage of 50-year average.

YCWA’s contract allocations are based on the gross acreage served by each member unit. The maximum “Base Project Water” allocation is computed by multiplying 90 percent of the gross acreage by 2.87 ac-ft per acre. The maximum “Supplemental Water Supply” is computed by multiplying 90 percent of the gross acreage by 2.13 ac-ft per acre. For member units that have water rights senior to YCWA’s, their contract allocations are based on their water right amounts.

In 2009, YCWA started providing water to the Wheatland Water District (WWD) under a water service contract. Until then, water users within WWD relied on solely groundwater for irrigation. The Wheatland Project now conveys water, diverted by YCWA at USACE’s Daguerrre Point Dam, to WWD through the South Canal system. The Wheatland Project is being constructed in two phases. Phase 1, which was completed in 2009, provides for delivery of surface water to WWD and the immediate irrigation of approximately 7,750 acres of the approximately 9,200 acres that will be served upon the completion of both phases. Under Phase 1, WWD’s contract with YCWA provides for a total allocation (base and supplemental) of 23,092 ac-ft per year. When Phase 2 is completed, this contract will allow for a total allocation (base and supplemental) of 40,230 ac-ft per year.

## 7.2.9 Existing Water Quality Information

As part of its acquisition of existing, relevant, and reasonably available data for inclusion in this document, Licensee found a considerable amount of water quality information, the most relevant

of which was collected from the 1950s to the present. Licensee consulted with and reviewed the following sources of information to prepare the description of water quality in this section:

- Licensee's own data
- California's Office of Environmental Health Hazard Assessment (OEHHA) fish ingestion advisories
- CDWR
- NID's Yuba-Bear Hydroelectric Project Relicensing ongoing water quality and water temperature studies
- PG&E's Drum-Spaulding Project Relicensing ongoing water quality and water temperature studies
- Sacramento River Watershed Program (SRWP) regional monitoring data
- USGS' California Water Science Center Investigations
- USGS' National Water Information System (NWIS) Reports
- US EPA's Storage and Retrieval (STORET) Reports
- Yuba River Temperature Monitoring Project performed by the United States Fish and Wildlife Service (USFWS)
- Upper Yuba River Studies Program's (UYRSP) technical reports
- Water quality data from the South Yuba River Citizens League (SYRCL)
- Water quality data from the Friends of Deer Creek (FODC)

Quantitative information from the above source documents is summarized below. Licensee's water temperature and water chemistry data are provided in Attachment 7.2A and Attachment 7.2B, respectively.

#### **7.2.9.1 Licensee's Water Temperature Data Collection Network**

Table 7.2.9-1 lists Licensee's stream temperature data collection network. Licensee is actively collecting stream water temperature data: in areas upstream of the Project (i.e., on the Middle Yuba River upstream of Our House Diversion Dam, on Oregon Creek upstream of Log Cabin Diversion Dam, and on the North Yuba River upstream of New Bullards Bar Reservoir); within the Project Area (includes New Bullards Bar and Englebright reservoirs); and downstream of the Project (i.e., on the Yuba River downstream of the USACE Daguerre Point Dam). Data have been collected at several locations in the Yuba River below USACE's Englebright Dam since 2003 and at other locations since the summer of 2008. Reservoir temperature data have been recorded twice per month by Licensee since 1990 at a single point near the upstream face of New Bullards Bar Dam and at USACE's Englebright Dam. Normally, reservoir data have been collected at 10-foot depth intervals, along with *in situ* air temperature.

**Table 7.2.9-1. Key of Licensee's active stream temperature data collection locations.**

Project Reach	Location	Designation for Recorders <sup>1</sup>	River Mile	Latitude	Longitude	Data Included in PAD	Streamflow Gauge, if Co-Located <sup>3</sup>
<b>MIDDLE YUBA RIVER</b>							
--	Upstream of Our House Diversion Dam Impoundment	T10a	MYR 12.2	39.413015	-120.994590	3/28/09-9/6/10	USGS 11408870 + 11408880
Our House Diversion Dam Reach	At Intake to Lohman Ridge Diversion Tunnel	T20	MYR 12.0	39.411910	-120.997427	7/3/08-6/6/10	USGS 11408870 (PG&E.NY17)
	Downstream of Our House Diversion Dam	T30	MYR 11.9	39.410661	-120.998604	10/24/08-6/6/10	USGS 11408880 (PG&E.NY18)
Oregon Creek Reach	Upstream of North Yuba River	T90a	MYR 0.0	39.368639	-121.135658	8/19/08-12/18/08, 3/28/09-9/6/10	--
		T90b					
<b>OREGON CREEK</b>							
--	Upstream of Log Cabin Diversion Dam Impoundment	T40	OC 4.3	39.440146	-121.056149	7/8/08-6/6/10	USGS 11409300 (PG&E.NY19)
Log Cabin Diversion Dam Reach	At Intake to Camptonville Diversion Tunnel	T50	OC 4.2	39.440491	-121.058746	7/8/08-6/6/10	USGS 11409350 (PG&E.NY30)
	Downstream of Log Cabin Diversion Dam	T60	OC 4.0	39.439455	-121.059264	8/30/08-6/6/10	USGS 11409400 (PG&E.NY20)
<b>NORTH YUBA RIVER</b>							
New Bullards Bar Dam Reach	Upstream of New Bullards Bar Reservoir	T65a	NYR 16.0	--	--	1/108-5/18/10	--
		T65b					
	At Low Flow Releases from New Bullards Bar Dam	T70a	NYR 2.4	39.392348	-121.141584	7/18/08-6/6/10	USGS 11413517 (PG&E.NY23)
		T70b					
Upstream of Middle Yuba River	T80a	NYR 0.0	39.368694	-121.136793	8/19/08-12/18/08, 3/28/09-9/6/10	--	
T80b							
<b>DOBBINS CREEK</b>							
--	At Lake Francis Outlet <sup>2</sup>	T140a	DC 2.4	39.359171	-121.205168	4/2/09-9/6/10	--
		T140b					
--	Upstream of Yuba River	T145a	DC 0.1	39.329735	-121.197641	4/3/09-9/6/10	--
T145b							
<b>DRY CREEK</b>							
--	Upstream of Yuba River	T185a	DryC 0.7	39.228930	-121.402270	4/1/09-6/7/10	--
		T185b					
<b>DEER CREEK</b>							
--	Upstream of Yuba River	T175a	DeerC 0.9	39.224091	-121.269866	2/3/09-8/4/10	--
		T175b					
<b>YUBA RIVER</b>							
Middle/ North Yuba River Reach	Downstream of Confluence of North Yuba River and Middle Yuba River	T100a	YR 39.5	39.367839	-121.136655	8/19/08-12/18/08, 3/28/09-9/6/10	--
		T100b					
	Upstream of New Colgate Powerhouse	T110a	YR 34.1	39.330602	-121.187675	8/19/08-12/18/08, 3/28/09-9/6/10	--
T110b							

**Table 7.2.9-1. (continued).**

Project Reach	Location	Designation for Recorders <sup>1</sup>	River Mile	Latitude	Longitude	Data Included in PAD	Streamflow Gage, if Co-Located <sup>3</sup>
<b>YUBA RIVER (continued)</b>							
New Colgate Powerhouse Reach	In Colgate Powerhouse Penstock	T120	YR 34.0	39.330824	-121.191565	1/1/08-8/8/10	--
	Downstream of New Colgate Powerhouse	T130a	YR 33.9	39.330260	-121.193169	8/19/08-12/18/08, 3/28/09-9/6/10	--
		T130b					
	Downstream of Dobbins Creek	T150a	YR 33.6	39.328398	-121.196162	3/28/09-8/8/10	--
		T150b					
	In Narrows #2 Powerhouse Penstock	T160a T160b	YR 23.9	39.238911	-121.270034	5/5/09-8/2/10	(PG&E NY24)
	Downstream of Narrows #2 Powerhouse at Smartville	T170	YR 23.6	39.235799	-121.272688	4/15/09-8/2/10	USGS 11419000 (PG&E NY28)
	Downstream of Narrows #2 Powerhouse at Smartville (data collected on 1-hr interval, rather than every 15 min)	Smartville a	YR 23.6	39.235799	-121.272688	WY2003 - 2007	USGS 11419000 (PG&E NY28)
		Smartville b Smartville c					
	USACE's Daguerre Point Dam Reach	Downstream of Deer Creek	T180a	YR 22.7	39.230047	-121.285165	11/8/08-8/2/10
T180b							
Downstream of Dry Creek		T190a	YR 13.3	39.219611	-121.415128	11/8/08-3/9/09	--
		T190b					
Upstream of USACE's Daguerre Point Dam		T200a Y200b	YR 13.2	39.208009	-121.443116	11/8/08-9/9/10	--
At USACE's Daguerre Point Dam Fish Ladder		T210a	YR 11.4	39.207853	-121.443529	11/18/08-9/7/10	--
		T210b					
At USACE's Daguerre Point Dam Fish Ladder (data collected on 1-hr interval, rather than every 15 min)		Daguerre a	YR 11.4	39.208009	-121.443116	WY2003 - 2007	--
		Daguerre b Daguerre c					
USACE's Daguerre Point Dam Reach		At Walnut Avenue (Near Western Extent of Yuba Goldfields)	T220a	YR 8.1	39.188220	-121.495307	8/28/08-9/13/10
	T220b						
	At Marysville Gage (data collected on 1-hr interval, rather than every 15 min)	Marysville a	YR 6.0	39.176164	-121.524386	WY2003 - 2007	USGS 11421000
		Marysville b Marysville c					
	Upstream of Simpson Lane (Between Yuba Goldfields and Marysville) (Downstream of Highway 70 Bridge)	T230a	YR 4.8	39.165328	-121.541350	8/28/08-9/13/10	--
		T230b					
		T240a T240b	YR 0.7	39.134510	-121.590720	8/21/08-9/26/10	--

**Table 7.2.9-1. (continued).**

Project Reach	Location	Designation for Recorders <sup>1</sup>	River Mile	Latitude	Longitude	Data Included in PAD	Streamflow Gage, if Co-Located <sup>3</sup>
	<b>FEATHER RIVER</b>						
--	Upstream of Yuba River	T250a T250b	--	39.139425	-121.607282	8/15/08-9/26/10	--
--	Downstream of Yuba River on Right Bank	T260a T260b	--	39.108603	-121.603149	8/15/08-9/26/10	--
--	Downstream of Yuba River on Left Bank	T270a T270b	--	39.108594	-121.604663	8/19/08-9/26/10	--

<sup>1</sup> Licensee has installed redundant water temperature recorders at all locations except locations that are co-located with secure USGS stream flow gages or secure penstock sites.

<sup>2</sup> Water temperature data collected only when Lake Francis releases water.

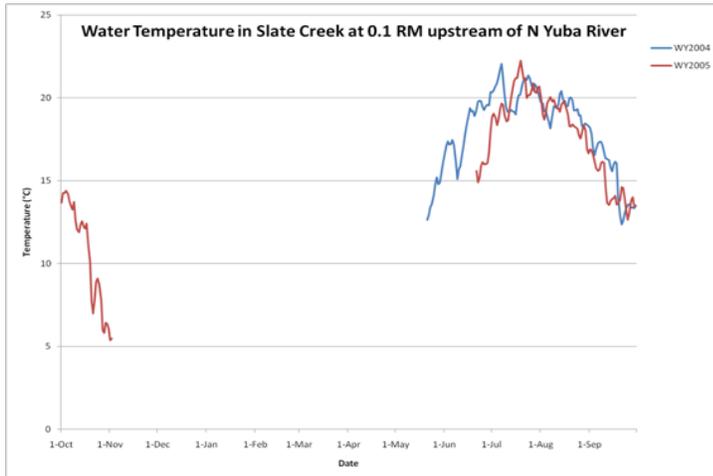
<sup>3</sup> Co-located means that a flow gage may be in the vicinity of the water temperature recorder but possibly not at the exact location.

7.2.9.1.1 Water Temperature Upstream of the Project Area

Licensee began collecting continuous water temperature data upstream of the Project in 2005 and has installed continuous water temperature data in the following locations as of August 2010 (Table 7.2.9-1):

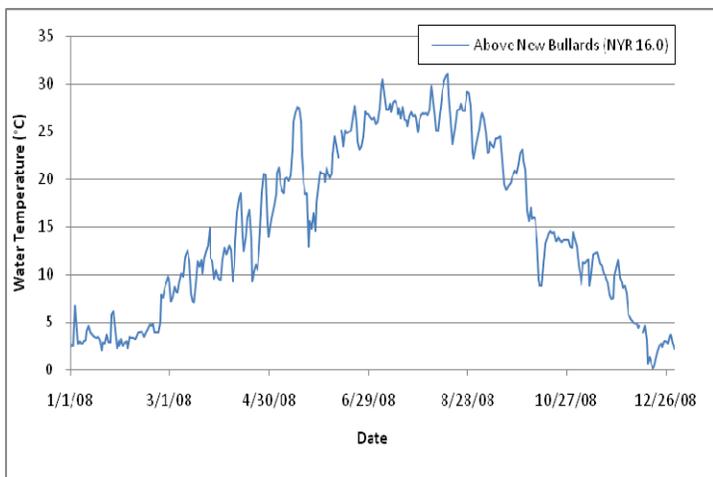
- North Yuba River (NYR) above New Bullards Bar Reservoir (NYR 10.7)
- Oregon Creek (OC) above Log Cabin Diversion Impoundment (OC 4.3)
- Middle Yuba River (MYR) above Our House Diversion Impoundment (MYR 12.2)
- South Yuba River (SYR) at Jones Bar above USACE’s Englebright Reservoir (SYR 7.1)

Figures 7.2.9-1 through 7.2.9-9 provide a summary of recent surface water temperature data collected upstream of the Project. Attachment 7.2A includes all data collected to date, in portable document format (PDF). Daily average water temperatures have been found to exceed 20°C in all major reaches upstream of the Project with the exception of the North Yuba River.



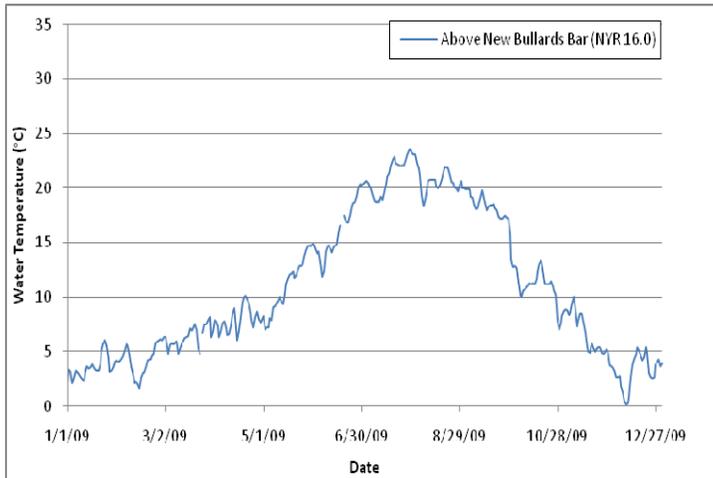
**Figure 7.2.9-1. Mean daily water temperature collected in Slate Creek 0.1 mile upstream of the North Yuba River in 2004-2005.**

Source: South Feather Water and Power Agency  
Other Slate Creek thermograph locations at RM 0.2, 6.4, 8.9, 9.1 and 9.7.

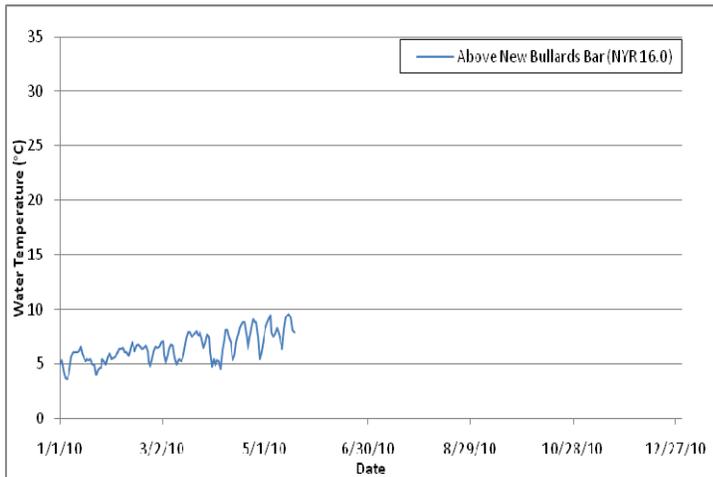


**Figure 7.2.9-2. Mean daily water temperature collected in the North Yuba River upstream of New Bullards Bar Reservoir (NYR 16.0) in 2008.**

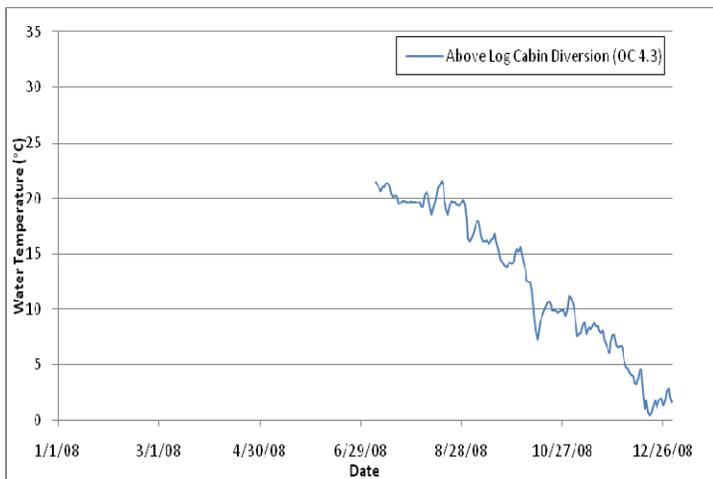
Source: YCWA



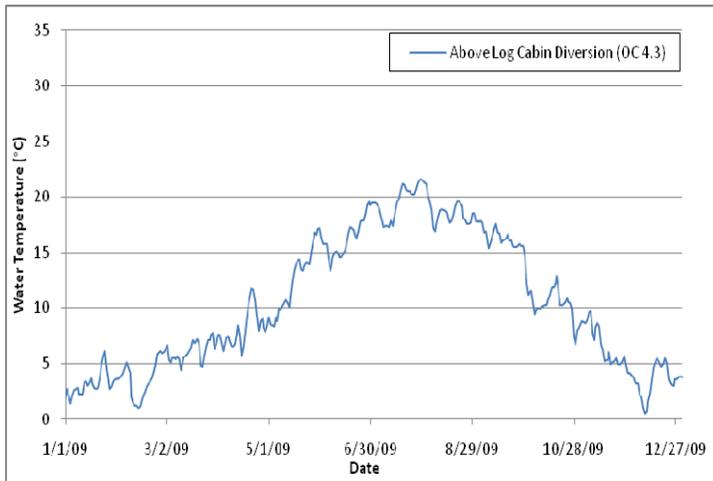
**Figure 7.2.9-3. Mean daily water temperature collected in the North Yuba River upstream of New Bullards Bar Reservoir (NYR 16.0) in 2009.**



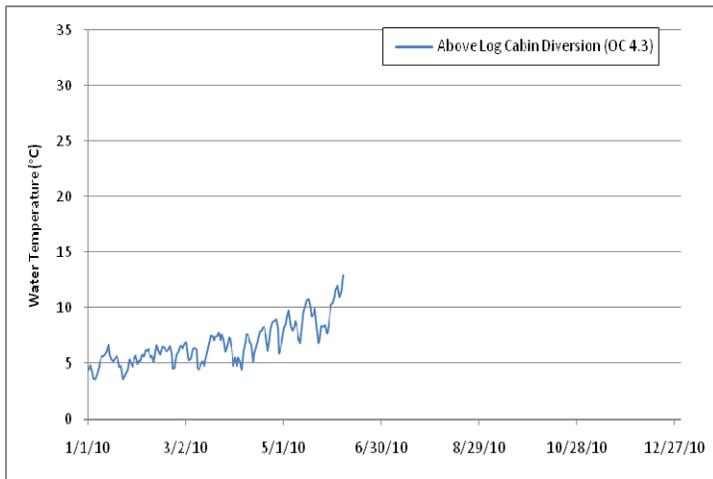
**Figure 7.2.9-4. Mean daily water temperature collected in the North Yuba River upstream of New Bullards Bar Reservoir (NYR 16.0) in 2010.**



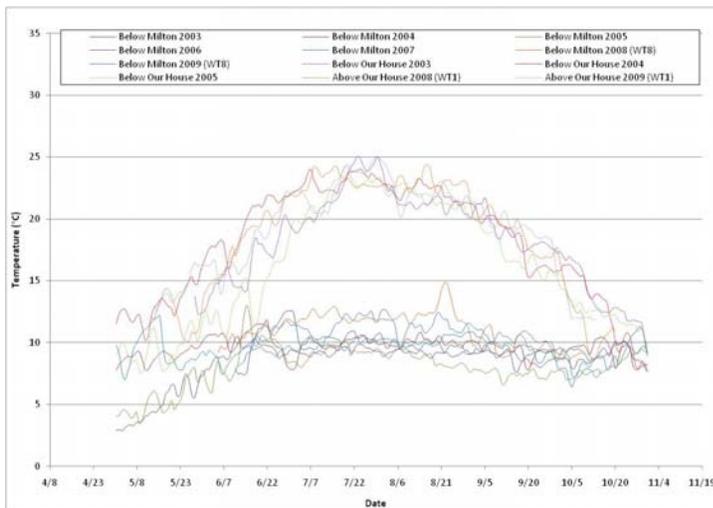
**Figure 7.2.9-5. Mean daily water temperature in Oregon Creek upstream of Log Cabin Diversion Dam impoundment (OC 4.3) in 2008.**



**Figure 7.2.9-6. Mean daily water temperature in Oregon Creek upstream of Log Cabin Diversion Dam impoundment (OC 4.3) in 2009.**

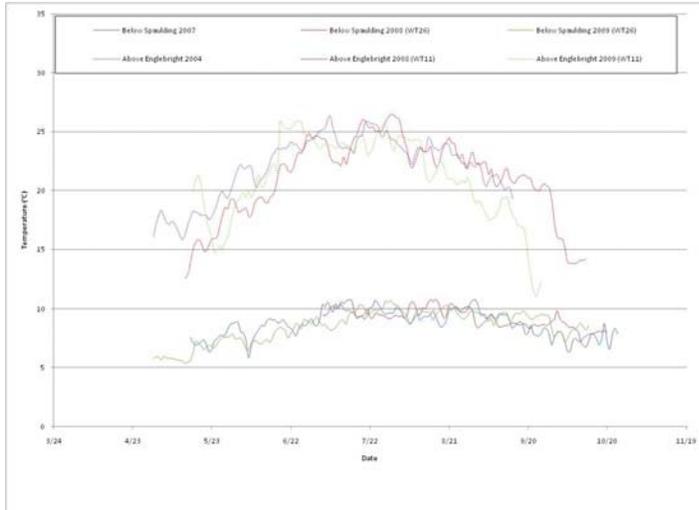


**Figure 7.2.9-7. Mean daily water temperature in Oregon Creek upstream of Log Cabin Diversion Dam impoundment (OC 4.3) in 2010.**



**Figure 7.2.9-8. Mean daily water temperature in the Middle Yuba River upstream of Our House Diversion Dam (three monitoring locations) from 2003-2009.**

Sources: 2003-2007 – UYRSP  
 2008-2009 - NID

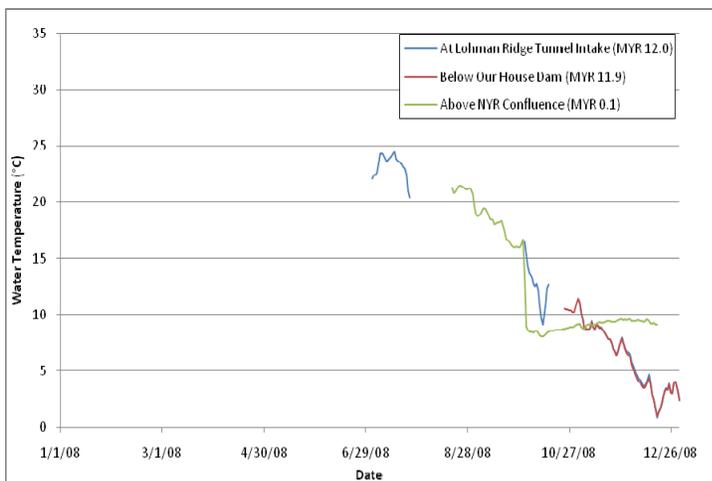


**Figure 7.2.9-9. Mean daily water temperature in the South Yuba River upstream of USACE's Englebright Reservoir (two monitoring locations) from 2004-2009.**

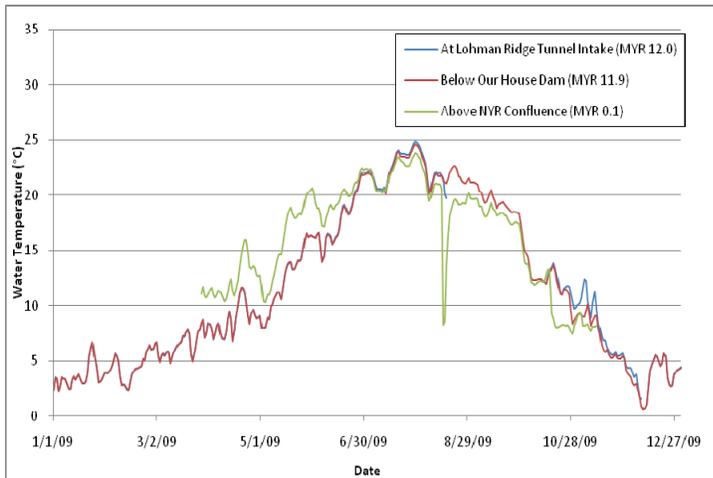
Sources: 2004-2007 – UYRSP  
 2008-2009 – PGE&E

**7.2.9.1.2 Water Temperature Within the Project Area**

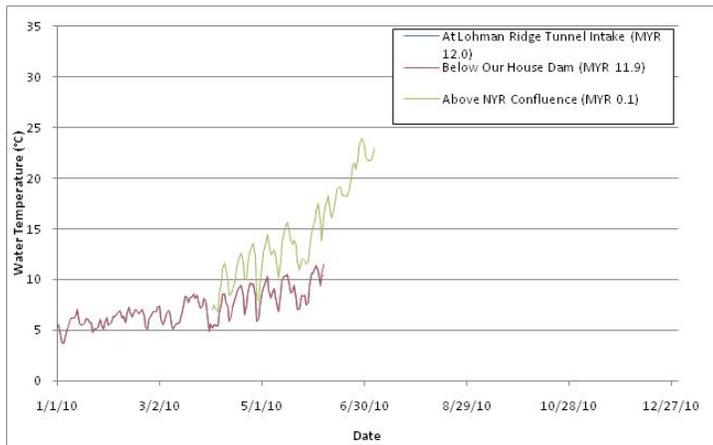
Licensee began collecting continuous water temperature data within the Project in 1995 and has installed continuous water temperature data recorders at 17 locations within the Project Area (Table 7.2.9-1). Figure 7.2.9-10 through Figure 7.2.9-28 below provide mean daily temperature measurements for locations with data. Licensee has collected reservoir temperature profiles on a generally bi-weekly basis in New Bullards Bar Reservoir and USACE's Englebright Reservoir since 1990. See Figures 7.2.9-19 and 7.2.9-25 for monthly profiles taken in 2008 at New Bullards Bar Reservoir and USACE's Englebright Reservoir respectively. Data collection is continuing through 2010.



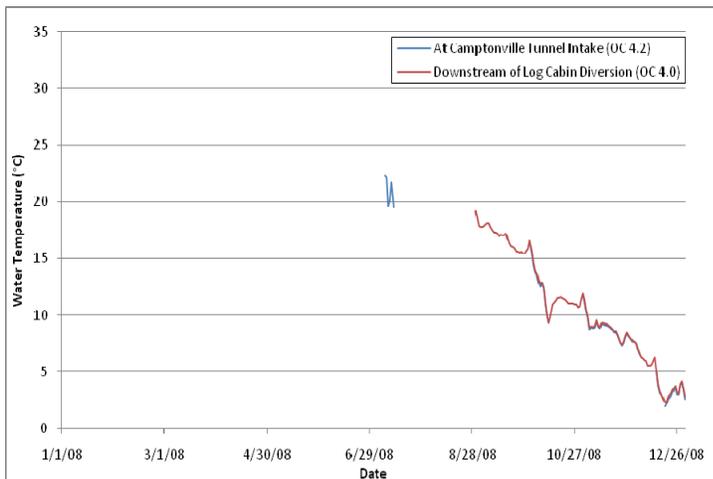
**Figure 7.2.9-10. Mean daily water temperatures in the Middle Yuba River in 2008.**



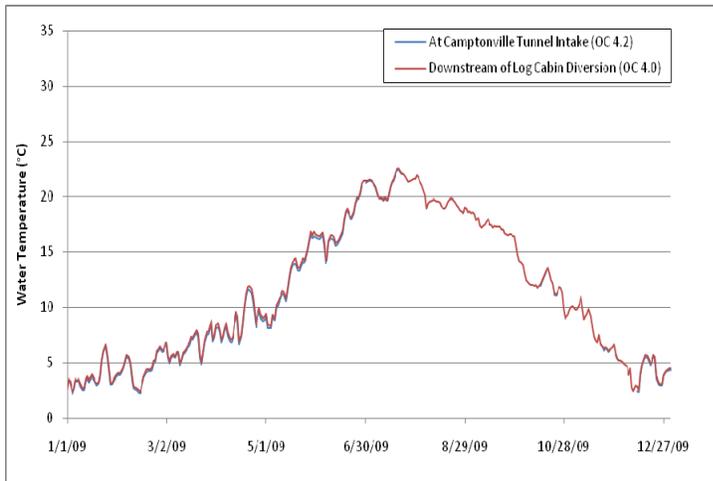
**Figure 7.2.9-11. Mean daily water temperatures in the Middle Yuba River in 2009.**



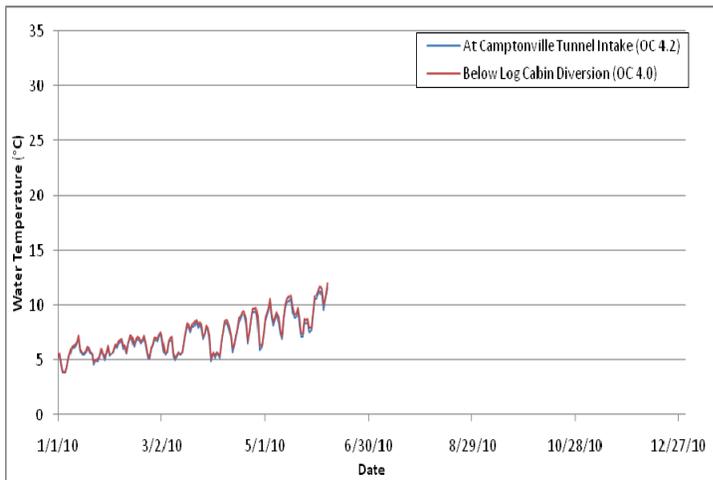
**Figure 7.2.9-12. Mean daily water temperatures in the Middle Yuba River in 2010.**



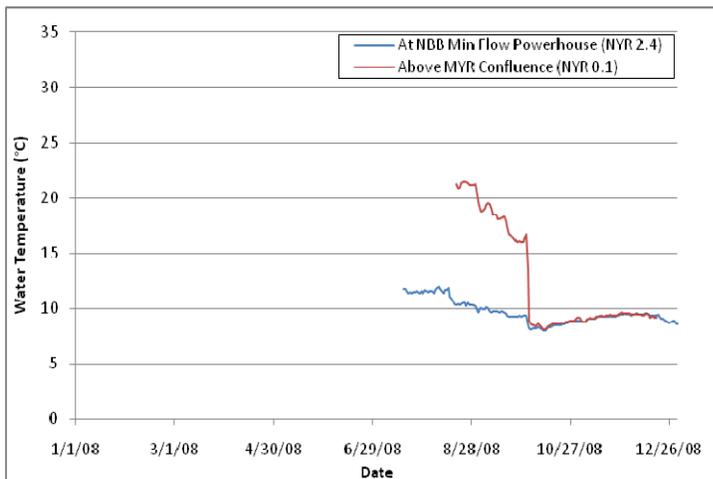
**Figure 7.2.9-13. Mean daily water temperatures in Oregon Creek in 2008.**



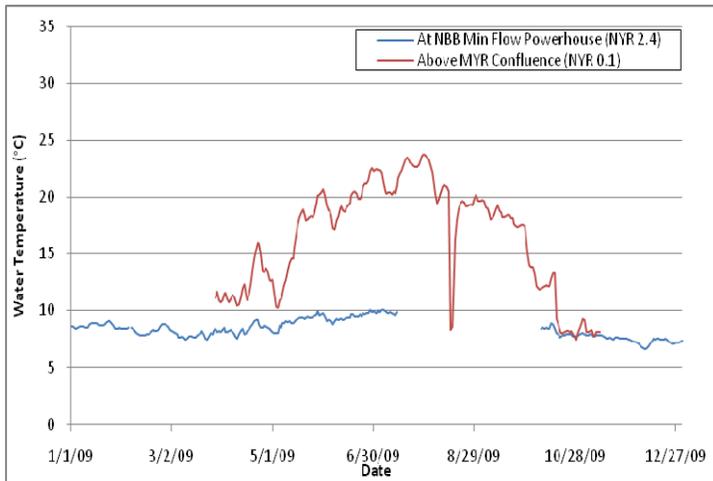
**Figure 7.2.9-14. Mean daily water temperatures in Oregon Creek in 2009.**



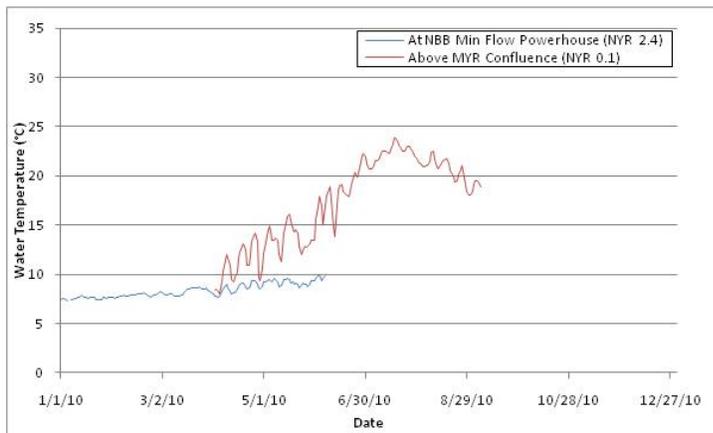
**Figure 7.2.9-15. Mean daily water temperatures in Oregon Creek in 2010.**



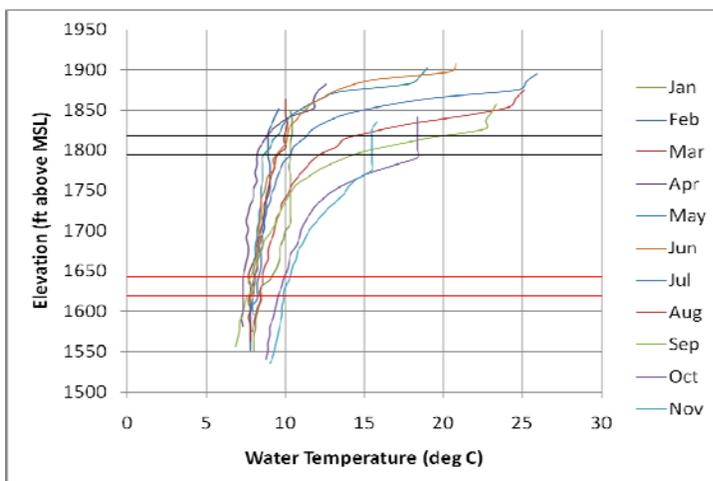
**Figure 7.2.9-16. Mean daily water temperatures in North Yuba River in 2008.**



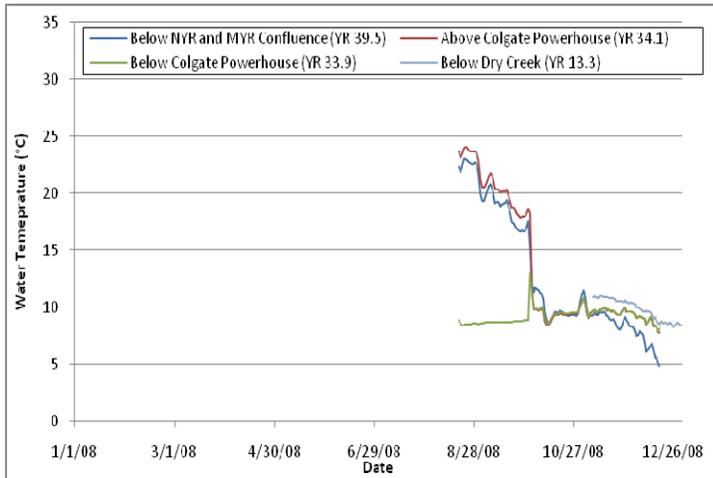
**Figure 7.2.9-17. Mean daily water temperatures in North Yuba River in 2009.**



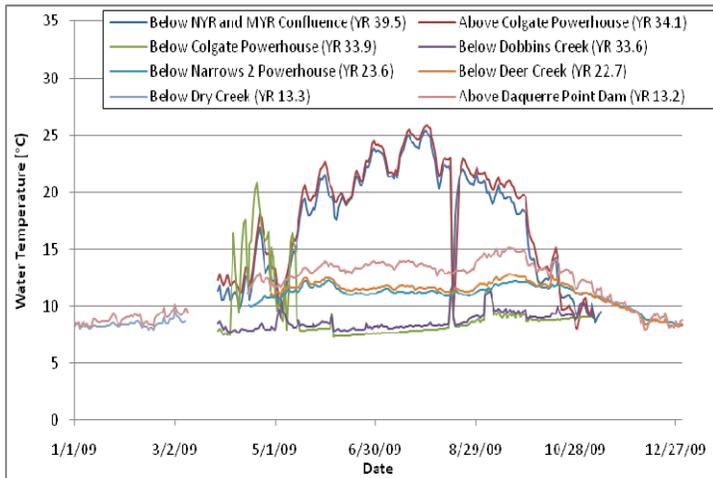
**Figure 7.2.9-18. Mean daily water temperatures in North Yuba River in 2010.**



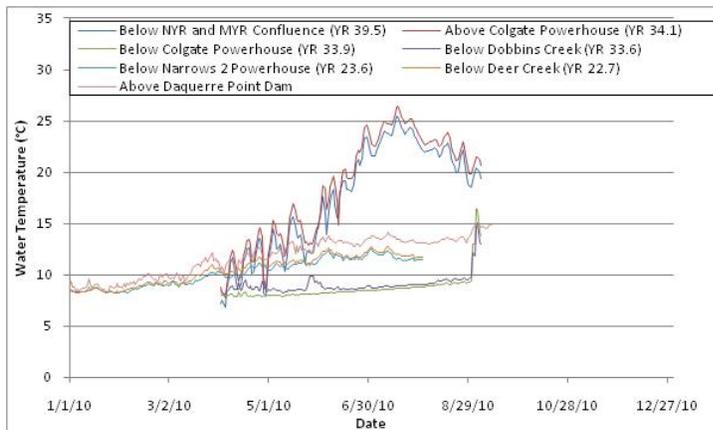
**Figure 7.2.9-19. Monthly temperature profiles of New Bullards Bar Reservoir in 2008. Upper power intake, which is not used, elevation range is shown as horizontal black lines, and lower power intake elevation range is shown as horizontal red lines.**



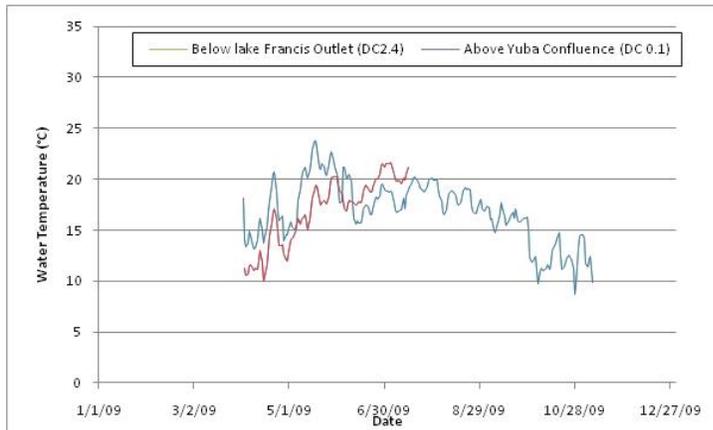
**Figure 7.2.9-20. Mean daily water temperatures at four locations in the Yuba River in 2008.**



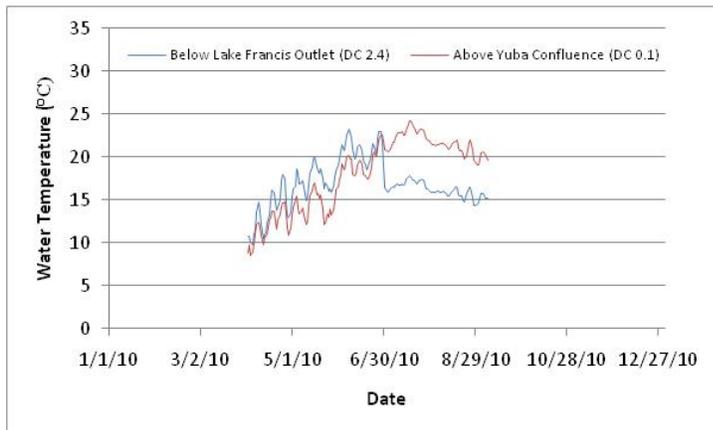
**Figure 7.2.9-21. Mean daily water temperatures at eight locations in the Yuba River in 2009.**



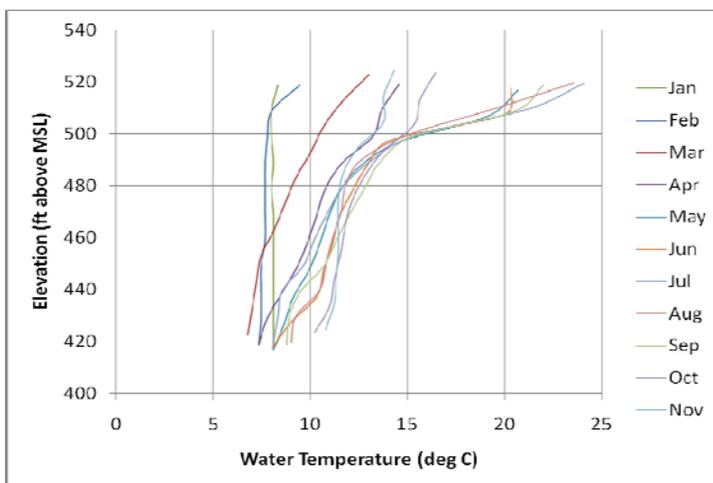
**Figure 7.2.9-22. Mean daily water temperatures at seven locations in the Yuba River in 2010.**



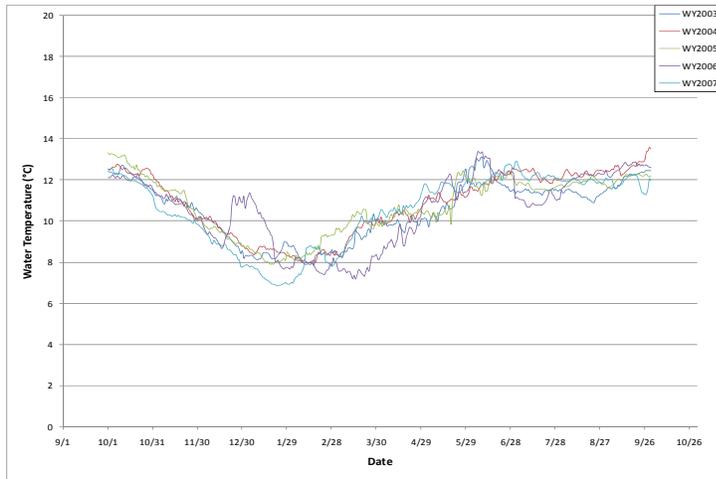
**Figure 7.2.9-23. Mean daily water temperatures in Dobbins Creek in 2009.**



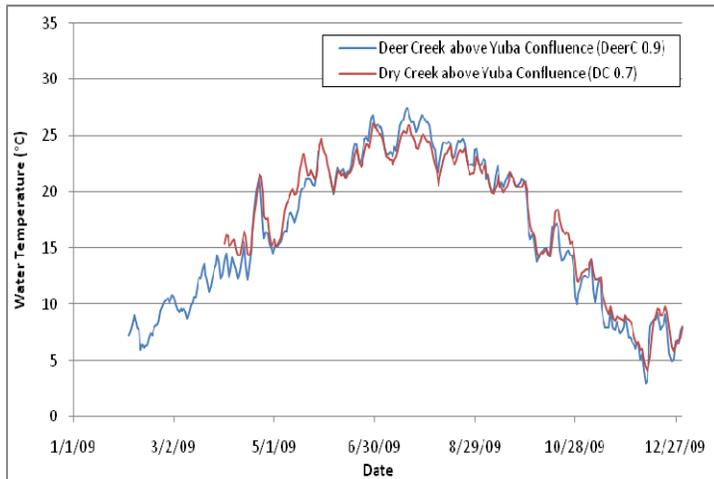
**Figure 7.2.9-24. Mean daily water temperatures in Dobbins Creek in 2010.**



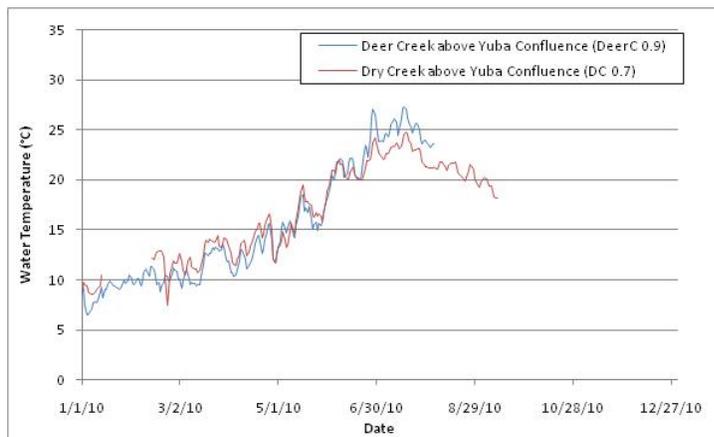
**Figure 7.2.9-25. Monthly temperature profiles of USACE's Englebright Reservoir in 2008. Note that data were unavailable for December.**



**Figure 7.2.9-26. Mean daily water temperatures in the Yuba River at Smartsville (YR 23.6) from 2003 through 2007.**  
 Source: YCWA



**Figure 7.2.9-27. Mean daily water temperatures in Deer Creek and Dry Creek in 2009.**



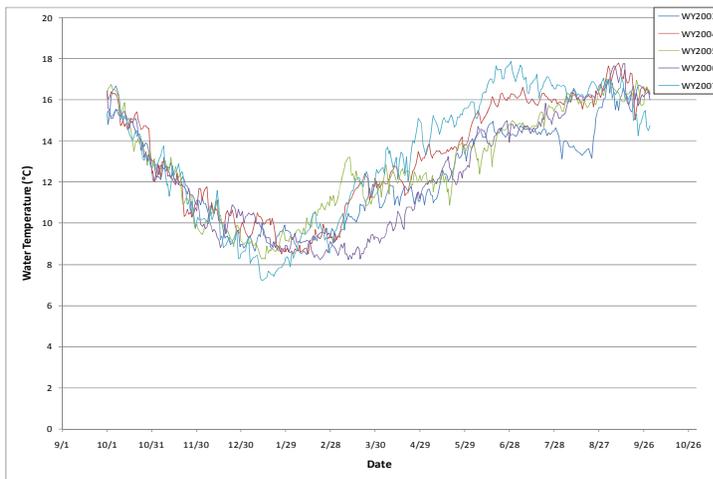
**Figure 7.2.9-28. Mean daily water temperatures in Deer Creek and Dry Creek in 2010.**

7.2.9.1.3 Water Temperature Downstream of the Project Area

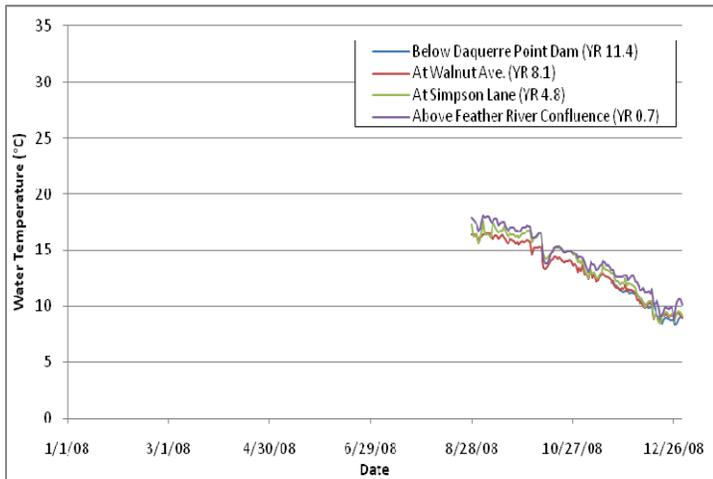
Licensee began collecting continuous water temperature data downstream of the Project Area (i.e., on the Yuba River downstream of the USACE’s Daguerre Point Dam) in 2003 (Table 7.2.9-1). Figure 7.2.9-29 through Figure 7.2.9-30 provide mean daily temperature measurements for Water Year 2003 through Water Year 2007 between USACE’s Daguerre Point Dam and the Yuba River at Marysville. Figure 7.2.9-31 through 7.2.9-36 provide an overlay comparison of Licensee data collection that began in summer 2008 for locations downstream of USACE’s Daguerre Point Dam. Data collection is continuing through 2010.



**Figure 7.2.9-29. Mean daily water temperatures in the Yuba River at USACE’s Daguerre Point Dam Fish Ladder from 2003 through 2007.**  
 Source: YCWA.

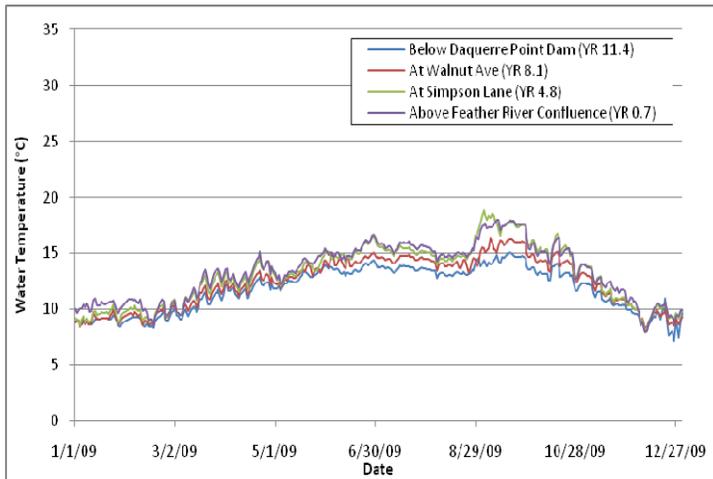


**Figure 7.2.9-30. Mean daily water temperatures in the Yuba River at USGS’ Marysville gage from 2003 through 2007.**  
 Source: YCWA



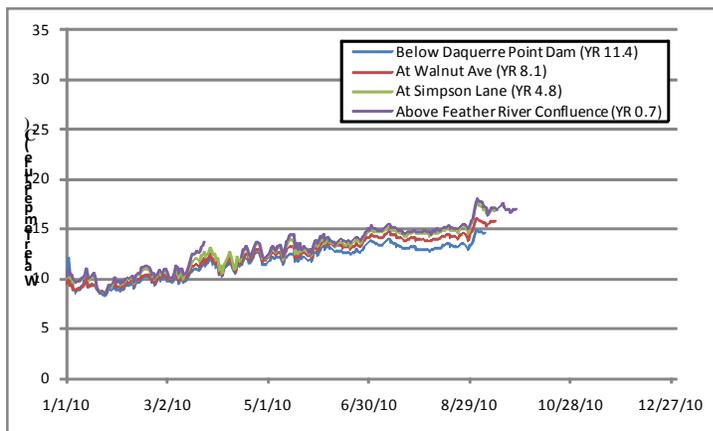
**Figure 7.2.9-31. Mean daily water temperatures in the Yuba River downstream of USACE's Daguerre Point Dam in 2008.**

Source: YCWA.



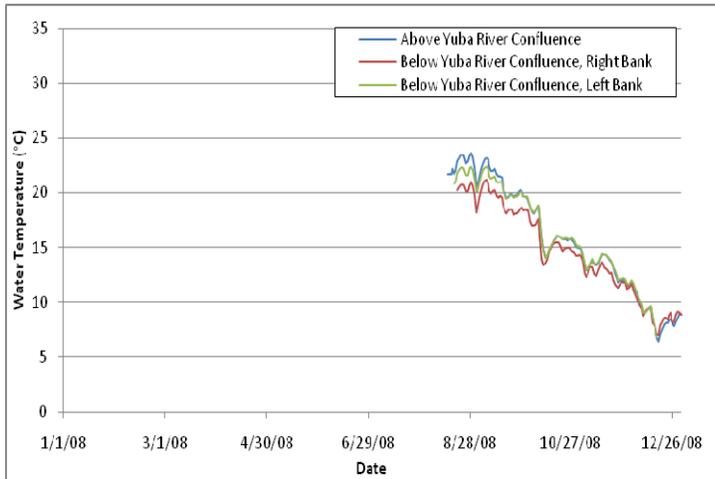
**Figure 7.2.9-32. Mean daily water temperatures in the Yuba River downstream of USACE's Daguerre Point Dam in 2009.**

Source: YCWA.

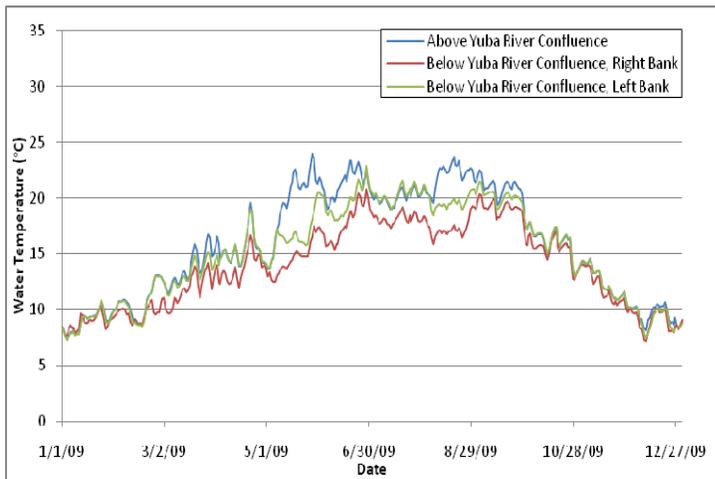


**Figure 7.2.9-33. Mean daily water temperatures in the Yuba River downstream of USACE's Daguerre Point Dam in 2010.**

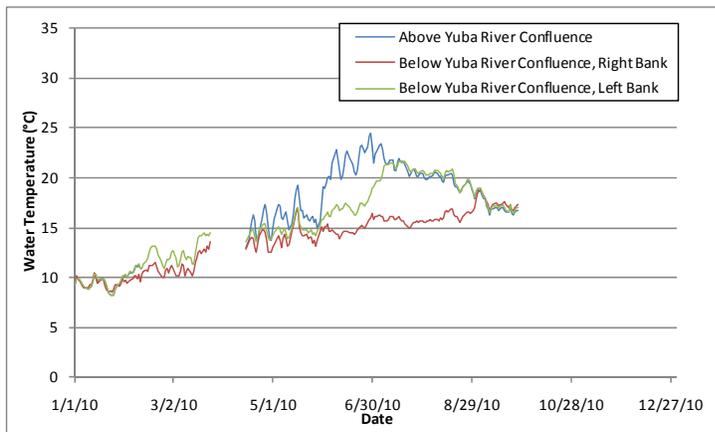
Source YCWA.



**Figure 7.2.9-34. Mean daily water temperatures in the Feather River near the Yuba River confluence in 2008.**  
 Source: YCWA.



**Figure 7.2.9-35. Mean daily water temperatures in the Feather River near the Yuba River confluence in 2009.**  
 Source: YCWA.



**Figure 7.2.9-36. Mean daily water temperatures in the Feather River near the Yuba River confluence in 2010.**  
 Source: YCWA.

## **7.2.9.2 Water Chemistry**

Water chemistry data were obtained from samples collected upstream, within, and downstream of the Project.

### **7.2.9.2.1 Water Chemistry Upstream of the Project Area**

Surface water flows into Project facilities from several sources: the North Yuba River; Oregon Creek at the Log Cabin Diversion Dam impoundment; the Middle Yuba River at Our House Diversion Dam impoundment; and the South Yuba River at USACE's Englebright Reservoir. Existing, relevant, and reasonably available water chemistry information for stream reaches upstream of the Project (i.e., on the Middle Yuba River upstream of Our House Diversion Dam, on Oregon Creek upstream of Log Cabin Diversion Dam, and on the North Yuba River upstream of New Bullards Bar Reservoir) is summarized in Table 7.2.9-2 and described further below. The contents of these source documents, as well as anecdotal information, are described.

**Table 7.2.9-2. Existing and relevant water chemistry data upstream of the Project Area.**

Location	River Mile	Date(s)	Temperature (°C)	pH (su)	Dissolved Oxygen (mg/L)	Iron (µg/L)	Metals (µg/L)	Pesticides (µg/L)	Hardness (mg/L as CaCO <sub>3</sub> )	Nutrients (mg/L)	Source
<b>NORTH YUBA RIVER</b>											
North Yuba River below Slate Creek	NYR 18	7/58 – 4/68	8.89 - 11.11	7.1 - 7.8	10.6- 10.8	--	--	--	27 - 61	Nitrate dissolved 0.2 - 0.5	STORET 2009
		10/71 – 6/72	--	1.0 - 11.0	--	Mercury filtered 0.4 - 0.6 Mercury unfiltered 0.2	Assorted pesticides— Not Detected	18-39	Nitrate + nitrite 0 - 0.04 Orthophosphate dissolved 0 - 0.06	USGS 2009	
North Yuba River Upstream of New Bullards Bar Reservoir	NYR 17	2001	--	7-8.1	8.3-12.3	--	--	--	--	Nitrate + nitrite 0.025 - 0.05	SYRCL 2005 <i>In</i> YCWA, et al. 2007
		09/09	8.8	8.3	10.2	Trace metals	--	72	Nitrate + nitrite Not detected Orthophosphate 0.028 J	Attachment 7.2B	
<b>OREGON CREEK</b>											
Oregon Creek above Log Cabin Diversion	OC 4.2	09/09	15.9	8.1	9.7	1770	Trace metals	--	90	Nitrate + nitrite 0.08 J Orthophosphate Not detected	Attachment 7.2B
Oregon Creek below Log Cabin Diversion	OC 4.1	09/09	16.1	7.8	7.9	56	Trace metals	--	79	Nitrate + nitrite Not detected Orthophosphate Not detected	Attachment 7.2B
<b>MIDDLE YUBA RIVER</b>											
Middle Yuba River Upstream of Our House Dam <sup>1</sup>	MYR 12.1	5/08-10/08	8.4 – 24.4	--	--	--	--	--	--	--	NID and PG&E 2010e
	MYR 12.1 and upstream	2001-2007	1.8-22.7	5.6-8.5	2.2-14.5	--	Arsenic 15.8 (avg)	--	--	--	SYRCL 2007
	MYR 12.1 and upstream	7/98 – 9/98	7.3 – 25.3	--	--	--	--	--	--	--	USFWS 1999
	MYR 12.1	09/09	18.3	7.5	8.2	83	Trace metals	--	75	Nitrate + nitrite 0.07 J Orthophosphate Not detected	Attachment 7.2B

**Table 7.2.9-2. (continued)**

Location	River Mile	Date(s)	Temperature (°C)	pH (su)	Dissolved Oxygen (mg/L)	Iron (µg/L)	Metals (µg/L)	Pesticides (µg/L)	Hardness (mg/L as CaCO <sub>3</sub> )	Nutrients (mg/L)	Source
Middle Yuba River Downstream of Our House Dam	MYR 12.0	09/09	18.0	7.3	7.7	31.8	Trace metals	--	64	Nitrate + nitrite Not detected Orthophosphate Not detected	Attachment 7.2B
Middle Yuba River Below Oregon Creek	MYR 4.3	10/52-10/67	9.4-17	6.4-7.9	8.5-11	--	Arsenic 0.20	--	23-72	0	STORET 2009
Middle Yuba River at Freemans Crossing	MYR 4.3	7/98 – 9/98	17.3 – 25.5	--	--	--	--	--	--	--	USFWS 1999
Middle Yuba River at Freemans Crossing	MYR 4	5/65-10/67	10.8	--	--	--	--	--	--	--	STORET 2009
<b>SOUTH YUBA RIVER</b>											
South Yuba River below Lake Spaulding	--	--	--	--	--	--	--	--	--	--	--
South Yuba River Below Canyon Creek	SYR 32.5	6/08-8/08	15.5-18.8	7.3-7.8	7.3-7.3	<10	Methyl-mercury, dissolved <0.050 µg/L Lead <0.04	--	26	Nitrate + nitrite <0.1-0.15	NID and PG&E 2010e
South Yuba River at Jones Bar	SYR 6.2	4/58 – 4/68	11.94 - 12.78	6.4 - 7.3	10.2 - 11.8	--	--	--	18.9 - 27	--	STORET 2009
South Yuba River at Bridgeport	SYR 0.1	10/57 – 4/68	12.78 - 22.22	7.2 - 8.0	7.7 - 11.5	--	--	--	23 - 56	--	STORET 2009
South Yuba River at Bridgeport	SYR 0.1	09/09	20.9	79	7.3	35.5	Trace metals	--	48	Nitrate + nitrite Not detected Orthophosphate Not detected	Attachment 7.2B

<sup>1</sup> Includes SYRCL sampling sites 7, 8, 27, 37, and 46.

OC Oregon Creek  
MYR Middle Yuba River  
NYR North Yuba River  
SYR South Yuba River

## Source Information

Licensee found five source documents<sup>4</sup> of relevant information regarding existing water quality in the Yuba River watershed upstream of the Project Area.

### Licensee's Summer 2009 Data

Information regarding water quality upstream of the Project Area was gathered during the low flow summer season in 2009, a period when Project operation and maintenance (O&M) effects were expected to be most pronounced, if they occur (Attachment 7.2B). Samples were collected upstream of the Project Area from the North Yuba River, Oregon Creek, the Middle Yuba River, and the South Yuba River. Each sample was analyzed for 35 analytes.

Surface water samples were collected between September 15 and 17, 2009. Temperatures ranged between 8.8 to 20.9 degrees Centigrade (°C). The sample collected in the South Yuba River upstream of Lake Englebright had the temperature of 20.9°C. Dissolved oxygen (DO) was generally between 7.3 and 9.5 milligrams per liter (mg/L). pH ranged between 7.3 and 10.2 standard units (su), while turbidity ranged from non-detect to 14.5 Nephelometric Turbidity Units (NTU) and hardness ranged from 48 to 90 mg/L.

### NID's Yuba-Bear and PG&E's Drum-Spaulling Hydroelectric Project Relicensing Studies

Water quality and water temperature monitoring studies are on-going in the Middle and South Yuba rivers upstream of the Project as part of the Federal Energy Regulatory Commission (FERC) relicensing of NID's Yuba-Bear Hydroelectric Project and PG&E's Drum-Spaulling Project. The closest upstream sample locations to the Project were the Middle Yuba River below Jackson Meadows Dam and the South Yuba River below the Canyon Creek confluence. Data were collected at these locations during the spring and summer of 2008 (NID and PG&E 2010e). Samples were analyzed for general chemistry, inorganic ions, metals, including methylmercury and mercury, and nutrients. Analyte concentrations were below aquatic toxicity benchmarks set forth by the EPA (EPA 2000; 2003), the CVRWQCB, and others in both seasons.

### SFWPA's South Feather Power Project Relicensing Studies

Water temperature monitoring studies were conducted in 2004 and 2005 as part of SFWPA's South Feather Power Project relicensing (FERC No. 2088). Stream temperature monitoring results on Slate Creek below SFWPA's Slate Creek Diversion Dam, a tributary to the North Yuba River, are included in this section were reviewed.

### South Yuba River Citizens League (2000-2009)

South Yuba River Citizens League has been performing monitoring since 2000 (SYRCL 2010). collected samples from the North Yuba River just upstream of New Bullards Bar Reservoir during an 8- to 12-month period in 2001 (SYRCL 2006). Seven samples were collected for six general water quality parameters: pH (7-8.1), turbidity (0-45 NTU), dissolved oxygen (8.3-12.3 mg/L), total organic carbon (TOC) (0.59-2.6 mg/L), nitrate-nitrite (0.025-0.05 mg/L), and electrical conductivity (20-30 microSiemens (µS)/cm).

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<sup>4</sup> A "source document" contains original data collected by the authors and associated conclusions, interpretations and other information developed *de novo* by the authors.

SYRCL collected *Escherichia coli* (*E. coli*) samples at various locations in the South Yuba and Middle Yuba rivers. In the upper reaches of these river systems, including the Jackson Meadows Dam Reach, *E. coli* concentrations were extremely low (0 MPN (most probable number)/100ml to 1 MPN/100ml). In the lower reaches of the South Yuba River, *E. coli* were more abundant, but still relatively low (0 MPN/100ml to 40 MPN/100ml).

In the Middle Yuba River, all of the average levels of bacteria and metals data collected by SYRCL, except for arsenic, are within EPA's drinking water standards (SYRCL 2006). The EPA standard for arsenic is 10 parts per billion (ppb), while the average measured arsenic level in the Middle Yuba River is 15.84 ppb. Kanaka Creek, which feeds into the Middle Yuba River 4 miles upstream of Our House Diversion Dam, is listed under Section 303(d) of the Clean Water Act as "impaired" due to arsenic levels and contributes to the measured high levels of arsenic (SYRCL 2007). This site accounted for the highest measured level of arsenic (47.2 ppb in August 2002).

SYRCL provided water quality data collected between 2001 and 2007 from five sites along the Middle Yuba River upstream of the Project: Site 7 (Below Jackson Meadows Reservoir); Site 8 (Plumbago Crossing above Kanaka Creek); Site 27 (Kanaka Creek); Site 37 (Milton Reservoir); Middle Fork downstream of Jackson Meadows; and Site 46 (Our House Dam Pike). The overall minimum and maximum conductivity values were 10  $\mu\text{S}/\text{cm}$  and 430  $\mu\text{S}/\text{cm}$ , respectively. The average conductivity was 102.9  $\mu\text{S}/\text{cm}$ . The overall minimum and maximum DO values were 2.2 mg/L and 14.5 mg/L, respectively. The average DO value was 9.9 mg/L. The overall minimum and maximum water temperature values were 1.8°C and 22.7°C, respectively. The overall average water temperature value was 10.7°C. The overall minimum and maximum turbidity values were 0 NTU and 6.89 NTU, respectively. The average turbidity value was 0.29 NTU. The overall minimum and maximum pH values were 5.6 and 8.5, respectively. The average pH value was 7.2.

SYRCL monitored total suspended solids (TSS), and bacterial levels at the five sites (#7, 8, 27, 37 and 46) as well. For these years, TSS averaged 2.36 mg/L with a high of 9.4 mg/L. The levels of *E. coli* averaged 9.74 MPN/100mL with a high of 101.7 MPN/100ml.

SYRCL provided temperature data to the CVRWQCB for the South Yuba River between Lake Spaulding and USACE's Englebright Reservoir for the years 2001 to 2006 (CVRWQCB 2009). In 2009, the CVRWQCB recommended that the South Yuba River be identified as impaired for temperature.

### USFWS

USFWS performed a stream and reservoir water temperature study of the Yuba River and its upstream tributaries in 1998-1999, in order to "*formulate and implement a water temperature monitoring program that was sufficiently comprehensive to provide an initial basin-wide estimate of thermal diversity in the Yuba River watershed under current conditions.* (USFWS 1999)" Field data collection was performed in summer 1998, and the data collection network extends to reaches upstream of, within, and downstream of the Project. Bi-weekly water temperature profiles were taken at the Licensee's New Bullards Bar Reservoir and USACE's Englebright Reservoir.

## **Anecdotal Information**

Licensee found three sources of anecdotal information that may be relevant to water quality upstream of the Project Area. The contents of these anecdotal sources are described here.

### EPA's STORET Database

Surface water quality data were retrieved for the Project Area from the STORET database management system on May 7, 2009 (EPA 2009). Results of the STORET query yielded six observations above the Project on the North Yuba River, six observations above the Project on the Middle Yuba River, and 10 observations above the Project on the South Yuba River. Summarized in Table 7.2.9-2, all data reflect surface water quality between 1952 and 1968.

### Sierra Foothill Research and Extension Center

Bordering USACE's Englebright Reservoir, the Sierra Foothill Research and Extension Center (REC) is one of nine agricultural research and extension centers in California administered by the University of California, Division of Agriculture & Natural Resources. It provides land, labor, facilities and management for agricultural research in oak woodland habitats, particularly range management.

One area of research for the Sierra Foothill REC is studying how water flowing through foothill woodlands is affected by such land management activities, such as oak tree removal and livestock grazing. This includes studies of how dissolved organic carbon and bacteria, such as total coliform and *E. coli*, are transported to streams located on the property used for grazing. Although no chemical data from Project waters were found from this source, scoping research performed by one researcher was informative. SYRCL is concerned with bacteria levels in Yuba surface water yet no data besides the SYRCL data were found. Chu et al. (2008) confirms that Yuba County agencies have not conducted any bacterial monitoring of freshwater recreational areas.

### USGS National Water Information System

Surface water quality data were retrieved for the Project Area from the USGS NWIS database management system on May 7, 2009 (USGS 2009). Results of the NWIS query yielded one observation above the Project on the North Yuba River, two observations above the Project on the Middle Yuba River below the confluence with Oregon Creek, and no observations above the Project on the South Yuba River (USGS 2009). Summarized in Table 7.2.9-2, all data reflect surface water quality between 1960 and 2004.

#### 7.2.9.2.2 Water Chemistry within the Project Area

Existing, relevant, and reasonably available water chemistry information collected from the Project is summarized in Table 7.2.9-3 and described below. The contents of these source documents, as well as anecdotal information, are described.

**Table 7.2.9-3. Existing and relevant water quality data within the Project Area.**

Location	River Mile	Date(s)	Temperature (°C)	pH (su)	Dissolved Oxygen (mg/L)	Iron (µg/L)	Metals (µg/L)	Pesticides	Hardness (mg/L as CaCO <sub>3</sub> )	Nutrients (mg/L)	Source
<b>NEW BULLARDS BAR RESERVOIR</b>											
Bullards Bar Reservoir Near Little Oregon Creek	NYR 4.4	5/65	15	7.5	--	--	--	--	30	--	STORET 2009
Bullards Bar Reservoir Near North San Juan	NYR 3.8	10/67	8.33-25.00	6.8 - 7.8	1.8 - 8	--	--	--	--	--	STORET 2009
Bullards Bar Reservoir Near Dam	NYR 3.1-- surface	09/09	23.2	8.4	7.7	15.5	Trace metals	--	38	Nitrate + nitrite Not detected Orthophosphate 0.028 J	Attachment 7.2B
	NYR 3.1-- bottom	09/09	7.4	7.2	8.02	14.5	Trace metals	--	34	Nitrate + nitrite Not detected Orthophosphate 0.028 J	Attachment 7.2B
<b>NEW BULLARDS BAR DAM REACH</b>											
North Yuba River at Bullards Bar Powerhouse	NYR 3	10/52 - 5/65	11.11 - 22	7.5 - 7.8	8.0	--	--	--	--	--	STORET 2009
		09/09	8.8	8.3	10.2	43.9	Trace metals	--	36	Nitrate + nitrite 0.08 J Orthophosphate Not detected	Attachment 7.2B
<b>MIDDLE/NORTH YUBA RIVER REACH</b>											
Yuba River Above New Colgate Powerhouse	YR 34.2	4/58-4/68	6.7-27	6.7-9.3	6.7-12.7	dissolved 20	Arsenic dissolved 10	--	19-76	Nitrate/Nitrite 0.2-1.0	STORET 2009
		10/02	12.0	7.9	5.9	--	--	--	--	--	USGS 2009
<b>NEW COLGATE POWERHOUSE REACH</b>											
Below New Colgate Powerhouse	YR 33.7	1/01 - 6/02	5.0 - 14.0	6.4 - 7.9	8.3 - 13.2	--	--	--	--	Trace amounts of nitrate, nitrite, ammonia & phosphates.	USGS 2009
		2000-2009	7.1-18.4	6.8-8.6	9.5-14.5	--	--	--	--	--	SYRCL 2010
		09/09	8.4	7.7	10.1	43	Trace metals	--	34	Nitrate + nitrite 0.09 J Orthophosphate Not detected	Attachment 7.2B

Table 7.2.9-3. (continued)

Location	River Mile	Date(s)	Temperature (°C)	pH (su)	Dissolved Oxygen (mg/L)	Iron (µg/L)	Metals (µg/L)	Pesticides	Hardness (mg/L as CaCO <sub>3</sub> )	Nutrients (mg/L)	Source
<b>USACE'S ENGLEBRIGHT RESERVOIR</b>											
USACE's Englebright Reservoir Near Dam	YR 24 -- surface	09/09	20.0	8.3	9.2	21.3	Trace metals	--	36	Nitrate + nitrite Not detected Orthophosphate Not detected	Attachment 7.2B
	YR 24 -- bottom	09/09	9.1	7.4	6.1	19.6	Trace metals	--	21	Nitrate + nitrite 0.12 J Orthophosphate Not detected	Attachment 7.2B
<b>NARROWS 2 POWERHOUSE REACH</b>											
Yuba River below USACE's Englebright Dam	YR 23.6	5/71	18.89	7.2	9.8	--	Mercury, total non-detect	--	--	--	STORET 2009
		10/60 - 3/66	N/A	7.1 - 8.2	--	dissolved 0 - 10	--	--	18 - 86	Nitrate dissolved, filtered 0 - 5.6	STORET 2009
		12/66 - 11/99	7.0 - 21.5	7.1 - 8.6	6.4 - 15.9	dissolved <10 - 86	Trace amounts of mercury	--	--	Nitrate dissolved, filtered 0 - 0.7	USGS 2009
		2/01 - 5/04	8.0 - 16.0	6.3 - 8.3	7 - 15.4	--	Trace amounts of pesticides	--	--	Trace amounts of nitrate, nitrite, ammonia & phosphates.	USGS 2009
		10/03-4/05	--	7.25-7.48	--	--	Copper 0.3-0.8 Mercury 0.00047-00371 Zinc 1-10.8	--	--	Nitrate + Nitrite Non-Detect Orthophosphate (filtered) 0.02-0.02	Jones & Stokes 2005
Parks Bar Bridge (Hwy 49)	YR 18	4/51-9/69	3.89-25.56	6.7-8.4	7.5-14	--	--	--	17- 66	--	STORET 2009
Yuba River at Smartville	YR 23.6	3/60-3/66	--	7.3-8.1	--	--	--	--	21-62	--	USGS 2009
		09/09	11.4	7.6	7.5	64.0	Trace metals	--	37	Nitrate + nitrite 0.07 J Orthophosphate Not detected	Attachment 7.2B

**Table 7.2.9-3. (continued)**

Location	River Mile	Date(s)	Temperature (°C)	pH (su)	Dissolved Oxygen (mg/L)	Iron (µg/L)	Metals (µg/L)	Pesticicides	Hardness (mg/L as CaCO <sub>3</sub> )	Nutrients (mg/L)	Source
<b>DEER CREEK (tributary creek in the Project vicinity but not a Project-affected reach)</b>											
Deer Creek	Confluence @ YR 23	10/57-9/69	8.3-25	7.3-8.2	8.5-12.7	--	--	--	29-73	Nitrite, dissolved 0.1-1.3	STORET 2009
		09/09	12.4	7.8	9.5	43.9	Trace metals	--	36	Nitrate + nitrite Not detected Orthophosphate Not detected	Attachment 7.2B
<b>USACE'S DAGUERRE POINT DAM IMPOUNDMENT</b>											
USACE's Daguerre Point Dam Impoundment	YR 11.4 to 11.5	<i>After a review of the data resources listed above, the Licensee is unaware of existing water quality data for this area.</i>									

Note:

- NYR North Yuba River
- SYR South Yuba River
- YR Yuba River

## Source Information

Licensee found three source documents with relevant information regarding existing water quality in the Project Area. The contents of these source documents, as well as anecdotal information, are described here.

### Licensee's Summer 2009 Data

Information regarding water quality in the Project Area was gathered during the low flow summer season in 2009, a period when Project O&M effects were expected to be most pronounced, if they occur (Attachment 7.2B). The study consisted of two elements: a general water quality element and a recreation element. The general water quality element consisted of collecting samples from the reservoirs and stream reaches of the Project Area and analyzing each sample for 35 analytes. The recreation study element consisted of collecting bacteria samples five times over 30 days, including one day on the Labor Day weekend. Secchi disc measurements were also made within reservoirs.

Surface water samples were collected between September 14 and 17, 2009. Temperatures ranged between 7.43 to 23.3 degrees °C. Dissolved oxygen was generally between 7.3 and 9.5 mg/L. Ph ranged between 6.1 (within Englebright Reservoir's hypolimnion) and 10.2 standard unit (su), while turbidity ranged from non-detect to 147.2 NTU and hardness ranged from 21 to 38 mg/L. The Secchi disc measurement for New Bullards Bar was 9 feet and for USACE's Englebright Reservoir, the Secchi disc depth was 12 feet. Within Project facilities, metals and dissolved metals concentrations were either non-detect using laboratory methods or present in trace amounts.

The recreation study element consisted of collecting samples adjacent to New Bullards Bar Reservoir's Emerald Cove and Dark Day Campground boat ramps on five separate days over a 30-day period that included the Labor Day weekend. Bacteria counts were made for these samples. Fecal coliform and *E. coli* were not found, while total coliform was found.

### Lake Wildwood Wastewater Treatment Plant Improvement Project. Phase IIA Baseline Yuba River Technical Studies

From 2003 to 2005, the lake Wildwood Wastewater Treatment Plant is not within the Project Area, but on Deer Creek. However, the Lake Wildwood community conducted several studies in the Project Area to explore changing its wastewater discharge location from Deer Creek to the Yuba River below USACE's Englebright Reservoir (Jones & Stokes 2005). Water quality samples collected from the Yuba River below USACE's Englebright Reservoir from 2003 to 2005 were analyzed for pesticides, selected metals, nutrients, and water treatment by-products. Pesticides were not detected. Of the metals analyzed, aluminum ranged between 18.8 and 125 microgram/Liter ( $\mu\text{g/L}$ ), copper ranged between 0.3 and 0.8  $\mu\text{g/L}$ , mercury ranged between 0.00047 and 0.00371  $\mu\text{g/L}$ , and zinc ranged from 1 to 10.8  $\mu\text{g/L}$ . Silver and lead were not detected. Other constituents measured included: pH (7.24-7.48 su), specific conductance (74-79  $\mu\text{mhos/cm}$ ), TOC (<0.6-2.1 mg/L), nitrate + nitrite (<0.03 - <0.06 mg/L), and electrical conductivity (20-30  $\mu\text{S/cm}$ ).

### USFWS

USFS performed a stream and reservoir water temperature study of the Yuba River and its upstream tributaries in 1998-1999, in order to “*formulate and implement a water temperature monitoring program that was sufficiently comprehensive to provide an initial basin-wide estimate of thermal diversity in the Yuba River watershed under current conditions.* (USFWS 1999)” Field data collection was performed in summer 1998, and the data collection network extends to reaches upstream of, within, and downstream of the Project. Bi-weekly water temperature profiles were taken at Licensee’s New Bullards Bar Reservoir and USACE’s Englebright Reservoir. Summary results are presented in Table 7.2.9-2.

### **Anecdotal Information**

Licensee found five sources of anecdotal information that may be relevant to water quality in the Project Area. The contents of these anecdotal sources are described here.

#### EPA’s STORET Database

Surface water quality data were retrieved for the Project Area from the STORET database management system on May 7, 2009 (EPA 2009). Results of the STORET query yielded four observations within New Bullards Bar Reservoir. All data reflect surface water quality between 1952 and 1967. Data were also found from four locations between New Bullards Bar Reservoir and USACE’s Daguerre Point Dam. Of the four locations, the water quality below USACE’s Englebright Reservoir has been sampled the most; STORET contains over 300 sample results of samples collected between 1960 and 1971.

#### Sierra Foothill Research and Extension Center

Bordering USACE’s Englebright Reservoir, the Sierra Foothill REC is one of nine agricultural research and extension centers in California administered by the University of California, Division of Agriculture & Natural Resources. It provides land, labor, facilities and management for agricultural research in oak woodland habitats, particularly range management.

One area of research for the Sierra Foothill REC is studying how water flowing through foothill woodlands is affected by such land management activities, such as oak tree removal and livestock grazing. This includes studies of how dissolved organic carbon and bacteria, such as total coliform and *E. coli*, are transported to streams located on the property used for grazing. Although no chemical data from Project waters were found from this source, scoping research performed by one researcher was informative. SYRCL is concerned with bacteria levels in Yuba surface water, yet no data besides the SYRCL data were found. Chu et al. (2008) confirms that Yuba County agencies have not conducted any bacterial monitoring of freshwater recreational areas.

### pH

Upon review of the data resources listed above, Licensee found that Deer Creek, a tributary creek in the Project vicinity but not a Project-affected reach, has been identified as impaired for pH (SWRCB 2006).

### South Yuba River Citizens League

Since 2000, as weather and access have allowed, SYRCL has been sampling up to 33 sites in the Yuba River watershed for dissolved oxygen, pH, conductivity, temperature, turbidity, total suspended solids, and some metals (arsenic, mercury), sometimes as often as monthly (SYRCL 2010). Based on these data, SYRCL has identified arsenic, bacteria, and mercury as constituents of concern in the watershed (SYRCL 2006, 2010). In the Project Area, SYRCL has been sampling downstream of Colgate Powerhouse, measured constituents consisted of pH (6.8-8.6 su), DO (9.5-14.5 mg/L), temperature (7.1-18.4 C), turbidity (0-16.6 NTU), and electrical conductivity (60-143  $\mu$ S/cm).

### USGS National Water Information System

Surface water quality data were retrieved for the Project Area from the USGS NWIS database management system on May 7, 2009 (USGS 2009). Results of the NWIS query yielded one observation above the Project on the North Yuba River; two observations above the Project on the Middle Yuba River below the confluence with Oregon Creek, and no observations above the Project on the South Yuba River. Summarized in Table 7.2.9-3, all data reflect surface water quality between 1960 and 2004.

#### 7.2.9.2.3 Water Chemistry Downstream of the Project Area

Existing, relevant, and reasonably available water chemistry information for stream reaches downstream of the Project Area (i.e., on the Yuba River downstream of USACE's Daguerre Point Dam is summarized in Table 7.2.9-4 and described further, below. The contents of these source documents, as well as anecdotal information, are described.

**Table 7.2.9-4. Existing and relevant water quality data downstream of the Project Area.**

River Reach	River Mile	Date(s)	Temperature (°C)	pH (su)	Dissolved Oxygen (mg/L)	Iron (µg/L)	Metals (µg/L)	Pesticides (µg/L)	Hardness (mg/L as CaCO <sub>3</sub> )	Nutrients (mg/L)	Source
<b>USACE'S DAGUERRE POINT DAM REACH</b>											
Below USACE's Daguerre Point Dam	YR 11.3	10/67-4/68	13.6-18.3	7.7-8.1	9.9-11.5	--	--	--	32-52	--	STORET 2009
		09/09	14.3	7.7	7.3	14.0	Trace metals	--	37	Nitrate + nitrite Not detected Orthophosphate Not detected	Attachment 7.2B
Yuba River at Walnut Avenue	YR 8.1	09/09	16.6	8.1	8.7	33.2	Trace metals	--	38	Nitrate + nitrite Not detected Orthophosphate Not detected	Attachment 7.2B
		10/67-6/82	3.33-27.22	6.6-8.1	8.0-16.2	--	--	--	20-90	--	STORET 2009
Yuba River at Marysville	YR 0.7	12/76-11/95	7 - 21.5	7.1-8.6	7.3-12.5	<10-30	Not detected	--	23-56	Trace nutrients	USGS 2009
		1996-98		7-7.8	8-12	--	Mercury, total 1.19-46.7 ng/L	--	--	Nitrate-Nitrite 0.05-0.14	LWA 2000
		2002-04		7.1-7.4	8.4-14.2	--	--	--	--	--	Nitrate-Nitrite <0.01-0.08
		09/09	16.1	8.0	7.7	243	Trace metals	--	40	Nitrate + nitrite Not detected Orthophosphate Not detected	Attachment 7.2B

su standard units  
YR Yuba River

## Source Information

Licensee found four source documents with relevant information regarding existing water quality downstream of the Project Area. The contents of these source documents, as well as anecdotal information, are described here.

### Licensee's Summer 2009 Data

Information regarding water quality in downstream of the Project was gathered during the low flow summer season in 2009, a period when Project O&M effects were expected to be most pronounced, if they occur (Attachment 7.2B). Samples were collected downstream of the Project in the Lower Yuba River from three locations. Each sample was analyzed for 35 analytes.

Surface water samples were collected between September 14 and 17, 2009. Temperatures ranged between 14.3 to 16.6 °C. DO was observed between 7.3 and 8.7 mg/L and pH ranged between 7.7 and 8.1 su. Turbidity and hardness increased from upstream to downstream: turbidity ranged from 1.2 to 15.4 NTU and hardness ranged from 37 to 40 mg/L.

### Sacramento River Watershed Program

The Sacramento River Watershed Program collected 27 samples over a 3-year period between 1996 and 1998 from a site near Marysville directly upstream of the Yuba River's confluence with the Feather River (LWA 2000). Samples were analyzed for pH (7-7.8 su), turbidity (1-153 mg/L), DO (8-12 mg/L), TOC (0.7-2.4 mg/L), nitrate-nitrite (0.05-0.14 mg/L), electrical conductivity (EC; 44-105 µS/cm), and mercury (total; 1.19-46.7 nanogram (ng)/L). Samples collected in the earliest rounds were also analyzed for seven trace metals which were taken off the analyte list in 1999, after these metals were found only in concentrations consistently below drinking water criteria (LWA 2000).

### Oroville Relicensing Water Quality Study

In support of the Oroville Dam's relicensing effort, between 2002 and 2004, CDWR collected 30 samples from a site near Marysville, directly upstream of the Yuba River's confluence with the Feather River (DWR 2004b). CDWR analyzed each sample for more than 50 analytes, including total and dissolved metals. General chemistry results were pH (7.1-7.4 su), turbidity (0.5-17.2 mg/L), DO (8.4-14.2 mg/L), TOC (0.8-3.6 mg/L), nitrate-nitrite (<0.01-0.08 mg/L), and electrical conductivity (76-28 µS/cm).

### USFWS

USFWS performed a stream and reservoir water temperature study of the Yuba River and its upstream tributaries in 1998-1999, in order to "*formulate and implement a water temperature monitoring program that was sufficiently comprehensive to provide an initial basin-wide estimate of thermal diversity in the Yuba River watershed under current conditions.*(USFWS 1999)" Field data collection was performed in summer 1998, and the data collection network extends to reaches upstream of, within, and downstream of the Project. Bi-weekly water temperature profiles were taken at the Licensee's New Bullards Bar Reservoir and USACE's Engebright Reservoir. Summary results are presented in Table 7.2.9-2.

## **Anecdotal Information**

Licensee found four sources of anecdotal information that may be relevant to water quality downstream of the Project Area. The contents of these anecdotal sources are described here.

### EPA's STORET Database

Surface water quality data were retrieved for the Project Area from the STORET database management system on May 7, 2009 (EPA 2009). As shown in Table 7.2.9-4, results of the STORET query yielded observations from two locations below USACE's Daguerre Point Dam. More than 500 records are available from the site above the confluence with the Feather River. All data reflect surface water quality between 1967 and 1982.

### Sierra Foothill Research and Extension Center

Bordering USACE's Englebright Reservoir, the Sierra Foothill REC is one of nine agricultural research and extension centers in California administered by the University of California, Division of Agriculture & Natural Resources. It provides land, labor, facilities and management for agricultural research in oak woodland habitats, particularly range management.

One area of research for the Sierra Foothill REC is studying how water flowing through foothill woodlands is affected by such land management activities, such as oak tree removal and livestock grazing. This includes studies of how dissolved organic carbon and bacteria, such as total coliform and *E. coli*, are transported to streams located on the property used for grazing. Although no chemical data from Project waters were found from this source, scoping research performed by one researcher was found to be informative. SYRCL is concerned with bacteria levels in Yuba surface water, yet no data besides the SYRCL data were found. Chu et al. (2008) confirms that Yuba County agencies have not conducted any bacterial monitoring of freshwater recreational areas.

### South Yuba River Citizens League

Since 2000, as weather and access have allowed, SYRCL has been sampling up to 33 sites in the Yuba River watershed for dissolved oxygen, pH, conductivity, temperature, turbidity, total suspended solids, and some metals (arsenic, mercury) (SYRCL 2010). Based on these data, SYRCL has identified arsenic, bacteria, and mercury as constituents of concern in the watershed (SYRCL 2006, 2010).

### USGS National Water Information System

Surface water quality data were retrieved for the Project Area from the NWIS database management system on May 7, 2009 (USGS 2009). Results of the NWIS query yielded observations made from 1976 to 1995 on the Yuba River above Marysville.

## **7.2.9.3 Mercury in the Yuba Watershed**

Mercury contamination in sport fish is found to be widespread in water bodies throughout northern California due to both: 1) historic mercury mining in the Coast Ranges; and 2) the use of mercury in the gold extraction processes of the Sierra-Nevada gold mines (CDWR 2007; Davis et al. 2008). In the Sierra-Nevada, a large fraction of the mercury used in hydraulic

mining of placer ores in the late 1800's was lost during processing and now persists in the environment. Mercury associated with gold mining has been measured in the sediment, water, and biota from the Sierra Nevada's gold mining regions, the Central Valley, the Sacramento-San Joaquin Delta and San Francisco Bay (CDWR 2007; Davis et al. 2008). Mercury is of concern because it is a potent neurotoxin that bioaccumulates in muscle tissue.

Since the early 1990's, the upper Yuba River watershed has been studied by University of California, Davis, and the USGS (Alpers et al. 2005; Hunderlach et al. 1999; May et al. 2000; Slotton et al. 1995 in May et al. 2000; and Slotton et al., in preparation in OEHHA 2009). Findings from these studies indicate that significant amounts of Gold Rush era mercury still exist in sediments, surface water and fish of the upper Yuba watershed. Sediments are being transported downstream into reservoirs on the Yuba River, where they are largely trapped (Hunderlach et al. 1999; Alpers et al. 2005).

Findings from these studies also indicate that fish tissue concentrations of mercury are greater than human health based criteria at some locations. As shown in Table 7.2.9-5, mercury in its bioavailable form, and attributable to historic gold mining, has been found in fish tissue at concentrations above reference concentrations<sup>5</sup> and California's OEHHA 1999 guideline of 0.30 parts per million (ppm) wet-weight in the North Fork Yuba, the Middle Fork Yuba, the South Fork Yuba River, and the lower Yuba River (May et al. 2000; OEHHA 2003; CVRWQCB 2009). Consequently, in the Project Area and its immediate vicinity, New Bullards Bar Reservoir, USACE's Englebright Reservoir, the reaches between New Bullards Bar Reservoir, the Middle Yuba River, the South Yuba River downstream of Lake Spaulding to USACE's Englebright Reservoir, and the Yuba River downstream of USACE's Englebright Reservoir to the Feather River, are all listed or proposed for listing for mercury impairment (Medium TMDL Priority).<sup>6</sup> Further, human-health based fish consumption advisories are also in place for USACE's Englebright Reservoir (OEHHA 2009).<sup>7</sup>

**Table 7.2.9-5. Mercury measured in fish tissue collected from the Project Vicinity.**

Location	Species Sampled	Number of Fish	Mercury, Total (ppm) <sup>1</sup>	Total Length (mm)	Data Source
<b>UPSTREAM OF THE PROJECT AREA</b>					
North Yuba River near Canyon Creek	Rainbow trout	5	0.19 - 0.14 (avg 0.11)	236 - 311	Slotton et al. (1997)
Middle Yuba River one mile upstream of Plumbago Road	Rainbow trout	5	0.05 - 0.19 (avg 0.11)	292 - 415	CVRWQCB (2009)
Middle Yuba River upstream of Kanaka Creek [one mile upstream of Tyler Foote crossing]	Rainbow trout	9	0.10 - 0.24 (avg 0.16)	210 - 387	

<sup>5</sup> Fish tissue, water, and sediment samples taken from the reference locations selected for these studies were non-zero but below regulatory benchmarks, as ambient sources of mercury also exist (May *et al.* 2000; Alpers *et al.* 2005). Ambient sources include aerial deposition from industrial sources and forest fires that release mercury sequestered biomass.

<sup>6</sup> Based on a review of the 2006 California 303(d) List and Total Maximum Daily Loads (TMDL) Priority Schedule and its 2009 proposed updates, as shown on the SWRCB's website: <http://www.swrcb.ca.gov>.

<sup>7</sup> OEHHA previously provided consumption advisories for the South Yuba River from Lake Spaulding to USACE's Englebright Reservoir and for Deer Creek (a tributary creek), but determined in 2009 that their sample size was inadequate to make this determination and retracted the advisory (OEHHA 2009).

**Table 7.2.9-5. (continued)**

Location	Species Sampled	Number of Fish	Mercury, Total (ppm) <sup>1</sup>	Total Length (mm)	Data Source
<b>UPSTREAM OF THE PROJECT AREA (continued)</b>					
Middle Yuba River just upstream of Oregon Creek and Highway 49	Rainbow Trout	3	0.15-0.21 (avg 0.18)	204 - 278	
	Sacramento Pikeminnow	2	0.56 and 0.81	321 - 339	
Middle Yuba River one mile downstream of the Highway 49 crossing	Sacramento Pikeminnow	4 (composite)	0.64	≥ 150	CVRWQCB (2009)
South Yuba River below Lake Spaulding	Brown trout	2	0.07 and 0.07	224 -249	Slotton et al. (1997) <i>IN</i> CVRWQCB (2009)
	Rainbow trout	3	0.06-0.11 (avg 0.080)	180 - 228	
South Yuba River at Washington	Rainbow trout	13	0.10 - 0.30 (avg 0.15)	183 - 345	Slotton et al. (1997) <i>IN</i> CVRWQCB (2009)
South Yuba River just downstream of Edwards Crossing	Rainbow trout	2	0.09 and 0.15	182 - 270	May et al. (2000) <i>IN</i> CVRWQCB (2009)
South Yuba River near Bridgeport	Smallmouth Bass	3 (composite)	0.69	≥ 150	CVRWQCB (2009)
<b>WITHIN THE PROJECT AREA</b>					
New Bullards Bar Reservoir-- East Arm near its confluence with the West Arm	Smallmouth Bass	13	0.22 - 0.68 avg 0.39	≥ 150	CVRWQCB (2009)
New Bullards Bar Reservoir-- East Arm near the Willow Creek inlet	Bluegill	3	0.12-0.39 (avg 0.21)	≥ 150	Melwani et al. (2007) <i>IN</i> CVRWQCB (2009)
	Carp	11	0.34-0.83 (avg 0.52)	≥ 150	
	Largemouth Bass	1	0.61	≥ 150	
	Smallmouth Bass	10	0.29-0.72 (avg 0.48)	≥ 150	
	Carp	6 (composite)	0.61	≥ 150	CVRWQCB (2009)
	Smallmouth Bass	5 (composite)	0.63	≥ 150	
New Colgate Powerhouse Reach, approximately 1.3 miles upstream of USACE's Englebright Reservoir	Smallmouth Bass	5	0.27 - 0.56 avg of 0.38	≥ 150	CVRWQCB (2009)
USACE's Englebright Reservoir—South Yuba Arm, Hogsback Ravine Arm, and mid-section.	largemouth smallmouth and spotted bass	56	0.45 (mean)	338 (mean)	May et al. (2000) and Slotton et al. (1997) <i>IN</i> CVRWQCB (2001); Slotton et. al. in press <i>IN</i> OEHA (2009)
	Bluegill and green sunfish	31	0.30 (mean)	161 (mean)	
	Rainbow trout	49	0.08 (mean)	290 (mean)	
	Carp	1	0.88	440	Slotton et al. (1997)
	Hardhead	1	0.47	540	
	Sacramento sucker	5	0.41-0.89	410-523	
Narrows 2 Powerhouse Reach, Lower Yuba River, approximately 2.2 miles downstream of Englebright Dam	Rainbow Trout	9	0.07 - 0.13 avg 0.10	≥ 150	Slotton et al. (1997) <i>in</i> CVRWQCB (2009)
Little Deer Creek at Pioneer Park, less than one mile from the confluence with Deer Creek (tributary to Yuba River)	Brown trout	6	0.23 - 0.39 avg 0.32	≥ 150	May et al. (2000); CVRWQCB (2009)

**Table 7.2.9-5. (continued)**

Location	Species Sampled	Number of Fish	Mercury, Total (ppm) <sup>1</sup>	Total Length (mm)	Data Source
<b>DOWNSTREAM OF THE PROJECT AREA</b>					
Daguerre Point Dam Reach, Lower Yuba River, approximately 0.9 miles upstream of its confluence with the Feather River	Rainbow Trout	1	0.02	≥ 150	CVRWQCB (2009)
	Sacramento Pikeminnow	1	0.46		
	Sacramento Sucker	2	0.22 and 0.38		
	Smallmouth Bass	4	0.26-0.72 (avg 0.43)		
Lower Yuba River, approximately 3.6 miles upstream of its confluence with the Feather River	Sacramento Pikeminnow	2	0.31 and 1.43	≥ 150	CVRWQCB (2009)
	Sacramento Sucker	5 (composite)	0.39		
	Rainbow Trout	3	0.08-0.1 (avg 0.09)	310 (avg)	Grenier et al. (2007) <i>IN</i> CVRWQCB (2009)
	Sacramento Pikeminnow	5	0.19-1.58 (avg 0.84)	≥ 150	
	Sacramento Sucker	3	0.11-0.73 (avg 0.26)	420 (avg)	

<sup>1</sup> All concentrations are in wet-weight.

In the Project Area, Slotton et al. (1997) also observed notably lower invertebrate mercury concentrations below many of the foothill reservoirs, as compared to concentrations in similar biota upstream. Specifically, the invertebrates below New Bullards Bar Dam were considerably lower in mercury than those collected upstream of the reservoir on the North Yuba River. Similarly, the invertebrates collected below the USACE’s Englebright Reservoir were consistently far lower in mercury than samples collected upstream of the reservoir on the Middle and South Yuba River. In contrast, however, reservoir dwelling fish had higher mercury tissue concentrations than fish collected from Coastal Range reservoirs, near historic mercury mines. This would suggest that mercury in the Sierra Nevada reservoirs is in a more bioavailable form than mercury in the Coastal Range reservoirs (Slotton et al. 1997).

### 7.2.10 List of Attachments

This section includes two attachments:

- Attachment 7.2A – Licensee’s Water Temperature Data
- Attachment 7.2B – Licensee’s 2009 Water Quality Data

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## **Section 7.2**

# **Water Resources Attachment**

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- **Attachment 7.2A: Licensee's Water Temperature Data**

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## **Section 7.2**

# **Water Resources Attachment**

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- **Attachment 7.2B: Licensee's 2009 Water Quality Data**

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