Amended Application for New License
Major Project – Existing Dam

Exhibit B
Project Operations and Resource Utilization

Security Level: Public

Yuba River Development Project
FERC Project No. 2246

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List of Attachments

None.

EXHIBIT B

PROJECT OPERATIONS AND RESOURCE UTILIZATION

1.0 Introduction

The Yuba County Water Agency (YCWA or Licensee) has prepared this Exhibit B, Project Operations and Resource Utilization, as part of its Amended Application for a New License Major Project – Existing Dam – (Amended FLA)[1] from the Federal Energy Regulatory Commission (FERC) for the Yuba River Development Project (Project), FERC Project No. 2246. This exhibit is prepared in conformance with Title 18 of the Code of Federal Regulations (C.F.R.), Subchapter B (Regulations under the Federal Power Act), Part 5 (Integrated Licensing Process). In particular, this exhibit conforms to the regulations in 18 C.F.R. Section (§) 5.18(a)(5)(iii), which require in part that an application include an Exhibit B, Project Operations and Resource Utilization, in conformance with 18 C.F.R. Section 4.51(c). This Exhibit B describes, in detail, the manner in which YCWA plans to operate the Project. As a reference, 18 C.F.R. Section 4.51(c) states:

> Exhibit B is a statement of project operation and resource utilization. If the project includes more than one dam with associated facilities, the information must be provided separately for each such discrete development. The exhibit must contain:
>
> (1) A statement whether operation of the powerplant will be manual or automatic, an estimate of the annual plant factor, and a statement of how the project will be operated during adverse, mean, and high water years,
>
> (2) An estimate of the dependable capacity and average annual energy production in kilowatt-hours (or a mechanical equivalent), supported by the following data:
>
> (i) The minimum, mean, and maximum recorded flows in cubic feet per second of the stream or other body of water at the powerplant intake or point of diversion, with a specification of any adjustment made for evaporation, leakage, minimum flow releases (including duration of releases), or other reductions in available flow, monthly flow duration curves indicating the period of record and the gauging stations used in deriving the curves, and a specification of the period of critical stream flow used to determine the dependable capacity,
>
> (ii) An area-capacity curve showing the gross storage capacity and usable storage capacity of the impoundment, with a rule curve showing the proposed operation of the impoundment and how the usable storage capacity is to be utilized;
>
> (iii) The estimated minimum and maximum hydraulic capacity of the powerplant (maximum flow through the powerplant) in cubic feet per second;
>
> (iv) A tailwater rating curve; and
>
> (v) A curve showing powerplant capability versus head and specifying maximum, normal, and minimum heads.

[1] YCWA filed with FERC an Application for a New License Major Project – Existing Dam – (Final License Application, or FLA) for the Project on April 27, 2014.

(3) A statement, with load curves and tabular data, if necessary, of the manner in which the power generated at the project is to be utilized, including the amount of power to be used on-site, if any, the amount of power to be sold, and the identity of any proposed purchasers; and

(4) A statement of the applicant's plans, if any, for future development of the project or of any other existing or proposed water power project on the stream or other body of water, indicating the approximate location and estimated installed capacity of the proposed developments.

Besides this introductory section, this Exhibit B includes seven sections. Section 2.0 gives an overview of existing Project operations. Section 3.0 describes historical hydrology representative of the Project Area. Section 4.0 describes operations planning and forecasting. Section 5.0 summarizes regulatory and contractual operating constraints of the Project. Section 6.0 describes project operations for each development. Section 7.0 describes YCWA's proposed operations. Section 8.0 includes a list of references cited.

See Exhibit A for a description of Project facilities and features, Exhibit C for a construction history and a construction schedule, Exhibit D for a description of Project costs and financing, and Exhibit E for a discussion of potential environmental effects and YCWA's proposed resource management measures. Project design drawings and Project maps are included in Exhibits F and G, respectively. Exhibit H contains a detailed description of the need for the electricity provided by the Project, the availability of electrical energy alternatives and other miscellaneous information.

All elevation data in this exhibit are in National Geodetic Vertical Datum of 1929 (NGVD 29), unless otherwise specified.

2.0 Project Overview

The existing Project consists of three developments – New Colgate, New Bullards Bar Minimum Flow and Narrows 2 – which, in total, include: one main dam; two diversion dams; four water tunnels; three powerhouses with associated switchyards with a combined capacity of 361.9 megawatts (MW); and appurtenant facilities and structures, including recreation facilities, gages and roads.

The Project, constructed and operated by YCWA, is a multiple-use project that provides flood control, power generation, irrigation, recreation, and protection and enhancement of fish and wildlife. It includes Our House and Log Cabin diversion dams, New Bullards Bar Dam and Reservoir, New Colgate Powerhouse and Narrows 2 Powerhouse.

Total usable storage capacity of the Project is 966,103 acre-feet (ac-ft). New Bullards Bar Reservoir, the Project's largest reservoir, operates as a storage reservoir to capture rain and snowmelt during the winter and spring months and is slowly drawn down through summer and fall months, releasing water for power generation, irrigation and domestic consumption purposes. Consequently, New Bullards Bar Reservoir reaches its peak storage at the end of the spring runoff season, and then is gradually drawn down as storage is released to the Yuba River. Releases are made through both the New Bullards Bar Minimum Flow Powerhouse at the base of the dam to the North Yuba River and through the New Colgate Power Tunnel and the New

Colgate Powerhouse on the Yuba River. The reservoir usually reaches its lowest elevation in early to mid-winter. The annual drawdown in normal water years (WYs) is about 90 feet (ft). The reservoir does not undergo significant daily changes in elevation.

New Bullards Bar Reservoir is used to provide irrigation water supply to about 90,000 acres (ac) of farmland in western Yuba County. Releases of water from storage are made through the spring and summer to provide flows diverted at United States Army Corps of Engineers' (USACE) Daguerre Point Dam at river mile 11.6 on the Yuba River. Water is released from storage in the fall for diversion at USACE's Daguerre Point Dam for rice stubble decomposition and waterfowl habitat.

New Bullards Bar Reservoir is also the main flood control facility for the Yuba River area. Approximately 23 percent of the usable capacity of the reservoir (170,000 ac-ft of storage capacity) is reserved from September 15 through March 31 for flood protection purposes.

In addition to providing flood protection, power and downstream water supply, YCWA pumps water directly from the New Bullards Bar Reservoir to supply water to the Cottage Creek Water Treatment Plant for Project recreation uses. Pumping averages approximately 6 ac-ft per year. This relatively small volume of pumping does not affect Project operations.

2.1 Use of YCWA's Water Balance/Operations Model in Exhibit B

YCWA has operated the Project since 1970. However, Project operations have changed through time. Therefore, in some cases historical operations information (e.g., flows, storage and generation) may not provide the best picture of current existing conditions. To better describe existing operations over a range of hydrologic conditions, YCWA developed the Yuba River Development Project Water Balance/Operations Model (Operations Model).[2]

Current project operations are simulated using historical inflows to the Project from WY 1970 through WY 2010 to simulate a 41-year long record of what flows throughout the system would have been if existing infrastructure and regulatory and operational regimes had been in place for the full period of record.

[2] As described in Section 3.3.2.1.1 of Exhibit E, Environmental Report, YCWA developed five hydrology databases, each of which covers WYs 1970 through 2010 and these are provided in Exhibit E, Appendix E6, of this Amended FLA. These datasets are: 1) Historic Hydrology; 2) Without-Project Hydrology; 3) With-Project Hydrology; 4) YCWA's Proposed Project (Existing) Hydrology; and 5) YCWA's Proposed Project (Future) Hydrology. The first dataset is composed of gaged flow data, while the other four datasets are products of Operations Model runs. The model run using the Without-Project Hydrology dataset is used in YCWA's Applicant-Prepared Draft Biological Assessment and YCWA's Applicant-Prepared Draft Essential Fish Habitat Biological Assessment provided in Volume IV of YCWA's Amended FLA. The model run using the With-Project Hydrology dataset is the No Action Alternative, and is used throughout YCWA's Amended FLA to represent baseline reservoir and flow conditions. YCWA's uses this dataset instead of the Historic Hydrology dataset to represent baseline conditions because using historical data would be misleading given changes in Project operations overtime. This run is sometimes referred to as the "Base Case" model run. The model run using the YCWA's Proposed Project (Existing) Hydrology dataset is also used throughout YCWA's Amended FLA to represent reservoir and flow conditions under YCWA's proposed Project. The model run using the YCWA's Proposed Project (Future) Hydrology dataset is used in Exhibit E Sections 3.3.2.3 and 3.3.3.3, which address water resources and aquatic resources cumulative effects, respectively. Each of the model runs is provided in Exhibit E, Appendix E6

A comparison of the results of the Operations Model run and historical operations yields similar, but different results. The difference is primarily due to changes in regulatory conditions, implementation of the Lower Yuba River Accord Agreement (Yuba Accord) and changes in agricultural water supply demand. Because of these factors, direct comparison of No Action Alternative and Historical Operations is not a relevant comparison. These two factors are further discussed below.

2.1.1 Changes in Regulatory Conditions

The existing conditions Operations Model run uses as input existing regulatory conditions for Project operations. These regulatory conditions include YCWA's water rights, the initial FERC license and amendments, the USACE Flood Control Manual, agreements with Pacific Gas & Electric Company (PG&E), agreements with the California Department of Fish and Wildlife (Cal Fish and Wildlife) and the Yuba Accord.

While the majority of the regulatory conditions affecting Project operations have not changed throughout the simulated period of record, the Yuba River Accord is a fairly recent change and has a substantial effect on overall Project operations. The Project was operated according to the Yuba Accord requirements in 2006 and 2007, as pilot projects, and the California State Water Resource Control Board (SWRCB) incorporated the Yuba Accord into YCWA's water rights in 2008 (SWRCB 2008). Accordingly, historical Project operations from 2006 through 2010 reflected the Yuba Accord.

Prior to 2006, Project operations included a wide range of regulatory conditions and operational agreements that are no longer relevant for Project operations, including the following:

- Prior to 1986, when infrastructure to deliver surface water to the southern parts of the county was completed, power generation was a major factor in the seasonal operations of New Bullards Bar Dam and Reservoir. Historical New Bullards Bar Reservoir storage during this period was subject to substantial annual variations, since there was not as much need to preserve storage for water supply reliability.
- YCWA conducted single-year water transfers in 1987, 1988, 1989, 1990, 1991, 1992, 1994, 1997, 2001, 2002, 2003, 2004, 2005, 2006 and 2007. These single-year transfers were individually approved by the SWRCB and were each scheduled according to the hydrology of the individual years.
- In 2001, the SWRCB (2003) issued Decision 1644 (revised and re-issued as Revised Decision 1644 in 2003) adding flow requirements on the Yuba River at Marysville and Smartsville to YCWA's water rights.

2.1.2 Water Delivery Demand

YCWA annual surface water irrigation demands have changed substantially since 1970 due to both the addition of lands for surface water irrigation and changes in land use. Additionally, many of the YCWA member units have participated in groundwater substitution transfers, where they elect to pump groundwater for irrigation and allow the surface water they would otherwise have received, to be released for subsequent use by entities outside of the Yuba River watershed. These combinations of factors have precluded the use of historical irrigation records as a representative demand for simulation. Accordingly, YCWA developed a synthetic demand, based on land use and applied water factors, for use in Operations Model.[3]

3.0 Hydrology

3.1 General

The Project is located in the Yuba River Basin and drains approximately 1,339 square miles (sq mi) (USGS 2004) of the western slope of the Sierra Nevada mountains, including portions of Sierra, Placer, Yuba and Nevada counties. The Yuba River is a tributary of the Feather River, which in turn is a tributary of the Sacramento River. The basin rises from an elevation of about 88 ft to about 8,590 ft. From 1901 through 2016, the annual unimpaired flow at the United States Geological Survey's (USGS) Smartsville Gage on the Yuba River has ranged from a high of 4,930,000 ac-ft in 1982 to a low of 370,000 ac-ft in 1977, with an average of about 2,330,000 ac-ft per year.[4] In general, basin runoff is nearly equally divided between runoff from rainfall during October through March and runoff from snowmelt during April through September.

Upper basins of the Middle Yuba and South Yuba rivers have been extensively developed for hydroelectric power generation and consumptive uses by the Nevada Irrigation District (NID) and PG&E. Total storage capacity of about 307,000 ac-ft on the Middle Yuba and South Yuba rivers and associated diversion facilities enable both NID and PG&E to export approximately 410,000 ac-ft per year from the Yuba River Basin to the Bear River and American River basins. In addition, the South Feather Water and Power Agency exports an average of about 70,000 ac-ft per year from Slate Creek, a tributary to the North Yuba River, to the Feather River Basin. While these upper basins lie outside of the Project area, their operations can significantly reduce the water supply available to the Project, particularly during dry and critical WYs.

3.2 Climate

The Yuba River Basin has dry, warm summers with little to no precipitation and cool, wet winters with moderate to heavy precipitation; usually in the form of snow above elevation 5,000 ft. Annual temperatures in the Project Area[5] range from below zero degrees Fahrenheit (°F) to above 100°F.

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[3] A complete description of the agricultural diversion demand timeseries is included in Attachment 2-2A to the *Water Balance/Operations Model*, Technical Memorandum 2-2, which is included in Appendix E6 to Exhibit E of YCWA's Amended FLA.

[4] The forecasted seasonal unimpaired flow at Smartsville is estimated each year by the California Department of Water Resources (DWR) and reported monthly in Bulletin 120, *Water Conditions in California*. The unimpaired flow at Smartsville controls YCWA's contractual delivery obligations to senior water right holders on the Yuba River downstream of Narrows 2 Powerhouse, and is used to calculate the Yuba River Index (YRI), defined in RD-1644, and the North Yuba Index (NYI), defined in the Yuba Accord.

[5] For the purposes of this document, "Project Area" is defined as the area within the FERC Project Boundary and the land immediately surrounding the FERC Project Boundary (i.e., within about 0.25-mile (mi) of the FERC Project Boundary) and includes Project-affected reaches between facilities and downstream to the next major water controlling feature or structure.

Average-annual precipitation data obtained from the DWR, Division of Flood Management, California Data Exchange Center stations in the Project basin ranges from approximately 20.96 inches near Marysville, California, at an elevation 88 ft, to approximately 57.13 inches near Camptonville, California, at an elevation 2,503 ft. Monthly average precipitation for Camptonville and Marysville stations are provided in Table 3.2-1.

Table 3.2-1. Average-monthly precipitation in the Project Vicinity.[6]

Average-Monthly Precipitation (inches)[1]		
Month	**Camptonville Ranger Station**	**City of Marysville**
January	11.43	4.01
February	8.91	3.73
March	7.43	2.88
April	4.71	1.53
May	2.33	0.75
June	0.85	0.22
July	0.04	0.03
August	0.13	0.06
September	0.51	0.34
October	3.32	1.21
November	6.85	2.44
December	10.63	3.76
Yearly	**57.13**	**20.96**

1 From the National Climactic Data Center Station Historical Listings for National Weather Service Network. Average precipitation period of record from July 948 through October 2007.

3.3 Hydrologic Records

There are 16 active USGS flow and reservoir gaging stations in the Project Area: 1 reservoir (elevation or storage) gaging station; 12 stream flow gaging stations; 3 tunnel and canal gages; and 1 powerhouse flow gaging station. There are also four additional gages within the Project Area that include valuable historical information about the operations of the Project. Table 3.3-1 summarizes physical information such as location, elevation, and period of record for each USGS gage within the Project Area. Table 3.3-2 summarizes USGS flow gage data, such as mean annual flows and maximum and minimum recorded flows (USGS 1992).

6 For the purpose of this Exhibit B, "Project Vicinity" refers to the area surrounding the Project on the order of United States Geological Survey (USGS) 1:24,000 quadrangles.

Table 3.3-1. Descriptions of United States Geological Survey (USGS) stream, canal, tunnel and powerhouse flow and reservoir storage gages in the Yuba River watersheds near the Project for USGS period of record.

USGS Gage No.	Gage Name	Comment	Location	Elevation (ft)	Drainage (sq mi)	Period of Record Start	Period of Record End
RIVER FLOW GAGES							
11408850	M Yuba R Nr Camptonville CA	N/A[1]	N/A	N/A	136	8/1/1967	9/30/1989
11408880	Middle Yuba River Below Our House Dam, Near Camptonville, CA	Natural flow of stream affected by Jackson Meadows Reservoir (station 11407800), Milton–Bowman Tunnel (station 11408000), which diverts upstream of station to Bowman Lake (station 11415500), and Lohman Ridge Tunnel (station 11408870), which diverts 300 ft upstream to Oregon Creek and then to New Bullards Bar Reservoir (station 11413515) via Camptonville Tunnel (station 11409350). Other small diversions upstream of station.	On right bank, 300 ft downstream of Our House Dam, and 4.0 mi southeast of Camptonville	1957.51 (NGVD 1929)	145	10/1/1968	Present
11409300	Oregon, CA; Camptonville, CA	N/A	On left bank, 500 ft downstream of Log Cabin Dam, 670 ft upstream of High Point Ravine, and 1.1 mi southwest of Camptonville	2,230 (NGVD 1929)	23	10/1/1967	9/30/2000
11409400	Oregon Creek Below Log Cabin Dam, Near Camptonville, CA	Lohman Ridge Tunnel (station 11408870) diverts water into the basin from the Middle Yuba River. Camptonville Tunnel (station 11409350), maximum capacity, about 1,000 ft^3/s, 520 ft upstream, diverts water out of the basin to New Bullards Bar Reservoir (station 11413515); diversion began October 1968.	On left bank, 500 ft downstream of Log Cabin Dam, 670 ft upstream of High Point Ravine, and 1.1 mi southwest of Camptonville	1,912.73 (NGVD 1929)	29.1	9/1/1968	Present
11413000	North Yuba River Below Goodyears Bar, CA	Records good. Several small diversions upstream of station for irrigation and mining.	On right bank, 200 ft downstream of St. Catherine Creek, 3.1 mi southwest of Goodyears Bar, and 6.4 mi southwest of Downieville	2,453 (NGVD 1929)	250	10/01/1930	Present
11413300	Slate Creek Below Diversion Dam, Near Strawberry Valley, CA	Slate Creek Tunnel (station 11413250) diverts up to 900 ft^3/s from Slate Creek Reservoir, capacity, 223 ac-ft, at diversion dam 300 ft upstream, to Sly Creek Reservoir (station 11395400). Diversion began in February 1962.	On right bank, 300 ft downstream of diversion dam, 0.2 mi upstream of Feney Ravine, and 4.5 mi northeast of town of Strawberry Valley.	3,570 (NGVD 1929)	49.4	10/01/1960	Present

Table 3.3-1. (continued)

USGS Gage No.	Gage Name	Comment	Location	Elevation (ft)	Drainage (sq mi)	Period of Record Start	Period of Record End
RIVER FLOW GAGES (cont'd)							
11413520	North Yuba River Below New Bullards Bar Dam, Near North San Juan, CA	Flow regulated by New Bullards Bar Reservoir (station 11413515) since 1969. Prior to 1969, flow regulated by Bullards Bar Reservoir (usable capacity, 31,500 ac-ft). New Colgate Powerhouse (station 11413510) diverts at New Bullards Bar Dam 0.2 mi upstream. Records include flow over New Bullards Bar Reservoir spillway.	On right bank, at old Colgate Dam, 0.2 mi downstream of New Bullards Bar Dam, and 2.5 mi northwest of North San Juan.	1,350 (NGVD 1929)	489	8/13/1966	9/30/2004
11417500	South Yuba River At Jones Bar, Near Grass Valley, CA	Flow regulated by Lake Spaulding, Fordyce Lake, and Bowman Lake (stations 11414140, 11414090, and 11415500) and many smaller reservoirs. Diversions into and out of basin for several powerhouses and for irrigation.	On left bank at Jones Bar, 100 ft upstream of Rush Creek, 0.9 mi downstream of bridge on State Highway 49, and 5 mi northwest of Grass Valley.	1,060 (NGVD 1929)	308	10/01/1940	Present
11418000	Yuba River Below Englebright Dam, Near Smartsville, CA	Diversions up to 1,800 ft³/s (see stations 11413250, 11414190, and 11414200) out of basin for power and irrigation upstream of station. Flow regulation by Lake Spaulding (station 11414140), Jackson Meadows and New Bullards Bar Reservoirs (stations 11407800 and 11413515), Englebright Reservoir beginning in 1941, capacity 54,339.8 ac-ft (revised), Bowman and Fordyce Lakes (stations 11415500 and 11414090), and many smaller reservoirs.	On right bank, 2,000 ft downstream of Englebright Dam, 0.5 mi upstream of Deer Creek, and 2.3 mi northeast of Smartsville.	278.68 (NGVD 1929)	1,108	10/01/1941	Present
11418500	Deer Creek Near Smartsville, CA	Natural flow of stream is affected by Scotts Flat Reservoir beginning in 1949, usable capacity, 26,300 ac-ft, increased to 49,000 ac-ft in July 1964; Deer Creek Reservoir, capacity 1,400 ac-ft beginning 1949; Lake Wildwood, capacity 3,840 ac-ft beginning in 1970, power developments and diversion for irrigation. At times water from South Yuba River is diverted to Deer Creek and water from Deer Creek is diverted to Bear River.	On left bank, 400 ft upstream of county road bridge, 0.9 mi upstream of mouth, and 2 mi northeast of Smartsville.	630 (NGVD 1929)	84.6	10/01/1935	Present
11421000	Yuba River Near Marysville, CA	Flow regulated by New Bullards Bar Reservoir since January 1969, and several other reservoirs. Many diversions upstream of station for power and for irrigation.	On left bank, 4.2 mi northeast of Marysville, and 5 mi downstream of Dry Creek	-2.95 (NGVD 1929)	1,339	10/01/1943	Present

Table 3.3-1. (continued)

USGS Gage No.	Gage Name	Comment	Location	Elevation (ft)	Drainage (sq mi)	Period of Record Start	Period of Record End
RIVER FLOW GAGES (cont'd)							
11413517	North Yuba River Low Flow Release Below New Bullards Bar Dam, CA	No records computed above 10.0 ft³/s. Flow regulated by New Bullards Bar Reservoir (station 11413515) since 1969. Prior to 1969, flow regulated by Bullards Bar Reservoir (usable capacity 31,500 ac-ft). New Colgate Powerhouse (station 11413510) diverts at New Bullards Bar Dam 0.2 mi upstream. Water is diverted to Feather River Basin through Slate Creek Tunnel (station 11413250). Camptonville Tunnel (station 11409350) diverts water from Middle Yuba River to New Bullards Bar Reservoir. Prior to October 2004, data published with New Bullards Bar Reservoir spillway as North Yuba River downstream of New Bullards Bar Dam (station 11413520).	On right bank 0.2 mi downstream of dam, and 2.7 mi northwest of North San Juan which is on State Highway 49.	1,350	489	10/01/2004	Present
TUNNEL AND CANAL FLOW GAGES							
11408870	Lohman Ridge Tunnel At Intake, Near Camptonville, CA	Tunnel diverts water from Middle Yuba River to New Bullards Bar Reservoir (station 11413515) for power development.	At tunnel intake at Our House Dam, and 4.0 mi southeast of Camptonville	2,014.77 (NGVD 1929)	N/A	10/01/1988	Present
POWERHOUSE FLOW GAGES							
11409350	Camptonville Tunnel At Intake, Near Camptonville, CA	Water is diverted to Oregon Creek from the Middle Yuba River through Lohman Ridge Tunnel (station 11408870) 1,000 ft upstream. Camptonville Tunnel diverts water from Oregon Creek to New Bullards Bar Reservoir (station 11413515) for power generation	At tunnel intake, at Log Cabin Dam, 1.0 mi southwest of town of Camptonville	1,952.00 (NGVD 1929)	N/A	10/01/1988	Present
11413250	Slate Creek Tunnel Near Strawberry Valley, CA	Tunnel diverts water from Slate Creek to Sly Creek Reservoir (station 11395400) for power development.	On right bank, 30 ft upstream of diversion dam on Slate Creek, 0.3 mi upstream of Feney Ravine, and 4.5 mi northeast of town of Strawberry Valley.	N/A	N/A	10/01/1962	Present
11417980	Narrows PH No 2 Bl Englebright Dam CA	N/A	N/A	N/A	N/A	10/01/1970	9/30/2011
11417970	Narrows No 1 PH A Englebright Dam, CA	N/A	N/A	N/A	N/A	10/01/1974	9/30/2011

Table 3.3-1. (continued)

USGS Gage No.	Gage Name	Comment	Location	Elevation (ft)	Drainage (sq mi)	Period of Record Start	Period of Record End
POWERHOUSE FLOW GAGES (cont'd)							
11413510	New Colgate Powerplant Near French Corral, CA	Water is diverted from North Yuba River at New Bullards Bar Reservoir (station 11413515). Colgate Powerhouse was rebuilt during the 1970 water year with an increased capacity. Prior to Oct. 31, 1973, Browns Valley Ditch diverted up to 10 ft³/s at times from the head of the penstock for use in irrigation.	At powerhouse, on right bank of Yuba River, 0.3 mi upstream of Dobbins Creek, and 2.3 mi northwest of French Corral	N/A	N/A	10/01/1966	Present
RESERVOIR STORAGE GAGES							
11413515	New Bullards Bar Reservoir Near North San Juan, CA	Reservoir is formed by concrete-arch dam with a concrete-sidehill spillway. Spill controlled by three 30-ft by 53-ft radial gates. Storage began in January 1969. Usable capacity, 727,380 ac-ft, between elevations 1,732.0 ft, minimum power pool and 1,956.0 ft, normal gross pool. Dead storage, 234,000 ac-ft. Total capacity at normal gross pool, 961,400 ac-ft, elevation, 1,956.0 ft. Water is released to New Colgate Powerhouse (station 11413510) through a tunnel at the dam. Water is diverted into the reservoir from Middle Yuba River via Lohman Ridge Tunnel to Oregon Creek then via Camptonville Tunnel (stations 11408870 and 11409350). Records, excluding extremes, represent total contents at 2400 hours.	In center of dam on North Yuba River, 2.2 mi upstream of Middle Yuba River, and 2.4 mi northwest of North San Juan	1,965 (NGVD 1929)	489	1/14/1969	Present
11417950	Harry L. Englebright Lake near Smartsville, CA	Reservoir is formed by a concrete arch dam, 1,142 ft long and 260 ft tall, completed in 1941 by the Army Corps of Engineers, water storage began the same year. Gross pool is 70,000 ac-ft, usable storage 45,000 ac-ft between elevation of spill lip, 527 ft and elevation of intake to Narrows Powerplant No. 1 (station 11417970); 450 ft. Reservoir receives inflow from North, Middle and South Forks of Yuba River which are regulated releases except during spill conditions. Dam has no low-level outlet except water that is released through Narrows Powerplant Nos. 1 and 2 (station 11417980).	In intake tower on right bank of reservoir, 0.9 mi upstream of Deer Creek and 2.7 mi northeast of Smartsville.	527 (NGVD 1929)	1,108	10/01/1973	9/30/2001

[1] N/A = Not available.

Table 3.3-2. Summary of hydrologic data from USGS stream, canal, tunnel, and powerhouse flow gages in the Yuba River watersheds near the Project for USGS period of record.[1]

USGS Gage		Mean Annual (cfs)				Mean Monthly (cfs)		Mean Daily (cfs)		Instantaneous (cfs)	
Gage Number	Gage Name	Mean	Median	Highest (year)	Lowest (year)	Highest (month)	Lowest (month)	Highest (date)	Lowest (date)	Highest (date)	Lowest (date)
RIVER FLOW GAGES											
11408850	M Yuba R Nr Camptonville CA	332	186	779 (1982)	37 (1977)	2,038 (Feb)	12 (Aug)	16,800 (17 Feb 1986)	11 (17 Aug 1977)	47,000 (1 Jan 1997)	N/A[2]
11408880	Middle Yuba River Below Our House Dam, Near Camptonville, CA	127	72	521 (2006)	26 (1977)	2,973 (Jan)	7 (Jan)	21,000 (2 Jan 1997)	2 (10 Jan 1982)	27,500 (2 Jan 1997)	N/A
11409300	Oregon C A Camptonville CA	69	76	146 (1982)	5 (1977)	664 (Feb)	1 (Periodic)	3,730 (1 Jan 1997)	0.53 (15 Aug 1997)	5170 (1 Jan 1997)	N/A
11409400	Oregon Creek Below Log Cabin Dam, Near Camptonville, CA	25	14	128 (1969)	4 (1977)	617 (Feb)	1 (Periodic)	5340 (17 Feb 1986)	0.34 (18 Sept 1972)	6400 (17 Feb 1986)	N./A
11413000	North Yuba River Below Goodyears Bar, CA	731	4680	1,566 (1982)	126 (1938)	4,526 (Jan)	67 (Aug)	29,600 (2 Jan 1997)	60 (Sep 1977)	45,500 (2 Jan 1997)	N/A
11413300	Slate Creek Below Diversion Dam, Near Strawberry Valley, CA	101	77	352 (1982)	10 (1976)	1,415 (Feb)	4 (Aug)	12,100 (1 Jan 1997)	0.3 (4 Mar 1962)	17,300 (1 Jan 1997)	N/A
11413520	North Yuba River Below New Bullards Bar Dam, Near North San Juan, CA	290	27	1,560 (1967)	5 (1977)	8,990 (Jan)	2 (Periodic)	48,200 (19 Feb 1986)	0.4 (5 Nov 1966)	91,600 (22 Dec 1964)	N/A
11417500	South Yuba River At Jones Bar, Near Grass Valley, CA	380	302	1,135 (1995)	13 (1949)	4,865 (Jan)	1 (Sept)	30,300 (2 Jan 1977)	1 (10 Sept 1944)	53,600 (24 Dec 1964	N/A
11418000	Yuba River Below Englebright Dam, Near Smartsville, CA	2,387	2071	5,251 (1982)	414 (1977)	22,351 (Jan)	41 (Nov)	13,4000 (2 Jan 1997)	0 (Periodic)	171,000 (22 Dec 1964)	N/A
11418500	Deer Creek Near Smartsville, CA	119	99	327 (1983)	5 (1977)	1,418 (Jan)	0 (Periodic)	10,200 (17 Feb 1986)	0 (5 Aug 1977)	16,000 (31 Dec 2005)	N/A
11421000	Yuba River Near Marysville, CA	2,361	1,995	5,818 (1982)	229 (1977)	26,180 (Jan)	31 (Jul)	140,000 (2 Jan 1997)	15 (Periodic)	180,000 (24 Dec 1964)	N/A
11413517	North Yuba River Low Flow Release below New Bullards Bar Dam, CA	7	6	7 (Periodic)	6 (Periodic)	6 (Periodic)	8 (Periodic)	10 (17 Mar 2004)	5 (19 Mar 2011)	N/A	N/A
TUNNEL AND CANAL FLOW GAGES											
11408870	Lohman Ridge Tunnel At Intake, Near Camptonville, CA	170	160	377 (2011)	67 (2015)	789 (May)	0 (Periodic)	850 (20 May 2005)	0 (Periodic)	N/A	N/A

Table 3.3-2. (continued)

USGS Gage		Mean Annual (cfs)				Mean Monthly (cfs)		Mean Daily (cfs)		Instantaneous (cfs)	
Gage Number	Gage Name	Mean	Median	Highest (year)	Lowest (year)	Highest (month)	Lowest (month)	Highest (date)	Lowest (date)	Highest (date)	Lowest (date)
TUNNEL AND CANAL FLOW GAGES (cont'd)											
11409350	Camptonville Tunnel At Intake, Near Camptonville, CA	210	192	448 (2011)	76 (1994)	908 (Apr)	0 (Periodic)	1,090 (25 Mar 1989)	0 (Periodic)	N/A	N/A
11413250	Slate Creek Tunnel Near Strawberry Valley, CA	98	92	209 (1995)	0 (1977)	690 (Apr)	0 (Periodic)	863 (6 Apr 1963)	0 (Periodic)	N/A	N/A
POWERHOUSE FLOW GAGES											
11417980	Narrows PH No 2 Bl Englebright Dam CA	1,587	1,529	2,855 (1983)	122 (1977)	3,620 (Jan)	0 (Periodic)	4,650 (15 Jan 1978)	0 (Periodic)	N/A	N/A
11417970	Narrows No 1 PH A Englebright Dam CA	302	263	628 (1982)	38 (1994)	821 (Oct)	0 (Periodic)	916 (25 Oct 1989)	0 (Periodic)	N/A	N/A
11413510	New Colgate Powerplant Near French Corral, CA	1,365	1,188	2,686 (1983)	233 (1969)	3,629 (Jun)	0 (Periodic)	4,200 (2 Jun 1971)	0 (Periodic)	N/A	N/A

[1] Period of record through September 30, 2016, where available.
[2] N/A = Not available.

3.4 Basin Transfers and Diversions

The Project includes one in-basin transfer and three out-of-basin transfers. An in-basin transfer is a bypass or diversion of water by a man-made conduit from a natural stream segment to another location within the original stream's water course. An out-of-basin transfer is a bypass or diversion of water by a man-made conduit from a natural stream segment to another location within a different water course. YCWA's in-basin and out-of-basin transfers are summarized in Table 3.4-1.

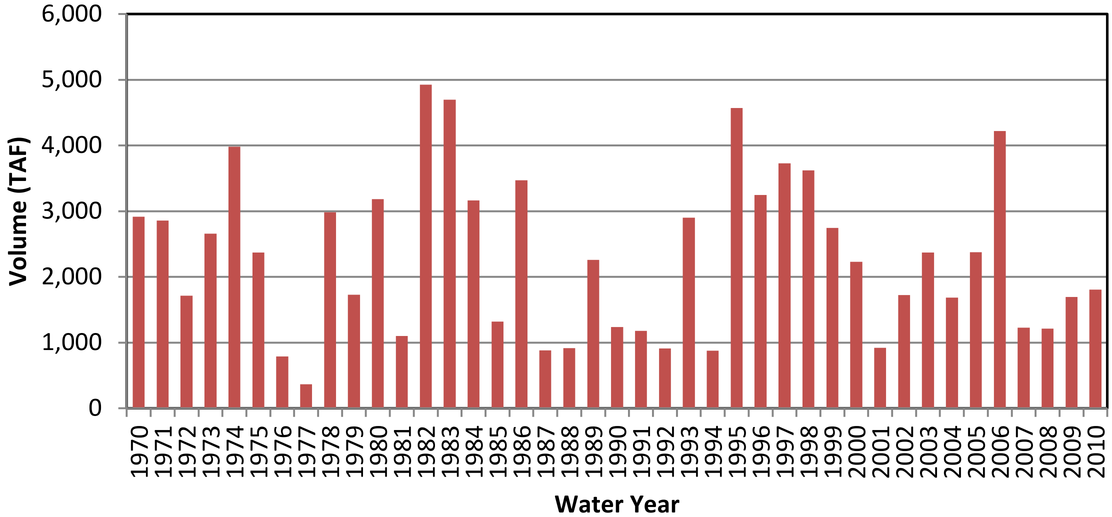
Table 3.4-1. In-basin transfers associated with the Project.

Conduit Name	Maximum Flow (cfs)	From	To	Powerhouse Downstream of Diversion
IN-BASIN TRANSFER				
Narrows 2 Tunnel	3,400	Englebright Reservoir	Yuba River	Narrows 2
OUT-OF-BASIN TRANSFERS				
Lohman Ridge Tunnel	860	Middle Yuba River	Oregon Creek	Narrows 2
Camptonville Tunnel	1,100	Oregon Creek	New Bullards Bar Reservoir	New Bullards Bar Minimum Flow
New Colgate Tunnel	3,400	North Yuba River	Yuba River	New Colgate

3.5 Typical Dry, Normal and Wet Years

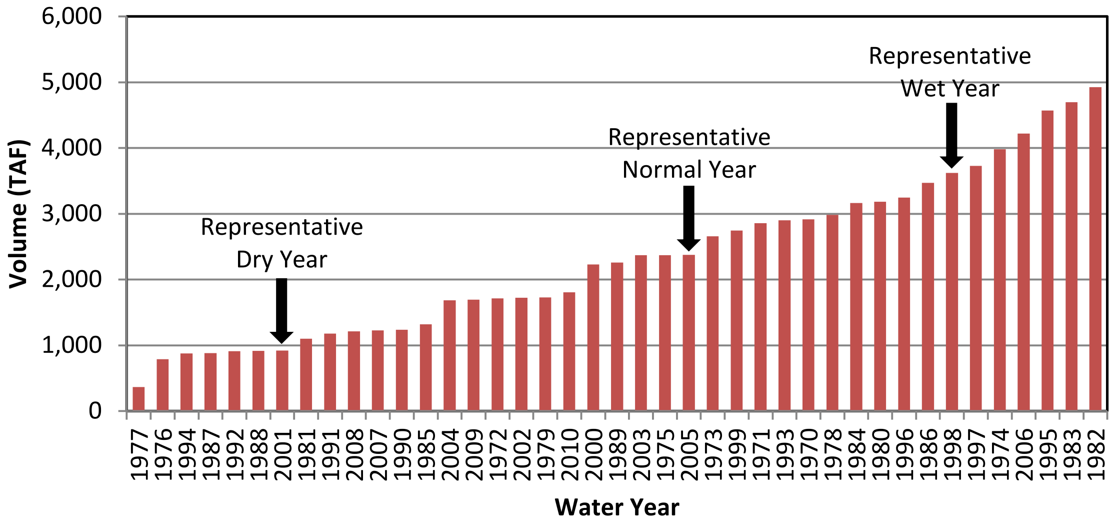
FERC regulations require that an applicant describe project operation in typical adverse (dry), mean (normal) and high (wet) WYs. YCWA has selected the dry, normal and wet WYs based on the 90-, 50- and 10-percent exceedance for unimpaired annual runoff in the Yuba River at Smartsville as estimated by the DWR for the period from WY 1970 through WY 2010. DWR's historical record of annual unimpaired Water Year Runoff for this location is shown chronologically in Figure 3.5-1 and ranked by WY from driest to wettest in Figure 3.5-2.[7]

[7] Subsequent to the relicensing period of record, the Yuba River watershed experienced one of the worst droughts on record, with annual unimpaired flow volumes at Smartsville of 1,538,000, 1.485,000, 881,000, and 876,000 for WYs 2012, 2013, 2014, and 2015, respectively. This represented the lowest three-year and four-year unimpaired flow volume for the period of record. However, there were lower single year (1977) and two-year (1976-1977) unimpaired volumes in the period of record.



Note: TAF = thousand acre-feet

Figure 3.5-1. Yuba River at Smartsville unimpaired runoff from WY 1970 through WY 2010.



Note: TAF = thousand acre-feet

Figure 3.5-2. Yuba River at Smartsville WY unimpaired runoff ranked in order of increasing runoff from WY 1970 through 2010.

For purposes of this Exhibit B, 2001 is considered the typical dry WY, 2005 is considered the typical normal WY, and 1998 is considered the typical wet WY.

3.6 Relicensing Hydrologic Records

The Project Relicensing Hydrology and Power Generation Data digital versatile disc (DVD), included in Technical Memorandum 2-2, *Water Balance/Operations Model*, Attachment 2-2F, Hydrology DVD (YCWA 2013a), contains the existing condition hydrological data, Exhibit E, Section 3.3.2 for a summary of regulated hydrologic statistics for the existing condition (i.e., baseline) within the Project Vicinity (YCWA 2013b).

4.0 Operations Planning and Forecasting

Project operation can be dramatically different in certain seasons depending on current and forecasted WY conditions. The expected volume and timing of runoff dictates Project operation in late winter and spring. New Bullards Bar Reservoir is operated to capture runoff from rainfall and snowmelt for flood protection, recreation, irrigation, domestic water supply and power generation, while meeting applicable minimum flow and other regulatory and contractual operating requirements.

Hydrologic and hydraulic operations planning for the Project is implemented to manage basin runoff throughout the WY for flood protection, irrigation, municipal water supply, recreation and power generation. The Project utilizes storage capacity within New Bullards Bar Reservoir to store spring runoff that occurs during the snowmelt season. To provide additional perspective regarding the amount of runoff that is available as spring snowmelt, the April-July unimpaired runoff in the Yuba River is 42.5 percent of the full WY unimpaired runoff, based on the 50-year average[8] from WY 1951 through 2000. This stored water is gradually released during summer and fall to augment stream flows, provide hydroelectric generation, and to meet consumptive water demands. New Bullards Bar Reservoir is generally operated in accordance with unofficial target storage curves to achieve reservoir levels and storage capacity that manages the available water effectively.

Operation planning forecasting for the Project is completed by YCWA. Monthly snow surveys in the Project watershed are performed during winter months, and, combined with snow course data from DWR, to provide information for YCWA's hydrologists who use the data to develop runoff forecast models. In addition, YCWA uses larger scale snowmelt runoff forecasts generated by DWR in the form of Bulletin 120 Forecasts. These data are used to determine best operational practices.

YCWA uses monthly precipitation and runoff data to schedule energy needs, flow releases and water demands for the Project as inputs into a forecasting model. Using this forecasting model, YCWA develops a water management plan in order to achieve end-of-month storage targets for New Bullards Bar Reservoir.

Weekly and daily operation of the Project is prioritized for facility and public safety, regulatory compliance, and to balance irrigation and domestic consumptive water demands with power generation. The Project is also operated to comply with YCWA's existing water rights licenses and permits.

[8] As measured by DWR at the "Yuba River near Smartsville plus Deer Creek" calculation point.

4.1 Dry, Normal, and Wet Year Reservoir Operations

While there are hydrological year-type-dependent minimum flows throughout the Project Area, Project operations are largely driven in all year-types by minimum flows and agricultural water supply demands on the Yuba River downstream of the Narrows 2 Powerhouse. In all years, New Bullards Bar Reservoir makes releases from storage to supplement flows from the Middle Yuba and South Yuba rivers, Oregon Creek, and other tributaries to Englebright Reservoir to ensure adequate supply is available for release to meet downstream objectives along the Yuba River from either the Narrows 1 or Narrows 2 powerhouses.

In relatively wet years, releases from New Bullards Bar Reservoir to meet minimum flows and agricultural water supply demands on the Yuba River downstream of the Narrows 2 Powerhouse could result in high New Bullards Bar Reservoir storage; if storage is sufficiently high so that it encroaches into the New Bullards Bar Reservoir flood reservation space, as defined by USACE (USACE 1972), releases from New Bullards Bar Reservoir would be made through the New Bullards Bar Reservoir spillway to ensure no water was stored within the flood reservation space. When flood management is not a consideration, either because storage is not encroached in the flood reservation space, or it is outside of period of flood concern (September through April), releases from New Bullards Bar Reservoir during relatively wet periods are made to manage storage within the reservoir. While there are not strict rule curves for New Bullards Bar Reservoir storage, YCWA generally operates throughout the summer for a maximum storage of 650,000 ac-ft at the end of September. The 650,000 ac-ft storage target ensures adequate storage for the following year in case of extreme drought yet generally results in manageable releases to provide preferable habitat for anadromous fish throughout the summer in the Yuba River downstream of the Narrows 2 Powerhouse.

In normal years, YCWA operates New Bullards Bar Reservoir very similarly to wet years; inflow to New Bullards Bar is such that, even in normal years, releases are driven by storage management concerns rather than for meeting minimum flows on the Yuba River below the Narrows 2 Powerhouse. Spill avoidance at New Bullards Bar Reservoir is generally is not a concern during normal years, but New Bullards Bar Reservoir releases may take into consideration the possibility of spill at Englebright Dam, and, if New Bullards Bar Reservoir storage allows for it, releases from New Bullards Bar Reservoir through the New Colgate Powerhouse are often reduced in anticipation of a storm event that would cause a brief increase in flow on the Middle Yuba and South Yuba Rivers and potentially create a spill at Englebright Dam. Otherwise, New Bullards Bar Reservoir releases in normal years are determined to manage storage throughout the spring and summer so reservoir storage peaks in the late spring, and then reaches approximately 650,000 ac-ft at the end of September.

In relatively dry years, Project operations are generally to meet minimum flows on the Yuba River downstream of the Narrows 2 Powerhouse and to provide for agricultural water supply for diversions in the vicinity of Daguerre Point Dam. New Bullards Bar Reservoir releases through the New Colgate Powerhouse are determined so that there is sufficient volume within Englebright Reservoir to supplement Middle Yuba and South Yuba River inflow to make the appropriate releases from either the Narrows 1 or Narrows 2 powerhouses. The end-of-

September storage target of 650,000 ac-ft rarely affects Project operations in dry years, but, if projected end-of-September New Bullards Bar storage is sufficiently low (i.e., below approximately 450,000 ac-ft), reductions in the current year's agricultural water supply could be implemented to ensure adequate storage in New Bullards Bar Reservoir to meet the following year's minimum flows and a portion of the following year's agricultural water supply demand.

Modeled elevation curves and flow duration curves are presented in Section 6.0 as a means to characterize the operation of the Project's reservoirs and powerhouses during typical dry, normal and wet years.

4.2 Operations, Maintenance, Inspection, and Access

Ongoing Project maintenance includes testing gates and valves at the dams and intakes throughout the year, when impact to Project operations can be minimized. All spill gates are operated in the spring and fall, consistent with the Division of Safety of Dams gate operation certificates. FERC requires annual testing of the gates and valve-testing every 5 years, but YCWA also operates gates and valves are operated at least once every 3 years for water rights purposes at each location and YCWA tests their large valves annually. Often, gates and valves are operated more frequently consistent with normal operating procedures.

YCWA typically conducts annual maintenance on the powerhouses during the fall (September through November), when consumptive water and power demand are generally low. Each powerhouse is taken out of service for approximately 1 to 3 weeks on staggered schedule. Maintenance includes inspections of equipment in the powerhouse and switchyard and may include replacing parts and calibrating components. Annual maintenance does not typically require a reservoir drawdown, but downstream Project operations can be affected by certain outages.

The only Project spillway gates are at New Bullards Bar Dam. New Bullards Bar Dam spillway gates are inspected annually to check items including functionality and structural integrity. Functional checks are conducted annually, while inspections take place in the summer, after flood season use, and in the fall prior to flood season use. New Bullards Bar Dam's spillway can be accessed by various means throughout the year. Walking access from above the New Bullards Bar Dam spillway is accomplished via Marysville Road. Stairways and adits within the dam allow walking access to the north side of the spillway. Access to the surface of the spillway is accomplished through the gate opening once the reservoir elevation has dropped below the spillway crest. Climbing access can also be gained from the bottom of New Bullards Bar Dam.

YCWA obtains access to Project facilities over a number of roads, including those which fall under the jurisdiction of the Forest Service.

5.0 Regulatory/Contractual Operating Constraints

5.1 Conditions in Current FERC License

The existing FERC license includes 60 articles. Of these, Licensee considers 19 articles (articles 28, 29, 30, 35, 36, 41, 42, 43, 44, 48, 50, 51, 52, 58, 60, 62, 65, 66 and 67), "expired" or "out of date" because each pertains to a construction activity that has been completed, a filing related to a construction activity that has been completed, or another activity that has been completed. As a result, the existing license contains 41 "active" articles. Of these, Articles 33, 34, 40, and 46 are more germane to Project operations than the other 37 articles. Each of these is provided below as it appears in the existing FERC License.

Article 33. The Licensee shall maintain the following minimum streamflow schedules for maintenance of fish life in the several streams listed:

(a)

(a) Stream	Flow (cfs)[1]	
	April 15 to June 15	June 16 to April 14
Middle Yuba (downstream of Hour House Diversion)	50	30
Oregon Creek (downstream of Log Cabin Diversion)	12	8
North Yuba (downstream of New Colgate Diversion)	5	5

[1] Or natural flow, whichever is less. Maximum 24-hour fluctuations of plus or minus 10 percent are permitted for flows in Middle Yuba downstream of Hour House Diversion and in Oregon Creek downstream of Log Cabin Diversion.

(b)

(b) Stream	Flow (cfs)[1]			Measurement Point
	Jan. 1 to Jun. 30	Jul. 1 to Sept. 30	Oct. 1 to Dec. 31	
Yuba River (downstream of Daguerre Dam)	245	70	400	Over the crest of Daguerre Point Dam and through fishway

[11] Provided that these flows shall be in addition to releases made to satisfy existing downstream water rights.

(c)
Water releases for fish life as specified in paragraphs (a) and (b) of this article shall be subject to the following reduction in any critical dry year, defined as a water year for which the April 1 forecast of the California Department of Water Resources predicts that streamflow in the Yuba River at Smartsville be 50 percent or less of normal:

Yuba River at Smartsville streamflow forecast percent of normal	Reduction in Water Releases for Fish Life, Percent
50%	15%
45%	20%
40% or less	30%

However, in no event shall releases for fish life below Daguerre Point Dam be reduced to less than 70 cfs. The critical dry year provisions herein shall be effective from the time the aforesaid forecast is available until the April 1 forecast of the following year.

(d)
In addition to maintaining winter minimum water releases for fish life in Yuba River below Daguerre Point Dam, as specified in paragraphs (b) and (c) of this article, the Licensee shall maintain uniform and continuous releases from Englebright Dam within the limits of the following schedule:

Period	Releases (cfs)[1]	Measurement Point
Oct. 16 to 31	600-1,050	New gaging station to be built downstream of the two Narrows powerhouses.
November	600-700	
December	600-1,400	
Jan. 1 to 15	1,000-1,850	
Jan. 16 to Mar. 31	600	

Provided that:
A. Variations from this schedule are permissible during emergencies, uncontrollable flood flows, and critical dry year curtailments.
B. With the exception of emergencies, releases required by U.S. Army Corps of Engineers flood control criteria, releases required to maintain a flood control buffer or for other flood control purposes, bypasses of uncontrolled flows into Englebright Reservoir, uncontrolled spilling, or uncontrolled flows of tributary streams downstream of Englebright Dam, Licensee shall make reasonable efforts to operate New Bullards Bar Reservoir and Englebright Reservoir to avoid fluctuations in the flow of the lower Yuba River downstream of Englebright Dam, and daily changes in project operations affecting releases or bypasses of flow from Englebright Dam shall be continuously measured at the United States Geological Survey gage at Smartsville, and shall be made in accordance with the following conditions:

i. Project releases or bypasses that increase streamflow downstream of Englebright Dam shall not exceed a rate of change of more than 500 cubic feet per second (cfs) per hour.
ii. Project releases or bypasses that reduce streamflow downstream of Englebright Dam shall be gradual and, over the course of any 24-hour period, shall not be reduced below 70 percent of the prior day's average flow release or bypass flow.
iii. Once the daily project release or bypass level is achieved, fluctuations in the streamflow level downstream of Englebright Dam due to changes in project operations shall not vary up or down by more than 15 percent of the average daily flow.
iv. During the period from September 15 to October 31, the licensee shall not reduce the flow downstream of Englebright Dam to less than 55 percent of the maximum five-day average release or bypass level that has occurred during that September 15 to October 31 period or the minimum streamflow requirement that would otherwise apply, whichever is greater.
v. During the period from November 1 to March 31, the licensee shall not reduce the flow downstream of Englebright Dam to less than the minimum streamflow release or bypass established under (iv) above; or 65 percent of the maximum five-day average flow release or bypass that has occurred during that November 1 to March 31 period; or the minimum streamflow requirement that would otherwise apply, whichever is greater.

Article 34. The Licensee shall maintain a minimum pool in New Bullards Bar Reservoir at elevation 1,730 ft.

Article 40. Consistent with the primary purpose of the power intakes in the New Bullards Bar Dam, the Licensee shall operate, within limits of the project, the multiple-level power intakes in New Bullards Dam to provide water of suitable quality in the Yuba River downstream of the New Narrows Power Plant for the production of anadromous fish as may be prescribed by the Commission upon the recommendations of the Director of the CDFG and the USFWS.

> **Article 46.** The Licensee shall operate the project reservoirs for flood control in accordance with rules prescribed by the secretary of the Army, such rules to be specified in a formal agreement between the Licensee and the District Engineer, U.S. Army Engineers District, Sacramento, California. Said agreement shall be subject to review from time to time at the request of either party; provided, however, that a different procedure of review may be prescribed by formal agreement.

With regards to Article 46, YCWA operates New Bullards Bar Reservoir from September 16 to May 31 to comply with Part 208, Flood Control Regulations, New Bullards Bar Dam and Reservoir, North Yuba River, California, pursuant to Section 7 of the Flood Control Act of 1944 (58 Stat. 890). Under the contract between the United States and YCWA that was entered into on May 9, 1966, YCWA agreed to reserve in New Bullards Bar Reservoir 170,000 ac-ft of storage space for flood control in accordance with rules and regulations enumerated in Appendix A of the Report on Reservoir Regulation for Flood Control (USACE 1972). The seasonal flood storage space allocation schedule is presented in Table 5.1-1 (specified values are for the end of each month).

Table 5.1-1. New Bullards Bar Reservoir flood storage space allocation in thousands of acre-feet.

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Storage Allocation	170	170	170	170	170	170	70	0	0	0	0	56

In addition to reservation of flood control space in New Bullards Bar Reservoir, the flood control regulations include rules governing ramping rates as well as target maximum flows in the Yuba River downstream of Englebright Dam and in the Feather River downstream of the confluence with the Yuba River.

YCWA also coordinates operations with PG&E's Narrows 1 Powerhouse downstream of Englebright Dam to use storage in Englebright Reservoir to capture winter storm freshets and reduce storm flows on the Yuba River. This operation is accomplished by evacuating storage space in Englebright Reservoir in anticipation of storm peak flows.

5.2 Measures in Other Licenses, Agreements and Contracts that Affect Operations

In addition to the current FERC license requirements, licenses, agreements and contracts include various streamflow-related requirements, which are summarized below. These licenses, agreements and contracts, and terms and conditions in them, affect Project operations, but are not part of the existing FERC license.

5.2.1 Lower Yuba River Accord (no expiration date in SWRCB Corrected Order Water Right 2008-0014)

In 2005, YCWA and 16 other interested parties signed memoranda of understanding that specify the terms of the Yuba Accord, a comprehensive, consensus-based program to protect and enhance aquatic habitat in the Yuba River downstream of Englebright Dam. Following environmental review, YCWA and parties executed the following four agreements in 2007, which together comprise the Yuba Accord: 1) the Lower Yuba River Fisheries Agreement, which specifies the Yuba Accord's lower Yuba River minimum streamflows and creates a detailed fisheries monitoring and evaluation program; 2) the Water Purchase Agreement, under which DWR purchases water from YCWA, some of which is provided by the Yuba Accord's minimum streamflows, for CALFED's[9] Environmental Water Account and State Water Project and Central Valley Project contractors; 3) the Conjunctive Use Agreements with seven of YCWA's member units, which specify the terms of the Yuba Accord's groundwater conjunctive-use program; and 4) amendments to the 1966 Power Purchase Contract between YCWA and PG&E.

The Yuba Accord was developed by a multi-agency resource team, including representatives from the Department of Commerce, National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS); United States Department of the Interior, Fish and Wildlife (USFWS); California Department of Fish and Game (CFDG; now Cal Fish and Wildlife); and a group of non-governmental organizations. Yuba Accord flow schedules 1 and 2 were developed to optimize habitat conditions for anadromous fish during high flow years. Schedule 6 flow schedules were developed to create the best habitat conditions for these fish that are possible during very low flow years, considering available water supplies and competing demands. Flow schedules 3, 4 and 5 then were developed by the resource team by using available water supplies to create habitat conditions during the months when additional flows (over Schedule 6 amounts) will provide the greatest benefits. The Yuba Accord also specifies requirements for "Conference Years," which are the very driest years, and are predicted to occur approximately one percent of the time.

YCWA has been operating the Project to implement the Yuba Accord since 2006. The 2006, 2007, and early 2008 operations were under 1-year pilot programs that were approved by the SWRCB through its Orders Water Right (WR) 2006-0009, WR 2006-0010, WR 2007-0002 and WR 2007-0012-DWR. Since 2008, YCWA has been operating the Project to implement the Yuba Accord according to the authorizations and requirements in SWRCB Corrected Order WR 2008-0014.

The Yuba Accord includes a specific set of flow schedules for the Yuba River. The flow schedule that is in effect at any particular time is determined by the North Yuba Index (NYI), a hydrologic index that was developed as a part of the Yuba Accord. The flow schedules are listed in Table 5.2-1. The NYI is shown in Figure 2.1-6.

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[9] An interagency committee with management and regulatory responsibility for Bay-Delta Estuary.

Table 5.2-1. Yuba Accord flow schedules.

Schedule	Oct 1-15	Oct 16-30	Nov 1-30	Dec 1-31	Jan 1-31	Feb 1-29	Mar 1-31	Apr 1-15	Apr 16-30	May 1-15	May 16-31	Jun 1-15	Jun 16-30	Jul 1-31	Aug 1-31	Sep 1-30	Total Annual Vol. (ac-ft)
MARYSVILLE GAGE (cfs)																	
1	500	500	500	500	500	500	700	1,000	1,000	2,000	2,000	1,500	1,500	700	600	500	574,200
2	500	500	500	500	500	500	700	700	800	1,000	1,00	800	500	500	500	500	429,066
3	500	500	500	500	500	500	500	700	700	900	900	500	500	500	500	500	398,722
4	400	400	500	500	500	500	500	600	900	900	600	400	400	400	400	400	361, 944
5	400	400	500	500	500	500	500	500	600	600	400	400	400	400	400	400	334,818
6	350	350	350	350	350	350	350	350	500	500	400	300	150	150	150	350	232,155
SMARTVILLE GAGE (cfs)																	
1	700	700	700	700	700	700	700	700	--	--	--	--	--	--	--	700	--
2	700	700	700	700	700	700	700	700	--	--	--	--	--	--	--	700	--
3	700	700	700	700	700	700	700	700	--	--	--	--	--	--	--	700	--
4	700	700	700	700	700	700	700	700	--	--	--	--	--	--	--	700	--
5	600	600	600	550	550	550	550	600	--	--	--	--	--	--	--	500	--
6	600	600	600	550	550	550	550	600	--	--	--	--	--	--	--	500	--

Notes:

- Marysville Gage flows represent average volumes for the specified period. Actual flows may vary from the indicated flows according to established criteria.
- Compliance with the Yuba Accord flow schedules is measured by a 5-day running average of average daily streamflows; with instantaneous flows never less than 90 percent of the specified requirement. Instantaneous flows will not be less than the applicable requirement for more than 48 consecutive hours.
- Marysville Gage Schedule 6 flows do not include an additional 30,000 ac-ft that SWRCB Corrected Order Water Right 2008-0014 requires YCWA to make available through groundwater substitution transfers. These additional flows would be allocated during Schedule 6 years.

The WY hydrologic classification for the Yuba River to determine the flow requirements of YCWA's water-right permits is based on the NYI. Determination of a year's flow schedule year type is made in February, March, April, and May, and for any subsequent updates. Table 5.2-2 shows the NYI schedule year-types.

Table 5.2-2. North Yuba River Index Schedule Year Types

Flow Schedule Year Type	North Yuba Index Value (thousand ac-ft)
Schedule 1	Greater than or equal to 1,400
Schedule 2	Greater than or equal to 1,040 and less than 1,400
Schedule 3	Greater than or equal to 920, and less than 1,040
Schedule 4	Greater than or equal to 820 and less than 920
Schedule 5	Greater than or equal to 693 and less than 820
Schedule 6	Greater than or equal to 500 and less than 693
Conference Year	Less than 500

During Conference Years, which are defined as years when the NYI is less than 500,000 ac-ft, and which are expected to occur approximately 1 percent of the time, YCWA is required: 1) to maintain minimum instream flows in the Yuba River at the levels specified in Article 33 of YCWA's existing FERC license without the reductions authorized by subsections (c) and (d) of that article; 2) to release any supplemental flows recommended by the Yuba Accord River Management Team (RMT) and approved by the SWRCB's Deputy Director for Water Rights or, if no such recommended flows are effective by April 11 of such a Conference Year, then to release any supplemental flows ordered by the SWRCB, after a hearing under California Code of Regulations, title 23, section 767; and 3) to limit total water supply diversions at Daguerre Point Dam to 250,000 ac-ft.

As stated above, YCWA has operated the Project in compliance with the Yuba Accord since 2006.

5.2.2 YCWA's Water Rights for Power (No Expiration Date)

YCWA holds pre-1914 appropriative rights dating from 1897 and post-1914 appropriative water rights confirmed by water-right licenses, for the purposes of operating the Project for hydroelectric power generation. Table 5.2-3 lists the post-1914 appropriative water-right licenses held by YCWA for power generation.

Table 5.2-3. Water-right licenses held by YCWA for operation of the Project for power generation.

Priority (date)	SWRCB Designation (application)	SWRCB Designation (license)	Source (waterbody)	Amount & Place of Diversion or Storage (amount & place)	Season (period)	Place of Beneficial Use (powerhouse)
2/11/1921	2197	435	North Yuba River	700 cfs at New Bullards Bar Dam	1/1 - 12/31	New Colgate Powerhouse
				5,000 ac-ft/yr at New Bullards Bar Dam	about 12/15 to about 7/15	
9/7/1922	3026	436	North Yuba River	10,000 ac-ft/yr at New Bullards Bar Dam	about 12/15 to about 7/15	New Colgate Powerhouse
4/30/1926	5004	777	North Yuba River	15,000 ac-ft/yr at New Bullards Bar Dam	about 12/15 to about 7/15	New Colgate Powerhouse

Table 5.2-3. (continued)

<table>
<tr><th>Priority (date)</th><th>SWRCB Designation (application)</th><th>SWRCB Designation (license)</th><th>Source (waterbody)</th><th colspan="2">Amount & Place of Diversion or Storage (amount & place)</th><th colspan="2">Season (period)</th><th>Place of Beneficial Use (powerhouse)</th></tr>
<tr><td rowspan="4">7/30/1927</td><td rowspan="4">5631</td><td rowspan="4">11565</td><td>Middle Yuba River</td><td>810 cfs at Our House Dam</td><td rowspan="3">490,000 ac-ft/yr storage in New Bullards Bar Res</td><td>1/1-12/31 (dir. div.)</td><td rowspan="3">10/15 to 6/30 (stor.)</td><td rowspan="4">New Colgate Powerhouse and Narrows 2 Powerhouse</td></tr>
<tr><td>Oregon Creek</td><td>240 cfs at Log Cabin Dam</td><td>1/1-12/31 (dir. div.)</td></tr>
<tr><td>North Yuba River</td><td>1,800 cfs at New Bullards Bar Dam</td><td>11/1-7/31 (dir. div.)</td></tr>
<tr><td>Yuba River</td><td colspan="2">1,800 cfs at USACE's Englebright Dam</td><td colspan="2">1/1- 12/31</td></tr>
<tr><td>3/1/1939</td><td>9516</td><td>3050</td><td>North Yuba River</td><td colspan="2">100 cfs at New Bullards Bar Dam</td><td colspan="2">1/1 - 12/31</td><td>New Colgate Powerhouse</td></tr>
<tr><td rowspan="2">9/12/1941</td><td rowspan="2">10282</td><td rowspan="2">5544</td><td rowspan="2">North Yuba River</td><td colspan="2" rowspan="2">5,335 ac-ft/yr at New Bullards Bar Dam</td><td colspan="2" rowspan="2">about 10/1 to about 3/1</td><td>New Colgate Powerhouse</td></tr>
<tr><td>Narrows 2 Powerhouse</td></tr>
<tr><td rowspan="3">2/20/1953</td><td rowspan="3">15205</td><td rowspan="3">11566</td><td>Middle Yuba River</td><td colspan="2">3,200 ac-ft/yr at Log Cabin Dam; storage in New Bullards Bar Res.</td><td colspan="2">5/1- 6/30</td><td rowspan="3">New Colgate Powerhouse and Narrows 2 Powerhouse</td></tr>
<tr><td>North Yuba River</td><td colspan="2">245 cfs and 700 ac-ft/yr at New Bullards Bar Dam</td><td colspan="2">3/15- 6/15 (dir. div.); 5/1- 6/30 (stor.)</td></tr>
<tr><td>Yuba River</td><td colspan="2">800 cfs at USACE's Englebright Dam</td><td colspan="2">11/1-7/15</td></tr>
<tr><td rowspan="4">10/2/1953</td><td rowspan="4">15563</td><td rowspan="4">11567</td><td>Middle Yuba River</td><td>30,000 ac-ft/yr at Our House Dam</td><td rowspan="3">all storage in New Bullards Bar Res.</td><td colspan="2">10/15 - 6/30</td><td rowspan="4">New Colgate Powerhouse and Narrows 2 Powerhouse</td></tr>
<tr><td>Oregon Creek</td><td>1,400 ac-ft/yr at Log Cabin Dam</td><td colspan="2">10/15 - 6/30</td></tr>
<tr><td>North Yuba River</td><td>146,000 ac-ft/yr at New Bullards Bar Dam</td><td colspan="2">10/15 - 6/30</td></tr>
<tr><td>Yuba River</td><td colspan="2">910 cfs at USACE's Englebright Dam</td><td colspan="2">11/1 - 6/30</td></tr>
</table>

YCWA operates the Project consistent with the terms and conditions of the above water rights.

5.2.3 Water Supply Deliveries

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 and recreational uses adjacent to the reservoir. The amount of this pumping averages approximately 6 ac-ft per year, which does not affect Project operations. YCWA anticipates that pumping of this small amount of water will continue during the period of the new license.

Downstream of the Project, water is diverted under YCWA's consumptive-use water-right permits to eight water users, which are collectively referred to as the YCWA Member Units. The places of water delivery to YCWA's Member Units are listed in Table 5.2-4.

Table 5.2-4. YCWA's annual contract amounts and place of delivery.

Member Unit	Water Right Based Supply (ac-ft)	Project Based Supply (ac-ft)	Total Contract (ac-ft)
BROWNS VALLEY IRRIGATION DISTRICT PUMPLINE DIVERSION FACILITY			
Browns Valley Irrigation District	24,505	9,500	34,005
SOUTH YUBA CANAL			
Brophy Water District	--	86.870	86,870
South Yuba Water District	--	54,307	54,307
Dry Creek Mutual Water Company	--	17,751	17,751
Wheatland Water District	--	40,230	40,230
HALLWOOD-CORDUA CANAL			
Cordua Irrigation District	60,000	24,000	84,000
Hallwood Irrigation Company	78,000	11,208	89,208
Ramirez Water District		30,389	30,389
Total	**162,505**	**274,255**	**436,760**

Browns Valley Irrigation District (BVID) receives water at the Pumpline Diversion Facility, located 1 mile upstream of Daguerre Point Dam. Brophy Water District (BWD), South Yuba Water District (SYWD), Dry Creek Mutual Water Company (DCMWC) and Wheatland Water District (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 Daguerre Point Dam. Cordua Irrigation District (CID), Hallwood Irrigation Company (HIC) and Ramirez Water District (RWD) receive water through the Hallwood-Cordua Canal (North Canal), located on the north abutment of Daguerre Point Dam. None of these facilities are under FERC's jurisdiction or Project facilities.

BVID, CID, and HIC have their own water rights on the Yuba River. Under settlement contracts with YCWA, CID and IDHIC receive surface water supplies as part of Project operations that are based on these Member Units water rights. All eight of the Member Units receive contracted Project supplies that are not water right based. 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 based supplies unless DWR April forecast of unimpaired runoff as measured at the Smartsville 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 5.2-5.

Table 5.2-5. YCWA's water supply contract shortage provisions.

Category	Unimpaired Runoff Forecast	Percentage of Settlement/ Contract Allocation Available
PRE-1914 RIGHTS SETTLEMENT WATER RIGHT BASED SUPPLY		
Browns Valley Irrigation District	All	100%
Cordua Irrigation District Hallwood Irrigation Company	f[1] ≥ 40%	100%
	f < 40%	80%
YCWA CONTRACT SUPPLY		
Base Project Water (All Member Units with these supplies)	f > 85%	100%
	40% < f ≤ 85%	75%
	f < 40%	Determined annually by Licensee in its reasonable discretion considering forecasted runoff and operational conditions.

[1] f is the April 1 DWR forecast of unimpaired Yuba River runoff near Smartsville in percentage of 50-year average.

YCWA's contract volumes 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 solely on groundwater for irrigation. The Wheatland Project now conveys surface water, diverted by YCWA at Daguerre 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 ac of the approximately 9,200 ac 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. Phase 2, which is now mostly complete, will allow for a total allocation (base and supplemental) of 40,230 ac-ft per year.

5.3 Other Operating Constraints

Other operating constraints of the Project include water availability, water transfers and power contracts, each of which is discussed below.

5.3.1 Water Availability

One of YCWA's major considerations each year is anticipated water availability. YCWA begins estimating water availability each year in January and continually updates the estimate throughout the spring runoff period. When estimating available water supply, YCWA considers current reservoir storage and DWR Bulletin 120 forecasts of unimpaired flow at the Smartsville gage on the Yuba River and the Goodyears Bar gage on the North Yuba River. Estimates of available water supply and other water needs are compared to estimates of required releases, consumptive demands within YCWA, and target levels for fall carryover storage in the New Bullards Bar Reservoir.

5.3.2 YCWA Transfers

Water transfers are an important component of the Project operations. In the 30 years from 1987 through 2016, YCWA transferred water in 23 years, averaging 91,685 ac-ft for stored water transfers and 25,346 ac-ft for groundwater substitution transfers in each transfer year (Table 5.3-1). Stored water transfers were made by YCWA from storage releases from New Bullards Bar Reservoir. Groundwater substitution transfers were made by YCWA in coordination with its Member Units.

Table 5.3-1. YCWA historical sales from 1987 to 2016.

Year	Water Year Type (Sacramento Valley 40-30-30 Index)	Buyer	Stored Water Transfer (ac-ft)	Groundwater Substitution Transfer (ac-ft)
1987	Dry	California Department of Water Resources	83,100	--
1988	Critical	California Department of Water Resources	135,000	--
1989	Dry	California Department of Water Resources	90,000	--
		California Department of Water Resources for California Department of Fish and Game	110,000	--
		City of Napa	7,000	--
		East Bay Municipal Utility District	60,000[1]	--
1990	Critical	City of Napa	6,700	--
		California Department of Water Resources	109,000	--
		Tudor Mutual Water Company/Feather Water District	2,951	--
1991	Critical	State Water Bank	99,200[2]	84,840
		State Water Bank - California Department of Fish and Game	28,000	--
		City of Napa	7,500	--
1992	Critical	State Water Bank	30,000[3]	--
1994	Critical	California Department of Water Resources	--	26,033
1997	Wet	Bureau of Reclamation for Refuge Water	25,000[4]	--
		Sacramento Area Flood Control Agency for American River Fishery	48,857	--
2001	Dry	Environmental Water Account	50,000[5]	--
		California Department of Water Resources	52,912	61,140
2002	Dry	Environmental Water Account	79,742	55,248
		California Department of Water Resources	22,050	--
		Contra Costa Water District	5,000	--
2003	Above Normal	Environmental Water Account	65,000[6]	--
		Contra Costa Water District	5,000	--
2004	Below Normal	Environmental Water Account	100,000[6]	--
		California Department of Water Resources	487	--
2005	Above Normal	Environmental Water Account	60,866	--
2006	Wet	Environmental Water Account	60,000[1]	--
2007	Dry	Yuba Accord Water Purchase Participants	65,000[6,7,8]	--
2008	Critical	Yuba Accord Water Purchase Participants	117,212[6]	48,875
2009	Dry	Yuba Accord Water Purchase Participants	91,100[6,7]	88,901[10]
2010	Below Normal	Yuba Accord Water Purchase Participants	74,179[6,7]	66,211
2012	Below Normal	Yuba Accord Water Purchase Participants	81,681[6,7]	--
2013	Dry	Yuba Accord Water Purchase Participants	112,419[6,7]	64,730[11]
2014	Critical	Yuba Accord Water Purchase Participants	104,663[6,7]	56,984[12]
2015	Critical	Yuba Accord Water Purchase Participants	59,131	30,000
2016	Below Normal	Yuba Accord Water Purchase Participants	60,000	--
		Total	**2,108,750**	**582,961**
		Average per Year	**91,685**	**25,346**

[1] Sold but not delivered.
[2] In 1991, BVID transferred an additional 5,500 ac-ft to the State Water Bank through conservation.
[3] In 1992, BVID transferred an additional 5,500 ac-ft to the State Water Bank through conservation.
[4] In 1997, the transfer included 5,000 ac-ft from BVID.
[5] In 2001, BVID transferred an additional 4,500 ac-ft to DWR (stored water transfer) and 3,500 ac-ft to the Environmental Water Account (EWA) (groundwater substitution pumping).
[6] In 2002, 2003, 2007, 2008, 2009, 2010, 2012, 2013, 2014, and 2015 BVID transferred an additional 3,100 ac-ft to the Santa Clara Valley Water District through conservation.
[7] Transfers to the Yuba Accord Water Purchase Participants include 60,000 ac-ft of stored water for the EWA.
[8] The 2007 transfer was under Yuba Accord Pilot Program. It also included 60,000 ac-ft of transfer to the EWA purchased in 2006.
[9] Sacramento Valley Index as defined in SWRCB RD-1641.
[10] In 2009, Cordua Irrigation District transferred an additional 8,322 ac-ft of groundwater substitution transfer to the DWR Drought Water Bank.
[11] In 2013, Cordua Irrigation District transferred an additional 7,774 ac-ft of groundwater substitution transfer to the DWR Drought Water Bank.
[12] In 2014, Cordua Irrigation District transferred an additional 1,976 ac-ft of groundwater substitution transfer to the DWR Drought Water Bank.

Historically, prior to implementation of the Yuba Accord, individual 1-year stored water transfers may occur when the projected end-of-September storage in New Bullards Bar Reservoir was sufficient for YCWA to reasonably ensure full local water supplies from the Project in the following year. In addition, for cross-Delta water transfers to service areas south of the Delta, the Delta must be in balanced water conditions[10] and available conveyance capacity must exist at the State Water Project's Harvey O. Banks Pumping Plant or the Central Valley Project's C.W. Jones Pumping Plant, both near in Tracy, CA, to convey the transfer water to willing buyers. Stored water transfers have typically occurred from July through September. Under the Yuba Accord, transfer releases can occur throughout the year as part of the releases to the Yuba Accord flow and end-of-September target storage in New Bullards Bar Reservoir, but through re-operation of the state and federal projects only delivered across the Delta in the summer months.

5.3.3 YCWA Power Purchase Contracts

In 1966, YCWA entered into a 50-year power purchase contract with PG&E. The contract stipulated that YCWA provide to PG&E the electric power output from the Project and PG&E pay for the operating and maintenance expenses of the Project. The contract expired on April 30, 2016. YCWA currently sells all of the electrical output from the Project into the California Independent System Operator (CAISO) daily and real-time energy markets, and receives payment from the CAISO pursuant to the CAISO daily and real-time energy market payment rules. YCWA engages outside firms to act as scheduling coordinator for the CAISO, and to provide assistance on bidding and settlements for the CAISO markets. All electrical generation scheduling is driven by water throughput requirements to meet regulatory flow requirements, consumptive demands, and flood control objectives. Because the Project is primarily operated for water supply and flood control objectives the overall operations of the Project have not changed significantly with the end of the PG&E contract.

6.0 Existing Operations

Operation of YCWA's reservoirs, dams, and powerhouses under YCWA's No Action Alternative are presented below for the three Project developments: New Colgate, New Bullards Bar Minimum Flow, and Narrows 2. The Project does not include USACE's Englebright Reservoir and Dam and PG&E's Narrows 1 Powerhouse downstream of Englebright Dam. YCWA coordinates operations of these facilities with USACE and PG&E; therefore, these facilities are also discussed in this section.

6.1 New Colgate Development

The New Colgate Development is located on the main stems of the North Yuba River, Middle Yuba River and Yuba River, and Oregon Creek, a tributary to the Middle Yuba River. The development includes two diversion dams (Our House and Log Cabin), two diversion tunnels

[10] Balanced water conditions are periods when it is agreed that releases from upstream reservoirs plus unregulated flows approximately equal the water supply needed to meet Sacramento Valley in-basin uses plus required Delta outflows and exports (USBOR and DWR 1986).

(Lohman Ridge and Camptonville), one storage reservoir (New Bullards Bar Reservoir), one power tunnel and penstock (New Colgate), and one powerhouse (New Colgate).

6.1.1 Reservoir Operation

New Colgate development includes two impoundments and one reservoir: Our House Diversion Impoundment on the Middle Yuba River, Log Cabin Diversion Impoundment on Oregon Creek, and New Bullards Bar Reservoir on the North Yuba River.

6.1.1.1 Our House Diversion Dam Impoundment

Our House Diversion Dam Impoundment has an estimated capacity of 280 ac-ft, but YCWA does not store water within the impoundment. YCWA operates it primarily to divert water to New Bullards Bar Reservoir in winter and spring during high flow periods through the Lohman Ridge Diversion Tunnel.

The storage capacity curve showing the usable and gross storage capacities of Our House Diversion Impoundment is provided in Figure 6.1-1. The surface area at the normal maximum water surface elevation (NMWSE) of 2,030 ft is 13.8 ac.

Our House Diversion Dam Impoundment is operated as a diversion with no storage in the Operations Model. While the storage is not operated, elevation-storage-area curves are presented in Figure 6.1-2.

The spillway rating curve for Our House Diversion Dam is presented in Figure 6.1-2. The elevation of the spillway crest for the dam is 2,030 ft. Historically, the estimated maximum instantaneous flow downstream of the Diversion Dam was 27,500 cfs, occurring on January 2, 1997.

Drainage area into Our House Diversion Impoundment is about 144.8 sq mi. Inflow is regulated by local accretion and releases from NID's Milton Diversion Dam. Up to 860 cfs is diverted into the Lohman Ridge Diversion Tunnel to Log Cabin Diversion Dam Impoundment. The invert elevation for the Lohman Ridge Diversion Tunnel is at 2,015 ft.

There are no rule curve requirements for Our House Diversion Impoundment. Modeled monthly flow duration curves for the Middle Yuba downstream of Our House Diversion Dam and for the Lohman Ridge Diversion Tunnel are provided in Figures 6.1-3 and 6.1-4. Flow duration curves are based on YCWA's No Action Alternative model run for WYs 1970 through 2010. Figure 6.1-5 and Figure 6.1-6 show flow duration curves during the representative dry (2001), normal (2005), and wet (1998) WYs for the Middle Yuba downstream of Our House Diversion Dam and for the Lohman Ridge Diversion Tunnel.

There are two outlets from the Our House Diversion Dam; a 24-in fish release outlet with an engineers' estimated maximum capacity of 59 cfs when the impoundment water surface elevation (WSE) is at the Lohman Ridge Diversion Tunnel invert elevation; and a 72-in low level outlet with an engineers' estimated capacity of 463 cfs when the impoundment WSE is at the Lohman Ridge Diversion Tunnel invert elevation. The fish release outlet is adjusted each day to ensure the required flow is released, but the low level outlet is rarely used under current operations.

When Our House Diversion Dam is being operated to release inflow to the Our House Diversion Dam impoundment, the fish release outlet valve is adjusted once per day to maintain the impoundment WSE at a constant level, ensuring outflows are the same as inflows. Allowing the WSE to drop too low would induce additional accumulation of sediment and debris at the dam; maintaining the pool elevation keeps most of the sediment and debris at the upstream end of the impoundment, away from the dam.

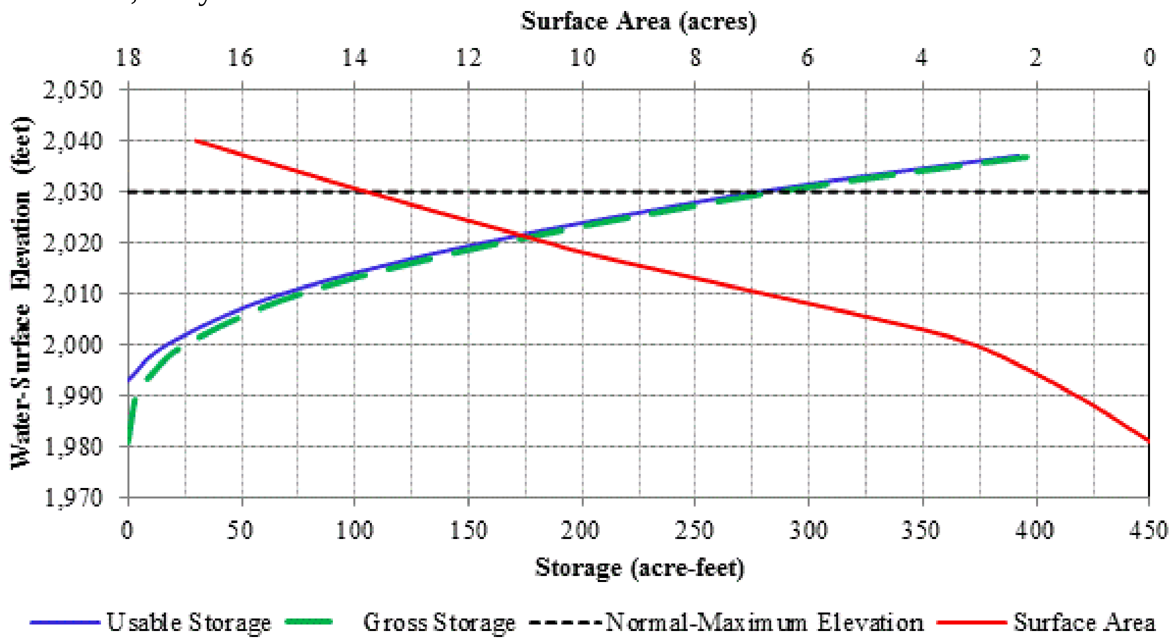

Figure 6.1-1. Our House Diversion Impoundment storage-capacity curve.

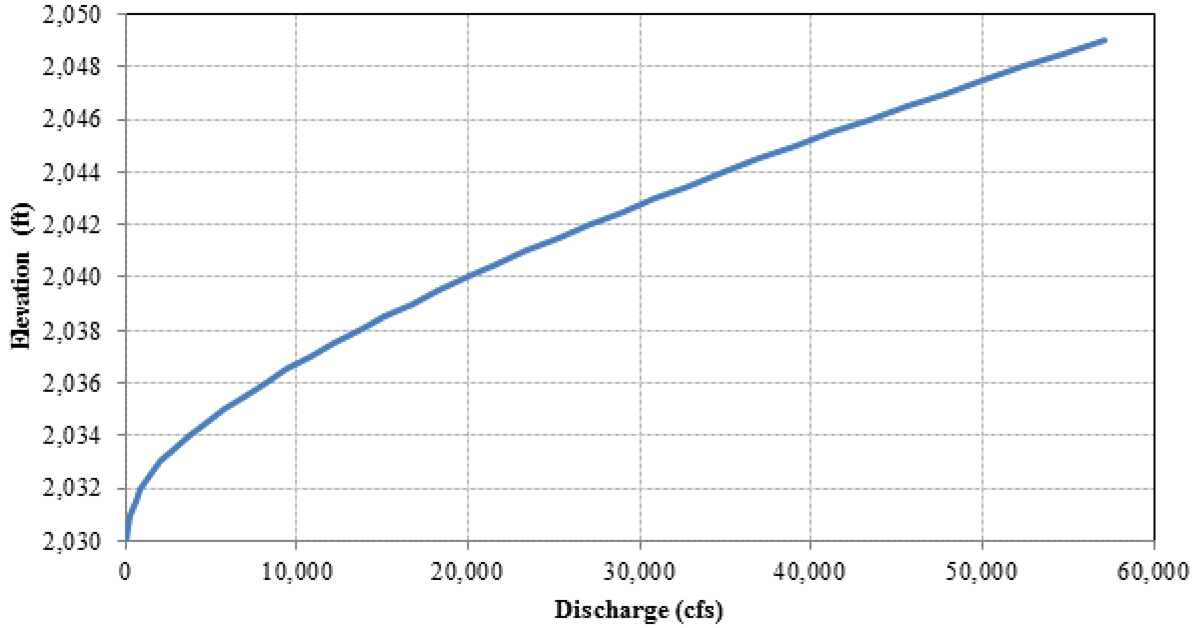

Figure 6.1-2. Our House Diversion Dam spillway rating curve.

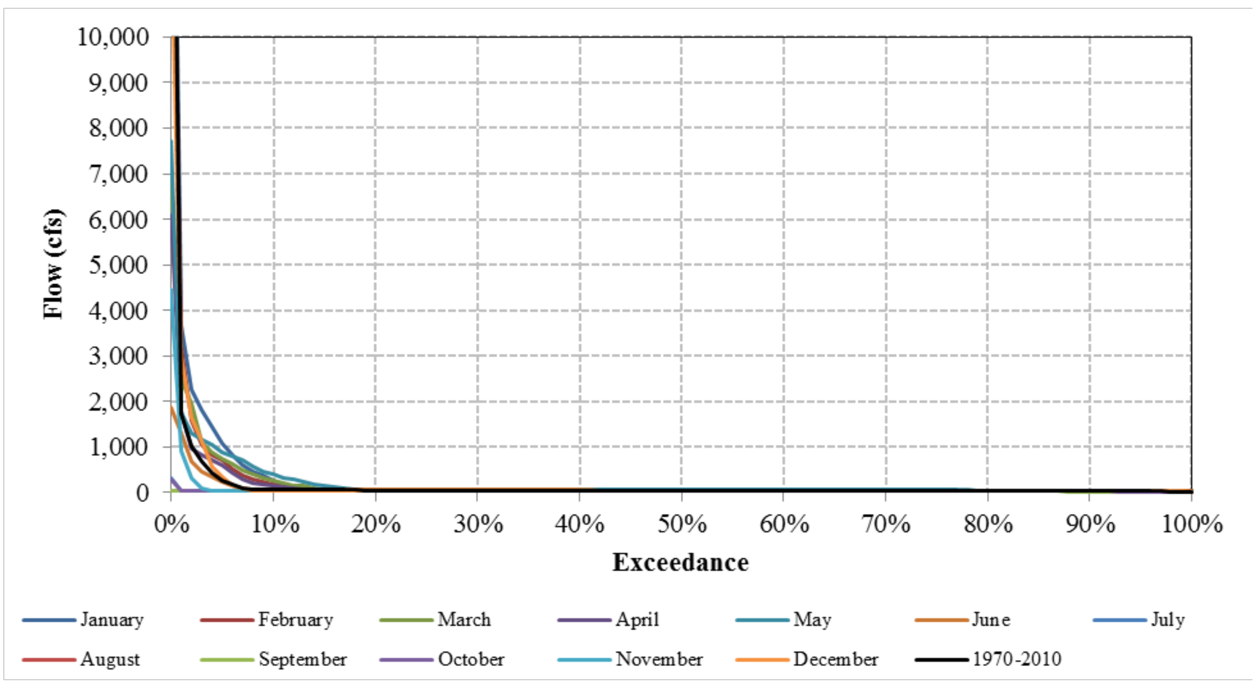

Figure 6.1-3. Modeled monthly flow duration curves for the Middle Yuba River downstream of Our House Diversion Dam for Water Years 1970 through 2010 under YCWA's No Action Alternative Operations Model run.

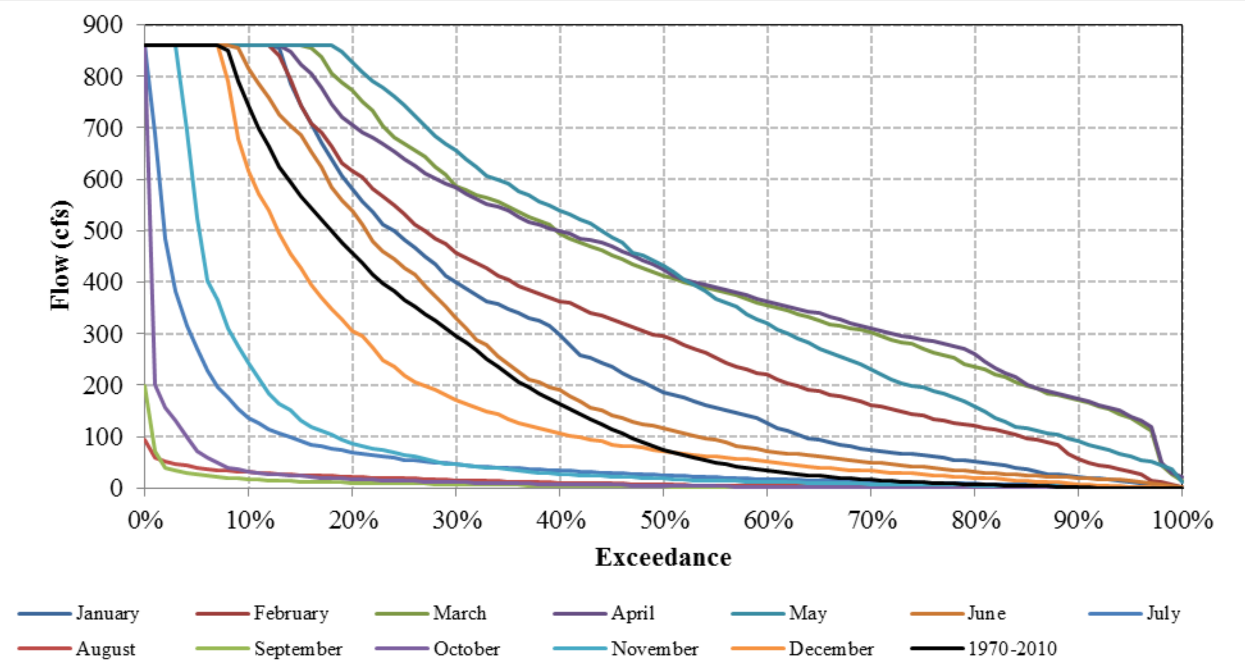

Figure 6.1-4. Modeled monthly flow duration curves for the Lohman Ridge Diversion Tunnel for Water Years 1970 through 2010 under YCWA's No Action Alternative Operations Model run.

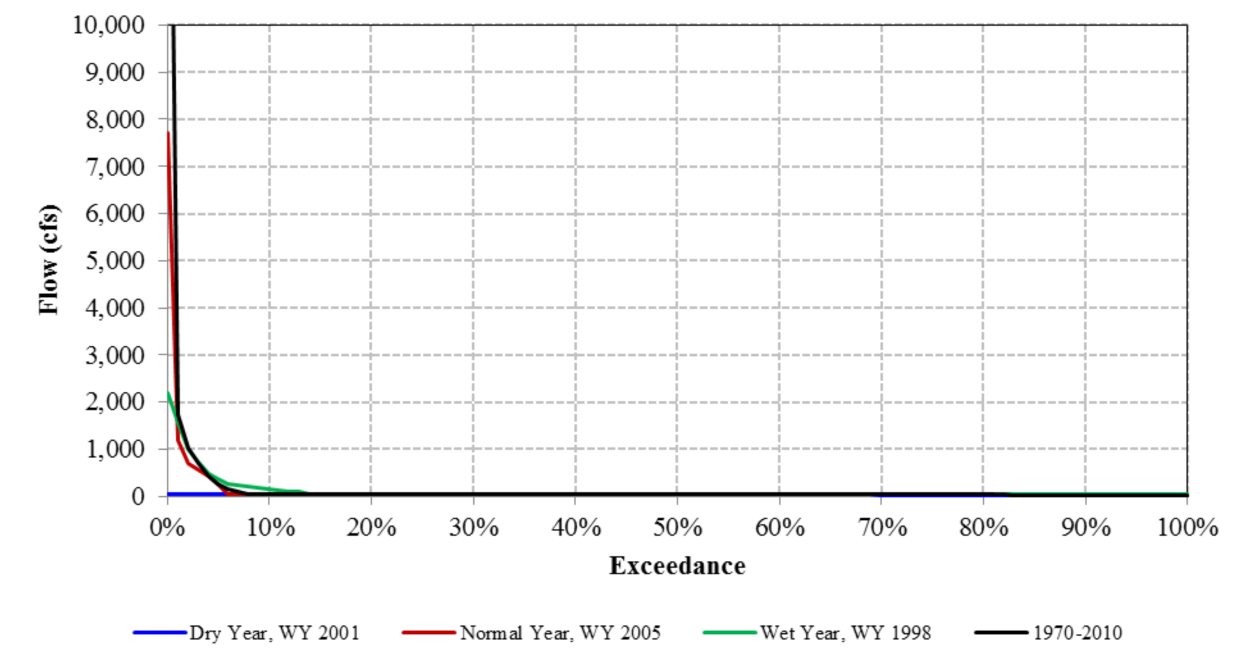

Figure 6.1-5. Modeled flow duration curves for the Middle Yuba River downstream of Our House Diversion Dam for the representative dry (2001), normal (2005) and wet (1998) Water Years and for the period of record under YCWA's No Action Alternative Operations Model run.

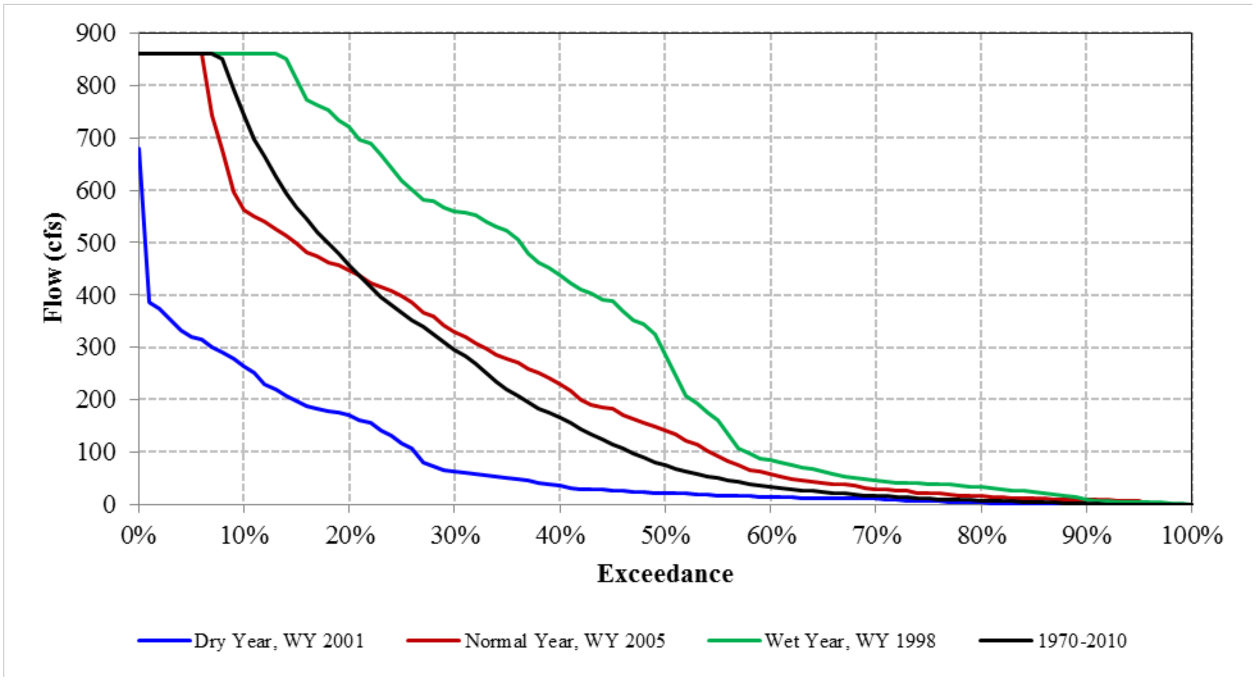

Figure 6.1-6. Modeled flow duration curves for the Lohman Ridge Diversion Tunnel for the representative dry (2001), normal (2005), and wet (1998) Water Years and for the period of record under YCWA's No Action Alternative Operations Model run.

6.1.1.2 Log Cabin Diversion Dam Impoundment

Log Cabin Diversion Dam Impoundment has an estimated capacity of 90 ac-ft. YCWA operates it primarily to divert water to New Bullards Bar Reservoir in the winter and spring during high flow periods and does not store water within the impoundment. Water from Oregon Creek is diverted to New Bullards Bar Reservoir, along with water from the Middle Yuba River through the Camptonville Diversion Tunnel.

The storage-capacity curve showing the usable and gross storage capacities of Log Cabin Diversion Impoundment is provided in Figure 6.1-7. The surface area at the NMWSE of 1,970 ft is 5.4 ac.

Log Cabin Diversion Dam Impoundment is operated as a diversion with no storage in the Operations Model. While the storage is not operated, elevation-storage-area curves are presented in Figure 6.1-7.

A spillway rating curve for Log Cabin Diversion is unavailable; therefore, it is not presented in this document. Inflow above approximately 1,100 cfs (the capacity of the Camptonville Diversion Tunnel) is spilled over the dam. Historically, the estimated maximum instantaneous flow below the Diversion Dam was 6,400 cfs, occurring on February 17, 1986.

Drainage area into Log Cabin Diversion Impoundment is about 29.1 sq mi. Inflow is regulated by local accretion and diversions from the Middle Yuba River at Our House Diversion through the Lohman Ridge Diversion Tunnel. Up to 1,100 cfs is diverted into the Camptonville Diversion Tunnel to New Bullards Bar Reservoir. The invert elevation for the Camptonville Tunnel is 1,952 ft.

There are no rule curve requirements for Log Cabin Diversion Impoundment. Modeled monthly flow duration curves for Oregon Creek downstream of Log Cabin Diversion Dam and for the Camptonville Diversion Tunnel are provided in Figures 6.1-8 and 6.1-9. Flow duration curves are based on YCWA's No Action Alternative model run for WYs 1970 through 2010. Figure 6.1-10 and Figure 6.1-11 show flow duration curves during the representative dry (2001), normal (2005), and wet (1998) WYs for Oregon Creek downstream of Log Cabin Diversion Dam and for the Camptonville Diversion Tunnel.

There are two outlets from the Log Cabin Diversion Dam; an 18-in fish release outlet with an engineers' estimated maximum capacity of 18 cfs when the impoundment WSE is at the Camptonville Diversion Tunnel invert elevation; and a 60-in low level outlet with an engineers' estimated capacity of 348 cfs when the impoundment WSE is at the Camptonville Diversion Tunnel invert elevation. The fish release outlet is adjusted each day to ensure the required flow is released, but the low level outlet is rarely used under current operations.

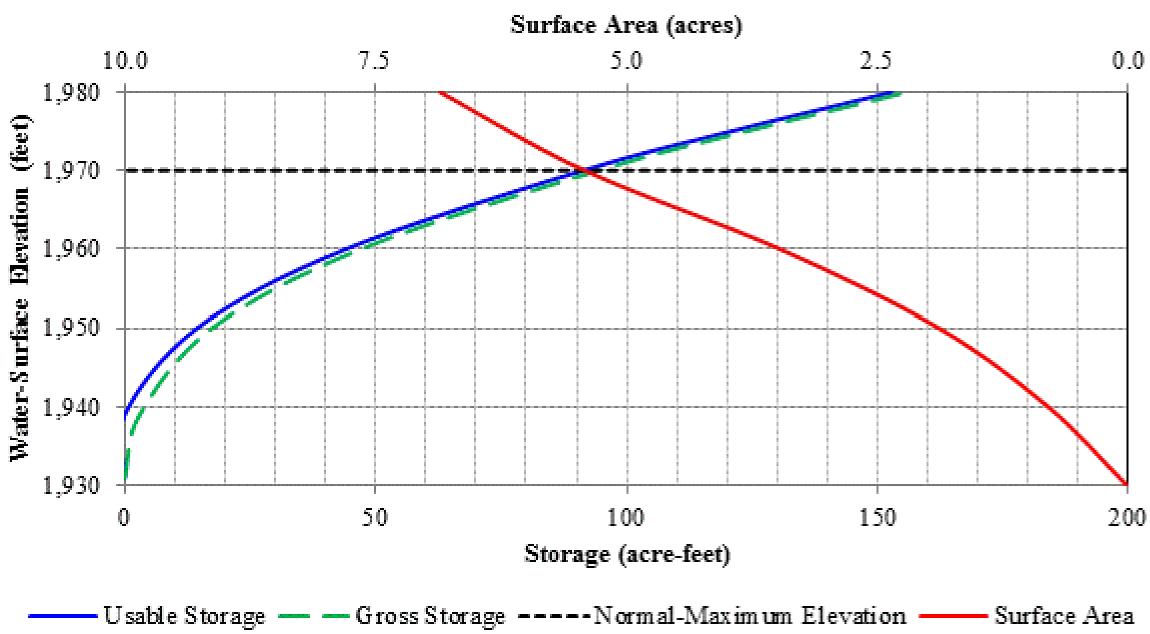

Figure 6.1-7. Log Cabin Diversion Impoundment storage-capacity curve.

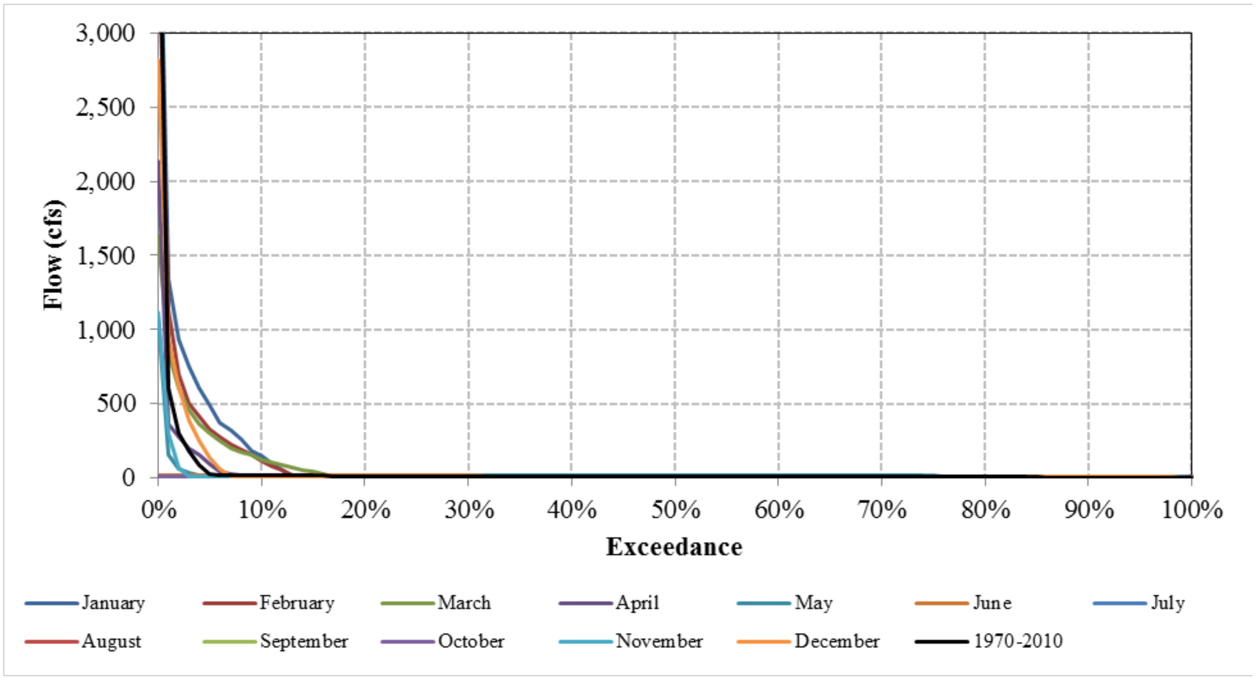

Figure 6.1-8. Modeled monthly flow duration curves for Oregon Creek downstream of Log Cabin Diversion Dam for Water Years 1970 through 2010 under YCWA's No Action Alternative Operations Model run.

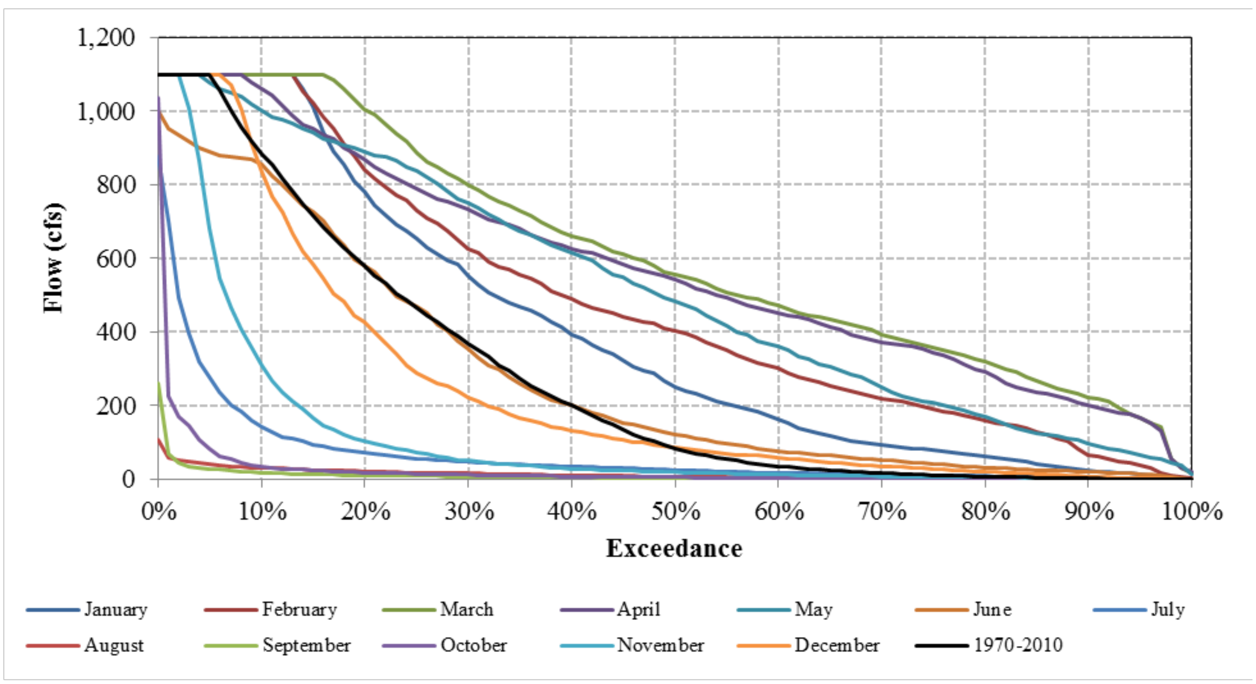

Figure 6.1-9. Modeled monthly flow duration curves for the Camptonville Diversion Tunnel for Water Years 1970 through 2010 under YCWA's No Action Alternative Operations Model run.

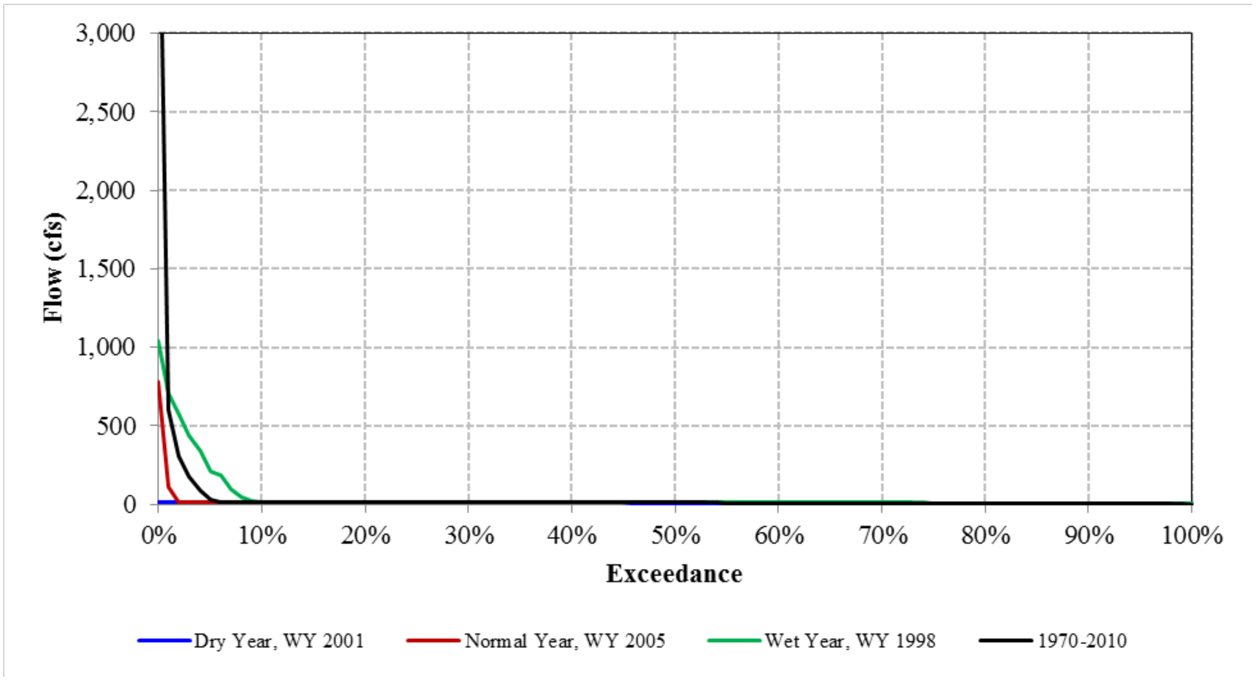

Figure 6.1-10. Modeled flow duration curves for Oregon Creek downstream of Log Cabin Diversion Dam for the representative dry (2001), normal (2005), and wet (1998) Water Years and for the period of record under YCWA's No Action Alternative Operations Model run.

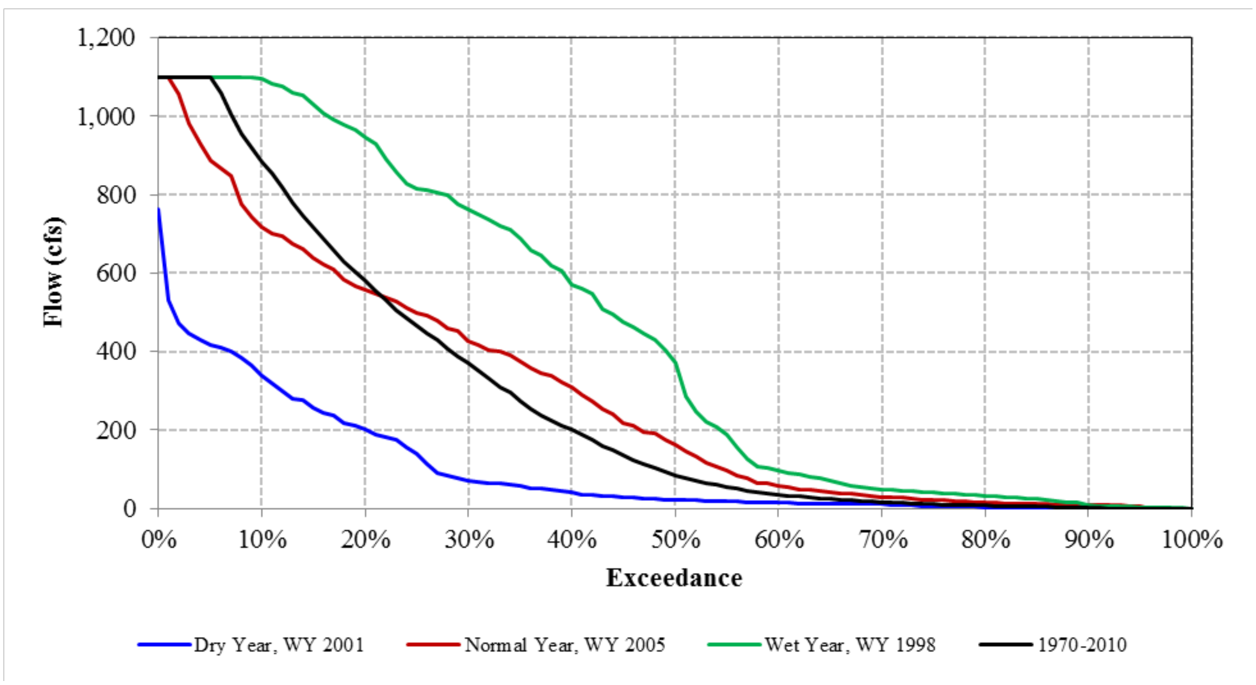

Figure 6.1-11. Modeled flow duration curves for the Camptonville Diversion Tunnel for the representative dry (2001), normal (2005), and wet (1998) Water Years and for the period of record under YCWA's No Action Alternative Operations Model run.

6.1.1.3 New Bullards Bar Reservoir

New Bullards Bar Reservoir is the principal storage facility for the Project. The reservoir has a gross storage capacity of 966,103 ac-ft (i.e., storage at the NMWSE) and a regulatory minimum pool of 1,730 ft, as required by YCWA's FERC license, which equates to a storage of approximately 230,000 ac-ft. Thus, the reservoir's operable capacity is 736,103 ac-ft. This is not to be confused with usable storage, which is 961,103 ac-ft, and is the volume of water in the reservoir between NMWSE and the elevation of the invert of the 72-inch hollow jet low level outlet (i.e., El. 1,395 ft). A portion, 170,000 ac-ft, of the operable capacity must be held empty from November 1 through March 31 for flood management; the full pool of the reservoir is available for storage between June 1 and September 15. The required storage volume is linearly interpolated between these two quantities on other dates.

Releases from New Bullards Bar Reservoir are made through the New Colgate Power Tunnel to the New Colgate Powerhouse on the Yuba River; the New Bullards Bar Minimum Flow Powerhouse at the base of the dam; the dam's low level outlet; or the gated spillway.[11] The New Colgate Power Tunnel is approximately 5.2 mi long and has a maximum flow capacity of 3,400 cfs. The New Bullards Bar Minimum Flow Powerhouse has a maximum flow capacity of 5 cfs. The low level outlet at the base of New Bullards Bar Dam has a maximum capacity of 1,250 cfs with an invert elevation of 1,395 ft, but it is rarely used. The New Bullards Bar Dam Spillway has a crest elevation of 1,902 ft and a maximum capacity of 124,000 cfs at full pool. Minimum flow on the North Yuba River downstream of New Bullards Bar Dam is met through a combination of releases from the New Bullards Bar Minimum Flow Powerhouse and seepage from the New Bullards Bar Dam. Any additional non-spill releases are made through the New Colgate Powerhouse. The spillway is only used during flood management operations.

Figure 6.1-12 shows modeled average-daily storage in New Bullards Bar Reservoir, as well as the maximum-daily storage minimum-daily storage for the period of record and various percent exceedance levels of daily storage.

The storage-capacity curve showing the usable and gross storage capacities of New Bullards Bar Reservoir is provided in Figure 6.1-13. The surface area at the maximum water-surface elevation of 1,956 ft is 4,790 ac.

Modeled daily average water-surface elevations for New Bullards Bar Reservoir for each WY are graphically presented in Figure 6.1-14. As indicated on the figure, the reservoir storage and elevation can fluctuate significantly from year to year; although, the median and mean curves represent general reservoir operation.

[11] The New Bullards Bar Power Intake has two ports, one at a centerline 1,808 ft and the other at a centerline elevation of 1,627.5 ft. In 1993, YCWA convened a Temperature Advisory Committee to obtain more refined recommendations for the operation of New Bullards Bar Reservoir's multi-port power intake. The committee was composed of YCWA, USFWS, and CDFG. After reviewing temperature model data and the operating options, USFWS and CDFG recommended that water releases from New Bullards Bar Reservoir be as cold as possible at all times. YCWA immediately implemented this recommendation and, since 1993, all controlled releases of water from New Bullards Bar Reservoir through New Bullards Bar Minimum Flow Powerhouse into the North Yuba River and through New Colgate Powerhouse into the Yuba River have been from the deeper port (El. 1,627.5 ft) of the New Bullards Bar Power Intake.

Operation of New Bullards Bar Reservoir in terms of storage for the representative dry (2001), normal (2005) and wet (1998) WYs is shown in Figure 6.1-15. The range of reservoir elevations in the representative dry (2001), normal (2005), and wet (1998) WYs and annual elevation fluctuation in New Bullards Bar Reservoir are summarized in Table 6.1-1.

Table 6.1-1. Modeled minimum and maximum elevations in New Bullards Bar Reservoir in the representative dry (2001), normal (2005) and wet (1998) Water Years under YCWA's No Action Alternative Operations Model run.

Water Year	Minimum Daily Elevation (ft)	Average Daily Elevation (ft)	Maximum Daily Elevation (ft)	Annual Elevation Fluctuation (ft)
2001 (Dry Year)	1,845	1,870	1,904	59
2005 (Normal Year)	1,861	1,898	1,956	95
1998 (Wet Year)	1,843	1,903	1,956	113

Figure 6.1-16 shows operational rule curves for New Bullards Bar Reservoir. The FERC Minimum Pool and Maximum Storage curves are defined under YCWA's existing FERC license. The Top of Conservation curve is defined by the USACE for YCWA's flood management operations (USACE 1972), and the target rule curve represents an operational objective rather than a physical or regulatory limitations of the reservoir operation.

The spillway rating curve for New Bullards Bar Reservoir Dam is presented in Figure 6.1-17. The elevation of the spillway crest for the dam is 1,902 ft.

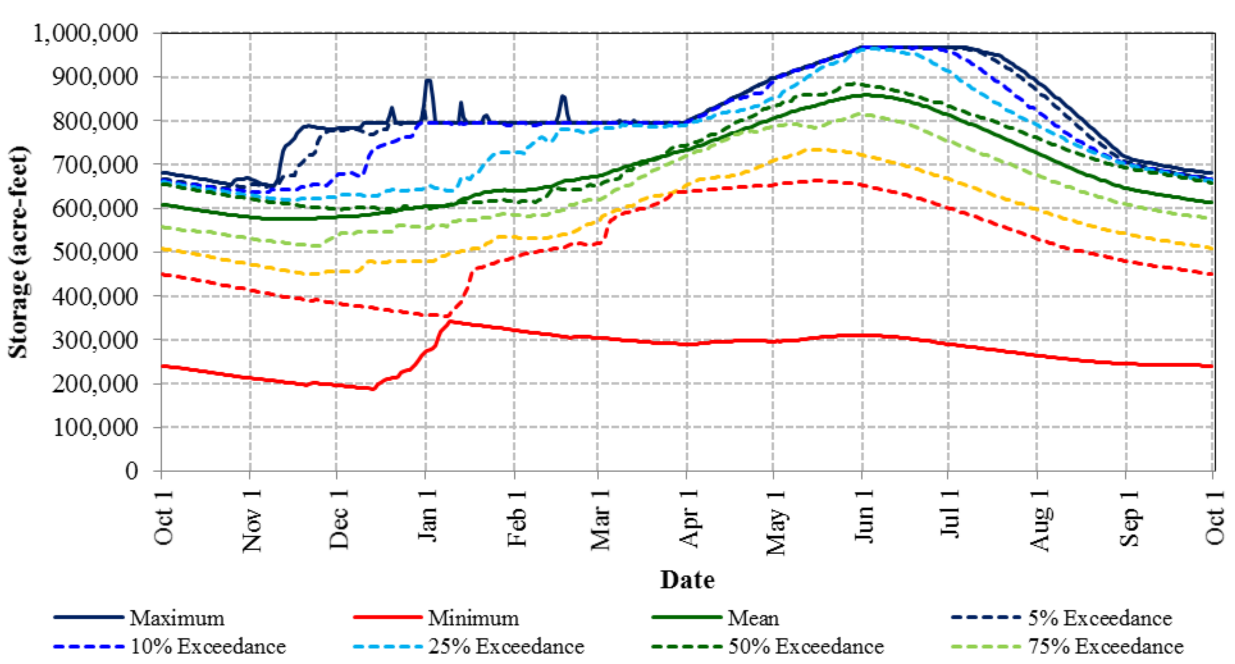

Figure 6.1-12. Modeled average-daily storage in New Bullards Bar Reservoir for various percent exceedances for the simulated period of Water Years 1970 through 2010 under YCWA's No Action Alternative Operations Model run.

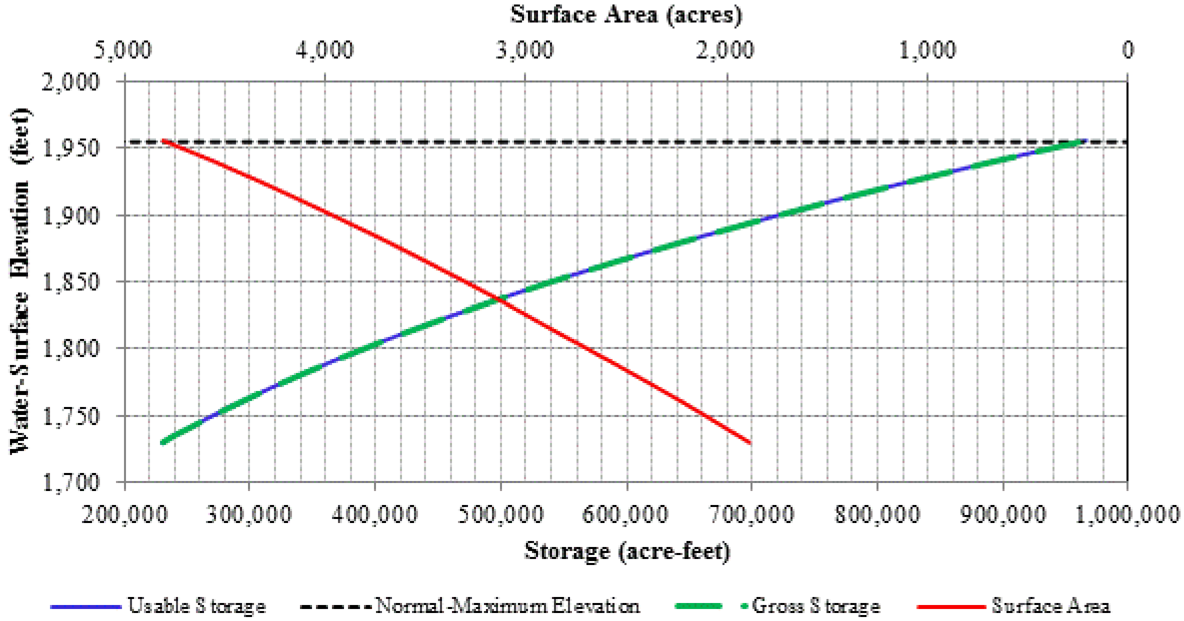

Figure 6.1-13. New Bullards Bar Reservoir storage-capacity curve.

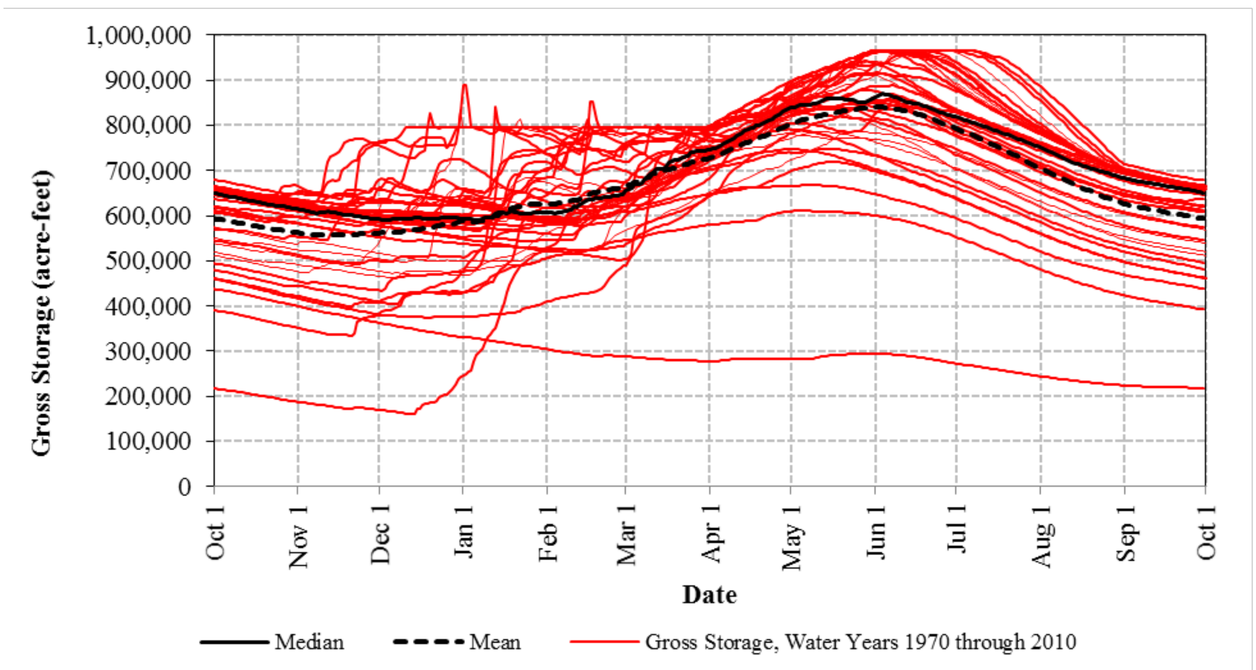

Figure 6.1-14. Modeled New Bullards Bar Reservoir median and mean storage for Water Years 1970 through 2010 under YCWA's No Action Alternative Operations Model run.

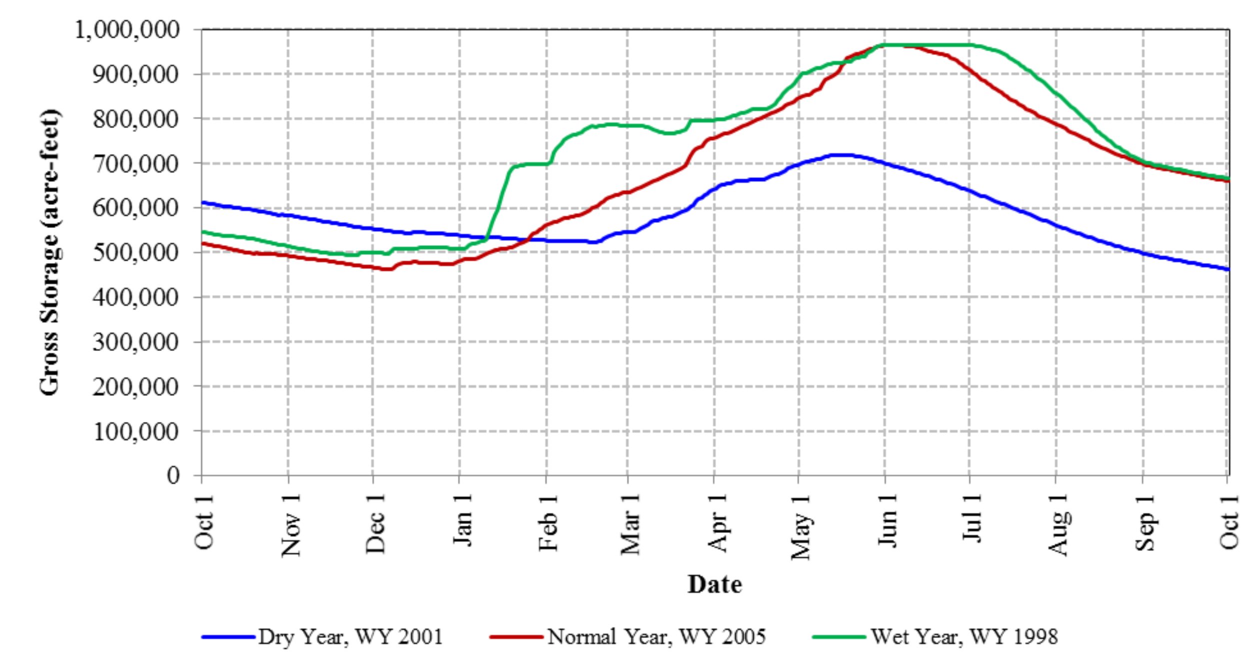

Figure 6.1-15. Modeled New Bullards Bar Reservoir storage for the representative dry (2001), normal (2005), and wet (1998) Water Years and for the period of record under YCWA's No Action Alternative Operations Model run.

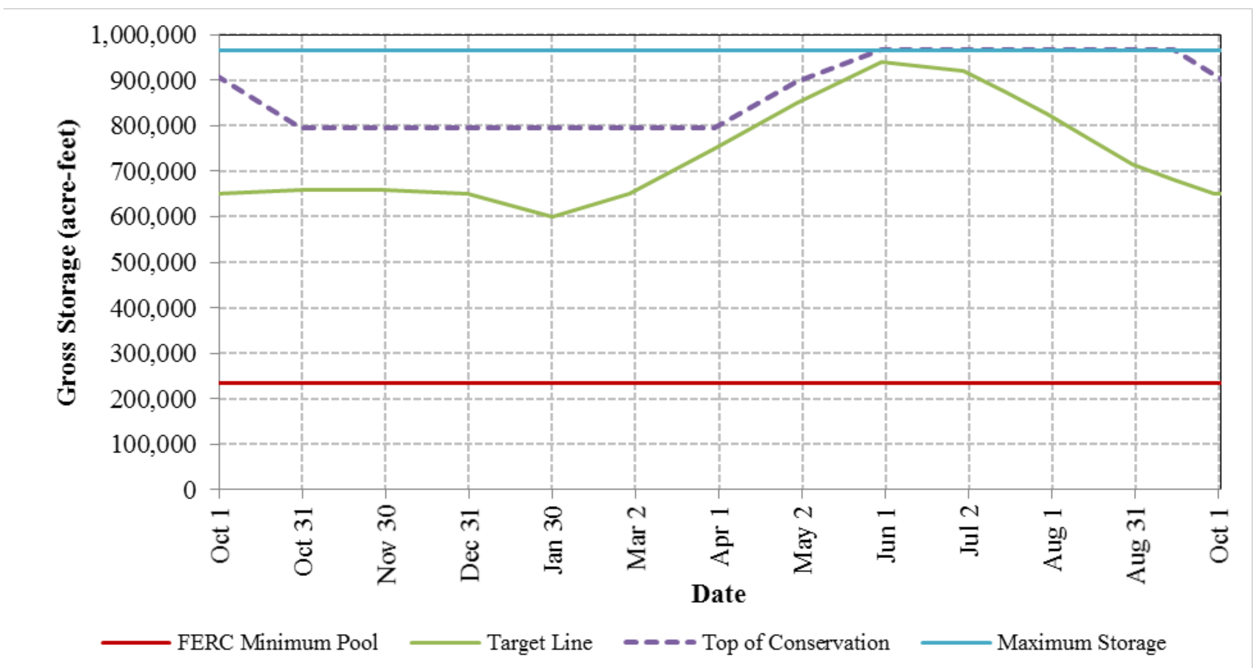

Figure 6.1-16. New Bullards Bar Reservoir rule curve.

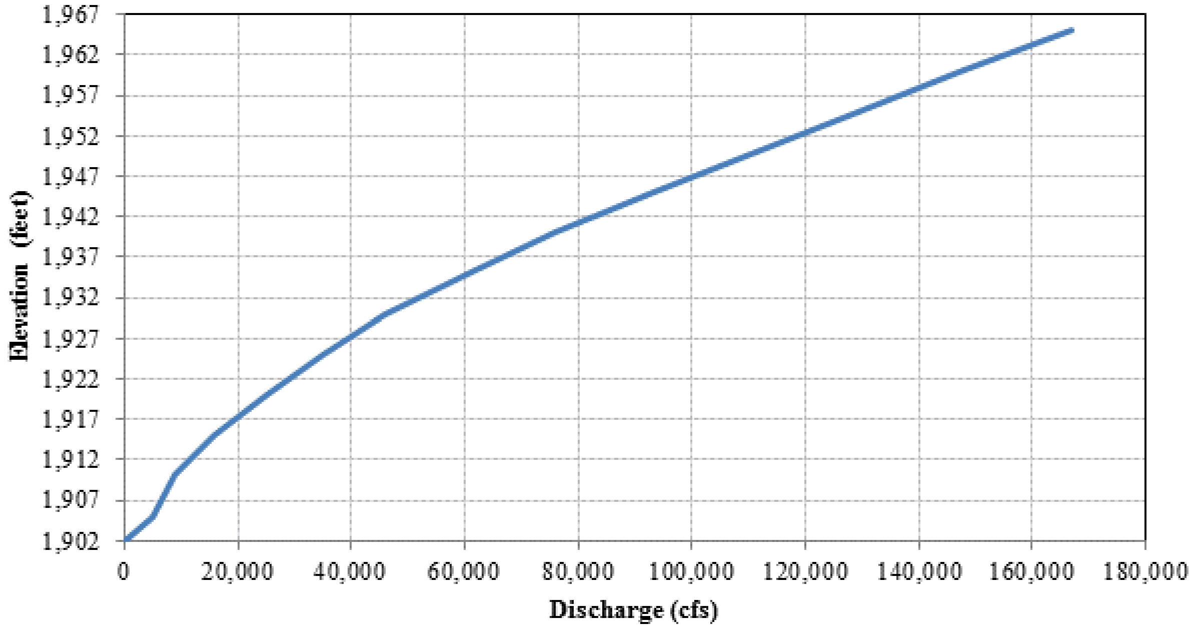

Figure 6.1-17. New Bullard Bar Dam spillway rating curve.

6.1.2 Plant Operations – New Colgate Powerhouse

New Colgate Powerhouse is a highly versatile facility, and is used for a combination of peaking, ancillary services and some base generation. Depending upon energy demand, the New Colgate Powerhouse generation can be fluctuated from a minimum of 1 MW with only one unit operating to its nameplate capacity of 315 MW with both units operating in less than 10 minutes, assuming both units are ramped up at the same time. This ability to rapidly fluctuate generation, together with substantial storage available in New Bullards Bar Reservoir makes New Colgate Powerhouse important and unique to the Northern California grid. The average annual flow through the New Colgate Powerhouse based on YCWA's No Action Alternative model run for WYs 1970 through 2010 was 1,063,093 ac-ft. With a theoretical powerhouse capacity of almost 3,000,000 megawatt-hours per year (MWh/yr) if the powerhouse always could be operated at full capacity, New Colgate Powerhouse has a plant factor of 0.45. This is comparable to the national average hydropower plant factor of 0.43.

Releases from New Bullards Bar Reservoir are made through the New Colgate Power Tunnel to the New Colgate Powerhouse on the Yuba River; the New Bullards Bar Minimum Flow Powerhouse at the base of the dam; the dam's low-level outlet; or the gated spillway. The New Colgate Power Tunnel is approximately 5.2 mi long and has a maximum flow capacity of 3,400 cfs. The New Colgate Power Tunnel has two intakes on New Bullards Bar Dam: an upper intake with an invert elevation of 1,800 ft, and a lower intake with an invert elevation of 1,620 ft. Since 1993, however, YCWA has exclusively used the lower intake to make releases from New Bullards Bar Reservoir to the New Colgate Powerhouse. The New Bullards Bar Minimum Flow Powerhouse has a maximum flow capacity of 5 cfs. The low-level outlet at the base of New

Bullards Bar Dam has a maximum capacity of 1,250 cfs with an invert elevation of 1,395 ft, but it is rarely used. The New Bullards Bar Dam Spillway has a crest elevation of 1,902 ft and a maximum capacity of 124,000 cfs at full pool. Minimum flow on the North Yuba River below New Bullards Bar Dam is met through a combination of releases from the New Bullards Bar Minimum Flow Powerhouse and seepage from the New Bullards Bar Dam. Any additional non-spill releases are made through the New Colgate Powerhouse. The spillway is only used during flood management operations.

6.1.2.1 Powerhouse Minimum, Maximum and Mean Flows

Minimum-, maximum- and mean-daily average flows based on YCWA's No Action Alternative model run for WYs 1970 through 2010, are 0 cfs, 1,468 cfs and 3,430 cfs, respectively. When flows on the Yuba River upstream of the New Colgate Powerhouse exceed approximately 20,000 cfs, the New Colgate Powerhouse tailrace elevations begin to impede operations of the two New Colgate Units, and releases through the New Colgate Powerhouse are shut off until flows recede to the point the Pelton wheels are not affected by the tail race elevation.

6.1.2.2 Powerhouse Hydraulic Capacity

New Colgate Powerhouse contains two Voith Siemens Pelton-type turbines with a nameplate capacity of 315 MW under a design head at the plant of 1,306 ft (there is approximately 80 ft of hydraulic head loss in the penstock at peak flow) and a rated flow of 3,430 cfs.

6.1.2.3 Powerhouse Flow Duration Curves

Annual and monthly flow duration curves for releases from New Colgate Powerhouse, based on YCWA's No Action Alternative model run for WYs 1970 through 2010, are provided in Figure 6.1-18.

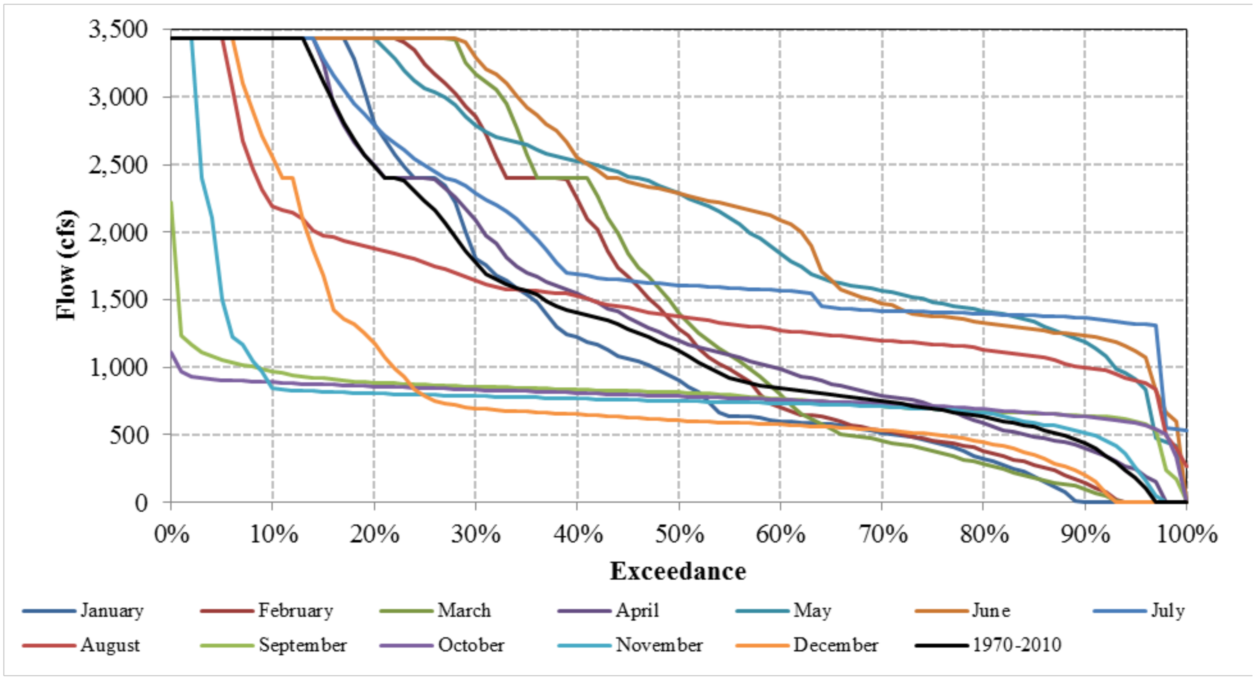

Figure 6.1-18. Modeled monthly flow duration curves for New Colgate Powerhouse for Water Years 1970 through 2010 under YCWA's No Action Alternative Operations Model run.

6.1.2.4 Powerhouse Capability Versus Head

Powerhouse capability versus head is shown in Figure 6.1-19. Minimum- and maximum-operating heads for New Colgate Powerhouse are 1,165 ft (corresponding to a reservoir surface elevation of 1,730 ft and 230,000 ac-ft of storage) and 1,390 ft (corresponding to a reservoir surface elevation of 1,955 ft and 966,400 ac-ft of storage), respectively.

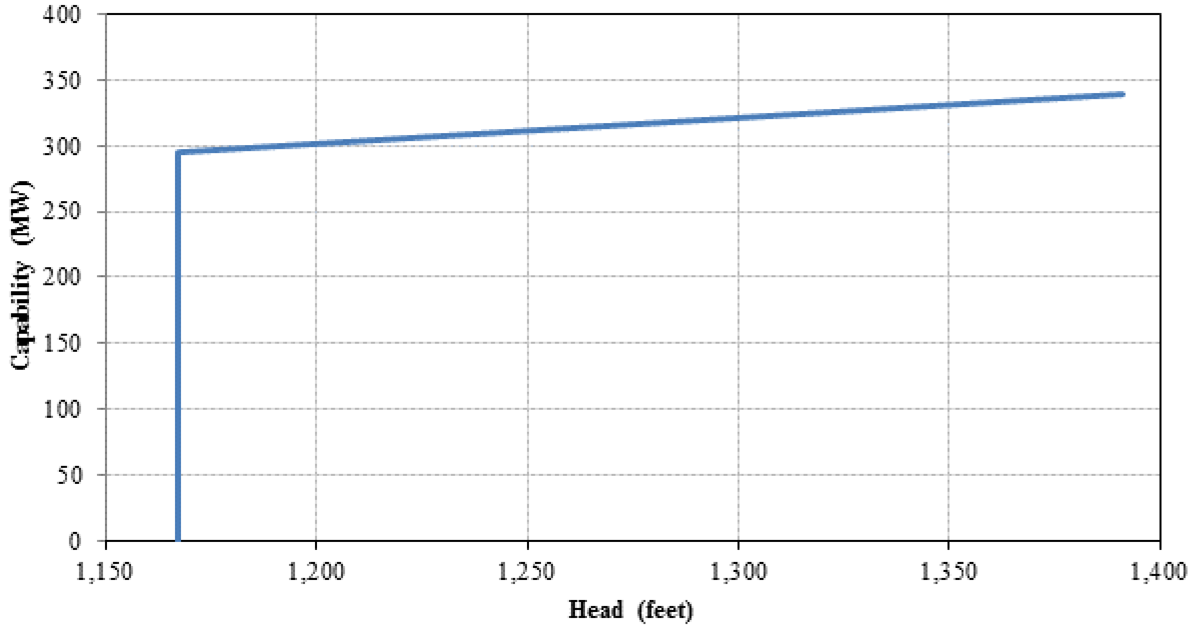

Figure 6.1-19. New Colgate Powerhouse capability curve.

6.1.2.5 Tailwater Rating Curve

New Colgate Powerhouse is a Pelton turbine, and is not dependent on tailwater elevation. The turbine elevation for New Colgate Powerhouse is 565 ft.

6.1.2.6 Load Curves

Because New Colgate Powerhouse is used for ancillary services, there is no diurnal or weekly load curve.

6.1.2.7 Average Annual Energy Production

New Colgate Powerhouse would have generated an average of 1,191,464 MWh/yr from 1970 to 2010 under YCWA's No Action Alternative model run. The average annual plant factor for the powerhouse for this time period is 0.43 based on the annual generation divided by the plant nameplate generating capability (315 MW) times the number of hours per year. Annual gross generation and plant factors for the powerhouse are provided in Table 6.1-2.

Table 6.1-2. Modeled generation and plant factors for New Colgate Powerhouse under YCWA's No Action Alternative Operations Model run.

Water Year	Annual Generation (MWh)	Annual Generation (aMW)	Plant Capability (MW)	Plant Factor
1970	1,312,930	150	315	0.48
1971	1,608,399	183	315	0.58
1972	1,113,675	127	315	0.40
1973	1,478,705	169	315	0.54

Table 6.1-2. (continued)

Water Year	Annual Generation (MWh)	Annual Generation (aMW)	Plant Capability (MW)	Plant Factor
1974	2,138,938	244	315	0.77
1975	1,401,246	160	315	0.51
1976	676,393	77	315	0.24
1977	357,320	41	315	0.13
1978	1,317,160	150	315	0.48
1979	1,018,937	116	315	0.37
1980	1,612,570	184	315	0.58
1981	748,926	85	315	0.27
1982	2,080,137	237	315	0.75
1983	2,194,381	250	315	0.79
1984	1,658,278	189	315	0.60
1985	803,925	92	315	0.29
1986	1,285,229	147	315	0.47
1987	635,428	72	315	0.23
1988	527,173	60	315	0.19
1989	1,045,467	119	315	0.38
1990	646,066	74	315	0.23
1991	642,914	73	315	0.23
1992	689,049	79	315	0.25
1993	1,442,651	165	315	0.52
1994	644,739	74	315	0.23
1995	1,890,444	216	315	0.68
1996	1,707,236	195	315	0.62
1997	1,387,501	158	315	0.50
1998	1,811,374	207	315	0.66
1999	1,597,567	182	315	0.58
2000	1,327,256	151	315	0.48
2001	617,821	70	315	0.22
2002	699,030	80	315	0.25
2003	1,336,869	153	315	0.48
2004	1,058,456	121	315	0.38
2005	1,101,017	126	315	0.40
2006	1,935,736	221	315	0.70
2007	814,676	93	315	0.30
2008	582,022	66	315	0.21
2009	831,731	95	315	0.30
2010	1,070,665	122	315	0.39
Total	**48,850,036**	**--**	**--**	**--**
Minimum	**357,320**	**40.8**	**--**	**0.13**
Average	**1,191,464**	**135.9**	**--**	**0.43**
Median	**1,113,675**	**127.0**	**--**	**0.40**
Maximum	**2,194,381**	**250.3**	**--**	**0.79**

Key: aMW = annual megawatt; MWh = megawatt-hour

6.1.2.8 New Colgate Powerhouse Dependable Capacity

The dependable capacity of a generating facility is defined as "*the generating capacity that the plant can deliver under the most adverse water supply conditions to meet the needs of an electric power system with a given maximum demand*." (Elliott et al. 1997). One of the critical parameters for defining dependable capacity is the period over which the capacity must be provided. Traditionally, a year or season from time of maximum storage to minimum storage is used for the time period over which capacity is calculated. For a peaking plant, such as the New Colgate Powerhouse, the dependable capacity critical period is less precisely defined and is specific to the plant demand and constraints.

For the purposes of determining dependable capacity of the Project's powerhouses, a different methodology is used for each powerhouse. As pointed out above, New Colgate Powerhouse is a peaking powerhouse. For the New Colgate Powerhouse, available water supply and flow are not limiting factors for determining dependable capacity; New Bullards Bar Reservoir storage has never been drawn down to a volume where water supply limited generation. Instead, generating capacity at the New Colgate Powerhouse is limited by available head; as a peaking plant, the full flow capacity of 3,430 cfs is available at any time. The dependable capacity for the New Colgate Powerhouse is determined by the generation capacity at New Bullards Bar Reservoir's minimum storage. Under the No Action Alternative, the minimum New Bullards Bar Reservoir storage of 161,958 ac-ft occurred on December 13, 1977. Based on this minimum storage and the full flow capacity through the New Colgate Powerhouse, the dependable capacity of the New Colgate Powerhouse under the No Action Alternative is 230,158 kilowatt (kW).

6.2 New Bullards Bar Minimum Flow Development

New Bullards Bar Minimum Flow Development is located on the North Yuba River and includes one powerhouse (New Bullards Bar Minimum Flow). New Bullards Bar Minimum Flow Powerhouse is immediately downstream of New Bullards Bar Dam (part of the New Colgate Development). The powerhouse penstock is a 70-ft long, 12-in diameter, steel penstock with a maximum capacity of 5 cfs. The powerhouse includes a single Pelton type turbine with a nameplate capacity of 150 kW of flow at 5 cfs.

6.2.1 Reservoir Operations

There are no reservoir operations associated with the New Bullards Bar Minimum Flow Development. Releases are made from the bottom of New Bullards Dam, part of the New Colgate Development, and are made irrespective of storage.

6.2.2 Plant Operations – New Bullards Bar Minimum Flow Powerhouse

New Bullards Bar Minimum Flow Powerhouse is operated as a "base load" facility, where flows are set at a constant rate to provide the required flow downstream of New Bullards Bar Dam.

6.2.2.1 Powerhouse Minimum, Maximum and Mean Flows

Since it runs at a continuous rate, the minimum-, maximum- and mean-daily average flows based on YCWA's No Action Alternative model run for WYs 1970 through 2010, are all 5 cfs.

6.2.2.2 Powerhouse Hydraulic Capacity

New Bullards Bar Minimum Flow Powerhouse consists of a single Pelton type turbine with a nameplate capacity of 150 kW under a design head of 560 ft and a rated flow of 5 cfs.

6.2.2.3 Powerhouse Flow Duration Curves

Annual and monthly flow duration curves for releases from New Bullards Bar Minimum Flow Powerhouse, based on YCWA's No Action Alternative model run for WYs 1970 through 2010, is provided in Figure 6.2-1.

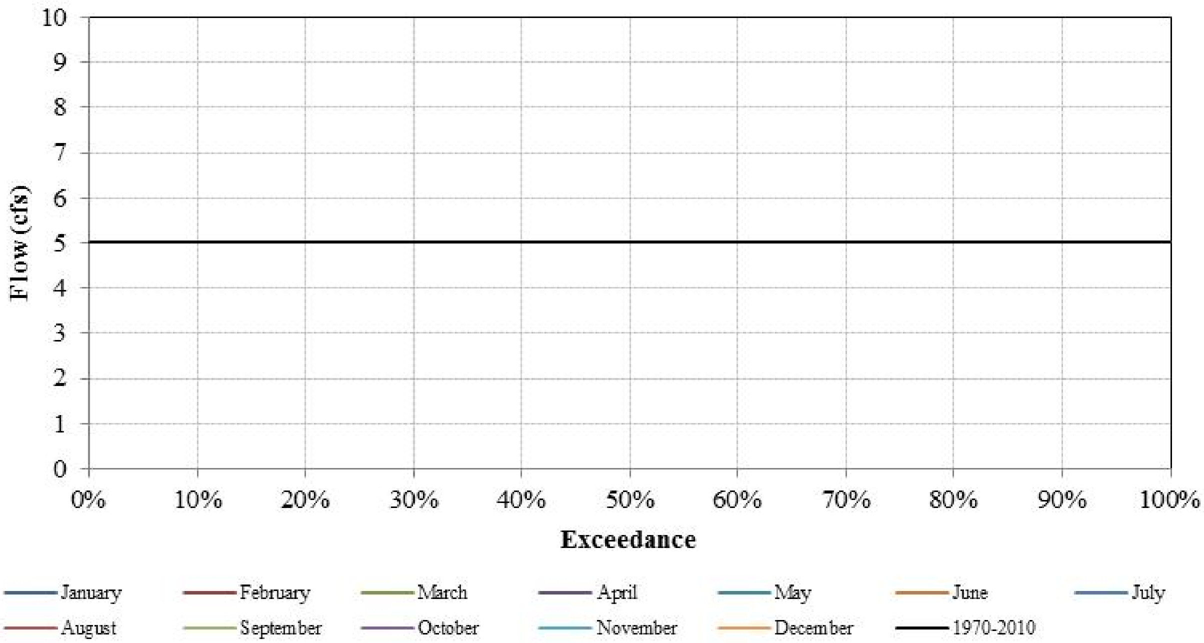

Figure 6.2-1. Modeled monthly flow duration curves for New Bullards Bar Minimum Flow Powerhouse for Water Years 1970 through 2010 under YCWA's No Action Alternative Operations Model run. All months have the same flow, so all monthly lines are under the black line

6.2.2.4 Powerhouse Capability Versus Head

New Bullards Bar Minimum Flow Powerhouse capability versus head is shown in Figure 6.2-2. The nameplate minimum- and maximum-operating heads for the New Bullards Bar Minimum Flow Powerhouse are 335 ft and 560 ft, respectively.

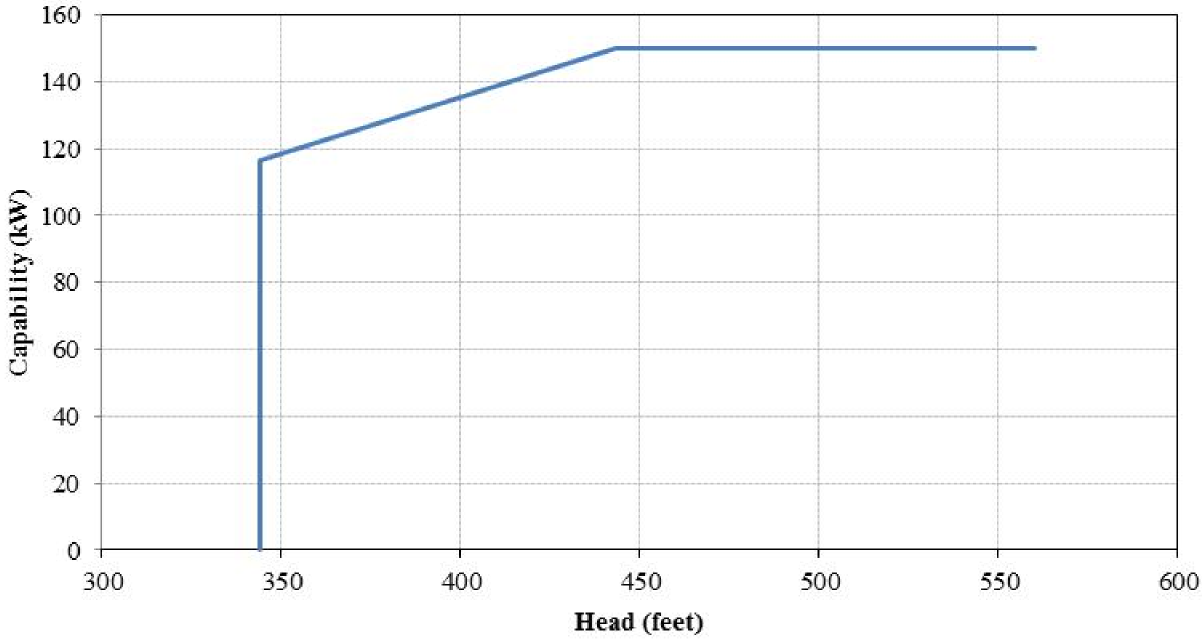

Figure 6.2-2. New Bullards Bar minimum flow powerhouse capability curve.

6.2.2.5 Tailwater Rating Curve

New Bullards Bar Minimum Flow Powerhouse is a Pelton turbine and is not dependent on tailwater elevation. The turbine centerline elevation for New Bullards Bar Minimum Flow Powerhouse is 1,391 ft.

6.2.2.6 Load Curves

Because New Bullards Bar Minimum Flow Powerhouse is a base-loaded plant without peaking capability, there is no diurnal or weekly load curve. There is no appreciable station service power usage.

6.2.2.7 Average Annual Energy Production

New Bullards Bar Minimum Flow Powerhouse generated an average of 1,280 MWh/yr from 1970 to 2010 under YCWA's No Action Alternative model run. The average annual plant factor for the powerhouse for this time period is 0.97 based on the annual generation divided by the plant generating capability (150 kW) times the number of hours per year. Annual gross generation and plant factors for the powerhouse are provided in Table 6.2-1.

Table 6.2-1. Modeled generation and plant factors for New Bullards Bar Minimum Flow Powerhouse under YCWA's No Action Alternative Operations Model run.

Water Year	Annual Generation (MWh)	Annual Generation (akW)	Plant Capability (kW)	Plant Factor
1970	1,288	147	150	0.98
1971	1,288	147	150	0.98

Table 6.2-1. (continued)

Water Year	Annual Generation (MWh)	Annual Generation (akW)	Plant Capability (kW)	Plant Factor
1972	1,291	147	150	0.98
1973	1,288	147	150	0.98
1974	1,288	147	150	0.98
1975	1,288	147	150	0.98
1976	1,291	147	150	0.98
1977	1,103	126	150	0.84
1978	1,191	136	150	0.91
1979	1,288	147	150	0.98
1980	1,291	147	150	0.98
1981	1,288	147	150	0.98
1982	1,288	147	150	0.98
1983	1,288	147	150	0.98
1984	1,291	147	150	0.98
1985	1,288	147	150	0.98
1986	1,288	147	150	0.98
1987	1,288	147	150	0.98
1988	1,274	145	150	0.97
1989	1,253	143	150	0.95
1990	1,288	147	150	0.98
1991	1,288	147	150	0.98
1992	1,291	147	150	0.98
1993	1,280	146	150	0.97
1994	1,288	147	150	0.98
1995	1,286	147	150	0.98
1996	1,291	147	150	0.98
1997	1,288	147	150	0.98
1998	1,288	147	150	0.98
1999	1,288	147	150	0.98
2000	1,291	147	150	0.98
2001	1,288	147	150	0.98
2002	1,279	146	150	0.97
2003	1,288	147	150	0.98
2004	1,291	147	150	0.98
2005	1,288	147	150	0.98
2006	1,288	147	150	0.98
2007	1,288	147	150	0.98
2008	1,291	147	150	0.98
2009	1,288	147	150	0.98
2010	1,288	147	150	0.98
Total	**52,480**	--	--	--
Minimum	**1,103**	**126**	--	**0.84**
Average	**1,280**	**146.0**	--	**0.97**
Median	**1,288**	**146.9**	--	**0.98**
Maximum	**1,291**	**147.3**	--	**0.98**

Key: akW = annual kilowatt; MWh = megawatt-hour

6.2.2.8 Minimum Flow Powerhouse Dependable Capacity

Dependable capacity at the New Bullards Bar Minimum Flow Powerhouse at the base of New Bullards Bar Dam is head limited. The New Bullards Bar Minimum Flow Powerhouse is used to meet a minimum required flow on the North Yuba River downstream of New Bullards Bar Dam.

The dependable capacity for the New Bullards Bar Minimum Flow Powerhouse is determined by evaluating the period with the lowest reservoir WSE. The minimum storage elevation that provides the minimum head for generation at the New Bullards Bar Minimum Flow Powerhouse occurs on December 13, 1977 for the No Action Alternative and is a reservoir storage of 160,977 ac-ft with a corresponding head of 297 ft. This defines the period used to determine the New Bullards Bar Minimum Flow Powerhouse's dependable capacity of 101 kW.

6.3 Narrows 2 Development

The Narrows 2 Development is located on the main stem of the Yuba River. The development includes one power tunnel and penstock (Narrows 2) and one powerhouse (Narrows 2). The Narrows 2 powerhouse is an indoor facility located at the base of the USACE's Englebright Dam.

6.3.1 Reservoir Operations

There are no Project reservoirs associated with the Narrows 2 Development.

6.3.2 Plant Operations – Narrows 2 Powerhouse

Narrows 2 Powerhouse is operated as a base loaded facility, with stable flows, as required by the Yuba Accord flow schedules seasonal irrigation demands and license terms for flow ramping and flow fluctuation.

6.3.2.1 Powerhouse Minimum, Maximum, and Mean Flows

Minimum-, maximum and mean-daily average flows based on YCWA's No Action Alternative model run for WYs 1970 through 2010, are 0 cfs, 1,683 cfs and 3,400 cfs, respectively.

6.3.2.2 Powerhouse Hydraulic Capacity

Narrows 2 Powerhouse Penstock is a 20-ft diameter, concrete lined tunnel in the upper 349-ft section, and is a 14-ft diameter, steel lined tunnel in the lower 368-ft section. The penstock has a maximum capacity of 3,400 cfs. Narrows 2 flow bypass is a valve and penstock branch off of the main Narrows 2 penstock that was added to the Project in 2008 to provide the capability to bypass flows of up to 3,000 cfs around the Narrows 2 Powerhouse during times of full powerhouse shutdowns. Narrows 2 Powerhouse consists of a vertical axis Francis turbine with a nameplate capacity of 46.7 MW at a head of 236 ft and flow of 3,400 cfs.

6.3.2.3 Powerhouse Flow Duration Curves

Annual and monthly flow duration curves for releases from Narrows 2 Powerhouse, based on YCWA's No Action Alternative model run for WYs 1970 through 2010, is provided in Figure 6.3-1. Under YCWA's new coordinated operations agreement with PG&E, no releases through the bypass are expected as part of normal operations. Accordingly, modeling of the No Action Alternative assumed there was no flow through the bypass.

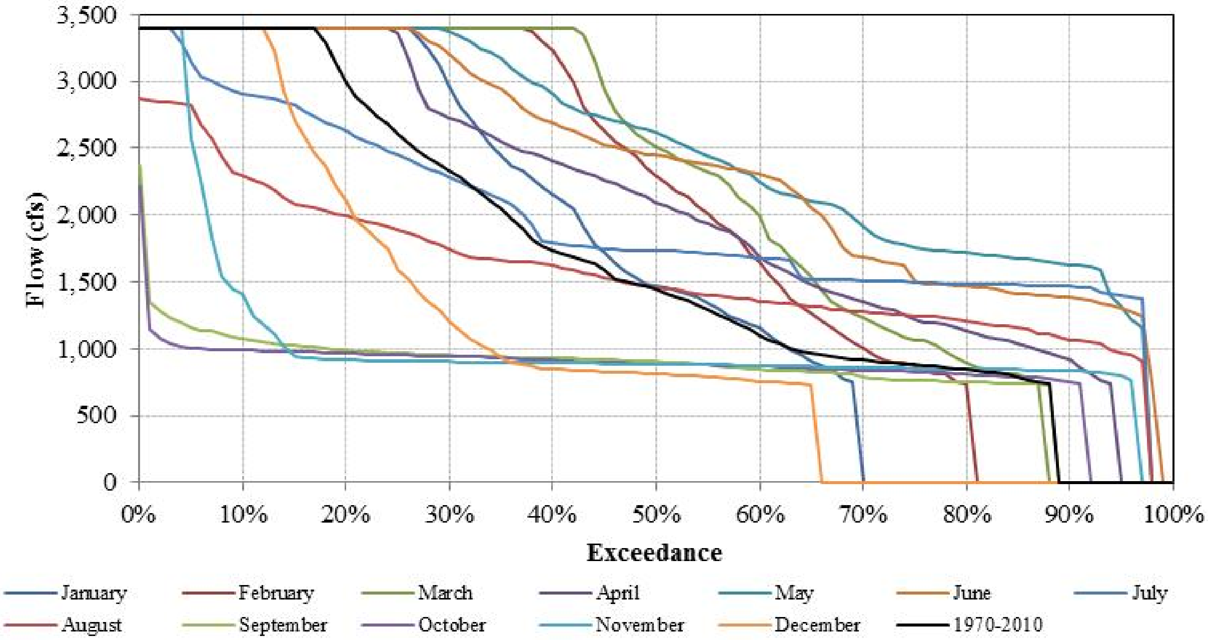

Figure 6.3-1. Modeled monthly flow duration curves for Narrows 2 Powerhouse for Water Years 1970 through 2010 under YCWA's No Action Alternative Operations Model run.

6.3.2.4 Powerhouse Capability Versus Head

Powerhouse capability versus head at full flow is shown in Figure 6.3-2. Minimum- and maximum-operating heads for Narrows 2 Powerhouse are 183 ft and 236 ft, respectively.

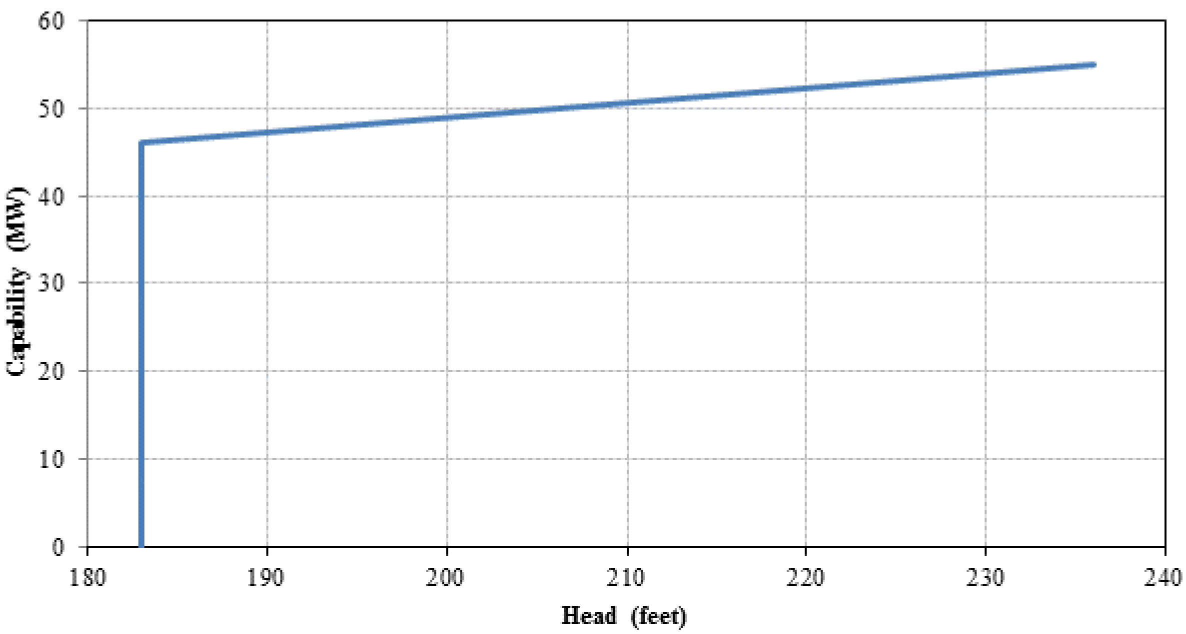

Figure 6.3-2. Narrows 2 Powerhouse capability curve.

6.3.2.5 Tailwater Rating Curve

The normal tailwater elevation for Narrows 2 Powerhouse is 287 ft. Tailwater elevation is a function of the combined release from Narrows 1 and Narrows 2 Powerhouses, and Englebright Reservoir spill. As such, a tailwater rating curve does not exist.

6.3.2.6 Load Curves

Because Narrows 2 Powerhouse is a base-loaded plant without peaking capability, there is no diurnal or weekly load curve.

6.3.2.7 Average Annual Energy Production

Narrows 2 Powerhouse generated an average of 225,301 MWh/yr from 1970 to 2010 under YCWA's No Action Alternative model run. The average annual plant factor for the powerhouse for this time period is 0.55 based on the annual generation divided by the plant generating capability (46.7 MW) times the number of hours per year. Annual gross generation and plant factors for the powerhouse are provided in Table 6.3-1.

Table 6.3-1. Modeled generation and plant factors for Narrows 2 Powerhouse under YCWA's No Action Alternative Operations Model run.

Water Year	Annual Generation (MWh)	Annual Generation (aMW)	Plant Capability (MW)	Plant Factor
1970	258,309	29.5	46.7	0.63
1971	317,173	36.2	46.7	0.77
1972	233,677	26.7	46.7	0.57
1973	284,830	32.5	46.7	0.70
1974	370,839	42.3	46.7	0.91
1975	270,482	30.9	46.7	0.66
1976	125,515	14.3	46.7	0.31
1977	17,801	2.0	46.7	0.04
1978	263,173	30.0	46.7	0.64
1979	208,097	23.7	46.7	0.51
1980	300,027	34.2	46.7	0.73
1981	150,484	17.2	46.7	0.37
1982	364,143	41.5	46.7	0.89
1983	382,403	43.6	46.7	0.93
1984	316,765	36.1	46.7	0.77
1985	178,371	20.3	46.7	0.44
1986	249,912	28.5	46.7	0.61
1987	104,767	12.0	46.7	0.26
1988	87,076	9.9	46.7	0.21
1989	196,787	22.4	46.7	0.48
1990	131,567	15.0	46.7	0.32
1991	118,666	13.5	46.7	0.29
1992	126,508	14.4	46.7	0.31
1993	288,978	33.0	46.7	0.71
1994	117,913	13.5	46.7	0.29
1995	325,792	37.2	46.7	0.80
1996	311,347	35.5	46.7	0.76
1997	282,512	32.2	46.7	0.69
1998	316,638	36.1	46.7	0.77

Table 6.3-1. (continued)

Water Year	Annual Generation (MWh)	Annual Generation (aMW)	Plant Capability (MW)	Plant Factor
1999	304,771	34.8	46.7	0.74
2000	247,624	28.2	46.7	0.60
2001	105,323	12.0	46.7	0.26
2002	166,733	19.0	46.7	0.41
2003	268,539	30.6	46.7	0.66
2004	232,081	26.5	46.7	0.57
2005	220,355	25.1	46.7	0.54
2006	330,403	37.7	46.7	0.81
2007	169,127	19.3	46.7	0.41
2008	104,919	12.0	46.7	0.26
2009	168,259	19.2	46.7	0.41
2010	218,670	24.9	46.7	0.53
Total	**9,237,357**	--	--	--
Minimum	**17,801**	**2**	--	**0.04**
Average	**225,301**	**25.7**	--	**0.55**
Median	**233,677**	**26.7**	--	**0.57**
Maximum	**382,403**	**43.6**	--	**0.93**

Key: aMW = annual megawatt; MWh = megawatt-hour

6.3.2.8 Narrows 2 Powerhouse Dependable Capacity

The Narrows 2 Powerhouse dependable capacity is flow limited. Historically, there were no releases through the Narrows 2 Powerhouse for most of 1977; all releases from Englebright Reservoir were made through PG&E's Narrows 1 Powerhouse during that time. Accordingly, the lack of releases through the Narrows 2 Powerhouse defines the critical streamflow for determining the dependable capacity for the powerhouse. The dependable capacity for the Narrows 2 Powerhouse under the No Action Alternative is 0 kW.

6.3.2.9 Narrows 2 – Flow Transitions[12]

YCWA and PG&E coordinate releases from the Project's Narrows 2 Powerhouse, Partial Bypass and Full Bypass and PG&E's Narrows Project in accordance with the streamflow requirements in Article 33 in the existing license for the Yuba River Development Project. Compliance with Article 33 is measured at the Smartsville and Marysville gages.

YCWA records flow at 15-minute intervals through the Narrows 2 Penstock using an acoustic velocity meter attached to the penstock upstream of the Full Bypass/Narrows 2 Powerhouse and Partial Bypass bifurcation, and retains flow data in its HYDSTRA database. Flow in the penstock downstream of the bifurcation is not directly measured. Rather, YCWA estimates flow through the Narrows 2 Powerhouse, Partial Bypass and Full Bypass based on: 1) recorded flow at the acoustic velocity; 2) operator logs of when the Full and Partial bypasses are opened and closed; and 3) records on Narrows 2 Powerhouse generation. Narrows 1 Powerhouse flow data

[12] For the purpose of this Exhibit B, a "transition" or "change-over" refers to decreasing or increasing the discharge from one facility in coordination with decreasing or increasing flows in another facility. A transition may include a shutdown of one facility.

are available from PG&E (YCWA does not measure flow through the Narrows 1 Powerhouse). In addition, YCWA obtains Smartsville flow data from PG&E.

6.3.2.9.1 Flow Transition Among Narrows 2 Development Facilities

The transition between Narrows 2 Powerhouse and the Full Bypass can be performed in response to an emergency when a forced outage occurs or during normal operations as part of shutdown of the powerhouse. The following is a description of YCWA's standard operational practices for flow transitions. While the facilities have been operated differently on occasion and may be operated differently in the future, only normal operations are described below.

If the Narrows 2 Powerhouse is operating and a Narrows 2 Powerhouse shutdown occurs because of a forced outage (i.e., unit trip), then the powerhouse turbine wicket gates are closed automatically and there is an automatic opening of the Full Bypass so that flow through the bypass is the same as the flow was though the powerhouse before the outage. The opening is started after a 3-minute safety delay during which time a horn is sounded at the exterior of the Full Bypass to warn persons in the area of an imminent release through the Full Bypass. This operation is automated and does not require any manual actions.[13] YCWA estimates the time from when a Narrows 2 Powerhouse forced outage occurs to the time the Full Bypass is fully opened to the desired level typically is about 5 minutes, depending on the flow level (i.e., 2 minutes after the warning horn stops).

Once a Narrows 2 Powerhouse outage is cleared (i.e., the powerhouse is ready to resume operation), the Narrows 2 Powerhouse unit is synchronized to the electrical grid, then the Full Bypass is closed either remotely (i.e., by PG&E from its Wise, California, Switching Center or by YCWA through its Supervisory Control And Data Acquisition [SCADA] system) or manually on-site in increments synchronized with increased load and resulting releases through the Narrows 2 Powerhouse.

If the Narrows 2 Powerhouse is operating and a planned powerhouse shutdown occurs, the transition from the Narrows 2 Powerhouse to the Full Bypass occurs as described above. This can be done either remotely by YCWA or PG&E, or manually on-site. This transition usually takes longer (i.e., 10 to 15 minutes) for a planned outage because there is no emergency and steady instream flows are maintained.

Since installation of the Full Bypass in January 2007, the Partial Bypass typically has been used only for a few specific reasons, which include: 1) maintenance on the Full Bypass when generation is not possible; 2) obtaining safe foot access upstream of the Full Bypass when generation is not possible; and 3) supplemental flow releases at lower levels than the long-term reliability operating ranges of the Full Bypass or Narrows 2 Powerhouse.

[13] In some cases, such as a momentary unit trip caused by a transmission line outage, YCWA's operators are able to fully restore flow through Narrows 2 Powerhouse before the automatic system begins flow through the Full Bypass.

Except for flow transitions, YCWA does not operate the Full or Partial bypasses when Narrows 2 Powerhouse is operating (i.e., water is passing through the turbine and generating electricity) and, except in very rare instances, does not operate both bypasses at the same time.

6.3.2.9.2 Transition Between Narrows 2 Powerhouse and Narrows 1 Powerhouse

PG&E, in coordination with YCWA, schedules the amounts of water that will flow through the Narrows 1 and 2 powerhouses. The flows can be adjusted remotely by YCWA through its SCADA system or by PG&E from its Wise Switching Center, or manually on-site. Dispatching decisions are based on a number of factors, which could potentially change on an hourly or daily basis. These include: minimum flow requirements;[14] water demand; conditions in the California electricity market; capacity and condition of the Narrows 2 and Narrows 1 powerhouse turbines, generators and bypasses; transmission line conditions; and a desire to minimize Englebright Reservoir and Yuba River elevation fluctuations.

The following is a description of YCWA's and PG&E's standard operational practices for flow transitions between the Narrows 1 and Narrows 2 powerhouses. While the facilities have been operated differently on occasion and may be operated differently in the future, only normal operations are described below.

If the Narrows 2 Powerhouse is operating, the Narrows 1 Powerhouse is not operating, and releases below the dam are to be reduced to a range where PG&E can begin to generate electricity and release the majority of the required flow at the Narrows 1 Powerhouse, then YCWA and PG&E synchronize the Narrows 1 Powerhouse unit to the electric grid, while reducing draft from Narrows 2 Powerhouse to compensate for increased releases from the Narrows 1 Powerhouse. As the Narrows 1 Powerhouse load is increased, releases from the Narrows 2 Powerhouse are decreased and the Full Bypass is opened to the flow rate, if any, that is needed to supplement the Narrows 1 Powerhouse release. If the required supplement is less than approximately 230 cfs, then the Partial Bypass is used instead of the Full Bypass. YCWA and PG&E estimate that this transition can take between 10 and 30 minutes to reach the full flow of the Narrows 1 Powerhouse.

If the Narrows 1 Powerhouse is operating, the Narrows 2 Powerhouse is not operating, and releases below the dam are to be increased, then the transition of releases from the Narrows 1 Powerhouse to the Narrows 2 Powerhouse occurs in reverse of the process described in the preceding paragraph.

The above changes can be made remotely by PG&E from its Wise Switching Center or by YCWA through its SCADA system, or manually on-site.

[14] The flow requirements in license 1404 and 2246 are not the same. Article 33 in license 2246 contains flow requirements in the Yuba River downstream of the Narrows 2 facilities and compliance with these requirements are monitored at the Smartsville and Marysville gages. Article 402 in license 1403 contains flow requirements for PG&E's Narrows Project, and the compliance location is the Smartsville Gage.

YCWA and PG&E have negotiated a new agreement for the coordinated operations of the Narrows 1 and 2 powerhouses for the period beginning May 1, 2016. The new agreement does not make any major changes in the coordinated operations of the two powerhouses as described above. A minor change is that in when the required release below Englebright Dam is in the range of the full capacity of the Narrows 1 Powerhouse (about 730 cfs) to 900 cfs, rather than releasing at the full capacity of Narrows 1 Powerhouse and releasing the remainder of the flow through the Partial or Full bypass, the required downstream release is in this range the full amount of flow will be released from the Narrows 2 Powerhouse and no flow will be released from the Narrows 1 Powerhouse. This change eliminates bypasses of flow within this flow range.

6.3.2.9.3 Typical Operations of Narrows 2 Facilities

Discharge can occur from the Narrows 1 and Narrows 2 powerhouses based on: water demand; market conditions; capacity and condition of the turbines, generators and bypasses; transmission line conditions; and a desire to maintain Englebright Reservoir elevations within a limited range and Yuba River flow fluctuations for the protection of fisheries and other reasons. Table 6.3-2 provides a summary of the typical flow ranges through the Narrows 2 Powerhouse and the Narrows 1 Powerhouse. There are a great many combinations of potential conditions that could require different operating conditions than those indicated in Table 6.3-2, but a complete description of all of them would be confusing and difficult to explain. YCWA needs to retain flexibility of operations, based on experience and familiarity with the equipment, safety, and protection of environmental resources.

Table 6.3-2. Typical distribution of flows under normal operations (i.e., excluding brief transition periods) among Narrows 2 Powerhouse (generation only), Partial Bypass, Full Bypass and Narrows 1 Powerhouse.

Range of Flow Releases to Yuba River (cfs)	Narrows 2 Powerhouse Release (generation)[1] (cfs)	Partial Bypass Release[1] (cfs)	Full Bypass Release[1] (cfs)	Narrows 1 Powerhouse Release[2] (cfs)
Up to 730	0			150 - 730
730 – 2,800	730-2,800	Typically not used	Used When Narrows 2 Powerhouse not available	0
2,800-4,130	2,070-3,400	Typically not used	Used When Narrows 2 Powerhouse not available	Up to 730
> 4,130	3,400	Typically not used	0	Up to 730

[1] The typical operating flow ranges of Narrows 2 facilities are limited by long-term reliability considerations, such as vibration and cavitation of the runner; and are as follows: the Narrows 2 Powerhouse between 700 and 3,400 cfs (with physical capacity to release as low as 600 cfs); the Partial Bypass between 0 and 230 cfs (with physical capacity to release as high as 650 cfs); and the Full Bypass between 150 and 3,000 cfs.

[2] The use of the Narrows 1 Powerhouse in this range is dependent on a number of economic and generator factors and can vary from no flow to the maximum Narrows 1 Powerhouse generation capacity. In this range, Narrows 2 Powerhouse alone or Narrows 1 Powerhouse with Narrows 2 Powerhouse may operate.

Figure 6.3-3 through Figure 6.3-12 show for each WY from 2007 through 2016, actual operations and information consisting of estimated 15-minute discharges from Narrows 1 Powerhouse, Narrows 2 Powerhouse, Partial Bypass and Full Bypass as well as flow at Smartsville Gage and spill over Englebright Dam. In these figures, Narrows 1 Powerhouse and Smartsville gage data are from PG&E, and the Narrows 2 Powerhouse, Partial Bypass and Full Bypass data are based on flow data in the Narrows 2 Penstock acoustic velocity meter and

YCWA operators' log books. Spills over Englebright Dam are based on measured Englebright Reservoir water surface elevation and PG&E's relationship for spills and water surface elevation.

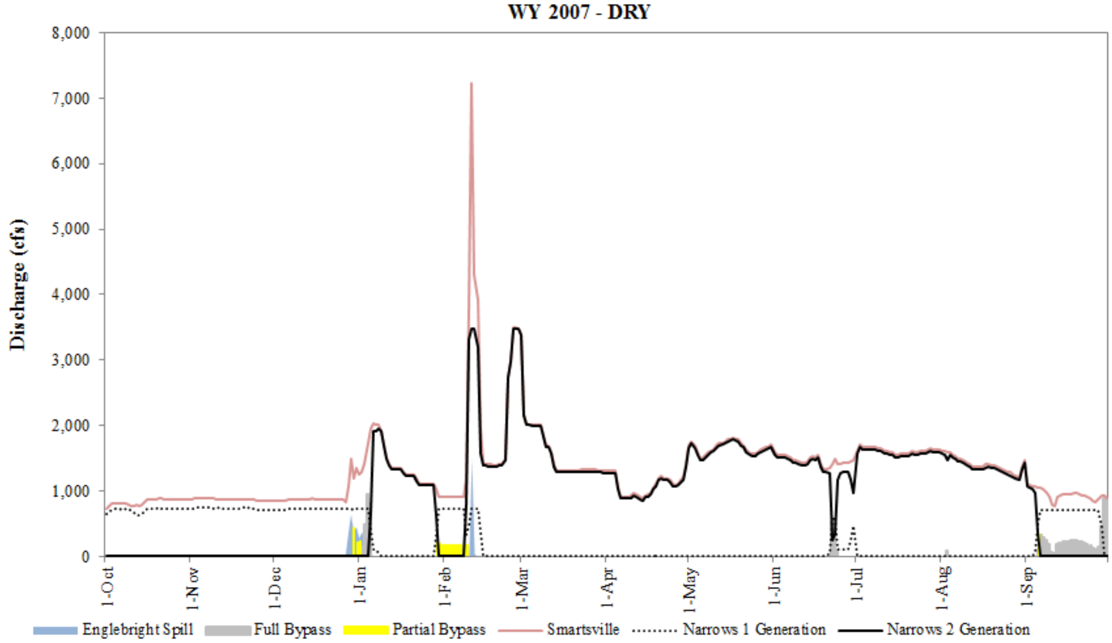

Figure 6.3-3. Historical mean daily discharge from Narrows 1 Powerhouse, Narrows 2 facilities, the Smartsville Gage, and Englebright Dam spill in Water Year 2007. The Narrows 2 Powerhouse was shut down during the period of October 1 through December 30, 2006 for the installation of the Narrows 2 Full Bypass. Siphons over Englebright Dam were used to provide flow to the Yuba River in addition to Narrows 1 Powerhouse releases. Accordingly, there is a difference between the flow from the Narrows 1 Powerhouse and Smartsville gage.

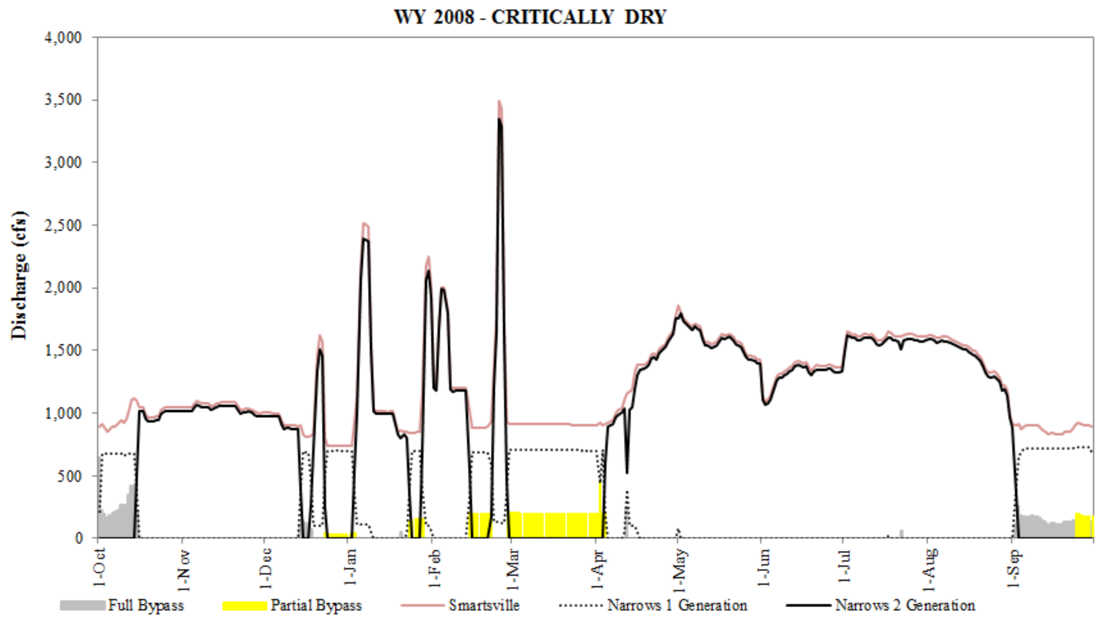

Figure 6.3-4. Historical mean daily discharge from Narrows 1 Powerhouse, Narrows 2 facilities, the Smartsville Gage, and Englebright Dam spill in Water Year 2008.

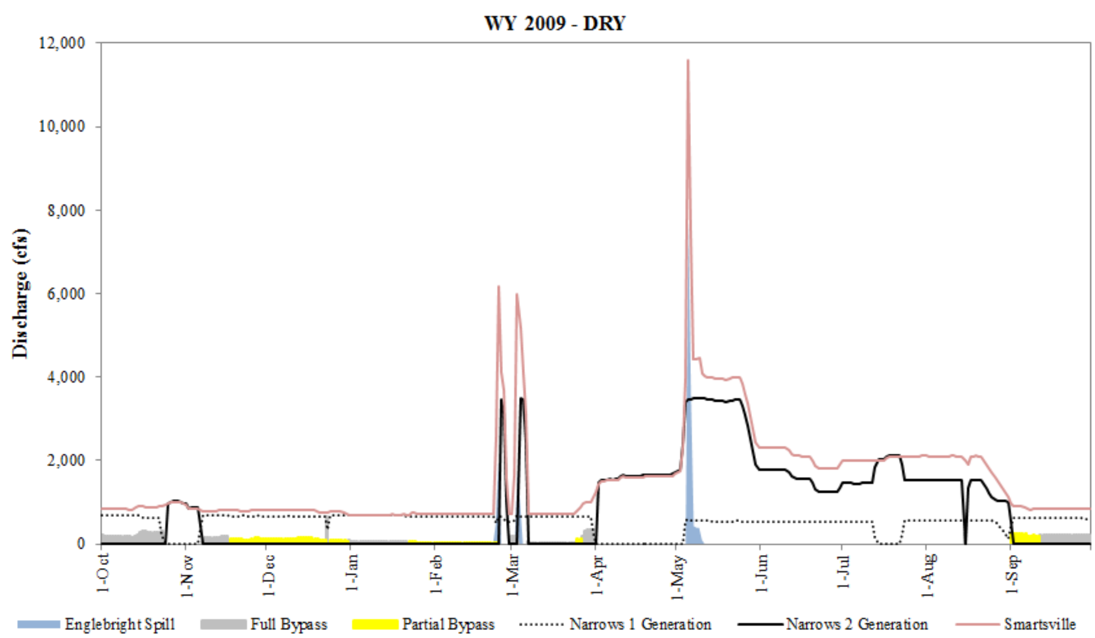

Figure 6.3-5. Historical mean daily discharge from Narrows 1 Powerhouse, Narrows 2 facilities, the Smartsville Gage, and Englebright Dam spill in Water Year 2009.

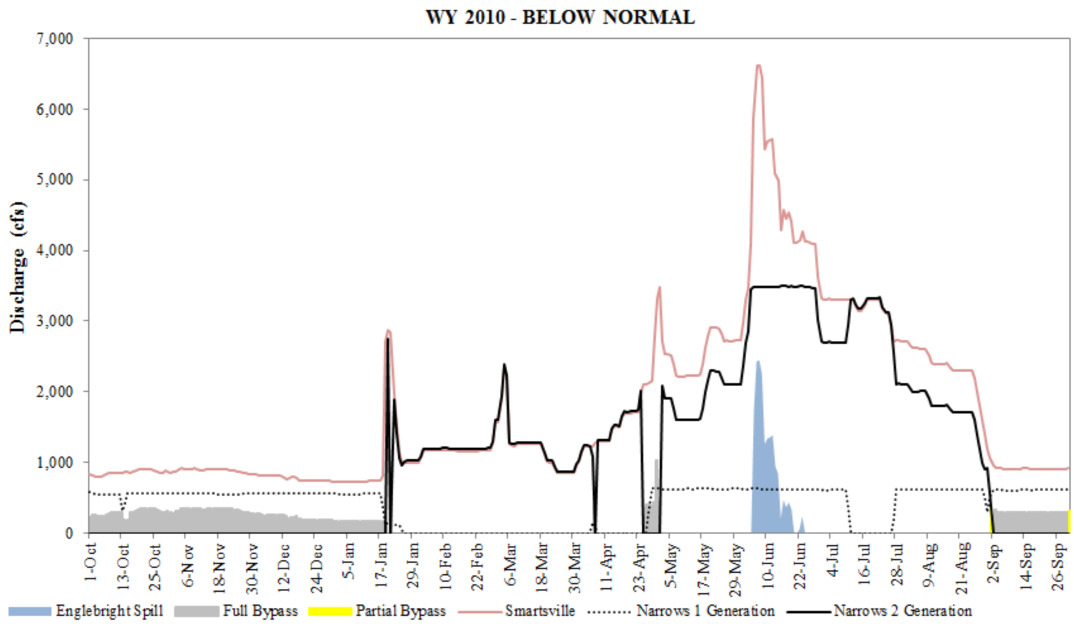

Figure 6.3-6. Historical mean daily discharge from Narrows 1 Powerhouse, Narrows 2 facilities, the Smartsville Gage, and Englebright Dam spill in Water Year 2010.

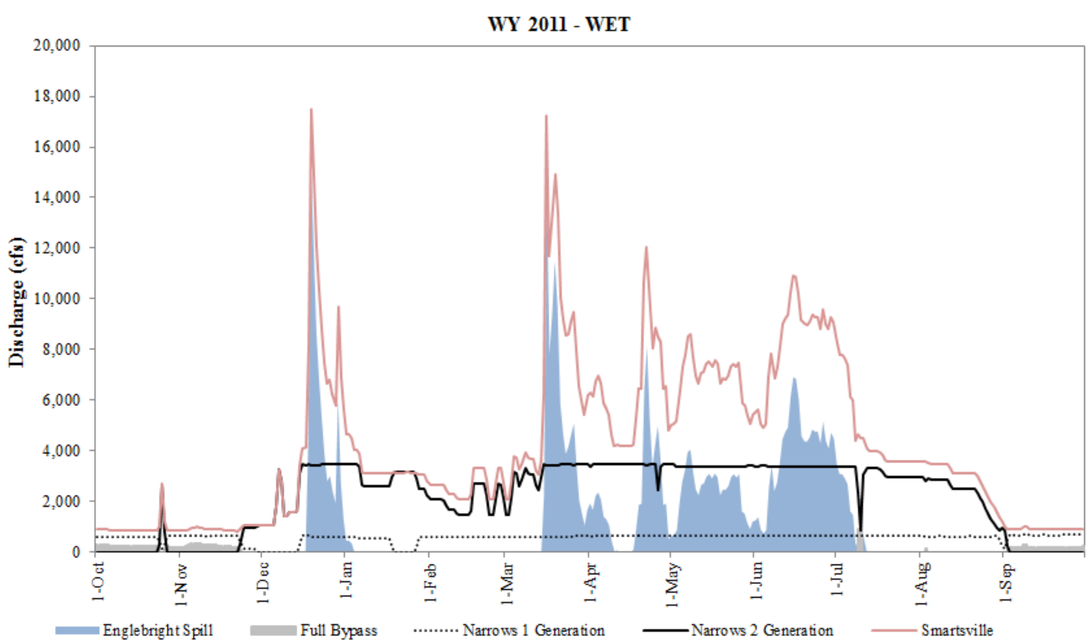

Figure 6.3-7. Historical mean daily discharge from Narrows 1 Powerhouse, Narrows 2 facilities, the Smartsville Gage, and Englebright Dam spill in Water Year 2011.

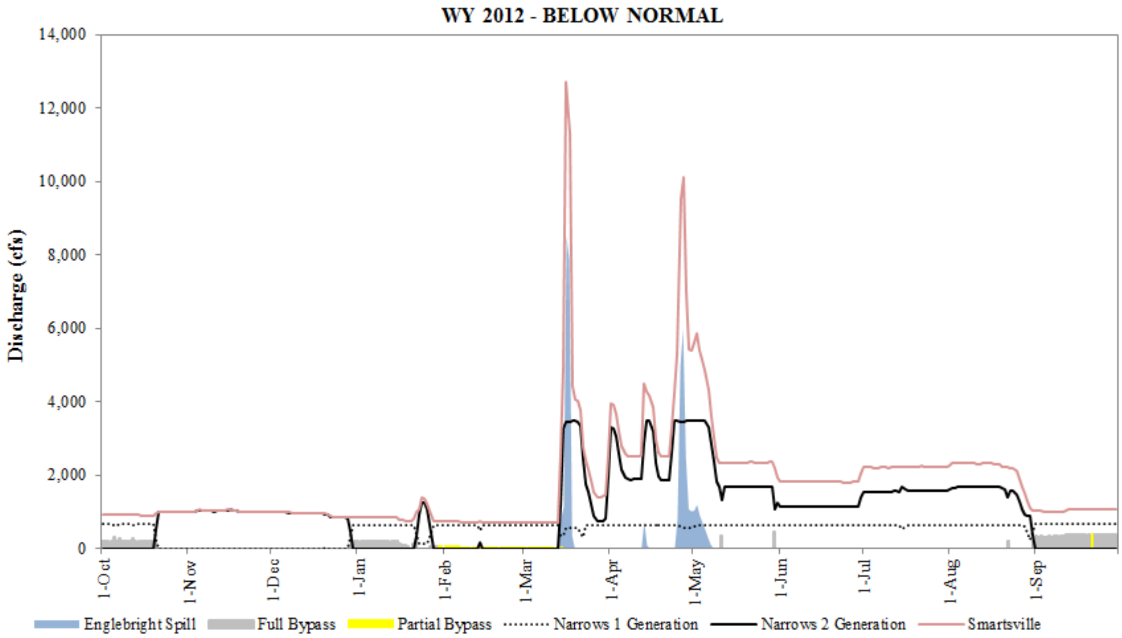

Figure 6.3-8. Historical mean daily discharge from Narrows 1 Powerhouse, Narrows 2 facilities, the Smartsville Gage, and Englebright Dam spill in Water Year 2012.

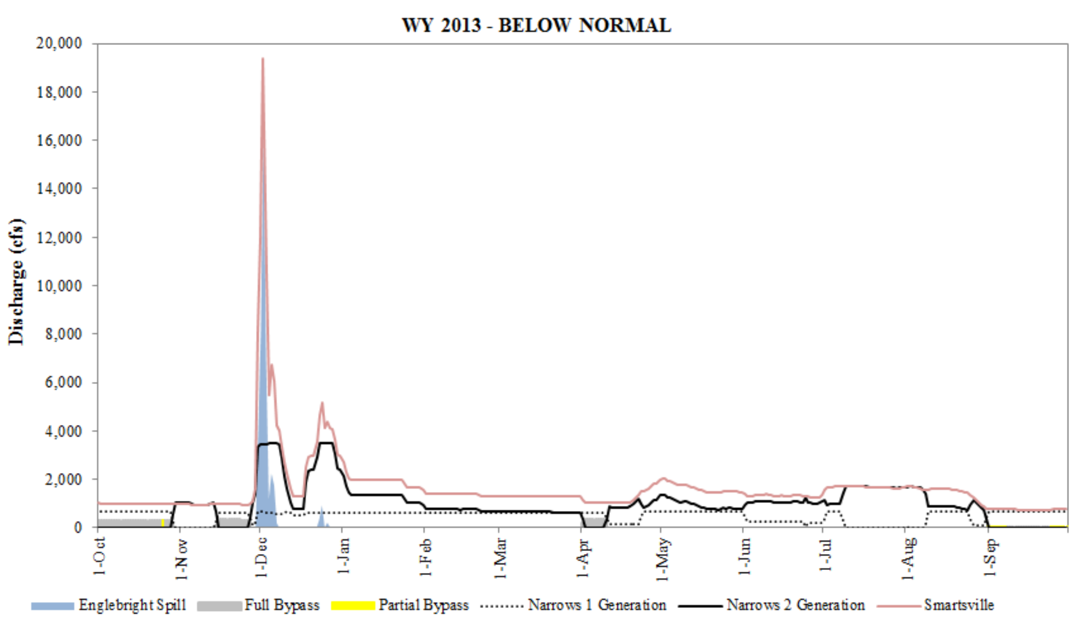

Figure 6.3-9. Historical mean daily discharge from Narrows 1 Powerhouse, Narrows 2 facilities, the Smartsville Gage, and Englebright Dam spill in Water Year 2013.

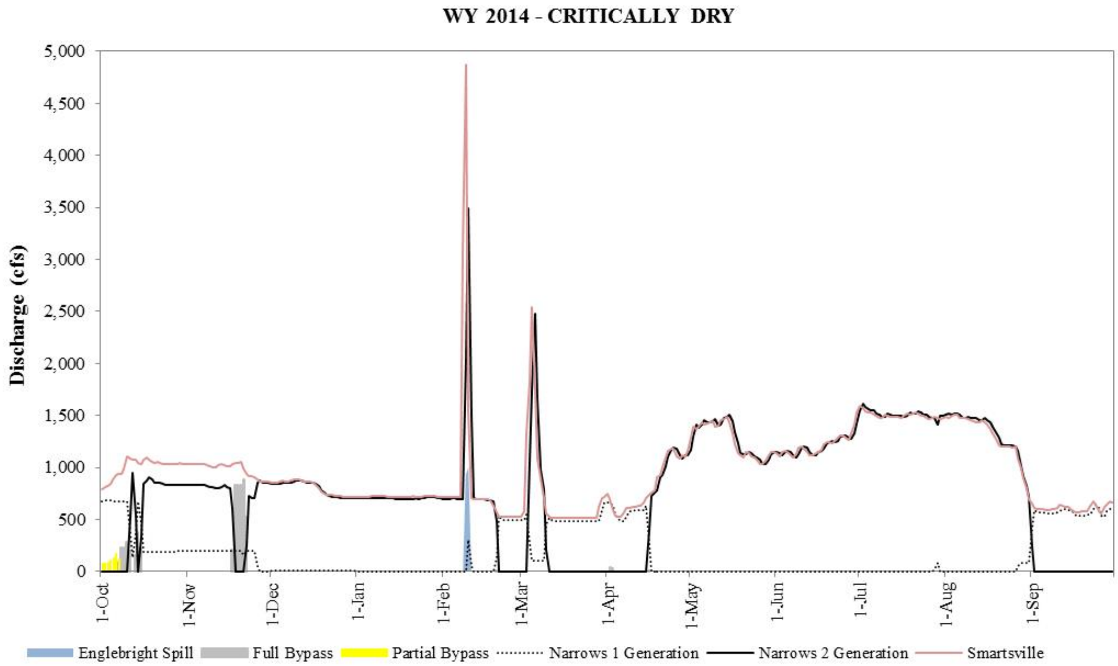

Figure 6.3-10. Historical mean daily discharge from Narrows 1 Powerhouse, Narrows 2 facilities, the Smartsville Gage, and Englebright Dam spill in Water Year 2014.

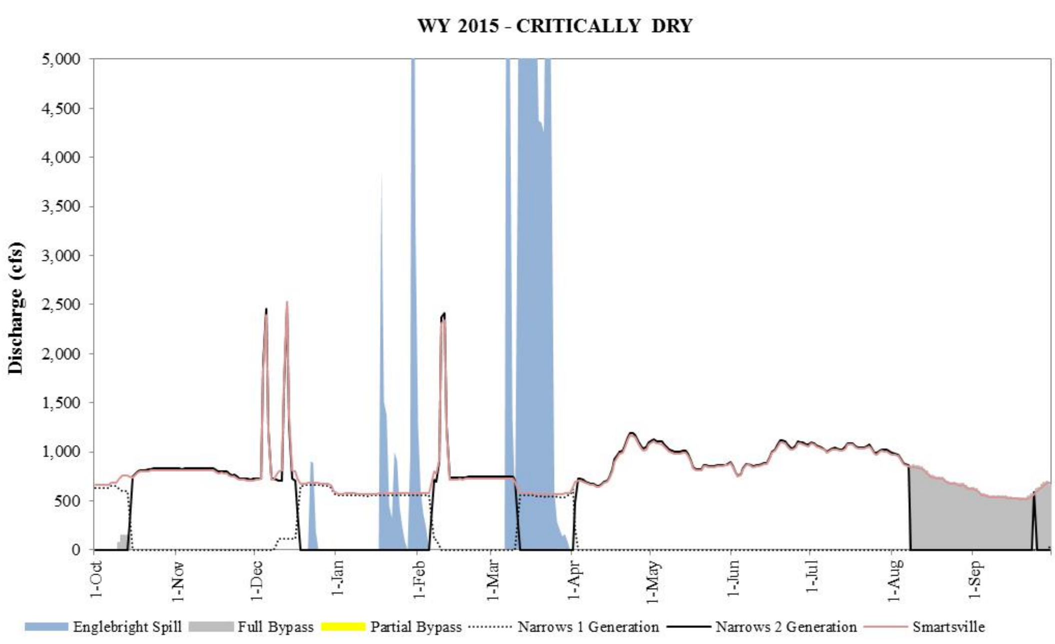

Figure 6.3-11. Historical mean daily discharge from Narrows 1 Powerhouse, Narrows 2 facilities, the Smartsville Gage, and Englebright Dam spill in Water Year 2015.

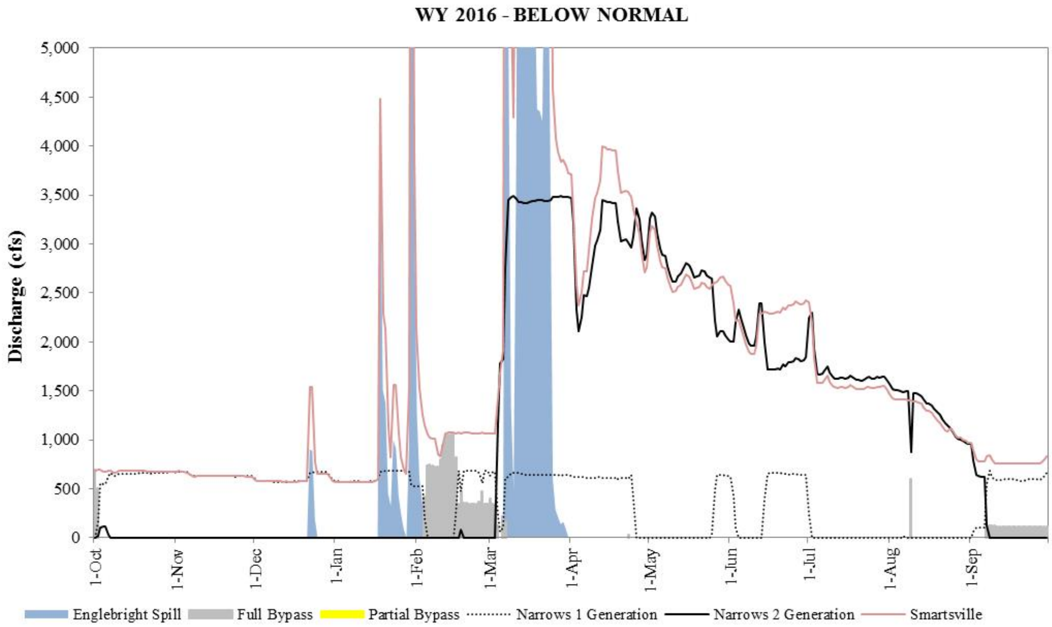

Figure 6.3-12. Historical mean daily discharge from Narrows 1 Powerhouse, Narrows 2 facilities, the Smartsville Gage, and Englebright Dam spill in Water Year 2016.

7.0 YCWA's Proposed Project Operations by Development

Operation of YCWA's reservoirs, dams, and powerhouses under YCWA's proposed Project are presented below for the three Project developments: New Colgate, New Bullards Bar Minimum Flow and Narrows 2.

YCWA has simulated operations of the proposed Project using the same modeling tools used for the No Action Alternative. Accordingly, many of the facility features are identical to those described in Section 6.0. Differences in operations from the No Action Alterative are described here, as are the model output resulting from simulated operations according to the proposed Project.

7.1 Changes to Operating Constraints

7.1.1 Changes to Proposed Facilities

Exhibit A of YCWA's Amended FLA describes YCWA's existing and proposed Project facilities. In summary, YCWA proposes to maintain all existing facilities with some minor modifications (e.g., increased capacities of outlets to accommodate proposed increased minimum flows), and to add two new Project facilities: 1) the New Bullards Bar Dam Auxiliary Flood Control Outlet; and 2) the New Colgate Powerhouse Tailwater Depression System (TDS). A discussion about the anticipated operations of each of these and how they would affect existing operations is provided below under the appropriate Project Development. Refer to Exhibit A for a detailed description of the new facilities.

7.1.2 Changes to Conditions in the FERC license

YCWA developed proposed conditions, including associated implementation plans, for the new licenses in collaboration with Relicensing Participants. Table 7.1-1 presents a comprehensive list of YCWA's proposed Condition and YCWA's understanding of agreement on each of the 41 conditions proposed by YCWA in Exhibit E, Appendix E2, which includes the full text of each condition, in this Amended FLA.

Table 7.1-1. List of YCWA's proposed conditions and the Relicensing Participants that YCWA understands agree with YCWA's proposed Condition. A green shaded row indicates a condition that YCWA and the Forest Service reached tentative agreement on as a FPA § 4(e) potential condition. A yellow shaded row indicates a condition that YCWA and Cal Fish and Wildlife and/or USFWS reached tentative agreement on as a FPA § 10(j) potential recommendation. A white shaded row indicates a condition that has not been collaboratively agreed to between YCWA and agencies.

YCWA's Proposed Condition			YCWA's Understanding of Relicensing Participants That Agree With YCWA's Proposed Condition[1]						
Designation in This Amended FLA	**Replaces YCWA Proposed Condition with This Designation in YCWA's 2014 FLA[2]**	**Name**	**FS**	**FWS**	**CDFW**	**SYRCL**	**FWN**	**AW**	**SC**
GENERAL									
GEN1[3]	GEN1 & TE3	*Organize Ecological Group and Host Meetings*	X	X	X		X	X	
GEN2	GEN2	*Annual Review of Special-Status Species Lists and Assessment of New Species on NFS Lands*	X				X		
GEN3[3]	GEN3	*Provide Environmental Training to Employees*	X	X	X		X		
GEN4	GEN4	*Develop and Implement a Coordinated Operations Plan to Assure Licensee's Compliance with the New License for the Yuba River Development Project*	X	X	X		X		
GEN5	--[4]	*Special-Status Species on NFS Lands*	X				X		
GEN6	--	*Review of Improvements on NFS Lands*	X				X		
GEOLOGY AND SOILS									
GS1[3, 5]	GS1	*Implement Erosion and Sediment Control Plan*	X		X		X		
GS2[5]	GS2	*Implement Our House and Log Cabin Diversion Dams Sediment Management Plan*	X	X	X		X		
GS3[5]	GS3 & GS4	*Implement Our House and Log Cabin Diversion Dams and New Bullards Bar Reservoir Woody Material Management Plan*	X	X	X		X		
WATER RESOURCES									
WR1[3, 5]	WR1	*Implement Hazardous Materials Management Plan*	X		X		X		

Table 7.1-1. (continued)

YCWA's Proposed Condition			YCWA's Understanding of Relicensing Participants That Agree With YCWA's Proposed Condition[1]						
Designation in This Amended FLA	Replaces YCWA Proposed Condition with This Designation in YCWA's 2014 FLA[2]	Name	FS	FWS	CDFW	SYRCL	FWN	AW	SC
WATER RESOURCES (cont'd)									
WR2	WR2	*Determine Water Year Types for Conditions Pertaining to Our House Diversion Dam, Log Cabin Diversion Dam and New Bullards Bar Dam*	X	X	X		X		
WR3	WR3	*Determine Water Year Types for Conditions Pertaining to Narrows 2 Powerhouse and Narrows 2 Full Bypass*							
WR4[5]	WR4	*Implement Streamflow and Reservoir Level Compliance Monitoring Plan*	X	X	X		X		
WR5	WR5	*Maintain New Bullards Bar Reservoir Minimum Pool*							
WR6	WR6	*Operate New Bullards Bar Reservoir for Flood Control*							
WR7[5]	TE1	*Implement Water Temperature Monitoring Plan*	X	X	X		X	X	
WR8[5]	--	*Implement Water Quality Monitoring Plan*	X	X	X		X	X	
WR9[5]	--	*Implement Drought Management Plan*							
AQUATIC RESOURCES									
AR1	AR1, in part	*Maintain Minimum Streamflows Below Our House Diversion Dam and Log Cabin Diversion Dam*	X		X		X		
AR2	AR2	*Control Project Spills at Our House Diversion Dam*	X	X	X	X	X	X	
AR3	AR3	*Maintain Minimum Streamflows at Narrows 2 Powerhouse and Narrows 2 Full Bypass*							
AR4	AR4	*Control Project Spills at New Bullards Bar Dam*	X		X		X		
AR5[5]	AR5	*Implement Aquatic Invasive Species Management Plan*	X	X	X		X		
AR6[5]	AR6	Implement New Bullards Bar Reservoir Fish Stocking Plan	X		X		X		
AR7[5]	AR7	*Implement Upper Yuba River Aquatic Monitoring Plan*	X				X		
AR8[5]	TE2	*Implement Lower Yuba River Aquatic Monitoring Plan*	X	X	X		X		
AR9	TE4	*Control Project Ramping and Flow Fluctuations Downstream of Englebright Dam*							
AR10	AR1, in part	*Maintain Minimum Streamflow Below New Bullards Bar Dam*							
AR11	--	*Periodically Close Lohman Ridge Diversion Tunnel*	X				X		
AR12	--	*Control Project Spills at Log Cabin Diversion Dam*	X	X	X	X	X	X	
TERRESTRIAL RESOURCES									
TR1[5]	TR1	*Implement Integrated Vegetation Management Plan*	X		X		X		
TR2[5]	TR2	*Implement Bald Eagle and American Peregrine Falcon Management Plan*	X	X	X		X		

Table 7.1-1. (continued)

YCWA's Proposed Condition			YCWA's Understanding of Relicensing Participants That Agree With YCWA's Proposed Condition[1]						
Designation in This Amended FLA	**Replaces YCWA Proposed Condition with This Designation in YCWA's 2014 FLA[2]**	**Name**	**FS**	**FWS**	**CDFW**	**SYRCL**	**FWN**	**AW**	**SC**
TERRESTRIAL RESOURCES (cont'd)									
TR3[5]	TR3	*Implement Ringtail Management Plan*	X	X	X		X		
TR4[5]	TR4	*Implement Bat Management Plan*	X	X	X		X		
RECREATIONAL RESOURCES									
RR1[5]	RR1	*Implement Recreation Facilities Plan*	X						
RR2	RR2	*Provide Recreation Flow Information*	X		X		X	X	
RR3	--	*Provide Whitewater Boating Below Our House Diversion Dam*	X	X	X		X		X
LAND USE									
LU1[5]	LU1	*Implement Transportation System Management Plan*	X	X	X		X		
LU2[5]	LU2	*Implement Fire Prevention and Response Plan*	X		X		X		
CULTURAL RESOURCES									
CR1[5]	CR1	*Implement Historic Properties Management Plan*	X				X		
AESTHETIC RESOURCES									
VR1[3, 5]	VR1	*Implement Visual Resource Management Plan*	X	X	X		X		
		Subtotal by Relicensing Participant	*34*	*19*	*27*	*2*	*33*	*6*	*1*
Subtotal of Tentatively Agreed to FPA § 4(e) Potential Conditions			*29 (17 with an implementation plan)*						
Subtotal of Tentatively Agreed to FPA § 10(j) Potential Recommendations			*5 (3 with an implementation plan)*						
Other YCWA Proposed Conditions			*7 (1 with an implementation plan)*						
Total			**41 (21 with an implementation plan)**						

[1] An "X" indicates those parties that YCWA understands agree with YCWA's proposed Conditions in this Amended FLA. One should not infer that if an "X" is not in the cell, the Relicensing Participant disagrees with the condition.
[2] The designation corresponds to the designation of a similar condition proposed by YCWA in its April 2014 FLA, which is replaced by the YCWA proposed condition in this Amended FLA.
[3] YCWA understands the Forest Service will use this FPA § 4(e) potential condition instead of the Forest Service's corresponding FPA § 4(e) "standard" administrative condition.
[4] A double dash indicates a YCWA proposed Condition in this Amended FLA that does not have a corresponding YCWA proposed condition in YCWA's April 2014 FLA.
[5] This proposed Condition includes a detailed implementation plan.

In particular, 12 of the above YCWA proposed Conditions would modify flow requirements in the existing license and, thereby, affect future Project operations. Each of these 12 proposed conditions is summarized below.

7.1.2.1 Water Year Types for Conditions Pertaining to New Bullards Bar Dam, Our House Diversion Dam, and Log Cabin Diversion Dam (YCWA's Proposed Condition WR2)

YCWA's Proposed Condition WR2 includes the definition of a new hydrologic index, the "Smartsville Hydrological Index," and associated WY types that are used to determine minimum required flows on the North Yuba River downstream of New Bullards Bar Dam, the Middle Yuba River downstream of Our House Diversion Dam, and on Oregon Creek downstream of

Log Cabin Dam These hydrologic year types are defined by published forecasts of annual unimpaired Yuba River flow near Smartsville and computed unimpaired flows for previous months. DWR publishes forecasts of annual volumes of unimpaired Yuba River flow near Smartsville in its Bulletin 120, Water Conditions in California, every year in early February, March, April and May. After the end of the WY (i.e., beginning of October), YCWA will use the actual annual volume of unimpaired Yuba River flow near Smartsville for the previous WY to determine the WY type used until the next forecast is released (i.e., in early February). Table 7.1-2 shows the Smartsville Hydrological Index thresholds and associated WY types.

Table 7.1-2. Smartsville hydrological index Water Year types and associated thresholds.

Water Year Type	Forecast of Total Unimpaired Runoff in the Yuba River at Smartsville in Thousand Acre-Feet or DWR Full Natural Flow Near Smartsville for the Water Year in Thousand Acre-Feet[1]
Wet	Greater than 3,240
Above Normal	2,191 to 3,240
Below Normal	1,461 to 2,190
Dry	901 to 1,460
Critically Dry	616 to 900

[1] DWR rounds the Bulletin 120 forecast to the nearest thousand acre-feet. The Full Natural Flow is provided to the nearest ac-ft, and YCWA will round DWR's Full Natural Flow to the nearest thousand ac-ft.

7.1.2.2 Water Year Types for Conditions Pertaining to Narrows 2 Powerhouse and Narrows 2 Full Bypass (YCWA's Proposed Condition WR3)

Proposed Condition WR3 defines the calculation of the North Yuba Index, to be used to identify the required flow schedule at the Smartsville and at Marysville gages. The schedules in this proposed condition are the same as the schedules described in Exhibits 2, 4 and 5 of the Lower Yuba River Fisheries Agreement. Table 7.1-3 shows the North Yuba Index thresholds and associated WY types.

Table 7.1-3. North Yuba Index Schedules and associated thresholds.

Water Year Type	Thousands of Acre-Feet
Schedule 1	Equal to or greater than 1,400
Schedule 2	Equal to or greater than 1,040 and less than 1,400
Schedule 3	Equal to or greater than 920 and less than 1,040
Schedule 4	Equal to or greater than 820 and less than 920
Schedule 5	Equal to or greater than 693 and less than 820
Schedule 6	Equal to or greater than 500 and less than 693
Conference Year	Less than 500

The North Yuba Index is calculated as the active storage in New Bullards Bar Reservoir on September 30 of the previous Water Year plus New Bullards Bar Reservoir inflow to date plus forecasted inflow[15] through September 30 of the current Water Year.

[15] Based on DWR-published Bulletin 120 in each of the months of February, March, April and May, and then thereafter whenever DWR issues an update to the Bulletin 120.

7.1.2.3 Minimum Flows in the Middle Yuba River Downstream of Our House Diversion Dam and Log Cabin Diversion Dam (YCWA's Proposed Condition AR1)

Under YCWA's proposed Condition AR1, there would be new flow requirements for the Middle Yuba River downstream of Our House Diversion Dam. The required flow will be determined based on the applicable Smartsville Hydrological Index water-year type. Table 7.1-4 shows the proposed monthly required flows for the Middle Yuba River downstream of Our House Diversion Dam by WY type, as included in proposed Condition AR1.

Table 7.1-4. Proposed Project flow requirements for the Middle Yuba River downstream of Our House Diversion Dam by Smartsville hydrological index Water Year type.

Month	Wet Water Year (cfs)[1]	Above Normal Water Year (cfs)[1]	Below Normal Water Year (cfs)[1]	Dry Water Year (cfs)[1]	Critically Dry Water Year (cfs)[1]
October 1 - 30	60	60	55	50	40
November 1-30	60	60	55	50	40
December 1 - 31	70	60	55	50	40
January 1 - 31	90	75	70	50	40
February 1- 29	90	75	70	50	40
March 1 - 31	100	90	80	55	45
April 1 - 30	120	100	90	70	60
May 1- 31	120	100	90	70	60
June 1 - 30	120	100	90	70	60
July 1 - 31	100	80	70	60	45
August 1 - 31	80	70	60	50	45
September 1- 30	70	60	55	50	45

[1] Or natural inflow if natural inflow is less.

In addition, YCWA' proposed Condition would establish new flow requirements for Oregon Creek downstream of Log Cabin Diversion Dam. The required flow will be determined based on the applicable Smartsville Hydrological Index WY type. Table 7.1-5 shows the monthly required flows for Oregon Creek downstream of Log Cabin Diversion Dam by WY type, as included in proposed Condition AR1.

Table 7.1-5. Proposed Project flow requirements for Oregon Creek downstream of Log Cabin Diversion Dam by Smartsville Hydrological Index Water Year type.

Month	Wet Water Year (cfs)[1]	Above Normal Water Year (cfs)[1]	Below Normal Water Year (cfs)[1]	Dry Water Year (cfs)[1]	Critically Dry Water Year (cfs)[1]
October 1 - 30	8	8	6	6	6
November 1-30	17	15	15	10	6
December 1 - 31	17	15	15	10	6
January 1 - 31	17	15	15	10	6
February 1- 29	24	19	18	12	12
March 1 - 31	30	30	18	12	12
April 1 - 30	43	43	27	18	18
May 1- 31	43	43	27	18	18
June 1 - 30	43	43	27	18	18
July 1 - 31	25	20	15	10	6
August 1 - 31	13	10	8	6	6
September 1- 30	13	10	8	6	6

[1] Or natural inflow if natural inflow is less.

7.1.2.4 Minimum Flows in the North Yuba River Flow Downstream of New Bullards Bar Dam (YCWA's Proposed Condition AR10)

Proposed Condition AR10 would require new flow requirements for the North Yuba River downstream of New Bullards Bar Dam. The required flow will be determined based on the applicable Smartsville Hydrological Index WY type. Table 7.1-6 shows the monthly required flows for the North Yuba River downstream of New Bullards Bar Dam by WY type, as included in Condition AR10.

Table 7.1-6. Proposed Project Flow Requirements for the North Yuba River downstream of New Bullards Bar Dam by Smartsville Hydrological Index Water Year type.

Month	Wet Water Year (cfs)	Above Normal Water Year(cfs)	Below Normal Water Year(cfs)	Dry Water Year(cfs)	Critically Dry Water Year(cfs)
October 1 - 30	13	13	13	13	7
November 1-30	13	13	13	13	7
December 1 - 31	13	13	13	13	7
January 1 - 31	13	13	13	13	7
February 1- 29	13	13	13	13	7
March 1 - 31	11	12	13	13	7
April 1 - 30	5	5	5	5	5
May 1- 31	5	5	5	5	5
June 1 - 30	5	5	5	5	5
July 1 - 31	11	12	13	13	7
August 1 - 31	11	12	13	13	7
September 1- 30	11	12	13	13	7

7.1.2.5 Control Project Spills at Our House Diversion Dam (YCWA's Proposed Condition AR2)

This proposed Condition would require YCWA to control the rate of spill cessation for flows over Our House Diversion Dam in non-tunnel-closure years. This condition, AR2, indicates the spill cessation measure will affect flows over Our House Diversion Dam of 600 cfs or less between April 1 and July 31 in Below Normal, Dry and Critically Dry WYs, and between May 1 and July 31 in Wet and Above Normal WYs (WR2). Under these conditions, the Our House Diversion Dam low-level outlet will be used to regulate Middle Yuba River flows downstream of Our House Diversion. The low level outlet valve would be used to reduce flows by a maximum of 100 cfs every 2 days for spills between 200 cfs and 600 cfs, and by a maximum of 50 cfs for spills less than 200 cfs.

7.1.2.6 Control Project Spills at Log Cabin Diversion Dam (YCWA's Proposed Condition AR12)

The proposed Project includes Condition AR12 that would control the rate of spill cessation for flows over Log Cabin Diversion Dam. This condition, AR12, indicates the spill cessation measure will affect flows over Log Cabin Diversion Dam between 100 cfs or less between April 1 and July 31. Under these conditions, the Log Cabin Diversion Dam low-level outlet will be used to regulate Oregon Creek flows downstream of Log Cabin Diversion Dam. The low level outlet valve would be used to reduce flows by a maximum of 20 cfs every 4 days.

7.1.2.7 Periodically Close Lohman Ridge Diversion Tunnel (YCWA's Proposed Condition AR11)

Under YCWA's proposed Condition AR11, if DWR's May Bulletin 120 forecast is a Wet, Above Normal or Below Normal WY, as defined in YCWA's proposed Condition WR2, and the subsequent end-of-September New Bullards Bar Reservoir storage is 600,000 ac-ft or greater, the Lohman Ridge Diversion Tunnel would close from October 1 through December 31.

In addition the condition requires that the Lohman Diversion Tunnel would be closed within 2 business days of when DWR publishes its April Bulletin 120 through September 30 if the Bulletin 120 April Forecast is for a Wet WY, as defined in YCWA's proposed Condition WR2, and the end-of-March New Bullards Bar Reservoir storage is 775,000 acre-feet or greater. Concurrent with the Lohman Ridge Diversion Tunnel closure, the low level outlet and fish release valve at Log Cabin Diversion Dam will be fully opened.

7.1.2.8 Provide Whitewater Boating Below Our House Diversion Dam (YCWA's Proposed Condition RR3)

Under YCWA's proposed Condition RR3, YCWA would provide weekend boating days from October 1 and March 31 between 600 cfs and 2,000 cfs, as measured at USGS streamflow gage 11408880, according to the schedule given in Table 7.1-7.

Table 7.1-7. Proposed Project whitewater boating flows below Our House Diversion Dam.

Water Year Type as Defined in Licensee's Proposed Condition WR2			Number of Weekend Whitewater Boating Days from October 1 through March 31
DWR's Full Natural Flow at Smartsville for the Full Water Year that Ended on September 30	**DWR's Bulletin 120 February Forecast**	**DWR's Bulletin 120 March Forecast**	
Wet, Above Normal, Below Normal or Dry	Any Water Year Type	Wet	8
Wet, Above Normal, Below Normal or Dry	Any Water Year Type	Above Normal	6
Wet, Above Normal, Below Normal or Dry	Any Water Year Type	Below Normal, Dry, or Critically Dry	4
Critically Dry	Wet or Above Normal	Any Water Year Type	2
Critically Dry	Below Normal, Dry, or Critically Dry	Any Water Year Type	0

7.1.2.9 Minimum Flows on the Yuba River Downstream of the Narrows 2 Powerhouse and Narrows 2 Full Bypass (YCWA's Proposed Condition AR3)

Under YCWA's proposed Condition AR3, the required conference year flows for the Yuba River near Smartsville and near Marysville are slightly modified from the Yuba Accord in Conference Years. Table 7.1-8 shows the proposed required flows for the Yuba River near Smartsville and Marysville, based on the Water Year type schedules defined in YCWA's proposed Condition WR3.

Table 7.1-8. Proposed Project flow requirements for the Yuba River downstream of Narrows 2 Powerhouse and Narrows 2 full flow bypass by North Yuba Index Flow Schedule.

Month	Schedule 1 (cfs)	Schedule 2 (cfs)	Schedule 3 (cfs)	Schedule 4 (cfs)	Schedule 5 (cfs)	Schedule 6 (cfs)	Conference Year (cfs)
YUBA RIVER - BELOW NARROWS 2 POWERHOUSE/NARROWS 2 FULL BYPASS (Compliance Point: USGS Streamflow Gage 11418000)							
October 1 – 15	700	700	700	700	600	600	500
October 16 - 30	700	700	700	700	600	600	500
November 1 - 30	700	700	700	700	600	600	500
December 1 - 31	700	700	700	700	550	550	500
January 1- 15	700	700	700	700	550	550	500
January 16 – 31	700	700	700	700	550	550	500
February 1 - 29	700	700	700	700	550	550	500
March 1- 31	700	700	700	700	550	550	500
April 1 – 15	700	700	700	700	600	600	500
April 16 – 30	--	--	--	--	--	--	--
May 1 – 15	--	--	--	--	--	--	--
May 16 – 31	--	--	--	--	--	--	--
June 1 - 15	--	--	--	--	--	--	--
June 16 – 30	--	--	--	--	--	--	--
July 1 – 31	--	--	--	--	--	--	--
August 1 – 31	--	--	--	--	--	--	--
September 1 – 30	700	700	700	700	500	500	500
YUBA RIVER - BELOW NARROWS 2 POWERHOUSE/NARROWS 2 FULL BYPASS (Compliance Point: USGS Streamflow Gage 11421000)							
October 1 - 15	500	500	500	400	400	350	350
October 16 - 30	500	500	500	400	400	350	350
November 1 - 30	500	500	500	500	500	350	350
December 1 - 31	500	500	500	500	500	350	350
January 1- 15	500	500	500	500	500	350	350
January 16 – 31	500	500	500	500	500	350	350
February 1 - 29	500	500	500	500	500	350	350
March 1- 31	700	700	500	500	500	350	350
April 1 - 15	1,000	700	700	600	500	350	300
April 16 - 30	1,000	800	700	900	600	500	245
May 1 - 15	2,000	1,000	900	900	600	500	245
May 16 - 31	2,000	1,000	900	600	400	400	245
June 1 - 15	1,500	800	500	400	400	300	245
June 16 - 30	1,500	500	500	400	400	150	150
July 1 - 31	700	500	500	400	400	150	150
August 1 - 31	600	500	500	400	400	150	150
September 1 - 30	500	500	500	400	400	350	150

7.1.2.10 Control Project Ramping and Flow Fluctuation Downstream of Englebright Dam (YCWA's Proposed Condition AR9)

Under YCWA's proposed Condition AR9, YCWA would operate New Bullards Bar Reservoir and Project facilities downstream of Englebright Dam and coordinate with PG&E on the operations of the Narrows 1 Powerhouse to avoid fluctuations in flow of the Yuba River downstream of Englebright Dam at the Smartsville gage and daily changes in Project operations affecting releases or bypasses of flow downstream of Englebright Dam at the Smartsville gage. Changes in Yuba River flow downstream of Englebright Dam would not increase at a rate of greater then 500 cfs per hour, nor decrease at a rate in excess of 200 cfs per hour at any point in the year. Also, at no point in the year would flows change, either up or down, by more than 15 percent of the average daily flow once they have been established at a base rate, nor would they be reduced by more than 30 percent of the previous day's flow.

In addition, between September 1 and December 31, and between January 1 and May 31, flow reductions under normal operations (i.e., non-spill management) would be limited according to the flows in Tables 7.1-9 and 7.1-10. In the two tables, "Base Flow" means the flows other than flows related to emergencies, required by the USACE flood control criteria, required to maintain a flood control buffer or for other flood control purposes, bypasses of uncontrolled flows into Englebright Reservoir, uncontrolled spilling, or uncontrolled flows of tributary streams downstream of Englebright Dam.

Table 7.1-9. Maximum flow reductions corresponding to the maximum 5-day average release (Base Flow) that has occurred during the period extending from September 1 through December 31.

Base Flow Range (cfs)	Maximum Allowable Flow Reduction (cfs)
450 – 549	200
550 - 849	250
850 – 1,049	300
1,050 – 1,349	350
1,350 – 1,599	400
1,600 – 1,849	450
1,850 – 2,199	500
2,200 – 2,549	550
2,550 – 2,899	600
2,900 – 3,199	650
3,200 – 3,549	700
3,550 – 4,130	750

Table 7.1-10. Maximum flow reductions corresponding to the maximum 5-day average release (Base Flow) that has occurred during the period extending from January 1 through May 31.

Base Flow Range (cfs)	Maximum Allowable Flow Reduction (cfs)
450 - 499	200
500 - 549	250
550 - 649	300
650 - 849	350
850 – 1,199	400
1,200 – 1,449	450
1,450 – 1,699	500
1,700 – 1,899	550
1,900 – 2,149	600
2,150 – 2,399	650
2,400 – 2,699	700
2,700 – 2,949	750
2,950 – 3,199	800
3,200 – 3,449	850
3,450 – 3,899	900
3,900 – 4,130	950

In addition, between April 1 through July 15, flow reductions under normal operations (i.e., non-spill management) would be limited according to the flows in Tables 7.1-11. The previous day's average flow will be based on USGS streamflow gage 11418000.

Table 7.1-11. Maximum flow reductions corresponding to the preceding day average flow that has occurred during the period extending from April 1 through July 15.

Previous Day Average Flow Range (cfs)	Maximum Flow Reduction (cfs)
400-999	79
1000-1999	150
2000-4200	200

7.1.2.11 Control Project Spills at New Bullards Bar Dam (YCWA's Proposed Condition AR4)

Under YCWA's proposed Condition AR4, YCWA would implement a spill cessation operation, where spills of 2,000 cfs or less from New Bullards Bar Dam from May 1 through July 13 would be reduced at a rate of 250 cfs per day until spill has ceased.

7.1.2.12 Implement Log Cabin and Our House Diversion Dams Sediment Management Plan (YCWA's Proposed Condition GS2)

Under YCWA's proposed Condition GS2, YCWA would operate the low level outlet valves at Our House and Log Cabin diversion dams during high flow events between October 1 and March 21 to move sediment trapped behind the diversion dams to the Middle Yuba River and Oregon Creek, respectively. These actions would be tied to events when inflows exceed 3,000 cfs at Our House Diversion Dam and 1,000 cfs at Log Cabin Diversion Dam. The low level outlet at each diversion dam would be opened fully for 9 days, closed half way on the 10th day, and then fully closed on the 11th day. The low-level outlet can be closed during the 11-day period if flow into the impoundment drops below the capacity of the low-level outlet, which is assumed to be 600 cfs for Our House Diversion Dam and 540 cfs for Log Cabin Diversion Dam.

7.1.3 Changes to Measures in Other Licenses, Agreements and Contracts that Affect Operations

Section 5.2 describes other licenses (i.e., not the FERC license), agreements and contracts that affect current Project operations. When FERC issues its new license, YCWA would apply to the SWRCB to modify any water rights, if necessary, to make them consistent with the new license. YCWA does not anticipate any changes will be needed to YCWA's water delivery contracts.

7.1.4 Changes to Other Operating Constraints

Section 5.3 describes other current operating constraints. YCWA will continue to make water transfers, when possible, and will abide by the requirements, which are unknown at this time, in a new power purchase contract.

7.2 New Colgate Development

7.2.1 Middle Yuba River Downstream of Our House Diversion Dam

The current fish release valve at Our House Diversion Dam has an estimated capacity of 59 cfs when the Our House Diversion Dam impoundment WSE is at the invert of the Lohman Ridge Tunnel, so an enlargement of the valve's capacity would be needed to release the flows in the proposed Project. Otherwise, operations for required flows would continue similarly to the No Action Alternative.

Increased minimum flows downstream of Our House Diversion Dam, closures of the Lohman Ridge Tunnel, whitewater boating flows, sediment management actions, and control of spills at Our House Diversion Dam will result is less water diverted to Oregon Creek through the Lohman Ridge Diversion Tunnel. As a result, less Middle Yuba River water will be available to divert to New Bullards Bar Reservoir through the Camptonville Tunnel.

Modeled monthly flow duration curves for the Middle Yuba downstream of Our House Diversion Dam and for the Lohman Ridge Diversion Tunnel are provided in Figures 7.2-1 and 7.2-2. Flow duration curves are based on YCWA's proposed Project model run for WYs 1970 through 2010. Figure 7.2-3 and Figure 7.2-4 show flow duration curves during the representative dry (2001), normal (2005), and wet (1998) WYs for the Middle Yuba downstream of Our House Diversion Dam and for the Lohman Ridge Diversion Tunnel.

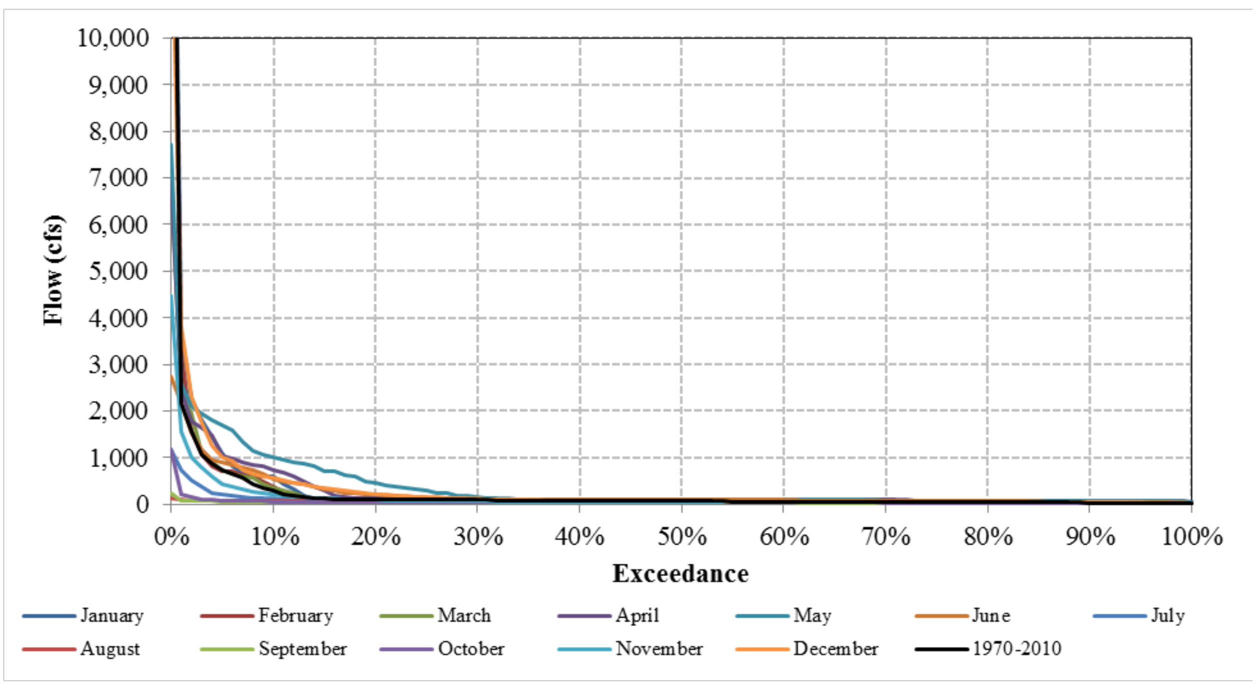

Figure 7.2-1. Modeled monthly flow duration curves for the Middle Yuba River downstream of Our House Diversion Dam for Water Years 1970 through 2010 under YCWA's proposed Project Operations Model run.

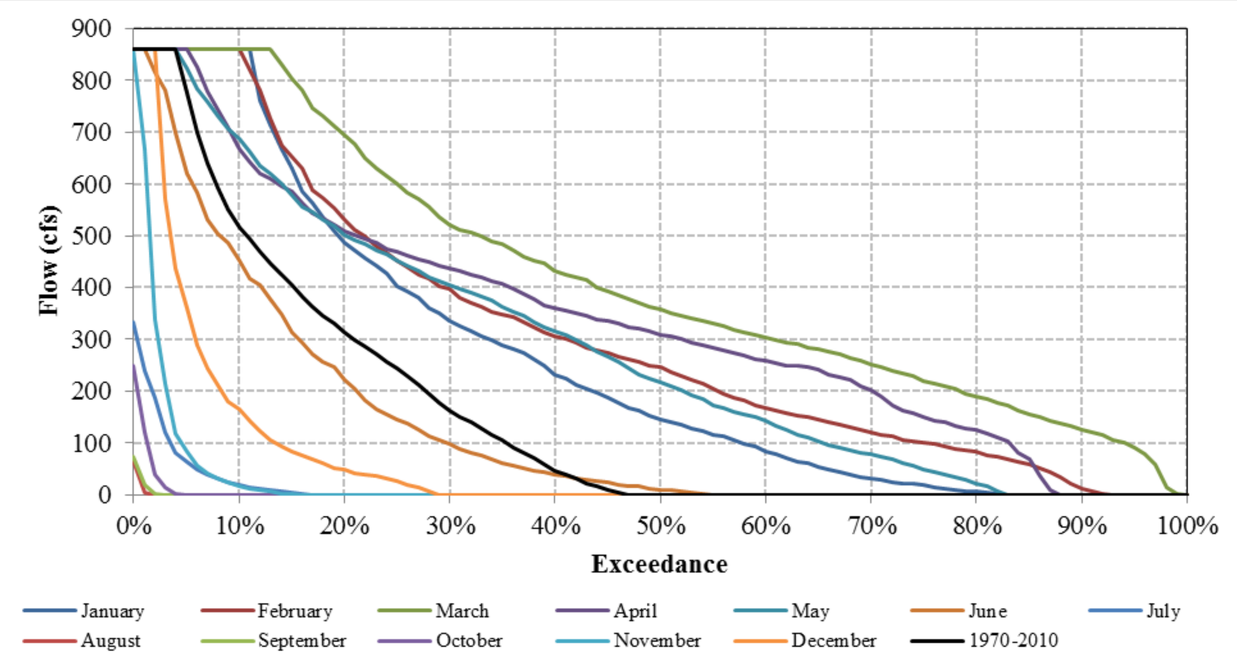

Figure 7.2-2. Modeled monthly flow duration curves for the Lohman Ridge Diversion Tunnel for Water Years 1970 through 2010 under YCWA's proposed Project Operations Model run.

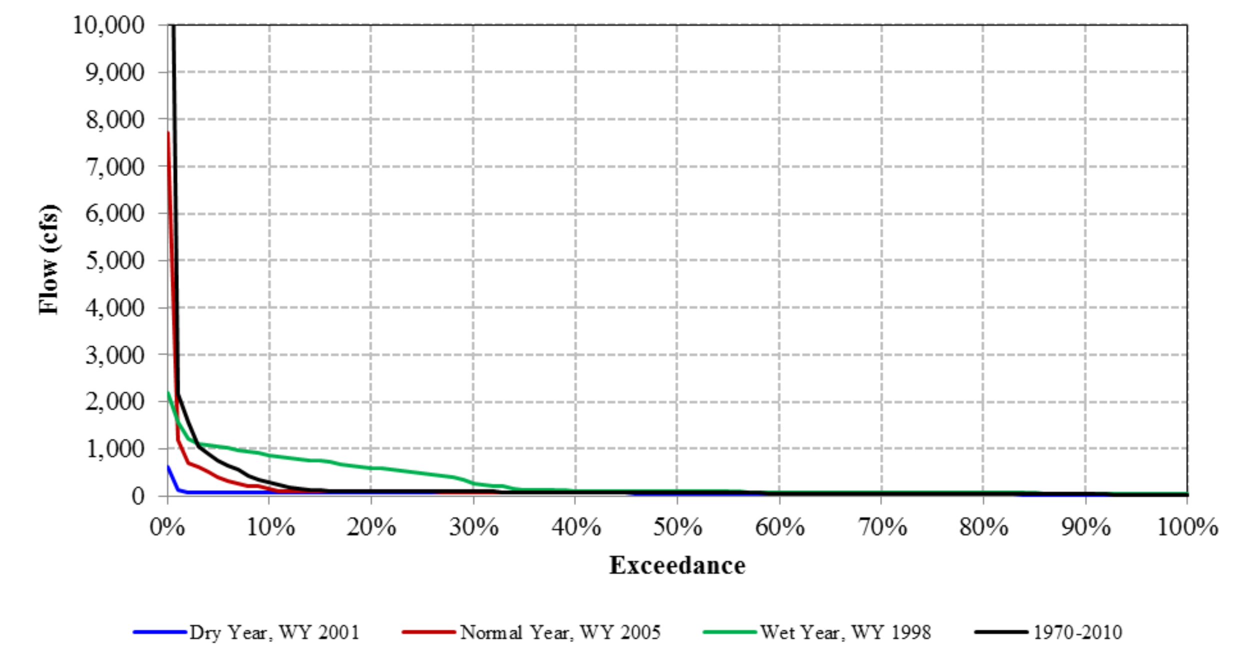

Figure 7.2-3. Modeled flow duration curves for the Middle Yuba River downstream of Our House Diversion Dam for the representative dry (2001), normal (2005) and wet (1998) Water Years and for the period of record under YCWA's proposed Project Operations Model run.

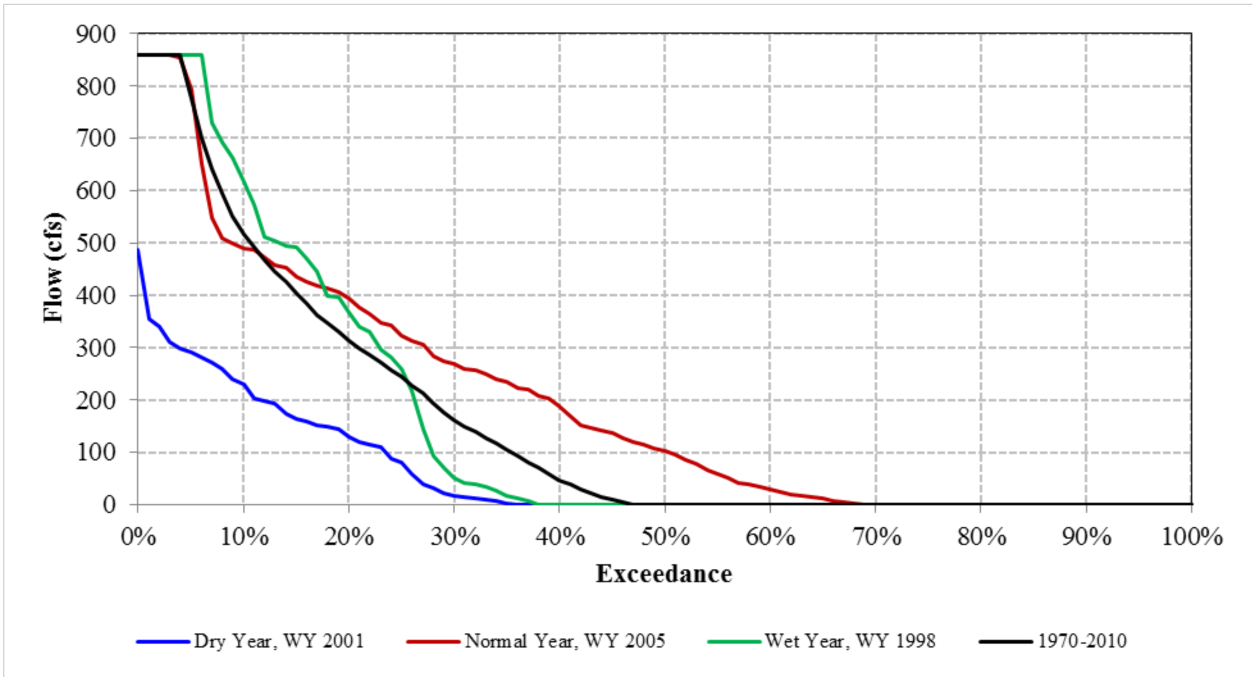

Figure 7.2-4. Modeled flow duration curves for the Lohman Ridge Diversion Tunnel for the representative dry (2001), normal (2005), and wet (1998) Water Years and for the period of record under YCWA's proposed Project Operations Model run.

7.2.2 Oregon Creek Downstream of Log Cabin Dam

The current fish release valve at the Log Cabin Diversion Dam has an estimated capacity of 18 cfs when the Log Cabin Diversion Dam impoundment WSE is at the invert of the Camptonville Tunnel, so an enlargement of the valve's capacity would be needed to release flows under the proposed Project. Otherwise, operations for required flows would continue similarly to the No Action Alternative.

Increased minimum flows downstream of Log Cabin Diversion Dam, opening of the Log Cabin Diversion Dam low level outlet when the Lohman Ridge Tunnel is closed, sediment management actions, and control of spills at Log Cabin Diversion Dam will result is less water diverted to New Bullards Bar Reservoir through the Camptonville Tunnel. Operation of the Camptonville Tunnel intake would continue similarly to the No Action Alternative.

Modeled monthly flow duration curves for Oregon Creek downstream of Log Cabin Diversion Dam and for the Camptonville Diversion Tunnel are provided in Figures 7.2-5 and 7.2-6. Flow duration curves are based on YCWA's proposed Project model run for WYs 1970 through 2010. Figure 7.2-7 and Figure 7.2-8 show flow duration curves during the representative dry (2001), normal (2005), and wet (1998) WYs for Oregon Creek downstream of Log Cabin Diversion Dam and for the Camptonville Diversion Tunnel.

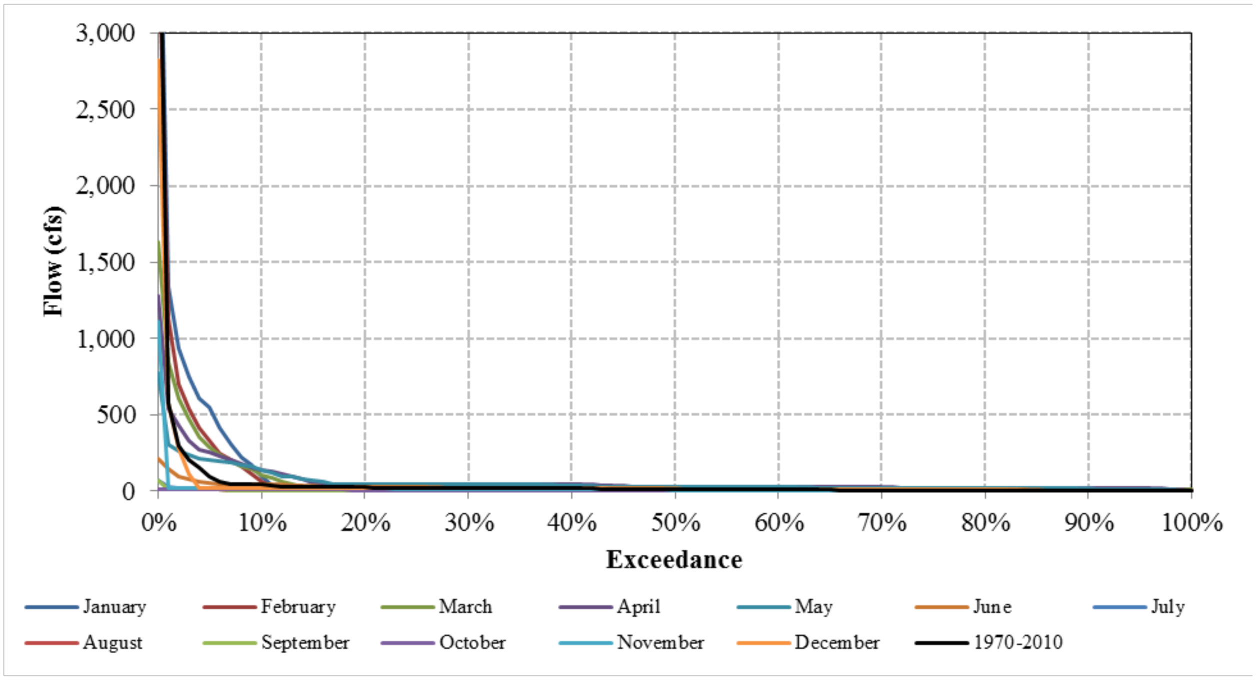

Figure 7.2-5. Modeled monthly flow duration curves for Oregon Creek downstream of Log Cabin Diversion Dam for Water Years 1970 through 2010 under YCWA's proposed Project Operations Model run.

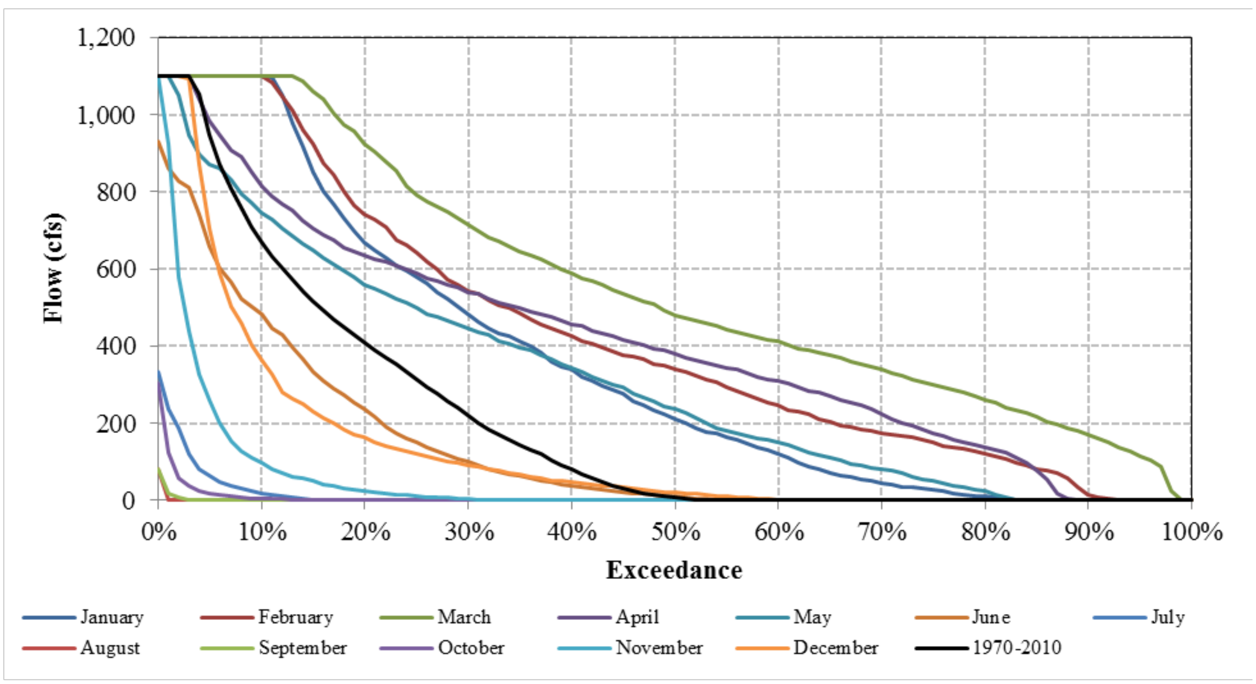

Figure 7.2-6. Modeled monthly flow duration curves for the Camptonville Diversion Tunnel for Water Years 1970 through 2010 under YCWA's proposed Project Operations Model run.

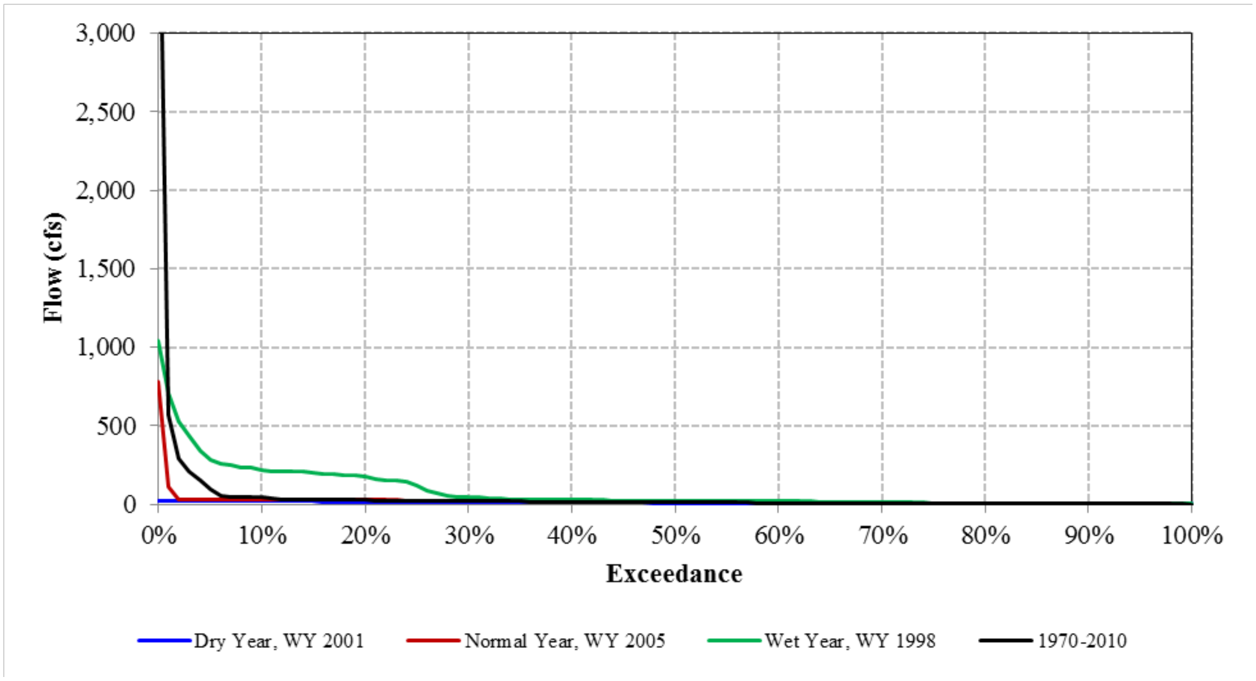

Figure 7.2-7. Modeled flow duration curves for Oregon Creek downstream of Log Cabin Diversion Dam for the representative dry (2001), normal (2005), and wet (1998) Water Years and for the period of record under YCWA's proposed Project Operations Model run.

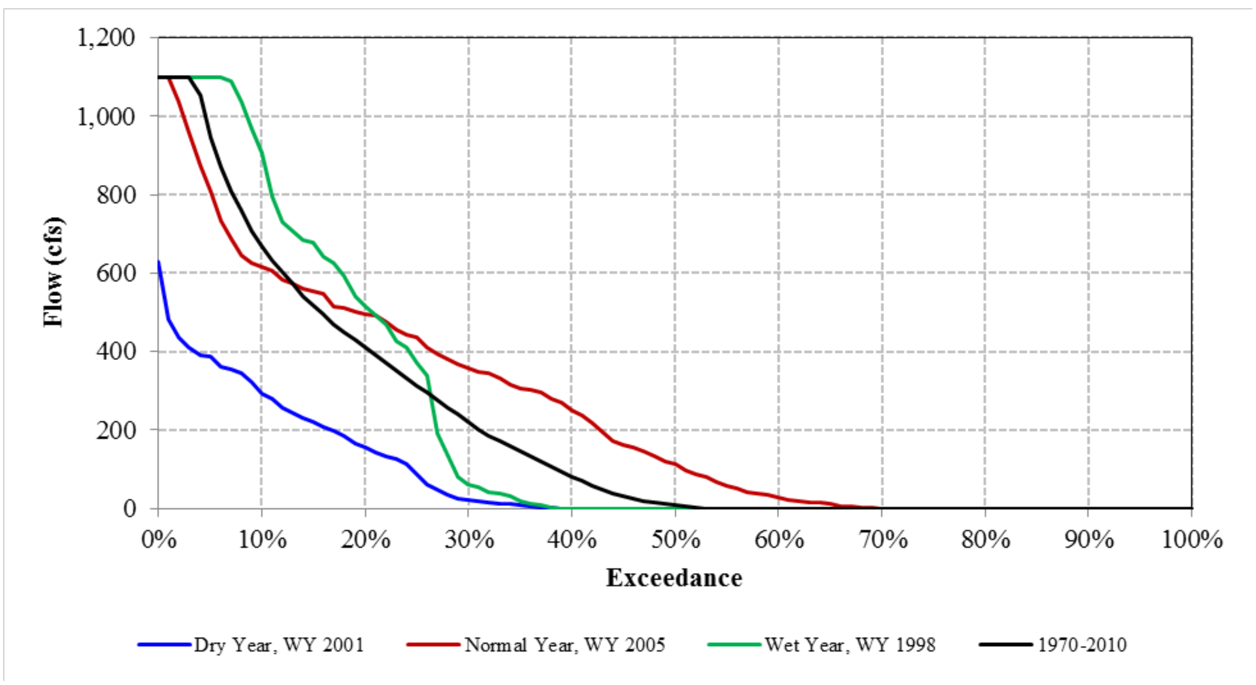

Figure 7.2-8. Modeled flow duration curves for the Camptonville Diversion Tunnel for the representative dry (2001), normal (2005), and wet (1998) Water Years and for the period of record under YCWA's proposed Project Operations Model run

7.2.3 New Bullards Bar Reservoir

The only flow-related conditions in YCWA's proposed Project directly focused on New Bullards Bar Reservoir operations is Condition AR4, but as the primary facility in the Project, an operational change on any other Project facility would have an effect on New Bullards Bar Reservoir operations. Increasing minimum instream flows upstream on the Middle Yuba River downstream of Our House Diversion Dam and Oregon Creek downstream of Log Cabin Diversion Dam, control of spills at Our House and Log Cabin diversion dams, Our House and Log Cabin diversion dams' sediment management actions, and Middle Yuba River whitewater boating flows below Our House Diversion Dam will all reduce inflows to New Bullards Bar Dam through the Camptonville Tunnel, and result in reduced releases to the New Colgate Powerhouse. Changes to minimum instream flows on the North Yuba River downstream of New Bullards Bar Dam, would also result in decreased releases to the New Colgate Powerhouse.

Proposed periodic Lohman Ridge Diversion Tunnel closures would result in substantially less water diverted to New Bullards Bar Reservoir from the Middle Yuba River and Oregon Creek, especially during Wet WYs when the Lohman Ridge Diversion Tunnel is closed from April through September. Fall closures would be less impactful since it occurs before the typical onset of the wet season in January with little to no diversions occurring because Our House and Log Cabin diversion dams are operating under inflow-outflow conditions, but December months can experience heavier than average precipitation if winter storm patterns start early.

Flows on the Yuba River downstream of Englebright Dam under the proposed Project would not change in most years. Since New Bullards Bar Reservoir releases are generally driven by flows requirements in the Yuba River downstream of Englebright Dam, decreases in New Bullards Bar Reservoir inflow due to changes in minimum instream flows or periodic tunnel closures on the Middle Yuba River and Oregon Creek, and increased releases to the North Yuba River would generally be offset by equivalently decreased releases from New Bullards Bar Dam through the New Colgate Powerhouse. There would not be much change in New Bullards Bar Reservoir storage under the proposed Project due to these changes.

Addition of the New Colgate Powerhouse TDS and the New Bullards Bar Dam Auxiliary Flood Control Outlet would have an effect on New Bullards Bar Reservoir operations during flood operations. The proposed TDS would increase New Bullards Bar Reservoir release capacity during flood events when spillway capacity is limited by allowing the New Colgate Powerhouse to continue to operate during high flow events through the injection of compressed air into the New Colgate Powerhouse tailrace when the stage of the Yuba River would otherwise prevent generation. Operating the TDS throughout a flood event would allow for increased releases from New Bullards Bar Reservoir, thus reducing New Bullards Bar Reservoir storage during the flood event, and ultimately reducing the peak flood release.

When the water surface elevation of flows in the New Colgate Powerhouse tailrace rises to an elevation of 555 ft, which corresponds to approximately 11,000 cfs of flow in the Yuba River upstream of the New Colgate Powerhouse, the first compressor would be started, and would be modulated to fully open as needed. The second compressor would be started when the water surface elevation in the tailrace reaches an elevation of 556 ft, and would be modulated to fully open, as needed. If necessary, the third compressor would be started when water level inside the tailrace conduit again reaches an elevation of 556 ft. Modulation of each compressor would maintain a water surface elevation in the tailrace within a range of 554 ft and 556 ft. If only one powerhouse unit is running, compressed air would still be discharged into both units. If the tailwater elevation continues to rise above elevation 556 ft with all three compressors operating at maximum pressure, plant operators would either reduce unit load or shut the units down As the tailwater recedes, the compressors would be shut down in reverse sequence to their startup, as the tailrace elevation drops to elevations below 556 ft. Typical duration of operation of the TDS is expected to be less than or equal to the historical duration of spills at New Bullards Bar Dam, which occurs an average of 21 days per year.

The compressors have been sized to allow the New Colgate Powerhouse to operate under flows similar to those observed in the January 1997 flood event where the maximum river stage at the New Colgate Powerhouse was at an elevation of 578 ft. The powerhouse has been assessed as being "flood proof" for a maximum tailwater elevation of 583 ft (YCWA 2004). There were 16 generation curtailment events between 1971 and 2016 that would have benefitted from the TDS. The cumulative loss of power generation during these 16 events was nearly 250,000 MWh, or approximately 5,560 MWh per year.

Other than allowing the New Colgate Powerhouse to operate during high flow events, and, as described above, by allowing for some earlier releases for flood management purposes and thus potentially reducing rates of peak releases from New Bullards Bar Dam, the proposed TDS would not affect Project operations. Modeling for the Proposed Project indicates the TDS would operate in 12 out of 41 years.

The proposed new Auxiliary Flood Control Outlet would allow for releases from New Bullard Bar Dam when the WSE is below the existing New Bullards Bar Dam spillway in anticipation of large storm events, and would increase New Bullards Bar Dam's exiting release capacity during high flow events. While the Auxiliary Flood Control Outlet is included in the simulation of the proposed Project in the Operations Model, only its increased release capacity during spill events is included in the proposed Project simulation; YCWA expects that flood management operations anticipatory releases through the Auxiliary Flood Control Outlet or flood management-related releases when storage is below the USACE flood reservation space are not included in modeling of the proposed Project. Those operations would be determined based on a number of real-time factors, including upstream snow-pack and forecasted storm intensity that are not included in the Operations Model. Modeling of the proposed Project to augment the existing New Bullards Bar Dam spillway capacity indicates the Auxiliary Flood Control Outlet could be used each time New Bullards Bar Reservoir spill operations are needed, but the existing capacity is adequate for all low-to-medium intensity storm events so the release from the dam can be made through either outlet. The modeling results show that the Auxiliary Flood Control Outlet additional release capacity and release capacity at a lower water-surface elevation would only be needed during very large storm events, or in roughly 8 out of 41 years. Any pre-emptive releases associated with the Forecasted Coordinated Operations program would likely be made using the Auxiliary Flood Control Outlet in even fewer occurrences than the 8 in 41 years.

Operation of New Bullards Bar Reservoir in terms of reservoir elevations in the representative dry (2001), normal (2005), and wet (1998) WYs and annual elevation fluctuation in New Bullards Bar Reservoir are summarized in Table 7.2-1.

Table 7.2-1. Modeled minimum and maximum elevations in New Bullards Bar Reservoir in the representative dry (2001), normal (2005) and wet (1998) Water Years under YCWA's proposed Project Operations Model run.

Water Year	Minimum Daily Elevation (ft)	Average Daily Elevation (ft)	Maximum Daily Elevation (ft)	Annual Elevation Fluctuation (ft)
2001 (Dry Year)	1,833	1,863	1,898	65
2005 (Normal Year)	1,824	1,886	1,956	132
1998 (Wet Year)	1,834	1,899	1,956	122

Figure 7.2-9 shows modeled average-daily storage in New Bullards Bar Reservoir as well as the maximum-daily storage, minimum-daily storage for the period of record and various percent exceedance levels of daily storage.

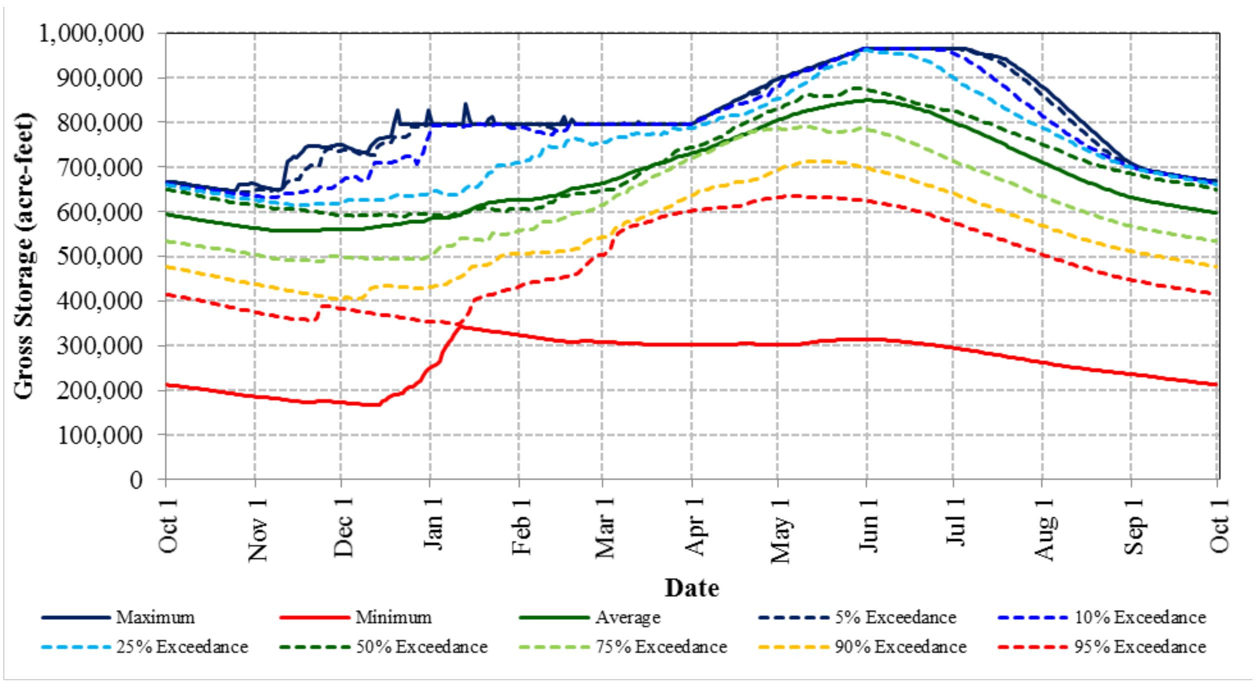

Figure 7.2-9. Modeled average-daily storage in New Bullards Bar Reservoir for various percent exceedances for Water Years 1970 through 2010 under YCWA's proposed Project Operations Model run.

Modeled daily average WSE for New Bullards Bar Reservoir for each WY are graphically presented in Figure 7.2-10. As indicated on the figure, the reservoir storage and elevation can fluctuate significantly from year to year; although, the median and mean curves represent general trends of reservoir operation.

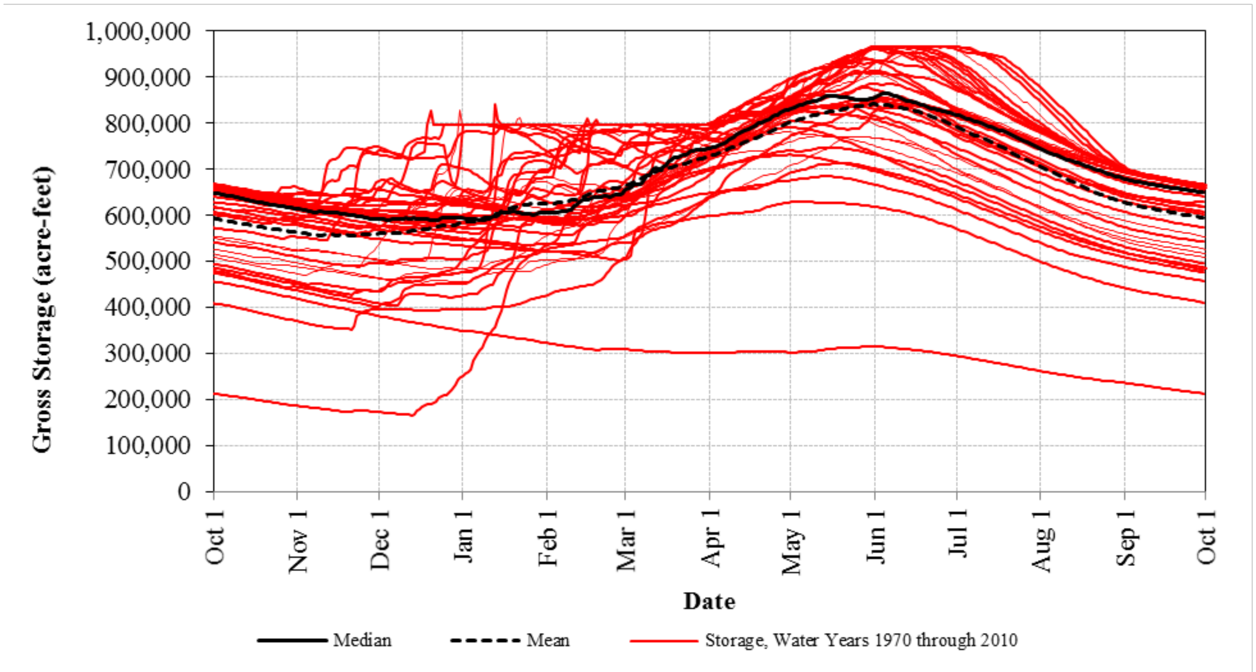

Figure 7.2-10. Modeled New Bullards Bar Reservoir median and mean storage for Water Years 1970 through 2010 under YCWA's proposed Project Operations Model run.

Operation of New Bullards Bar Reservoir in terms of storage for the representative dry (2001), normal (2005) and wet (1998) WYs is shown in Figure 7.2-11.

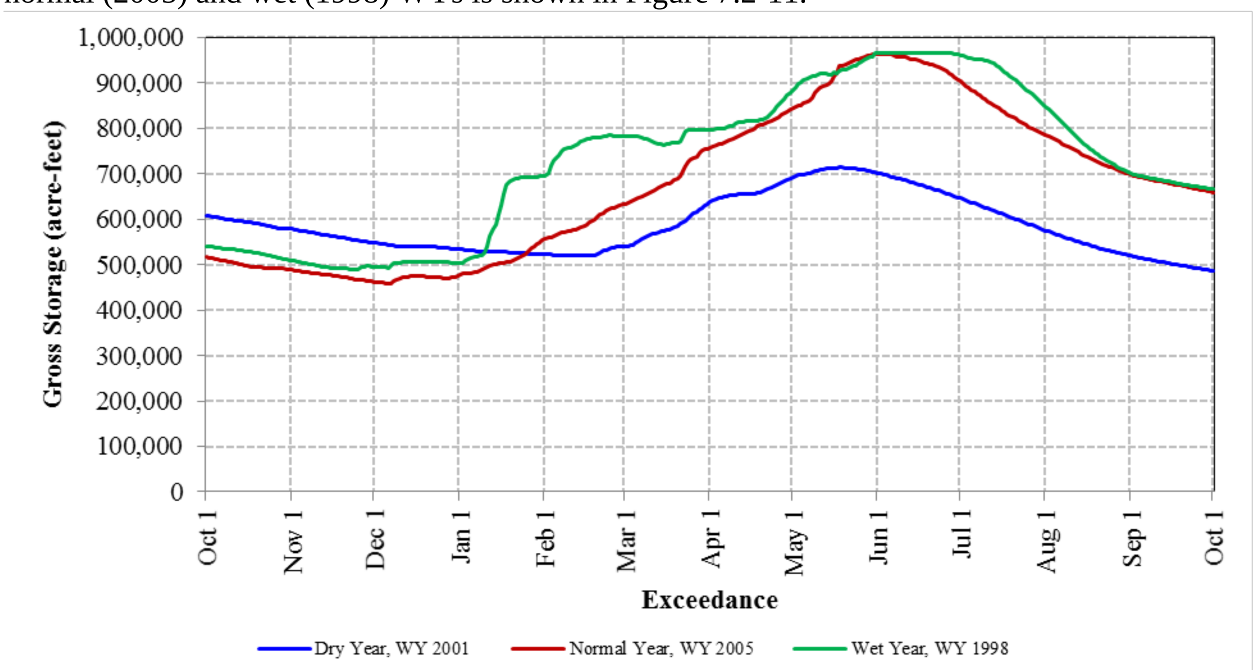

Figure 7.2-11. Modeled New Bullards Bar Reservoir storage for the representative dry (2001), normal (2005), and wet (1998) Water Years and for the period of record under YCWA's proposed Project Operations Model run.

7.2.4 Plant Operations – New Colgate Powerhouse

As described above, the proposed Project includes several conditions and measures that will generally reduce flows through the New Colgate Powerhouse, and one proposed feature that will allow for increased generation under certain conditions.

The average annual flow through the New Colgate Powerhouse based on YCWA's proposed Project model run for WYs 1970 through 2010 was 1,025,022 ac-ft. With a theoretical powerhouse capacity of almost 3 million MWh/yr if the powerhouse always could be operated at full capacity, New Colgate Powerhouse has a plant factor of 0.43. The national average hydropower plant factor of 0.43.

7.2.4.1 Powerhouse Minimum, Maximum and Mean Flows

Minimum-, maximum-, and mean-daily average flows based on YCWA's proposed Project model run for WYs 1970 through 2010, are 0 cfs, 1,415 cfs and 3,430 cfs, respectively.

7.2.4.2 Powerhouse Flow Duration Curves

Annual and monthly flow duration curves for releases from New Colgate Powerhouse, based on YCWA's proposed Project Operations Model run for WYs 1970 through 2010, are provided in Figure 7.2-12.

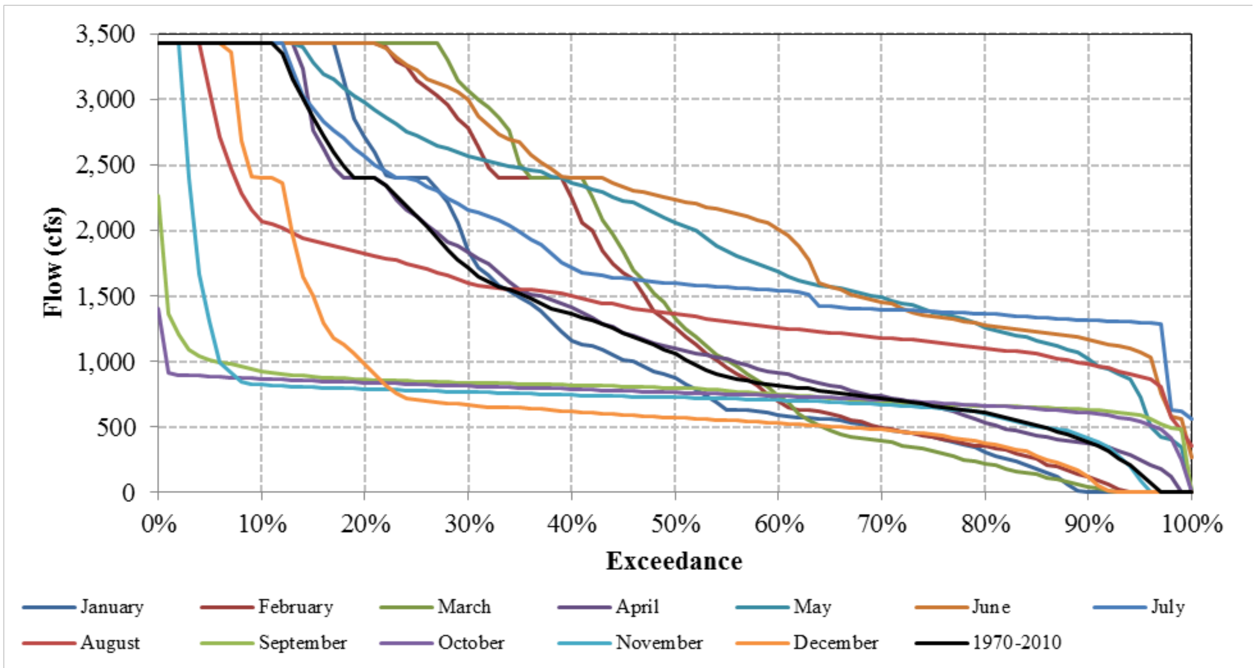

Figure 7.2-12. Modeled monthly flow duration curves for New Colgate Powerhouse for Water Years 1970 through 2010 under YCWA's proposed Project Operations Model run.

7.2.4.3 Average Annual Energy Production

New Colgate Powerhouse would have generated an average of 1,147,851 MWh/yr from 1970 to 2010 under YCWA's proposed Project Operations Model run. The average annual plant factor for the powerhouse for this time period is 0.42 based on the annual generation divided by the plant nameplate generating capability (315 MW) times the number of hours per year. Annual gross generation and plant factors for the powerhouse are provided in Table 7.2-2.

Table 7.2-2. Modeled generation and plant factors for New Colgate Powerhouse under the proposed Project Operations Model run.

Water Year	Annual Generation (MWh)	Annual Generation (aMW)	Plant Capability (MW)	Plant Factor
1970	1,311,652	150	315	0.48
1971	1,554,443	177	315	0.56
1972	1,076,188	123	315	0.39
1973	1,409,207	161	315	0.51
1974	1,952,470	223	315	0.71
1975	1,353,597	154	315	0.49
1976	624,202	71	315	0.23
1977	374,003	43	315	0.14
1978	1,279,968	146	315	0.46
1979	989,226	113	315	0.36
1980	1,583,773	181	315	0.57
1981	721,770	82	315	0.26
1982	2,052,358	234	315	0.74
1983	2,038,576	233	315	0.74
1984	1,635,002	187	315	0.59
1985	752,460	86	315	0.27
1986	1,226,909	140	315	0.44
1987	593,313	68	315	0.21
1988	509,599	58	315	0.18
1989	1,035,791	118	315	0.38
1990	607,515	69	315	0.22
1991	625,646	71	315	0.23
1992	671,771	77	315	0.24
1993	1,410,077	161	315	0.51
1994	620,762	71	315	0.22
1995	1,811,936	207	315	0.66
1996	1,657,276	189	315	0.60
1997	1,394,637	159	315	0.51
1998	1,686,126	192	315	0.61
1999	1,539,181	176	315	0.56
2000	1,286,632	147	315	0.47
2001	565,437	65	315	0.20
2002	695,552	79	315	0.25
2003	1,272,936	145	315	0.46
2004	1,018,321	116	315	0.37
2005	1,058,751	121	315	0.38
2006	1,895,132	216	315	0.69
2007	795,054	91	315	0.29
2008	561,608	64	315	0.20
2009	778,525	89	315	0.28

Table 7.2-2. (continued)

Water Year	Annual Generation (MWh)	Annual Generation (aMW)	Plant Capability (MW)	Plant Factor
2010	1,034,502	118	315	0.37
Total	**47,061,884**	**--**	**--**	**--**
Minimum	**374,003**	**42.7**	**--**	**0.14**
Average	**1,147,851**	**130.9**	**--**	**0.42**
Median	**1,076,188**	**122.8**	**--**	**0.39**
Maximum	**2,052,358**	**234.1**	**--**	**0.74**

Key: aWM = annual megawatt; MWh = megawatt-hour

7.2.4.4 New Colgate Powerhouse Dependable Capacity

Under the proposed Project, the minimum New Bullards Bar Reservoir storage of 160,977 ac-ft occurred on December 13, 1977. Based on this minimum storage and the full flow capacity through the New Colgate Powerhouse, the dependable capacity of the New Colgate Powerhouse under the proposed Project is 230,208 kW.

7.3 New Bullards Bar Minimum Flow Development

The New Bullards Bar Minimum Flow Powerhouse has an estimated capacity of 5 cfs, so any additional required releases to meet the required flows would be made from either the New Bullards Bar Dam low level outlet, or a new release valve would have to be added. Otherwise, operations for required flows would continue similarly to the No Action Alternative.

7.3.1 Powerhouse Minimum, Maximum and Mean Flows

Minimum-, maximum-, and mean-daily average flows based on YCWA's proposed Project model run for WYs 1970 through 2010, is 5.0 cfs, due to the powerhouse operating continuously at 5 cfs.

7.3.2 Powerhouse Flow Duration Curves

Annual and monthly flow duration curves for releases from New Bullards Bar Minimum Flow Powerhouse, based on YCWA's proposed Project model run for WYs 1970 through 2010, is provided in Figure 7.3-1.

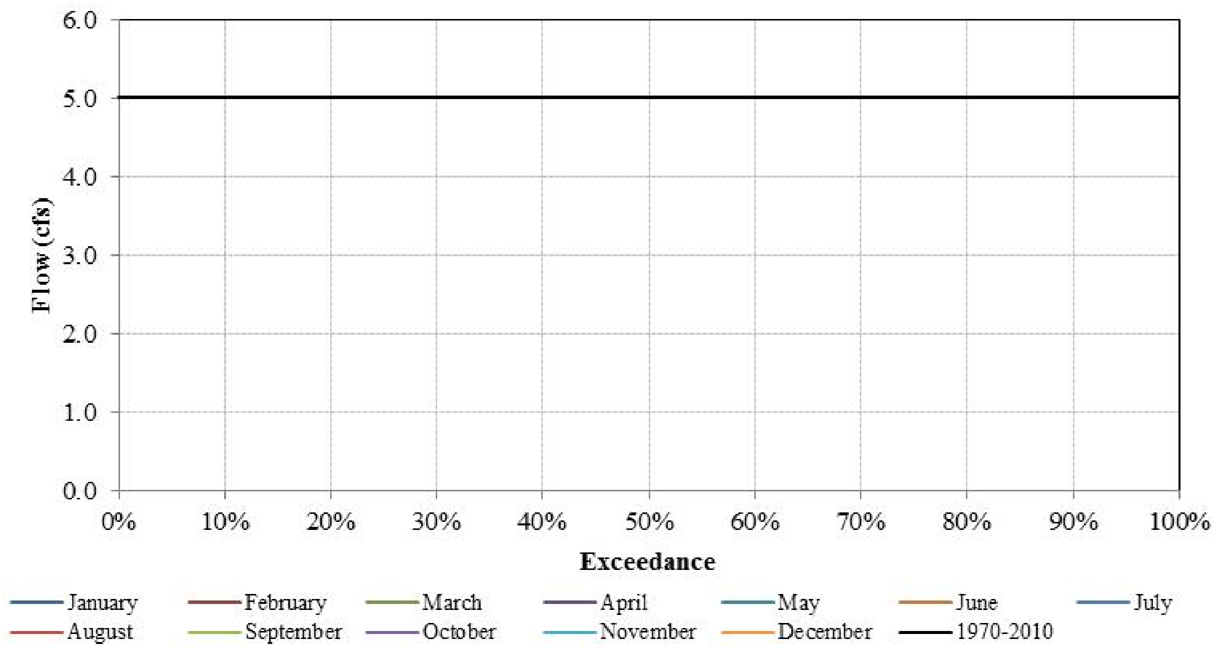

Figure 7.3-1. Modeled monthly flow duration curves for New Bullards Bar Minimum Flow Powerhouse for Water Years 1970 through 2010 under YCWA's proposed Project Operations Model run.

7.3.3 Average Annual Energy Production

New Bullards Bar Minimum Flow Powerhouse generated an average of 1,281 MWh/yr from 1970 to 2010 under YCWA's proposed Project model run. The average annual plant factor for the powerhouse for this time period is 0.97 based on the annual generation divided by the plant generating capability (150 kW) times the number of hours per year. Annual gross generation and plant factors for the powerhouse are provided in Table 7.3-1.

Table 7.3-1. Modeled generation and plant factors for New Bullards Bar Minimum Flow Powerhouse under YCWA's proposed Project Operations Model run.

Water Year	Annual Generation (MWh)	Annual Generation (akW)	Plant Capability (kW)	Plant Factor
1970	1,288	147	150	0.98
1971	1,288	147	150	0.98
1972	1,291	147	150	0.98
1973	1,288	147	150	0.98
1974	1,288	147	150	0.98
1975	1,288	147	150	0.98
1976	1,291	147	150	0.98
1977	1,125	128	150	0.86
1978	1,192	136	150	0.91
1979	1,288	147	150	0.98
1980	1,291	147	150	0.98
1981	1,288	147	150	0.98
1982	1,288	147	150	0.98
1983	1,288	147	150	0.98

Table 7.3-1. (continued)

Water Year	Annual Generation (MWh)	Annual Generation (akW)	Plant Capability (kW)	Plant Factor
1984	1,291	147	150	0.98
1985	1,288	147	150	0.98
1986	1,288	147	150	0.98
1987	1,288	147	150	0.98
1988	1,281	146	150	0.97
1989	1,261	144	150	0.96
1990	1,288	147	150	0.98
1991	1,288	147	150	0.98
1992	1,291	147	150	0.98
1993	1,280	146	150	0.97
1994	1,288	147	150	0.98
1995	1,286	147	150	0.98
1996	1,291	147	150	0.98
1997	1,288	147	150	0.98
1998	1,288	147	150	0.98
1999	1,288	147	150	0.98
2000	1,291	147	150	0.98
2001	1,288	147	150	0.98
2002	1,285	147	150	0.98
2003	1,288	147	150	0.98
2004	1,291	147	150	0.98
2005	1,288	147	150	0.98
2006	1,288	147	150	0.98
2007	1,288	147	150	0.98
2008	1,291	147	150	0.98
2009	1,288	147	150	0.98
2010	1,288	147	150	0.98
Total	**52,524**	--	--	--
Minimum	**1,125**	**128.4**	--	**0.86**
Average	**1,281**	**146.1**	--	**0.97**
Median	**1,288**	**146.9**	--	**0.98**
Maximum	**1,291**	**147.3**	--	**0.98**

Key: akW = annual kilowatt; MWh = megawatt-hours

7.3.4 Minimum Flow Powerhouse Dependable Capacity

Dependable capacity of the New Bullards Bar Minimum Flow Powerhouse is head limited. The Minimum Flow Powerhouse is operated to continuously release 5 cfs. On December 13, 1977, New Bullards Bar Reservoir storage reached an elevation of 1,691 ft, defining the New Bullards Bar Minimum Flow Powerhouse's dependable capacity of 102 KW.

7.4 Narrows 2 Development

The Narrows 2 Development is minimally affected by changes in Project operations upstream of Englebright Reservoir. The only changes from the No Action Alternative to the Proposed Project for operations of the Narrows 2 Development are Conditions AR3 and AR9.

7.4.1 Powerhouse Minimum, Maximum, and Mean Flows

Minimum-, mean-, and maximum-daily average flows based on YCWA's proposed Project model run for WYs 1970 through 2010, are 0 cfs, 1,684 cfs and 3,400 cfs, respectively.

7.4.2 Powerhouse Flow Duration Curves

Annual and monthly flow duration curves for releases from Narrows 2 Powerhouse, based on YCWA's proposed Project Operations Model run for WYs 1970 through 2010, is provided in Figure 7.4-1.

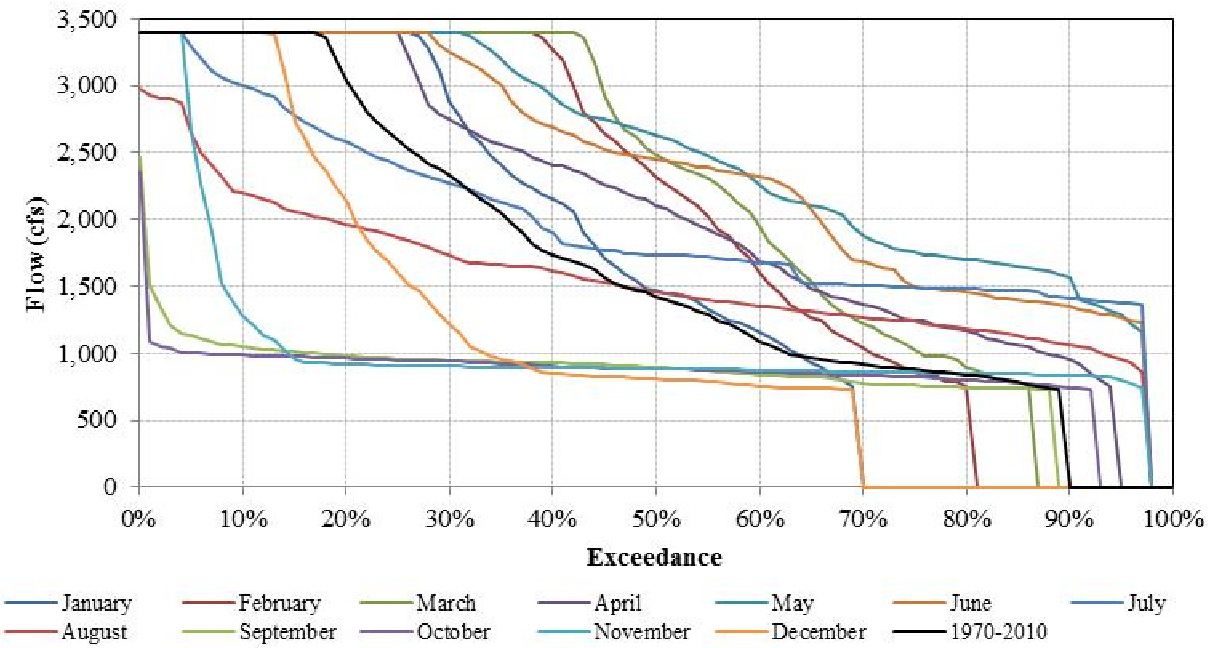

Figure 7.4-1. Modeled monthly flow duration curves for Narrows 2 Powerhouse for Water Years 1970 through 2010 under YCWA's proposed Project Operations Model run.

7.4.3 Average Annual Energy Production

Narrows 2 Powerhouse generated an average of 224,901 MWh/yr from 1970 to 2010 under YCWA's proposed Project Operations Model run. The average annual plant factor for the powerhouse for this time period is 0.55 based on the annual generation divided by the plant generating capability (46.7 MW) times the number of hours per year. Annual gross generation and plant factors for the powerhouse are provided in Table 7.4-1.

Table 7.4-1. Modeled generation and plant factors for Narrows 2 Powerhouse under YCWA's proposed Project Operations Model run.

Water Year	Annual Generation (MWh)	Annual Generation (aMW)	Plant Capability (MW)	Plant Factor
1970	260,901	29.8	46.7	0.64
1971	315,749	36.0	46.7	0.77

Table 7.4-1. (continued)

Water Year	Annual Generation (MWh)	Annual Generation (aMW)	Plant Capability (MW)	Plant Factor
1972	235,079	26.8	46.7	0.57
1973	284,416	32.4	46.7	0.69
1974	368,004	42.0	46.7	0.90
1975	270,127	30.8	46.7	0.66
1976	121,141	13.8	46.7	0.30
1977	15,963	1.8	46.7	0.04
1978	263,301	30.0	46.7	0.64
1979	211,339	24.1	46.7	0.52
1980	298,359	34.0	46.7	0.73
1981	150,450	17.2	46.7	0.37
1982	362,160	41.3	46.7	0.88
1983	381,163	43.5	46.7	0.93
1984	314,551	35.9	46.7	0.77
1985	178,378	20.3	46.7	0.44
1986	255,185	29.1	46.7	0.62
1987	99,968	11.4	46.7	0.24
1988	85,891	9.8	46.7	0.21
1989	198,013	22.6	46.7	0.48
1990	129,745	14.8	46.7	0.32
1991	118,525	13.5	46.7	0.29
1992	126,633	14.4	46.7	0.31
1993	286,758	32.7	46.7	0.70
1994	112,552	12.8	46.7	0.27
1995	321,398	36.7	46.7	0.79
1996	311,128	35.5	46.7	0.76
1997	286,119	32.6	46.7	0.70
1998	319,091	36.4	46.7	0.78
1999	305,495	34.9	46.7	0.75
2000	246,784	28.2	46.7	0.60
2001	96,442	11.0	46.7	0.24
2002	173,576	19.8	46.7	0.42
2003	267,599	30.5	46.7	0.65
2004	233,305	26.6	46.7	0.57
2005	220,092	25.1	46.7	0.54
2006	329,225	37.6	46.7	0.80
2007	173,050	19.7	46.7	0.42
2008	106,571	12.2	46.7	0.26
2009	167,361	19.1	46.7	0.41
2010	219,371	25.0	46.7	0.54
Total	**9,220,956**	--	--	--
Minimum	**15,963**	**2**	--	**0.04**
Average	**224,901**	**25.7**	--	**0.55**
Median	**235,079**	**26.8**	--	**0.57**
Maximum	**381,163**	**43.5**	----	**0.93**

Key: aMW = annual megawatt; MWh = megawatt-hours

7.4.4 Narrows 2 Powerhouse Dependable Capacity

The Narrows 2 Powerhouse dependable capacity is flow limited. Historically, there were no releases through the Narrows 2 Powerhouse for most of 1977; all releases from Englebright Reservoir were made through PG&E's Narrows 1 Powerhouse during that time. Accordingly, the lack of releases through the Narrows 2 Powerhouse defines the critical streamflow for determining the dependable capacity for the powerhouse. The dependable capacity for the Narrows 2 Powerhouse under the proposed Project is 0 kW.

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