3.0 PROJECT DESCRIPTION AND OPERATION

The Project is a power recovery project that operates on the West Branch of the SWP. The SWP provides southern California with affordable water supply to supplement local resources. The Project generates clean hydropower that helps to facilitate integration of renewable energy development, provides significant public recreation opportunities easily accessible to both visitors to the area and residents of the surrounding communities, and provides additional environmental benefits.

This Section provides a description of the Project by feature as follows: Section 3.1 describes the Project location; Section 3.2 details the existing Project facilities, features, and operations; Section 3.3 describes any changes to the existing Project facilities and operations proposed by Licensees at this time, and the reason for the proposed change; Section 3.4 provides a summary of the existing license requirements and environmental measures; Section 3.5 summarizes Project safety; Section 3.6 summarizes the Project generation and outflow records; and Section 3.7 provides the compliance history.

3.1 PROJECT LOCATION

The West Branch of the SWP is located in Los Angeles County, California, between the towns of Castaic and Gorman, near Interstate 5. It is approximately 17 to 34 miles northwest of the City of Los Angeles. Figure 3.1-1 shows the location of the Project.

3.2 EXISTING PROJECT BOUNDARIES, FACILITIES, FEATURES, AND OPERATIONS

This Section provides a description of the existing Project boundary, Project facilities, and operations. For relicensing purposes, Licensees have conducted a comprehensive review of these components.

3.2.1 <u>Existing Project Boundary</u>

The existing Project boundary covers 6,927.8 acres of land (Figure 3.1-1), with elevations ranging from 1,369 feet at the base of Elderberry Forebay Dam to 3,537 feet at the existing Project boundary edge, southeast of the Peace Valley Pipeline Intake. Within the total acreage, there are 2,790.25 acres of National Forest Service (NFS) lands within the ANF and LPNF, and 17 acres of land administered by the BLM.

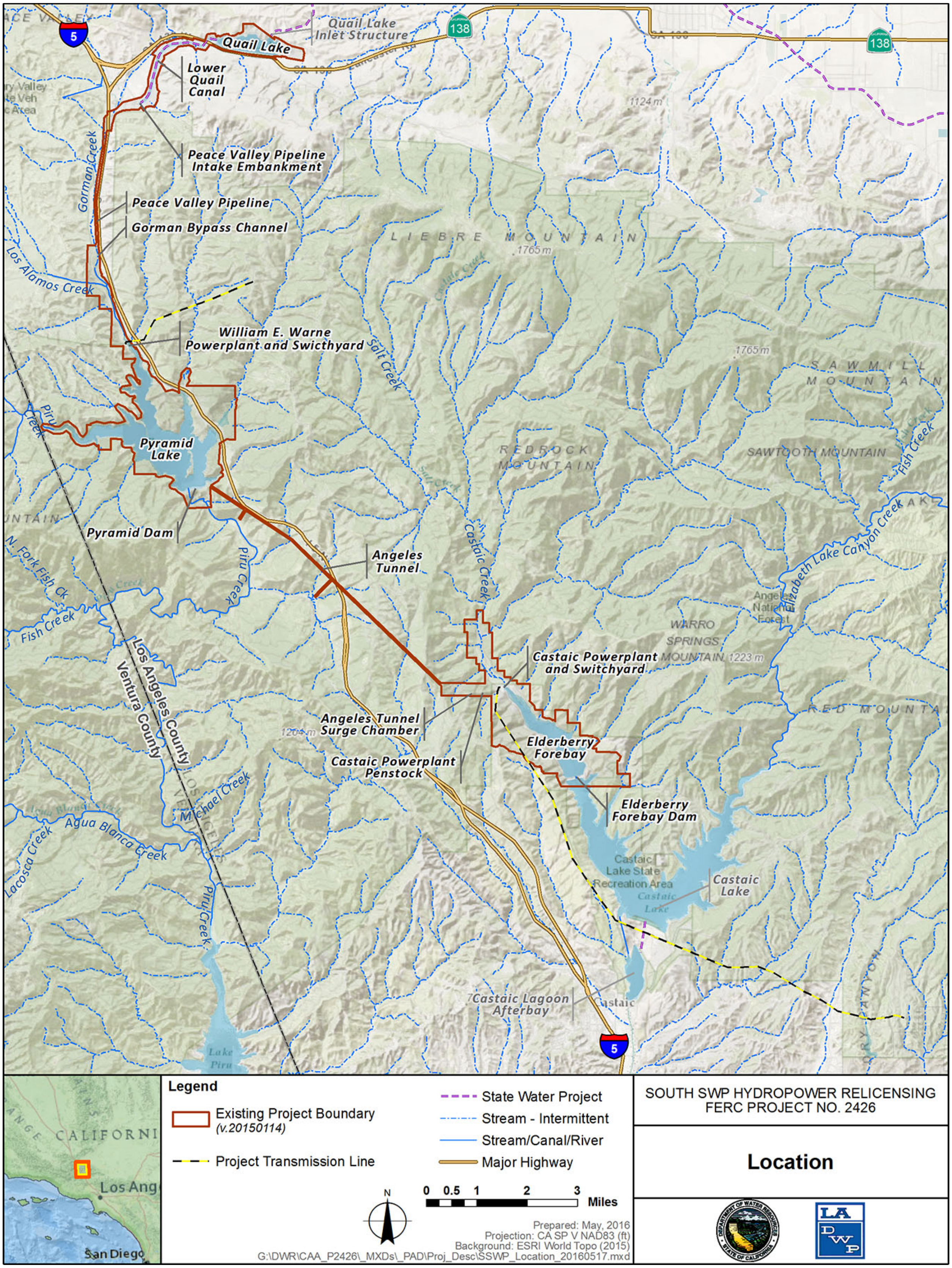


Figure 3.1-1. Existing Project Boundary and Major Project Facilities

Within the existing Project boundary, there are non-Project facilities including:

- A portion of the Quail Lake Inlet Structure
- Three short segments of Interstate 5 with California Department of Transportation (Caltrans) maintenance facilities near Liebre Creek
- A segment of Los Alamos Road
- The Goodell Fire Road/Castaic Canyon Road – 6N13 on the east side of the Elderberry Forebay
- A segment of Pyramid Road
- A portion of Templin Highway west Old Ridge Route (Private Street).

3.2.2 Existing Project Facilities and Features

The Project includes two power developments: (1) the Warne Power Development; and (2) the Castaic Power Development. The Project has a total licensed installed capacity of 1,350 MW. Each major Project feature is described below.

3.2.2.1 Warne Power Development

The major features of the Warne Power Development include Quail Lake, Lower Quail Canal, Peace Valley Pipeline Intake Embankment, Peace Valley Pipeline, Gorman Bypass Channel, the William E. Warne Powerplant (Warne Powerplant) Switchyard, the transmission line that interconnects Warne Powerplant with the SCE Pastoria-Pardee Transmission Line, recreational facilities, 7.2 miles of primary Project roads, and appurtenant facilities.

Quail Lake

Quail Lake (Figure 3.2-1) is the uppermost facility of the Project, and is a small regulating reservoir along the SWP that was created by constructing an embankment along a sag pond formed by the San Andreas fault. The lake is located 5 miles southwest of the bifurcation of the East and West branches of the SWP. Quail Lake was constructed in 1967.

Figure 3.2-1. Quail Lake from the West Shore Looking East

At a Normal Maximum Water Surface Elevation (NMWSE) of 3,324.5 feet, Quail Lake has a maximum capacity of 8,790 acre-feet (AF) and a surface area of about 290 acres.

The Quail Lake Outlet into Lower Quail Canal is a double-box culvert structure that passes beneath State Highway 138. Quail Lake and Lower Quail Canal serve as a forebay to Warne Powerplant; the slide gate between Quail Lake and the Lower Quail Canal is maintained in an open position. The Lower Quail Canal has an emergency outflow weir that is described in the following sub-section and therefore a spillway is not required for Quail Lake.

Lower Quail Canal

Water released from Quail Lake through the Quail Lake Outlet flows into Lower Quail Canal. The concrete-lined canal serves as a conveyance to the Peace Valley Pipeline Intake and is the forebay for Warne Powerplant. The Lower Quail Canal extends 2 miles from the Quail Lake Outlet to the Peace Valley Pipeline Intake. Lower Quail Canal has a bottom width of 24 feet, northern embankment height of approximately 50 feet, southern embankment height of about 40 feet, and maximum flow capacity of 3,129 cubic feet per second (cfs). The Lower Quail Canal volume is 1,150 AF at an elevation of 3,324.5 feet. An ungated emergency overflow weir is located on the north side of Lower Quail Canal. If an unplanned release occurs, water can be discharged over the ungaged weir into a detention basin located to the west and adjacent to the southernmost section of Lower Quail Canal.

Peace Valley Pipeline and Peace Valley Pipeline Intake Embankment

The Peace Valley Pipeline begins at the Peace Valley Pipeline Intake Embankment. The Peace Valley Pipeline Intake Embankment is a zoned earth and rockfill embankment located at the downstream end of the Lower Quail Canal. The Peace Valley Pipeline Intake Embankment is 50 feet tall, with a crest length of 350 feet, and crest elevation of 3,330 feet.

SWP water flowing from Quail Lake through Lower Quail Canal is discharged into the Peace Valley Pipeline to Warne Powerplant and then to Pyramid Lake. The Peace Valley Pipeline, which has a 12-foot diameter and is completely underground, serves as a penstock to the Warne Powerplant. It extends about 5.5 miles from the Peace Valley Pipeline Intake structure to the Warne Powerplant penstock. In the event of a Peace Valley Pipeline outage or scheduled SWP water flows exceeding the pipeline's capacity, the water is routed through the Gorman Bypass Channel directly into Pyramid Lake.

Gorman Bypass Channel

The Gorman Bypass Channel flow capacity is 700 cfs and conveys SWP water from Lower Quail Canal to Pyramid Lake, bypassing the Peace Valley Pipeline and Warne Powerplant, when necessary, with an alignment generally paralleling that of the Peace Valley Pipeline. The man-made channel begins at the Peace Valley Pipeline Intake Embankment and crosses Interstate 5 about 0.7 miles downstream from the embankment. Local drainage, if any, drains into the Bypass Channel near Interstate 5. About 3.2 miles downstream from the Peace Valley Pipeline Intake Embankment, the Gorman Bypass Channel and Peace Valley Pipeline alignments change. The Peace Valley Pipeline continues on the east side of Gorman Creek along Pyramid Lake Road until it crosses Gorman Creek again to the west and connects to the Warne Powerplant. Between Interstate 5 and Orwin Road, the Gorman Bypass Channel does not receive local drainage. The Gorman Bypass Channel continues from Orwin Road to Pyramid Lake on the west side of Gorman Creek to Pyramid Lake, bypassing local drainage inflow with an encased section crossing Gorman Creek and a siphon crossing Los Alamos Creek (i.e., Cañada de Los Alamos), a tributary to Gorman Creek.

Warne Powerplant

Warne Powerplant (Figure 3.2-2), an above ground, steel-reinforced, concrete powerhouse is located at the northern (upstream) end of Pyramid Lake, at the terminus of the Peace Valley Pipeline. The powerplant has two 37.5-MW Fuji Electric Pelton-type turbines, each connected to a Toshiba generator. Each turbine has a rated head of 650 feet, runner speed of 200 revolutions per minutes (rpm), rated output of 51,000 horsepower (hp), and a rated discharge of 782 cfs. The total combined flow capacity for the powerplant is 1,564 cfs. The two, three-phase Toshiba electric generators each have a capacity of 39,100 kilovolt-amperes (kVA), at a power factor of 0.95, and a frequency of 60 hertz (Hz), producing a voltage of 13,800 volts. The powerplant has a licensed authorized installed capacity of 75 MW with average annual generation of 346 gigawatt hours (GWh) and average monthly generation of 29 GWh during the period of 2000 through 2014 (Section 3.6). The powerplant has a dependable capacity of 20.7

MW. The dependable capacity is based on the average powerplant generation (MW) during 2014, a critically dry year.

Figure 3.2-2. Warne Powerplant Entrance Looking South

Warne Switchyard and Transmission Line

The Project includes a 3-mile-long, single-circuit, 220-kilovolt (kV) transmission line that connects output from the Project through the Warne Switchyard to SCE's Pardee-Pastoria transmission line. The line is built on steel lattice towers along a 150-foot wide right-of-way.

The Warne Switchyard is located west and immediately adjacent to the Warne Powerplant and contains two generator step-up transformers. The single-line diagram showing the transfer of electricity from the Project to the transmission grid is considered Critical Energy Infrastructure Information (CEII) and is provided separately (Appendix C).

Recreation Facilities

Recreational amenities, such as shoreline access, parking, restrooms, and fishing, are available at Quail Lake. Only non-water/body-contact recreation is allowed at Quail Lake.

Primary Roads and Trails

Primary Project roads for the Warne Power Development include the access roads on top of the Quail Detention Embankment from State Highway 138 to the Peace Valley Pipeline Intake Embankment, and the access roads from Interstate 5 to Warne Powerplant.

3.2.2.2 Castaic Power Development

The major features of the Castaic Power Development include Pyramid Dam, Pyramid Lake, the Angeles Tunnel and seven penstocks, the Castaic Powerplant and Switchyard, the Elderberry Forebay and Dam, Storm Bypass Channel and Check Dams, Castaic Switchyard and the transmission lines that interconnect Castaic Switchyard with the Independent System Operator (ISO) power grid, and approximately 3.9 miles of access roads. Facilities above the surge chamber at the southeastern end of the Angeles Tunnel are owned and operated by DWR. The remainder of the facilities, including the surge chamber, are owned and operated by LADWP.

Pyramid Dam

Pyramid Dam (Figure 3.2-3), at the southern end of Pyramid Lake, is a 1,090-foot-long zoned earth and rock fill dam. The dam is 400 feet high with a fill volume of about 7 million cubic yards (mcy). The crest of the dam is 35 feet wide with an elevation of 2,606 feet. Water is released from the spillway or a low-level outlet of Pyramid Dam to the 18-mile long section of Piru Creek (Pyramid reach), which extends from Pyramid Dam to the NMWSE of Lake Piru.

Figure 3.2-3. Pyramid Dam and Lake from the Vista del Lago Visitor's Center Looking South

Pyramid Dam has two spillways, a gate-controlled spillway, and an uncontrolled emergency spillway. The gated spillway is controlled by a single radial gate that measures 40 feet wide by 31 feet tall and consists of a concrete-lined chute terminating in a flip bucket.

The low-level outlet works utilize the stream bypass tunnel (diversion tunnel) used during construction of the dam. This stream release facility is a 15-foot-diameter, concrete-lined tunnel approximately 1,350 feet long through the right abutment of the dam, and is used for downstream releases to Pyramid reach.

Seepage through the dam is also collected at the toe of the dam, where it is gaged before being released into Pyramid reach. The maximum safe, designed release from the low-level outlet of Pyramid Dam to Pyramid reach is 18,000 cfs.

Pyramid Lake

Pyramid Lake serves as regulated storage for the Castaic Powerplant. At a NMWSE of 2,578 feet, Pyramid Lake has a storage capacity of 169,902 AF and a usable storage capacity of 22,221 AF. As discussed under Section 3.2.3.2, current operating agreements limit fluctuation of the lake to only the upper 19 feet under normal operating conditions, thus making the usable storage only a small fraction of the total storage available in the lake. Pyramid Lake also serves as emergency storage for the SWP. The lake has a normal maximum surface area of approximately 1,300 acres, a shoreline length of approximately 21 miles, and a maximum depth of approximately 280 feet deep. Approximately 3 percent of the total inflow to Pyramid Lake is from natural inflow; the majority of the inflow to the lake is SWP water. Pyramid Lake receives natural inflow into the west arm of the lake from Piru Creek and a combination of natural and SWP water inflows into the north arm of the lake from Gorman Bypass Channel and Gorman Creek.

Angeles Tunnel and Penstocks

The Angeles Tunnel, the principal outlet from Pyramid Lake, supplies water to Castaic Powerplant in the generating mode and returns water to the lake from Elderberry Forebay when the powerplant is operating in the pumping mode. Angeles Tunnel is 7.2 miles long, has a diameter of 30 feet, and has a maximum flow capacity of 18,400 cfs.

The penstock assembly for the six units in Castaic Powerplant consists of a double trifurcation immediately downstream of the south portal of Angeles Tunnel, a penstock shutoff valve on each branch of the trifurcations, and six 2,200-foot-long steel penstocks ranging in diameter from 9 feet to 13.5 feet serving the six powerhouse units (Unit Nos. 1-6). Unit No. 7 powerplant is served by a 1,900-foot-long steel penstock ranging in diameter from 7 feet to 9 feet branching from a Y-connection between the tunnel portal and the main trifurcation. Combined flow capacity for all seven penstocks is 17,840 cfs.

Castaic Powerplant

The Castaic Powerplant (Figure 3.2-4), an aboveground/underground, steel-reinforced, concrete powerhouse is located on the northern (upstream) end of Elderberry Forebay and is a pumping-generating plant with the ability to pump water back to Pyramid Lake using off-peak energy when it is economical to do so. Elderberry Forebay serves as an afterbay for Castaic Powerplant while in generating mode and as a forebay while in pumping mode. Pyramid Lake serves as the upper reservoir of the powerplant.

The powerplant has six Voith Siemens Hydro, reversible pump/turbines and motor/generators, Francis-type pump-turbine units each with a rated head of 1,048 feet, a runner speed of 257 rpm, a rated output of 355,000 hp, and an approximated rated discharge of 3,500 cfs (generator capacity is 250,000 kVA with a power factor of 0.85, a frequency of 60 Hz and voltage of 18,000 volts). It has one Alstom Pelton-type pump starting turbine unit with a rated head of 950 feet, a runner speed of 225 rpm, rated output of 69,000 hp, and an approximate rated discharge of 752 cfs (generator capacity is 70,000 kVA with a 0.80 power factor, frequency of 60 Hz, and voltage of 11,000 volts). These seven units have a combined licensed capacity and generating capacity of 1,275 MW with a plant capacity of 17,840 cfs. Pumping capability at normal static head ranges from 2,200 cfs, with one unit operating to about 12,000 cfs with six units pumping. The powerplant’s dependable capacity for 2014 was 20.1 MW. The dependable capacity is the average powerplant generation (MW) over a year. Because Castaic Powerplant is a pumped storage facility, it is capable of generating at or near plant capacity if needed for a period of a few hours.

Figure 3.2-4. Castaic Powerplant and Penstocks from the East Looking West

Castaic Powerplant generates electricity during on-peak periods, typically weekday daylight hours, when extra power is needed in the Los Angeles area. During off-peak periods, typically nights and Sundays, the powerplant pumps water from Elderberry Forebay back into Pyramid Lake for storage until it is needed for power generation. This water can be routed through the turbine generators in a very short time to meet peak and/or unanticipated demands on LADWP's electric system. The pumping function at Castaic Powerplant improves the availability of water for peak power generation, which enhances the power generation benefits to the Los Angeles area.

Elderberry Forebay Dam and Forebay

Elderberry Forebay Dam (Figure 3.2-5), completed in 1974, is a 1,990-foot-long zoned earthfill dam with a height of 200 feet and a fill volume of 6 mcy. The crest of the dam is 25 feet wide with an elevation of 1,550 feet. The outlet tower, located approximately 400 feet upstream of Elderberry Forebay Dam, includes: one 5-foot-wide by 6-foot-high main gate, six 8-foot-wide by 12-foot-high lower gates, two 8-foot-wide by 9-foot-high upper gates, twelve 13-foot-wide by 12-foot-high storm gates, and one 5-foot-wide by 6-foot-high guard gate. The outlet tower to the forebay connects to a 21-foot-diameter conduit that runs under Elderberry Forebay Dam and releases water into Castaic Lake (a non-Project facility).

Figure 3.2-5. Elderberry Forebay Dam and Elderberry Forebay Looking East

An overflow weir built into a natural topographic saddle located approximately 300 feet east of the left abutment of the dam serves as an uncontrolled emergency spillway. The crest elevation of the overflow weir is 1,540 feet, with a capacity of at least 12,000 cfs. Elderberry Forebay Dam, including this emergency spillway, is the lowermost facility of the Project.

Elderberry Forebay is located directly below Castaic Powerplant, serving as an afterbay when the plant is generating power and as a forebay when the plant is pumping water back to Pyramid Lake. The forebay also receives a very small amount of local inflow from Castaic Creek, which enters at the northern end of the reservoir. Of the total inflow to Elderberry Forebay, only 1 percent is from Castaic Creek. The remaining inflow to Elderberry Forebay is SWP water from Pyramid Lake conveyed via the Angeles Tunnel. At a NMWSE of 1,530 feet, Elderberry Forebay has a capacity of 28,231 AF, a surface area of 500 acres, and a shoreline length of 7 miles.

Storm Bypass Channel and Check Dams

The Storm Bypass Channel is on Castaic Creek above Elderberry Forebay and includes a series of three check-dam basins with a total area of approximately 21 acres for capturing sediment runoff during high flow events to reduce the continued accumulation of sediment near the powerplant and ensuring the sustained efficiency of the Castaic Powerplant operation. Sediment and debris are removed from the check-dam basins as needed, and spoils are disposed of onsite on State-owned lands.

Castaic Switchyard and Transmission Line

The Castaic Switchyard is a fenced switchyard located adjacent to the powerhouse and uses a double-breaker, double-bus scheme. It has three outgoing lines for transmitting power: Castaic Olive line 1, Castaic Sylmar line 1, and Castaic Northridge line 1. There are seven three-phase step-up-transformers, one for each of the generating units.

The existing Project includes the 11.4-mile, 230-kV transmission line that delivers energy from the Castaic Switchyard to the Haskell Junction substation, and transmits energy to the Castaic Powerplant when the reversible turbine generating equipment is in the pump-back operating mode. The line consists of three circuits (i.e., Northridge, Sylmar, and Olive) that are carried on two parallel double-circuit steel towers. The southern towers carry the Castaic – Northridge and Castaic – Sylmar 230-kV circuits. The northern towers carry the Castaic – Olive 230-kV circuit, and the second position is currently vacant, but LADWP filed a non-capacity license amendment with FERC on March 10, 2016 to construct the fourth transmission line from Castaic Switchyard to Haskell Junction.

Recreation Facilities

Recreation resources including Project recreation facilities are described in detail in Section 4.9, including extensive day use facilities and boat docks on Pyramid Lake and a large overnight campground nearby. The Los Alamos Campground, located about two miles northwest of Pyramid Lake, is part of the licensed recreation facilities for the Project. The campground provides 93 individual campsites and 3 group campsites, and is managed by Parks Management Company under a concessionaire contract with DWR.

The Vista del Lago Visitors Center is located on the east side of Pyramid Lake. The Vista del Lago Visitors Center provides many different interpretive displays used to educate and inform the public on the SWP, the facilities, their purpose and operations, and public safety aspects.

Primary Roads and Trails

Primary roads (3.9 miles) and trails include the LADWP road from Templin Highway to the Castaic Powerplant; the maintenance road on the west side of Elderberry Forebay to the Elderberry Forebay Dam; the maintenance road/trail at the end of Templin Highway, providing access across Castaic Creek to the Castaic Storm Bypass Channel; and the access roads for recreation facilities on the east side of Pyramid Lake and near Pyramid Dam and Lake.

3.2.3 Project Operations

Project operations and summary statistics are presented in the following sub-sections.

3.2.3.1 Hydrologic Period of Record

For the purpose of this PAD, Licensees have chosen a 15-year period of record extending from calendar year 2000 through calendar year 2014. This period contains wet years like 2006 and critical dry years like 2014. All operations data presented in this report were obtained from DWR's State Water Project Monthly Operations Data at http://www.water.ca.gov/swp/operationscontrol/monthly.cfm (DWR 2015b), which among other things, contains daily operation data of Project storage and conveyance facilities and Project generation records.

Data collection occurs on a daily basis by Southern Field Division (SFD) personnel working for the Water Operations Section. These data are collected via: (1) metered instrumentation; (2) remote supervisory control and data acquisition (SCADA) telemetry; (3) handheld recorders onsite; and (4) visual gage observations onsite. The information is sent to DWR's Regulatory Compliance and Reporting Branch, is available on-line from DWR's website, and is published in monthly SWP project-wide operation reports. Detailed gage information is available in Section 4.4. Appendix D contains additional information on hydrology and project generation.

3.2.3.2 Water Diversions and Operational Considerations

Licensees' first and foremost consideration when operating the Project is the safety of the public, Licensees' employees, and Licensees' contractors. After safety of persons, Licensees' next operational consideration is the safety of Project facilities and downstream facilities.

There are several major operational constraints for the Project regarding lake levels and Pyramid reach releases. For Pyramid Lake, per the 1970 Amendment No. 1 to the 1969 Memorandum of Understanding between DWR and USFS, during normal operation conditions, water surface level variations do not exceed 14 feet during each 7-day period beginning midnight each Sunday, and do not exceed 8 feet each day. In addition, the water surface of Pyramid is not lowered below an elevation of 2,560 feet without taking additional safety precautions and making appropriate notifications.

Article 58 of the existing license requires Licensees to maintain Pyramid Lake surface elevations at the highest, most practicable levels commensurate with other Project purposes during the summer recreation season.

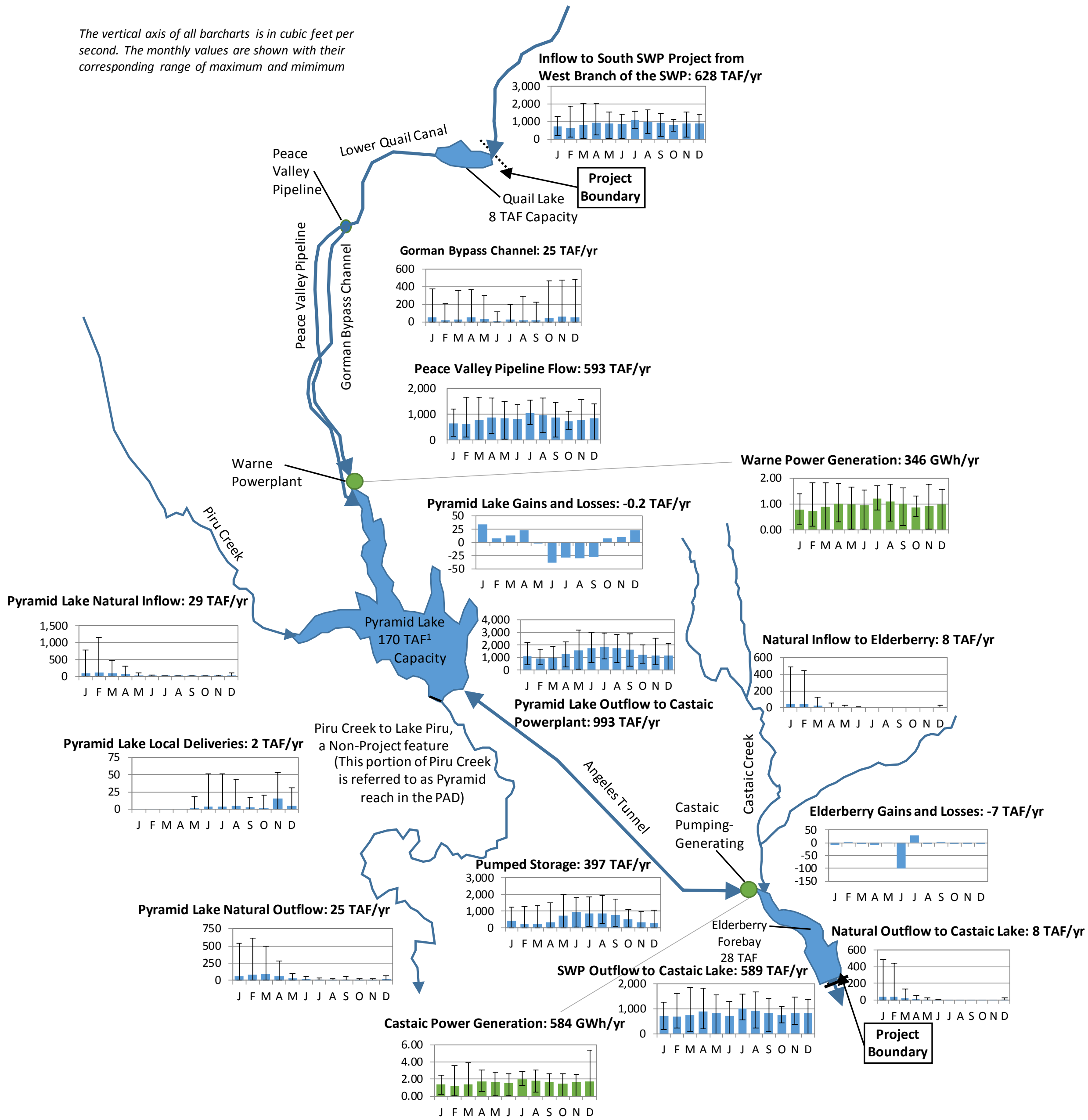
Pyramid Lake operation is also subject to an agreement between the Licensees that places additional constraints on Pyramid Lake operation. Under normal operating conditions, the lake level is maintained at an elevation of at least 2,567 feet, and the releases out of Pyramid Lake through Angeles Tunnel are balanced to the SWP water scheduled into Pyramid Lake on a weekly basis.

According to provisions of Article 52 of the Project FERC license, outflows from Pyramid Dam to Pyramid reach are required to match natural inflow into Pyramid Lake to the extent operationally feasible and consistent with safety requirements (DWR 2007a and 2014a). The effect of Article 52 is reflected in 2006 and later operations. Article 52 also states that any natural flows above the maximum safe release from Pyramid Lake to Pyramid reach can be appropriated according to the conditions of existing water rights. DWR holds water right permit number 18709 (priority date May 3, 1979) authorizing the appropriation of water from Piru Creek at Pyramid Lake when flows are greater than the demands of the downstream water users. United Water Conservation District (UWCD) also holds water rights to natural flow in Piru Creek and stores SWP water for the Ventura County Watershed Protection District (VCWPD).

Water is discharged from Pyramid Lake to Pyramid reach for delivery to UWCD which currently receives deliveries of SWP water under the revised guidelines of Article 52 of the Project's license, which allow for the delivery of up to 3,150 AF of SWP water via Piru Creek to UWCD on behalf of VCWPD between November 1 and the end of February each year. UWCD also has appropriative rights to natural flow in Piru Creek under water right permit numbers 11181 (priority date September 18, 1947) and 19373 (priority date March 25, 1982). In addition, SWP supplies are delivered from Pyramid Lake to support lake recreation.

3.2.3.3 Total Project Inflows and Outflows

A schematic of the Project is shown in Figure 3.2-6, along with annual average volumes and monthly patterns for Project inflows, outflows, and power generation from 2000 through 2014. The Project inflows include SWP water supply delivery into Quail Lake and local natural inflows to Pyramid Lake and Elderberry Forebay; local natural inflows represent approximately 4 percent of total Project inflows.



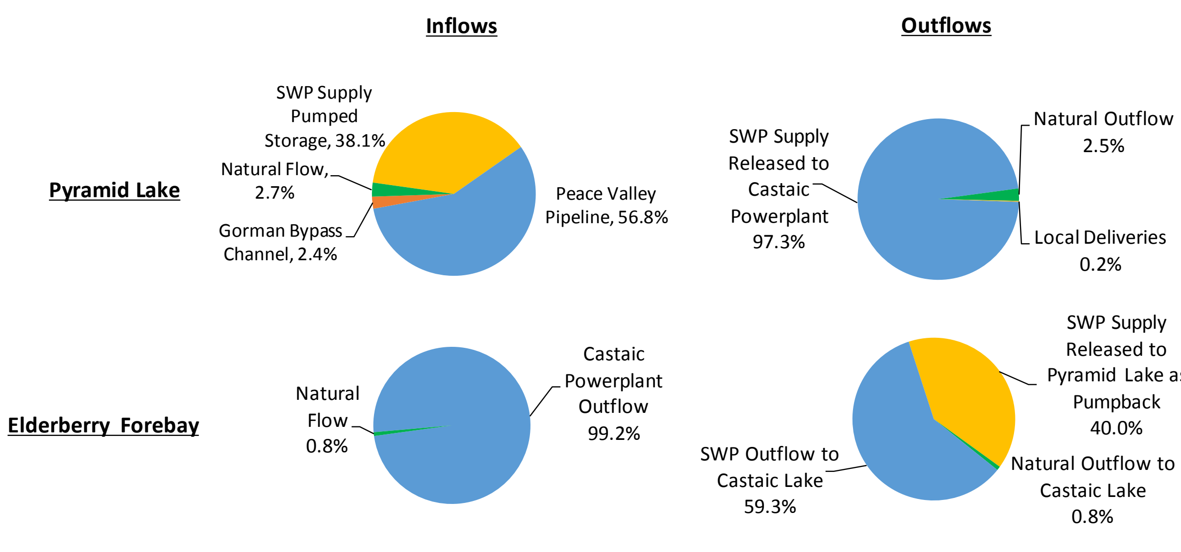
Source: DWR 2015b
Note:
[1]169,902 Capacity at NMWSE
Key:
TAF = thousand acre-feet
yr = year

Figure 3.2-6. Annual Average Flow Volumes and Monthly Average Flows, 2000 through 2014

Figure 3.2-6 shows the computed loss of an average of about 10 TAF per year between the inflow to Quail Lake and the total of Gorman Bypass Channel and Peace Valley Pipeline outflows. The water balance was computed from DWR operational data. In this data, the flow to the Gorman Bypass Channel is not metered but is estimated from the percent opening of the gates controlling the release to the channel. The flow in the Peace Valley Pipeline is not measured at the intake, but downstream at Warne Powerplant. Because these are calculated measurements based on percentage of gate opening and not direct measurements based on actual flow there is room for error in the published operation data that could account for the imbalance. All of this flow is SWP water supply, contained within SWP facilities and does not impact natural flows or the natural environment.

Project outflows include both the release of SWP water supply and natural inflows from Pyramid Lake and Elderberry Forebay.

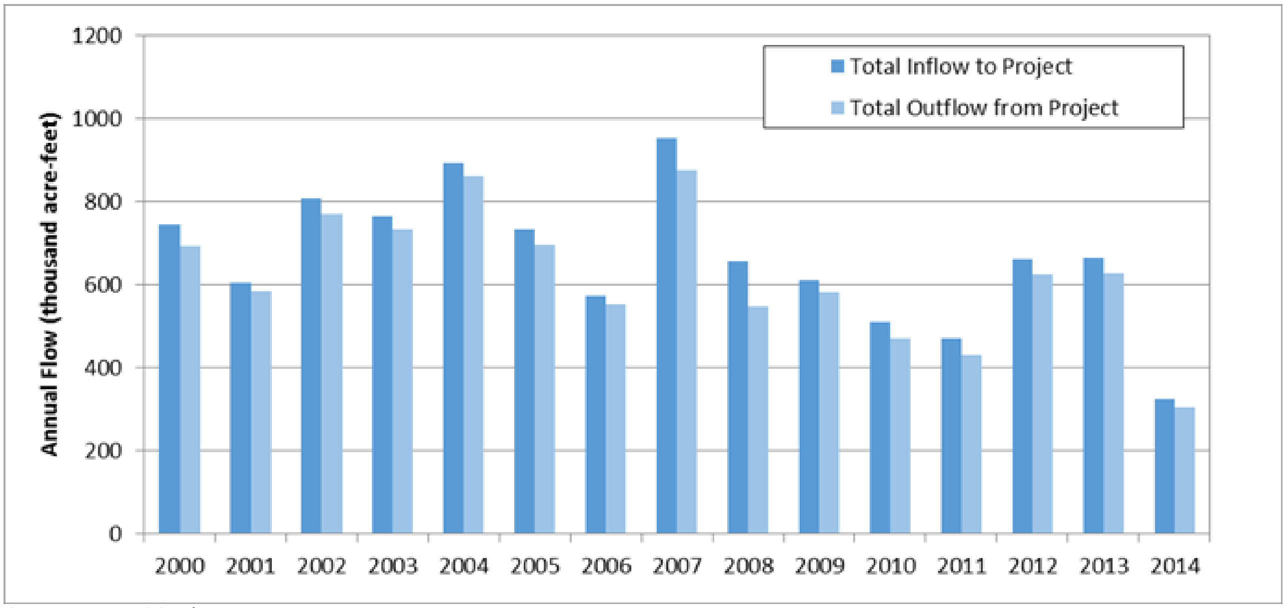
Figure 3.2-7 demonstrates the inflow and outflow for Pyramid Lake and Elderberry Forebay. As shown, natural inflow only accounts for approximately 3 percent of the total Pyramid Lake inflow and only 1 percent of total inflow to Elderberry Forebay. As described above, Elderberry Forebay is located directly below Castaic Powerplant and serves as an afterbay when the plant is generating power and as a forebay when the plant is pumping water back to Pyramid Lake. The amount of water used for pumped storage operations represents 38 percent of Pyramid Lake inflow and 40 percent of the total Elderberry Forebay outflow on an annual basis.



Source: DWR 2015b
Note:
Each pie-chart may be off by 0.1 percent because of rounding.

Figure 3.2-7. Average Annual Inflow and Outflow for Pyramid Lake and Elderberry Forebay, 2000 through 2014

Figure 3.2-8 compares the total inflow to the Project (SWP water and local inflow) and entire outflow (SWP water, local water use, downstream releases) from the Project. The difference consists of system losses.

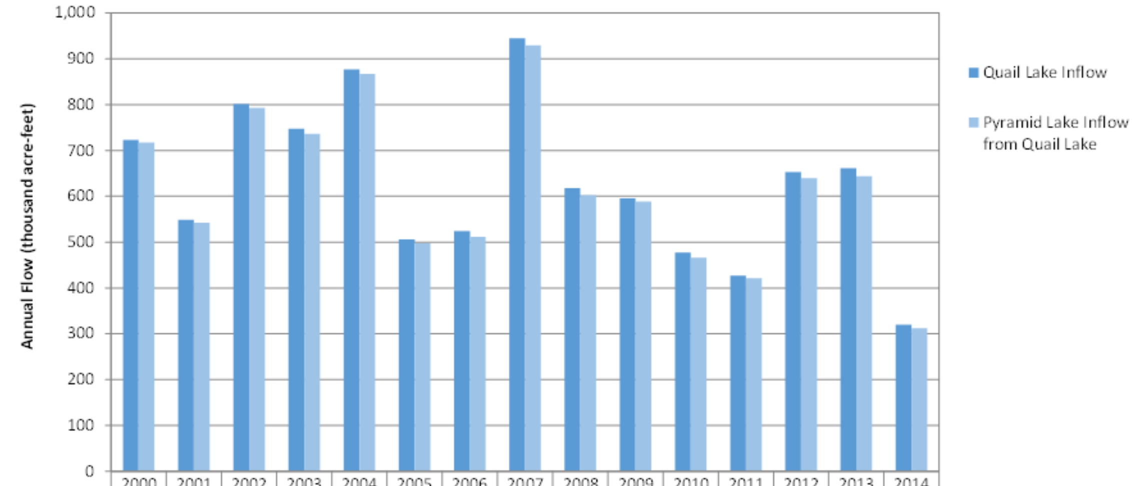


Source: DWR 2015b

Figure 3.2-8. Comparison of Annual Total Inflow and Annual Total Outflow for the Project, 2000 through 2014

3.2.3.4 Quail Lake and Warne Powerplant Operations

Quail Lake and Lower Quail Canal serve as a forebay to Warne Powerplant and receive flow from the Oso Pumping Plant (non-Project Facility) located 2.8 miles upstream. Figure 3.2-9 compares the SWP water inflow into Quail Lake and SWP water inflows to Pyramid Lake, which come from Quail Lake through Lower Quail Canal, discharging to the Peace Valley Pipeline and the Gorman Bypass Channel. Annual average losses between 2000 through 2014 between Quail Lake and Pyramid Lake are approximately 10,000 AF, calculated using the operational data for the difference in inflow to Quail Lake and the outflow to the Peace Valley Pipeline and the Gorman Bypass Channel (DWR 2015b). Overall, with minor losses, the SWP water is preserved in this section of the Project. The only source of water used for Warne Powerplant generation is SWP water and there is no natural flow into Quail Lake or Lower Quail Canal.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Quail Lake Inflow	723	549	802	748	877	505	525	945	618	595	477	427	653	661	320
Pyramid Lake Inflow from Quail Lake	718	542	793	737	867	497	511	930	602	589	466	421	640	644	312

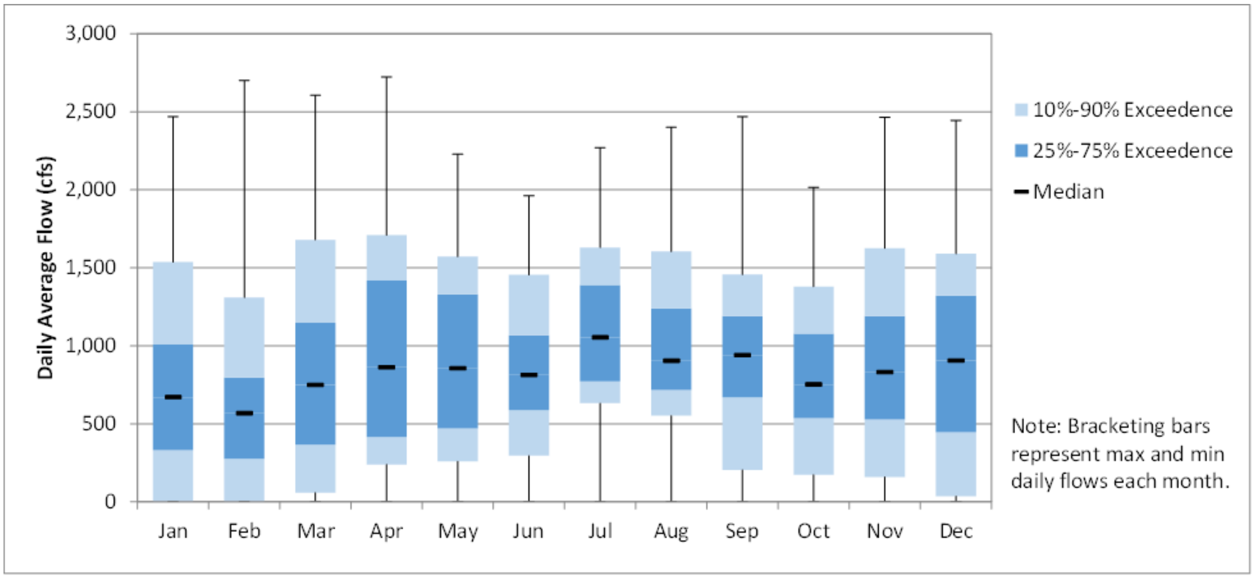
Source: DWR 2015b

Figure 3.2-9. Comparison of Annual Quail Lake Inflows and Pyramid Lake Inflows from Warne Powerplant and Inflows from the Gorman Bypass Channel, 2000 through 2014

The box-and-whisker plots in this PAD are summaries of flow exceedance curves, which can be found in Appendix D. The plots also show median values, which in some cases are close to the x-axis because 50 percent of the data points are at very low flows.

The following figures show the flow ranges for Quail Lake inflows (from West Branch SWP) and outflows (to Pyramid Lake via Warne Powerplant or the Gorman Bypass Channel) displayed as exceedance plots. The exceedance plots display the monthly distribution of the daily average flow value.

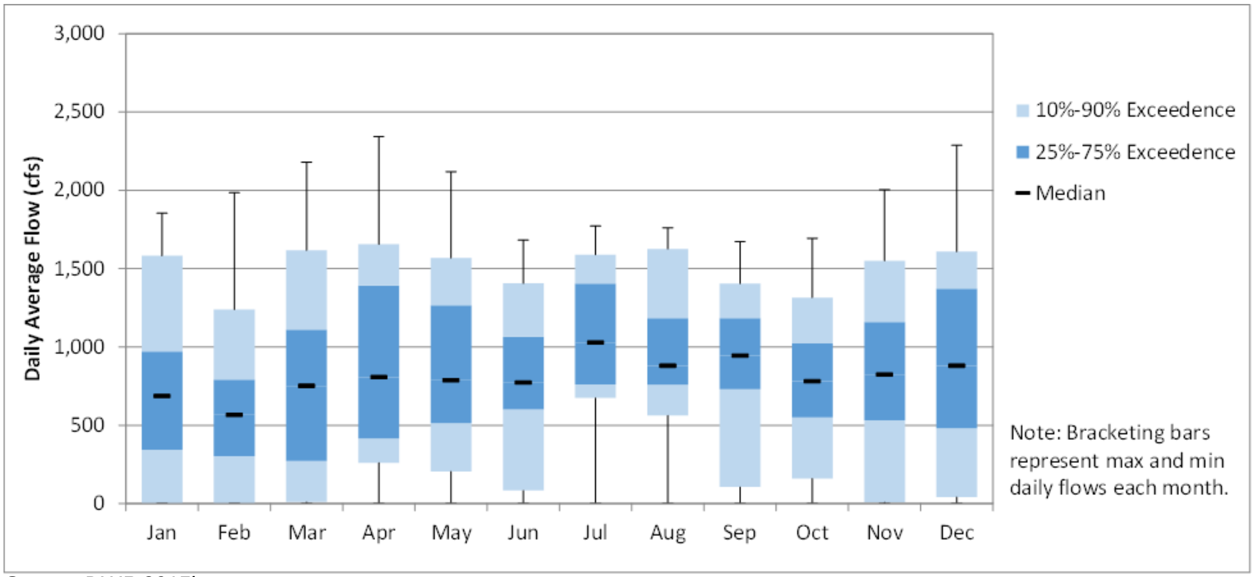
Figure 3.2-10 shows the range and seasonal variation in daily SWP inflows to Quail Lake from 2000 through 2014. Inflows to Quail Lake tend to be higher in the summer months, although the median values of flows (a measure of central tendency) do not vary greatly throughout any particular year.



Source: DWR 2015b
Key:
cfs = cubic feet per second

Figure 3.2-10. Range and Exceedance Probability of Daily Inflows by Month from the West Branch SWP to Quail Lake, 2000 through 2014

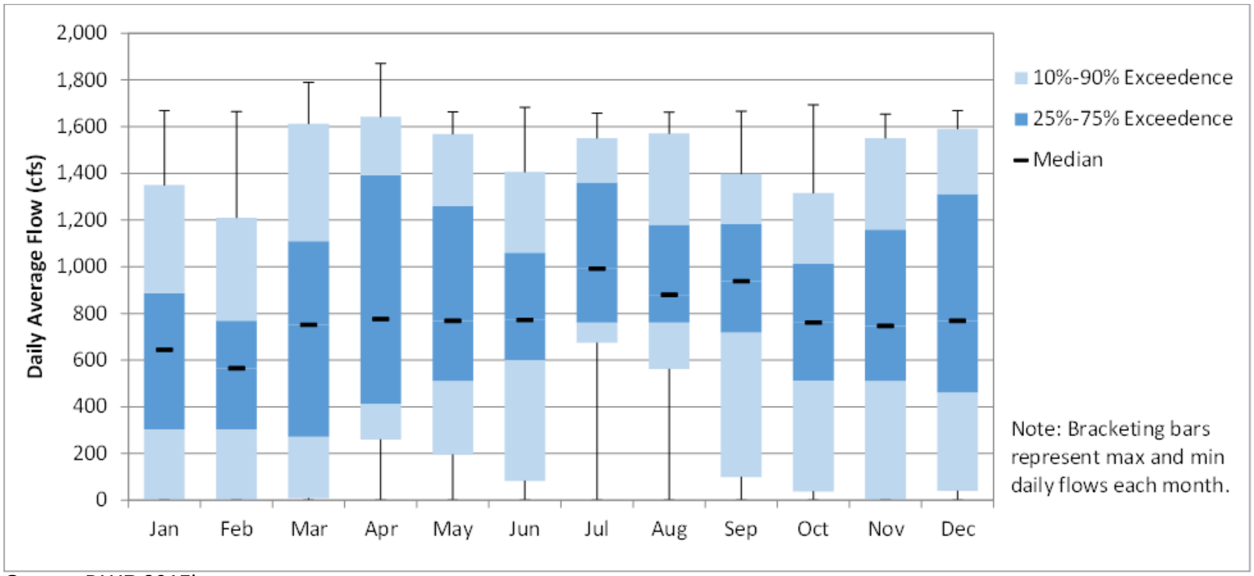
Figure 3.2-11 shows the total Project inflow to Pyramid Lake, which is representative of the total outflow from Quail Lake. Quail Lake releases water through the Lower Quail Canal to Pyramid Lake by two different routes, the Warne Powerplant via the Peace Valley Pipeline and the Gorman Bypass Channel. Quail Lake releases are relatively consistent throughout the year.



Source: DWR 2015b
Key:
cfs = cubic feet per second

Figure 3.2-11. Range and Exceedance Probability of Daily Inflows to Pyramid Lake by Month from Quail Lake Releases, Including Inflows from Warne Powerplant and the Gorman Bypass Channel, 2000 through 2014

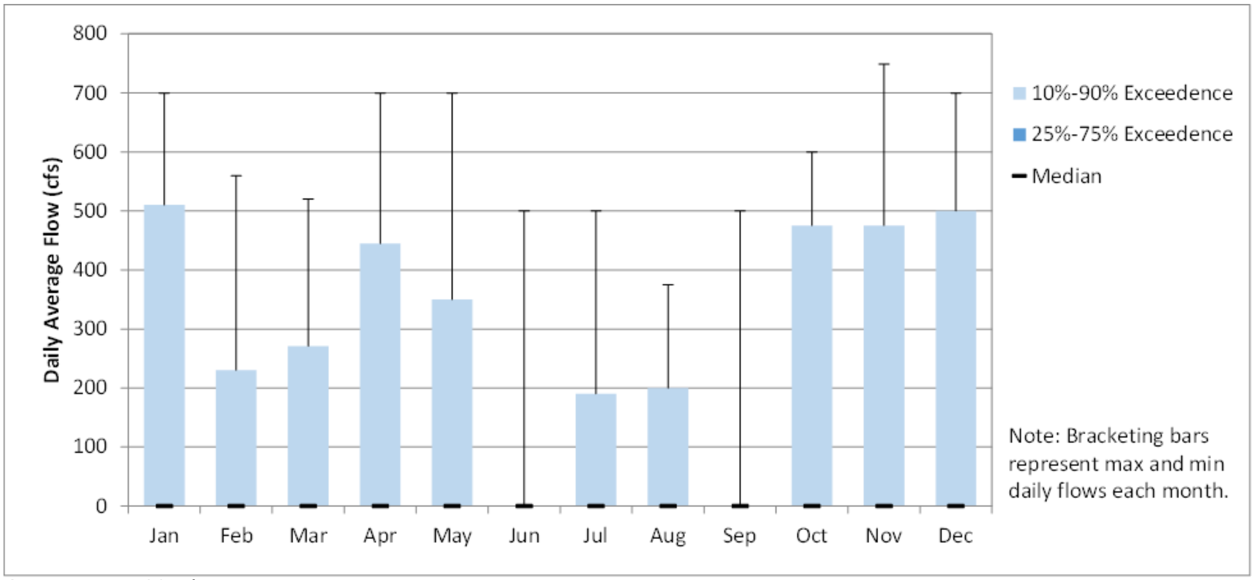
Figure 3.2-12 demonstrates the Quail Lake outflow released through the Lower Quail Canal and Peace Valley Pipeline for delivery to Pyramid Lake through the Warne Powerplant. The majority of outflow from Quail Lake is conveyed through the Peace Valley Pipeline and these releases are relatively consistent throughout the year. Outflow from Quail Lake can also be conveyed via the Gorman Bypass Channel.



Source: DWR 2015b
Key:
cfs = cubic feet per second

Figure 3.2-12. Range and Exceedance Probability of Daily Inflows to Pyramid Lake by Month from Warne Powerplant, 2000 through 2014

The portion of SWP water conveyed through Gorman Bypass Channel has varied widely between years due to Warne Powerplant generation capability or maintenance of Peace Valley Pipeline. There was no water conveyed through the Gorman Bypass Channel from 2000 through 2006. Figure 3.2-13 shows flows conveyed through the Gorman Bypass Channel occur less than 25 percent of the days in any month from 2007 to 2014. From 2007 through 2014, Gorman Bypass Channel flows ranged from a maximum of approximately 22 percent in 2009, to a minimum of less than 1 percent of Quail Lake releases in 2013. Deliveries through the Gorman Bypass Channel were particularly high in 2007 through 2009, in part because maintenance work on the Peace Valley Pipeline limited its conveyance capacity. Similarly, releases to the Gorman Bypass Channel vary widely on a daily basis, with large flows occurring during a small number of days each year and little to no flow occurring in the remaining days.



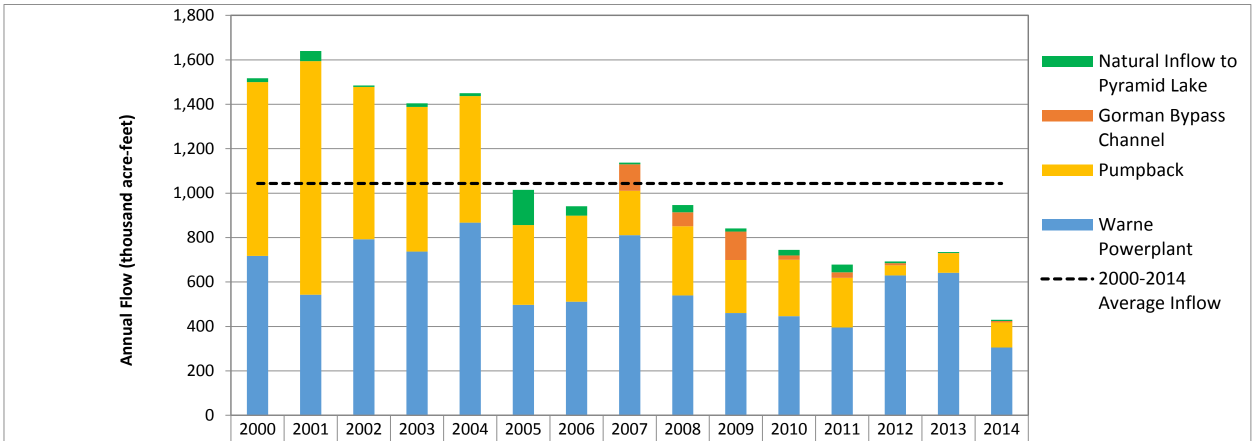
Source: DWR 2015b
Key:
cfs = cubic feet per second

Figure 3.2-13. Range and Exceedance Probability of Daily Inflows by Month to Pyramid Lake from Gorman Bypass Channel, 2007 through 2014

3.2.3.5 Pyramid Lake Operations

The range of annual inflows and outflows at Pyramid Lake from 2000 through 2014 is shown in Figures 3.2-14 and 3.2-15. As indicated in these figures, the movement of water through Pyramid Lake is primarily driven by SWP operations, including inflow of SWP water conveyed from Quail Lake to Pyramid Lake, as well as water released to and pumped through Castaic Powerplant from Elderberry Forebay. Article 52, described in Section 3.2.3.2, requires Licensees to release natural inflow to Pyramid reach. This operation is reflected after 2006.

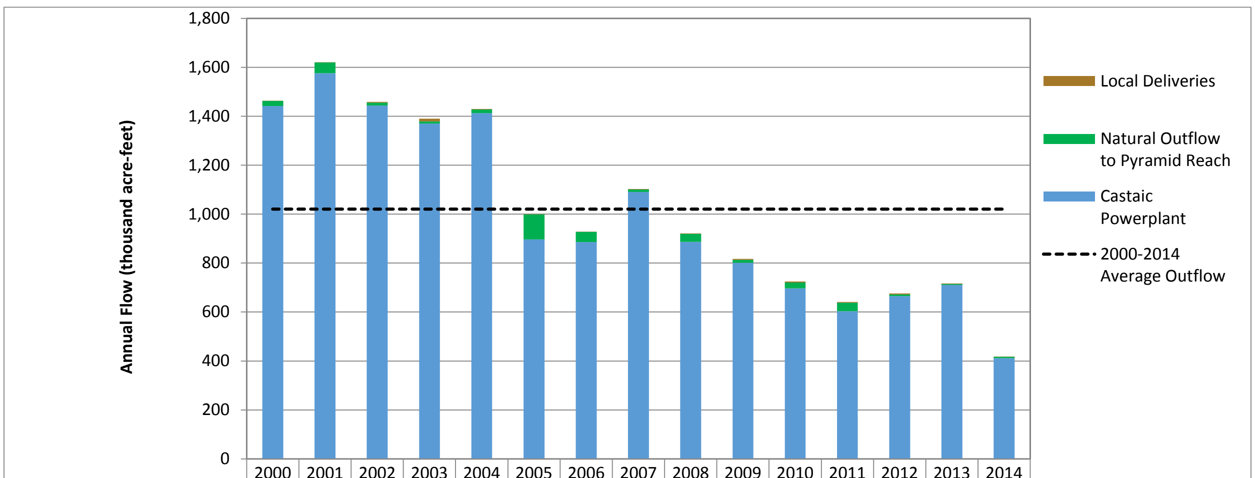
Pyramid Lake inflows and releases also include natural flows and deliveries to local water users, as described below. Natural inflow only accounts for approximately 3 percent of the total Pyramid Lake inflow. In addition, the combined gains and losses from reservoir evaporation and reservoir seepage result in an annual average net loss of about 200 AF per year from the reservoir.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Natural Inflow to Pyramid Lake	17	46	7	15	13	158	43	8	32	13	26	34	7	4	6
Gorman Bypass Channel	0	0	0	0	0	0	0	119	63	128	19	26	10	2	7
Pumpback	782	1,052	685	652	569	359	387	200	312	239	253	223	45	88	113
Warne Powerplant	718	542	793	737	867	497	511	811	539	460	447	396	630	642	305

Source: DWR 2015b

Figure 3.2-14. Annual Inflows to Pyramid Lake, 2000 through 2014



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Local Deliveries	0	0	3	11	2	0	0	2	2	3	3	3	3	2	0
Natural Outflow to Pyramid Reach	21	43	12	9	14	103	42	10	33	13	25	36	8	4	6
Castaic Powerplant	1,442	1,576	1,444	1,370	1,413	897	886	1,091	887	801	697	603	665	711	411

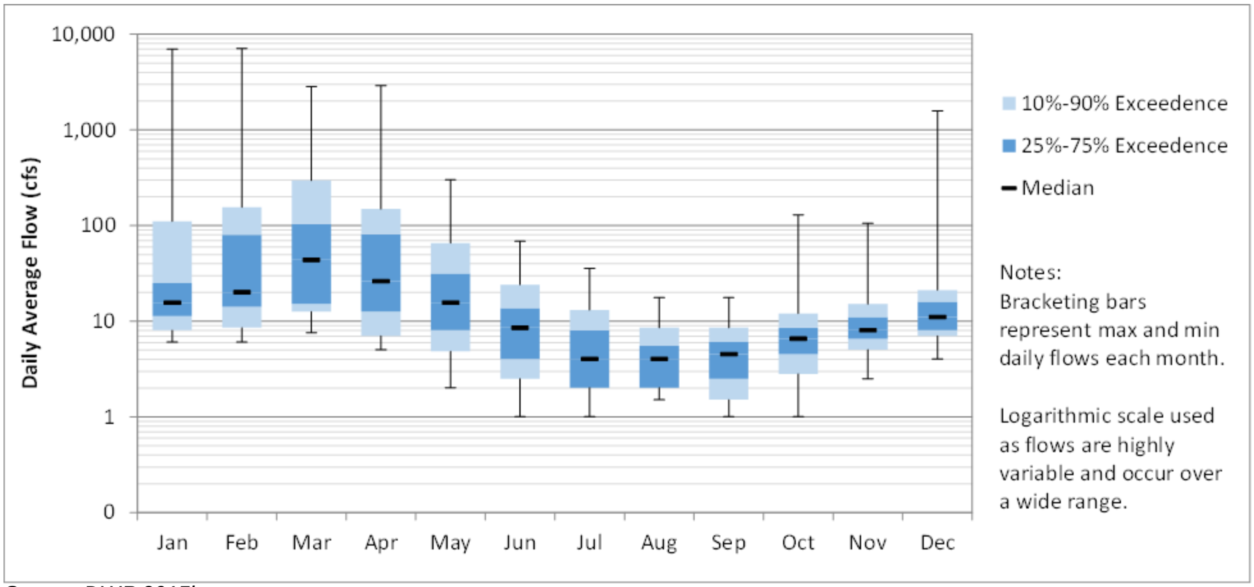
Source: DWR 2015b

Figure 3.2-15. Annual Outflows from Pyramid Lake, 2000 through 2014

The following Section provides additional details of the information found in Figures 3.2-14 and 3.2-15. The discussion is broken into three parts: (1) natural inflow and outflow; (2) pumping and generating operation; and (3) local water use.

Natural Inflow and Outflow

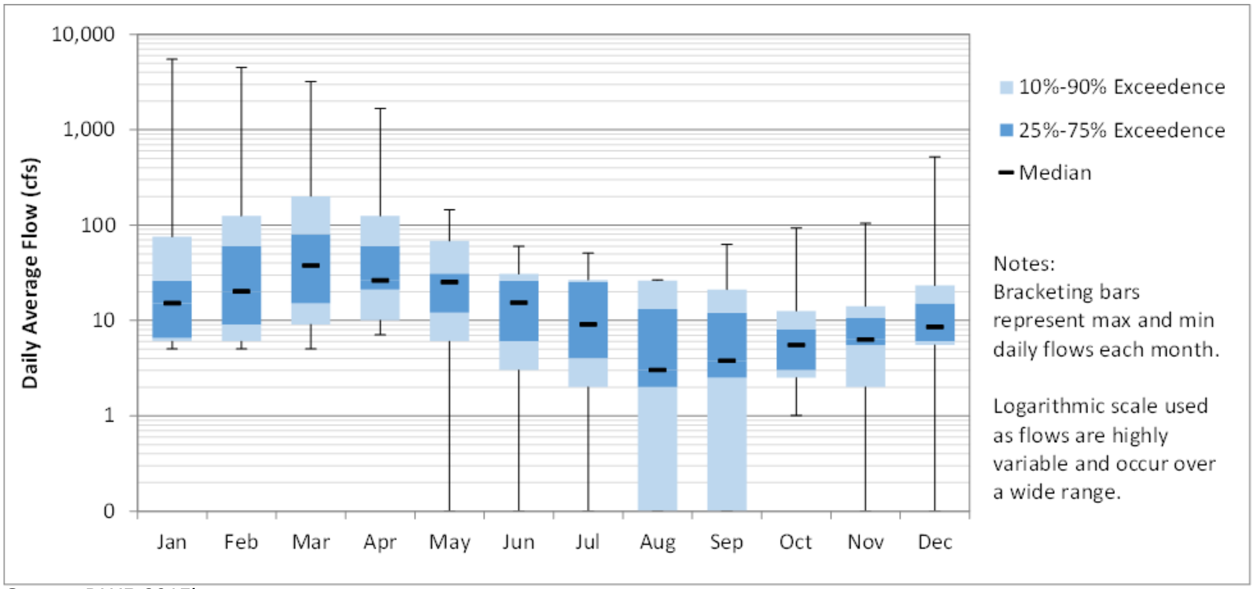
Pyramid Lake receives local inflow, including flows from Piru Creek and Gorman Creek. These natural inflows account for approximately 3 percent of the total inflow to Pyramid Lake and primarily occur during the winter and spring and are highly variable. Figure 3.2-16 shows the range and seasonal variation in natural inflows during this period. While the figure shows the minimum flow of 1 cfs in summer, DWR has observed little or no inflow in drier years. Natural inflow is generally lowest in the summer months and highest in the winter and spring months.



Source: DWR 2015b
Key:
cfs = cubic feet per second

Figure 3.2-16. Range and Exceedance Probability of Daily Natural Inflows by Month into Pyramid Lake, 2000 through 2014

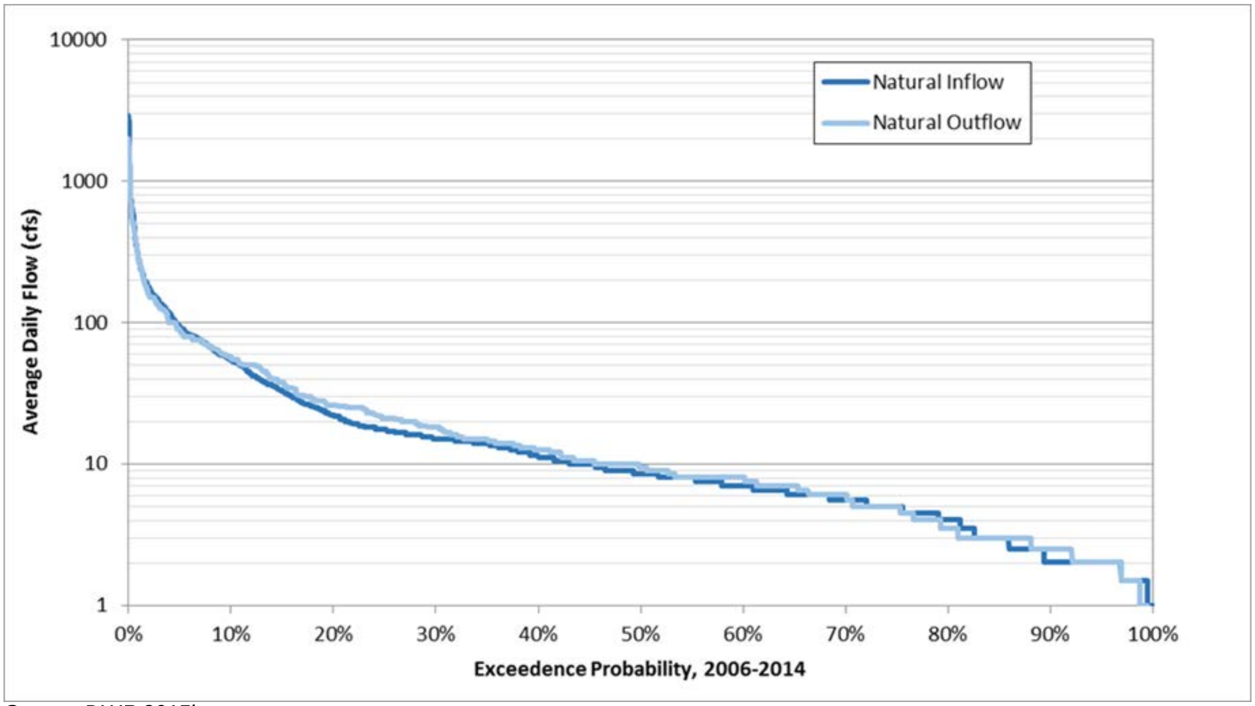
Natural outflows from Pyramid Lake to Pyramid reach tend to peak in the winter and spring months. The range and exceedance probability of daily natural outflows from Pyramid Lake from 2000 through 2014 is shown in Figure 3.2-17.



Source: DWR 2015b
Key:
cfs = cubic feet per second

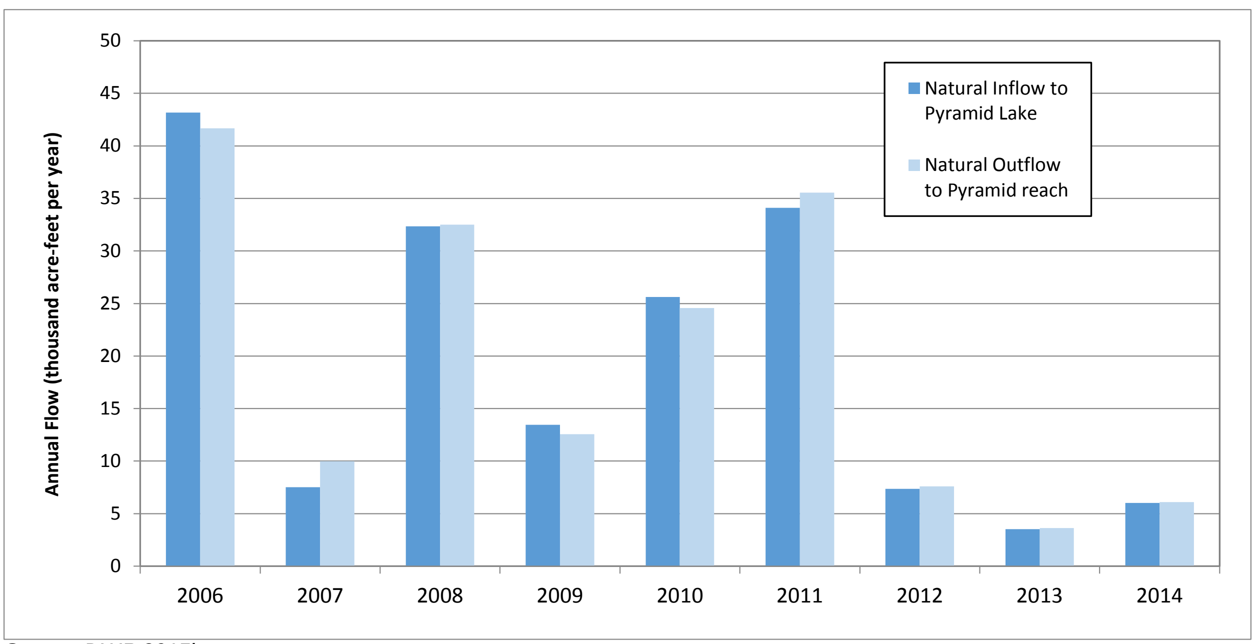
Figure 3.2-17. Range and Exceedance Probability of Daily Natural Flow Releases by Month from Pyramid Lake to Pyramid reach, 2000 through 2014

From 2006 (the first full year when the new natural flow provisions of Article 52 were implemented) to 2014, the variation in daily natural inflow at Pyramid Lake and outflows of natural flow to Pyramid reach were similar (Figure 3.2-18). The annual volume of these flows was also roughly equal (Figure 3.2-19). Together, these indicate that natural flows from tributaries to Pyramid Lake were passed through Pyramid Lake to Pyramid reach below Pyramid Dam without being stored.



Source: DWR 2015b
Key:
cfs = cubic feet per second

Figure 3.2-18. Exceedance Probability of Natural Inflows and Outflows at Pyramid Lake When Current Provisions of Article 52 of the FERC License Governing Project Operations have been in Effect, 2006 through 2014



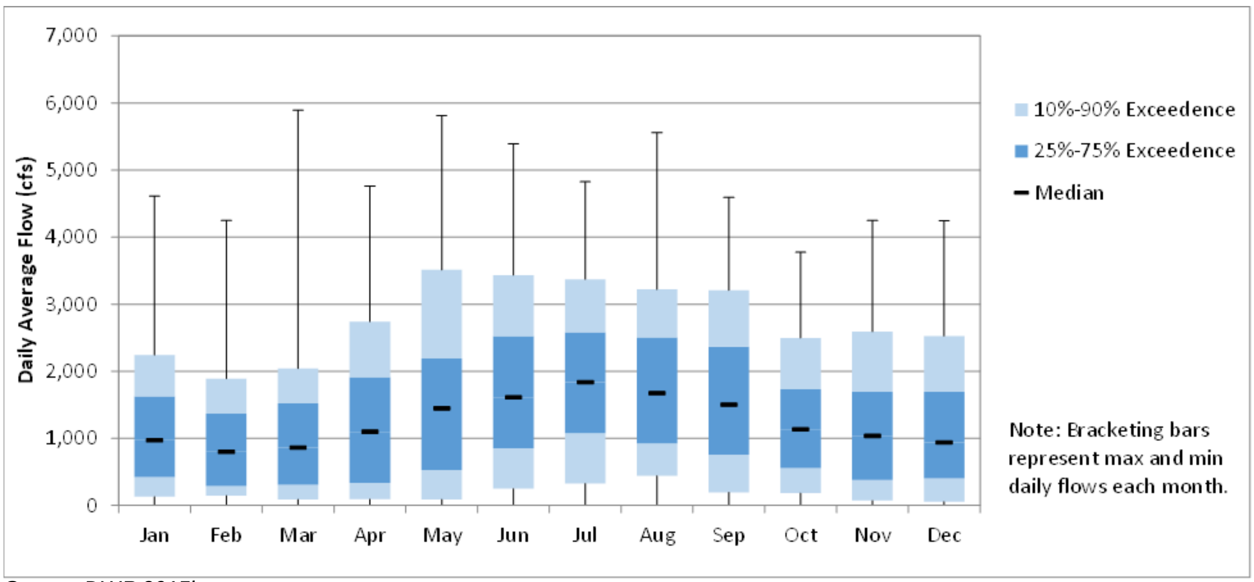
Source: DWR 2015b

Figure 3.2-19. Annual Natural Inflows and Outflows at Pyramid Lake When Current Provisions of Article 52 of the FERC License Governing Project Operations have been in Effect, 2006 through 2014

Figure 3.2-19 shows an apparent imbalance between the natural inflow and outflow at Pyramid Lake in some years, even though there is a long-term balance. USFWS staff conducting biological surveys downstream of Pyramid Dam noticed that breeding arroyo toads were being unintentionally washed out by releases. Based on results from the arroyo toad Recovery Plan (USFWS 1999a), DWR and USFWS entered into an informal agreement where DWR operates to reschedule natural releases to protect the arroyo toad. The release restrictions are temporarily stored in Pyramid Lake and released at a later time to maintain the required natural release volumes over time. These short-term operational adjustments may cause short term imbalances between the natural inflow and outflow.

Pumping and Generating Operation

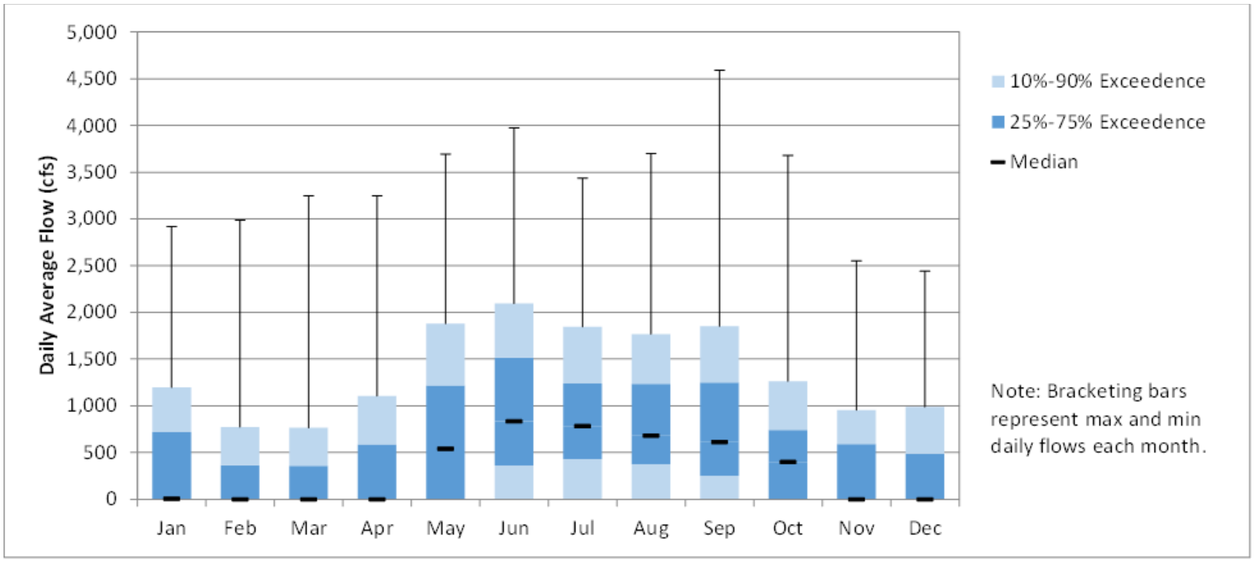
Releases from Pyramid Lake to Castaic Powerplant and Elderberry Forebay via the Angeles Tunnel consist of SWP water. The range and exceedance probability of daily SWP water releases from Pyramid Lake to Castaic Powerplant and Elderberry Forebay is shown in Figure 3.2-20.



Source: DWR 2015b
Key:
cfs = cubic feet per second

Figure 3.2-20. Range and Exceedance Probability of Daily Releases by Month from Pyramid Lake to Castaic Powerplant via the Angeles Tunnel, 2000 through 2014

A portion of the SWP water in Pyramid Lake is used for pumped storage operations. During off-peak periods, when local power demands and costs are low, Castaic Powerplant is operated to pump water into Pyramid Lake from Elderberry Forebay through the Angeles Tunnel. This process is reversed to generate power during on-peak periods when power demands and costs are high. Figure 3.2-21 shows pumped storage operations tend to peak in the summer months and there are years when no pumped storage operations occur during winter months. Note that the pumpback inflows are a combination of the previous releases described above and those shown in Figure 3.2-21.

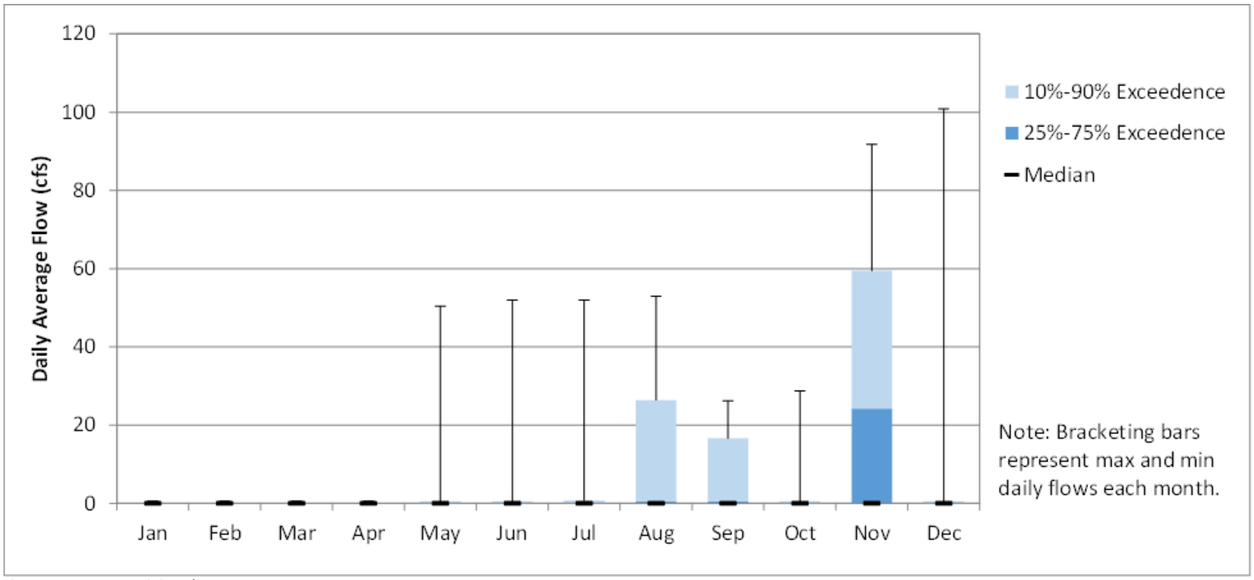


Source: DWR 2015b
Key:
cfs = cubic feet per second

Figure 3.2-21. Range and Exceedance Probability of Daily Inflows by Month to Pyramid Lake from Elderberry Forebay, 2000 through 2014

Local Use

SWP water is delivered to support Pyramid Lake recreation. SWP water is released from Pyramid Lake to Pyramid reach for delivery to UWCD. UWCD currently receives deliveries of SWP water on behalf of VCWPD under the revised guidelines of Article 52 of the Project FERC license adopted in 2005 that allows for delivery of up to 3,150 AF of SWP water via Piru Creek to UWCD between November 1 and the end of February each year. UWCD also has appropriative rights to natural flow in Piru Creek under water right permit numbers 11181 (priority date September 18, 1947) and 19373 (priority date March 25, 1982). Figure 3.2-22 shows the range and exceedance probability of total daily releases for these local deliveries, and Table 3.2-1 shows the annual volumes delivered from 2000 through 2014.



Source: DWR 2015b
Key:
cfs = cubic feet per second

Figure 3.2-22. Range and Exceedance Probability of Daily Releases by Month from Pyramid Lake for Recreation and Delivery to United Water Conservation District, 2000 through 2014

Table 3.2-1. Annual Deliveries from Pyramid Lake to Local Water Users, 2000 through 2014

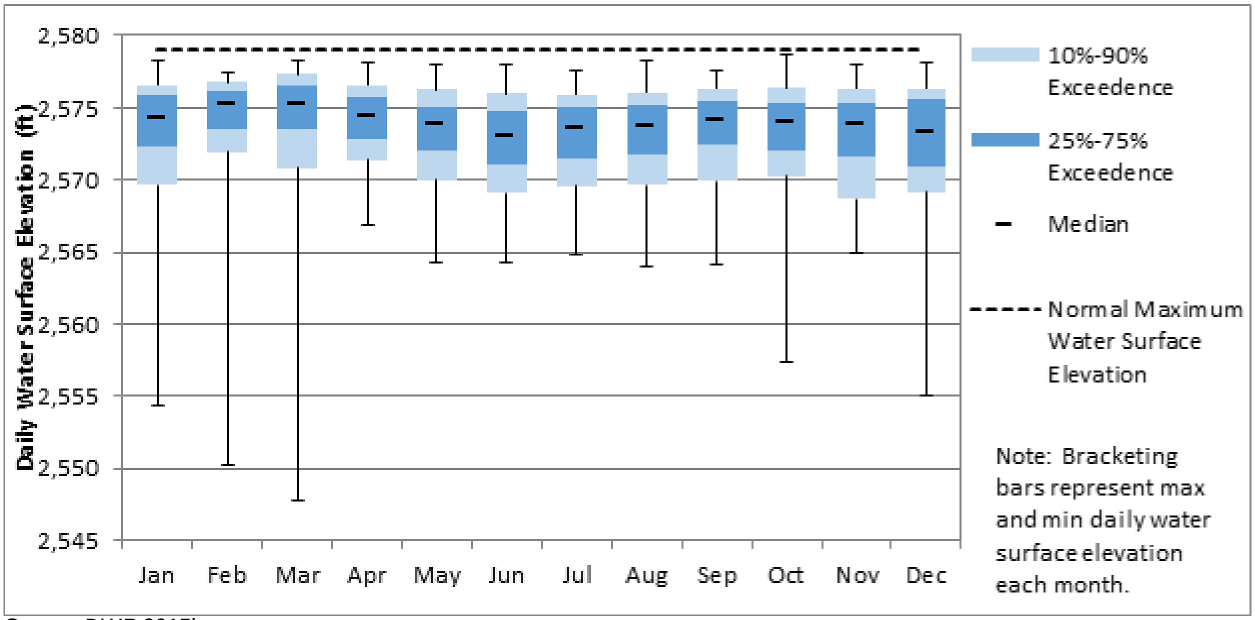
Year	Annual Deliveries (acre-feet)	
	Deliveries for Recreation (SWP)	Deliveries to United Water Conservation District
2000	11	0
2001	13	0
2002	18	0
2003	16	10,681
2004	20	2,431
2005	9	0
2006	10	0
2007	6	1,890
2008	36	1,980
2009	31	3,150
2010	37	3,150
2011	21	2,520
2012	13	3,150
2013	73	2,258
2014	44	0

Source: DWR 2015b
Key:
SWP = State Water Project

Table 3.2-1 shows a high delivery to UWCD in 2003. In this year, natural inflow owed to UWCD under its prior year water rights was stored during January through March and released over the spring and summer.

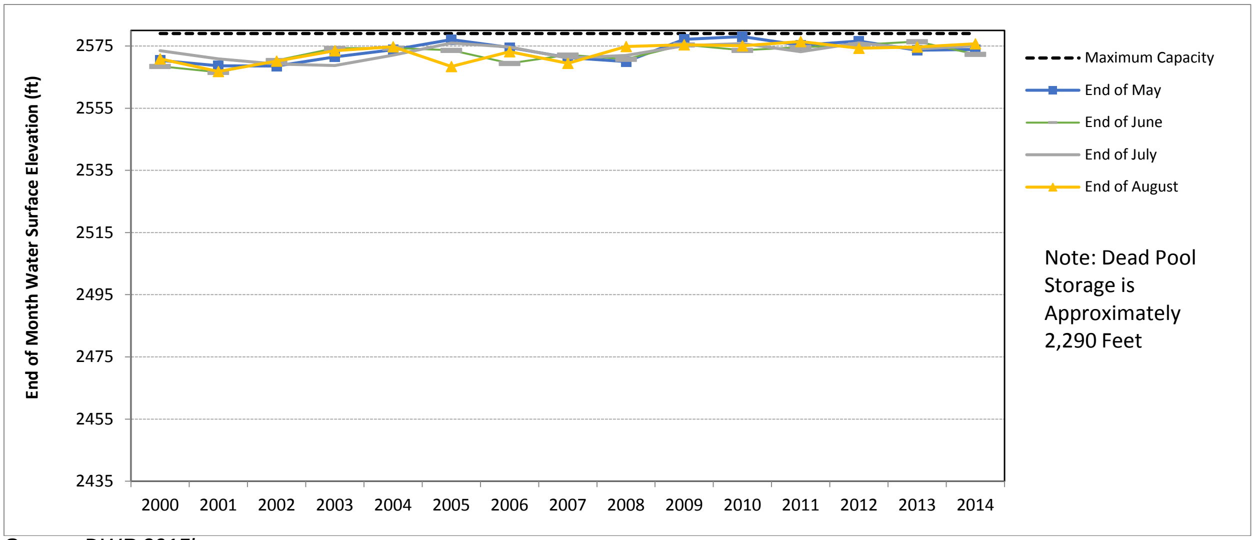
3.2.3.6 Pyramid Lake Levels

Pyramid Lake is typically operated within a narrow range of storage and water surface elevation, close to its NMWSE, as shown in Figure 3.2-23. Figure 3.2-24 shows the end of month water surface elevations in May, June, July, and August from 2000 through 2014, which represent the approximate water surface elevations during the major summer holidays—Memorial Day (end of May storage), the Fourth of July (end of June storage), and Labor Day (end of August storage)—when Project recreation use tends to peak. While reservoir elevations have fluctuated somewhat over this period, they have been relatively consistent in recent years as demonstrated in the figure by a small range in the median monthly daily water surface elevation values.



Source: DWR 2015b
Key:
ft = feet

Figure 3.2-23. Range and Exceedance Probability of Daily Pyramid Lake Water Surface Elevation by Month, 2000 through 2014



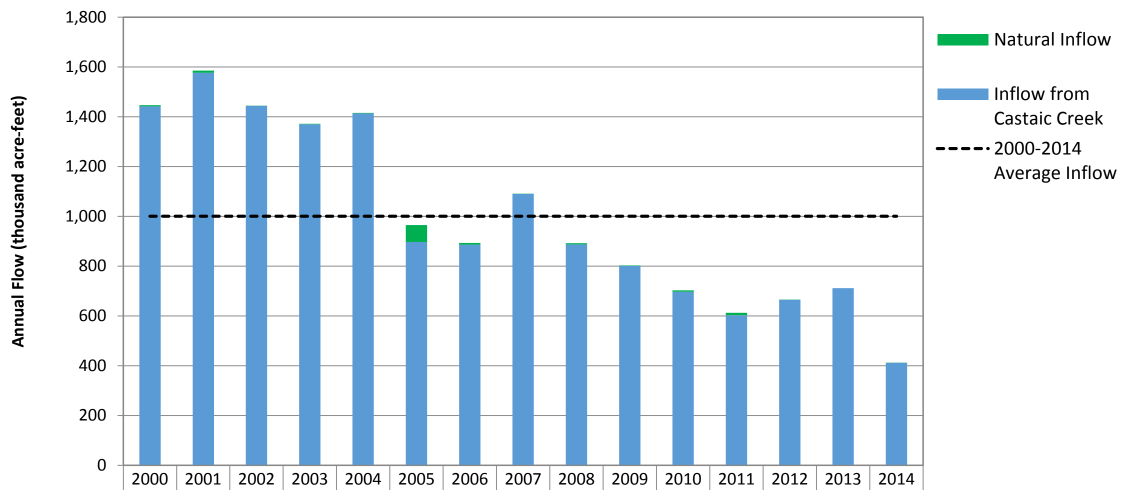
Source: DWR 2015b
Key:
ft = feet

Figure 3.2-24. Pyramid Lake End of Month Water Surface Elevation in May, June, July and August, 2000 through 2014

3.2.3.7 Castaic Powerplant and Elderberry Forebay Operations

Elderberry Forebay provides regulatory storage for Castaic Powerplant, serving as a key part of Castaic Powerplant pumped storage operation. Inflows into Elderberry Forebay are from Castaic Powerplant. They are conveyed from Pyramid Lake via the Angeles Tunnel, as well as from natural inflows from local tributaries, as described below.

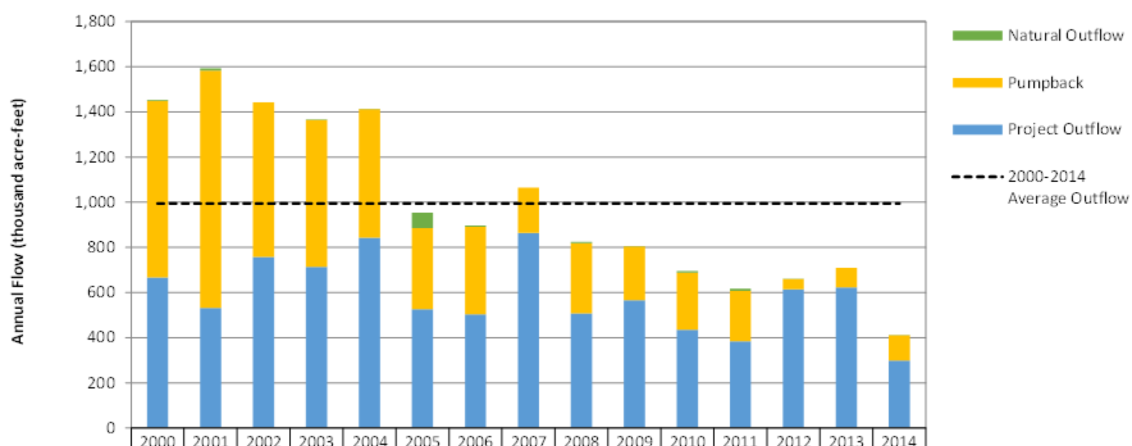
Annual inflows (including the inflow from Castaic Powerplant and local natural inflow) and outflows (including the pumpback to Pyramid Lake and releases to Castaic Lake [non-Project facility]) of Elderberry Forebay from 2000 through 2014 are shown in Figures 3.2-25 and 3.2-26. Since Licensees do not have water rights to the natural inflows to Elderberry Forebay, the natural inflows to Elderberry Forebay from Castaic Creek and other local drainages (Figure 3.2-25) and the natural outflows to Castaic Lake (non-Project facility) (Figure 3.2-26) are balanced on a daily basis (DWR 2015b). Except for wet years like 2005, natural inflow is very limited and accounts for only 1 percent of the total inflow to Elderberry Forebay.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Natural Inflow	4	9	0	2	2	69	7	0	5	2	7	9	0	0	0
Inflow from Castaic Creek	1,442	1,576	1,444	1,370	1,413	897	886	1,091	887	801	697	603	665	711	411

Source: DWR 2015b

Figure 3.2-25. Annual Inflows to Elderberry Forebay, 2000 through 2014

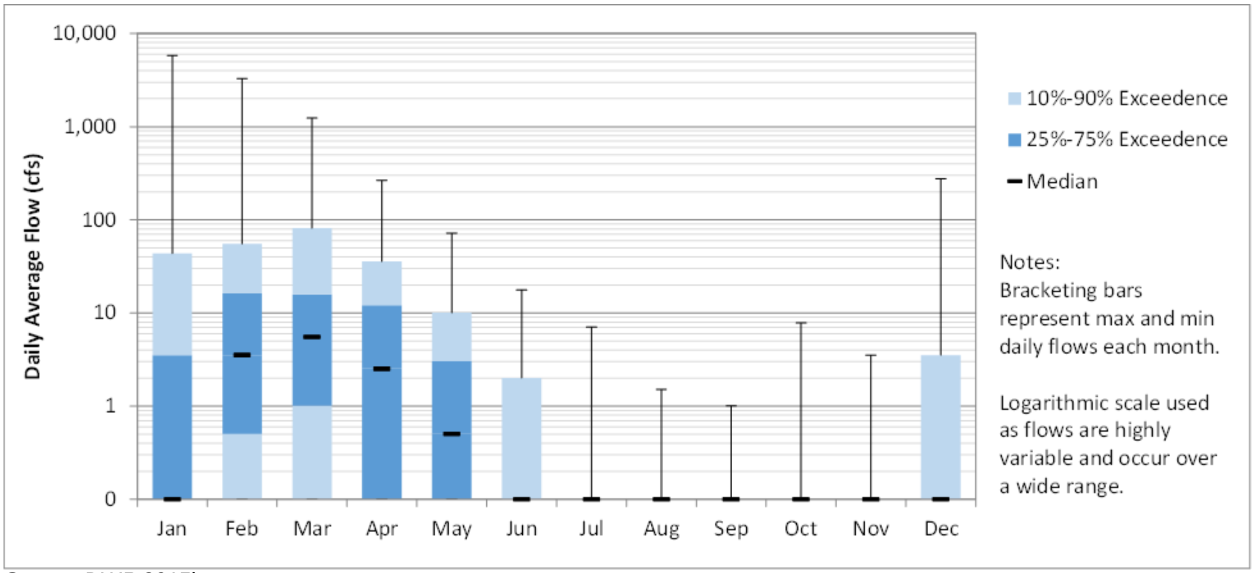


	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Natural Outflow	4	9	0	2	2	69	7	0	5	2	7	9	0	0	0
Pumpback	782	1,052	685	652	569	359	387	200	312	239	253	223	45	88	113
Project Outflow	667	532	757	713	843	526	504	864	508	566	435	385	614	623	299

Source: DWR 2015b

Figure 3.2-26. Annual Outflows from Elderberry Forebay, 2000 through 2014

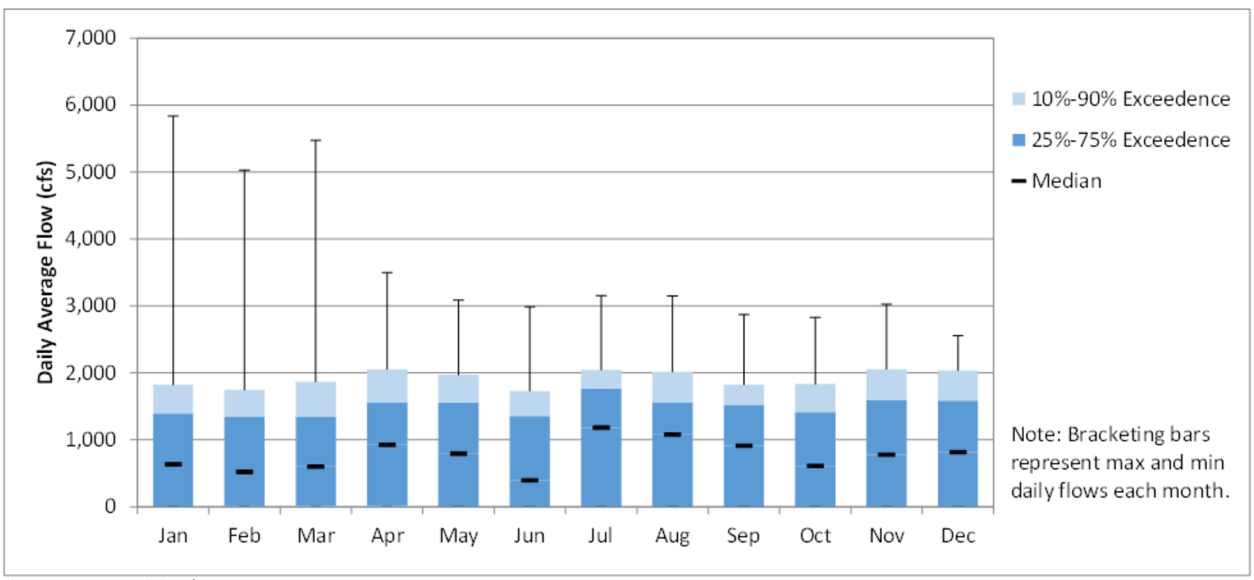
In addition to releasing natural inflows from Elderberry Forebay, DWR schedules SWP water from Pyramid Lake to Castaic Lake (non-Project facility) and this schedule provides the basis for the total release from Elderberry Forebay Figure 3.2-27 shows the range and exceedance probability of daily natural inflows to Elderberry Forebay and the same range is shown in the total outflow from Elderberry Forebay in Figure 3.2-28, with the greatest variability in the winter and early spring.



Source: DWR 2015b
Key:
cfs = cubic feet per second

Figure 3.2-27. Range and Exceedance Probability of Daily Natural Inflow by Month to Elderberry Forebay, 2000 through 2014

In addition to the variance that is a result of high natural flows during the wet months, daily variance can also be attributed to the operation of Elderberry Forebay as DWR provides weekly (Monday through Sunday) water schedules to LADWP. LADWP has until the end of the week (Sunday) to pass the scheduled water through Elderberry Forebay, resulting in flows that are not uniform throughout the week.



Source: DWR 2015b
Key:
cfs = cubic feet per second

Figure 3.2-28. Range and Exceedance Probability of Daily Releases by Month from Elderberry Forebay to Castaic Lake, 2000 through 2014

3.3 PROPOSED PROJECT CHANGES

At this time, Licensees propose no changes to the existing Project works. However, Licensees have an initial proposal to modify the existing Project boundary to encompass all Project facilities, including all Project recreation developments, while removing lands that are not related to Project functions (Section 3.3.1). Additionally, Licensees anticipate proposing the addition of one existing facility to the licensed Project works (Section 3.3.2). Additional changes to the Project may occur as the relicensing process proceeds.

3.3.1 Proposed Changes to the Existing Project Boundary

Licensees propose to modify the existing Project boundary, in some areas adding lands to the boundary (e.g., Los Alamos Campground), and in other areas removing lands from the boundary (e.g., the area surrounding Pyramid Lake beyond the 100-foot buffer, described below) to be consistent with Project operation and maintenance needs. The proposed Project boundary encompasses 4,512 acres of land (see Figure 3.3-1). Excluding transmission lines, the Project elevations range from 1,369 feet at the base of Elderberry Forebay Dam to 3,537 feet at the Peace Valley Pipeline Intake Embankment. The major changes to the Project boundary are the inclusion of the Warne transmission line in the boundary and the reduction of the boundary around Pyramid Lake and Elderberry Forebay. In addition, the Licensees filed exhibits with FERC showing the alignment and right-of-way for the transmission line (exhibits 2426-287 and 2426-300). The proposed project boundary includes the Castaic transmission line. Within the total proposed acreage, there are 2,227 acres of federal lands. The majority of the federal lands are managed by the ANF. A very small portion (less than 5 acres) is administered by BLM. The net effect of this proposed change would be approximately 35 percent reduction of the total area, including approximately 21 percent reduction of federal land. Figure 3.3-1 shows Licensees' current proposed changes to the existing Project boundary.

The proposed changes are based on Licensees' current and historic use of land for Project purposes and Licensees' comprehensive review of facilities, operations, and land information to date.

As shown in Figure 3.3-1, compared to the existing Project boundary, the proposed Project boundary has included the Los Alamos Campground, the Warne Transmission Line, as well as a revised boundary around Pyramid Lake with a 100-foot buffer from the lakeshore established by the NMWSE. The Project boundary around Elderberry Forebay is delineated based on Project operations and maintenance needs.

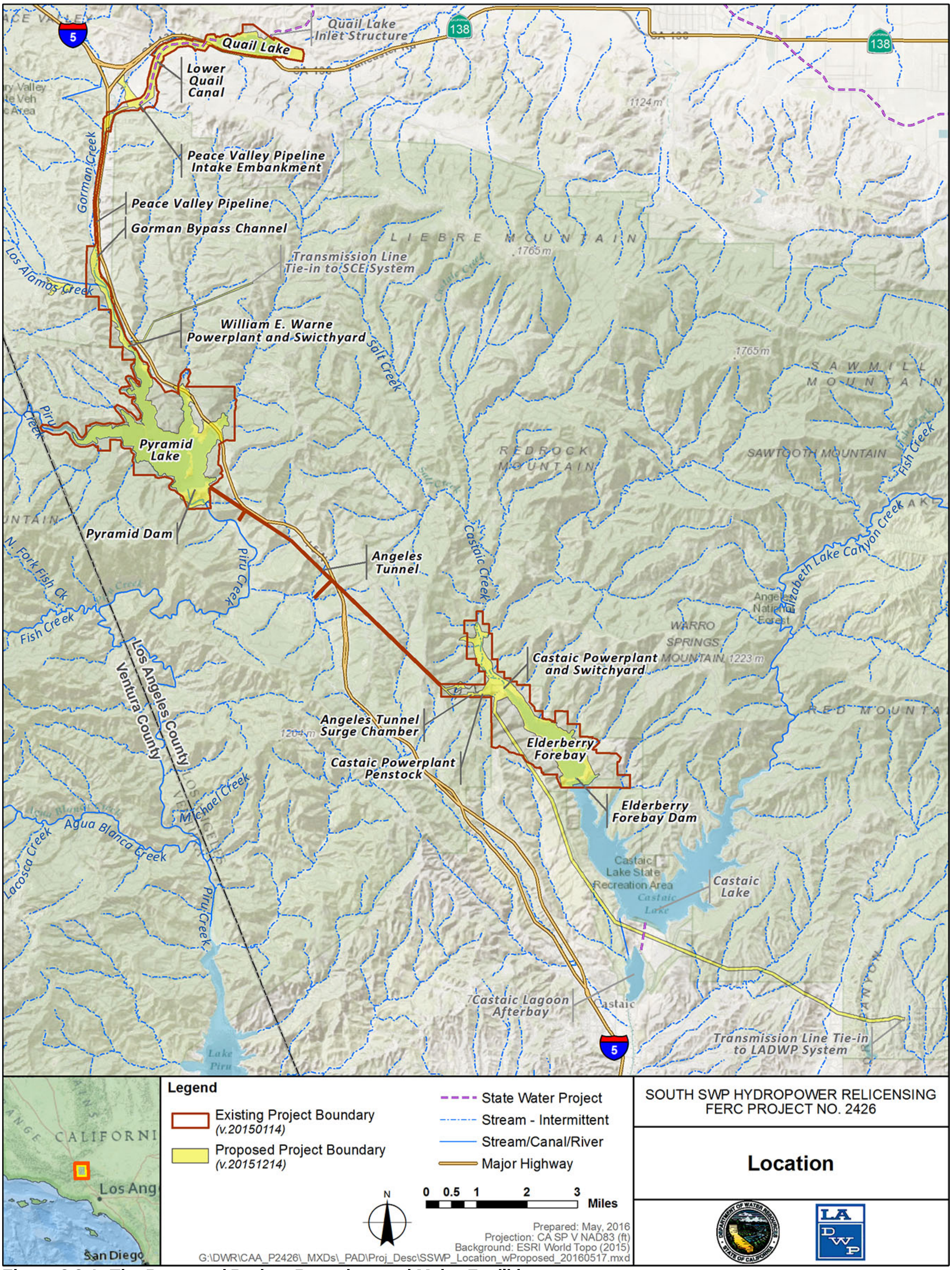


Figure 3.3-1. The Proposed Project Boundary and Major Facilities

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3.3.2 Proposed Changes to the Existing Project Facilities

Licensees propose one change to the list of facilities included in the FERC license. Licensees propose to include the existing Quail Detention Embankment, which is located adjacent to the Peace Valley Pipeline Intake Embankment.

3.3.2.1 Quail Detention Embankment

The Quail Detention Embankment (Figure 3.3-2) lies along the northwest portion of the Lower Quail Canal, between Interstate 5 and the Peace Valley Pipeline Intake Embankment. The Quail Detention Embankment serves as a flood-management structure to attenuate waters from Quail Lake or the Lower Quail Canal, and to protect Interstate 5 if an unplanned release of water occurs from these facilities.

Figure 3.3-2. Quail Detention Embankment, Looking Northwest from the Peace Valley Pipeline Intake Embankment

The Quail Detention Embankment has a crest length of 1,840 feet, a maximum height of 50 feet above original ground surface. The nominal crest elevation is 3,255 feet and the crest width is 40 feet. The detention basin behind the Quail Detention Embankment has a volume of 1,100 AF at an elevation of 3,250 feet. An excavation into bedrock on the right abutment of the Quail Detention Embankment resulted in a 300-foot-wide unlined, uncontrolled spillway capacity of at least 5,100 cfs. The invert elevation of the spillway is 3,250 feet, 5 feet below the crest elevation of the embankment. The Quail Detention Embankment Outlet underneath the embankment is an uncontrolled 12-foot by 12-foot reinforced concrete double-box conduit and has a maximum capacity of 10,000 cfs. In the event of an unplanned release of water from Lower Quail Canal or Quail Lake, release from the Quail Detention Embankment Outlet passes under the Gorman Creek Bridge of Interstate 5 and flows down Gorman Creek to Pyramid Lake.

3.3.3 Proposed Changes to the Existing Project Operations

Licensees propose no changes to the existing Project operations.

3.3.4 Proposed Changes to Existing Protection, Mitigation and Enhancement Measures

At this time, Licensees do not propose modifications or additional measures to the existing Project resource protection measures. Based on the results of studies or other considerations, the Licensees may propose modified or additional measures in their license application.

3.4 CURRENT LICENSE REQUIREMENTS AND ENVIRONMENTAL MEASURES

Table 3.4-1 summarizes articles in the existing FERC license referenced in Section 3.0. Appendix E provides the list of full articles and a summary of FERC orders and issuances amending the Project License.

Table 3.4-1. Summary of Existing License Articles (as Referenced in this Section)

License Article	Summary of Article Subject
Article 51	Requirements for a revised Exhibit S that includes mitigation and enhancement measures for protecting fish and wildlife species.
Article 52	Conditions and guidance for stream releases from Pyramid Dam into Pyramid reach.
Article 58	Requirements for maintaining lake levels for recreation purposes in Silverwood Lake and Pyramid Lake.

3.5 PROJECT SAFETY

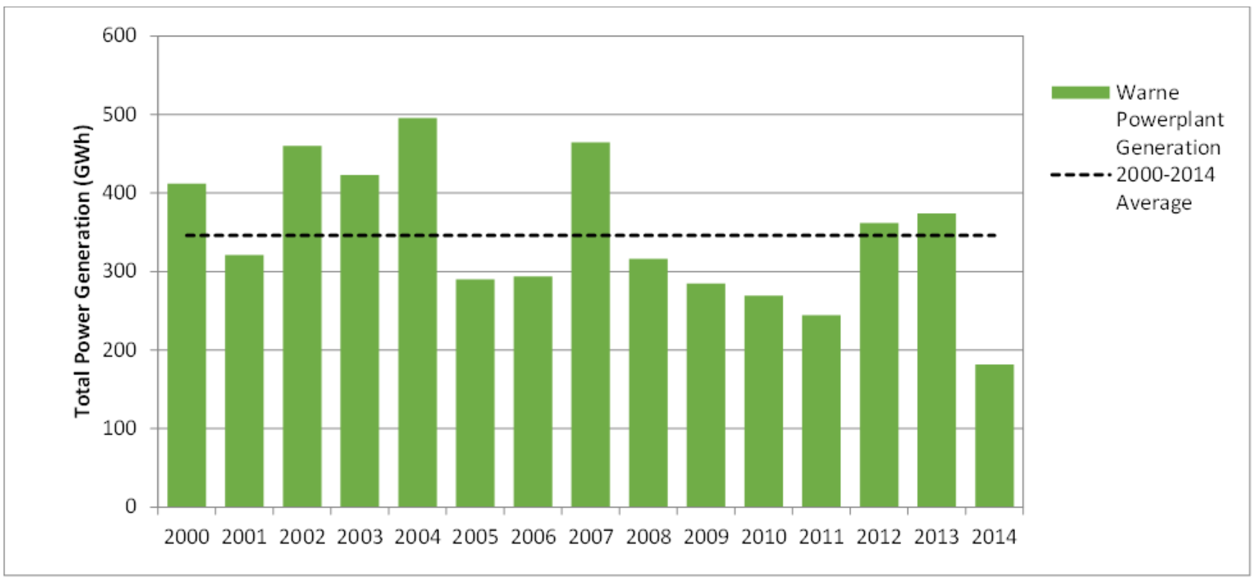
The Project is subject to the oversight and routine inspection of FERC's Division of Dam Safety and Inspections in accordance with provisions in the CFR Title 18 Part 12, including the inspection by an independent consultant (subpart D). Licensees maintain the Project facilities in good condition and comply with applicable State and local safety requirements. Licensees maintain signs, lights, and other safety devices above and below the powerhouses, intakes, spillways, and other appurtenant facilities as reasonably needed to protect the public in the recreational use of Project lands and waters. DWR's Division of Safety of Dams (DSOD) monitors Pyramid Dam and Elderberry Forebay Dam and their associated facilities in accordance with provisions in the California Water Code (CWC).

3.6 PROJECT GENERATION AND OUTFLOW RECORDS

Generation and outflow records at Warne and Castaic Powerplants for the last 15 years are summarized below. As described above, for DWR, hydropower generation is a secondary purpose of the Project, with hydropower operations mainly intended to offset the cost and energy consumption associated with SWP operations. For LADWP's operation of Castaic Powerplant, hydropower generation is the primary purpose. By pumping water during times of low demand (nights and weekends), LADWP derives its generation when water is released during times of high demand (days). This additional generation complements LADWP's local generation capacity and adds stability to the region's electrical grid.

3.6.1 Warne Powerplant

Total annual power generation at Warne Powerplant from 2000 through 2014 is shown in Figure 3.6-1. Warne Powerplant is primarily operated as an energy recovery plant, so its purpose is to recapture a portion of the energy expended by pumping and conveyance operations involved in the delivery of SWP water. As a result, the quantity of power generation within any period is directly tied to the quantity of SWP water within that same period.

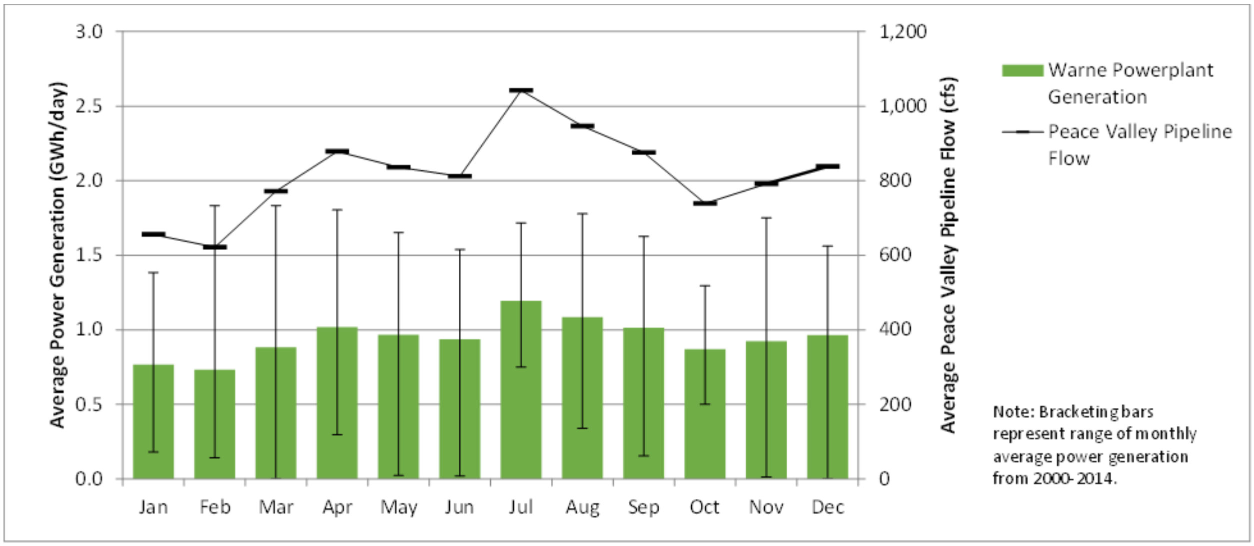


Source: DWR 2015b
Key:
GWh = gigawatt-hours

Figure 3.6-1. Annual Generation at Warne Powerplant, 2000 through 2014

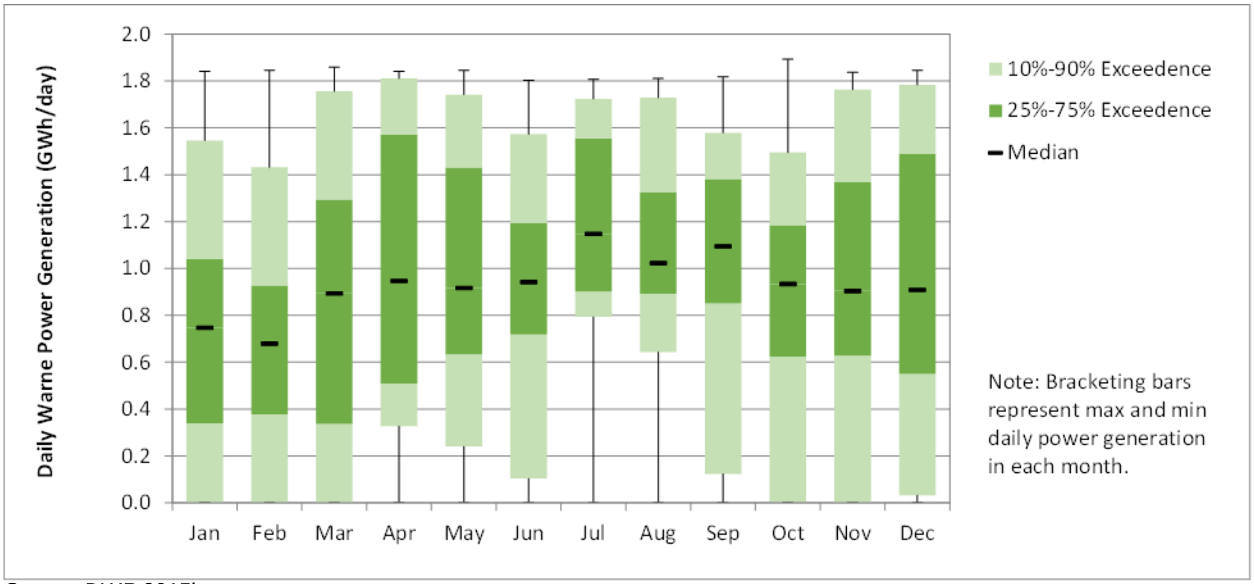
Average monthly power generation at Warne Powerplant from 2000 through 2014 shown below in Figure 3.6-2 generally matches the pattern of monthly average flow in the Peace Valley Pipeline. Average annual generation is approximately 346 GWh. The range and exceedance probability of daily power generation is summarized for each month in Figure 3.6-3. Total monthly power generation records are summarized in Table

3.6-1, and the time series of monthly average power generation from 2000 through 2014 is shown in Figure 3.6-4.



Source: DWR 2015b
Key:
GWh = gigawatt-hours

Figure 3.6-2. Monthly Average Generation at Warne Powerplant and Monthly Average Scheduled SWP Water Supply through Warne Powerplant via the Peace Valley Pipeline, 2000 through 2014



Source: DWR 2015b
Key:
GWh = gigawatt-hours

Figure 3.6-3. Range and Exceedance Probability of Daily Generation by Month at Warne Powerplant, 2000 through 2014

Table 3.6-1. Monthly Generation at Warne Powerplant, 2000 through 2014

	Monthly Total Warne Powerplant Generation (GWh)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
2000	28	18	24	46	27	32	32	34	37	39	53	42	412
2001	29	12	12	16	40	23	26	27	34	38	38	25	321
2002	22	24	40	43	50	44	49	36	35	25	45	46	460
2003	6	4	46	49	45	34	39	55	36	26	34	48	423
2004	43	35	38	40	38	46	52	53	49	35	19	48	495
2005	6	16	0	38	23	24	39	29	32	36	27	19	290
2006	40	27	42	21	28	26	40	28	22	16	4	0	294
2007	27	51	57	54	51	25	47	48	47	30	0	27	465
2008	34	6	14	27	20	38	41	34	17	18	33	34	316
2009	23	26	28	18	29	28	29	29	18	15	20	20	284
2010	19	16	11	10	15	19	28	34	33	40	21	23	269
2011	12	21	21	18	13	28	23	27	27	17	20	17	244
2012	26	15	25	33	43	28	30	30	31	25	45	31	362
2013	17	22	32	35	27	26	53	31	33	26	33	38	374
2014	23	15	21	9	1	1	27	10	5	18	24	29	181
Average	**24**	**21**	**27**	**31**	**30**	**28**	**37**	**34**	**30**	**27**	**28**	**30**	**346**

Source: DWR 2015b
Key:
GWh = gigawatt-hours

Source: DWR 2015b
Key:
GWh = gigawatt-hours

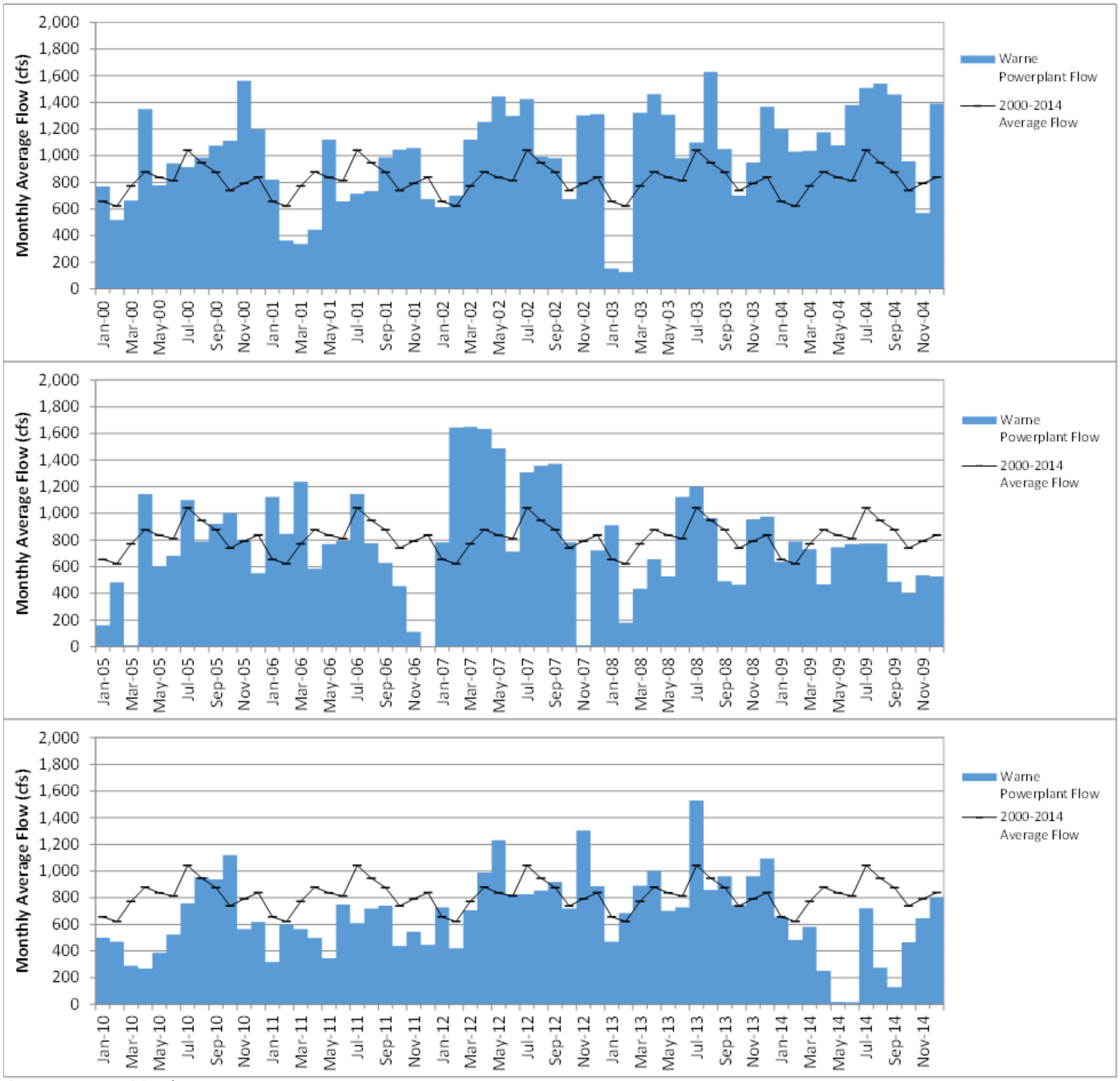
Figure 3.6-4. Monthly Average Generation at Warne Powerplant, 2000 through 2014

The range of daily SWP water flow from Warne Powerplant to Pyramid Lake from 2000 through 2014 is shown in Section 3.2 in Figure 3.2-12. Monthly outflow records from Warne Powerplant for the last 15 years are summarized in Table 3.6-2, and the corresponding time series of monthly average flows during this period is shown in Figure 3.6-5.

Table 3.6-2. Monthly Flow through Warne Powerplant, 2000 through 2014

	Monthly Flow through Warne Powerplant (TAF)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
2000	47	30	41	80	48	56	56	61	64	68	93	74	718
2001	50	20	21	26	69	39	44	45	59	64	63	42	542
2002	38	39	69	75	89	77	88	61	58	41	78	81	793
2003	9	7	81	87	80	58	68	100	62	43	56	84	737
2004	74	59	64	70	66	82	93	95	87	59	34	85	867
2005	10	27	1	68	37	41	68	49	55	62	47	34	497
2006	69	47	76	35	47	47	70	48	37	28	7	0	511
2007	48	91	101	97	91	42	80	83	82	48	1	44	811
2008	56	10	27	39	32	67	74	59	29	29	57	60	539
2009	39	44	45	28	46	46	48	48	29	25	32	32	460
2010	31	26	18	16	24	31	47	59	56	69	34	38	447
2011	20	33	35	30	21	45	37	44	44	27	32	27	396
2012	45	24	43	59	76	49	51	53	55	44	78	55	630
2013	29	38	55	59	43	43	94	53	57	46	57	67	642
2014	40	27	36	15	1	1	44	17	8	29	38	49	305
Average	**40**	**35**	**47**	**52**	**51**	**48**	**64**	**58**	**52**	**45**	**47**	**52**	**593**

Source: DWR 2015b
Key:
TAF = thousand acre-feet

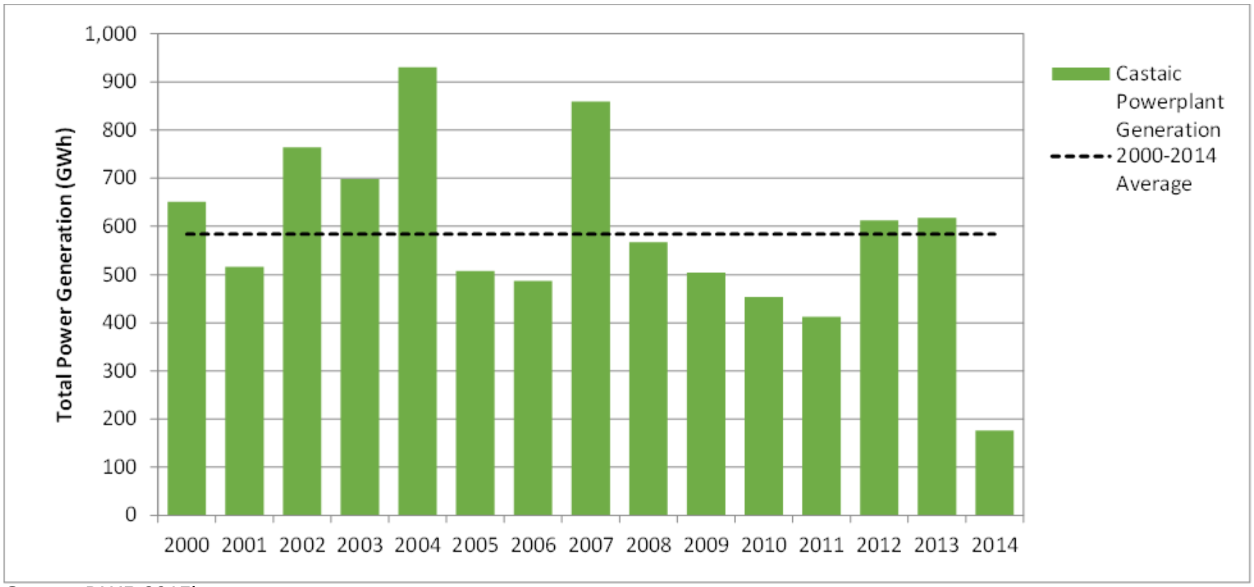


Source: DWR 2015b
Key:
cfs = cubic feet per second

Figure 3.6-5. Monthly Average Flow through Warne Powerplant, 2000 through 2014

3.6.2 Castaic Powerplant

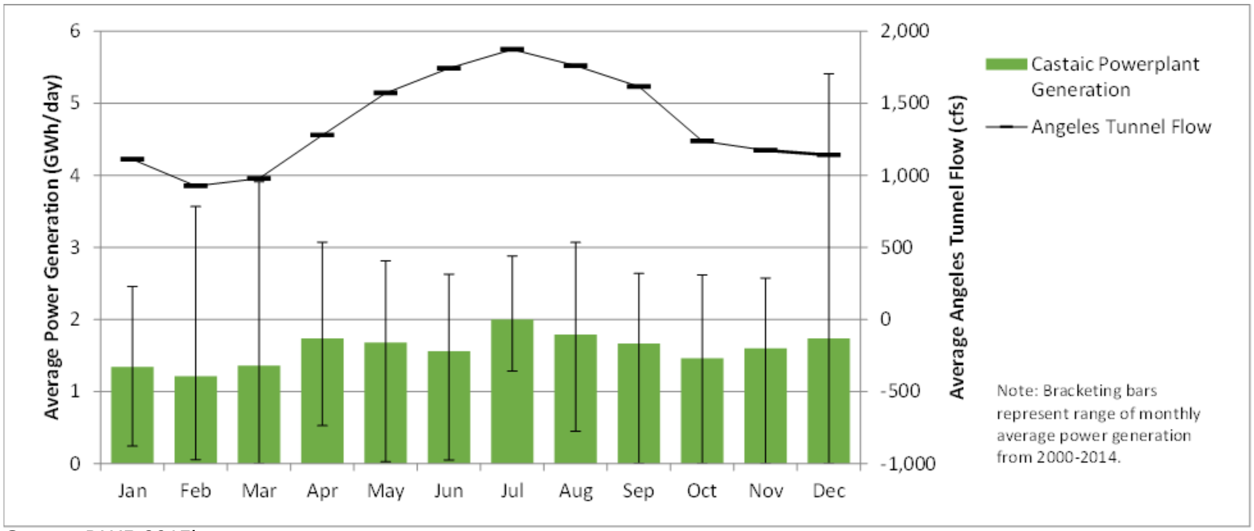
Total annual power generation at Castaic Powerplant from 2000 through 2014 is shown in Figure 3.6-6. Average annual generation is approximately 584 GWh, not considering pump-back energy requirements. While the Project is primarily operated for recovery of energy expended by pumping and conveyance operations involved in the delivery of SWP water, the Castaic Powerplant also takes advantage of pumped storage operations to maximize power generation opportunities. As a result, the quantity of power generation within any period is not directly tied to the quantity of water deliveries to SWP contractors within that same period. Instead, total generation is tied to both water deliveries and to the quantity of water used for pumped storage.



Source: DWR 2015b
Key:
GWh = gigawatt-hours

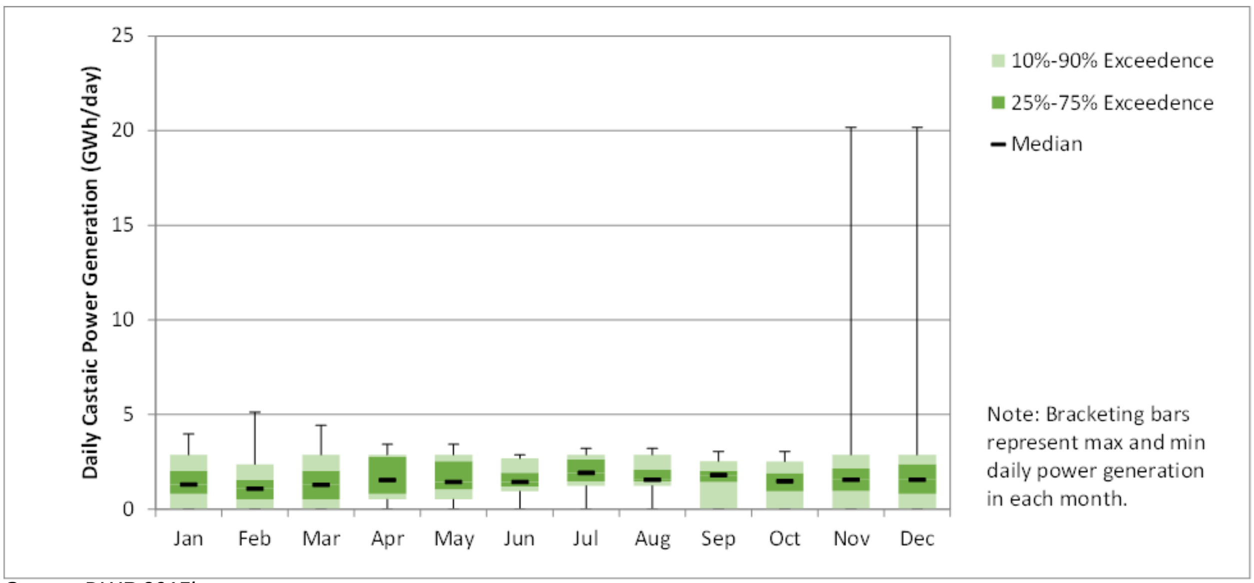
Figure 3.6-6. Annual Generation at Castaic Powerplant, 2000 through 2014

Average monthly power generation at Castaic Powerplant from 2000 through 2014 is shown in Figure 3.6-7. The range and exceedance probability of daily power generation is summarized for each month in Figure 3.6-8. Total monthly power generation records are summarized in Table 3.6-3, total monthly power generation flows are summarized in Table 3.6-4, the time series of monthly average power generation is shown in Figure 3.6-9, and the time series of monthly average power generation and pump-back flow from 2000 through 2014 is shown in Figure 3.6-10.



Source: DWR 2015b
Key:
GWh = gigawatt-hours

Figure 3.6-7. Monthly Average Generation at Castaic Powerplant and Monthly Average Pyramid Lake Discharge to Castaic Powerplant Via the Angeles Tunnel, 2000 through 2014



Source: DWR 2015b
Key:
GWh = gigawatt-hours

Figure 3.6-8. Range and Exceedance Probability of Daily Generation by Month at Castaic Powerplant, 2000 through 2014

Table 3.6-3. Monthly Generation at Castaic Powerplant, 2000 through 2014

	Monthly Total Castaic Powerplant Generation (GWh)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2000	48	28	38	79	44	45	43	46	52	81	77	68	651
2001	45	19	14	25	68	37	44	42	58	60	61	41	516
2002	34	40	67	72	84	74	84	57	58	40	74	79	764
2003	8	9	66	86	82	59	65	88	60	43	53	80	698
2004	71	57	62	67	66	79	89	89	79	53	50	168	930
2005	25	38	0	69	35	38	62	47	51	60	52	28	507
2006	65	47	66	33	45	44	66	46	34	27	14	0	487
2007	35	100	121	92	87	44	88	95	77	47	26	47	860
2008	76	27	12	51	43	64	69	57	30	29	59	49	567
2009	39	2	1	30	60	51	53	47	45	53	60	62	504
2010	48	26	18	16	24	30	45	55	54	64	33	41	453
2011	28	37	36	31	21	45	40	45	44	32	29	26	412
2012	40	24	41	56	75	48	50	52	54	45	75	53	613
2013	26	34	52	58	45	44	87	51	54	46	56	65	618
2014	37	27	36	17	1	2	42	14	0	0	0	0	176
Average	**42**	**34**	**42**	**52**	**52**	**47**	**62**	**56**	**50**	**45**	**48**	**54**	**584**

Source: DWR 2015b
Key:
GWh = gigawatt-hours

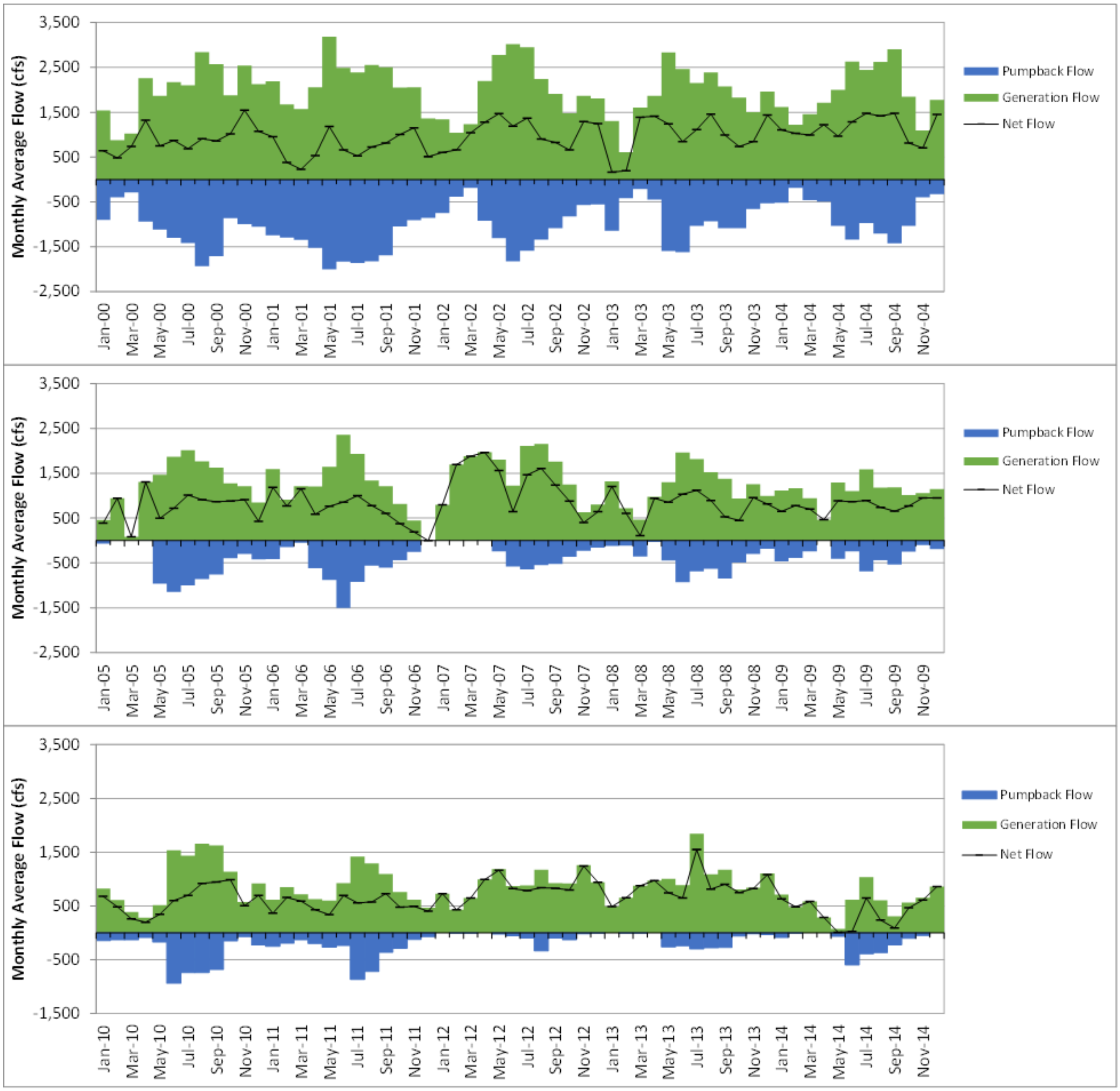
Source: DWR 2015b
Key:
GWh = gigawatt-hours

Figure 3.6-9. Time Series of Monthly Average Power Generation at Castaic Powerplant, 2000 through 2014

Table 3.6-4. Monthly Power Generation Flow through Castaic Powerplant, 2000 through 2014

	Monthly Flow through Castaic Powerplant (TAF)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
2000	95	50	63	135	115	129	129	175	153	116	151	131	1,442
2001	135	93	97	123	196	148	147	157	149	126	123	84	1,576
2002	83	58	76	131	171	180	182	138	114	91	111	111	1,444
2003	80	34	99	111	174	147	132	147	124	112	90	121	1,370
2004	100	70	90	102	123	156	150	161	173	114	65	109	1,413
2005	28	52	5	78	90	111	124	109	96	78	72	52	897
2006	98	51	74	72	101	140	119	82	72	50	26	0	886
2007	49	94	116	117	111	73	130	132	105	77	38	49	1,091
2008	81	42	29	58	80	117	111	94	82	58	75	61	887
2009	69	65	58	28	80	66	98	73	71	62	63	71	801
2010	51	34	24	17	32	91	88	102	97	70	34	57	697
2011	38	47	44	37	37	55	87	79	65	47	37	29	603
2012	45	25	40	59	73	52	54	72	55	57	75	58	665
2013	30	36	54	58	62	53	113	67	70	50	50	68	711
2014	44	27	36	17	5	37	64	37	18	35	39	53	411
Average	**68**	**52**	**60**	**76**	**97**	**104**	**115**	**108**	**96**	**76**	**70**	**70**	**993**

Source: DWR 2015b
Key:
TAF = thousand acre-feet



Source: DWR 2015b
Key:
cfs = cubic feet per second

Figure 3.6-10. Time Series of Monthly Average Power Generation and Pump-Back Flow through Castaic Powerplant, 2000 through 2014

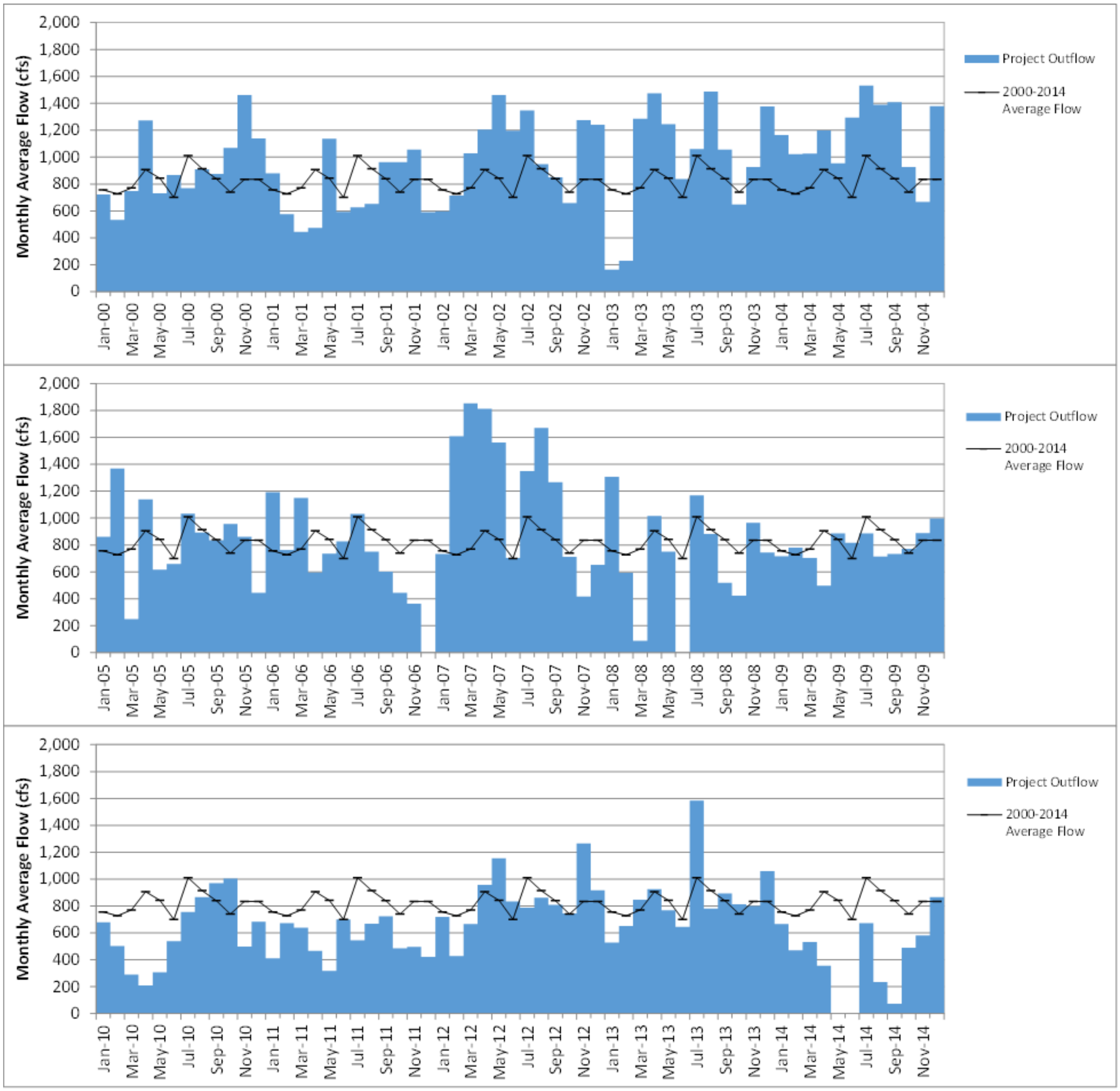
3.6.3 Total Project Outflow

The total Project outflow and detailed operations are described in Section 3.2.3. The following table and figure show the detailed monthly information, corresponding to the time series of monthly average power generation information displayed in Sections 3.6.1 and 3.6.2. Total outflow from the downstream end of the Project boundary includes natural and total flow released from Elderberry Forebay. Table 3.6-5 summarizes monthly outflow volumes for the last 15 years, and Figure 3.6-11 shows the time series of monthly average Project outflows over the same period.

Table 3.6-5. Monthly Project Outflow from Elderberry Forebay to Castaic Lake, 2000 through 2014

	Outflow from Elderberry Forebay to Castaic Lake (TAF)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
2000	44	31	46	76	45	52	47	56	52	66	87	70	671
2001	54	32	27	28	70	35	39	40	57	59	63	36	541
2002	37	40	63	72	90	71	83	58	51	41	76	76	757
2003	10	13	79	88	77	50	65	91	63	40	55	85	715
2004	72	59	63	71	59	77	94	85	84	57	40	85	845
2005	53	76	15	68	38	39	63	55	50	59	51	27	595
2006	73	42	71	35	45	49	63	46	36	27	22	0	511
2007	45	89	114	108	96	42	83	103	75	44	25	40	864
2008	80	34	5	60	46	0	72	54	31	26	57	46	513
2009	44	43	43	30	55	49	55	44	44	48	53	61	567
2010	42	28	18	13	19	32	46	53	58	62	30	42	442
2011	25	37	39	28	20	42	34	41	43	30	29	26	394
2012	44	25	41	57	71	50	48	53	48	46	75	56	615
2013	33	36	52	55	47	38	97	48	53	50	48	65	623
2014	41	26	33	21	0	0	41	14	4	30	35	53	299
Average	**47**	**41**	**47**	**54**	**52**	**42**	**62**	**56**	**50**	**46**	**50**	**51**	**597**

Source: DWR 2015b
Key:
TAF = thousand acre-feet



Source: DWR 2015b
Key:
cfs = cubic feet per second

Figure 3.6-11. Monthly Average Project Outflow from Elderberry Forebay to Castaic Lake, 2000 through 2014

3.7 COMPLIANCE HISTORY

Under the existing license, three non-compliance events related to the Project have occurred since the year 2000. The events are related to Biennial Trout Stocking Report Filing (in 2007 and 2014), Arroyo Toad (*Anaxyrus californicus)* and Sensitive Species Monitoring Report Filing (in 2012), and Project Safety-Related Plan and Schedule Filing (in 2014). The non-compliance events are summarized in the following sections. Licensees have addressed all issues and no penalties or corrective actions were required by FERC for any of these events. The non-compliance events, as applicable to the Project facilities, are summarized below.

3.7.1 Biennial Trout Stocking Report Filing

Exhibit S, as required by license Article 51, includes fishery mitigation and enhancement measures such as trout stocking to mitigate the Project impacts on local fishery resources. As amended in 1999[3] and 2000,[4] DWR is required to annually stock 20,000 pounds of catchable trout in each of Silverwood Lake, Pyramid Lake, and Castaic Lake (a non-Project facility), and 4,000 pounds of catchable trout in Piru Creek. The annual stock in Piru Creek was later reduced to 3,000 pounds of catchable trout until the stocking practice was suspended in 2008 as a result of litigation against CDFW's hatchery and stocking operations and concerns over potential impacts to special-status species. The 1999 Order also includes a requirement for filing trout stocking reports by June 30, 2002, and June 30 of every other year thereafter.

FERC issued a violation notice dated April 20, 2007, regarding DWR's 2006 Biennial Fish Stocking Report covering the April 2004 through April 2006 reporting period, citing incomplete creel census data for a portion of the reporting period.[5] On February 28, 2014, FERC issued another violation notice regarding the July 2006 through June 2012 Trout Stocking Reports, citing incomplete creel census data and deviation from requirements for filing by June 30 of 2008, 2010, and 2012.[6] No penalties or corrective actions were required by FERC; however, Licensees have implemented measures to resolve staffing issues, provide additional staff training for license requirements, and improve monitoring of contractor performance. Licensees filed the 2014 report prior to the deadline although creel census data for 2012-2014 was unavailable at the time of filing. The data are now available and will be filed with the 2016 report. Licensees do not anticipate future challenges in complying with any license terms, including those associated with the biennial trout stocking report-filing requirements.

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[3] FERC Order Modifying and Approving Amendment to Exhibit S (89 FERC ¶ 62,066), issued October 25, 1999.
[4] FERC Order Modifying and Approving Castaic Lake Trout Stocking Plan (91 FERC ¶ 62,178), issued June 12, 2000.
[5] FERC letter to DWR regarding Biennial Fish Stocking Report, dated April 20, 2007.
[6] FERC letter to DWR regarding July 2006 through June 2012 Trout Stocking Reports, dated February 28, 2014.

3.7.2 Arroyo Toad and Sensitive Species Monitoring Report Filing

Exhibit S, as required by license Article 51, includes wildlife mitigation and enhancement measures to protect the arroyo toad and other sensitive species and to mitigate Project impacts, if any. Licensees are required to submit annual monitoring reports within 45 days of completing the final survey of the season with concurrent filing to the USFWS, SWRCB, USFS, and CDFW.

FERC issued a violation notice dated January 12, 2012,[7] regarding Licensees 2011 Arroyo Toad and Sensitive Species Monitoring Report, citing deviation from requirements for filing within 45 days of completing the final survey of the season. No penalties or corrective actions were required by FERC; however, the subsequent 2012 report was submitted 32 days late. While no violation was issued, Licensees made some program improvements, and in 2014, FERC approved Licensees request to amend the report submittal deadline from 45 days to 90 days.[8] Licensees filed the 2014 and 2015 reports prior to the deadline and in full compliance of the requirements. Licensees do not anticipate future challenges in complying with the annual Arroyo Toad and Sensitive Species Monitoring Report filing requirements.

3.7.3 Project Safety-Related Plan and Schedule Filing

Based on Title 18 of CFR Part 12D Reports are required to be submitted periodically as determined by FERC (currently every 5 years) with a corrective plan and schedule to be submitted within 60 days of filing of the Part 12D report, per 18 CFR 12.39[a].

FERC issued a violation notice dated October 21, 2014,[9] regarding Licensees overdue responses to the Seventh Part 12D Independent Consultants' Recommendations for the Elderberry Forebay Dam. Additionally, FERC cited the three-year delay in submitting the Seventh Part 12D Report and missing multiple Annual Dam Safety Surveillance and Monitoring Reports and Annual Emergency Action Report Status Report in the violation notification. No penalties or corrective actions were required by FERC. Licensees submitted the required corrective plan and schedule on February 25, 2015,[10] and both are currently under FERC review for acceptance. On February 24, 2015, Licensees submitted the Castaic Powerplant Elderberry Forebay Dam Monitoring Report, including monitoring data and supplemental plots of monitoring data on March 16, 2015,[11] covering the information through 2014. Licensees have implemented measures to

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[7] FERC letter to DWR regarding 2011 Arroyo Toad and Sensitive Species Monitoring Report, dated January 12, 2012.
[8] FERC Order Amending Filing Schedule for Arroyo Toad and Sensitive Species Monitoring Reports, issued May 8, 2014.
[9] FERC letter to LADWP regarding Plan and Schedule for Addressing the Seventh Part 12D Independent Consultants' Recommendation (Project No. 2426-CA, NATDAM No. CA01080), dated October 21, 2014.
[10] FERC letter to FERC regarding Plan and Schedule for Addressing the Seventh Part 12D Independent Consultant's Recommendations (Project No. 2426-CA, NATDAM No. CA01080), dated February 25, 2015.
[11] Letter to FERC regarding Castaic Power Plant Elderberry Forebay Dam Monitoring Report Submittal (Project No. 2426, NATDAM No. CA01080), dated February 24, 2015.

provide additional staff training and knowledge transfer for license requirements and do not anticipate future challenges in complying with annual report filing requirements and timely preparation and filing of Part 12D reports and corrective plans and schedules in response to Part 12D reports.