3.0 PROJECT DESCRIPTION AND OPERATION

The Project is a power recovery project that operates on the East Branch of the SWP. The SWP provides southern California with affordable water supply to supplement local resources. The Project generates clean hydropower, 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 DWR 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 Project is located on the East Branch of the SWP in the County of San Bernardino, California, between the cities of Hesperia and San Bernardino. Figures 1.2-1 and 3.1-1 show the location of the Project.

3.2 EXISTING PROJECT BOUNDARY, FACILITIES, FEATURES, AND OPERATIONS

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

3.2.1 Existing Project Boundary

The existing Project boundary covers 3,744 acres of land (Figure 3.1-1), with elevations ranging from 1,778 to 5,377 feet. Within the total acreage, 220.98 acres are federal lands managed by the USFS as part of the SBNF. Most of these federal lands are located along the west side of Silverwood Lake, San Bernardino Tunnel and Surge Chamber, and Devil Canyon Powerplant Penstocks areas.

Figure 3.1-1 shows the existing Project boundary for the Project. Around Silverwood Lake, the Project boundary is bordered by State Highway 173 to the north and State Highway 138 to the west and south.

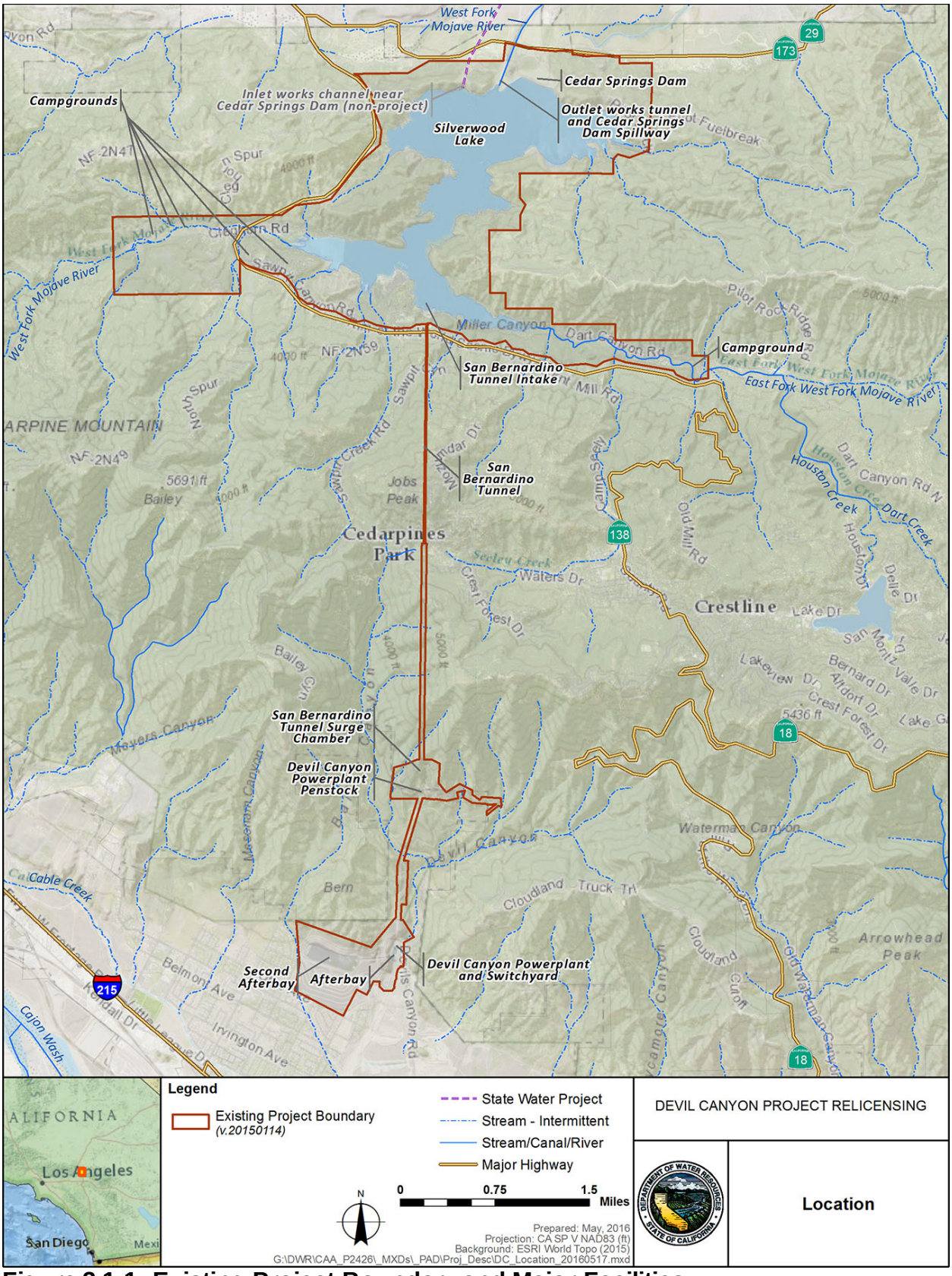


Figure 3.1-1. Existing Project Boundary and Major Facilities

South of Silverwood Lake, the existing Project boundary includes a corridor along the alignment of the San Bernardino Tunnel and the Devil Canyon Powerplant penstocks, as well as related slope drainage improvements and primary Project access roads, the Devil Canyon Powerplant and Switchyard, and the Devil Canyon Afterbay and Second Afterbay.

Within the existing Project boundary, non-Project facilities and features include:

- Inlet Works at Silverwood Lake, including the transition structure, chute, energy dissipation structure, and associated riprap, which is part of the conveyance from the Mojave Siphon on the SWP outside of the Project boundary
- The water intake, treatment facilities, and distribution facilities of the Crestline-Lake Arrowhead Water Agency (CLAWA)
- The Cleghorn Wastewater Treatment Plant, collection system, and outflow pipeline of the Crestline Sanitary District on the west side of State Highway 138 near the park administration building
- The Administrative Building and other facilities of the DPR
- The Pacific Crest National Scenic Trail (PCT) and several trails of the Silverwood Lake State Recreation Area (SRA)
- A small section of State Highway 138
- The Southern California Edison (SCE) transmission system
- The San Bernardino Pipeline, Santa Ana Pipeline, Azusa Pipeline, and Rialto Pipeline from the Devil Canyon Afterbay, including their valves, turnouts, meters, and connections
- The Inland Feeder, Santa Ana Pipeline, and Rialto Pipeline from the Devil Canyon Second Afterbay, including their valves, turnouts, meters, and connections

3.2.2 Existing Project Facilities and Features

Existing Project facilities include Cedar Springs Dam, Silverwood Lake, San Bernardino Tunnel intake, San Bernardino Tunnel and Penstocks, Devil Canyon Powerplant and Switchyard, Devil Canyon Afterbay, Devil Canyon Second Afterbay, recreational facilities, and appurtenant facilities (Figure 3.1-1).

3.2.2.1 Cedar Springs Dam and Silverwood Lake

Cedar Springs Dam and Silverwood Lake (Figure 3.2-1), located on the West Fork Mojave River, are about 90 miles southeast of the bifurcation of the East and West branches of the SWP and 25 miles north of the City of San Bernardino. Completed in

1971, Cedar Springs Dam is a 249-foot-tall, zoned earth and rockfill dam, with a dam crest that is 42 feet wide and 2,230 feet long, at an elevation of 3,378 feet. It contains approximately 7.6 million cubic yards (mcy) of embankment. At the Normal Maximum Water Surface Elevation (NMWSE) of 3,353 feet, Silverwood Lake has a storage capacity of 73,031 acre-feet (AF), a usable storage capacity of 33,820 AF, normal maximum surface area of 962 acres, and a shoreline length of about 13 miles.

Figure 3.2-1. Downstream Face of Cedar Springs Dam and Silverwood Lake from the Right Abutment

The Cedar Springs Dam Spillway is located on the left abutment of the dam and consists of a 120-foot long un-gated crest with rectangular lined concrete channel.

The Cedar Springs Dam low-level outlet works is located in the left abutment of the dam directly below the spillway. The low-level outlet works consists of an un-gated intake tower, a pressure tunnel connecting the intake tower to a gate chamber, a free-flow tunnel downstream from the gate chamber that discharges into the spillway chute just upstream from the stilling basin, and an air intake that also serves as an emergency exit. The maximum capacity of the low-level outlet works is 5,000 cfs.

3.2.2.2 San Bernardino Tunnel and Penstocks

The San Bernardino Tunnel intake is a vertical reinforced concrete tower on the south end of Silverwood Lake that draws water from the reservoir and conveys it into the San Bernardino Tunnel (Figure 3.1-1).

The San Bernardino Tunnel is a pressure conduit, which conveys water from Silverwood Lake to the Devil Canyon Penstocks. The 3.81-mile-long concrete-lined tunnel is 12.75 feet in diameter and has a design capacity of 2,811 cfs at Silverwood Lake NMWSE.

Water enters the Devil Canyon Powerplant via two surface penstocks. The above-ground penstocks (one 1.3-mile-long, 9.5 feet to the South Portal to 8 feet at the plant and one 1.3-mile-long, steel penstock with a diameter varying from 12.5 feet to the south Portal to 8 feet to the plant) run parallel, generally following the ground slope from the South Portal, or end, of the San Bernardino Tunnel to the Devil Canyon Powerplant. The maximum capacities of the two penstocks at Silverwood Lake NMWSE are about 1,200 cfs and 1,600 cfs, respectively.

3.2.2.3 Devil Canyon Powerplant and Switchyard

The Devil Canyon Powerplant (Figure 3.2-2) is located at the base of the San Bernardino Mountains in the City of San Bernardino and is designed to recover power in electrical form from the waters of the SWP as it drops from the high desert through the Devil Canyon Powerplant turbines.

Figure 3.2-2 Devil Canyon Powerplant and Devil Canyon Afterbay from the Road Leading to the Second Afterbay

The elevation drop from Silverwood Lake provides the Devil Canyon Powerplant with a normal static head of 1,406 feet at the NMWSE of Silverwood Lake. The powerplant has

a total licensed authorized installed capacity of 280 MW and a dependable capacity of 24.8 MW, with average annual generation of 946 gigawatt hours (GWh) and average monthly generation of 79 GWh between 2000 and 2014 (see Section 3.6). The dependable capacity is based on the average powerplant generation during 2014, a critically dry year.

The Devil Canyon Powerplant has four generation units. These include one Baldwin-Lima-Hamilton Pelton-type turbine and one Sulzer Escher Wyss Pelton-type turbine, each with 1,357 feet rated head, 277 revolutions per minute (rpm) runner speed, 81,000 horsepower (hp) rated output, 670 cfs approximate rated discharge, and a licensed capacity of 59.85 MW The other two are Voith Pelton-type turbines each with 1,250 feet rated head, 277 rpm runner speed, 76,548 hp rated output, 800 cfs approximate rated discharge, and licensed capacity of 80 MW. The Devil Canyon switchyard includes four step-up transformers.

There are multiple current transformers and potential transformers in the switchyard. The main function of the transformers is metering and protection. The ratings of the current transformers and potential transformers, which are part of the interconnected transmission system, are CEII and are provided separately (Single-Line Diagram of the Devil Canyon Powerplant in Appendix D).

3.2.2.4 Devil Canyon Afterbay

Water from the Devil Canyon Powerplant flows to the off-stream Devil Canyon Afterbay, which has a surface area of 4 acres at a NMWSE of 1,932 feet, a capacity of 49 AF, and an embankment crest elevation of 1,940 feet. Completed in 1974, the afterbay provides a minimal amount of regulatory capacity for matching the powerplant's inflows and outflows to different pipelines for SWP water deliveries outside of the Project boundary.

SWP water supply in Devil Canyon Afterbay is either conveyed to the Devil Canyon Second Afterbay for future delivery or via the four pipelines to meet downstream water supply demands. SWP water is delivered to the Devil Canyon Second Afterbay via the 1,100-foot-long, 40-foot-wide, 27-foot-deep concrete-lined Cross Channel with an approximately 13-foot-high uncontrolled weir structure at the inlet to the Cross Channel. SWP water scheduled to meet downstream water supply demands is delivered through the following four pipelines: the Rialto Pipeline; Azusa Pipeline; Santa Ana Pipeline; or the San Bernardino Pipeline.

The Devil Canyon Afterbay includes a spillway structure designed for emergency purposes but has never been used, and is obsolete due to the construction of the Second Afterbay. This spillway and the four pipelines connected to the Devil Canyon Afterbay including their valves, turnouts, meters, and connections are not part of the Project facilities. There are no other releases from the Devil Canyon Afterbay.

3.2.2.5 Devil Canyon Second Afterbay

Completed in 1995, the Devil Canyon Second Afterbay (Figure 3.2-3) was added to the Project to increase the operational flexibility and capacity of the Devil Canyon Powerplant. The Devil Canyon Second Afterbay NMWSE is 1,930 feet, and gross storage capacity of 960 AF with a surface area of approximately 36 acres. Devil Canyon Second Afterbay is an off-channel, below-original-ground level water holding structure.

Figure 3.2-3. Devil Canyon Second Afterbay from the West Side of the Afterbay

All operational releases from the Devil Canyon Second Afterbay are made through the outlet structure. SWP water deliveries through the outlet structure can be made through one of three pipelines: the Rialto, Santa Ana, and Inland Feeder. The Devil Canyon Second Afterbay also has an emergency overflow spillway discharge outlet, as well as a low-level emergency outlet release. The Rialto Pipeline, Santa Ana Pipeline, and Inland Feeder, including their valves, turnouts, meters, and connections within the Project boundary, are non-Project facilities.

3.2.2.6 Other Project Facilities

Recreation Facilities

Recreational amenities, such as shoreline access, parking, restrooms, camping, picnicking, and fishing, are available at Silverwood Lake. Public access to the Devil Canyon Afterbay and Second Afterbay is not permitted.

The Project includes recreational facilities at Silverwood Lake as noted in Figure 3.1-1 and described in Section 4.9 of this PAD.

Primary Roads and Trails

Primary Project roads include the access road from the gate at Hwy 173 to the top of Cedar Springs spillway, Cleghorn Road from the Cleghorn Trailhead, across Hwy 138 to the west end of the campgrounds in Cleghorn Canyon, and Sawpit Canyon Road from the Hwy 138 off-ramp to the Sawpit Boat Ramp.

Primary Project trails include the Cleghorn Hiking and Biking Trail from Cleghorn Road to Garces Overlook, East Fork of the West Fork Mojave River Hiking and Biking Trail from Miller Canyon Road to Devil's Pit, Lynx Point, and Jamajab Point; Sawpit Canyon Hiking and Biking Trail to Mesa Hike-and-Bike Campsites; and Miller Canyon Picnic Area Trail to Black Oak Picnic Area (collectively the Silverwood Hike and Bike Trail Network).

3.2.3 Project Operations

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

3.2.3.1 Hydrologic Period of Record

For the purpose of this PAD, DWR has chosen a 15-year hydrologic and operating period of record extending from calendar year 2000 through 2014. This period contains a good variation of hydrologic conditions, including wet years like 2006 and drought years like 2014. All operations data presented in this report were obtained from DWR's SWP Monthly Operations Data available at the following link: http://www.water.ca.gov/swp/operationscontrol/monthly.cfm (DWR 2015a) which, among other things, contains daily operating data of Project storage and conveyance facilities, as well as Project generation records. Southern Field Division (SFD) personnel working for the Water Operations Section collected data primarily on a daily basis. 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 was sent to DWR's Regulatory Compliance and Reporting Branch, is available online from DWR's website, and is published in monthly SWP project-wide operation reports. Hydrologic data are provided in Appendix E.

3.2.3.2 Water Diversions and Operational Considerations

DWR's first and foremost consideration when operating the Project is the safety of the public, DWR employees, and DWR contractors. DWR's next consideration is the safety of its facilities and downstream facilities. Besides the physical limitations of the Project facilities, Project power generation is driven by how Silverwood Lake is operated and used to convey SWP water supply.

Cedar Springs Dam and Silverwood Lake operate for SWP water supply delivery and hydropower generation. DWR does not utilize any local natural flow for SWP purposes or intend to operate for local natural inflow regulation or control (e.g., flood control). Due to operational constraints, delivery turnout outages, or safety issues, the instantaneous natural outflow volume to the West Fork Mojave River may not be equal to the instantaneous natural inflow volume. Upon construction of Cedar Springs Dam, DWR entered into operational agreements with CLAWA, Las Flores Ranch, and the Mojave Water Agency (MWA) to satisfy their surface water rights.

- CLAWA – CLAWA's current diversion point is at the south shore of Silverwood Lake. Per a 1989 agreement between DWR and CLAWA, DWR obtained CLAWA's combined water rights for Houston Creek, a tributary to the East Fork of the West Fork Mojave River which is a tributary to Silverwood Lake, with a diversion limitation of up to 3.37 cfs and a total annual volume of up to 1,302 AF. As outlined in the agreement, in exchange with DWR for CLAWA's rights to Houston Creek water, CLAWA is able to take a like amount from Silverwood Lake. The agreement prescribes the terms and methodology to determine the amount of natural inflow, in addition to the local water from Houston Creek appropriated by DWR for CLAWA. CLAWA has a separate SWP contract for 5,800 AF per year taken from their intake on Silverwood Lake (at the same location as indicated above).

- Las Flores Ranch – During the construction of Cedar Springs Dam, DWR removed stream diversion works owned and operated by Las Flores Ranch. As a replacement for the removed Las Flores Ranch diversions, DWR built new diversion works for Las Flores Ranch within the DWR right-of-way at the Mojave Siphon, outside the Project boundary, consisting of more than 3,000 feet of pipeline with a 23 cfs capacity. As described in the 1980 agreement between DWR and Las Flores Ranch, to satisfy the prior surface water rights of Las Flores Ranch, the Ranch exchanged its allocation of natural inflow for a like amount of DWR SWP water delivered via the Mojave Siphon located upstream of the Project. The exchange amounts are approximated as nearly as possible to the natural flow amounts that would have existed without Cedar Springs Dam. The 1980 agreement outlines the methodology for determining the amount of natural outflow based on the combined gaged inflow at two stations above Cedar Springs Dam (West Fork Mojave River and East Fork of the West Fork Mojave River). Exhibit A of the 1980 agreement provides a synthetic outflow amount based on the inflow at the two gaging stations when the combined gaged inflow is less than 300 cfs. When the combined gaged inflow is above 300 cfs, Exhibit A of the 1980 agreement stipulates that the change in storage method for determining natural outflow will be used.

- MWA – Any natural inflow to Silverwood Lake that is not used by Las Flores Ranch and CLAWA (as described above) is released from Cedar Springs Dam to MWA. MWA also serves as the controlling agency for the water of the adjudicated Mojave Groundwater Basin downstream of Cedar Springs Dam. A 1982 agreement between DWR and MWA outlines the relationship for

determining the amount of natural outflow based on the combined gaged inflow at two stations above Cedar Springs Dam (West Fork Mojave River and East Fork of the West Fork Mojave River). The relationship and computation method for the total combined outflow are identical to those in the 1980 agreement with Las Flores Ranch. Exhibit A of the 1982 agreement provides a synthetic outflow amount based on the inflow at the two gaging stations when the combined gaged inflow is less than 300 cfs. When the combined gaged inflow is more than 300 cfs, Exhibit A of the 1982 agreement stipulates that the change in storage method for determining natural outflow will be used.

In addition to the water right agreement described above, MWA also receives SWP water delivered from Silverwood Lake as part of the Mojave River Basin Groundwater Banking Program.

The operations of Silverwood Lake are also subject to the operational constraints in the agreements with USFS and CDFW (formerly California Department of Fish and Game [CDFG]). These constraints are not reflected in the existing FERC license. During emergency conditions, all of the limits outlined in the agreements below may be exceeded.

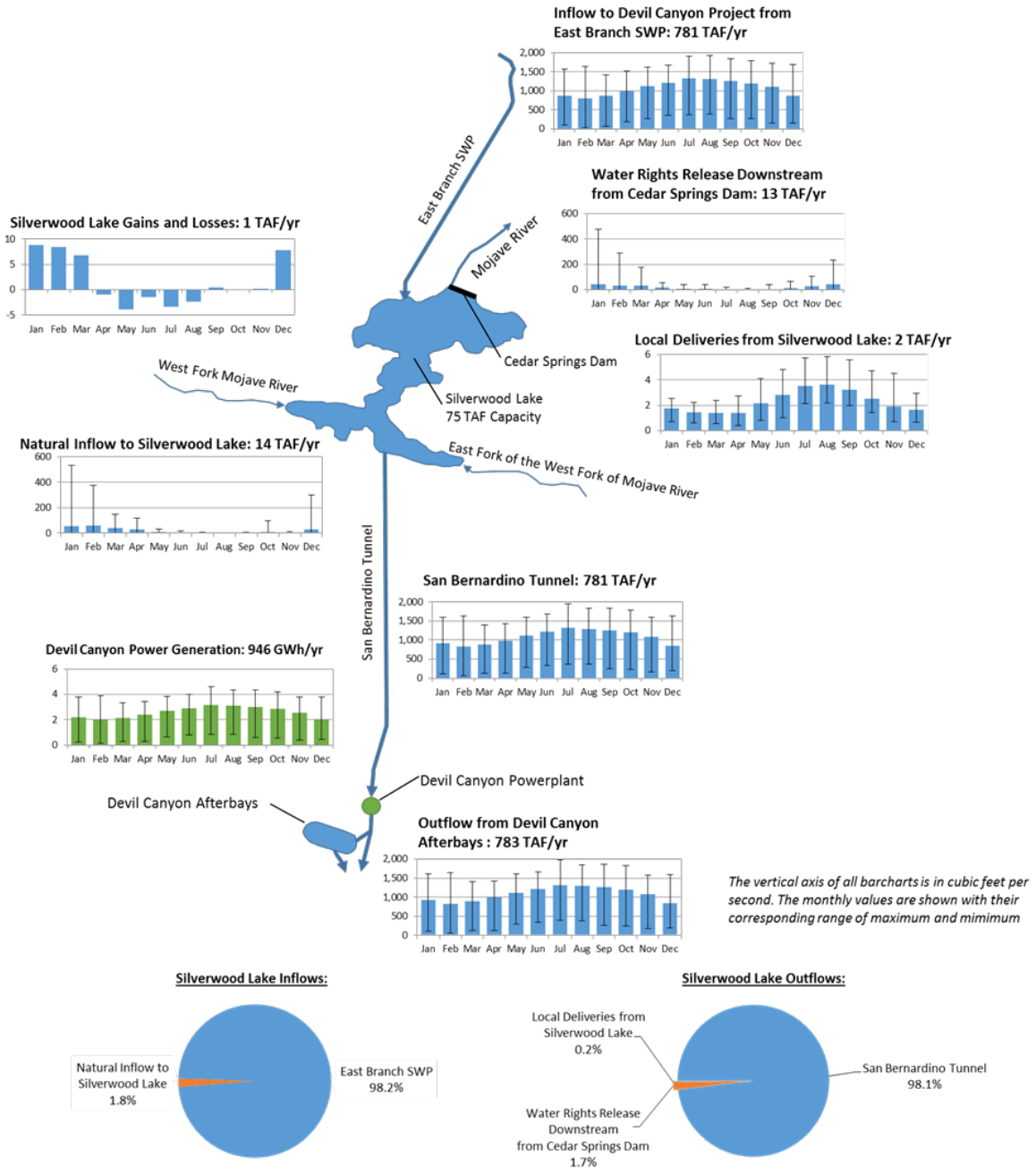
- The USFS agreement was signed in 1968 and amended in 1971. It established operating goals to maintain a water surface elevation in Silverwood Lake from March 1 to September 15 of each year, within a range of not more than 30 inches during each 7-day period, beginning at midnight Sunday, and within a range of not more than 11 inches each day. However, the agreement also recognizes that the weekend water level recovery pattern may result in a daily rise of up to 18 inches during this weekend cycle, and there may be periods of reservoir operations where the fluctuations have to exceed the 11-inches-per-day fluctuation limit to economically meet DWR's commitments for SWP water supply delivery. Therefore, DWR may exceed the 11-inches-per-day fluctuation limit by 3 inches for a total of 15 days between March 1 and September 15. A consultation process is also provided if there is a need to exceed the 11-inches-per-day limit beyond 15 days.

- The 2003 agreement with CDFW (formerly California Department of Fish and Game [CDFG]) stipulates additional operations constraints to help protect bass spawning. On April 1, DWR reports the Silverwood Lake water level to CDFW and during the period of April 1 to June 30 DWR will manage the lake such that the lake is not lowered more than three feet from the April 1 reported level. A consultation process was established in the agreement if DWR needs to lower the lake level by more than three feet during this period.

In addition, Article 58 of the existing FERC license requires DWR to maintain Silverwood Lake surface elevations at the highest, most practicable level commensurate with other Project purposes during the summer recreation season.

3.2.3.3 Project Inflows and Outflows

Figure 3.2-4 shows the schematic of the Project with annual and monthly flow statistics at different locations from 2000 through 2014. The Project inflows are based on SWP delivery and minor local West Fork Mojave River and East Fork of the West Fork Mojave River inflows. Project outflows occur at several locations: (1) CLAWA withdrawals from Silverwood Lake through their intake per their agreement to divert natural and SWP contracted flows; (2) DWR's release of natural inflows to the West Fork Mojave River for MWA; (3) SWP water delivery to MWA (2003, 2005, and 2011) for the Mojave River Basin Groundwater Banking Program (4) water delivery releases from Devil Canyon Afterbay and Second Afterbay to SWP contractors; and (5) spills from Devil Canyon Second Afterbay to Devil Canyon drainage channel, if any. In addition, evaporation of SWP water occurs in Silverwood Lake. The prominent flow component is the SWP water delivery discharged into Silverwood Lake and then passed through the San Bernardino Tunnel, Devil Canyon Powerplant, and afterbays, and delivered to downstream SWP contractors. The monthly patterns of inflows and outflows are near identical (Figure 3.2-4), indicating that the Project is not used for carryover of water supplies between years or redistribution of supplies within years, but rather for regulation of flows on a sub-monthly timescale. The Project receives highly variable natural inflows primarily during fall and winter months. Overall, these natural inflows and outflows are minor compared to the total amount of water passing through Silverwood Lake. Annually, approximately 795,000 AF flows through Silverwood Lake, of which approximately 14,000 AF (only 2 percent of the total inflow to Silverwood Lake) is natural inflow and the remaining 781,000 AF (the remaining 98 percent of the total inflow to Silverwood Lake) is SWP water.



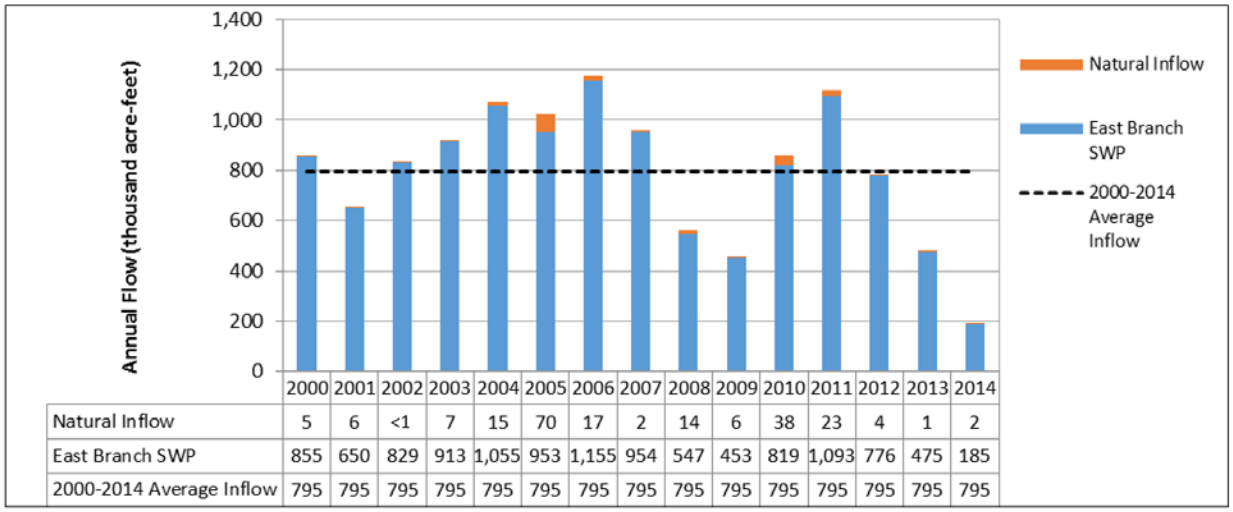
Source: DWR 2015a
Key:
TAF = thousand acre-feet
yr = year

Figure 3.2-4. Project Schematic with Annual Average Flow Volumes and Monthly Average Flows, 2000 through 2014

As shown in Figure 3.2-4, on average the outflow from Devil Canyon Afterbay and Second Afterbay is 2 thousand acre-feet (TAF), or 0.26 percent, more than the recorded San Bernardino Tunnel inflow. The water balance computation is based on operational reports of the inflow and outflow to the afterbays. The San Bernardino Tunnel flow, the inflow to the afterbays, is not directly measured but is "back computed" from the metered Devil Canyon hydropower generation. The total outflow of the Devil Canyon afterbays is the summation of the flow from multiple pipelines, any inaccuracy in the individual pipeline flows are additive in the total afterbay outflow. All of this flow is SWP water supply, contained within SWP facilities and does not impact natural flows or the natural environment.

3.2.3.4 Silverwood Lake Inflows

Silverwood Lake inflows include natural inflows from the West Fork Mojave River, East Fork of the West Fork Mojave River, other local drainages, and water supply from the SWP. Figure 3.2-5 shows the annual inflows to Silverwood Lake. The statistics reflect operating agreements with local water rights users and operations described previously for natural inflow calculations. As demonstrated in Figure 3.2-5, natural inflow is about 2 percent of the total annual inflow to Silverwood Lake ranging from less than 1,000 AF to 70,000 AF, while East Branch SWP inflows to Silverwood Lake range from 185,000 AF to 1,155,000 AF.



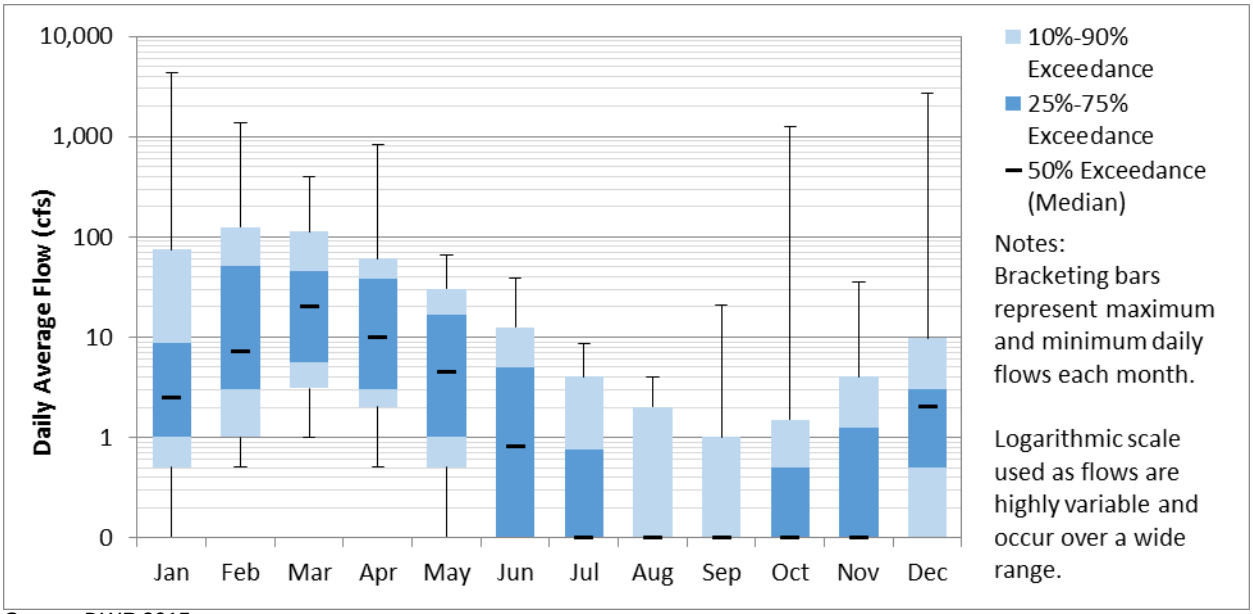
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Natural Inflow	5	6	<1	7	15	70	17	2	14	6	38	23	4	1	2
East Branch SWP	855	650	829	913	1,055	953	1,155	954	547	453	819	1,093	776	475	185
2000-2014 Average Inflow	795	795	795	795	795	795	795	795	795	795	795	795	795	795	795

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

Figure 3.2-5. Annual Inflows to Silverwood Lake, 2000 through 2014

The box-and-whisker plots in this PAD are summaries of flow exceedance curves, which can be found in Appendix E. 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.

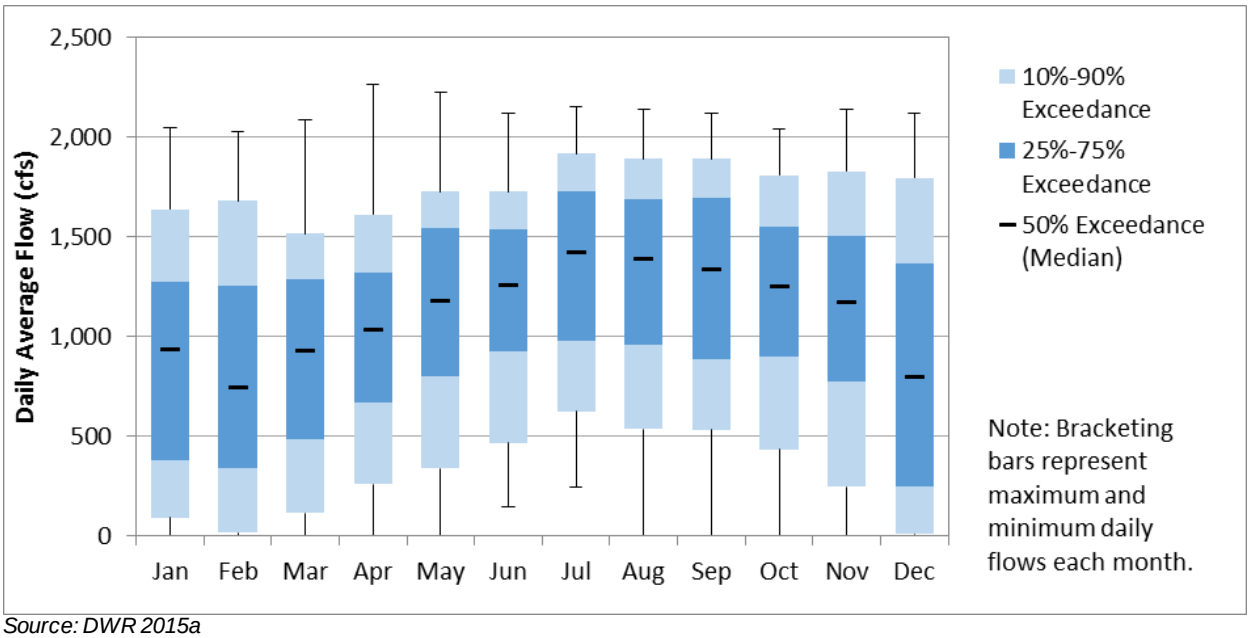
Figure 3.2-6 shows the monthly range in daily natural inflows. This logarithmic exceedance chart demonstrates that natural inflow to Silverwood Lake occurs primarily in the fall and winter months and the amount of inflow is highly variable during these months. However, during the summer months, it is common for Silverwood Lake to receive little or no natural inflow, as represented in the figure by the 50 percent exceedance (median) values of zero for the months of July through November, meaning that half of the recorded daily average flows in these months were zero.



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

Figure 3.2-6. Range and Exceedance Probability of Daily Natural Inflows to Silverwood Lake by Month, 2000 through 2014

Figure 3.2-7 shows monthly SWP water supply inflow to Silverwood Lake. The daily average flows generally follow a seasonal trend with the most SWP flow to Silverwood Lake peaking in mid-summer in order to meet summer water supply demands. The SWP inflows to Silverwood Lake are significantly greater than the local natural inflows to the Project (i.e., median daily average values range from 0 to approximately 20 cfs for natural inflows compared to median daily average values ranging from approximately 700 to 1,400 cfs for SWP inflows) (Figure 3.2-4). On an average, the natural inflows account for about 2 percent of the total inflow into Silverwood Lake.



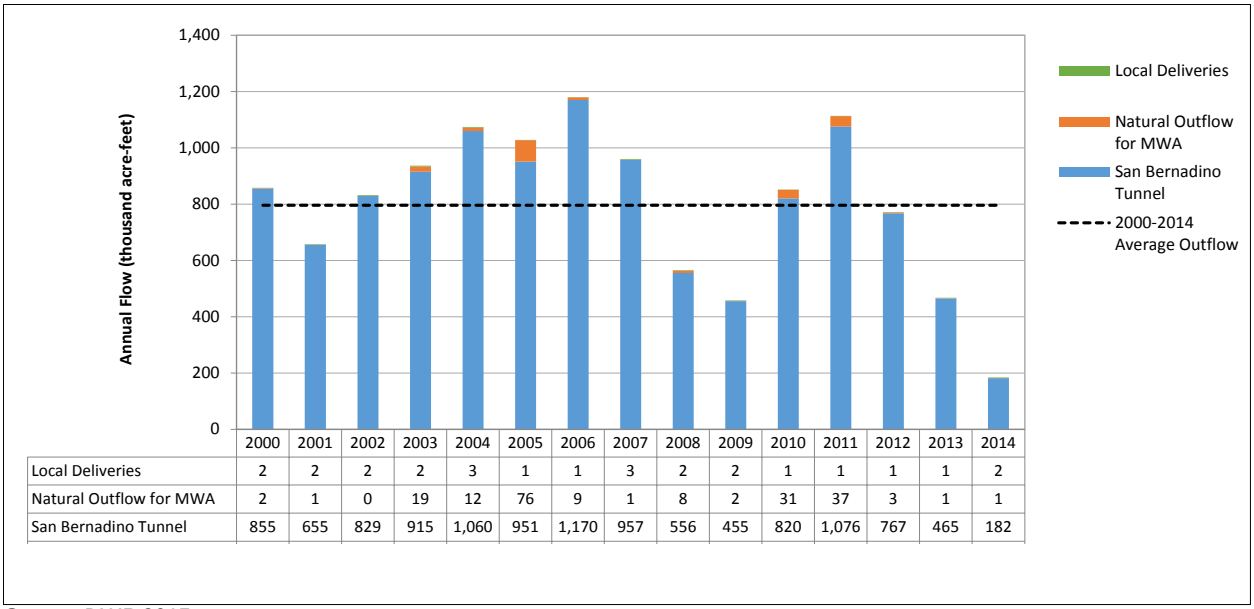
Source: DWR 2015a
Key:
cfs = cubic feet per second

Figure 3.2-7. Range and Exceedance Probability of Daily Inflows to Silverwood Lake from the East Branch of the SWP by Month, 2000 through 2014

3.2.3.5 Silverwood Lake Outflows

Silverwood Lake outflows include the SWP water supply release to the San Bernardino Tunnel, the release from Cedar Springs Dam to the West Fork Mojave River, and local diversions.

Figure 3.2-8 shows the annual outflows from Silverwood Lake. Annual local deliveries are very small (averaging about 2,000 AF) in magnitude compared to other deliveries (averaging nearly 800,000 AF), and therefore are not detectable in Figure 3.2-8. Per the operational agreements with users of natural flow described in Section 3.2.3.2, the "natural outflow for MWA" released from Cedar Springs Dam is the water released to meet MWA's water right. Since all natural inflow to Silverwood Lake cannot be included in SWP water deliveries through the San Bernardino Tunnel, MWA will typically receive larger volumes of water in wet years, such as 2005.

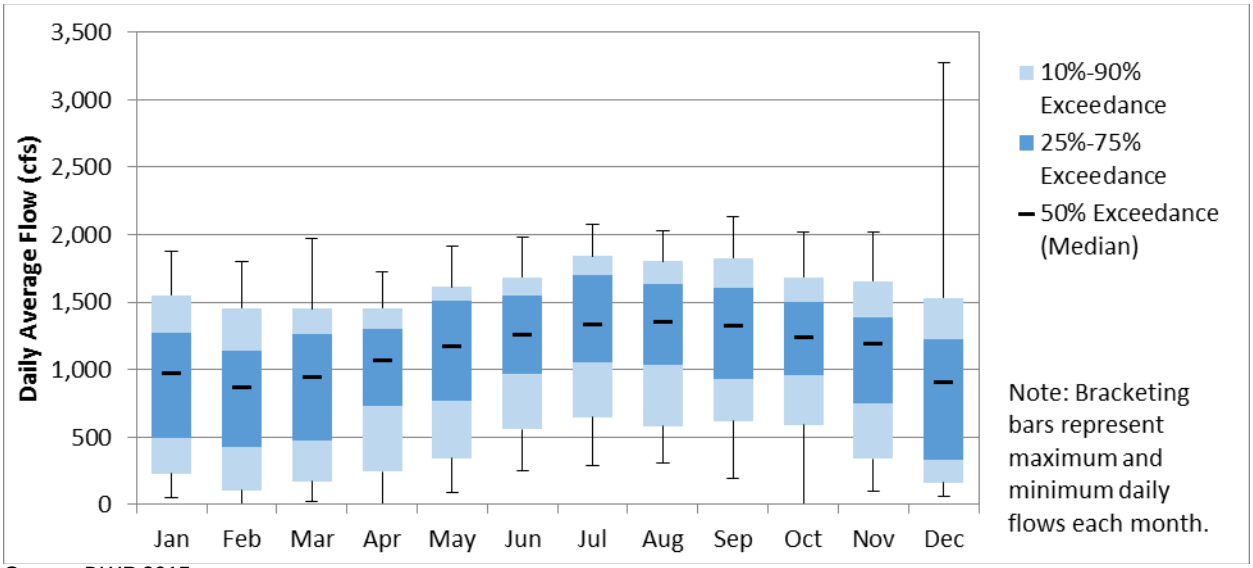


	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Local Deliveries	2	2	2	2	3	1	1	3	2	2	1	1	1	1	2
Natural Outflow for MWA	2	1	0	19	12	76	9	1	8	2	31	37	3	1	1
San Bernadino Tunnel	855	655	829	915	1,060	951	1,170	957	556	455	820	1,076	767	465	182

Source: DWR 2015a
Key:
MWA = Mojave Water Agency

Figure 3.2-8. Annual Outflows from Silverwood Lake, 2000 through 2014

A significant portion of Silverwood Lake outflows are SWP water supplies that are released into the San Bernardino Tunnel, conveyed through Devil Canyon Powerplant, stored in Devil Canyon Afterbay or Second Afterbay, and scheduled for delivery to meet downstream SWP water demands. From 2000 through 2014, daily releases to the San Bernardino Tunnel averaged 1,089 cfs and ranged from 0 cfs to 3,270 cfs. The range and seasonal variation in daily average water supply releases from Silverwood Lake to the San Bernardino Tunnel during this period are shown in Figure 3.2-9.

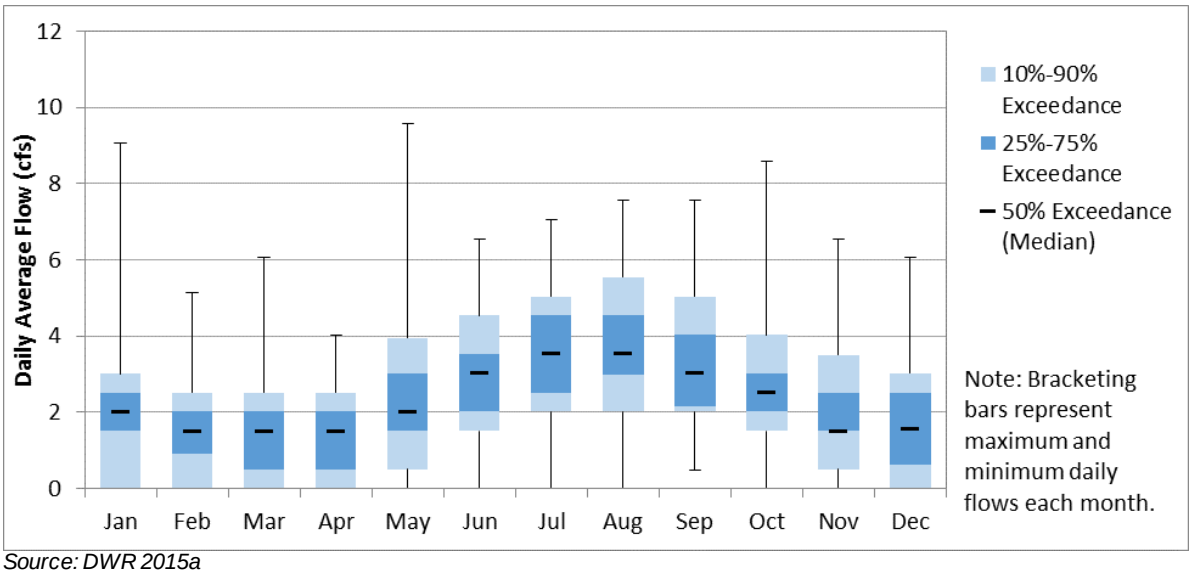


Source: DWR 2015a
Key:
cfs = cubic feet per second

Figure 3.2-9. Range and Exceedance Probability of Daily SWP Water Supply Discharges from Silverwood Lake to Devil Canyon Powerplant via the San Bernardino Tunnel by Month, 2000 through 2014

Records indicate local water diversions include deliveries to CLAWA (a combination of local water diversions including delivery to the Silverwood Lake SRA and SWP contract delivery) and MWA (SWP contract delivery). From 2000 through 2014, CLAWA received an average of 1,582 AF per year from Silverwood Lake, ranging from 815 AF to 2,602 AF per year. In addition, Silverwood Lake SRA received an average of 79 AF per year from Silverwood Lake, ranging from 48 AF to 103 AF. MWA receives their SWP contract delivery before the SWP water enters Silverwood Lake. MWA rarely receives SWP water from the releases from Silverwood Lake through Cedar Springs Dam to the Mojave River. From 2000 through 2014, water released from Silverwood Lake to MWA for their SWP water delivery accounted for approximately 1 AF of water on a single day during the 15-year record. The daily rate of these cumulative local diversions, including CLAWA, MWA, and Silverwood Lake SRA, from 2000 through 2014, is summarized in Figure 3.2-10. Annual deliveries to each user are summarized in Table 3.2-1.

Note that MWA's SWP delivery points are outside of the Project boundary near Mojave Siphon. Although it is possible for MWA to receive its SWP delivery via release from Cedar Springs Dam, it has rarely happened.



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

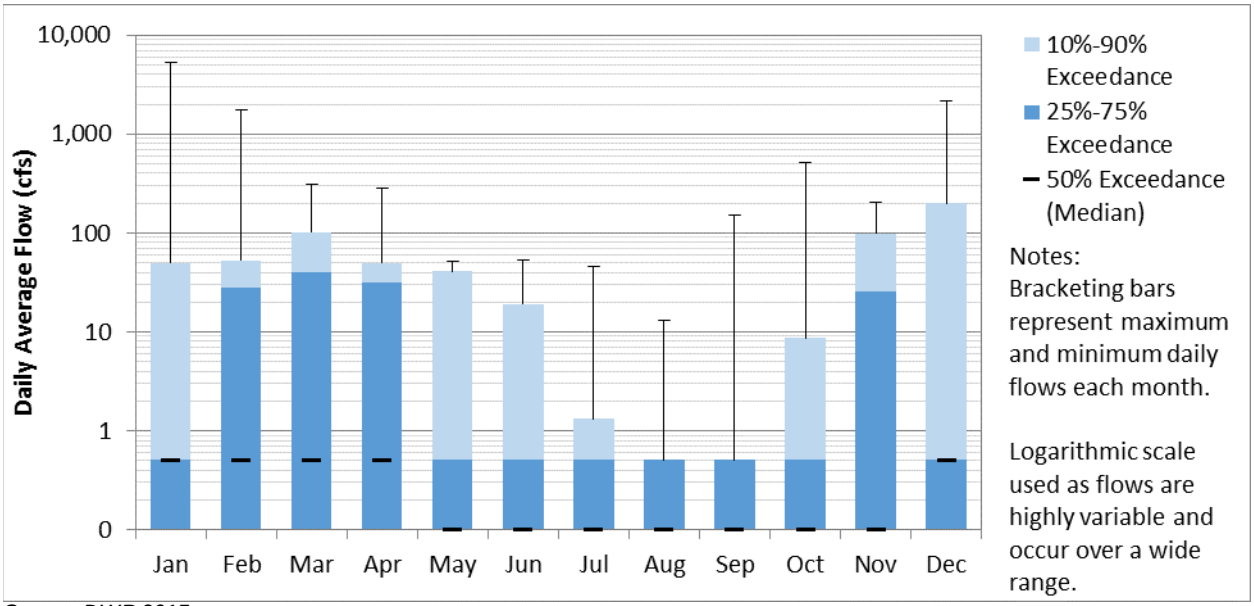
Figure 3.2-10. Range and Exceedance Probability of Daily Discharges from Silverwood Lake for Delivery to Local Water Users by Month, 2000 through 2014

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

Year	Annual Deliveries (AF)		
	CLAWA (Water Rights and SWP Delivery)	Silverwood Lake SRA	MWA (SWP Delivery)
2000	1,458	74	0
2001	1,657	78	0
2002	2,190	77	0
2003	2,136	95	0
2004	2,489	86	0
2005	991	83	0
2006	1,153	92	0
2007	2,602	103	0
2008	1,806	80	0
2009	1,555	75	0
2010	920	56	0
2011	815	73	0
2012	971	79	1
2013	1,372	80	0
2014	1,619	48	0
Average	1,582	79	0

Source: DWR 2015a
Key:
AF = acre-feet
CLAWA = Crestline-Lake Arrowhead Water Agency
MWA = Mojave Water Agency
SRA = State Recreation Area
SWP = State Water Project

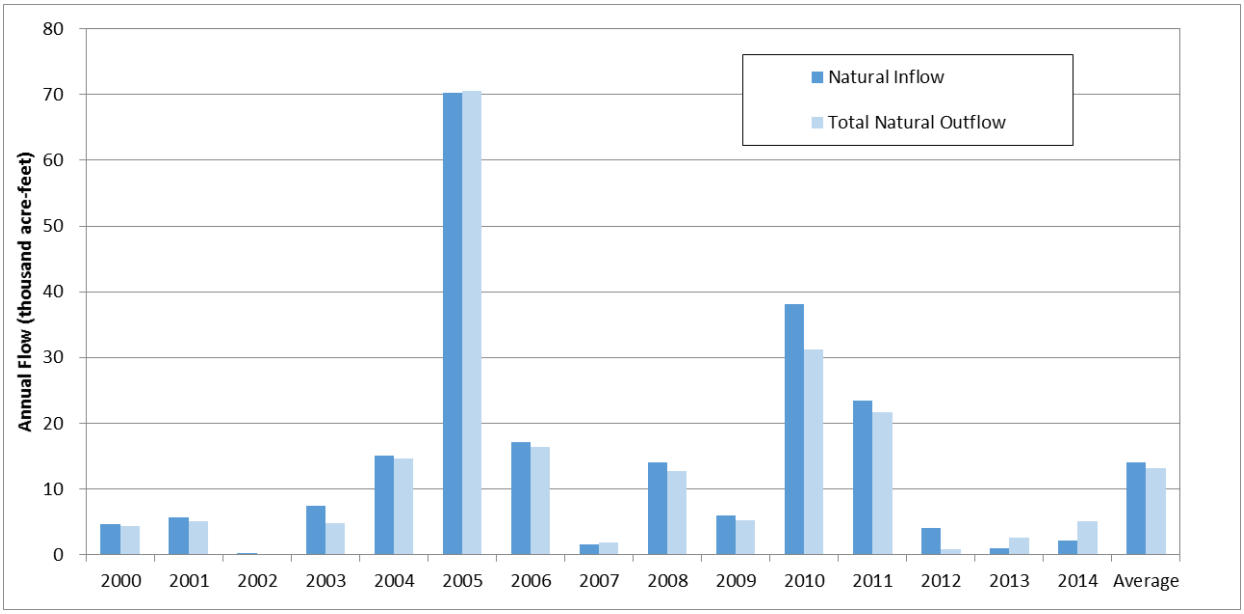
The operation agreements mentioned above require that all natural inflow be released. The range and seasonal variation in daily average natural flow releases from Silverwood Lake to the West Fork Mojave River during this period are shown in Figure 3.2-11. Note that the natural flow herein refers to the release from Cedar Springs Dam for MWA, after the diversion of water by CLAWA directly from Silverwood Lake and the diversion of water by Las Flores Ranch through exchange at Mojave Siphon.



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

Figure 3.2-11. Range and Exceedance Probability of Daily Natural Flow to the West Fork Mojave River Downstream from Cedar Springs Dam by Month, 2000 through 2014

Figure 3.2-12 shows the comparison of the calculated natural inflows and total natural outflows (combined flows for CLAWA water diversions, Las Flores Ranch water diversions through exchange, and MWA delivery). The natural inflow and outflow at Silverwood Lake were compiled from DWR operational records. DWR attempts to operate such that the natural outflow matches the natural inflow to support downstream water rights. Most of the year, the comparison suggests the balance for natural flows on the West Fork Mojave River; however, Figure 3.2-12 indicates that there are times when the operational data does not show the expected match. These discrepancies are due to local operational agreements and unexpected short term operational issues. For instance, in 2003, 2005, and 2011 there were exchanges between Metropolitan Water District of Southern California (MWD) and MWA for ground water recharge that impact the water balance in those years. Also, from November 2010 to November 2012, and again from February 2013 to June 2013 system repairs required suspension of water rights deliveries to the Las Flores Ranch. The withheld diversions were carried over as a balance due to Las Flores Ranch and were delivered over the period from June 2013 to the present. With the repayment of withheld diversions complete, the system reflects a balanced inflow and outflow.

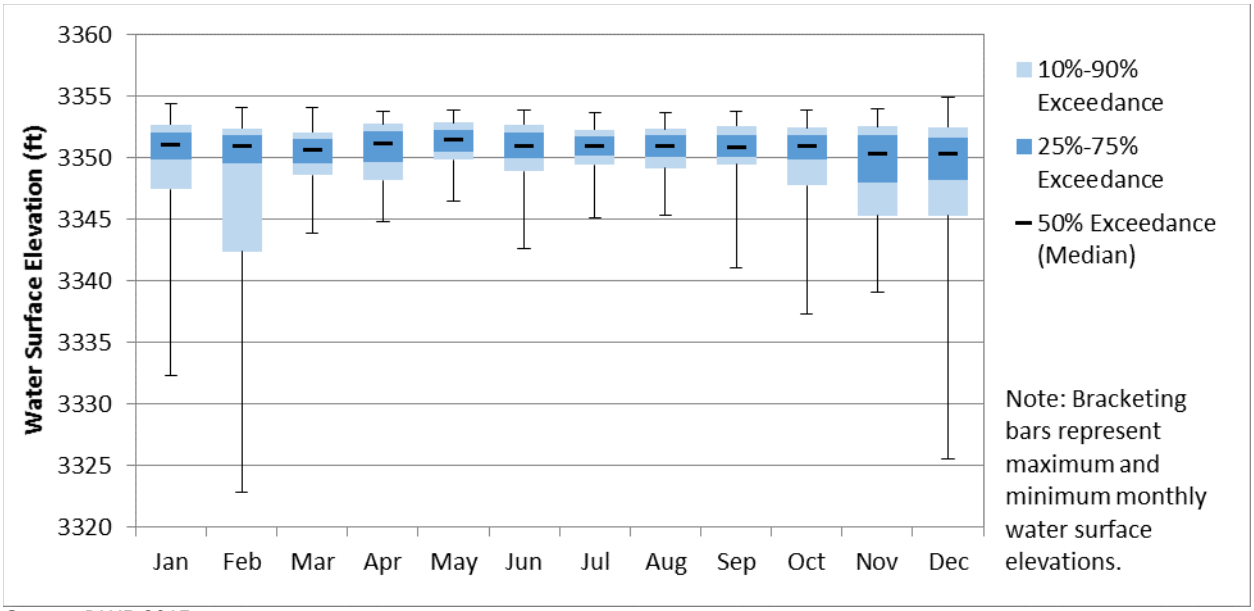


Source: DWR 2015f

Figure 3.2-12. Annual Total Natural Inflow and Outflow at Silverwood Lake from Local Tributaries to Silverwood Lake, 2000 through 2014

3.2.3.6 Silverwood Lake Levels

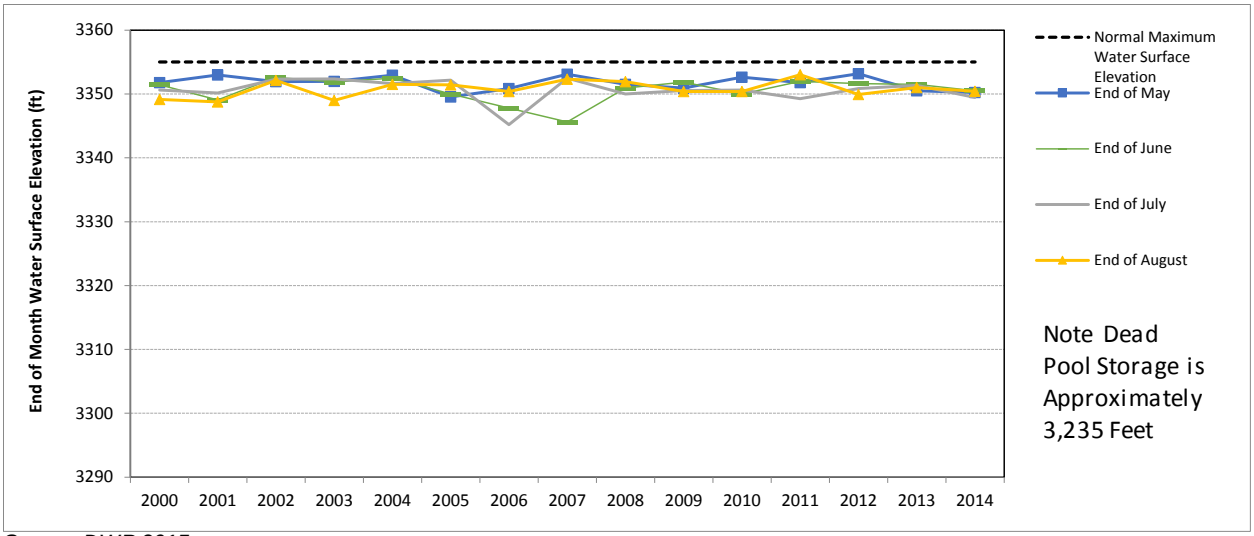
Silverwood Lake is generally operated within a narrow range of storage and water surface elevation, as shown in Figure 3.2-13. Silverwood Lake provides emergency water storage and is rarely drawn down substantially due to the operating constraints discussed in Section 3.2.3.2, and then only when there is an interruption in SWP water supply deliveries from the East Branch of the SWP.



Source: DWR 2015a
Key:
ft = feet

Figure 3.2-13. Range and Exceedance Probability of Daily Silverwood Lake Water Surface Elevation by Month, 2000 through 2014

Figure 3.2-14 shows the average end-of-month water surface elevations in May, June, July, and August from 2000 through 2014 that 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 Silverwood Lake recreation use tends to be at its peak. While surface elevations have fluctuated somewhat over this period, they have been relatively consistent in recent years.



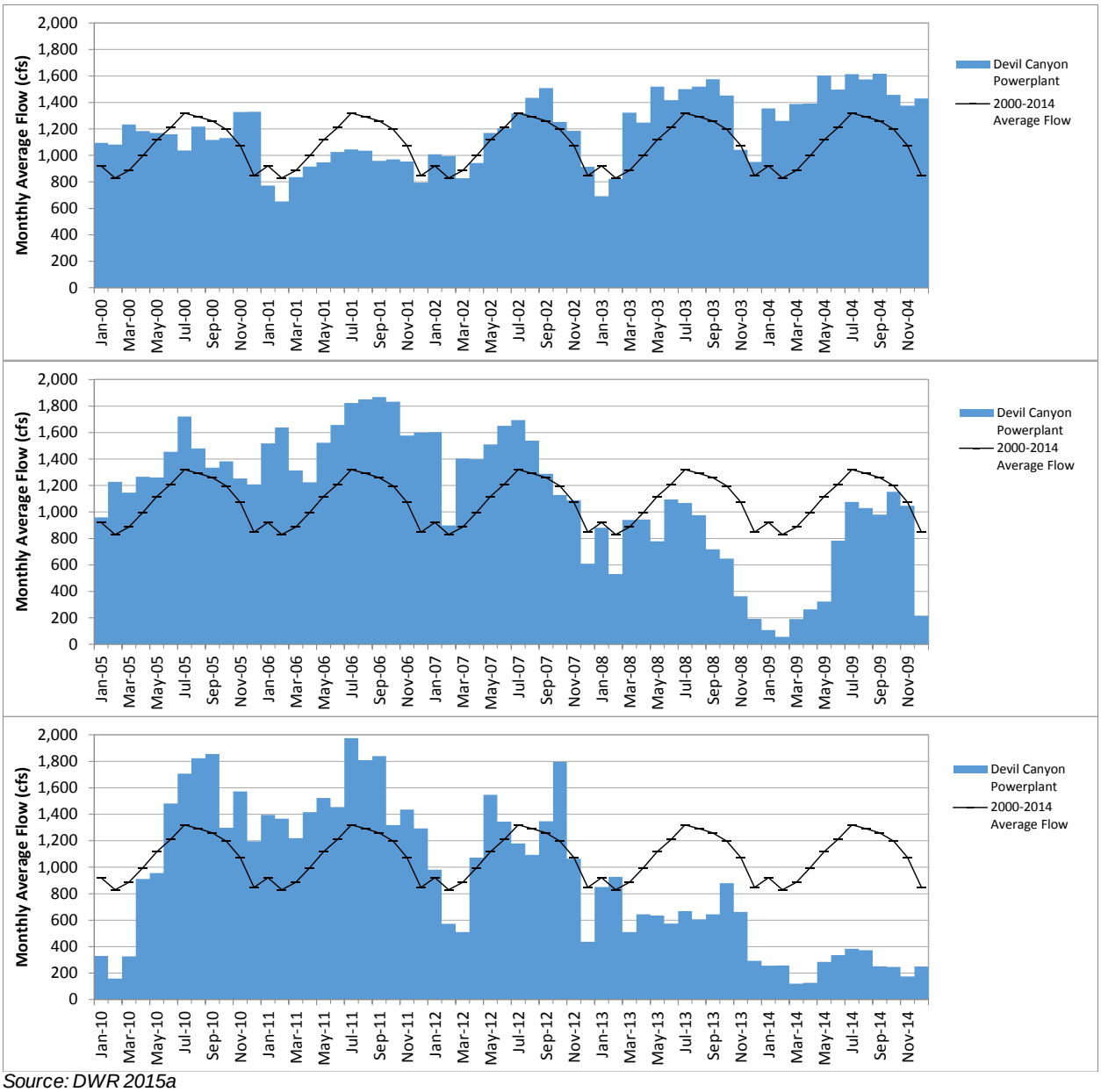
Source: DWR 2015a
Key:
ft = feet

Figure 3.2-14. Silverwood Lake End-of-Month Water Surface Elevation in May, June, July, and August, 2000 through 2014

3.2.3.7 Devil Canyon Powerplant and Afterbay Operations

The range and seasonal variation in daily average inflows to the Devil Canyon Powerplant via the San Bernardino Tunnel from 2000 through 2014 are shown in Figure 3.2-9. Power generation records at the Devil Canyon Powerplant are summarized in Section 3.6.

After passing through the Devil Canyon Powerplant, water flows into the Devil Canyon Afterbay or Second Afterbay, and is subsequently scheduled for SWP delivery via the Inland Feeder, Azusa Pipeline, Rialto Pipeline, San Bernardino Pipeline, and Santa Ana Pipeline. The cumulative SWP water deliveries from the Devil Canyon Afterbay and Second Afterbay represent the total outflows from the downstream end of the Project boundary. There is no limit on the maximum rate of drawdown at either the Devil Canyon Afterbay or Second Afterbay. Figure 3.2-15 summarizes the average monthly cumulative outflows from the Devil Canyon Afterbay and Second Afterbay from 2000 through 2014, and Table 3.2-2 summarizes total monthly cumulative outflows from the afterbays.



Source: DWR 2015a
Key:
ft = feet

Figure 3.2-15. Monthly Average Cumulative Outflow from Devil Canyon Afterbays, 2000 through 2014

Table 3.2-2. Monthly Cumulative Outflow from the Devil Canyon Afterbays, 2000 through 2014

	Monthly Cumulative Outflow from the Devil Canyon Afterbays (TAF)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
2000	67	61	74	69	70	69	71	76	68	70	80	81	855
2001	48	34	50	55	60	62	64	63	57	59	57	48	655
2002	61	56	52	55	72	71	80	87	90	77	72	56	829
2003	43	46	82	74	93	86	94	96	93	88	61	59	915
2004	84	73	85	82	99	89	98	96	96	89	80	88	1,060
2005	59	68	70	75	77	89	107	91	78	86	77	74	951
2006	92	91	79	73	94	101	113	113	108	110	96	101	1,170
2007	98	50	84	85	94	98	105	95	76	70	65	37	957
2008	54	31	60	53	47	65	66	61	45	41	21	12	556
2009	6	3	14	15	20	49	65	64	58	84	63	13	455
2010	20	9	20	55	61	87	103	111	109	79	93	74	820
2011	85	74	74	84	93	86	120	110	108	80	85	78	1,076
2012	59	32	31	62	94	77	72	70	78	102	65	26	767
2013	50	50	31	37	38	34	40	36	37	54	39	18	465
2014	16	14	7	8	18	20	23	22	15	14	10	15	182
Average	56	46	54	59	69	72	81	79	74	73	64	52	781

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

3.2.3.8 Non-Project Water Use

Non-Project water use includes local water right diversions by CLAWA, Las Flores Ranch, and MWA.

3.3 PROPOSED PROJECT CHANGES

This Section provides the description of proposed Project changes by DWR. At this time, DWR proposes no changes to existing Project operations. DWR proposes to modify the existing Project boundary as described in Section 3.3.1.

3.3.1 Proposed Changes to the Existing Project Boundary

DWR proposes to modify the existing Project boundary, in some cases adding lands to the boundary (e.g., the drainage area west of the Devil Canyon Second Afterbay) and in some cases removing land from the boundary (e.g., the area between Silverwood Lake and State Highway 138) to be consistent with the Project operation and maintenance needs. The net effect is that the area within the boundary would be reduced from 3,744 acres to 2,070 acres. This change would reduce the 220.98 acres of federal land (7.5 percent of the total area within the existing Project boundary) to 132 acres of federal land (approximately 6 percent of the total area within the proposed Project boundary). Figure 3.3-1 shows DWR's current proposed changes to the existing Project boundary. Subsequent figures in this PAD only show the proposed Project boundary.

The proposed changes are based on DWR's current and historic use of land for the Project, DWR's comprehensive review of facilities, operations, and land information to date, as well as additional new information and data available for facilitating a more refined boundary delineation. The most significant change in the delineation is the use of a 100-foot buffer from Silverwood Lake's NMWSE to define the proposed Project boundary around portions of the lake, which reduces the land area considerably on the eastern and southern side of Silverwood Lake.

3.3.2 Proposed Changes to Existing Project Facilities

DWR proposes no change to the existing Project facilities at this time.

3.3.3 Proposed Changes to the Existing Project Operations

DWR proposes no change to the existing Project operations at this time.

3.3.4 Proposed Changes to Existing Protection, Mitigation, and Enhancement Measures

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

3.4 CURRENT LICENSE REQUIREMENTS AND ENVIRONMENTAL MEASURES

Table 3.4-1 summarizes articles in the existing FERC license referenced in this Section. Appendix F 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 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 CFR Title 18 Part 12, including the inspection by an independent consultant (subpart D). DWR maintains the Project facilities, which are in good repair, and complies with applicable State and local safety requirements. DWR maintains 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. In addition, with respect to Project lands and waters located within the Silverwood Lake SRA, DPR shares public safety responsibilities with DWR. DWR's Division of Safety of Dams (DSOD) also monitors Cedar Springs Dam, Devil Canyon Second Afterbay, and associated facilities in accordance with provisions in the California Water Code. The Devil Canyon Afterbay is not under DSOD's jurisdiction.

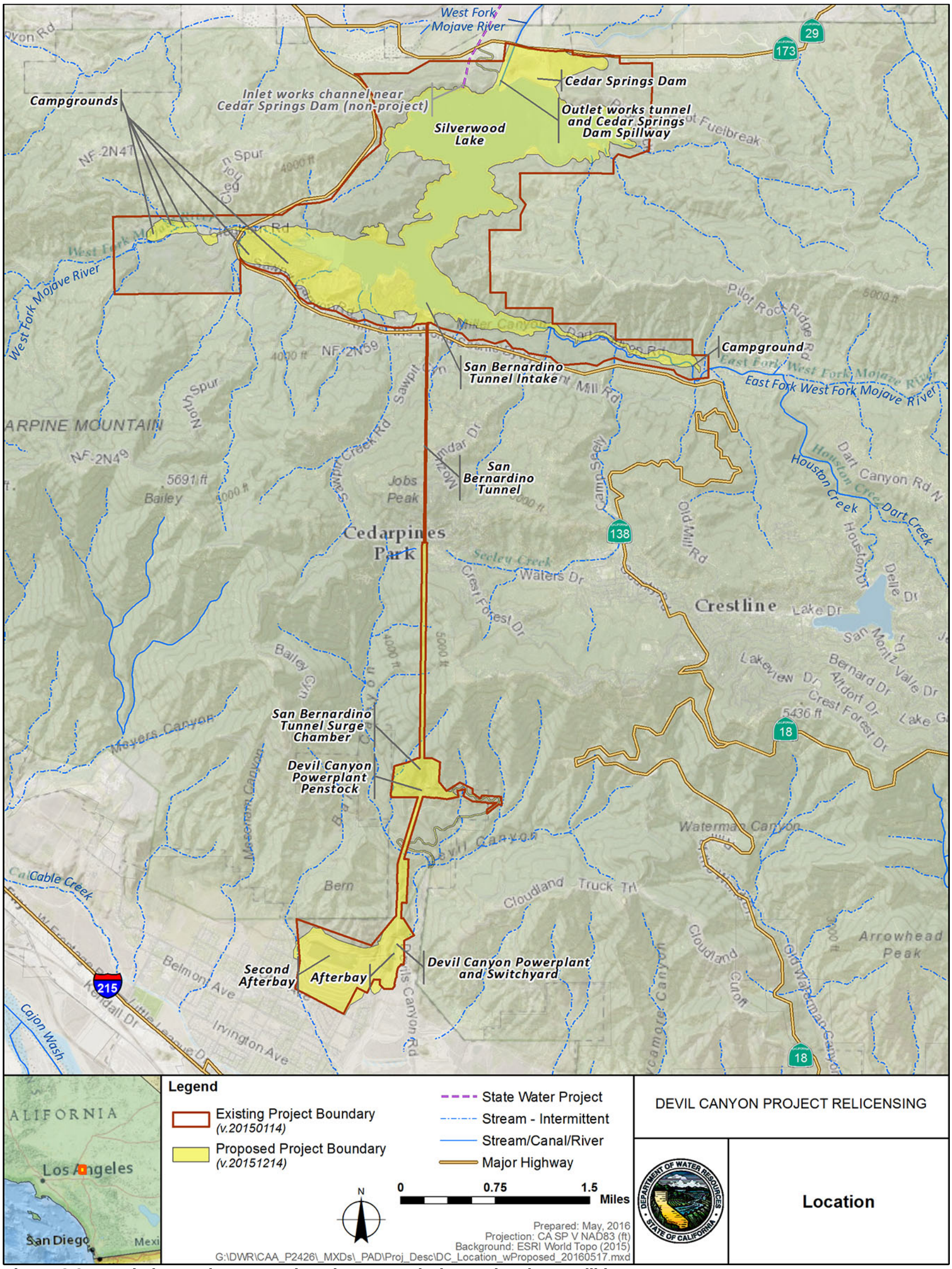


Figure 3.3-1. Existing and Proposed Project Boundaries and Major Facilities

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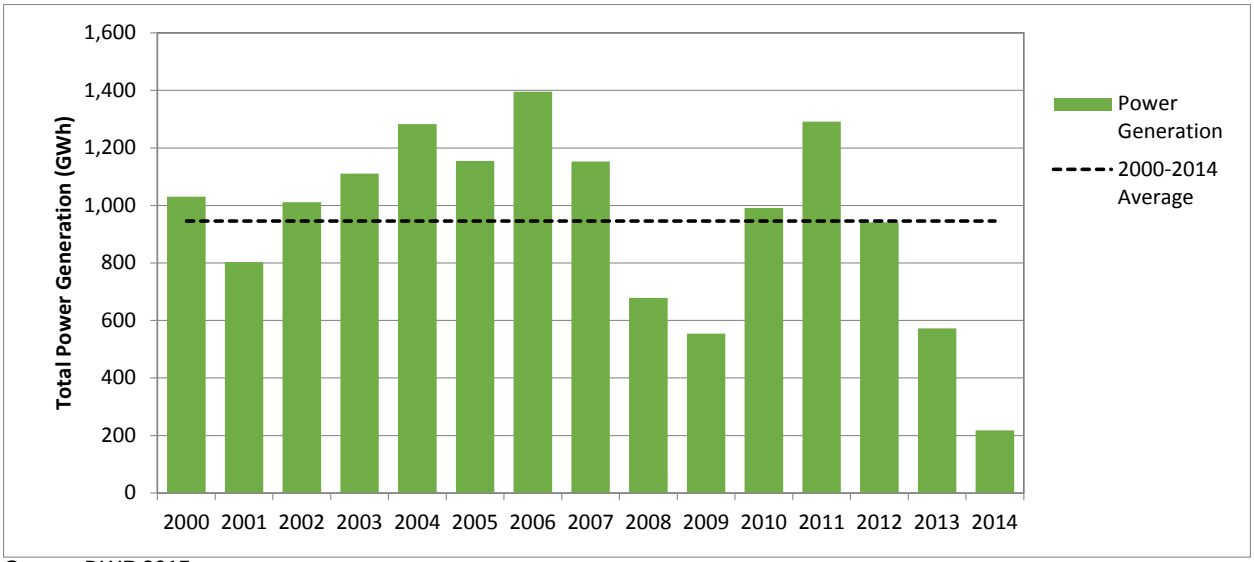
3.6 PROJECT GENERATION AND OUTFLOW RECORDS

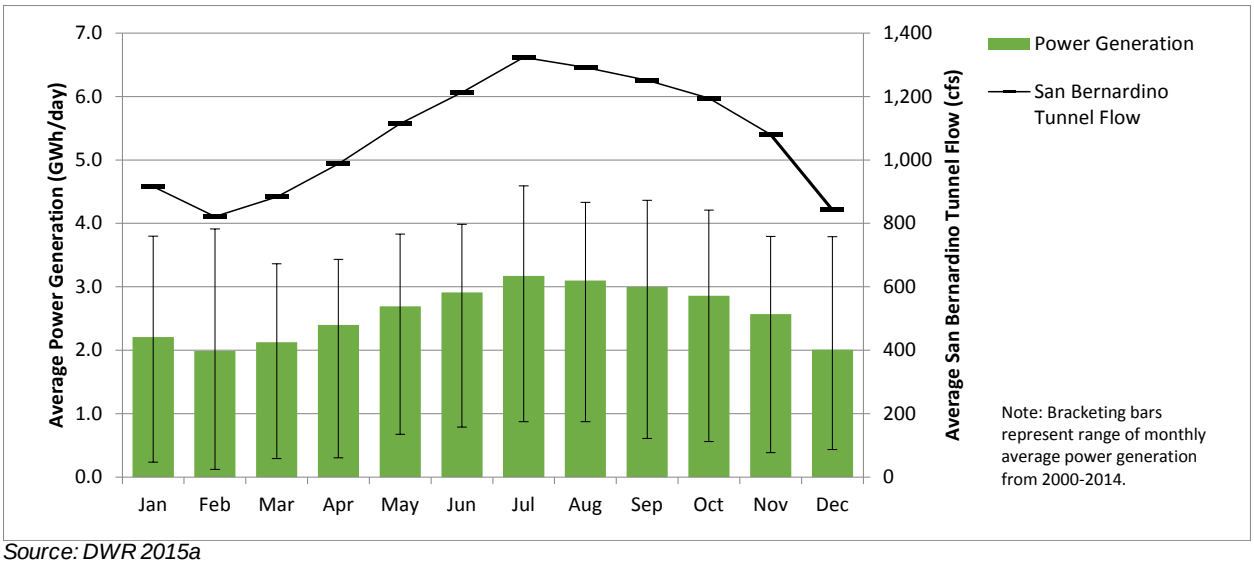
Total annual power generation at the Devil Canyon Powerplant from 2000 through 2014 is shown in Figure 3.6-1. As stated above, the Devil Canyon Powerplant is primarily operated as an energy-recovery plant. Thus, the quantity of power generation within a given year ties directly to the quantity of SWP water deliveries within that same year.



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

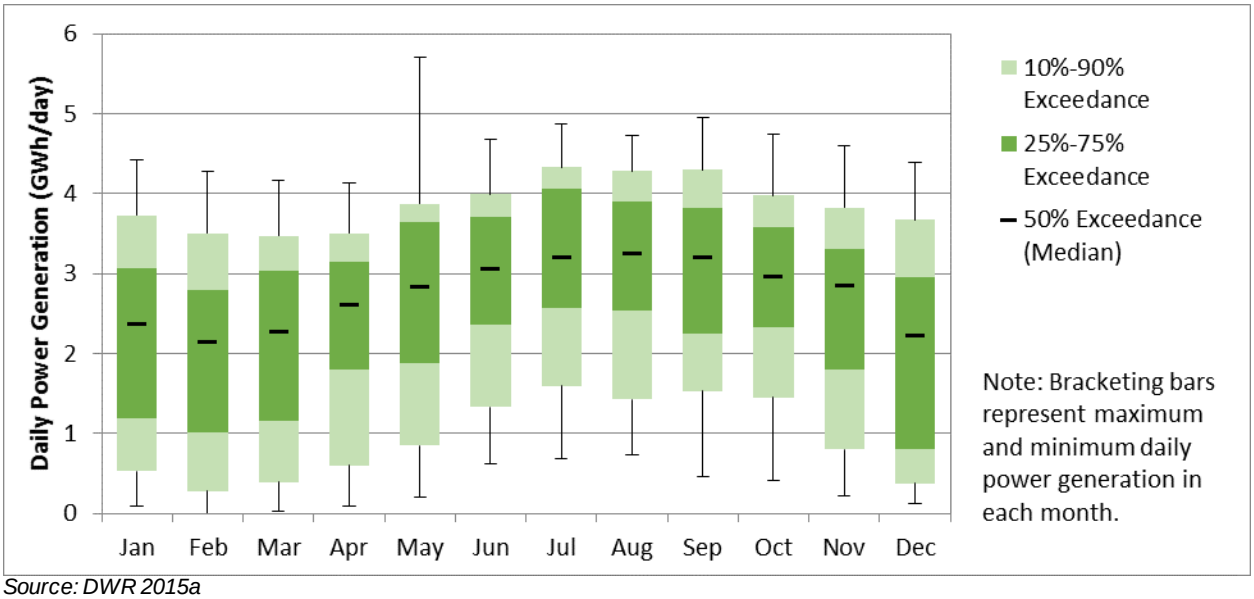
Figure 3.6-1. Annual Power Generation at the Devil Canyon Powerplant, 2000 through 2014

Average monthly power generation from 2000 through 2014 is summarized in Figure 3.6-2, and the range of daily power generation is summarized by month in Figure 3.6-3. Monthly average power generation records from 2000 through 2014 are summarized in Figure 3.6-4, and total monthly power generation is summarized in Table 3.6-1.



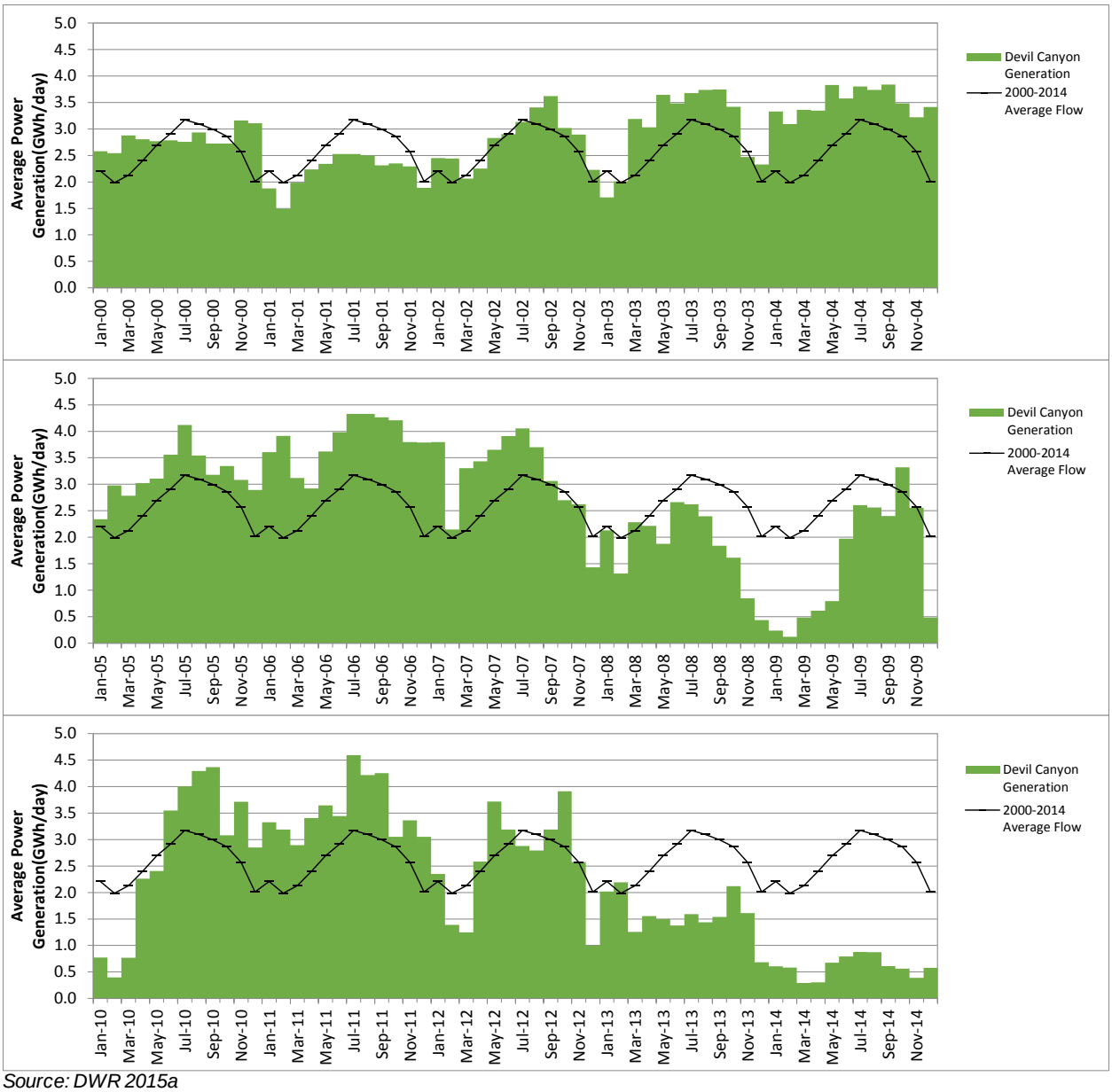
Source: DWR 2015a
Key:
GWh = gigawatt-hours

Figure 3.6-2. Daily Average Power Generation at Devil Canyon Powerplant, 2000 through 2014, and Monthly Average Silverwood Lake Discharge to the Devil Canyon Powerplant via the San Bernardino Tunnel



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

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



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

Figure 3.6-4. Monthly Average Power Generation at the Devil Canyon Powerplant, 2000 through 2014

Table 3.6-1. Monthly Total Devil Canyon Powerplant Energy Generation, 2000 through 2014

	Monthly Total Devil Canyon Powerplant Energy Generation (GWh)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
2000	80	74	89	84	86	84	85	91	82	84	95	96	1,030
2001	58	42	62	67	73	76	78	77	69	73	69	59	803
2002	76	68	64	68	88	87	97	106	109	94	87	69	1,012
2003	53	56	99	91	113	105	114	116	112	106	74	72	1,111
2004	103	90	104	100	119	107	118	116	115	108	97	106	1,283
2005	73	83	86	91	96	107	128	110	95	104	92	90	1,154
2006	112	110	97	88	112	120	134	134	128	130	114	117	1,396
2007	118	60	102	103	113	117	126	115	92	84	79	44	1,153
2008	66	38	71	66	58	80	81	74	55	50	25	14	679
2009	7	3	15	18	25	59	81	79	72	103	77	15	555
2010	24	11	24	68	75	106	124	133	131	95	111	88	991
2011	103	89	90	102	113	103	142	131	128	95	101	95	1,291
2012	73	40	39	77	115	96	89	87	96	121	77	31	941
2013	63	61	39	47	46	41	49	45	46	66	48	21	572
2014	19	16	9	9	21	24	27	27	18	17	12	18	217
Average	68	56	66	72	84	87	98	96	90	89	77	62	946

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

3.7 COMPLIANCE HISTORY

Under the existing license, one non-compliance license violation event related to the Project has occurred since the year 2000. The event was related to a Biennial Trout Stocking Report Filing in 2007 and 2014 and is summarized below.

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[2] and 2000[3], DWR is required to annually stock 20,000 pounds of catchable trout in Silverwood Lake. 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[4]. 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.[5] No penalties or corrective actions were required by FERC; however, DWR has implemented measures to resolve staffing issues, provide additional staff training for license requirements, and improve monitoring of contractor performance. DWR filed the recent 2014 report prior to the deadline and in full compliance of the requirements. DWR does not anticipate future challenges in complying with any license terms including those associated with the biennial trout stocking report-filing requirements.

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