4.0 EXISTING ENVIRONMENT AND RESOURCE IMPACTS

This Section is divided into 13 sub-sections: Section 4.1 provides a general description of the Project setting and Sections 4.2 through 4.13 provide existing, relevant, and reasonably available information (i.e., baseline conditions) regarding the resources potentially affected by the Project, as well as known or potential Project impacts on these resources. Source documents are cited throughout this Section and listed in detail in Section 8.0. The resource areas include:

- Air Quality and Noise (Section 4.2)
- Geology and Soils (Section 4.3)
- Water Resources (Section 4.4)
- Fish and Other Aquatic Resources (Section 4.5)
- Wildlife and Botanical Resources (Section 4.6)
- Wetlands, Riparian, and Littoral Habitats (Section 4.7)
- Endangered Species Act-Listed and Candidate Species (Section 4.8)
- Recreation and Land Use (Section 4.9)
- Aesthetic Resources (Section 4.10)
- Cultural Resources (Section 4.11)
- Socioeconomic Resources (Section 4.12)
- Tribal Resources (Section 4.13)

The amount of detail included in the description of each existing resource and potential impact is commensurate with the available information and relative importance of the resource in this relicensing.

4.1 GENERAL DESCRIPTION OF PROJECT SETTING

4.1.1 <u>River Basin</u>

The Project spans an area from the southerly edge of the Mojave Desert through the western part of the San Bernardino Mountain Range. The Project uses water passing through the SWP to generate power.

As shown in Figure 4.1-1, one river basin is intercepted by the Project: the West Fork Mojave River. A general description of the basin is provided below.

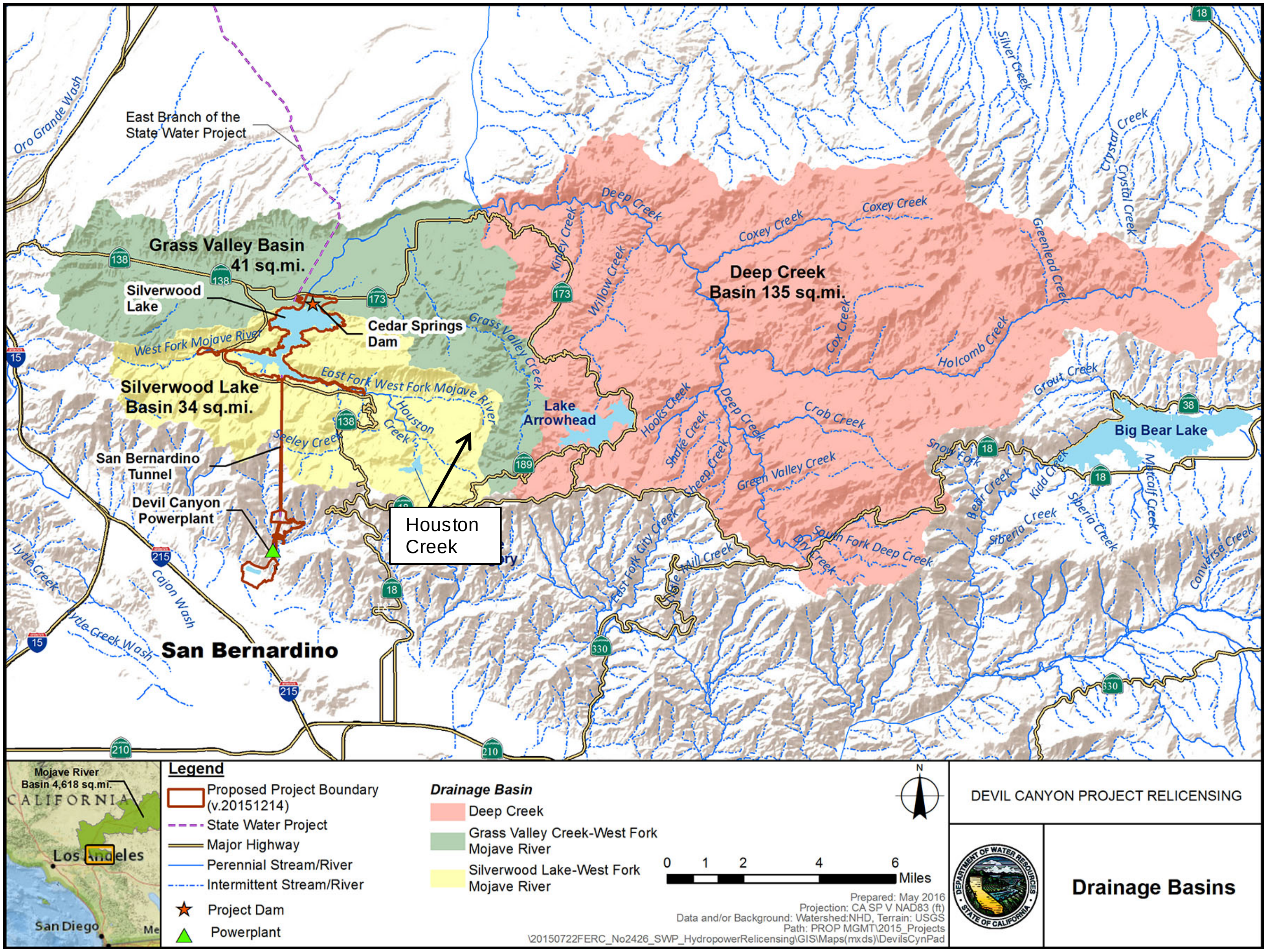


Figure 4.1-1. Drainage Basins in the Vicinity of Project Facilities

Cedar Springs Dam forms the Project's Silverwood Lake and is located along the SWP and the West Fork Mojave River, which is an intermittent stream.

The Mojave River is an intermittent river that begins at the confluence of the West Fork Mojave River and Deep Creek on the north side of the San Bernardino Mountains and flows north and east into the Mojave Desert for approximately 100 miles before terminating into the Mojave River Wash on the western edge of the Mojave National Preserve. River flows are mostly subsurface, with the exception of the headwaters and several bedrock gorges in the lower reaches. Downstream of the Project, the Mojave River runs through the California cities of Hesperia, Victorville, and Barstow.

While the Mojave River basin covers approximately 4,600 square miles, the majority of water in the Mojave River comes from the relatively small, higher elevation sub-basins of the West Fork Mojave River, which is upstream of the Project, and Grass Valley Creek and Deep Creek, which enter into the Mojave River downstream of the Project.

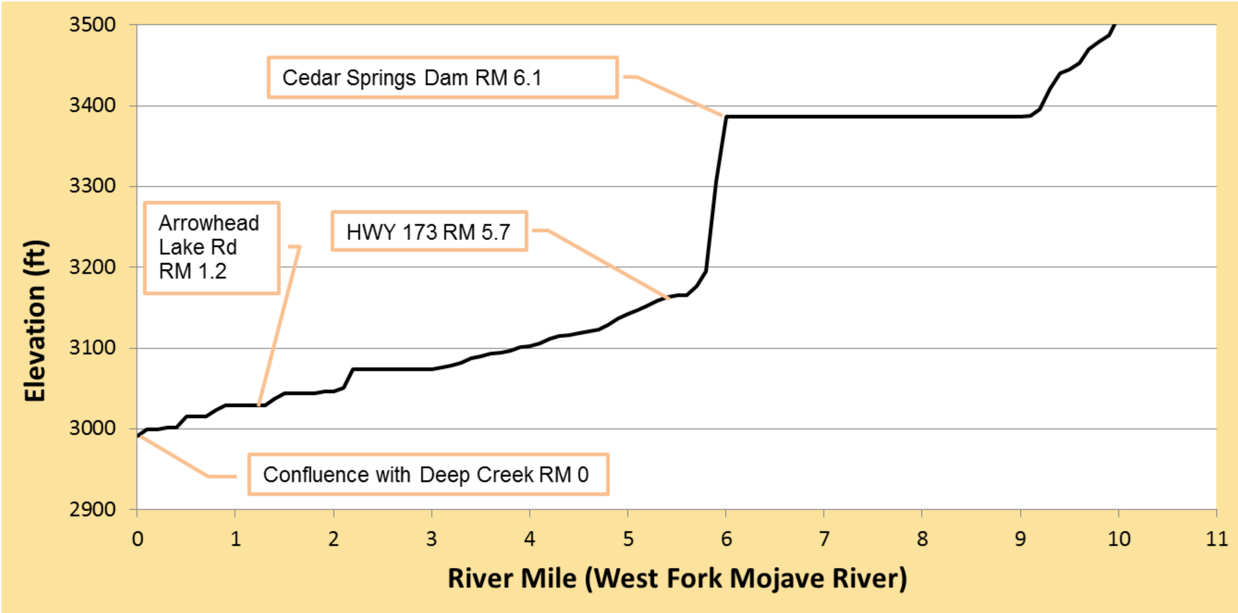
The West Fork Mojave River and East Fork of the West Fork Mojave River enter into the Project's Silverwood Lake, and mix with the SWP waters that pass through the reservoir on the way to the cities in the San Bernardino basin. The East Fork of the West Fork Mojave River collects water from Houston Creek, which has a small reservoir called Lake Gregory at its headwaters. Lake Gregory Dam was built in 1938 by the Crest Forest County Water District. Today, the lake serves primarily as a recreation destination that includes a San Bernardino County Regional Park. The Silverwood Lake Basin above Cedar Springs Dam is approximately 34 square miles of steep mountainous terrain with elevations that range from 3,400 feet to 6,000 feet.

From July through November, there is little inflow into Silverwood Lake from the West Fork Mojave and East Fork of the West Fork Mojave Rivers; the majority of the inflow occurs from December through May (Figure 3.2-6). Combined inflow from the two tributaries averages less than 1,000 to 70,000 AF per year (Figure 3.2-5).

The West Fork Mojave River reforms below Cedar Springs Dam, which is located 6.1 miles upstream of the confluence of Deep Creek.

Grass Valley Creek has a small private reservoir called Grass Valley Lake, which is located near its headwaters west of Lake Arrowhead. From its confluence with Grass Valley Creek, the West Fork Mojave River proceeds 2.1 miles to join with Deep Creek and form the Mojave River just upstream of the Mojave Forks Dam, which is a U.S. Army Corps of Engineers (USACE) flood-control dam built in 1971 to provide flood protection to the cities located downstream on the Mojave River. The area drained by Grass Valley Creek and the 6.4 miles of West Fork Mojave River downstream from the Project (i.e., Grass Valley Basin) is approximately 41 square miles and consists of both steep mountainous terrain, with elevations that range from 3,000 feet to 6,000 feet, and a long narrow valley to the west of the West Fork Mojave River.

Figure 4.1-2 shows the gradient in the West Fork Mojave River, with notable features identified.



Key:
RM = river mile
ft = feet

Figure 4.1-2. West Fork Mojave River Profile

The sub-basin that is drained by Deep Creek is 135 square miles of rugged mountainous terrain with elevations that range from 3,000 feet to 8,200 feet. Deep Creek collects water from several tributaries, including Coxey, Holcomb, Willow, and Little Bear creeks. The privately owned Lake Arrowhead, formed by Lake Arrowhead Dam, is located near the headwaters of Little Bear Creek. The dam was completed in 1922 by Arrowhead Lake Company to create Lake Arrowhead as a resort destination.

The two other Project impoundments, Devil Canyon Afterbay and Devil Canyon Second Afterbay, are engineered water bodies and only hold water passed through the Devil Canyon Powerplant via the San Bernardino Tunnel that has its origin in Silverwood Lake. The two afterbays do not collect flows from the basin in which they are located and do not discharge into State of California surface waters.

Refer to Section 4.4 for a detailed description of hydrology.

4.1.2 Climate

The climate in the Project region is classified as arid or Cold Desert Climate. The area loses more water via evapotranspiration than falls as precipitation. Average annual precipitation is approximately 6 inches, with rare snowfalls, and the average annual evapotranspiration rate is 57 inches. Air temperatures range from approximately 100 degrees Fahrenheit (°F) in July to about 30°F in January.

4.1.3 Major Land Uses

The topography around the Project consists of steep mountainous terrain surrounded by arid chaparral scrub vegetation dominated by junipers, Joshua tree (*Yucca brevifolia*), and sagebrush, with elevations from approximately 2,000 to 3,500 feet. Slopes range from 2 to 100 percent, and rock outcrops are common.

The area immediately adjacent to Silverwood Lake is owned by the State of California and managed by DPR for public recreational uses. Silverwood Lake is located within the boundary of SBNF, but not on NFS lands. The San Bernardino Tunnel and Devil Canyon Penstock traverse State, NFS, and private lands and terminate at the Devil Canyon Powerplant and Afterbays, which are primarily located on State lands and a small portion of municipal lands.

Silverwood Lake is wholly within San Bernardino County. Land use policies for private land in the Project area are provided by San Bernardino County's General Plan. The General Plan was adopted in March 2007 and has undergone several revisions through April 2014. NFS lands in the vicinity of the Project are managed under policies outlined in the SBNF Land and Resource Management Plan, which was adopted in 2006 and is meant to provide strategic guidance for management of the SBNF for a period of 10 to 15 years.

Refer to Section 4.9 for a detailed description of land use in the Project vicinity.

4.1.4 Major Water Uses

Water passing through Silverwood Lake and Devil Canyon Powerplant serve as a major source of water for the greater Los Angeles and San Bernardino Valley communities. The northern part of the Project lies within the Lahontan RWQCB's planning territory, and the southern part is within the Santa Ana RWQCB's territory. Both agencies have issued basin plans, but only the Lahonton Basin Plan identifies designated beneficial uses for surface waters potentially affected by the Project.

Refer to Section 4.4 for a detailed description of water uses in the Project area.

4.2 AIR QUALITY AND NOISE

This Section provides information regarding existing air quality and noise conditions. Besides this general introductory information, this Section includes four main sub-sections: Section 4.2.1 describes air quality management plans and regulations that pertain to the Project region; Section 4.2.2 describes air quality conditions in the Project area; Section 4.2.3 describes noise management plans and regulations that pertain to the Project region; and Section 4.2.4 describes noise conditions at Project facilities.

4.2.1 Pertinent Air Quality Management Plans and Regulations

The California Air Resources Board (CARB), as part of the California Environmental Protection Agency (CAL-EPA), is responsible for protecting public health and the environment from the harmful effects of air pollution. Pollutants associated with air emissions, such as ozone (O_3), particulate matter, and nitrogen dioxide (NO_2), are associated with respiratory illness. Carbon monoxide (CO), another air pollutant, can be absorbed through the lungs into the bloodstream and reduce the ability of blood to carry oxygen. Sources of air emissions include commercial facility operations, fugitive dust, vehicles and trucks, aircraft, boats, trains, and natural sources such as biogenic and geogenic hydrocarbons and wildfires.

To reduce harmful exposure to air pollutants, the federal Clean Air Act requires the EPA to set outdoor air quality standards for the nation with the option for states to adopt additional, or more protective standards, if needed. CARB has adopted ambient (outdoor) air quality standards (AAQS) that are more protective than federal standards, and has implemented standards for some pollutants not addressed by federal standards. An AAQS establishes the concentration above which the pollutant is known to cause adverse health effects to sensitive groups within the greater population, such as children and the elderly. The goal is for localized effects not to cause or contribute to an exceedance of the standards. Criteria pollutants for which AAQS have been established include O_3, particulate matter, CO, NO_2, sulfur dioxide and lead. California and federal AAQS for criteria pollutants are presented in Table 4.2-1.

Both the California and federal governments use ambient air monitoring data to classify areas according to their attainment status with respect to criteria pollutants. These designations are used to identify areas with air quality problems. The three basic designation categories are:

- Attainment – Ambient air quality is not in violation of the established standard for the specific criteria pollutant.
- Nonattainment – Ambient air quality violates the established standard for the specific criteria pollutant.
- Unclassified – There is currently insufficient data for determining attainment or nonattainment.

Table 4.2-1. California and Federal Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards[1]		Federal Standards[2]		
		Concentration[3]	Method[4]	Primary[3,5]	Secondary[3,6]	Method[7]
Ozone (O_3)[8]	1 Hour	0.09 ppm (180 $\mu g/m^3$)	Ultraviolet Photometry	--	Same as Primary Standard	Ultraviolet Photometry
	8 Hour	0.070 ppm (137 $\mu g/m^3$)		0.070 ppm (137 $\mu g/m^3$)		
Respirable Particulate Matter (PM10)[9]	24 Hour	50 $\mu g/m^3$	Gravimetric or Beta Attenuation	150 $\mu g/m^3$	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	20 $\mu g/m^3$		--		
Fine Particulate Matter (PM2.5)[9]	24 Hour	--	--	35 $\mu g/m^3$	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	12 $\mu g/m^3$	Gravimetric or Beta Attenuation	12.0 $\mu g/m^3$	15 $\mu g/m^3$	
Carbon Monoxide (CO)	1 Hour	20.0 ppm (23 mg/m^3)	Non-Dispersive Infrared Photometry	35 ppm (40 mg/m^3)	--	Non-Dispersive Infrared Photometry
	8 Hour	9.0 ppm (10 mg/m^3)		9 ppm (10 mg/m^3)		
	8 Hour (Lake Tahoe)	6 ppm (7 mg/m^3)		--	--	
Nitrogen Dioxide (NO_2)[10]	1 Hour	0.18 ppm (339 $\mu g/m^3$)	Gas Phase Chemiluminescence	100 ppb (188 $\mu g/m^3$)	--	Gas Phase Chemiluminescence
	Annual Arithmetic Mean	0.030 ppm (57 $\mu g/m^3$)		0.053 ppm (100 $\mu g/m^3$)	Same as Primary Standard	
Sulfur Dioxide (SO_2)[11]	1 Hour	0.25 ppm (655 $\mu g/m^3$)	Ultraviolet Fluorescence	75 ppb (196 $\mu g/m^3$)[9]	--	Ultraviolet Fluorescence; Spectrophotometry (Pararosaniline Method)
	3 Hour	--		--	0.5 ppm (1,300 $\mu g/m^3$)	
	24 Hour	0.04 ppm (105 $\mu g/m^3$)		0.14 ppm (for certain areas)[10]	--	
	Annual Arithmetic Mean	--		0.030 ppm (for certain areas)[10]	--	
Lead[12,13]	30 Day Average	1.5 $\mu g/m^3$	Atomic Absorption	---	--	High Volume Sampler and Atomic Absorption
	Calendar Quarter	--		1.5 $\mu g/m^3$ (for certain areas)[12]	Same as Primary Standard	
	Rolling 3-Month Average	--		0.15 $\mu g/m^3$		
Visibility Reducing Particles[14]	8 Hour	See footnote 13	Beta Attenuation and Transmittance through Filter Tape	No National Standards		
Sulfates	24 Hour	25 $\mu g/m^3$	Ion Chromatography			
Hydrogen Sulfide	1 Hour	0.03 ppm (42 $\mu g/m^3$)	Ultraviolet Fluorescence			
Vinyl Chloride[12]	24 Hour	0.01 ppm (26 $\mu g/m^3$)	Gas Chromatography			

Source: CARB 2015
Key: µg = microgram; m^3 = cubic meter; mg = milligram; ppb = part per billion; ppm = part per million; O_3 = ozone
Notes:
[1] California standards for ozone, carbon monoxide (except 8-hour Lake Tahoe), sulfur dioxide (1 and 24 hour), nitrogen dioxide, and particulate matter (PM10, PM2.5, and visibility reducing particles), are values that are not to be exceeded. All others are not to be equaled or exceeded. California ambient air quality standards are listed in the Table of Standards in Section 70200 of Title 17 of the California Code of Regulations.
[2] National standards (other than ozone, particulate matter, and those based on annual arithmetic mean) are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest 8-hour concentration measured at each site in a year, averaged over three years, is equal to or less than the standard. For PM10, the 24 hour standard is attained when the expected number of days per calendar year with a 24 hour average concentration above 150 $\mu g/m^3$ is equal to or less than one. For PM2.5, the 24 hour standard is attained when 98 percent of the daily concentrations, averaged over three years, are equal to or less than the standard. Contact the U.S. EPA for further clarification and current national policies.
[3] Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 torr. Most measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 torr; ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.
[4] Any equivalent measurement method which can be shown to the satisfaction of the CARB to give equivalent results at or near the level of the air quality standard may be used.
[5] National Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health.
[6] National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.
[7] Reference method as described by the U.S. EPA. An "equivalent method" of measurement may be used but must have a "consistent relationship to the reference method" and must be approved by the U.S. EPA.
[8] On October 1, 2015, the national 8-hour ozone primary and secondary standards were lowered from 0.075 to 0.070 ppm.
[9] On December 14, 2012, the national annual PM2.5 primary standard was lowered from 15 $\mu g/m^3$ to 12.0 $\mu g/m^3$. The existing national 24 hour PM2.5 standards (primary and secondary) were retained at 35 $\mu g/m^3$, as was the annual secondary standard of 15 $\mu g/m^3$. The existing 24-hour PM10 standards (primary and secondary) of 150 $\mu g/m^3$ also were retained. The form of the annual primary and secondary standards is the annual mean, averaged over 3 years.
[10] To attain the 1-hour national standard, the 3-year average of the annual 98^{th} percentile of the 1-hour daily maximum concentrations at each site must not exceed 100 ppb. Note that the national 1-hour standard is in units of parts per billion (ppb). California standards are in units of parts per million (ppm). To directly compare the national 1-hour standard to the California standards, the units can be converted from ppb to ppm.
[11] On June 2, 2010, a new 1-hour SO_2 standard was established and the existing 24-hour and annual primary standards were revoked. To attain the 1-hour national standard, the 3-year average of the annual 99^{th} percentile of the 1-hour daily maximum concentrations at each site must not exceed 75 ppb. The 1971 SO_2 national standards (24-hour and annual) remain in effect until one year after an area is designated for the 2010 standard, except that in areas designated nonattainment for the 1971 standards, the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standards are approved.
Note that the 1-hour national standard is in units of parts per billion (ppb). California standards are in units of parts per million (ppm). To directly compare the 1-hour national standard to the California standard, the units can be converted to ppm. In this case, the national standard of 75 ppb is identical to 0.075 ppm.
[12] The ARB has identified lead and vinyl chloride as 'toxic air contaminants' with no threshold level of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.
[13] The national standard for lead was revised on October 15, 2008 to a rolling 3-month average. The 1978 lead standard (1.5 $\mu g/m^3$ as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.
[14] In 1989, the ARB converted both the general statewide 10-mile visibility standard and the Lake Tahoe 30-mile visibility standard to instrumental equivalents, which are "extinction of 0.23 per kilometer" and "extinction of 0.07 per kilometer" for the statewide and Lake Tahoe Air Basin standards, respectively.

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In addition to the above designations, California includes a sub-category of the nonattainment designation:

- Nonattainment-transitional – Nonattainment areas that are making progress and nearing attainment.

4.2.2 Air Quality in Project Area

To manage air quality problems, California is divided into 15 air basins, each of which is associated with one or more Air Quality Management Districts. The area of San Bernardino County in which the Project is located is within the South Coast Air Quality Management District (CAL-EPA 2014a). Table 4.2-2 shows the current federal and State attainment status for each pollutant in San Bernardino County.

Table 4.2-2. Attainment Status for Air Quality Pollutants in San Bernardino County[1]

Pollutant	State Attainment Status	National Attainment Status
Ozone (8-hour)	Nonattainment	Nonattainment
Carbon Monoxide	Attainment	Attainment
Nitrogen Dioxide	Attainment	Nonattainment[2]
Fine Particulate Matter	Nonattainment	Nonattainment
Respirable Particulate Matter	Nonattainment	Nonattainment
Sulfur Dioxide	Attainment	Attainment
Lead	Attainment	Attainment
Sulfates	Attainment	No Federal Standards
Hydrogen Sulfide	Unclassified	
Visibility Reducing Particles	Unclassified	

Sources: EPA 2014b; EPA 2015
Notes:
[1]The federal 1-hour ozone rule was vacated on June 15, 2005.
[2]Areas outside of attainment are now known as 'Maintenance' areas.

The Project is situated within geographic areas that are currently designated as nonattainment for 8-hour ozone, NO_2 (federal only), Fine Particulate Matter (PM2.5), and Respirable Particulate Matter (PM10).

Greenhouse gas (GHG) emissions associated with development of hydroelectric systems has been a topic of study by the International Hydropower Association since 2006. In July 2008, a Working Group established to initiate such studies published "Scoping Paper - Assessment of Greenhouse Gas Status of Freshwater Reservoirs," in which it was observed that reservoirs 5 years or less in age emitted higher levels of GHG, principally methane, than reservoirs 10 years and older. Although there is a wide range of variables associated with reservoir conditions, GHG emissions from the older reservoirs were comparable to natural lakes (United Nations Educational 2008). This observation was verified in a study performed by Pelletier et al. (2009) for the Hydro-

Quebec Eastmain 1 Project. Notably, the Project reservoirs have been in existence for nearly 50 years (Silverwood Lake began operation in 1967). GHG emissions would not be expected to be an issue 40 years after filling.

Meteorological data are currently being collected in the Project vicinity at three Remote Automatic Weather Stations, as shown in Figure 4.2-1, with data management by the Western Region Climate Center. Meteorological data are also collected within the existing Project boundary at two weather stations owned and operated by DWR: the Silverwood Lake Weather Station, located near the park entrance kiosk on Sawpit Canyon Road; and the Devil Canyon Powerplant Weather Station, located approximately 1,000 feet south of the Devil Canyon Afterbay (pers. comm., Goebl 2015). The types of meteorological data collected and period of operation for each weather station are summarized in Table 4.2-3.

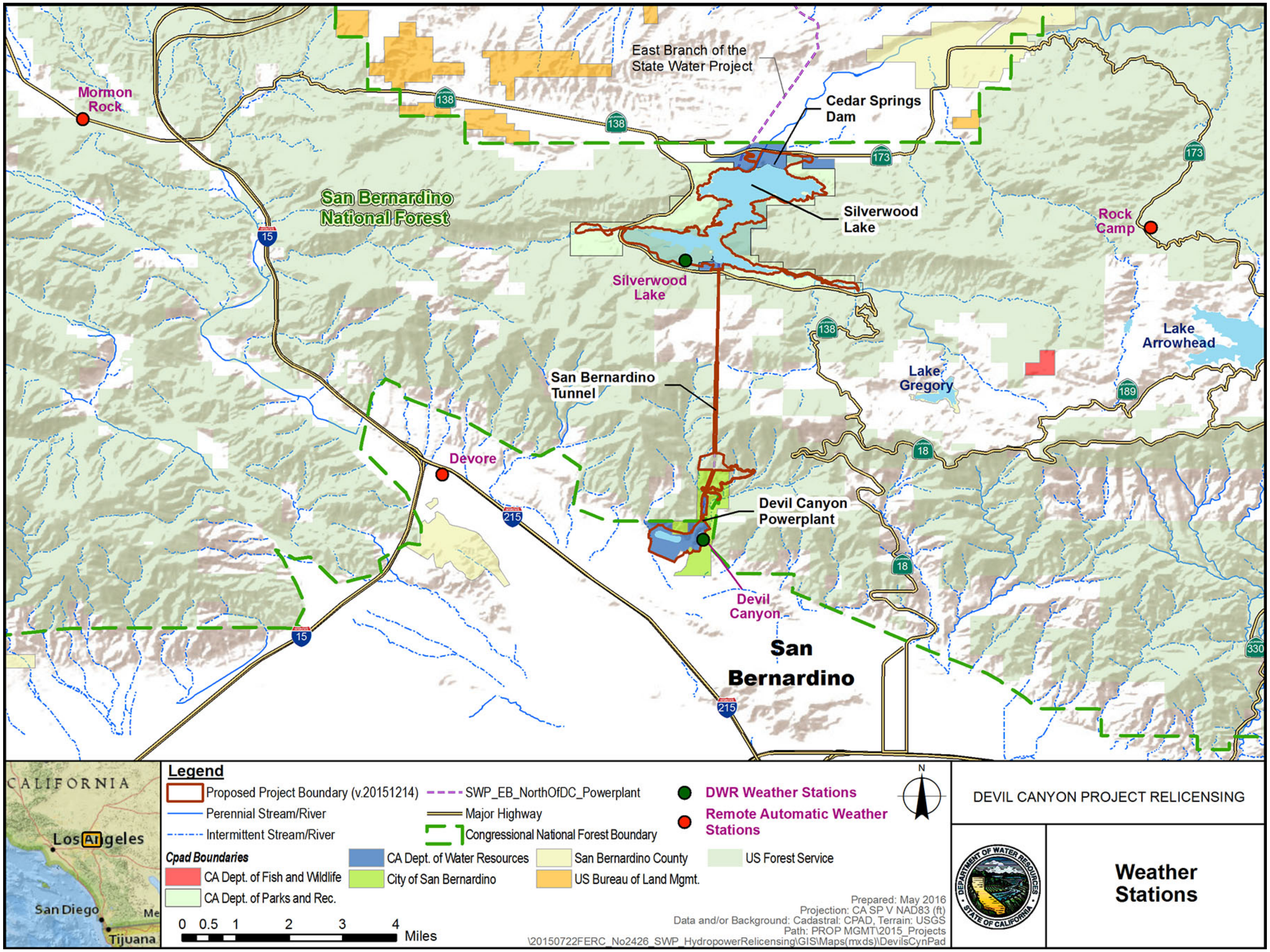


Figure 4.2-1. Weather Stations Located in the Project Vicinity

Table 4.2-3. Weather Station Information

Weather Station	Data Managed by	Latitude	Longitude	Elev	Period of Operation	Data Types
Mormon Rock[1] (Project vicinity)	Western Region Climate Center	34°19'03"	-117°30' 07"	3,300	10/1/1999 - present	Hourly: solar radiation, wind speed, wind direction, air temperature, Fuel temperature, fuel moisture, humidity, dew point, precipitation
Devore[2] (Project vicinity)	Western Region Climate Center	34°13'16"	-117°24'16"	2,057	11/1/1990 - present	Hourly: solar radiation, wind speed, wind direction, air temperature, Fuel temperature, fuel moisture, humidity, dew point, precipitation
Rock Camp[3] (Project vicinity)	Western Region Climate Center	34°17'17"	-117°12'45"	4,900	11/1/2003 - present	Hourly: solar radiation, wind speed, wind direction, air temperature, Fuel temperature, precipitation
Silverwood Lake[4] (existing Project boundary)	DWR	--	--	--	2000 - present	Daily: high and low temperatures, evaporation rate, precipitation, snow accumulation
Devil Canyon Powerplant[4] (existing Project boundary)	DWR	--	--	--	2000 - present	Daily: high and low temperatures, precipitation

Sources [1]*Western Region Climate Center 2015a*
[2]*Western Region Climate Center 2015b*
[3]*Western Region Climate Center 2015c*
[4]*Personal communication, Goebl 2015*
Key:
FERC = Federal Energy Regulatory Commission

4.2.3 Pertinent Noise Management Plans and Regulations

Noise is defined as unwanted sound. It is emitted from many sources, including airplanes, factories, railroads, power generation plants and highway vehicles. The magnitude of noise is described by its sound pressure. Since the range of sound pressure varies greatly, a logarithmic scale is used to relate sound pressures to a common reference level, the decibel. Sound pressures described in decibels are called sound levels.

Sound levels, measured using an “A-weighted decibel scale,” are expressed as decibels (dBA). This scale is frequency adjusted to represent the way the human ear responds to sounds. Throughout this discussion, all noise levels are expressed in dBA. The degree of disturbance or annoyance of unwanted sound depends essentially on three factors:

- The amount and nature of the intruding noise
- The relationship between the background noise and the intruding noise
- The type of activity occurring where the noise is heard

With regard to the first factor, it is important to note that individuals have different sensitivity to noise. Loud noises bother some people more than others. In addition, people react differently to various patterns of noise, often depending on whether such noise is viewed as uncomfortable or offensive.

With regard to the second factor, individuals tend to judge the annoyance of an unwanted noise in terms of its relationship to noise from other sources (i.e., background noise). The blowing of a car horn at night when background noise levels are approximately 45 dBA generally would be more objectionable than the blowing of a car horn in the afternoon when background noises might be 55 dBA.

The third factor is related to the interference of noise with activities of individuals. In a 60-dBA environment, normal work activities requiring high levels of concentration may be interrupted by loud noises, while activities requiring manual effort may not be interrupted to the same degree. Time-averaged descriptors are utilized to provide a better assessment of time-varying sound levels. The three most common noise descriptors used in community noise surveys are the equivalent sound level (Leq), percentile distributions of sound levels (L%), and the day-night average sound level (Ldn).

The Leq is an energy-averaged sound level that includes both steady background sounds and transient short-term sounds. The Leq is equivalent in energy to the fluctuating sound level over the measurement period. The Leq is commonly used to describe traffic noise levels, which tend to be characterized by fluctuating sound levels.

The L% indicates the sound level exceeded for a percentage of the measurement period. For example, the L_{90} is the sound level exceeded for 90 percent of the measurement period and is commonly used to represent background sound levels. The L_{10} is the sound level exceeded for 10 percent of the measurement period and represents the peak sound levels present in the environment.

The Ldn is another descriptor used to evaluate community noise levels. The Ldn is a 24-hour average sound level, which includes a 10-dBA penalty added to nighttime sound levels (i.e., 10 p.m. to 7 a.m.) because people tend to be more sensitive to noise during the nighttime. The Ldn sound level is commonly used to describe aircraft and train noise levels.

For the State, noise intensity is also discussed in terms of the Community Noise Equivalent Level, which presents a weighted average noise level that increases the relative significance of evening and nighttime noise. The Community Noise Equivalent Level descriptor is used to evaluate community noise levels, which includes a 5- and 10-dBA penalty added to evening (i.e., 7 p.m. to 10 p.m.) and nighttime sound levels, respectively, in consideration of people's increased sensitivity to noise during the evening and nighttime periods.

County noise standards are generally established based on land use and zoning designations. This is done to ensure that acceptable noise levels are consistent with community development goals and policies. As such, there can be variability between various counties' noise standards. The Project is located solely in San Bernardino County. Table 4.2-4 summarizes San Bernardino County's noise standards.

Table 4.2-4. San Bernardino County's Noise Standards

On-site Sound Level Descriptor	Day (7 a.m. - 10 p.m.)	Night (10 p.m. - 7 a.m.)
Residential		
Hourly Leq	55 dBA	45 dBA
Industrial		
Hourly Leq	70 dBA	70 dBA

Source: San Bernardino County 2008
Key:
dBA = decibel
Leq = equivalent sound level

4.2.4 Noise at Project Facilities

Generally, noise from the Devil Canyon Powerplant, which is the only main source of ongoing Project noise, occurs at very low levels. In the direct surrounding area of the powerplant, there are no residences or commercial properties. Periodic sources of Project-related noise include activities such as vegetation management and road maintenance. Also, recreation activities related to Project facilities may generate a seasonal source of noise (e.g., jet skis and motorized boats).

4.3 GEOLOGY AND SOILS

This Section provides information regarding existing geology and soil resources. Besides this general introductory information, this Section is divided into eight main sub-sections: Section 4.3.1 describes the regional geologic setting, with Sections 4.3.1.1 through 4.3.1.3 focusing on the geomorphology, tectonic history, and seismicity; Section 4.3.2 summarizes the Project-specific geologic conditions, with Sections 4.3.2.1 and 4.3.2.2 summarizing general bedrock and surface deposits; Section 4.3.3 describes soil types associated with the Project; Sections 4.3.4 through 4.3.7 provide summaries of the geologic and soils conditions associated with Project-specific features, including bedrock, surface deposits and soils; and surface materials; faulting and seismic conditions, and erosion potential and sedimentation; and Section 4.3.8 provides information regarding mineral resources in proximity to the Project.

4.3.1 Regional Geologic Setting

4.3.1.1 Geomorphology

The Project is located within the northeastern portion of the Transverse Ranges Geomorphic Province (Figure 4.3-1). To the north of the Transverse Ranges are the Coast Ranges and the Mojave Desert province (immediately adjacent to the Project area), including Antelope and Summit valleys. To the south is the Peninsular Ranges province that includes the San Bernardino Valley.

The Transverse Ranges are a geologically complex region of southern California characterized by east-west oriented mountain ranges (e.g., the San Gabriel and San Bernardino mountains) and valleys, in contrast to the northwest trending mountains and valleys of the Coast Ranges and Peninsular Ranges provinces and much of the rest of the State. Ongoing intense north-south compressional tectonic forces are causing relatively fast uplift of the Transverse Ranges' mountain blocks, and as a result have developed the characteristically steep terrain. (California Geological Society 2002a as cited in DWR 2009)

The Project is situated in the western end of the San Bernardino Mountains, approximately 5 to 10 miles east of the Cajon Valley that separates the approximately 55-mile-long and up to 30-mile-wide San Bernardino Mountains from the San Gabriel Mountains.

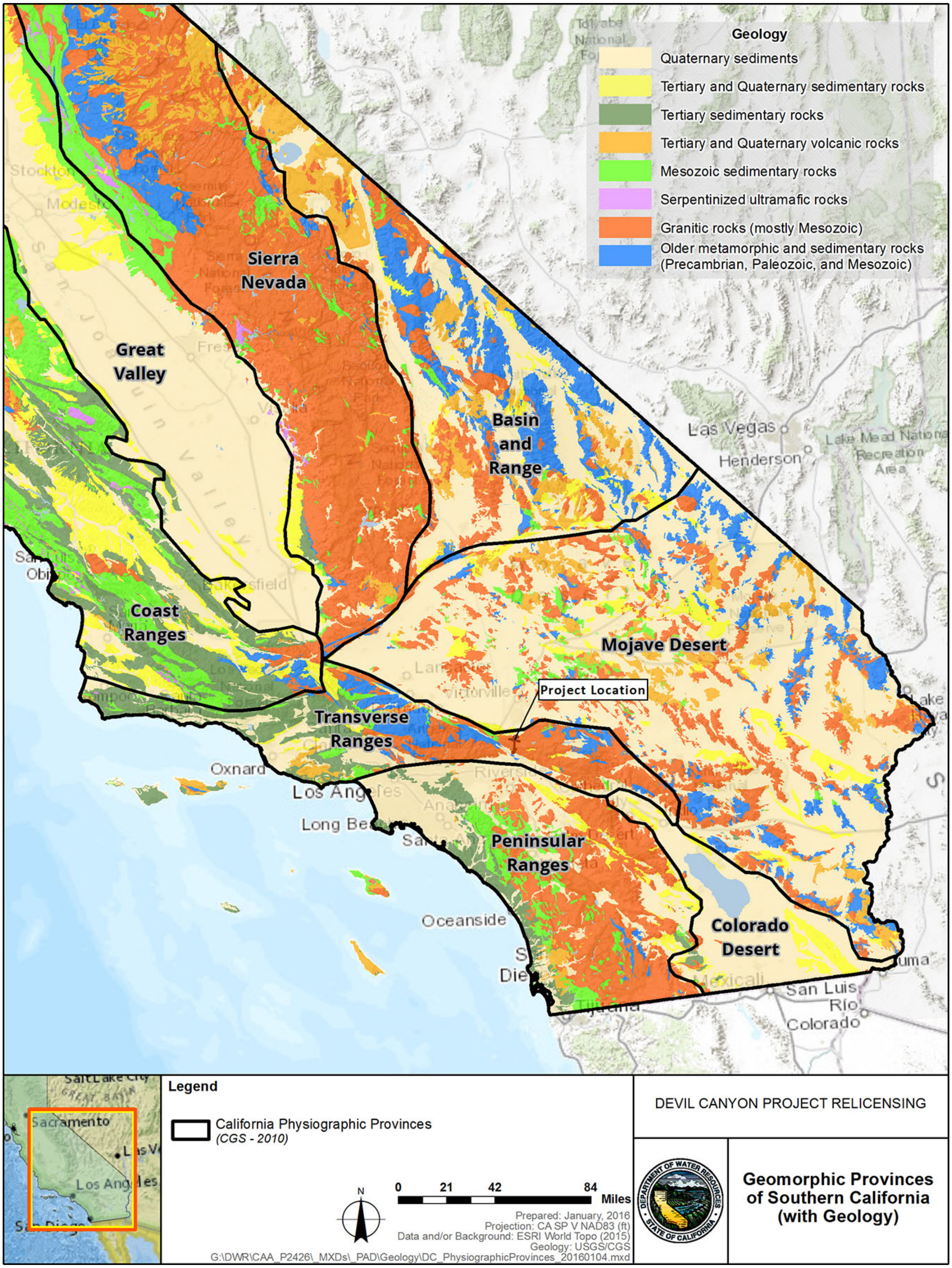


Figure 4.3-1. Geomorphic Provinces of Southern California (with Geology)

4.3.1.2 Tectonic History

A myriad of forces – including the accretion of seafloor crust and oceanic sediments along the western margin of the North American continent, their subsequent uplift, intrusion by granitic batholiths, periods of volcanism during subduction, horizontal translational displacement and concurrent erosion – have resulted in the formation of California's broad geologic features and present-day landscape associated with the Project. (DWR 2009).

Approximately 700 million years ago (mya), the North American continent rifted away from the Rodinia supercontinent, exposing the west coast of the North American continent to the world's oceans. Southern California's current geologic features are a product of long-term tectonic activity associated with episodic subduction, which lasted from about 438 mya to about 144 mya (Paleozoic to the Mesozoic eras). (Atwater 2000).

During the Mesozoic Era, about 250 to 65 mya, the ancestral southern California coast lay over a subduction zone similar to that currently in Alaska or north of Australia. Much of the basement rock of California formed during that time. Through late Cretaceous and Eocene time (about 70 to 35 mya), continental and marine sediments were deposited on the continental shelf. (Atwater 2000).

As sea levels fell or the continental margin rose, during the late Eocene and Oligocene Epochs (about 35 to 23 mya), the continental margin was exposed and a lowland of meandering rivers and floodplains developed. By early Miocene (about 23 mya), the sea again covered the continental margin and marine sediments were again deposited. The region's geologic features were then further altered by transform movement between the Pacific and North American Plates, along the San Andreas fault (Figure 4.3-2). Starting about 20 mya, the subduction system between the Pacific and North American Plates was gradually replaced by the transform motion of the San Andreas fault separating the generally westward-drifting North American Plate from the northwest-drifting Pacific Plate. (Atwater 2000).

The Pacific Plate detached slivers of the continental rim and transported them northwestward. One slice of a mountain block became trapped in the shear between the North American and Pacific Plates. This slice of a mountain block rotated clockwise forming a rift valley on its east. Subsequently, volcanic intrusions followed fractures in the block and organic sediments filled the deep rift valley. The rotated block, today's Transverse Ranges, continues to rotate, causing the ongoing tilting, folding and uplift of the growing mountain range. Thrust faults also border the northern and southern mountain block margins (Atwater 2000), further separating its geology from the surrounding geology.

4.3.1.3 Seismicity

Southern California is a region of high seismic activity. Numerous active, potentially active, and inactive faults are scattered across the region. Many Holocene and historically active faults are found throughout the region. Within 62 miles of the Project, significant earthquakes (magnitude [M] 6.0 or greater on the Richter magnitude scale) have historically occurred on the six faults described in the following paragraphs (Figure 4.3-2).

The most prominent tectonic feature associated with the Project is the San Andreas Fault Zone, which passes through a portion of the Project alignment (see Figure 4.3-2). The fault is a right-lateral strike-slip feature that trends roughly northwest for about 600 miles from the Imperial Valley in southern California to Point Arena on the northern California coast, and then continues offshore to the west. The largest historic earthquake to affect southern California was the estimated M 7.9 Fort Tejon earthquake in 1857. This earthquake caused a 225-mile long surface rupture of the San Andreas fault from the likely epicentral area northwest of Parkfield, Monterey County, to at least Cajon Pass (Figure 4.3-2) northwest of San Bernardino and approximately 6 miles from the Project. The 1857 earthquake, along with the 1906 San Francisco earthquake of northern California, represent the two largest fault ruptures in California history. (SCEDC 2015).

The San Jacinto fault, located less than 5 miles southwest of the Project (see Figure 4.3-2), though not as prominent relative to the Project, is considered the most seismically active fault in southern California. Several significant earthquakes have occurred historically on various segments of this approximately 130-mile-long fault. Historic events have occurred in 1899 (estimated M 6.7), 1918 (estimated M 6.8), 1968 (M 6.4) and 1987 (M 6.6). (SCEDC 2015).

The San Fernando fault ruptured on February 9, 1971, triggering the M 6.6 San Fernando/Sylmar earthquake. This 17-mile-long segment of the 55-mile-long Sierra Madre-Cucamonga fault is located about 55 miles west of the Project area. However, the Cucamonga segment is less than 10 miles from the Project area (SCEDC 2015).

The Whittier-Elsinore fault is located approximately 25 miles southwest of the Project (outside area shown in Figure 4.3-2). Though it is one of the largest fault zones in southern California, extending about 135 miles, it is one of the least active. Historical records indicate that an estimated M 6.0 occurred on the Elsinore fault in 1910 (SCEDC 2015).

The Newport-Inglewood-Rose Canyon fault is located about 50 miles southwest of the Project (outside area shown in Figure 4.3-2). This 165-mile long fault system extends from San Diego to Los Angeles. In 1934, the M 6.4 Long Beach earthquake occurred on the fault with an epicenter near Huntington Beach (SCEDC 2015).

In 1992, the M 7.3 Landers earthquake ruptured on the combined Johnson Valley, Landers-Kickapoo, Homestead Valley, Emerson and Camp Rock faults. This fault system is located from about 45 to 60 miles northeast of the Project (outside area shown in Figure 4.3-2) (SCEDC 2015).

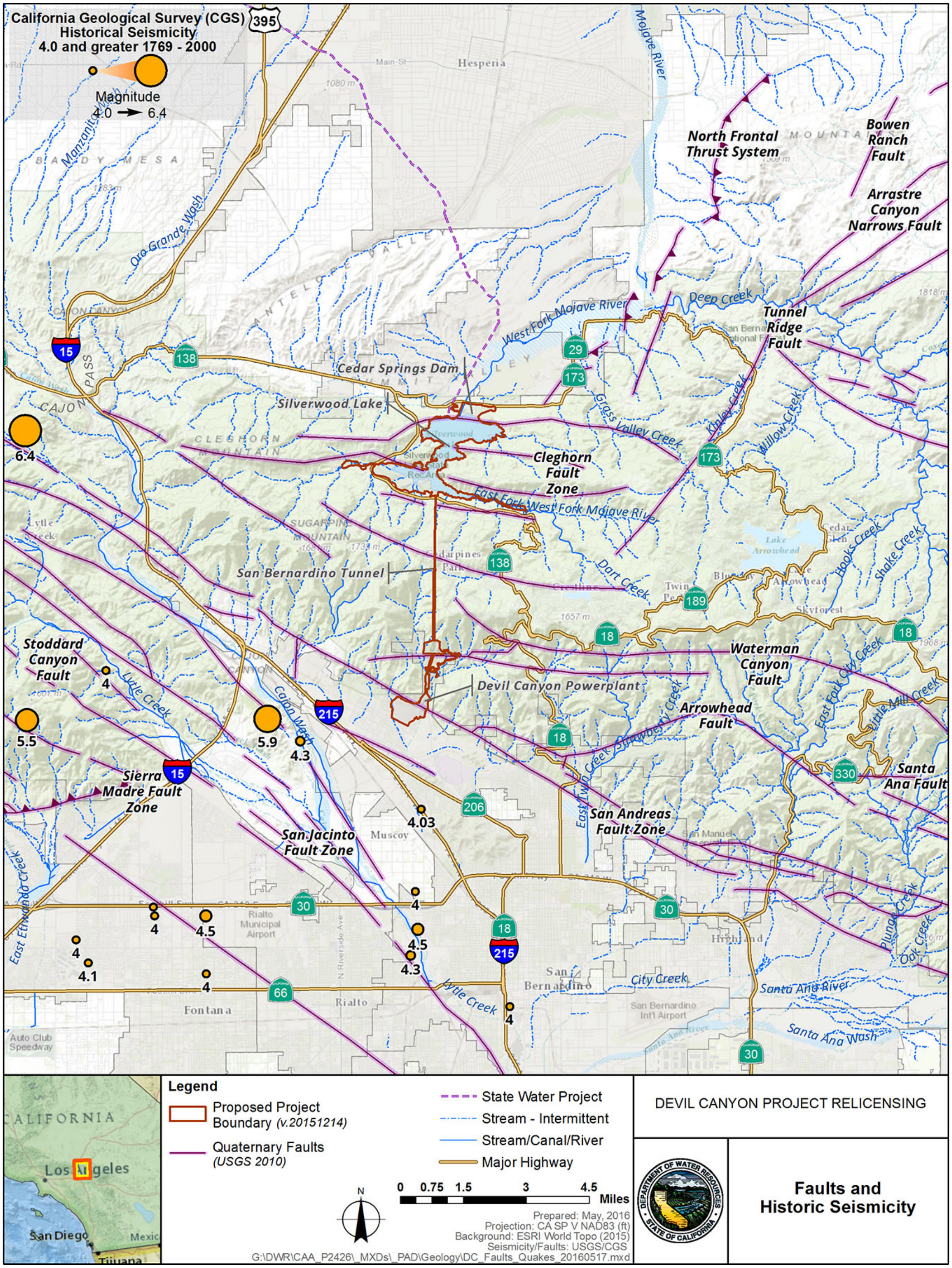


Figure 4.3-2. Fault Zones and Historic Seismicity in the Project Vicinity

4.3.2 Project Geologic Setting

The Project is within the San Bernardino Mountains, which comprise mainly gneissic and granitic rocks of Mesozoic age. Tertiary to Quaternary continental sediments, including the Crowder Formation (formerly identified as the Harold Formation) along with older (Pleistocene) and younger (Holocene) alluvium are found locally along structural troughs and valley floors of the mountain range (Figure 4.3-3). (DWR 1994c).

The San Bernardino Mountain block appears to have been uplifted along a system of high-angle reverse and normal faults, which are subparallel to the San Andreas fault. In a broad sense, the mountain mass appears to have northward tilt toward the bordering Mojave Desert Province. (DWR 1994c).

Mountain terrain with steeply sloped valley walls characterizes the largest part of the Silverwood Lake, San Bernardino Tunnel, and Devil Canyon Penstock and Powerplant areas. From Silverwood Lake, the slope rises abruptly to 3,620 feet at Cleghorn Ridge. Patches of shallow residual soil intermingled with boulders and disjointed rock masses characterize the slopes. Localized slope failures are common.

On the north side of the Project, steep cobble-filled channels dissect rocky slopes rising from the West Fork Mojave River in this area above its confluence with Miller Canyon Creek. The West Fork Mojave River flows down a gently sloping (3 percent grade) channel near the trace of the Cleghorn fault, which continues upstream to the west and through Miller Canyon to the east. Alluvium underlying the nearly level floodplain on the river is estimated to be 20 feet deep at the former site of the town of Cedar Springs. The overlying alluvium across the floodplain is composed of easily eroded sandstone and is interbedded with colluvium from debris flow deposits. Impermeable land surfaces, steep channel gradients (as much as 17 percent) and high intensity rainfall have the potential to generate debris flows in the area. Forest fires intensify the debris flow conditions. (DPR 1997).

On the south side of the San Bernardino Mountains, older residual soils, stream gravels, and fanglomerates occur as irregular caps on ridges or form terraces and benches adjacent to ephemeral streams. The older residual soils are commonly silty or clayey sands, occurring in areas of slight erosion that usually grades into deeply weathered gravels and sands, which occur as deposits topographically higher than present stream channels. Although the deposits are generally classified as gravel with minor silt or clay, boulders 4 to 8 feet and larger in diameter are present. Individual clasts are commonly weathered and occasionally are decomposed. Bands of these deposits stand at slopes up to 37 degrees, indicating that they are relatively well consolidated. (Martinez 2014).

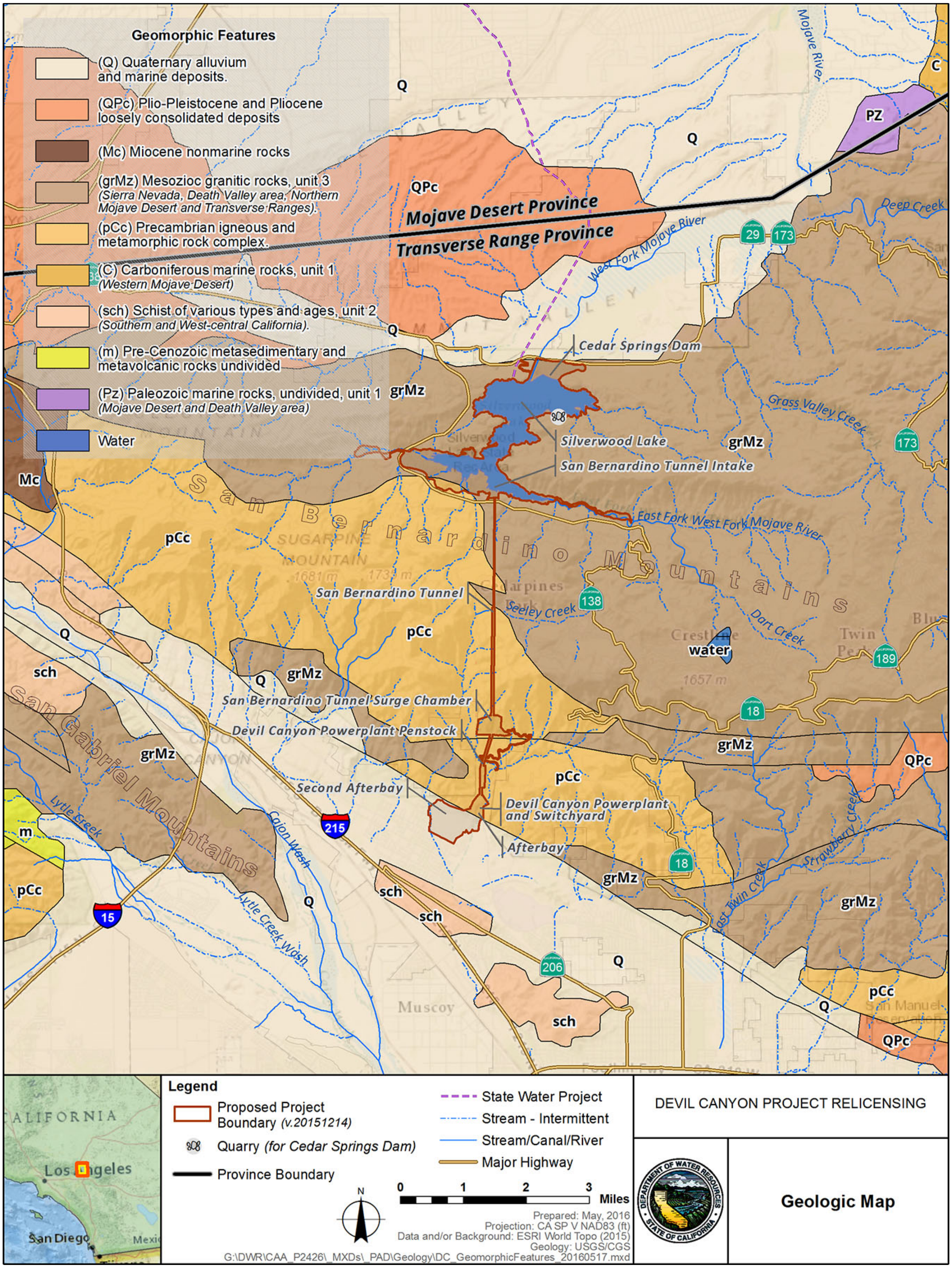


Figure 4.3-3. Geologic Map of the Project Area

Holocene alluvium consisting of boulders and gravels with minor amounts of silt, clay, and sand is present in the beds of active streams in the region. Boulders up to 15 feet and larger in diameter are present, although the deposits are primarily a sandy gravel. These materials are usually highly permeable and unconsolidated. Individual clasts are usually unweathered, hard, and strong (DWR 1995a).

4.3.2.1 General Bedrock

Geologic materials that comprise the San Bernardino Mountains consist mainly of Paleozoic to Mesozoic intrusive igneous rocks (Figure 4.3-3) that have been uplifted to their current elevations during the Cenozoic era (approximately 65 mya to present). The intrusive igneous rocks have intruded older metamorphic rocks in the region. The metamorphic rocks include diorite gneiss, quartzite, schist, and marble. Diorite gneiss is the most abundant metamorphic rock type. These rocks usually have near-vertical foliation indicating that substantial horizontal pressures affected them.

The near-surface rocks of the San Bernardino Mountains are weathered to decomposed, and are commonly highly fractured. The depth of weathering is variable, but in some areas may extend to as much as 300 feet. Though hard and strong when unweathered, the many joints and shears present in the rocks of the area significantly reduce their overall strength. Rock adjacent to fault zones is sheared, crushed, and commonly deeply weathered. (DWR 1995a).

The current landscape of the San Bernardino Mountains is a product of rapid uplift and concurrent erosional dissection of the exposed rock surface by streams and rivers that gradually strip away soil and rock materials, carrying them downstream to coalescing alluvial fans and valley basins along the margins of the range.

4.3.2.2 Surface Deposits

In the Cedar Springs Dam and Silverwood Lake area, Tertiary to Quaternary period continental sediments are found in structural troughs and on the valley floors of the mountain range (Figure 4.3-3) (Glick 2010). This includes the Crowder Formation and older and recent alluvium.

The Crowder Formation was deposited between 17 and 9.5 mya. It is a white to slightly pinkish, poorly indurated but well-bedded, arkosic sandstone with interbedded pebble to cobble conglomerates of distinctive Sidewinder Volcanics and Paleozoic quartzite derived from the north (Barry 2012).

In the vicinity of Cedar Springs Dam, two surficial Quaternary units overlie the bedrock and Crowder Formation deposits. The higher of the two Quaternary units is the oldest (about 500,000 years old). It is distinguished by its deeply incised geomorphic surface, and bright red soils on preserved stable surface remnants. The topographically lower and younger unit (about 60,000 years old) has a generally well-preserved continuous geomorphic surface and weakly developed yellowish soils. (Barry 2012).

In the Devil Canyon area, surficial alluvial deposits are generally restricted to the natural drainage channels and to the vicinity of the Devil Canyon Second Afterbay and the alluvial fan apron at the base of the mountain front (DWR 1995a).

4.3.3 Soil Types

Residual soils, stream gravels, and fanglomerates occur as irregular cappings on the ground surfaces, or form terraces and benches adjacent to active streams. The residual soils are commonly silty or clayey sands, occurring in areas of slight erosion, and grade downward to deeply weathered bedrock. Older stream deposits and fanglomerates of boulders, gravels, and sands occur topographically higher than present stream channels. These deposits are generally classified as gravel with minor silt or clay; however, boulders 4 to 8 feet and larger in diameter are present. Individual clasts are commonly weathered and occasionally decomposed. Banks of these deposits stand as slopes up to 37 degrees, indicating that they are relatively well consolidated. (Martinez 2014).

Holocene alluvium consisting of boulders and gravels with minor amounts of silt, clay, and sand is present in the beds of active streams in the region. Boulders up to 15 feet and possibly larger in diameter are present, although the deposits are primarily sandy gravel. These materials are usually highly permeable and unconsolidated. Individual clasts are usually unweathered, hard, and strong. (Martinez 2014).

In general, soils derived from the weathering of the granitic bedrock units are well to excessively well drained, with low to moderate erosion potential. However, once these oftentimes-thin soils lying directly on hard bedrock become saturated, they may become highly erodible and subject to mass movement. Likewise, both the older and younger alluvial soils are well to excessively well drained. While generally these soils have low to moderate erosion potential, they may erode when subjected to concentrated flows of water.

4.3.3.1 Paleontology

The bedrock units associated with the Project area are intrusive igneous in nature and therefore possess no paleontological materials.

In the area of Cedar Springs Dam and Silverwood Lake, the Crowder Formation contains fossilized insects, rodents, birds and larger mammals representing 29 taxa (Reynolds 1984).

4.3.4 Cedar Springs Dam and Silverwood Lake

4.3.4.1 Bedrock, Surface Deposits and Soils

Bedrock in the Cedar Springs Dam and Silverwood Lake area consists primarily of Jurassic period granitic rock, although Precambrian gneiss, and a Paleozoic section of gneiss, schist, and marble are found in the region (Figure 4.3-3). Bedrock foliation in the region dips 5 to 15 degrees to the northeast and strikes 70 degrees west of north generally parallel with the structural grain of the San Bernardino Mountains. Bedrock weathering depth is widely variable. Near faulted zones, weathering may extend to 50 feet deep while a short distance away hard rock is at a depth of only 4 feet. (Glick 2010).

The granite ranges from light-gray quartz monzonite to darker-colored quartz diorite with a poorly to moderately well-developed foliation. Dikes of orthoclase feldspar are common. Weathering depths vary from shallow on steep side slopes to relatively deep in the channel area and on gentle slopes. Intensely fractured and jointed rock is deeply weathered, with the darker, dioritic rock weathering more severely than the lighter monzonitic rock. Relatively fresh granitic rock is exposed in the quarry site for the Cedar Springs Dam (Figure 4.3-3). The quarry wall with a maximum of 10 benches, each about 20 feet high, appears in aerial photographs to be stable and not eroding. (Barry 2011). Overlying bedrock in the Cedar Springs Dam area and around the reservoir is the Plio-Pleistocene epoch Crowder Formation that rests unconformably on the crystalline bedrock. These sedimentary rocks were deposited on bedrock and are composed of poorly bedded to massive, poorly indurated arkosic sandstone with local interbeds of conglomeratic silty and clayey sandstone. The gently north-dipping formation occupies valley bottoms and laps up the north side of the granitic bedrock. However, on the north side of the valley in which Silverwood Lake resides, the Crowder Formation dips steeply southward and is overturned against one of the high-angle faults of the Cedar Springs Dam site (Glick 2010). Where Crowder Formation rock is exposed along the shoreline, the erosion potential should be higher than the basement rocks (Barry 2011).

Unconsolidated Quaternary sediments are present in the submerged river and creek channels. These stream alluvium deposits consist of sandy gravel to gravelly sand and colluvium/slope wash that average about 30 feet thick. At the base of the dam abutments, however, these deposits were found to be as much as 50 feet thick. (Glick 2010). Older alluvium deposits along the former banks of the Mojave River are remnants of Pleistocene river terraces. These deposits consist primarily of silty sand and gravelly silty sand. As with the Crowder Formation, where the alluvium is encountered along the shoreline, erosion potential of the alluvial deposits should be higher than the granitic bedrock. (Barry 2011).

Most of the soils around Cedar Springs Dam and Silverwood Lake are derived from the weathering of the granitic bedrock. They consist of up to 18 inches of well drained to excessively drained loamy sand to coarse sandy and gravelly loam overlying bedrock, but are also found to consist of as much as 50 inches of sandy clay loam. Alluvial-derived soils consist generally of up to 60 inches of well drained to excessively drained stratified gravelly loamy coarse sand and massive sandy to coarse sandy loam. Soils derived from the weathered granite line nearly all of the lake shoreline while alluvial soils border only a small area of the shoreline of the northwest lobe of the lake. Riverwash soils of silty, sandy and gravelly alluvium lie in the bed of the Mojave River. (USDA 2015a). A U.S. Department of Agriculture (USDA)-National Resources Conservation Service (NRCS) Custom Soil Resource Report of the Silverwood area is presented in Appendix G of this PAD. A map showing the soil series around Cedar Springs Dam and Silverwood Lake is shown in Figure 4.3-4.

4.3.4.2 Faulting and Seismic Considerations

The structural fabric of the Cedar Springs Dam area is subparallel to and structurally controlled by the San Andreas fault, located only 7 miles to the southwest.

The West Silverwood Lake Fault Zone (WSLFZ) is a critical structure to Cedar Springs Dam because it has been proposed to link faults under the dam to the Cleghorn Fault Zone. South of the northwest lobe of Silverwood Lake, the east and west strands of the WSLFZ can be seen in the bedrock; however, the lack of geomorphology indicative of active faulting suggests that the west strand of the WSLFZ is inactive. The east strand of the WSLFZ is a less clear structure, and as mapped, appears to connect a minor basement fault south of the northern lobe of Silverwood Lake to a fault beneath Cedar Springs Dam. However, given that a major portion of the east strand of the WSLFZ is underwater and does not juxtapose different rock types, it is difficult to determine if this connection is real. (Barry 2012).

The Cleghorn Fault Zone traverses the southern part of Silverwood Lake roughly following the paths of the East Fork of the West Fork Mojave River and the West Fork Mojave River (Figure 4.3-2). The Cleghorn Fault Zone is the most active fault within the vicinity of the reservoir. The most recent displacement on the Cleghorn fault appears to have occurred less than approximately 60,000 years ago. (Barry 2012).

The Grass Valley fault is considered part of the southern Cleghorn Fault Zone, which suggests late Pleistocene left-lateral slip. This sense of motion is consistent with its trend, which is parallel to the left-lateral Cleghorn fault, but geologic offsets and possible geomorphic offsets near the Cedar Springs Dam can be interpreted to be consistent with either right- or left-lateral activity. Based on the geomorphic expressions, it is likely that the Grass Valley fault is significantly less active than the Cleghorn fault. (Barry 2012).

To comply with the California Water Code and the California Code of Regulations (CCR), DWR is required to retain a consulting board to review and assess the safety conditions of SWP dams. Consultants are selected based on their knowledge of geotechnical, structural, and civil engineering, including their experience evaluating dam performance. Their independent assessments include the review of dam performance during earthquakes, evaluation of instrumentation data, inspection of each dam, and evaluation of studies performed by DWR. The consultants then prepare reports on each dam, approving dams as safe for continued operation and making recommendations. Based on these recommendations, DWR prepares action plans.

Cedar Springs Dam is inspected and reports are generated every 5 years, consistent with Title 18 of the CFR Part 12D. The Eighth 5-year FERC Part 12D Safety Inspection Report for Cedar Springs Dam was submitted in 2015. The report noted that the dam was safe for continued operation.

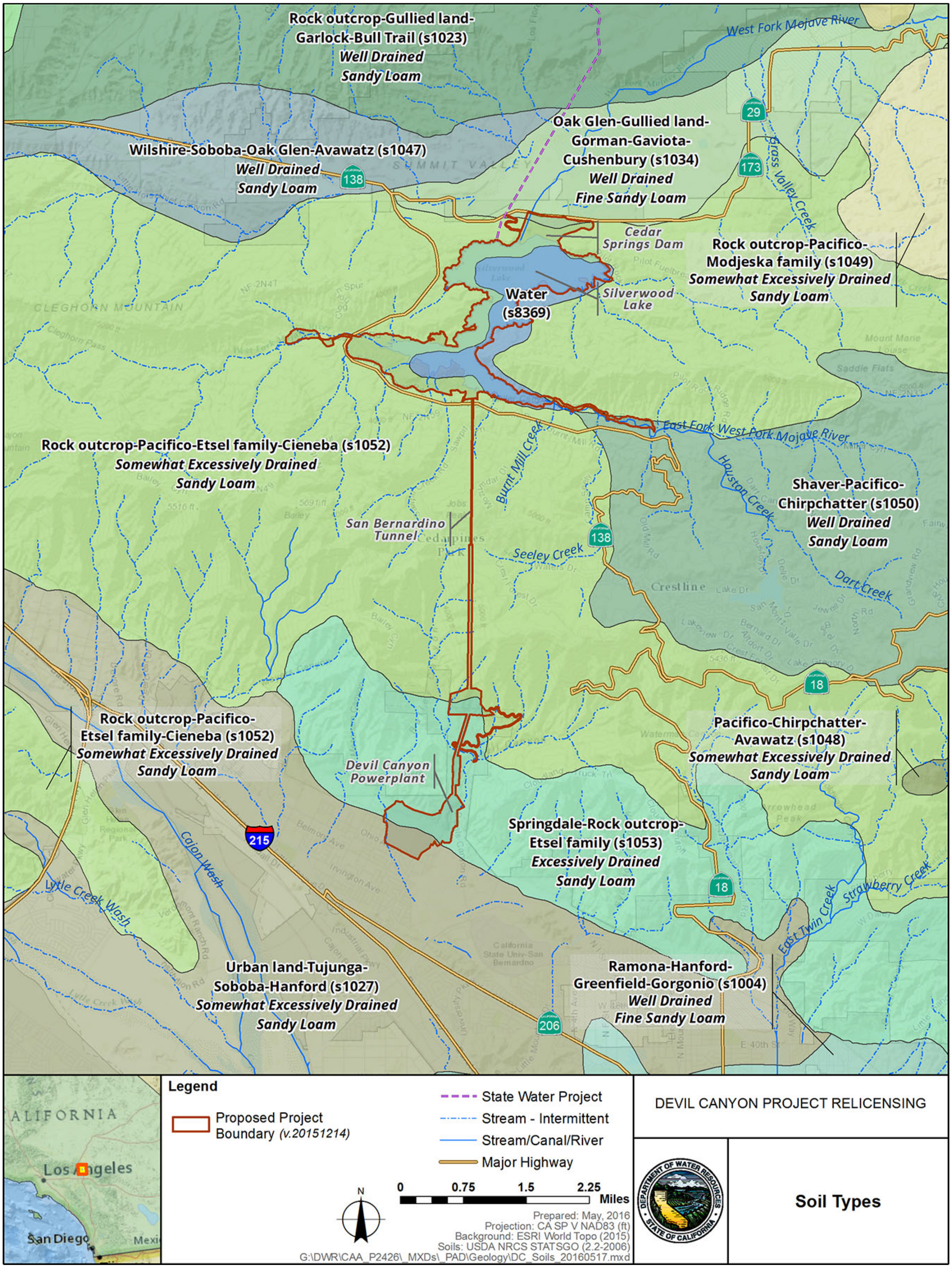


Figure 4.3-4. Soils Map of the Project Area

As a supplement to the FERC Part 12D safety inspection, FERC's Dam Safety Performance Monitoring Program requires that a Potential Failure Mode Analysis (PFMA) be performed for FERC-licensed dams. The PFMA involves document review and site visits to develop a comprehensive list of potential failure modes at each dam and was most recently conducted in 2014. From this review process, three documents are generated: the FERC Part 12D Safety Inspection report; the PFMA report; and the Supporting Technical Information Document, which summarizes project elements and details that do not change significantly over time.

Annually, DWR performs reviews and updates to the Emergency Action Plan (EAP) for the Cedar Springs Dam. In addition to the EAP updates, DWR conducts annual orientations, tabletop exercises, annual drills, and emergency equipment testing for the facility.

4.3.4.3 Erosion and Sedimentation

Hillside Erosion

Mountain terrain with steeply sloped valley walls characterizes the largest part of the area surrounding Cedar Springs Dam and Silverwood Lake. From Silverwood Lake, the slopes rise abruptly to 3,620 feet at Cleghorn Ridge. Patches of shallow residual soil intermingled with boulders and disjointed rock masses characterize the slopes. Talus deposits, areas with accumulated rock fall debris, are common in the Project area and often broaden into the alluvial fan deposits found along the lake perimeter. (DWR 2006). Localized slope failures, periodically accelerated by local rains, have been common (Federal Power Commission 1976). Historically, county and State roads have been subjected to small-scale land movements resulting in continuing annual maintenance for these roads.

Shoreline Erosion

Shoreline erosion can be attributed to a number of factors, including soil type, soil grain size, shoreline morphology, and wave action produced by recreational activities (boating) and prevailing winds. Water level fluctuations can also exacerbate this erosion. Silverwood Lake water surface elevations during the recreation season are maintained at a relatively consistent level over a range of hydrologic year types (see Section 3.2.3.6). (DWR 2006).

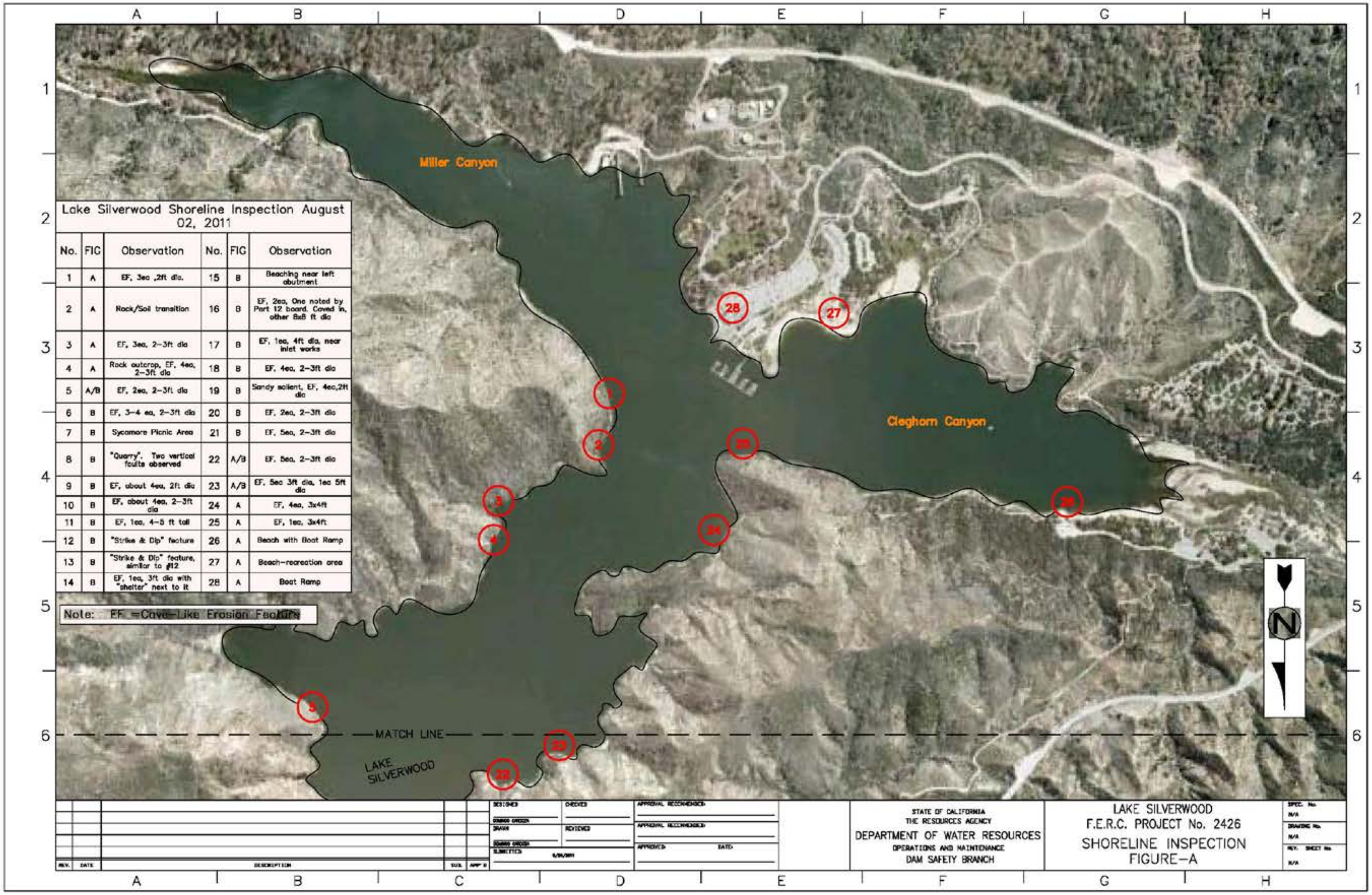
In some areas of the lake shoreline, wave erosion has removed the local top soil, slope wash, and/or colluvium, exposing the underlying bedrock (DWR 2006). On August 2, 2011, DWR conducted a shoreline geologic inspection by boat and by foot to assess overall shoreline stability and local erosional conditions near Cedar Springs Dam and around Silverwood Lake. This work was performed to address recommendations by the Independent Consulting Board, in the now superseded Seventh Five-Year Part 12D Safety Inspection Report, that a more detailed shoreline survey be conducted. The results of the inspection are discussed below and presented in Figures 4.3-5 through 4.3-7.

The investigation noted that there are two primary types of material near the shoreline: consolidated and unconsolidated materials. The consolidated materials include granitic and metamorphic bedrock, and to a lesser degree the Crowder Formation, none of which generally experience significant erosion. Any erosion of the rocky shores typically involves rock falls where the toe of the bluff has been gradually undercut by wave action. These rock falls can result in locally generated rock rip-rap, which in turn provides increased protection to the shoreline.

Minor reservoir level variations have restricted erosional damage to the top elevation of the shoreline banks. On the date of the inspection, the water surface elevation was 3,349.15 feet. The erosion and undercutting is focused on one elevation of the banks by the momentum of the waves as they crash onto the shore. During the inspection, eroded hollows were observed at more than 50 steep sloping locations, developing in weathered granitic or metamorphic rocks at joint intersections or along the weathered contact between rock types. Of these, all but two were less than 5 feet in any single dimension. These eroded hollows were not observed in shallowly sloped areas, the wall of the shoreline quarry, the dam embankment, or areas with nearby structures.

The investigation confirmed that Silverwood Lake is experiencing minor shoreline erosion. However, none of the erosion observed is considered significant and none of the erosion is believed to affect the overall shoreline rim stability or the dam stability. (Barry 2011). Since the 2011 inspection, all areas of significant erosion located near the left abutment of the dam were repaired and stabilized in November 2015 (Figure 4.3-7).

On November 20, 2014, a visual site inspection of the Cedar Springs Dam along with its appurtenant structures was performed as part of the Eighth Five-Year Part 12D Safety Inspection. As noted in the subsequent report the field inspection team concluded that the reservoir rim appears to be in satisfactory condition.

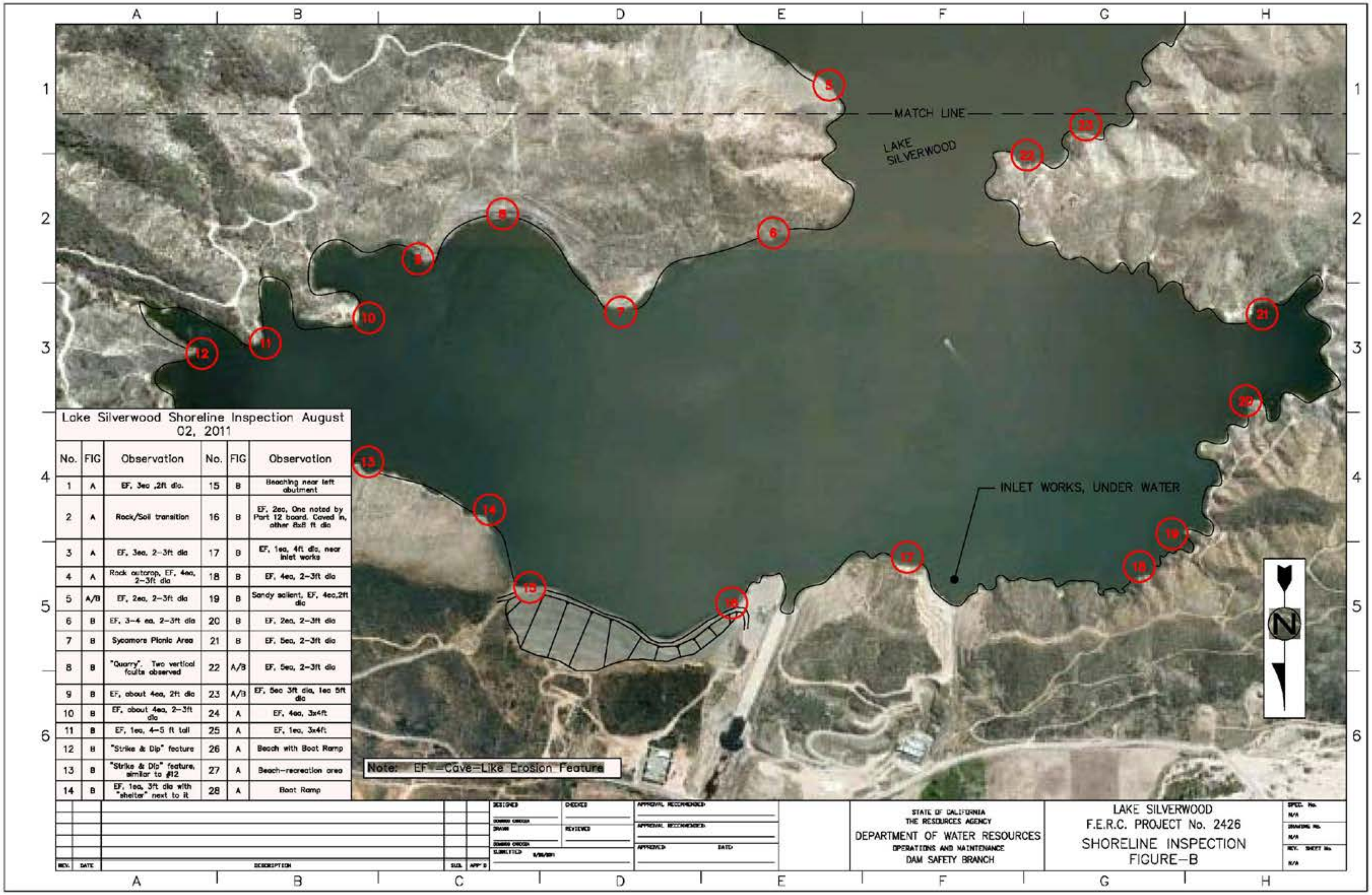


Lake Silverwood Shoreline Inspection August 02, 2011

No.	FIG	Observation	No.	FIG	Observation
1	A	EF, 3ea ,2ft dia.	15	B	Beaching near left abutment
2	A	Rock/Soil transition	16	B	EF, 2ea, One noted by Part 12 board. Caved in, other 8x8 ft dia
3	A	EF, 3ea, 2–3ft dia	17	B	EF, 1ea, 4ft dia, near inlet works
4	A	Rock outcrop, EF, 4ea, 2–3ft dia	18	B	EF, 4ea, 2–3ft dia
5	A/B	EF, 2ea, 2–3ft dia	19	B	Sandy salient, EF, 4ea,2ft dia
6	B	EF, 3–4 ea, 2–3ft dia	20	B	EF, 2ea, 2–3ft dia
7	B	Sycamore Picnic Area	21	B	EF, 5ea, 2–3ft dia
8	B	"Quarry". Two vertical faults observed	22	A/B	EF, 5ea, 2–3ft dia
9	B	EF, about 4ea, 2ft dia	23	A/B	EF, 5ea 3ft dia, 1ea 5ft dia
10	B	EF, about 4ea, 2–3ft dia	24	A	EF, 4ea, 3x4ft
11	B	EF, 1ea, 4–5 ft tall	25	A	EF, 1ea, 3x4ft
12	B	"Strike & Dip" feature	26	A	Beach with Boat Ramp
13	B	"Strike & Dip" feature, similar to #12	27	A	Beach–recreation area
14	B	EF, 1ea, 3ft dia with "shelter" next to it	28	A	Boat Ramp

Source: Barry 2011

Figure 4.3-5. Silverwood Lake Shoreline Inspection (Map 1 of 2)



Lake Silverwood Shoreline Inspection August 02, 2011

No.	FIG	Observation	No.	FIG	Observation
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7	B	Sycamore Picnic Area	21	B	EF, 5ea, 2-3ft dia
8	B	"Quarry". Two vertical faults observed	22	A/B	EF, 5ea, 2-3ft dia
9	B	EF, about 4ea, 2ft dia	23	A/B	EF, 5ea 3ft dia, 1ea 5ft dia
10	B	EF, about 4ea, 2-3ft dia	24	A	EF, 4ea, 3x4ft
11	B	EF, 1ea, 4-5 ft tall	25	A	EF, 1ea, 3x4ft
12	B	"Strike & Dip" feature	26	A	Beach with Boat Ramp
13	B	"Strike & Dip" feature, similar to #12	27	A	Beach-recreation area
14	B	EF, 1ea, 3ft dia with "shelter" next to it	28	A	Boat Ramp

Source: Barry 2011

Figure 4.3-6. Silverwood Lake Shoreline Inspection (Map 2 of 2)

Figure 4.3-7. 2015 Erosion and Stabilization Repair

Wind Erosion

Particulate matter emissions of less than or equal to 10 microns due to wind erosion can vary dramatically with changing surface conditions. Crust formation, mechanical disturbance, soil texture, moisture, and chemical content of the soil can affect the amount of dust emitted during a wind event.

Windblown dust is typically not a concern for the Project in the Silverwood Lake area as most areas are located in mountainous terrain, in areas of relatively well-vegetated soils or slightly weathered bedrock. Ground surface that is exposed typically lacks the fine-grained material that would lead to windblown particulate matter.

Sedimentation

Though there is currently no available record of sedimentation rates at the lake, where streams and creeks enter Silverwood Lake, deltaic deposits of sand and gravel accumulate.

In October 2003, the Old Fire burned much of the SBNF between Interstate 15 and Seven Oaks Dam. The USFS estimated that 42 percent of the 21,466 acre West Fork Mojave River watershed near Silverwood Lake burned. The area of the watershed that drains into Silverwood Lake via Cleghorn Canyon is approximately 3,500 acres. (Barry 2011). Section 4.9.4 of this PAD provides further information on this fire. Prior to re-opening in June 2004, Silverwood Lake SRA employees, contractors, and volunteers rebuilt recreational amenities, removed up to 6 feet of silt from roadways, chopped down hundreds of trees, and cleared debris from the lake. Silt was dredged from the

West Fork Mojave River, and a stretch of Sawpit Creek was re-channeled. (Los Angeles Times 2004).

Massive amounts of vegetation debris were carried into Silverwood Lake during the winter 2005 through 2006 storm events, which led to closure of the lake to recreational activities for a period. Efforts to remove floating material included the use of "tuff" booms to contain the floating debris and a skimmer vessel to remove and collect the debris (Gino Young, personal communication 2015). In conjunction with the Federal Emergency Management Agency (FEMA), DWR took emergency protective measures to secure Silverwood Lake park facilities and mitigate potential impacts to public safety, water quality, and operations and maintenance.

4.3.5 San Bernardino Tunnel, Intake and Surge Chamber

4.3.5.1 Bedrock, Surface Deposits and Soils

The intake tower, surge chamber and most of the north-south trending San Bernardino Tunnel is in Paleozoic to Mesozoic gneissic and granitic (granodiorite and quartz monzonite) bedrock (Figure 4.3-3). Scattered throughout the granite-gneiss complex are pods of Paleozoic marble. (DWR 1974a). The granite-gneiss complex bedrock is variably banded, often with 10 to 40 percent biotite. Gneissic foliation planes are typically flat dipping, but locally may be highly contorted in proximity to faults and shear zones. When fresh, the bedrock is white or pink to nearly black. Pegmatite dikes and sills occur frequently throughout the unit.

The rocks, where moderately to strongly weathered, are rusty brown. Near the ground surface and close to fault zones, the complex rock is decomposed, severely weathered, weak, and friable. At depth and away from damage zones, the rock is fresh, hard, strong, and well jointed to blocky. The marble is commonly moderately weathered, hard and blocky. (DWR 1974a).

4.3.5.2 Faulting and Seismic Considerations

The area around the San Bernardino Tunnel, Intake Tower, and Surge Chamber is structurally complex. Segments of the Cleghorn Fault Zone pass in proximity to the intake tower. Steeply dipping faults, generally east-west trending and north dipping, cross the tunnel alignment and juxtapose the granite-gneiss complex against the marble. (DWR 1974a).

4.3.5.3 Erosion Potential and Sedimentation

Erosion is an ongoing natural process, making the influence of the Project difficult to determine. The steep terrain in which most of the Project resides is subject to ongoing minor erosion, which at times is exacerbated by heavy rains and loss of vegetation due to fire.

4.3.6 <u>Devil Canyon Penstocks, Power Plant and Afterbays</u>

4.3.6.1 Bedrock

Bedrock along the penstocks consists primarily of moderately to deeply weathered metadiorite of the granite-gneiss complex and marble (Figure 4.3-3). Holocene alluvium, Pleistocene alluvium and the granite-gneiss complex locally support penstock footings. The penstock crosses a fault zone approximately 1 mile north of the Devil Canyon Powerplant (Figure 4.3-2). The rock in the zone consists of crushed granite-gneiss, marble, serpentine, clay gouge and large blocks of hard limestone and strongly weathered granite-gneiss. (DWR 1976).

The Jurassic age granitic rock is intensely weathered to decomposed on the surface, and although highly fractured and sheared, it is relatively competent (DWR 2014d). It ranges in color from pinkish white to rusty brown and is usually intensely weathered to decomposed, low to moderately hard, and weak and friable in outcrop and trench exposures. The rock is mostly closely fractured, locally sheared, fine to coarse grained, and commonly feldspar enriched. (DWR 1995a and 2001a).

The Late Cretaceous-early Tertiary Pelona Schist is a fine-grained metamorphic rock composed of muscovite, chlorite, albite and quartz. It is usually light brown and ranges from closely to moderately foliated. The rock is commonly sheared and is low to moderately hard with occasional hard zones. Calcium carbonate minerals are present along the planes of schistosity but not in the body of the rock. Small amounts of granitic rock and marble appear within this unit at the site, probably due to ancient faulting. (DWR 1995a and 2001a).

The Permian marble is mostly bleach white crystalline rock that usually appears as stringers in the granitic rock. It is moderately to highly foliated, slightly weathered, hard, strong, and medium to coarse grained. It is usually moderately to closely fractured. The rock generally reacts strongly to hydrochloric acid, can be subject to solution weathering, and may occasionally form cavities. Due to its brittle character, it has a tendency to break down when handled by equipment. (DWR 1995a and 2001a).

4.3.6.2 Soils and Surface Materials

Older alluvium in the Devil Canyon area is a mixture of granitic sand, gravel, cobbles, and boulders with about 5 to 15 percent silt or low plasticity clay. It is moderately to well consolidated, slightly cemented, and compact to very dense. The clasts are mostly subrounded to subangular and attain an average maximum size of about 4 to 8 feet, although much larger clasts are known to exist. The oversize material in the Devil Canyon Second Afterbay and in the Cross Channel ranged from intensely weathered/decomposed rock to fresh and hard rock. (DWR 1995a and 2001a).

The young alluvium was deposited by local drainages, including Devil Canyon and Bailey Canyon, and is composed of predominantly coarse-grained soils, including silty and poorly graded sands, and silty and poorly graded gravels with hard, fresh granitic and marble cobbles. Boulders in this unit can be very large. The clasts are mostly subrounded to subangular. This unit is loose on the surface and extends to a depth of at least 3 feet. (DWR 1995a and 2001a).

Most of the soils around Devil Canyon Penstocks, Powerplant, and Afterbays are derived from the weathering of the granitic bedrock or alluvial deposits. The granite-derived soils consist generally of 12 to as much as 50 inches of well drained to excessively drained sandy loam to very coarse sands and gravel overlying bedrock. Alluvial-derived soils are found in stream channels or on the upper portion of the alluvial fans at the base of the mountain front.

Coarse alluvial sediments line the bottom of Devil Canyon, crossing the penstock alignment twice, and underlie the canyon bottom east of the Powerplant and Afterbay. These soils generally consist of up to 72 inches of excessively drained gravelly to cobbley loamy sands to gravelly loamy sands. Alluvial fan deposits generally consist of up to 60 inches of well drained to excessively drained stratified gravelly loamy coarse sand and massive sandy to coarse sandy loam. A USDA-NRCS Custom Soil Resource Report for the Devil Canyon area is presented in Appendix G of this PAD (USDA 2015). A map showing the soil series around the Devil Canyon facilities is shown in Figure 4.3-4.

Fill materials range from dumped, loose, unconsolidated sands to compacted, engineered embankments and fills. The source of all fill materials at the site is local excavations in alluvium and bedrock. (DWR 1995a and 2001a).

4.3.6.3 Faulting and Seismic Considerations

The Devil Canyon facilities are located in an area of high seismicity, located along the San Andreas fault, San Bernardino North Section, about 3.7 miles southeast of its intersection with the San Jacinto fault (Figure 4.3-2). The Devil Canyon Powerplant area straddles the most active trace of the approximately 1-mile-wide San Andreas Fault Zone. This northernmost trace of the fault zone passes through the afterbay areas just south of the powerplant (DWR 1975), less than 2,000 feet from the southern end of the penstocks. Located about 600 feet north of the San Andreas Fault Zone, but still south of the penstocks, is the Santa Ana Fault Zone. This zone is at least 260 feet wide and is nearly parallel to the San Andreas Fault Zone as it crosses the Devil Canyon Afterbay. The Santa Ana fault is believed to be an active branch of the San Andreas and capable of surface displacement. (DWR 2001a).

The Devil Canyon Second Afterbay is located immediately adjacent to the northern trace of the San Andreas Fault Zone. The main trace of the fault at the Project site is relatively narrow (several meters wide), borders the north side of the Devil Canyon Second Afterbay, crosses the cross channel between the two afterbays, and passes to the south of the powerplant. One trace of the San Andreas fault may pass through the side channel spillway of the Devil Canyon Afterbay. No trace was found during construction of the Devil Canyon Second Afterbay. (DWR 2014e).

Designers of the Devil Canyon Second Afterbay and cross channel from the Devil Canyon Afterbay anticipated the potential adverse loading conditions and effects due to the close proximity to the site of the San Andreas Fault Zone, as well as the potential for higher groundwater levels caused by leakage through the asphaltic concrete liner system (DWR 2014e).

The Devil Canyon Second Afterbay Dam is inspected every 5 years, consistent with Title 18 of the CFR Part 12D Reports. The Eighth 5-year FERC Part 12D Safety Inspection Report for Devil Canyon Second Afterbay Dam was submitted in 2015. The report noted that the dam was suitable for continued safe and reliable operation.

4.3.6.4 Erosion Potential and Sedimentation

Erosion is an ongoing natural process, making the influence of the Project difficult to determine. The steep terrain in which most of the Project resides is subject to ongoing erosion, which at times is exacerbated by heavy rains and loss of vegetation due to fire.

The Devil Canyon drainage channel contains alluvial sediments which when subject to concentrated flow could become mobilized. Historically, county and State roads have been subjected to small-scale land movements resulting in continuing annual maintenance for the Project.

4.3.7 <u>West Fork Mojave River Downstream of Cedar Springs Dam</u>

4.3.7.1 Bedrock

Jurassic-age granitic rock is exposed east of the West Fork Mojave River downstream of Cedar Springs Dam. The granitic rock is part of the same unit described in Section 4.3.4 Cedar Springs Dam and Silverwood Lake (Glick, 2010).

4.3.7.2 Soils and Surface Materials

The West Fork Mojave River downstream of Cedar Springs Dam is largely cut into Crowder Formation deposits. Soils that have developed on the Crowder Formation consist generally of up to 60 inches of well drained to excessively drained stratified gravelly loamy coarse sand and massive sandy to coarse sandy loam. Riverwash soils of silty, sandy and gravelly alluvium lie in the bed of the river. A USDA-NRCS Custom Soil Resource Report of the Silverwood area is presented in Appendix G of this PAD (USDA 2015). A map showing the soil series around the Mojave River is shown in Figure 4.3-4.

4.3.7.3 Faulting and Seismic Considerations

The North Frontal Fault Zone (NFFZ) is a well-recognized active fault northeast of Cedar Springs Dam and Silverwood Lake (Figure 4.3-2). It was previously assumed that the Cleghorn fault was connected to the NFFZ via unnamed faults in Summit Valley and the West Silverwood Lake Fault Zone. Recent investigation, however, found no evidence of movement on the NFFZ south of the Mojave River and, as such, there is no connection with the Cleghorn fault. (Barry 2012).

4.3.7.4 Erosion Potential and Sedimentation

Erosion is an ongoing natural process, making the influence of the Project difficult to determine. The steep terrain in which most of the Project resides is subject to ongoing erosion, which at times is exacerbated by heavy rains and loss of vegetation due to fire. Historically, county and State roads have been subjected to small-scale land movements resulting in continuing annual maintenance for the Project.

4.3.8 Mineral Resources

Several mining claims in the Project area are identified in the U.S. Geological Survey (USGS) Mineral Resources On-Line Spatial Data website (Figure 4.3-8). Most involved placer operations, though a few involved possible load deposits. Two mining occurrences were identified within the Silverwood Lake Drainage Basin; however, neither is considered significant. The first and closest site was a gemstone claim located on the East Fork of the West Fork Mojave River within 1 mile of the Project. The second was a surficial limestone claim located in the western portion of the basin approximately 2 miles from the western extent of the Project. No production has taken place at either of these sites and there has been little to no activity since the discovery of these locations with the exception of routine claim maintenance.

One mining prospect location was mapped in the southeast portion of the Silverwood Lake Basin just north of Highway 18. This gold prospect went past the occurrence stage and may have included subsequent work, including surface trenching, adits, shafts, drill holes, extensive geophysics, geochemistry, and or geologic mapping.

The closest past producer to the Project, the former Devil Canyon Quarry, was located outside of the Silverwood Lake Drainage Basin approximately 1.5 miles east of the Devil Canyon Powerplant. This site included the mining of surficial limestone deposits (http://mrdata.usgs.gov/). All claims are currently closed.

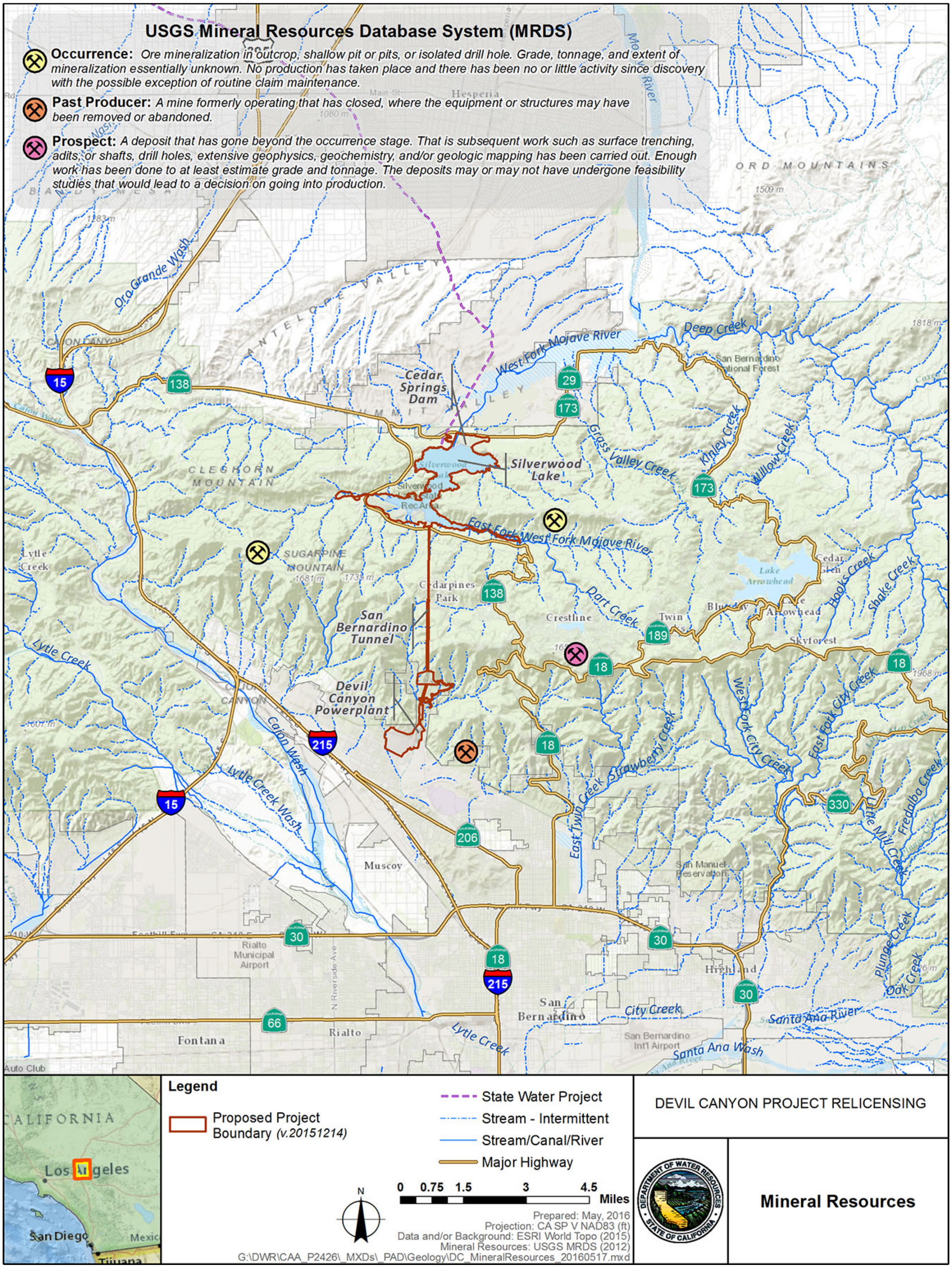

Figure 4.3-8. Mineral Resources in the Project Area

4.4 WATER RESOURCES

This Section provides information regarding existing water resources conditions. Besides this general introductory information, this Section includes seven main sub-sections: Section 4.4.1 describes the Project area gage information; Section 4.4.2 describes the morphometric data for Silverwood Lake; Section 4.4.3 describes the potentially affected area; Section 4.4.4 describes the project hydrology; Section 4.4.5 describes the potentially affected water rights; Section 4.4.6 describes the designated beneficial uses and water quality standards; and Section 4.4.7 describes the existing water quality for Silverwood Lake, Devil Canyon Afterbay, and Devil Canyon Second Afterbay.

This water resources Section focuses on Silverwood Lake and the 6.1-mile-long section of the West Fork Mojave River from Cedar Springs Dam to the confluence of the West Fork with Deep Creek, which forms the main stem of the Mojave River. The Devil Canyon Afterbay and Devil Canyon Second Afterbay are off-stream-constructed waterbodies and only hold SWP water passed through the Devil Canyon Powerplant. There is no local inflow intercepted by the two afterbays. All water flowing through these facilities is SWP water. More information on the afterbays can be found in Section 3.0.

This Section describes the existing environment, including morphometric data, beneficial uses, water quality, and contaminants found in fish tissue in Silverwood Lake.

4.4.1 Project Area Gage Information

DWR operates 11 gages in the Project area, as listed in Table 4.4-1 and shown in Figure 4.4-1. Flow data for these gages is available from two sources as noted in the Table 4.4-1, the USGS National Water Information System (waterdata.usgs.gov) and the California Department of Water Resources California Data Exchange Center (cdec.water.ca.gov). The frequency of data updates is unique to each gage and can change over time as new data is obtained and reviewed. The period of record included in Table 4.4-1 should be used as a general description of the data availability at the time this report was written. These gages are in the Project area; however, they are not part of the Project facilities.

Table 4.4-1. Gages in the Project Area

Gage ID	Gage Name	Gage Owner	Data Source	Data Reported (units)	Reported Frequency	Period of Record	
						Begin Date	End Date
10260780	EB CA AQUEDUCT A MOJAVE SIPHON PP NR HESPERIA CA[1]	DWR	waterdata.usgs.gov	Discharge (cfs)	Daily	1995-10-01	2014-09-30
10260782	MOJAVE SIPHON PP BYPASS NR HESPERIA CA[1]	DWR	waterdata.usgs.gov	Discharge (cfs)	Daily	1998-10-01	1999-09-30
10260822	LAS FLORES REL FROM EB CA AQUEDUCT NR HESPERIA CA	DWR	waterdata.usgs.gov	Discharge (cfs)	Daily	1995-10-01	2014-09-30
10260790	SILVERWOOD LK NR HESPERIA CA	DWR	waterdata.usgs.gov	Reservoir storage (AF)	Daily	1995-10-01	2014-09-30
SLW	LAKE SILVERWOOD	DWR	cdec.water.ca.gov	Reservoir Elevation (ft)	Hourly	2011-11-08	Present
				Reservoir Storage (AF)	Hourly	2011-11-08	Present
				Reservoir Outflow (cfs)	Hourly	2011-11-08	Present
				Reservoir Storage (AF)	Monthly	1972-10-1	Present
10260820	WF MOJAVE R BL SILVERWOOD LK CA	DWR	waterdata.usgs.gov	Discharge (cfs)	Daily	1980-10-01	2014-09-30
10260550	WF MOJAVE R AB SILVERWOOD LAKE NR HESPERIA CA[2]	DWR	waterdata.usgs.gov	Discharge (cfs)	Daily	1995-10-01	2014-09-30
WFM	WEST FORK MOJAVE RIVER UPPER CLEGHORN[2]	DWR	cdec.water.ca.gov	River Stage (ft)	15 minute	2005-11-29	Present
10260700	EF OF WF MOJAVE R AB SILVERWOOD LK NR HESPERIA CA[3]	DWR	waterdata.usgs.gov	Discharge (cfs)	Daily	1995-10-01	2014-09-30
EFM	EAST FK OF WEST FK MOJAVE R UPR MILLER[3]	DWR	cdec.water.ca.gov	River Stage (ft)	15 minute	2005-11-29	Present
11063682	EB CA AQUEDUCT A DEVIL CYN PP NR SAN BERNARDINO CA	DWR	waterdata.usgs.gov	Discharge (cfs)	Daily	1995-10-01	2014-09-30

Sources: USGS 2016, DWR 2016c
Notes:
[1]Station 10260782 has been discontinued. Gage 10260780 and 10260782 have been combined into one station.
[2]Stations 10260550 and WFM are the same station. The data reported for this station is reported in both waterdata.usgs.gov and cdec.water.ca.gov, the station naming is different in each database.
[3]Stations 10260700 and EFM are the same station. The data reported for this station is reported in both waterdata.usgs.gov and cdec.water.ca.gov, the station naming is different in each database.
Key:
AF = acre-feet
cfs = cubic feet per second
DWR = California Department of Water Resources
ft = feet
USGS = U.S. Geological Survey

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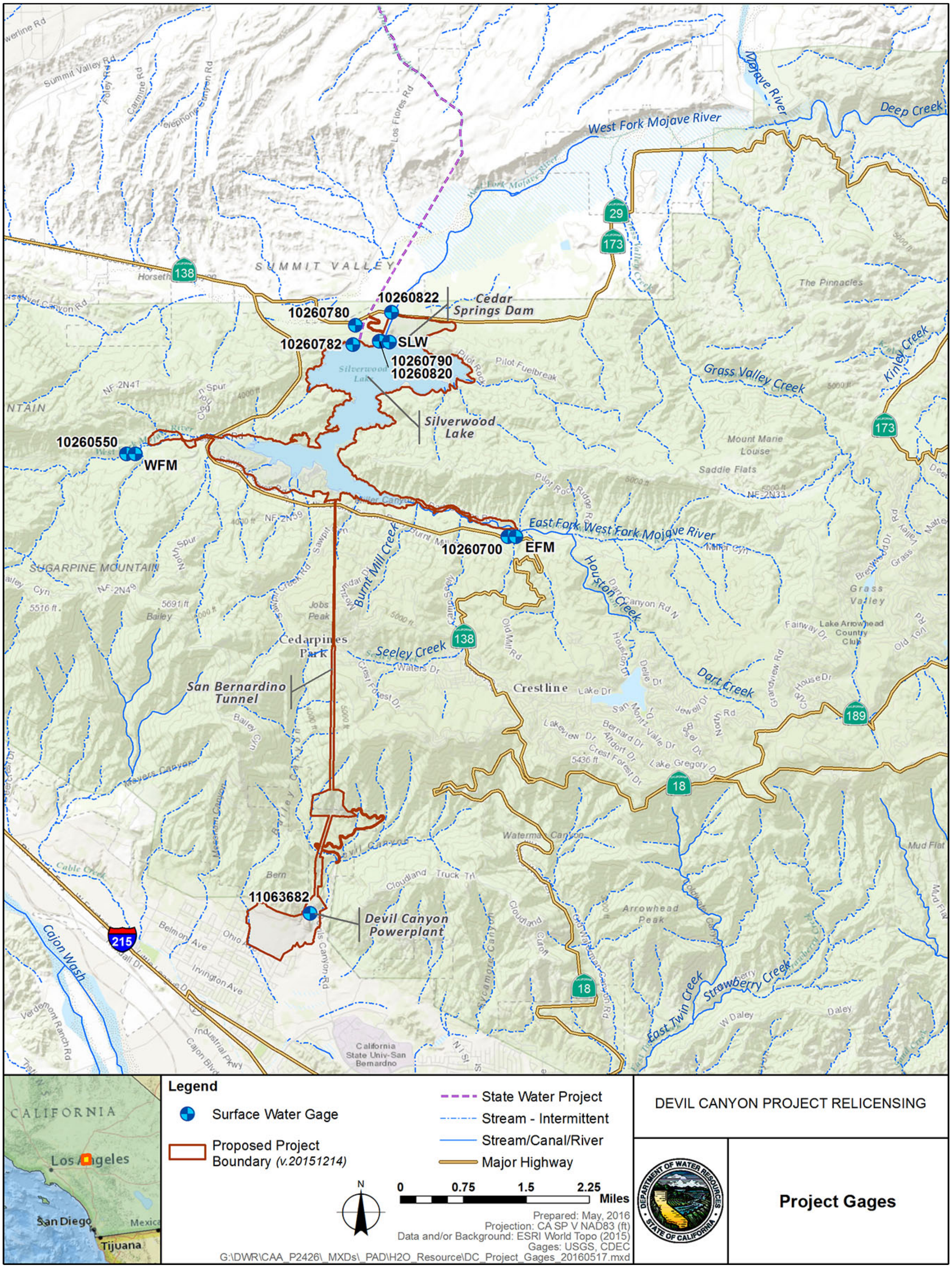


Figure 4.4-1. Gages in the Vicinity of the Project Boundary

4.4.2 Morphometric Data for Silverwood Lake

Table 4.4-2 summarizes the available relevant morphometric characteristics of Silverwood Lake, including surface area, volume, maximum depth, mean depth, flushing rate, shoreline length, and substrate composition.

Table 4.4-2 Summary of Morphometric Characteristics of Silverwood Lake

Morphometric Characteristics	Silverwood Lake
NMWSE	3,353
Surface Area (acres)	995 at NMWSE
Volume (acre-feet)	73,031 at NMWSE
Maximum Depth (feet)[a]	165
Mean Depth (feet)	76 at NMWSE
Flushing Rate (days)[1, b]	32.4
Shoreline Length (miles)[c]	13 at NMWSE
Primary Substrate Composition[2]	Silt, sand, gravel, cobbles, and boulders

Sources: [a]DWR 2014j, [c]DWR 2014d, [b]DWR 2015a
Notes:
[1]Average flushing rate, calculated using the average daily storage divided by the average daily outflow. The average monthly flushing rate varies seasonally with average monthly flushing rates of 26.9 days in June and 40.9 days in February.
[2]For more information related to the geology and soils in the Project area, see Section 4.3, "Geology and Soils."
Key:
NMWSE = Normal maximum water surface elevation

4.4.3 Potentially Affected Area

The Cedar Springs Dam and Silverwood Lake operate for SWP water supply delivery and hydropower generation, and are not intended to operate for local natural inflow regulation or control (e.g., flood control). However, the construction of Cedar Springs Dam interfered with, and impounded, the natural flow regimen of local tributaries and the related local water rights. Therefore, DWR entered into operational agreements with these users to satisfy prior surface water rights. These agreements pertain to the process and quantity of local runoffs that are made available to each by DWR under their respective water rights. Due to the implementation of these agreements, the instantaneous natural outflow volume may not be equal to the instantaneous natural inflow volume. Any water that is not used by Las Flores Ranch and CLAWA is released to MWA from Cedar Springs Dam. The Project does not use any local West Fork Mojave River or East Fork of the West Fork Mojave River water. More information on the agreements and operations can be found in Section 3.2.3. Flow exceedance curves for affected stream reaches can be found in Appendix E.

4.4.4 Project Hydrology

The Project's hydropower generation capacity is not dependent on the natural inflow and outflow; instead, the Project's hydropower generation capacity is dependent on the availability of SWP flows. Flow duration curves for Project operations are found in Section 3.2.3.

As discussed in Section 3.2, Silverwood Lake is operated to pass the natural inflow, less local water rights diversions from the lake, to the Mojave River within normal operational constraints.

The natural inflow to Silverwood Lake is made up of flows from the East Fork of the West Fork Mojave River and West Fork Mojave River, plus several small, intermittent streams, including Houston Creek. To estimate the natural inflow from the smaller intermittent streams, the total natural inflow is computed using a procedure developed based on a correlation of pre-project natural inflows from USGS gage 0260700, East Fork above West Fork; USGS gage 10260550, West Fork above Cedar Springs; and natural outflow from USGS gage 10260800, West Fork Mojave River below Cedar Springs. This calculation is outlined in Exhibit A of the 1980 operational agreement between DWR and Las Flores Ranch (DWR 1980). Figure 3.2-6 shows the monthly distribution and variability to the computed natural inflows to Silverwood Lake.

The local water rights diversions from the lake are discussed in Section 3.2.3. Figure 3.2-10, shows the monthly distribution and variability of these diversions. The “natural outflow” from Silverwood Lake, for comparison to the natural inflow, is computed as the actual release to the Mojave River. Figure 3.2-11 shows the monthly distribution and variability of this natural outflow.

Figures 3.2-5 and 3.2-8, show the annual total natural inflow and outflow by year from 2000 through 2014, respectively. In both figures the monthly and annual comparisons of the natural inflow and outflow are similar, with differences both positive and negative. These differences are due to several factors. First, the natural inflow is not a measured volume, but a computed volume based on historical correlations of ungaged flows. In addition, the local diversion data to CLAWA includes both water rights and SWP water supply; only the water right volume should be used in the comparisons, but this was not possible due to data limitations. Further, the extreme variability in the natural inflows makes matching the natural inflow and outflow difficult on a short-term basis due to other operational constraints. Finally, unexpected short term operational issues, as noted in Section 3.2.3.5, forced the carryover of deliveries as a balance due in some years. DWR performs an accounting of the operations on a short-term basis with a “true-up” process at the end of each year to account for short-term variability.

4.4.5 Potentially Affected Water Rights

4.4.5.1 Local Water Rights

Table 4.4-3 and Table 4.4-4 list the local water rights and associated agreements for the West Fork Mojave River that could be potentially affected by the Project. This table does not include the water rights required to operate the SWP. More information regarding the water rights and associated operations is available in Section 3.2.3.2.

Table 4.4-3 Potentially Affected Local Water Rights

Local Water Right Users	Priority (date)	SWRCB Designation (application)	SWRCB Designation (permit)	SWRCB Designation (license)[a]	Source (waterbody)	Amount & Place of Diversion or Storage (amount & place)	Season (period)	Place of Beneficial Use	Purpose
California Department of Water Resources	8/29/1916	461	959	1377	Sawpit Canyon	108.6 AF/year (maximum diversion 0.15 cfs) at Saw pit Canyon	3/1-10/31 of each season and through the remainder of the year as required for domestic purposes	Saw pit Canyon	Irrigation and domestic use
	7/10/1934	4077	2563	1378		24 AF/year (maximum diversion 0.033 cfs) at Saw Pit Canyon	4/1-about 11/15 of each season and throughout the remainder of the year as required for domestic purposes	Saw pit Canyon	Irrigation and domestic use
	7/19/1977	25435	20419	-	Houston Creek	1000 AF/year (maximum direct diversion 2.59 cfs)	1/1 to 12/31 by direct diversion and 11/1 to 5/31 collection to storage	CLAWA service area	Municipal

Table 4.4-3 Potentially Affected Local Water Rights (continued)

Local Water Right Users	Priority (date)	SWRCB Designation (application)	SWRCB Designation (permit)	SWRCB Designation (license)[a]	Source (waterbody)	Amount & Place of Diversion or Storage (amount & place)	Season (period)	Place of Beneficial Use	Purpose
California Department of Water Resources	9/27/1977	25511	20418	--	Houston Creek	302 AF/year (maximum direct diversion 0.78 cfs)	1/1 to 12/31 by direct diversion and 11/1 to 5/31 collection to storage	CLAWA service area	Municipal
Las Flores Ranch[b]	1882	S001460	N/A – pre 1914 Claim		West Fork Mojave River	23 cfs	1/1 to 12/31	Las Flores Ranch	Irrigation and Stockwatering
	1873	S001461							

Source: State Water Resources Control Board 2016
Notes:
[a]License information provided, where applicable. If no license information is provided, this indicates that the local water right user has a permit and for that water right, not a license.
[b]Las Flores Ranch water rights were transferred to Hesperia Venture I, LLC in 2012.
Key:
AF = acre-feet
cfs = cubic feet per second
CLAWA = Crestline-Lake Arrowhead Water Agency
N/A = not applicable

Table 4.4-4 Local Water Users and Associated Agreements

Local Water Users	Diversion Location	Diversion Capacity	Year of Agreement
Crestline-Lake Arrowhead Water Agency[a]	South shore of Silverwood Lake	DWR obtained CLAWA's combined water rights for Houston Creek, 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	1989 Agreement between the Department of Water Resources of the State of California and the Crestline-Lake Arrowhead Water Agency to Conserve Local Runoff Originating in the Houston Creek Watershed above Cedar Springs Dam.
Las Flores Ranch[b]	Mojave Siphon	Flow rates equal to the rate of natural streamflow entering the lake with a maximum diversion capacity of 23 cfs[1]	1980 Agreement between the State of California Department of Water Resources and the Las Flores Ranch, Ltd., for Operation of Las Flores Ranch Diversion to satisfy their water right diversion West Fork Mojave River downstream of Cedar Springs Dam.
Mojave Water Agency[a]	West Fork Mojave River downstream of Cedar Springs Dam	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 does not divert from the West Fork Mojave River, but allows water for groundwater recharge.	1982 Agreement between the State of California, Department of Water Resources and the Mojave River Water Agency to Conserve Flood Waters Originating in the Watershed Above Cedar Springs Dam to satisfy their established use along West Fork Mojave River downstream of Cedar Springs Dam.

Notes:
[a]SWP contractor
[b]Las Flores Ranch water rights were transferred to Hesperia Venture I, LLC in 2012.
Key:
AF = acre-feet
cfs = cubic feet per second
CLAWA = Crestline-Lake Arrowhead Water Agency
DWR = California Department of Water Resources
SWP = State Water Project

4.4.5.2 SWP Water Supply Contracts

As part of the SWP, the Project is operated primarily to deliver SWP water to various contractors in Southern California who have long-term water supply contracts with DWR. Table 4.4-5 lists the SWP contractors that are served by SWP water that passes through the Project and their associated maximum contractual annual water delivery amounts.

Table 4.4-5. SWP Contractors Served by the East Branch of the SWP

SWP Contractor	Annual Maximum SWP Water Delivery Amount (AF)[1]
Delivery Upstream of the Project	
Mojave Water Agency[2]	82,800
Subtotal	**82,800**
Delivery at Silverwood Lake	
Crestline–Lake Arrowhead Water Agency[3]	5,800
Subtotal	**5,800**
Delivery Downstream of the Project	
San Gabriel Valley Municipal Water District	28,800
San Bernardino Valley Municipal Water District	102,600
San Gorgonio Pass Water Agency	17,300
Coachella Valley Water District	138,350
Desert Water Agency	55,750
Metropolitan Water District of Southern California[4]	1,911,500
Subtotal[4]	**2,254,300**

Source: The State Water Project 2015 Draft Delivery Capability Report April 2015
Notes:
[1]The Mojave Water Agency rarely receives SWP delivery through Silverwood Lake. There is only one month from 2000 through 2014 that Mojave Water Agency received SWP delivery of 1 AF from Silverwood Lake.
[2]Crestline–Lake Arrowhead Water Agency is served by diversions from Silverwood Lake, rather than via the San Bernardino Tunnel
[3]Metropolitan Water District of Southern California is served by both the East and West Branches of the SWP
Key:
AF = acre-feet

4.4.6 Designated Beneficial Uses and Water Quality Standards

The SWRCB was created by the State Legislature in 1967 with the mission of ensuring the highest reasonable quality for waters of California, while allocating those waters to achieve the optimum balance of beneficial uses. The mission of the nine RWQCBs is to develop and enforce water quality objectives and implementation plans that will best protect the beneficial uses of the State's waters, recognizing local differences in climate, topography, geology, and hydrology. Silverwood Lake and the West Fork Mojave River are located within the Lahontan RWQCB. The Devil Canyon Afterbay and Devil Canyon Second Afterbay are physically located within the jurisdiction of the Santa Ana RWQCB, but are engineered water bodies that do not collect flows from the basin and do not discharge into surface waters. Therefore, beneficial uses and water quality objectives defined by the Santa Ana Regional Board are not discussed in this Section. From the Devil Canyon Afterbays, drinking water supplies are delivered to various downstream water contractors.

The Lahontan RWQCB establishes water quality standards in its Water Quality Control Plan, commonly known as the Lahontan Basin Plan. The Lahontan Basin Plan (California RWQCB Lahontan Region 1995) presents designated beneficial uses for surface water and groundwater and established numeric and narrative water quality objectives necessary to support the beneficial uses. Beneficial uses are categorized for major water bodies in the region:

- Inland surface waters (rivers, streams, lakes, and inland wetlands)
- Groundwater
- Coastal waters (bays, estuaries, lagoons, harbors, beaches, and ocean waters)
- Coastal wetlands

4.4.6.1 Beneficial Uses

Table 4.4-6 presents Lahontan Basin Plan definitions of beneficial uses and summarizes the designated beneficial uses of Silverwood Lake and the West Fork Mojave River. Both Silverwood Lake and the West Fork Mojave River overlie the Upper Mojave River Valley groundwater basin. In addition to direct precipitation, natural recharge of the basin is from ephemeral stream flow, infrequent surface flow of the Mojave River, and underflow of the Mojave River into the basin from the southwest (Eccles 1981; Stamos and Predmore 1995; Lines 1996).

Table 4.4-6. Designated Beneficial Uses of Surface Waters Potentially Affected by the Project

Beneficial Use	Description	Surface Waters	
		Silverwood Lake	West Fork Mojave River
		UPPER MOJAVE HU 628.20	MOJAVE HU 628.00
Municipal and Domestic Supply (MUN)	Beneficial uses of waters used for community, military, or individual water supply systems, including but not limited to, drinking water supply.	X	X
Agricultural Supply (ARG)	Beneficial uses of waters used for farming, horticulture, or ranching, including but not limited to, irrigation, stock watering, and support of vegetation for range grazing.	X	X
Ground Water Recharge (GWR)	Beneficial uses of waters used for natural or artificial recharge of groundwater for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers.	X	X

Table 4.4-6. Designated Beneficial Uses of Surface Waters Potentially Affected by the Project (continued)

Beneficial Use	Description	Surface Waters	
		Silverwood Lake	West Fork Mojave River
		UPPER MOJAVE HU 628.20	MOJAVE HU 628.00
Water Contact Recreation (REC-1)	Beneficial uses of waters used for recreational activities involving body contact with water where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, waterskiing, skin and scuba diving, surfing, whitewater activities, fishing, and use of natural hot springs.	X	X
Noncontact Water Recreation (REC-2)	Beneficial uses of waters used for recreational activities involving proximity to water, but not normally involving body contact with water where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tide pool and marine life study, hunting, sightseeing, and aesthetic enjoyment in conjunction with the above activities.	X	X
Commercial and Sportfishing (COMM)	Beneficial uses of waters used for commercial or recreational collection of fish or other organisms, including but not limited to, uses involving organisms intended for human consumption.	X	X
Warm Freshwater Habitat (WARM)	Beneficial uses of waters that support warm water ecosystems, including but not limited to, preservation and enhancement of aquatic habitats, vegetation, fish, and wildlife, including invertebrates.	N/A	X
Cold Freshwater Habitat (COLD)	Beneficial uses of waters that support cold water ecosystems, including but not limited to, preservation and enhancement of aquatic habitats, vegetation, fish, and wildlife, including invertebrates.	X	X
Wildlife Habitat (WILD)	Beneficial uses of waters that support wildlife habitats, including but not limited to, the preservation and enhancement of vegetation and prey species used by wildlife, such as waterfowl.	X	X

Source: California RWQCB Lahontan Region 1995
Key:
HU = Hydrologic unit
N/A = beneficial use not designated for this water body

4.4.6.2 Water Quality Objectives

The Lahontan Basin Plan presents water quality objectives designed to protect established beneficial uses. Table 4.4-7 presents objectives for inland surface waters. Table 4.4-8 presents numeric water quality objectives that apply to select water bodies in the Lahontan Region.

4.4.6.3 National Toxics Rule and California Toxics Rule

In addition to state standards in the Lahontan Basin Plan, federal water quality standards for certain toxic pollutants are contained in the National Toxics Rule (NTR) (40 CFR § 131.36) and the California Toxics Rule (CTR) (40 CFR § 131.37). The EPA adopted the NTR on December 22, 1992, and later amended it on May 4, 1995, and on November 9, 1999. About 40 criteria in the NTR are applied in California. This rule promulgates for 14 states the chemical-specific, numeric criteria for priority toxic pollutants necessary to bring all states into compliance with the requirements of Section 303(c)(2)(B) of the CWA. For a few states, EPA promulgated a limited number of criteria which were previously identified as necessary in disapproval letters to such states, and which the state has failed to address. For other states, federal criteria are necessary for all priority toxic pollutants for which EPA has issued Section 304(a) water quality criteria guidance and that are not the subject of approved state criteria. These standards are the legally enforceable standards in the named states for all purposes and programs under the CWA, including planning, monitoring, National Pollutant Discharge Elimination System (NPDES) permitting, enforcement and compliance.

On March 2, 2000, the SWRCB adopted the Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (State Implementation Policy or SIP). The SIP establishes implementation provisions for priority pollutant criteria and objectives and provisions for chronic toxicity control. On May 18, 2000, the EPA adopted the CTR. The CTR promulgated new toxics criteria for California and incorporated the previously adopted NTR criteria that were applicable in the State. EPA promulgated this rule to protect human health and the environment and to fill a gap in California water quality standards that was created in 1994 when a State court overturned the State's water quality control plans containing water quality criteria for priority toxic pollutants. The rule promulgated (1) ambient aquatic life criteria for 23 priority toxics; (2) ambient human health criteria for 57 priority toxics; and (3) a compliance schedule provision which authorizes the State to issue schedules of compliance for new or revised NPDES permit limits based on the federal criteria. The State must use the criteria together with the State's existing water quality standards when controlling pollution in inland waters and enclosed bays and estuaries. The numeric water quality criteria contained in the final rule are identical to EPA's recommended CWA Section 304(a) criteria for these pollutants published in December 1998 (63 Federal Register (FR) 68353).

Table 4.4-7. Summary of Water Quality Objectives for Inland Surface Waters in the Lahontan Region

Parameter	Summary of Water Quality Objectives
Non-degradation Objective	Whenever the existing quality of water is better than the quality of water established in this Basin Plan as objectives (both narrative and numerical), such existing quality shall be maintained unless appropriate findings are made under the policy.
Unionized Ammonia	The fraction of toxic NH_3 to total ammonia species (NH_4^+ + NH_3) is a function of temperature and pH. Basin Plan Tables 3-1 to 3-4 were derived from USEPA ammonia criteria for freshwater. Ammonia concentrations shall not exceed the values listed for the corresponding conditions in these tables .
Coliform Bacteria	Waters shall not contain concentrations of coliform organisms attributable to anthropogenic sources, including human and livestock wastes. The fecal coliform concentration during any 30-day period shall not exceed a log mean of 20/100 ml, nor shall more than 10 percent of all samples collected during any 30-day period exceed 40/100 ml.
Biostimulatory Substances	Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect the water for beneficial uses.
Chemical Constituents	Waters designated as MUN shall not contain concentrations of chemical constituents in excess of the maximum contaminant level (MCL) or secondary maximum contaminant level (SMCL) based upon drinking water standards specified in Title 22 of the California Code of Regulations, which are incorporated by reference into this plan: Table 64431-A of Section 64431 (Inorganic Chemicals), Table 64431-B of Section 64431 (Fluoride), Table 64444-A of Section 64444 (Organic Chemicals), Table 64449-A of Section 64449 (Secondary Maximum Contaminant Levels-Consumer Acceptance Limits), and Table 64449-B of Section 64449 (Secondary Maximum Contaminant Levels-Ranges). Waters designated as AGR shall not contain concentrations of chemical constituents in amounts that adversely affect the water for beneficial uses (i.e., agricultural purposes). Waters shall not contain concentrations of chemical constituents in amounts that adversely affect the water for beneficial uses.
Total Residual Chlorine	For the protection of aquatic life, total chlorine residual shall not exceed either a median value of 0.002 mg/L or a maximum value of 0.003 mg/L.
DO	The dissolved oxygen concentration, as percent saturation, shall not be depressed by more than 10 percent, nor shall the minimum dissolved oxygen concentration be less than 80 percent of saturation. For waters with the beneficial uses of COLD, COLD with SPWN, WARM, and WARM with SPWN, the minimum dissolved oxygen concentration shall not be less than that specified in Basin Plan Table 3-6. Cold Freshwater Habitat shall have a minimum 30 day mean DO of 6.5 mg/L; for Warm Freshwater Habitat, the minimum 30-day mean shall be at 5.5 mg/L (Lahontan Basin Plan Table 3-6).
Color	Waters shall be free of coloration that causes nuisance or adversely affects the water for beneficial uses.
Floating Materials	Waters shall not contain floating material, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect the water for beneficial uses. For natural high quality waters, the concentrations of floating material shall not be altered to the extent that such alterations are discernable at the 10 percent significance level.
Oil and Grease	Waters shall not contain oils, greases, waxes or other materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or otherwise adversely affect the water for beneficial uses. For natural high quality waters, the concentration of oils, greases, or other film or coat generating substances shall not be altered.
Nondegradation of Aquatic Communities and Populations	All wetlands shall be free from substances attributable to wastewater or other discharges that produce adverse physiological responses in humans, animals, or plants; or which lead to the presence of undesirable or nuisance aquatic life. All wetlands shall be free from activities that would substantially impair the biological community as it naturally occurs due to physical, chemical and hydrologic processes.
Pesticides	For the purposes of this Basin Plan, pesticides are defined to include insecticides, herbicides, rodenticides, fungicides, pesticides and all other economic poisons. Pesticide concentrations, individually or collectively, shall not exceed the lowest detectable levels, using the most recent detection procedures available. There shall not be an increase in pesticide concentrations found in bottom sediments. There shall be no detectable increase in bioaccumulation of pesticides in aquatic life. Waters designated as MUN [Municipal and Domestic Supply] shall not contain concentrations of pesticides or herbicides in excess of the limiting concentrations specified in Table 64444-A of Section 64444 (Organic Chemicals) of Title 22 of the California Code of Regulations.
pH	In fresh waters with designated beneficial uses of COLD or WARM, changes in normal ambient pH levels shall not exceed 0.5 pH units. For all other waters of the Region, the pH shall not be depressed below 6.5 nor raised above 8.5.
Radioactivity	Radionuclides shall not be present in concentrations that are deleterious to human, plant, animal, or aquatic life or that result in the accumulation of radionuclides in the food web to an extent that presents a hazard to human, plant, animal, or aquatic life. Waters designated as MUN shall not contain concentrations of radionuclides in excess of the limits specified in Table 4 of Section 64443 (Radioactivity) of Title 22 of the California Code of Regulations.
Sediment	The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect the water for beneficial uses.
Settleable Materials	Waters shall not contain substances in concentrations that result in deposition of material that causes nuisance or that adversely affects the water for beneficial uses. For natural high quality waters, the concentration of settleable materials shall not be raised by more than 0.1 milliliter per liter.
Suspended Materials	Waters shall not contain suspended materials in concentrations that cause nuisance or adversely affects the water for beneficial uses. For natural high quality waters, the concentration of total suspended materials shall not be altered to the extent that such alterations are discernible at the 10 percent significance level.
Taste and Odor	Waters shall not contain taste or odor-producing substances in concentrations that impart undesirable tastes or odors to fish or other edible products of aquatic origin, that cause nuisance, or that adversely affect the water for beneficial uses. For naturally high-quality waters, the taste and odor shall not be altered.

Table 4.4-7. Summary of Water Quality Objectives for Inland Surface Waters in the Lahontan Region (continued)

Parameter	Summary of Water Quality Objectives
Temperature	The natural receiving water temperature of all waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Board that such an alteration in temperature does not adversely affect the water for beneficial uses. For waters designated WARM, water temperature shall not be altered by more than five degrees Fahrenheit (5°F) above or below the natural temperature. For waters designated COLD, the temperature shall not be altered. Temperature objectives for COLD interstate waters and WARM interstate waters are as specified in the “Water Quality Control Plan for Control of Temperature in The Coastal and Interstate Waters and Enclosed Bays and Estuaries of California” including any revisions.
Toxicity	All waters shall be maintained free of toxic substances in concentrations that are toxic to, or produce detrimental physiological responses in human, plant, animal, or aquatic life.
Turbidity	Waters shall be free of changes in turbidity that cause nuisance or adversely affect the water for beneficial uses. Increases in turbidity shall not exceed natural levels by more than 10 percent.

Source: California RWQCB Lahontan Region 1995
Key:
ARG = Agricultural Supply
CCR = California Code of Regulations
COLD = Cold Freshwater Habitat
COMM = Commercial and Sportfishing
DO = Dissolved oxygen
F = Fahrenheit
GWR = Ground Water Recharge
mg/L = milligram per liter
ml = milliliter
EPA = U.S. Environmental Protection Agency
MUN = Municipal and Domestic Supply
REC-1 = Water Contact Recreation
REC-2 = Noncontact Water Recreation
WARM = Warm Freshwater Habitat
WILD = Wildlife Habitat

Table 4.4-8. Numerical Water Quality Objectives for Silverwood Lake and West Fork Mojave River

Surface Water	Water Quality Objectives (mg/L)							
	TDS	Cl	SO_4	F	B	NO_3	N	PO_4
Silverwood Lake								
Annual Average value	220	55	20	--	--	--	--	--
90th Percentile Value	440	110	110	--	--	--	--	--
West Fork Mojave River (at Forks – northeast of Silverwood Lake and outside of the Project boundary)								
Annual Average Value	--	55	35	1.5	0.2	--	--	--
90th Percentile Value	--	100	100	2.5	0.3	--	--	--
West Fork Mojave River (at Lower Narrows – northeast of Silverwood Lake and outside of the Project boundary)								
	312					5		

Source: California RWQCB Lahontan Region 1995
Key:
B = boron
Cl = chloride
F = fluoride
FERC = Federal Energy Regulatory Commission
mg/L = milligram per liter
N = nitrogen, total
NO3-N = nitrate
SO4 = sulfate
PO4 = dissolved orthophosphate
TDS = total dissolved solids (total filterable residue)

4.4.6.4 Waterbody-Specific Objectives

In addition to the general objectives, the Lahontan Basin Plan has established waterbody-specific objectives for certain surface waters, including Silverwood Lake. The objectives for the West Fork Mojave River are listed in Table 4.4-8 for reference; however, these reaches are outside the Project boundary. The Lahontan Basin Plan also sets numerical water quality objectives for total dissolved solids (TDS) and nitrate for reaches of the Mojave River (outside of the Project boundary) that flow underground in a confined channel, and that normally flow underground, but will surface under high-flow conditions. Numerical objectives are designed to represent the maximum amount of pollutants that can remain in the water column without causing any adverse effect on organisms using the aquatic system as habitat, on people consuming those organisms or water, and on other current or potential beneficial uses.

4.4.6.5 Total Maximum Daily Loads

The RWQCB is responsible for implementing provisions and pollution control requirements that the federal CWA specifies for surface waters of the United States within its region. CWA Section 303(d) requires the State to identify "impaired" waterbodies (surface waterbodies that do not fully achieve their designated beneficial uses and/or are in noncompliance with water quality objectives). Following the identification of impaired water bodies, the State establishes a priority list that identifies the pollutants that cause the impairments and then develops pollutant loading limits called Total Maximum Daily Loads (TMDL) for each pollutant. The TMDL analysis seeks to establish quantifiable and measurable numeric targets. These targets must ensure compliance with water quality standards (beneficial uses and water quality objectives).

The 2012 303(d) list includes Silverwood Lake for mercury and polychlorinated biphenyls (PCB). Evidence shows at least one use is not supported and a TMDL is needed; the expected TMDL completion year is 2025 (California RWQCB Lahontan Region 2014). According to the California Office of Environmental Health Hazard Assessment (OEHHA), the sources of these compounds in the lake are not known (OEHHA 2013).

4.4.7 <u>Existing Water Quality</u>

Project water quality monitoring has been conducted by DWR since 1968. The water quality program monitors eutrophication, salinity and other parameters of concern for drinking water, recreation, and fish and wildlife purposes. Additional data are collected by the MWD. The monitoring program consists of collection, analysis, data archiving, and dissemination of data and information describing the quality of surface water resources. Extensive water quality sampling and analysis is ongoing by both DWR and MWD; the frequency of monitoring by parameter is summarized in Tables 4.4-9 and 4.4-10. Results of water quality analyses are also summarized below.

4.4.7.1 Silverwood Lake

Water sources for Silverwood Lake are drainage from the Silverwood Lake watershed and imports from the East Branch of the SWP. Based on its limited average hydraulic flushing rate of 32.4 days (Table 4.4-2) and natural inflows, Silverwood Lake does not moderate water quality the way larger reservoirs do.

<u>General Parameters</u>

As noted above, the Lahontan Basin Plan establishes water quality objectives for Silverwood Lake for TDS, chloride, and sulfate. Based on surface water samples (surface to 1 meter depth) collected by DWR from January 2010 through May 2015, average TDS (256 milligrams per liter [mg/L]) are above the annual average objective of 220 mg/L; the maximum 90^{th} percentile TDS objective of 440 mg/L was not exceeded during the 2010 through 2015 time period (Table 4.4-11). Dissolved chloride values averaged 63 mg/L, in excess of the 55 mg/L annual average objective; the 90^{th} percentile objective of 110 mg/L was not exceeded during the 2010 through 2015 time period. Average dissolved sulfate concentrations (40 mg/L) also exceeded the annual average water quality objective of 20 mg/L; the 90^{th} percentile objective of 110 mg/L was not exceeded during the 2010 through 2015 time period.

Table 4.4-9. Frequency of DWR Water Quality Monitoring in Silverwood Lake and Devil Canyon Second Afterbay

Parameter	Monitoring Frequency Silverwood Lake	Monitoring Frequency Devil Canyon Second Afterbay
Project Standard Parameters (Alkalinity, Aluminum, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Calcium, Chloride, Chromium, Copper, Fluoride, Iron, Lead, Magnesium, Manganese, Mercury, Nitrate, Selenium, Silver, Sodium, Dissolved Solids, Specific Conductance, Sulfate, Turbidity, and Zinc)	Quarterly	Monthly
Nutrients	Monthly	Monthly
Total Organic Carbon	--	Monthly
Dissolved Organic Carbon	--	Monthly
Turbidity	Quarterly	Monthly
Bromide	Monthly	Monthly
Phytoplankton	Weekly (Bi-monthly in winter)	--
Pesticides and Herbicides	--	3 times per Year
Methyl Tert-Butyl Ether (purgeable organics)	--	3 times per Year
Reservoir Profile (pH, Dissolved Oxygen, Depth, Temperature, Electrical Conductivity)	Weekly (Bi-monthly in winter)	--

Source: DWR 2015a

Table 4.4-10. Frequency of MWD Water Quality Monitoring in Silverwood Lake

Parameter	Monitoring Frequency
Aluminum, Copper	Monthly
Ammonia, Total + Nitrite	Monthly
Arsenic	Weekly
Bacteriological	Monthly
Bromide	Weekly
Chrome 6	Quarterly
Color	Quarterly
Cyanide, Total	Annually
Dissolved Organic Carbon	Weekly
Gamma Isotopics	Quarterly
General Minerals	Monthly
Gross Alpha & Beta	Quarterly
Methylene Blue Active Substances	Annually
Mercury	Bi-Annually
Nitrate/Sulfate	Monthly
Nitrite	Annually
Perchlorate	Quarterly
Phosphorus, Soluble Reactive	Monthly
Phosphorus, Total	Monthly
Taste and Odor	Bi-Weekly
Total Kjeldahl Nitrogen	Monthly
Total Organic Carbon	Weekly
Total Organic Nitrogen	Annually
Trace Metals	Bi-Annually
Tritium	Quarterly
Ultraviolet	Weekly
Volatile Organic Compounds	Quarterly

Source: MWD 2015
Note: Sampling Frequency at Silverwood Lake Outlet at North Park

Table 4.4-11. Summary of DWR Water Quality Data for Silverwood Lake – General Parameters, January 2010 through May 2015

Parameter	Units	Reporting Limit	2010 through 2015 Minimum	2010 through 2015 Maximum	2010 through 2015 Average[1]	Number of Samples
Total Alkalinity	mg/L as $CaCO_3$	1	46	84	71	22
Dissolved Bromide	mg/L as $CaCO_3$	0.01	0.04	1	0.23	68
Dissolved Calcium	mg/L	1	12	31	21	22
Dissolved Chloride	mg/L	0.1	19	102	63	24
Dissolved Fluoride[2]	mg/L	0.1	<R.L.	0.1	<R.L.	20
Hardness	mg/L as $CaCO_3$	1	53	118	94	22
Dissolved Magnesium	mg/L	1	5	14	10	22
Dissolved Sodium	mg/L	1	18	84	53	22
Total Dissolved Solids	mg/L	1	110	378	256	23
Suspended Solids[3]	mg/L	0.1	<R.L.	12.4	2.7	65
Turbidity	NTU	1	<R.L.	4	1.4	24
Dissolved Sulfate	mg/L	1	16	74	40	24

Source: DWR 2010 through 2015, Station SI002000
Notes:
[1]Half the reporting limit value used for averaging where applicable.
[2]Dissolved fluoride data summarized from August 2002 through August 2007; 18/23 records were below the reporting limit.
[3]Suspended solids data summarized from November 1985 through November 1990; 3/65 records were below the reporting limit.
Key:
CaCO3 = calcium carbonate
mg/L = milligram per liter
NTU = Nephelometric Turbidity Unit
R.L = reporting limit
< = less than

Field Measurements

DWR uses meters to collect monthly data for conductivity, dissolved oxygen, temperature, pH, and turbidity at the surface (1 meter depth) of Silverwood Lake at station SI002000 (Table 4.4-12; Figure 4.4-2). Secchi depth is measured with a Secchi disc. Average dissolved oxygen in surface samples for the period of January 2010 through May 2015 exceeded the minimum Lahontan Basin Plan (30 day mean) objective of 6.5 mg/L for water bodies designated with a Cold Freshwater Habitat beneficial use. Peak dissolved oxygen levels in surface waters are observed in February (when temperatures were lowest), and lowest levels are observed in August (when temperatures were highest).

In addition to surface samples, field parameters (temperature, conductivity, dissolved oxygen, and pH) are also measured by DWR throughout the water column one to four times per month at two stations in Silverwood Lake (Figure 4.4-2). Based on the 2013 and 2014 data (the most recent years of complete data), dissolved oxygen is depicted by month in Figure 4.4-3. The stratification observed is typical of a warm monomictic lake with one mixing in the winter; the lake does not freeze. The clinograde oxygen profiles in warmer weather reflect an excess of oxygen consumption in the hypolimnion. Based on these data, a thermocline developed in the lake in March and the lake was mixed again by November. In February 2014, dissolved oxygen varied by 1.4 (Station 1) to 2.3 (Station 2) mg/L from the top to the bottom of the water column; the lake was mixed and well oxygenated throughout. The minimum water temperature in February 2014 was 9.1 degrees Celsius (°C). In August 2014, levels of dissolved oxygen at Stations 1 and 2 varied by more than 6 mg/L. The lake was stratified with a thermocline at approximately 22 meters. On this date in August, average dissolved oxygen above the thermocline (0 to 22 meters) was 5.5 mg/L at Station 1 and 6.4 mg/L at Station 2. Average dissolved oxygen below the thermocline (24 m to bottom) was 0.4 mg/L at Station 1 and 0.5 at Station 2. Anoxic conditions were observed in August at both stations in the lowest 4 meters of the lake. The maximum water temperature in August was 23.5°C.

The Lahontan Basin Plan objective for dissolved oxygen is a mean annual concentration greater than 7 mg/L, with no single determination less than 5.0 mg/L, except when natural conditions cause lesser concentrations. The mean annual dissolved oxygen concentration for 2013 (latest year with 12 months of available data) was 7.0 mg/L at both Stations 1 and 2 – just at the 7 mg/L standard. Individual dissolved oxygen concentrations below 5.0 were observed due to lake stratification.

Table 4.4-12. Summary of DWR Water Quality Data for Silverwood Lake – Field Parameters, January 2010 through May 2015

Parameter	Units	Reporting Limit	2010 through 2015 Minimum	2010 through 2015 Maximum	2010 through 2015 Average	Number of Samples
Field Conductivity	µS/cm	1	205	599	444	62
Field Dissolved Oxygen	mg/L	0.1	6.1	11.5	8.1	62
Water Temperature	°C	0.1	7.5	26.5	16.0	63
Field pH	pH units	0.1	7.7	9.1	8.3	63
Field Secchi Depth	m	0.1	1.0	7.5	4.5	63
Turbidity	NTU	1	<R.L.	4.0	1.4	22

Source: DWR 2010 through 2015, Station SI002000
Note: Data from surface samples
Key:
°C = degrees Celsius
mg/L = milligram per liter
NTU = Nephelometric Turbidity Unit
µS/cm = microsiemens per centimeter
< = less than

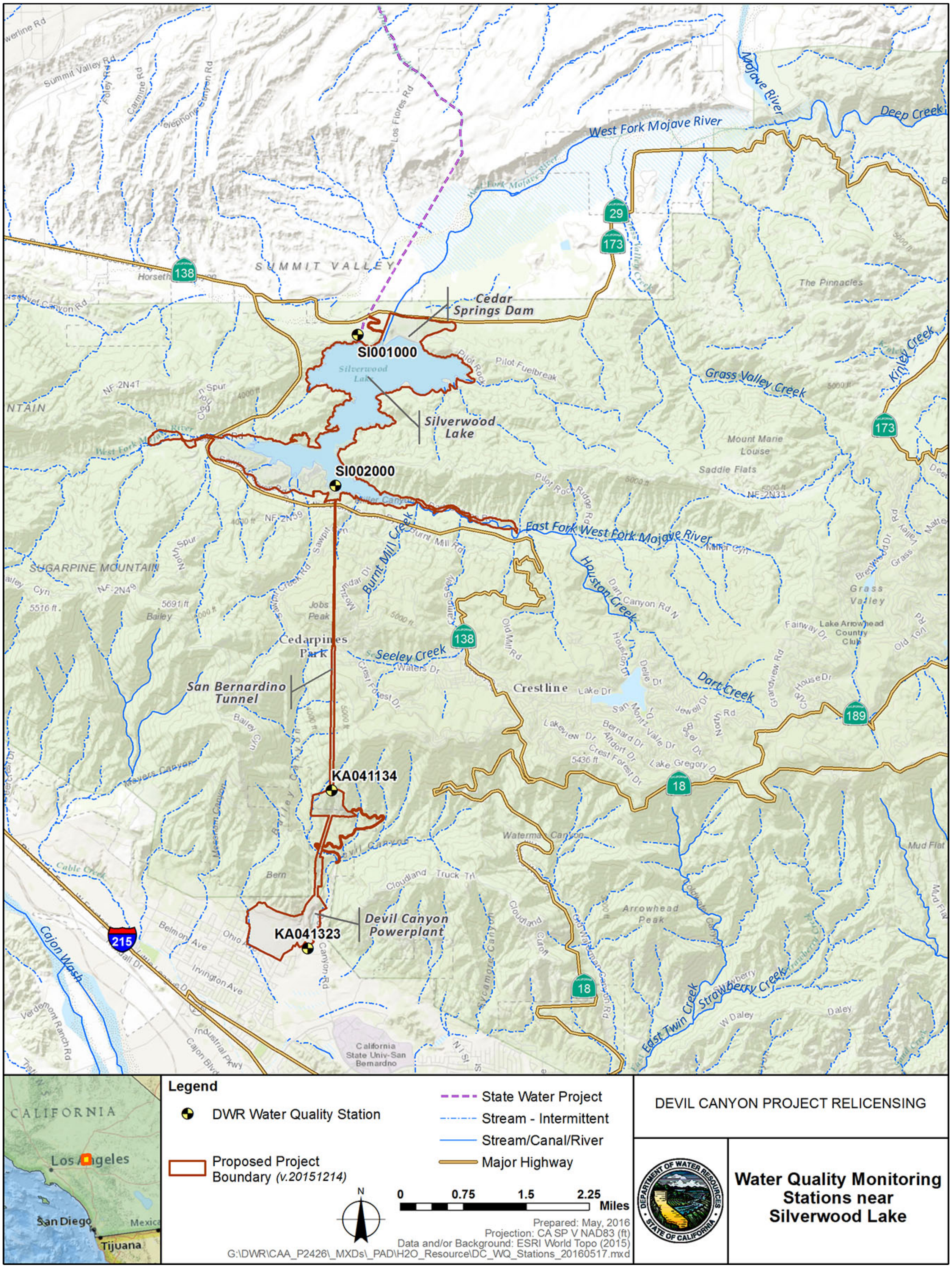
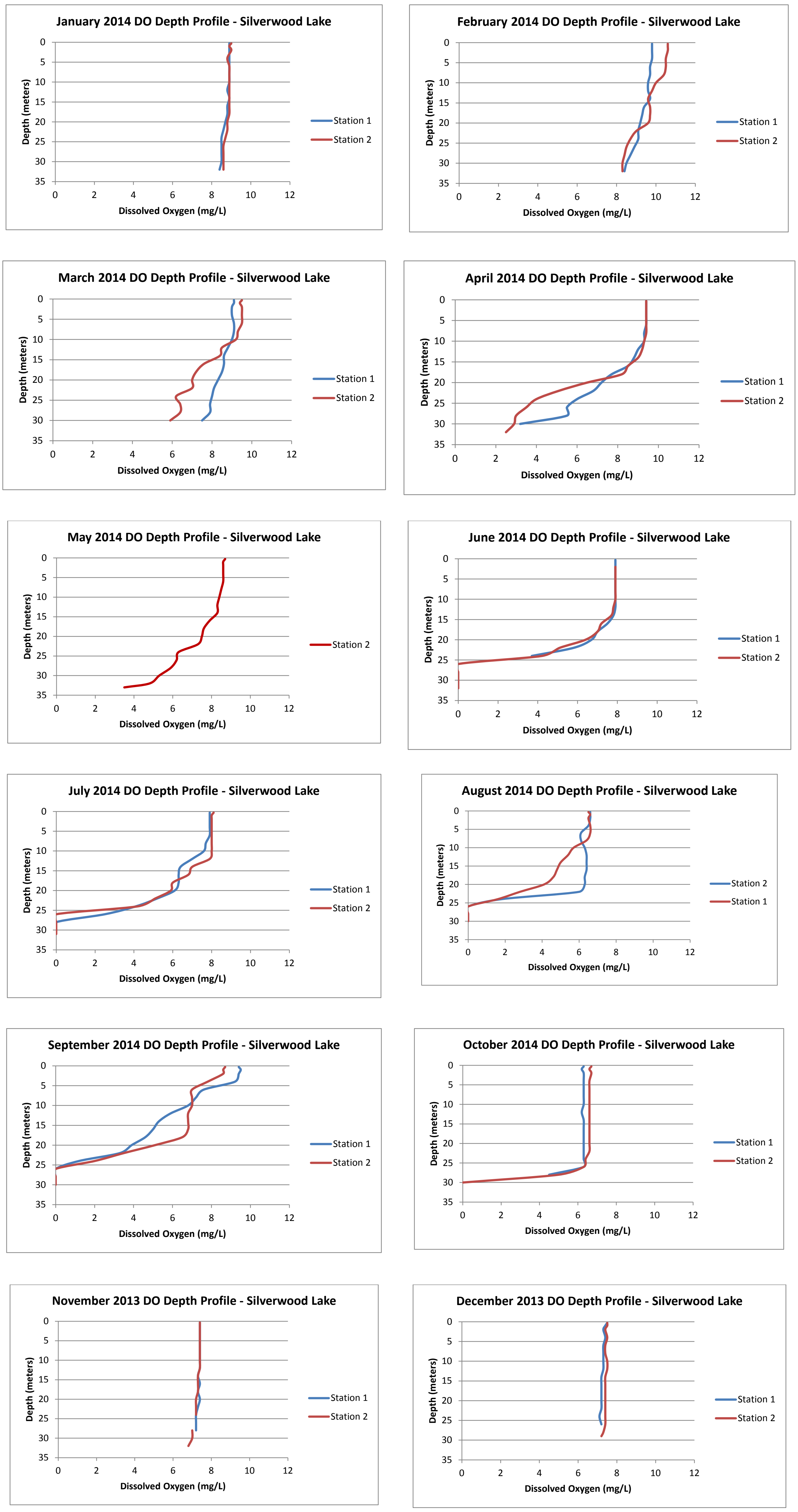


Figure 4.4-2. Water Quality Monitoring Stations near Silverwood Lake



Source: DWR 2014d
Key:
mg/L = milligram per liter

Figure 4.4-3. Dissolved Oxygen Monthly Depth Profile Silverwood Lake, 2014 (2013 for November and December)

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Nutrients

Nutrients in surface waters are required for proper aquatic ecosystem function. However, readily available nutrients along with other favorable environmental conditions can result in algal growth at levels that cause taste and odor in drinking water, produce algal toxins, and add organic carbon. Anaerobic conditions from excess algal growth can also lead to high ammonia levels (SWP Contractors Authority and DWR 2012). DWR applies copper –based algaecides (copper sulfate pentahydrate, Komeen®, Nautique®, Captain XTR®, EarthTec®) and sodium carbonate peroxyhydrate algaecide (PAK®27) on an as-needed basis to control algal blooms in Silverwood Lake (DWR 2016a). Table 4.4-13 summarizes Silverwood Lake nutrient data from January 2010 through May 2015.

To prevent the development of biological nuisances, and to control accelerated or cultural eutrophication, the EPA recommendation is a maximum of 25 micrograms per liter (µg/L) total phosphates as phosphorus (P) within lakes and reservoirs (EPA 1986). Average total phosphorus concentrations in Silverwood Lake are higher than this recommendation (50 µg/L as P); however, no specific phosphorus limitations are specified in the Lahontan Basin Plan for Silverwood Lake (California RWQCB Lahontan Region 1995). The Lahontan Basin Plan objective states that “waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect the water for beneficial uses.”

Observed maximum and average nitrogen levels are below the primary drinking water standards of 1 mg/L nitrite-nitrogen and 10 mg/L nitrate-nitrogen. Over the five-year data period (January 2010 through May 2015) the highest observed dissolved ammonia nitrogen value of 0.26 mg/L occurred on December 18, 2013. With pH of 7.7 and water temperature of 10.6°C on that date, the 4-day average concentration for ammonia nitrogen standard would be a maximum of 2.06 mg/L and the one-hour average concentration would be a maximum of 8.96 mg/L for waters designated with a Cold Freshwater Habitat beneficial use (California RWQCB Lahontan Region 1995).

Table 4.4-13. Summary of DWR Water Quality Data for Silverwood Lake – Nutrients, January 2010 through May 2015

Parameter	Units	Reporting Limit	2010 through 2015 Minimum	2010 through 2015 Maximum	2010 through 2015 Average[1]	Number of Samples
Dissolved Ammonia	mg/L as N	0.01	<R.L.	0.26	0.06	72
Dissolved Nitrate	mg/L	0.1[a]	<R.L.	4.4 (0.99 NO_3-N)	1.81 (0.41 NO_3-N)	24
Dissolved Nitrate + Nitrite	mg/L as N	0.01	<R.L.	0.93	0.39	75
Total Kjeldahl Nitrogen	mg/L as N	0.1	0.1	1.3	0.45	66
Dissolved Ortho-phosphate	mg/L as P	0.01	<R.L.	0.07	0.03	75
Total Phosphorus	mg/L as P	0.01	0.01	0.11	0.05	66

Source: DWR 2010 through 2015, Station SI002000
Notes:
[1]Half the reporting limit value used for averaging where applicable.
[a]Three samples with reporting limits greater than 0.1 mg/L
Key:
mg/L = milligram per liter
N = Nitrogen
NO_3-N = Nitrate
P = Phosphorus
R.L. = reporting limit
< = less than

Trace Elements

Results of analyses for trace elements in Silverwood Lake water are presented in Table 4.4-14. Of the inorganic chemicals for which maximum contaminant levels (MCL) exist, none of the observed concentrations exceed the MCLs or the Public Health Goals (PHG), with the exception of arsenic. MCLs are the maximum permissible level of a contaminant in water which is delivered to any user of a public water system. Primary MCLs are drinking water standards to address health concerns; secondary MCLs address compounds that affect the taste and odor of drinking water. The Calderon-Sher Safe Drinking Water Act requires OEHHA to develop a PHG for each drinking water contaminant that is regulated with an MCL. Drinking water that complies with all MCLs is considered safe to drink, even if some contaminants exceed PHG levels. A PHG represents a health-protective level for a contaminant that SWRCB and California’s public water systems should strive to achieve if it is feasible to do so.

Table 4.4-14. Summary of DWR Water Quality Data for Silverwood Lake – Trace Elements, January 2010 through May 2015

Parameter	Units	Reporting Limit	2010 through 2015 Minimum	2010 through 2015 Maximum	2010 through 2015 Average[1]	Number of Samples
Dissolved Aluminum	mg/L	0.01	<R.L.	0.01	<R.L.	23
Antimony[2]	mg/L	0.005	<R.L.	<R.L.	<R.L.	3
Dissolved Arsenic	mg/L	0.001	0.001	0.006	0.0029	23
Dissolved Barium	mg/L	0.05-0.005	<R.L.	0.044	0.030	23
Dissolved Beryllium	mg/L	0.001	<R.L.	<R.L.	<R.L.	23
Dissolved Boron	mg/L	0.1	0.1	0.3	0.1636	22
Dissolved Cadmium	mg/L	0.001	<R.L.	<R.L.	<R.L.	23
Dissolved Chromium	mg/L	0.001	<R.L.	0.001	<R.L.	23
Chromium, Hexavalent[3]	mg/L	0.01	<R.L.	<R.L.	<R.L.	22
Dissolved Copper	mg/L	0.001	0.001	0.004	0.002	23
Dissolved Iron	mg/L	0.005	<R.L.	0.027	0.009	23
Dissolved Lead	mg/L	0.001	<R.L.	<R.L.	<R.L.	23
Dissolved Manganese	mg/L	0.005	<R.L.	0.009	<R.L.	23
Dissolved Mercury	mg/L	0.0002	<R.L.	0.0007	<R.L.	22
Dissolved Nickel	mg/L	0.001	<R.L.	0.001	0.0009	23
Dissolved Selenium	mg/L	0.001	<R.L.	0.002	0.0009	23
Dissolved Silver	mg/L	0.001	<R.L.	<R.L.	<R.L.	23
Dissolved Zinc	mg/L	0.005	<R.L.	<R.L.	<R.L.	23

Source: DWR 2010 through 2015, Station SI002000
Notes:
[1]Half the reporting limit value used for averaging where applicable.
[2]Results from three samples taken in 2000.
[3]Results from 22 samples taken from 1972 through 1976.
Key:
mg/L = milligram per liter
R.L. = reporting limit
< = less than

The observed maximum dissolved arsenic value in Silverwood Lake (from 2010 through 2015) of 0.006 mg/L is below the MCL of 0.010 mg/L, but above the PHG of 0.000004 mg/L. In the SWP system, the source of arsenic is groundwater that is allowed into the SWP between Check 21 and Check 41 (approximately 100 miles north of Silverwood Lake) (SWP Contractors Authority and DWR 2012).

Dissolved copper levels in water samples from Silverwood Lake (2010 through 2015 average of 0.002 mg/L) are below the Action Levels of 1.3 and 0.3 mg/L established by the Lead and Copper Rule, 22 CCR § 64672.3.

Organic Chemicals

DWR has collected samples for organic chemicals in Silverwood Lake, including pesticides, herbicides, and purgeable (volatile) organics. Based on more than 5 years of data (January 1997 through May 2002) from station SI002000 (Figure 4.4-2), most organic chemicals have not been detectable in Silverwood Lake water (Table 4.4-15). Of the 64 compounds tested, results for five parameters were above the laboratory reporting limit:

- 1,2,4-Trimethylbenzene – Used in United States commerce in the manufacture of trimellitic anhydride, dyes, and pharmaceuticals and as a solvent and paint thinner. The maximum observed concentration (0.65 µg/L) is well below the public health protective concentration of 330 µg/L (OEHHA 2001).

- Toluene – Occurs naturally as a component of crude oil and is produced in petroleum refining and coke oven operations; toluene is a major aromatic constituent of gasoline. The maximum observed concentration (2.5 µg/L) is below the Criterion Concentration for taste and odor of 42 µg/L (Federal Register, Vol. 54, No. 97, pp. 22138, 22139) and below the PHG of 150 µg/L (OEHHA 2001).

- Methyl tert-butyl ether (MTBE) – Was used as a gasoline additive, designed to improve air quality. California has prohibited the use of MTBE in gasoline since January 1, 2004. The maximum observed concentration in Silverwood Lake from 1997 to 2002 was 12 µg/L (in 1997); this value was below the primary MCL and PHG of 13 µg/L (OEHHA 2001) but above the secondary MCL for taste and odor of 5 µg/L. However, more recent samples in Silverwood Lake (2002) were below the reporting limit (1 µg/L) for MTBE.

- m-Xylene and o-Xylene – Used in the chemical industry as solvents for products including paints, inks, dyes, adhesives, pharmaceuticals, and detergents. Used in the petroleum industry as antiknock agents in gasoline. The maximum observed concentration of m-xylene was 1.9 µg/L in 1997. The maximum observed concentration of o-xylene was 0.97 µg/L in 1997. Standards are for the sum of isomers: California Primary MCL of 1,750 µg/L and California Public Health Goal (OEHHA 2001) of 1,800 µg/L. The taste and odor standard is 17 µg/L (Federal Register, Vol. 54, No. 97, pp. 22138,22139).

Table 4.4-15. Summary of DWR Water Quality Data for Silverwood Lake – Organic Chemicals, January 1997 through May 2002

Parameter	Units	Reporting Limit	1997 – 2002 Minimum	1997 – 2002 Maximum	Number of Samples	Number of Samples over R.L.
1,1,1,2-Tetrachloroethane	µg/L	0.5	<R.L.	<R.L.	73	0
1,1,1-Trichloroethane	µg/L	0.5	<R.L.	<R.L.	73	0
1,1,2,2-Tetrachloroethane	µg/L	0.5	<R.L.	<R.L.	73	0
1,1,2-Trichloroethane	µg/L	0.5	<R.L.	<R.L.	40	0
1,1-Dichloroethane	µg/L	0.5	<R.L.	<R.L.	73	0
1,1-Dichloroethene	µg/L	0.5	<R.L.	<R.L.	73	0
1,1-Dichloropropene	µg/L	0.5	<R.L.	<R.L.	73	0
1,2,3-Trichlorobenzene	µg/L	0.5	<R.L.	<R.L.	73	0
1,2,3-Trichloropropane	µg/L	0.5	<R.L.	<R.L.	73	0
1,2,4-Trichlorobenzene	µg/L	0.5	<R.L.	<R.L.	73	0
1,2,4-Trimethylbenzene	µg/L	0.5	<R.L.	0.65	73	3
1,2-Dibromo-3-chloropropane (DBCP)	µg/L	0.5	<R.L.	<R.L.	73	0
1,2-Dibromoethane (EDB)	µg/L	0.5	<R.L.	<R.L.	40	0
1,2-Dichlorobenzene	µg/L	0.5	<R.L.	<R.L.	73	0
1,2-Dichloroethane	µg/L	0.5	<R.L.	<R.L.	73	0
1,2-Dichloropropane	µg/L	0.5	<R.L.	<R.L.	73	0
1,3,5-Trimethylbenzene	µg/L	0.5	<R.L.	<R.L.	73	0
1,3-Dichlorobenzene	µg/L	0.5	<R.L.	<R.L.	73	0
1,3-Dichloropropane	µg/L	0.5	<R.L.	<R.L.	73	0
1,4-Dichlorobenzene	µg/L	0.5	<R.L.	<R.L.	73	0
2,2-Dichloropropane	µg/L	0.5	<R.L.	<R.L.	73	0
2-Chlorotoluene	µg/L	0.5	<R.L.	<R.L.	73	0
4-Chlorotoluene	µg/L	0.5	<R.L.	<R.L.	73	0
4-Isopropyltoluene	µg/L	0.5	<R.L.	<R.L.	73	0
Benzene	µg/L	0.5	<R.L.	<R.L.	73	0
Bromobenzene	µg/L	0.5	<R.L.	<R.L.	73	0
Bromochloromethane	µg/L	0.5	<R.L.	<R.L.	73	0
Bromodichloromethane	µg/L	0.5	<R.L.	<R.L.	73	0
Bromoform	µg/L	0.5	<R.L.	<R.L.	73	0
Bromomethane	µg/L	0.5	<R.L.	<R.L.	73	0
Carbon tetrachloride	µg/L	0.5	<R.L.	<R.L.	73	0
Chlorobenzene	µg/L	0.5	<R.L.	<R.L.	40	0
Chloroethane	µg/L	0.5	<R.L.	<R.L.	73	0
Chloroform	µg/L	0.5	<R.L.	<R.L.	73	0
Chloromethane	µg/L	0.5	<R.L.	<R.L.	73	0
Dibromochloromethane	µg/L	0.5	<R.L.	<R.L.	73	0
Dibormomethane	µg/L	0.5	<R.L.	<R.L.	73	0

Table 4.4-15. Summary of DWR Water Quality Data for Silverwood Lake - Organic Chemicals, January 1997 through May 2002 (continued)

Parameter	Units	Reporting Limit	1997 – 2002 Minimum	1997 – 2002 Maximum	Number of Samples	Number of Samples over R.L.
Dichlorodifluoromethane	µg/L	0.5	<R.L.	<R.L.	73	0
Ethyl benzene	µg/L	0.5	<R.L.	<R.L.	73	0
Ethylene Dibromide	µg/L	0.5	<R.L.	<R.L.	34	0
Hexachlorobutadiene	µg/L	0.5	<R.L.	<R.L.	73	0
Isopropylbenzene	µg/L	0.5	<R.L.	<R.L.	73	0
Methyl tert-butyl ether (MTBE)	µg/L	1	<R.L.	12	73	67
Methylene chloride	µg/L	0.5	<R.L.	<R.L.	73	0
Naphthalene	µg/L	0.5	<R.L.	<R.L.	73	0
Phenol[1]	µg/L	1	<R.L.	<R.L.	2	0
Styrene	µg/L	0.5	<R.L.	<R.L.	73	0
Tetrachloroethene	µg/L	0.5	<R.L.	<R.L.	73	0
Toluene	µg/L	0.5	<R.L.	2.5	73	4
Trichloroethene	µg/L	0.5	<R.L.	<R.L.	73	0
Trichlorofluoromethane	µg/L	0.5	<R.L.	<R.L.	73	0
Vinyl chloride	µg/L	0.5	<R.L.	<R.L.	73	0
cis-1,2-Dichloroethene	µg/L	0.5	<R.L.	<R.L.	73	0
cis-1,3-Dichloropropene	µg/L	0.5	<R.L.	<R.L.	73	0
m + p Xylene	µg/L	0.5	<R.L.	<R.L.	39	0
m-Xylene	µg/L	0.5	<R.L.	1.9	37	4
n-Butylbenzene	µg/L	0.5	<R.L.	<R.L.	73	0
n-Propylbenzene	µg/L	0.5	<R.L.	<R.L.	73	0
o-Xylene	µg/L	0.5	<R.L.	0.97	73	3
p-Xylene	µg/L	0.5	<R.L.	<R.L.	30	0
sec-Butylbenzene	µg/L	0.5	<R.L.	<R.L.	73	0
tert-Butylbenzene	µg/L	0.5	<R.L.	<R.L.	73	0
trans-1,2-Dichloroethene	µg/L	0.5	<R.L.	<R.L.	73	0
trans-1,3-Dichloropropene	µg/L	0.5	<R.L.	<R.L.	73	0

Source: DWR 1997 through 2002, Station SI002000
Note:
[1]Data from two sampling events in 1976
Key:
µg/L = micrograms per liter
R.L. = reporting limit
< = less than

Mercury and PCBs in Fish from Silverwood Lake

In 2013, OEHHA published Safe Eating Guidelines for Silverwood Lake that recommended anglers consume rainbow trout (*Onchorynchus mykiss*) and avoid eating most other fish species from the lake due to contamination by mercury and PCBs. The statewide survey of fish was conducted by the Surface Water Ambient Monitoring Program (SWAMP) (Davis et al. 2010).

The EPA recommended water quality criterion for concentrations of methylmercury in fish tissue of trophic level 4 fish (150-500 mm; fillet wet weight) is 0.20 mg/kg. The OEHHA methylmercury threshold for fish tissue is 0.44 parts per million (ppm). For the purposes of risk assessment, total mercury is analyzed for most fish studies and assumed to be 100 percent methylmercury (Klasing & Brodberg 2008). Largemouth bass (*Micopterus salmoides*) samples from Silverwood Lake averaged 0.49 ppm mercury. The National Academy of Science guidelines (National Academy of Sciences 1973) establish a maximum total PCB concentration of 500 µg/kg (wet weight) in tissue samples for the protection of aquatic life from bioaccumulation of toxic substances. OEHHA adopted an advisory tissue level (ATL) of 120 parts per billion (ppb); the ATL is the threshold for considering a recommendation of no consumption. Based on the SWAMP study, PCB concentrations in fish tissue from Silverwood Lake averaged 93 ppb in largemouth bass (Davis et al. 2010). Fish tissue results for PCBs published in the 2013 Health Advisory range from 6 ppb in rainbow trout to 1,250 ppb in blackfish and tui chub.

In the water phase, the maximum dissolved mercury value in the last 5 years in Silverwood Lake was 0.0007 mg/L, below the MCL of 0.002 mg/L and the PHG of 0.0012 mg/L. Similarly, PCBs (PCB-1016, PCB-1221, PCB-1232, PCB-1242, PCB-1248, PCB-1254 and PCB-1260) have not been detected in Silverwood Lake water (sampled at Devil Canyon Second Afterbay) over the last 5 years.

TMDLs for these compounds are planned by 2025, consistent with Section 3.4 of the Listing Policy, which states, "a water segment shall be placed on the Section 303(d) list if a health advisory against the consumption of edible resident organisms has been issued by OEHHA or DHS."

4.4.7.2 Devil Canyon Afterbay and Devil Canyon Second Afterbay

DWR collects water samples for analysis at Station KA041134 and Station KA041323 (Figure 4.4-2).

General Parameters

Water quality from January 2010 through May 2015 for general parameters is summarized in Table 4.4-16. Since flows to the afterbays are conveyed via tunnel, water quality in the Devil Canyon Second Afterbay is very similar to the quality of Silverwood Lake. For the January 2010 through March 2015 period, the average TDS value was 13 mg/L higher in the Devil Canyon Second Afterbay. However, excluding one extremely high TDS reading (1,184 mg/L in July 2014) results showing an average of 255 mg/L TDS for the Devil Canyon Second Afterbay, which is essentially the same as the average value in Silverwood Lake. Turbidity readings are higher in the Devil Canyon Second Afterbay as compared with Silverwood Lake, with a maximum reading of 18 Nephelometric Turbidity Units (NTU) in the last 5 years and an average of 2.3 NTU (0.9 NTU greater than Silverwood Lake).

Table 4.4-16. Summary of DWR Water Quality Data for Station KA041134 and Station KA041323– General Parameters, January 2010 through May 2015

Parameter	Units	Reporting Limit	2010 through 2015 Minimum	2010 through 2015 Maximum	2010 through 2015 Average[1]	Number of Samples
Alkalinity	mg/L as $CaCO_3$	1	44	86	71	76
Bromide	mg/L	0.01	<R.L.	0.35	0.23	70
Calcium	mg/L	1	12	31	22	65
Chloride	mg/L	1	19	103	66	70
Hardness	mg/L as $CaCO_3$	1	49	128	93	66
Magnesium	mg/L	1	2	14	10	65
Sodium	mg/L	1	18	83	53	65
Specific Conductance	µS/cm	1	204	598	448	74
Sulfate	mg/L	1	15	75	41	70
Total Dissolved Solids	mg/L	1	113	1184	269	75
Turbidity	NTU	1	<R.L.	18	2.6	89

Source: DWR January 2010 through March 2011, Station KA041134; DWR April 2011 through May 2015, Station KA041323
Note:
[1]Half the reporting limit value used for averaging where applicable.
Key:
$CaCO_3$ = calcium carbonate
mg/L = milligram per liter
µS/cm = microsiemens per centimeter
NTU = Nephelometric Turbidity Unit
< = less than

Nutrients

Nitrogen and phosphorus levels in Devil Canyon Second Afterbay are similar (slightly lower) to values for Silverwood Lake (Table 4.4-17).

Table 4.4-17. Summary of DWR Water Quality Data for Station KA041323 and Station KA041134 – Nutrients, January 2010 through May 2015

Parameter	Units	Reporting Limit	2010 through 2015 Minimum	2010 through 2015 Maximum	2010 through 2015 Average[1]	Number of Samples
Nitrite + Nitrate	mg/L as Nitrogen	0.01	0.05	1.04	0.46	67
Organic Carbon, Dissolved	mg/L as Carbon	0.5	<1.0	5.7	2.7	69
Organic Carbon, Total	mg/L as Carbon	0.5	1.1	5.80	3.01	62
Ortho Phosphate	mg/L as Phosphorus	0.01	<R.L.	0.08	0.04	62
Total Phosphorus	mg/L	0.01	0.01	0.16	0.06	62

Source: DWR 2010 through March 2011, Station KA041134; DWR April 2011 through May 2015, Station KA041323
Note:
[1]Half the reporting limit value used for averaging where applicable.
Key:
mg/L = milligram per liter
R.L. = reporting limit
< = less than

Trace Elements

With the exception of manganese, the levels of trace elements in water from the Devil Canyon Second Afterbay are similar to values for Silverwood Lake (Table 4.4-18). Manganese is normally contained in bottom sediments of lakes and reservoirs as insoluble particulate oxides. With aerobic conditions, values of dissolved manganese would be anticipated to be low, as evidenced by the values in Silverwood Lake (0.009 mg/L maximum and an average below the detection limit of 0.005 mg/L). On two separate dates at Station KA041134 (February and March 2011), three manganese values of over 1 mg/L were recorded. Without the three high results from 2011, the average manganese value of water from the Station KA041323 and Station KA041134 over the last 5 years is below the reporting limit of 0.005 mg/L.

Table 4.4-18. Summary of DWR Water Quality Data for Station KA041134 and Station KA041323 – Trace Elements, January 2010 through May 2015

Parameter	Units	Reporting Limit	2010 through 2015 Minimum	2010 through 2015 Maximum	2010 through 2015 Average[1]	Number of Samples
Antimony	mg/L	0.001	<R.L.	<R.L.	<R.L.	17
Arsenic	mg/L	0.001	<R.L.	0.006	0.003	80
Beryllium	mg/L	0.001	<R.L.	<R.L.	<R.L.	80
Boron	mg/L	0.1	0.10	0.30	0.15	65
Chromium	mg/L	0.001	<R.L.	0.001	<R.L.	80
Copper	mg/L	0.001	<R.L.	0.004	0.001	80
Iron	mg/L	0.005	<R.L.	0.056	0.008	80
Lead	mg/L	0.001	<R.L.	<R.L.	<R.L.	80
Manganese[2]	mg/L	0.005	<R.L.	0.119	<R.L.	80
Selenium	mg/L	0.001	<R.L.	0.002	<R.L.	80
Zinc	mg/L	0.005	<R.L.	<R.L.	<R.L.	80

Source: DWR 2010 through March 2011, Station KA041134; DWR April 2011 through May 2015, Station KA041323
Notes:
[1]Half the reporting limit value used for averaging where applicable.
[2]The majority of manganese samples were less than the reporting limit of 0.005 mg/L; three high results recorded in 2011 (on two separate dates) in excess of 1 mg/L; maximum and five-year average results tabulated above exclude those data. Key:
mg/L = milligram per liter
R.L. = reporting limit
< = less than

Pesticides

Based on sampling from 2010 through 2014 at DWR Stations KA041323 and KA041134, pesticides, herbicides, and volatile organics have not been detected in the Devil Canyon Second Afterbay with the following exceptions:

- 6/19/13 Simazine 0.02 µg/L
- 3/20/13 Dacthal (DCPA) 0.02 µg/L and Simazine 0.05 µg/L
- 6/20/12 Simazine 0.02 µg/L
- 3/21/12 Diuron 0.39 µg/L
- 6/15/11 Simazine 0.02 µg/L
- 3/16/11 Simazine 0.03 µg/L and Diuron 0.62 µg/L
- 6/16/10 Simazine 0.02 µg/L
- 3/17/10 Diuron 1.68 µg/L and Simazine 0.02 µg/L

Simazine is a pre-emergence herbicide used for control of broad-leaved and grassy weeds on a variety of deep-rooted crops. The federal MCL and PHG are 4 µg/L (EPA 2014a); this value was not exceeded in samples from the Devil Canyon Afterbay from 2010 through2014.

DCPA is a pre-emergent herbicide used to control annual grasses and broadleaf weeds on ornamental turf and plants, strawberries, seeded and transplanted vegetables, cotton, and field beans. The EPA has concluded that DCPA and its metabolites do not currently pose a significant cancer or chronic non-cancer risk from non-turf uses to the overall United States population from exposure through contaminated drinking water (EPA 1998). No federal MCL has been established.

Diuron is a pre- and post-emergent herbicide treatment of both crop and non-crop areas, a mildewcide and preservative in paints and stains, and an algaecide in commercial fish production, residential ponds, and aquariums. The drinking water level of comparison (DWLOC) is 28 µg/L; neither MCLs nor drinking water health advisories (HA) have been established by the EPA Office of Water (EPA 2003).

Radiological Compounds

MWD conducts analytical tests on samples from MWD's distribution and surface waters. Radiological compounds were tested in 2009 from the Devil Canyon Second Afterbay (Table 4.4-19). Observed values were below MCLs.

Table 4.4-19. Summary of MWD Water Quality Data for Devil Canyon Second Afterbay – Radiological Parameters for Four Consecutive Quarters in 2009

	Average Values (in picoCuries per liter)								
	Gross Alpha	**Gross Beta**	**Radium 226**	**Radium 228**	**Combined Radium**	**Strontium**	**Tritium**	**Uranium**	**Radon 222**
MCL	15	50[a]	NA	NA	5[b]	8	20,000	20	NA[c]
DLR	3	4	1	1	1	2	1,000	1	100
Silverwood Lake	3.5	4.2	ND	ND	ND	ND	ND	2.7	ND

Source: MWD 2010
Notes:
[a]The gross beta particle activity MCL is 4 millirem/year annual dose equivalent to the total body or any internal organ. The screening level is 50 pCi/L.
[b]Standard is for radium 226 and radium 228 combined.
[c]To date, there has been no significant regulatory action on the proposed federal standards.
Key:
NA = Not Applicable. Standards have not been established for these constituents.
DLR = Detection Limits for Purposes of Reporting
MCL = Maximum Contaminant Level
ND = Non- detect. All results less than DLR were reported as ND.

4.5 FISH AND OTHER AQUATIC RESOURCES

This Section provides information regarding existing fish and other aquatic resources conditions. For the purpose of this PAD, aquatic resources include fish, amphibians, semi-aquatic reptiles, aquatic mollusks, benthic macroinvertebrates, and aquatic vegetation. Terrestrial reptiles and mollusks are discussed in Section 4.5. Besides this general introductory information, this Section includes one sub-section, Section 4.5.1. Section 4.5.1 is further divided into eight sub-sections. Section 4.5.1.1 lists and describes special-status aquatic species that may be affected by the Project. Section 4.5.1.2 describes aquatic invasive species (AIS) that could occur in Project reservoirs or conveyance facilities, and provides for each species a brief life history of the species, its status, and any known occurrences and abundance within or adjacent to the Project area. Sections 4.5.1.3 through 4.5.1.8 describe existing, relevant and reasonably available information regarding the use of algaecides and aquatic herbicides, fish, amphibians, reptiles and turtles, aquatic mollusks, benthic macroinvertebrates, aquatic macrophytes, algae and cyanobacteria known or suspected to occur at Project facilities or to be affected by the Project.

4.5.1 <u>Special-Status Aquatic Resources and Aquatic Invasive Species</u>

The text below provides a description of the special-status aquatic species as well as the AIS, and identifies the potential for occurrences in the Project vicinity and Project area.

4.5.1.1 Special-Status Aquatic Species

For the purpose of this PAD, a special-status aquatic species is considered one that is found on NFS land and listed by USFS as Sensitive (FSS); listed by National Marine Fisheries Service (NMFS) as a Species of Concern (NMFS-S); listed by CDFW as a Species of Special Concern (SSC); or considered fully protected under California law. Aquatic species that are listed as threatened or endangered, or proposed, or a candidate for listing under the ESA, are addressed in Section 4.8.

DWR developed the list of special-status species known or with the potential to occur in the Project vicinity by first reviewing the CDFW website which lists SSC, as well as species listed by other agencies (CDFW 2015a). A query of the CDFW, California Natural Diversity Database (CNDDB) (CDFW 2015a) was then performed based on a search of the USGS 7.5-minute quadrangles in which the Project is located (i.e., Silverwood Lake and San Bernardino North), and the adjacent quadrangles (i.e., Hesperia, Apply Valley South, Lake Arrowhead, Cajon, Harrison Mountain, and Devore) covering approximately 493 square miles. This is an area much larger than that potentially affected by the Project, but is intended to ensure a comprehensive list.

On the basis of these queries and additional literature and information searches, DWR determined that seven special-status aquatic species are known to occur or have the potential to occur in the Project vicinity. Five of these species were documented in at least one of the databases: including two fish, one amphibian, one semi-aquatic snake, and one turtle species. DWR then researched the known distribution, habitat associations, and requirements of these species to exclude from further consideration species known to be endemic to restricted geographic areas and habitat types not found in the Project area. Searches of the CNDDB database also listed the Santa Ana speckled dace (*Rhinichthys osculus).* The species was not included here because it is restricted to the headwaters of the Santa Ana River and the San Gabriel River drainages, with no aquatic connection to the Project.

Based on DWR's review, the arroyo chub (*Gila orcutti*), Sacramento hitch (*Lavinia exilicauda*), western spadefoot (*Spea hammondii*), two-striped garter snake (*Thamnophis hammondii*), and southern western (or western) pond turtle (*Actinemys* [*Emys*] *pallida* [or *marmorata pallida]*), each designated as a SSC, are the only special-status aquatic species that may potentially occur in the Project area or otherwise be affected by continued Project Operations and Maintenance (O&M). No FSS or NMFS-S species were identified. Arroyo chub, Sacramento splittail (*Pogonichthys macrolepidotus*), and Sacramento hitch are not native to the Project area, but are introduced individuals or populations that may potentially occur in the Project area. A summary is provided in Table 4.5-1.

Table 4.5-1. Summary of Factors Reviewed to Develop the List of Special-Status Species Potentially Affected by the Project

Common Name	Scientific Name	Federal and State Status	Known Occurrences in Project Vicinity	Project Vicinity Within Species Known Native Range	Other Considerations
Arroyo Chub	*Gila orcutti*	SSC	Yes	Yes	
Sacramento hitch	*Lavinia exilicauda*	SSC	Yes	No	This fish species is not native to the Mojave River drainage
Western spadefoot	*Spea hammondii*	SSC	Yes	Yes	
Two-striped garter snake	*Thamnophis hammondii*	SSC	Yes	Yes	
Southern western (or western) pond turtle	*Actinemys* [*Emys*] *pallida* [or *marmorata pallida]*	SSC	Yes	Yes	
Santa Ana speckled dace	*Rhinichthys osculus*	SSC	Yes	No	This fish species is not native to the Mojave River drainage

Source: CDFW 2015a
Note:
[1]A single Sacramento splittail was recorded in Silverwood Lake in 1977. Swift (1993) and Moyle (2002) suggest that it was a result of transport through the SWP. Based on the species' habitat requirements, it is highly improbable that a self-sustaining population could exist in Silverwood Lake.
Key:
SSC = California State species of special concern

Arroyo Chub[6]

The arroyo chub (*Gila orcutti*) is native to coastal drainages of the Los Angeles plain, where much of its habitat has been lost or degraded by development. Although extirpated in most of its native range, arroyo chub was inadvertently or intentionally introduced into other drainages, including Deep Creek and other tributaries of the Mojave River in the 1930s, where it has contributed to the near extinction of the only native fish, Mohave tui chub (*Siphateles bicolor mohavensis*) by competition and hybridization (Hubbs and Miller 1943; Miller 1946, 1968, Swift et al. 1993). Moyle et al. (2015) assigned a "high" concern status (i.e., considered to be under severe threat but extinction was less imminent than for those with a critical concern status) to this species based on occurrences within the native range, and "moderate" concern status (i.e. no immediate threat of extinction but are in long-term decline or had naturally small, isolated populations which warrant frequent status reassessment) when introduced populations outside of the native range are also considered.

Arroyo chubs are relatively small minnows (Family Cyprinidae), usually no larger than 4.8 inches standard length (SL) (Moyle 2002). They are adapted for warm waters with low dissolved oxygen concentrations and wide water temperature fluctuations (Castleberry and Cech 1986). Streams with slow-moving water, mud or sand substrate, and greater than 1.3 feet deep are preferred habitat (Wells and Diana 1975), although individuals have been found in pool habitats with gravel, cobble, and boulder substrates (Feeney and Swift 2008).

Arroyo chubs typically spawn in June and July, although spawning can occur from February through August. Eggs hatch in 4 days at 75°F (Moyle 2002).

Greenfield and Deckert (1973) found that algae comprised 60-80 percent of the stomach contents of sampled arroyo chubs. Other food items include insects and small crustaceans. A floating water fern (*Azolla* sp.) has also been identified as an important food source (Greenfield and Deckert 1973).

Henkanaththegedara et al. (2008) documented arroyo chub in the Mojave River at Mojave Narrows near Victorville (approximately 14 miles downstream of Mojave Forks Dam) and Afton Canyon (approximately 90 miles downstream of Mojave Forks Dam).

[6] Photo credit: Paul Barrett, USGS [public domain], via Wikimedia Commons

Sacramento Hitch[7]

Sacramento hitch (*Lavinia exilicauda*) is native to Central California, including the Sacramento-San Joaquin River system in low elevation streams and the Delta. Currently the species occurs in scattered small populations across much of the native range, with the exception of the southern San Joaquin River and its tributaries where they are absent (CDFW 2015a). Outside of its native range, populations of Sacramento hitch have been established in San Luis Reservoir and other reservoirs. These occurrences are attributed to transport by the SWP (Moyle 2002). Moyle et al. (2015) assigned a “moderate” concern status to this species.

This is a large deep-bodied minnow, which may grow to over 13 inches SL. Habitats are typically warm water, with tolerance for temperatures greater than 86°F and tolerance for salinities up to 9 parts per thousand (ppt), and include lowland clear streams, turbid sloughs, lakes and reservoirs. When in streams, Sacramento hitch inhabit pools or runs with aquatic vegetation and prefer gravel substrates to mud substrates. Spawning typically starts in February and can end as late as July. Females are usually sexually mature in 2 to 3 years, whereas males may mature in the first, second, or third year. Fecundity may be as high as 50,000 to 60,000 eggs per female. Hitch spawn in riffles of tributaries of lakes and rivers, and potentially sloughs after spring rains. Spawning occurs over gravel and eggs hatch in 3 to 7 days at temperatures from 59° to 72°F. Young hitch will reside around aquatic plants or other areas of cover in shallow water. (Moyle 2002).

Feeding occurs mainly during daylight hours in open waters or at the surface (Moyle 2002). Small hitch feed on drift at the heads of pools during the summer. Their diet consists of aquatic insects, terrestrial insects, and filamentous algae.

There are documented occurrences of this species from Silverwood Lake in 1988 (Swift 1993 and Moyle 2002) and in the Mojave River (Henkanaththegedara et al. 2008). According to Henkanaththegedara (2008), the first record of Sacramento hitch in the Mojave River system dates back to 1973.

[7] Photo from: http://www.biologicaldiversity.org/resourcespace/?c=90&k=f449c606f0

Western Spadefoot[8]

The western spadefoot (*Spea hammondii*) range is located throughout the Central Valley and adjacent foothills, and is usually common where it occurs, although the current distribution has been substantially reduced by conversion of native habitats to other land uses such as agriculture and development. The species is known from near sea level to about 4,500 feet elevation (Jennings and Hayes 1994, Morey 2005); however, most populations are found below 3,300 feet (Morey 2005). Breeding habitats include vernal pools, vernal playas, rainwater pools, stock ponds, and pools in intermittent streams. Although most breeding sites dry seasonally, permanent ponds are occasionally used. Absence of fish is usually a prerequisite for successful breeding.

This species occurs primarily in grasslands, but populations also occur within open valley-foothill hardwood woodlands or open chaparral, where breeding habitat is present and soils are suitable for burrowing. Populations may adapt well to rangeland practices, but reportedly do not long persist in areas converted to irrigated agriculture. On July 1, 2015 (80 FR 56423), USFWS published results of a petition review (also known as a "90-day finding") to consider listing western spadefoot under the ESA, determining that the petition presented "substantial scientific or commercial information indicating that the petitioned actions may be warranted." Therefore, USFWS initiated a more thorough review of available data to determine whether listing is warranted. The results of the 90-day finding have no immediate effect on the regulatory status of the species (i.e., western spadefoot is not a candidate species or proposed for listing at this time).

Western spadefoot is typically an "explosive breeder," often emerging and spawning within 1 or 2 days after relatively warm winter or spring rains. Eggs develop and hatch in a few days and larvae complete metamorphosis in 30 to 79 days (Morey 2005). Similar to other spadefoot species, western spadefoot larvae are capable of feeding on animal tissue and may be cannibalistic. After metamorphosis, juvenile and adult western spadefoot are terrestrial and primarily fossorial, and may spend long periods buried in loose soil or occasionally in existing mammal burrows.

The occurrence of western spadefoot in San Bernardino County is uncertain. Jennings and Hayes (1994) depict a verified, historical museum record of western spadefoot for southwest San Bernardino County (considered extirpated); however, other sources do not include the county within the species' current range. USFWS (2005) indicates no extant or extinct populations within San Bernardino County. HELIX (2014) did not include western spadefoot as a species potentially occurring in the Tapestry Project area north of Silverwood Lake. Aspen Environmental Group and Hunt & Associates Biological Consulting (2005) reported hearing a call which may have been of this species during the Horsethief Creek Bridge Replacement Surveys.

[8] Photo credit: Chris Brown, USGS, via Wikimedia Commons

Two-striped Garter Snake[9]

The two-striped garter snake (*Thamnophis hammondii*) is a highly aquatic snake found from Monterey and San Benito Counties to northwest Baja California, Mexico in the Coast, Transverse, and Peninsular Ranges and coastal plain. Known occurrences are distributed from sea level to about 8,000 feet elevation, mostly associated with streams (Jennings and Hayes 1994, Stebbins 2003). Jennings and Hayes (1994) reported evidence that two-striped garter snake has been extirpated or has declined due to habitat loss and degradation attributable to urbanization, flood control projects, overgrazing, introduced species, and deliberate killing, and suggested that drought may have accelerated these declines. However, Frost et al. (2007) indicate that two-striped garter snake "is probably the most common snake in southern California away from urban areas," warranting the International Union for Conservation of Nature (IUCN) Red List category of "Least Concerned."

Preferred habitats for the two-striped garter snake include rocky, perennial or intermittent streams; large, low gradient streams; and ponds (e.g., oases, stock ponds, and stormwater retention ponds), provided, in each case, that dense riparian vegetation is also present (Jennings and Hayes 1994; Frost et al. 2007). Two-striped garter snakes are primarily aquatic-feeding, with fish, fish eggs, amphibians, and earthworms documented as prey (Stebbins and McGinnis 2012). Although these snakes are rarely found far from water, uplands adjacent to riparian areas may be used in winter (Jennings and Hayes 1994). Two-striped garter snakes are ovoviviparous and may bear as many as 25 young in a single litter.

The CNDDB identifies seven records of two-striped garter snake in the Project vicinity, but outside of the Project area, all associated with streams, including multiple records from Grass Valley Creek (CDFW 2015a). A two-striped garter snake was observed during surveys for the Horsethief Creek Bridge Replacement Project (Aspen Environmental Group 2005).

[9] Photo credit: Connor Long (Own work) [CC BY-SA 4.0 (http://creativecommons.org/licenses/by-sa/4.0)], via Wikimedia Commons

Southern Western Pond Turtle[10]

Southern western (or western) pond turtles (*Actinemys* [*Emys*] *pallida* [or *marmorata pallida*] are the only freshwater turtles native to California. Long considered a single species, the two subspecies, southern western pond turtle and northern western pond turtle, have been recently elevated as two separate but full species on the basis of molecular evidence (Spinks et al. 2014); the northern western pond turtle (*Actinemys marmorata marmorata*) and the southern western pond turtle. Populations in the central coast range of California south of San Francisco, including populations of the Mojave River drainage, are assigned to southern western pond turtle. Because much of the published information on western pond turtles is derived from studies of northern western pond turtle, our understanding of southern western pond turtle, summarized in the following account, may not be entirely accurate.

Both species of western pond turtle are considered habitat generalists and may occur in a wide variety of aquatic habitats, including pools, side channels, and backwaters of streams; ponds, lakes, ditches, and marshes, although natural habitats of the southern western pond turtle were likely mostly associated with streams. The southern western pond turtle has experienced substantial declines due to loss of habitat, introduced species, and historical over-collection, and has been designated as SSC by CDFW (Jennings and Hayes 1994)**.**

Although highly aquatic, pond turtles often overwinter in forested habitats and eggs are laid in shallow nests in sandy or loamy soil in summer at upland sites as much as 1,200 feet from aquatic habitats (Jennings and Hayes 1994). Hatchlings do not typically emerge from the covered nests until the following spring. Reese and Welsh (1997) documented western pond turtle away from aquatic habitats for as much as 7 months a year and suggested that terrestrial habitat use was at least in part a response to seasonal high flows. Basking sites are an important habitat element (Jennings and Hayes 1994) and substrates include rocks, logs, banks, emergent vegetation, root masses, and tree limbs (Reese undated). Terrestrial activities include basking, overwintering, nesting, and moving between ephemeral sources of water (Holland 1991). During the terrestrial period, Reese and Welsh (1997) found that radio-tracked western pond turtles were burrowed in leaf litter.

Breeding activity may occur year-round in California, but egg-laying tends to peak in June and July in colder climates, when females begin to search for suitable nesting sites upslope from water. Adult western pond turtles have been documented traveling long distances from perennial watercourses for both aestivation and nesting, with long-range movements to aestivation (i.e., hibernation in response to high temperatures and arid conditions) sites averaging about 820 feet, and nesting movements averaging

[10] Photo credit: Yathin S. Krishnappa, [CC BY-SA 3.0 (http://creativecommons.org/licenses/by-sa/3.0)], via Wikimedia Commons

about 295 feet (Rathbun et al. 2002). Introduced species of turtles (e.g., red-eared sliders [*Trachemys scripta elegans*]) are likely to compete with western pond turtle for basking sites, and bullfrogs and predatory fish species may prey on western pond turtle hatchlings.

There is one CNDDB record of southern western pond turtle in the Project vicinity, a 2006 observation of two adults at Summit Valley, 1.7 miles north of Cedar Springs Dam (Silverwood Lake quadrangle) (CDFW 2015a). Aspen Environmental Group (2006) documented the species at multiple locations on Horsethief Creek during surveys for the Horsethief Creek Bridge Replacement Project, and HELIX (2014) reported 13 observations along Horsethief Creek and West Fork Mojave River downstream of Cedar Springs Dam. Those areas are located outside of the proposed Project boundary.

4.5.1.2 Aquatic Invasive Species

According to the USFWS, "aquatic invasive species (sometimes called exotic, invasive, nonindigenous or non-native) are aquatic organisms that invade ecosystems beyond their natural, historic range." On August 18, 2015, DWR generated a list of AIS by using the Nonindigenous Aquatic Species (NAS) application available at the USGS website (USGS 2015), with a search for records within San Bernardino County. Those species that did not occur within 100 miles of the Project vicinity or did not have suitable habitat in the Project area, and those occurrences preceding the term of the previous license, were eliminated. Six species were left for consideration from the NAS list of AIS.

DWR also utilized CalWeedMapper, a web application used as a tool for mapping invasive plant distribution, and California State Parks, Division of Boating and Waterways (DBW) databases to generate a list of invasive aquatic plant species that occur or have the potential to occur within or near the existing Project boundary. DWR identified five additional AIS (Cal-IPC 2015a; DBW 2015).

Additionally, DWR identified two AIS, cyanobacteria species and channeled apple snail (*Pomacea canaliculata*) as occurring or having the potential to occur within the Project area (DWR 2014d; CDFW 2015a) due to suitable habitat in the Project area and varying vectors of transport.

Finally, DWR added zebra mussel (*Dreissena polymorpha*) and quagga mussel (*Dreissena rostriformis bugensis*) to the list, as they are considered a high threat species by the State, although there are no documented records in San Bernardino County. The United States has listed both as Restricted Species under the Lacey Act, and they are regulated under FGC § 2301 and § 2302.

The discussion of aquatic invasive species below is focused on the occurrence and the potential occurrence of these 15 AIS – two amphibians, one crustacean, six mollusks (snails and bivalves) and six aquatic algae and vascular plants. Table 4.5-2 lists the 15 AIS known to occur or have the potential to occur in the Project vicinity.

Table 4.5-2. Aquatic Invasive Species Known to Occur or with the Potential to Occur in the Project Vicinity

Species	Status or Listing: (1) CCR, (2) FGC, (3) Lacey Act, (4) Cal-IPC, (5) CDFA	Habitat Requirements	Known From Project Vicinity[1]
American bullfrog *(Lithobates catesbeianus*)	None	Quiet waters of ponds, lakes, reservoirs, irrigation ditches, streams, and marshes (CDFW 2015g)	Yes. Mojave Forks Regional County Park (1989) and Deep Creek at the Mojave River Flood Control Dam (1989). Also in Horsethief Creek and West Fork Mojave River downstream of Cedar Springs Dam (Aspen Environmental Group 2006)
African clawed frog (*Xenopus laevis*)	(1) 14 CCR§ 671(c)(3), Restricted Species	Warm, stagnant grassland ponds and streams in arid and semi-arid regions (Garvey 2000).	No. The closest reported occurrence was in Riverside City in 1996, ~24 miles south of the Project.
Red swamp crayfish *(Procambarus clarkii*)	None	Freshwater lakes, ponds, streams, canals, seasonal swamps and marshes, and ditches with mud or sand bottoms and organic debris (USGS 2015).	No. The closest reported occurrence was in Lake Arrowhead, San Bernardino County, in 1959, ~6 miles north of the Project.
European ear snail *(Radix auricularia*)	None	Freshwater lakes, ponds, and slow-moving rivers with mud bottoms (USGS 2015).	No. The closest reported occurrence was in an unspecified location in San Bernardino County in 1996
Asian clam (*Corbicula fluminea*)	None	Freshwater lakes, reservoirs and streams, especially with sandy, bottom sediments (USGS 2015).	No. The closest reported occurrence was south of Silverwood Lake near Lake Evans, Fairmount Park in 1969, ~20 miles south of the Project
Quagga mussel (*Dreissena rostriformis bugensis*)	(1) 14 CCR§ 671(c)(10), Restricted Species; (2) FGC §§ 2301 and 2302 Regulated	Freshwater lakes, reservoirs and streams colonizing soft and hard substrates (USGS 2015).	No. The closest reported occurrence was in Lake Mathews Reservoir in 2007, ~30 miles south of the Project.

Table 4.5-2. Aquatic Invasive Species Known to Occur or with the Potential to Occur in the Project Vicinity (continued)

Species	Status: (1) CCR, (2) FGC, (3) Lacey Act, (4) Cal-IPC, (5) CDFA	Habitat Requirements	Known From Project Vicinity[1]
Zebra mussel (*Dreissena polymorpha*)	(1) 14 CCR§ 671(c)(10), Restricted Species; (2) FGC §§ 2301 and 2302 Regulated; (3) Federal Lacey Act (18 U.S.C. 42) lists as Injurious wildlife	Freshwater lakes, reservoirs and streams colonizing any stable substrate (USDA 2013).	No. The closest reported occurrences were in San Justo Reservoir, San Benito County 2008, approximately 286 miles northwest of the Project and in a pump in Hollister at Ridgemark Golf Course in 2012, roughly 280 miles northwest of the Project.
New Zealand mudsnail *(Potamopyrgus antipodarum*)	(1) 14 CCR § 671(c)(9), Restricted Species	Freshwater and brackish lakes, streams, and reservoirs (CDFW 2015a)	No. The closest reported occurrence was in a manmade channel in Anaheim in 2013, roughly 46 miles south of the Project.
Channeled apple snail *(Pomacea canaliculata*)	(1) 14 CCR §671(c)(9), Restricted Species	Reservoirs, ponds, rivers, ditches, wetlands, and agricultural areas, such as rice and taro fields (CDFW 2015e).	No. The closest reported occurrence was in Riverside County in a channel that runs into the Salton Sea in Mecca in 2007, ~125 miles southeast of the Project.
Cyanobacteria Species	None	Freshwater bodies (USGS 2015)	Yes. Silverwood Lake (DWR 2014a).
Curly leaf pondweed *(Potamogeton crispus*)	(4) Cal-IPC 'moderate'	Quiet waters, especially brackish, alkaline, or eutrophic waters of ponds, lakes, and streams (Cal-IPC 2015a)	No. The closest reported occurrences were in San Bernardino North and Lake Arrowhead quads.
Eurasian watermilfoil *(Myriophyllum spicatum*)	(4) Cal-IPC 'high'	Surface of freshwater lakes, ponds, and slow-moving waters (Cal-IPC 2015a).	No. The closest reported occurrences were in San Bernardino North and Lake Arrowhead quads.
Hydrilla (*Hydrilla verticillata*)	(1) 3 CCR§§ 3410, 4500; (4) Cal-IPC 'high'; (5) CDFA A-rated	Freshwater lakes, ponds, and slow-moving waters (Cal-IPC 2015a).	No. The closest reported occurrence was reported in Barstow quad (Kratville 2013).
Water hyacinth *(Eichhornia crassipes*)	(4) Cal-IPC 'high'	Both natural and man-made freshwater systems (e.g., ponds, sloughs and rivers) (Cal-IPC 2015a).	No. The closest reported occurrence was reported in Devore quad.

Table 4.5-2. Aquatic Invasive Species Known to Occur or with the Potential to Occur in the Project Vicinity (continued)

Species	Status: (1) CCR, (2) FGC, (3) Lacey Act, (4) Cal-IPC, (5) CDFA	Habitat Requirements	Known From Project Vicinity[1]
Parrot's feather milfoil (*Myriophyllum aquaticum*)	(4) Cal-IPC 'high'	Ponds, lakes, streams, canals, and ditches, usually in still or slow-moving water, but occasionally in faster-moving water of streams and rivers (Cal-IPC 2015a).	No. The closest reported occurrence was reported in both Big Bear Lake and Yucaipa quads.

[1]Sources: Cal-IPC 2015a, DWR 2014a, Kratville 2013, USGS 2015,
Key:
§ = Section
CDFW = California Department of Fish and Wildlife
CCR = California Code of Regulations
CDFA = California Department of Food and Agriculture
Cal-IPC = California Invasive Plant Council
FGC = Fish and Game Code
Lacey Act (16 U.S.C. §§ 3371–3378) = federal law, as amended in 2008, prohibiting traffic in certain fish, wildlife and plant species

Invasive Amphibians

American Bullfrog[11]

The American bullfrog (*Lithobates catesbeianus*) is the largest frog in North America (up to 8 inches snout to vent length [SVL]). Native to eastern and central North America, American bullfrog was first introduced to California in the twentieth century as a food source, and subsequently as a biological control, and further spread by fish stocking. The species is currently widespread and well-established in California, with populations found up to 6,000 feet elevation (Zeiner et al. 1988).

American bullfrogs are highly aquatic and closely associated with permanent or semi-permanent water bodies, including ponds, lakes, reservoirs, irrigation ditches, streams, and marshes, and are capable of dispersing long distances during wet periods (CDFW 2015d). In California, breeding can occur as early as March and as late as July, depending on local conditions, but generally later than native amphibians in the same areas and over a longer period of time (Jones et al. 2005, Cook and Jennings 2007). Breeding sites are often characterized by abundant submerged aquatic or emergent vegetation. Individual clutches are large (10,000 to 20,000 eggs per female). Tadpoles are found in warm, shallow water, and grow to large sizes before metamorphosing, often in their second year (Jones et al. 2005). The presence of predatory fish, particularly bass (*Micropterus* sp.) and sunfish (*Lepomis* sp.), is a good indicator of bullfrog habitat suitability. Larvae benefit by the presence of fish feeding on predatory aquatic insects that could have preyed upon bullfrog larvae; bullfrog larvae are generally avoided in the presence of fish (Kruse and Francis 1977, Werner and McPeek 1994, Adams et al. 2003).

Similar to most native frogs, American bullfrog is an opportunistic, gape-limited predator. However, this species grows to such a large size that a broad array of species are potential prey, particularly those closely associated with aquatic habitats, including smaller frogs, turtles, fish, and crayfish, as well as aerial insects, birds, and bats (Nafis 2013, CDFW 2015a). American bullfrog has also been implicated in the spread of the chytrid fungus, *Batrachochytrium dendrobatidis* (Bd), the agent in the potentially fatal disease of frogs called chytridiomycosis, although several native species have also been shown to be carriers (Padgett-Flohr 2008, Feller et al. 2011).

Management options for American bullfrog are limited to localized areas, as eradicating bullfrogs from large water bodies is currently infeasible. Currently, there are only a few methods for managing bullfrogs, including chemical control, bullfrog-specific traps and hunting. Prevention remains the best means of management (Snow and Witmer 2010).

[11] Photo credit: Jarek Tuszynski [CC BY-SA 3.0 (http://creativecommons.org/licenses/by-sa/3.0)], via Wikimedia Commons

NAS documented two American bullfrog occurrences within the Project vicinity. The first occurrence was reported at Yates Road Mojave River crossing at the Mojave Forks Regional County Park in 1989, roughly 3 miles from the Project. The second reported bullfrog occurrence was in Deep Creek at the Mojave River Flood Control Dam in 1989, roughly 5.5 miles from the Project area (USGS 2015). American bullfrogs were also documented by surveys associated with investigations for the Horsethief Creek Bridge Replacement Project in 2004, characterized as a large breeding population in Horsethief Creek and in pools in the West Fork Mojave River between Cedar Springs Dam Spillway and Highway 173 (Hunt & Associates Biological Consulting and Aspen Environmental Group 2005). HELIX (2014) reports the continued presence of American bullfrog on the West Fork Mojave River and Horsethief Creek. As a result of potential habitat within the Project area, known occurrences nearby and varying vectors of transport, this species has the potential to occur within the Project area.

African Clawed Frog[12]

The African clawed frog (*Xenopus laevis*) is a smooth-skinned frog that grows to more than 5.5 inches SVL. Native to sub-Saharan Africa, the African clawed frog was brought to the United States in the 1940s and widely used as a standard laboratory animal/human pregnancy test animal, and sold in the pet trade (California Herps 2015).

African clawed frog is classified as a "detrimental animal" and restricted by 14 CCR § 671, FGC § 2110 (Importation, Transportation and Possession of Restricted Species), because it poses a threat to native wildlife. As such, it is illegal to import, transport, or possess live animals of this species, except under permit from CDFW.

Reproducing populations of African clawed frog are known to occur in Arizona and California, where the species is well-established in San Diego, Los Angeles, and Orange Counties, and adjacent parts of Ventura and San Bernardino Counties. Crayon (2005) indicates that warm-water lotic (i.e., moving water) systems, including areas of brackish water, are particularly vulnerable to infestation once the species becomes established within a drainage, although drought may limit its spread and predatory fish may limit size of populations.

African clawed frogs are highly aquatic; however, the frogs are capable of dispersing over land in response to habitats drying out and more often will bury themselves within the mud of drying ponds. They are opportunistic scavengers and predators, known to take a wide variety of prey, although aquatic invertebrates tend to predominate where diets of wild frogs have been studied (Crayon 2005). Other frogs, fish eggs, and small fish (at least under confined or high density conditions) may also be vulnerable prey

[12] Photo credit: Chris Brown, USGS [public domain], via Wikimedia Commons

items. Cannibalism on larvae may also allow African clawed frog to persist in areas where other prey are scarce.

Efforts to eradicate African clawed frog populations in California have included draining ponds, using poisons, and capturing and removing frogs (Crayon 2005). However, these approaches have generally been unsuccessful, because of the difficulty in eliminating entire populations and because sites are usually recolonized from adjacent areas.

NAS reported one occurrence of the African clawed frog in Riverside City in 1996, approximately 25 miles from the Project area. As a result of potential habitat within the Project area and varying vectors of transport, this species has the potential to occur within the Project area.

Invasive Crustaceans

Red Swamp Crayfish[13]

The red swamp crayfish (*Procambarus clarkii*) is a dark red crustacean with extended claws and head. The first walking leg bears bright red rows of tubercles on its side margin and palm. Adults can grow as large as 4.7 inches and can weigh in excess of 1.75 ounces. Populations in the United States are the likely result of a release from aquaculture or aquarium trade (USGS 2015).

The life cycle of the red swamp crayfish is relatively short, with sexual maturity occurring as early as 2 months of age. Breeding takes place in the fall and females can produce up to 500 eggs. Egg production takes roughly 6 weeks, followed by a 3 week incubation period and an additional 8 week maturation period. The red swamp crayfish demonstrates cyclic dimorphism, alternating between sexually active and inactive periods (USGS 2015).

This species inhabits freshwaters, including rivers, lakes, ponds, streams, canals, seasonally flooded swamps and marshes, and ditches with mud or sand bottoms and plenty of organic debris. Additionally, the red swamp crayfish has been known to colonize rice fields, irrigation channels, and reservoirs. The species is an ecosystem engineer, primarily constructing simple burrows. The species is tolerant of a variety of water quality parameters including salinities less than 12 ppt, pH from 5.8 to10, dissolved oxygen levels greater than 3 ppm, variable water temperatures and variable pollution levels (USGS 2015).

It is possible that the species causes an assortment of environmental impacts, including but not limited to alteration of food web, bioaccumulation of toxic substances,

[13] Photo from: < http://nas.er.usgs.gov/queries/factsheet.aspx?SpeciesID=217>

community dominance, modification of physical-chemical habitat properties, consumption of native plants and algae, and predation on native species (USGS 2015).

NAS reported an occurrence in Lake Arrowhead, San Bernardino County, in 1959, roughly 7 miles from the Project area. As a result of potential habitat within the Project area, a known nearby occurrence, and multiple vectors of transport, this species has the potential to occur within the Project area.

Invasive Mollusks

European Ear Snail[14]

The European ear snail (*Radix auricularia*) is a small freshwater mollusk inhabiting lakes, ponds, and slow-moving rivers with mud bottoms. The species can live on rock or vegetation in low or high flow environments and is tolerant of oxygen-depleted conditions and extreme pollution (USGS 2015). The spread of the species can be attributed to the translocation of eggs on plant material via the aquarium trade as well as the movement of boats and equipment between water bodies (Golden Sands 2015).

The species self-fertilizes and partakes in two breeding events per year. One individual can produce up to 1,300 eggs each year. The European ear snail feeds mostly on decaying organic material and algae. It is an important host organism to many trematode parasites, especially the liver flukes *Fasciola gigantica* and *F. hepatica*. The species is also an important prey item for a few fish and turtle species. Its impacts to native aquatic communities are largely unknown (Golden Sands 2015).

Manual removal of snails is possible, but infeasible in most cases. This snail's preference for soft substrates makes access for eradication purposes difficult, and those individuals burrowed into the substrate are often difficult to find. Pesticides are used to control snails, but are not species-selective. They may be effective on the European ear snail, but other snails would also likely be harmed by the use of pesticides. No effective biological control agent is known at this time (Golden Sands 2015).

NAS reported one occurrence in an unspecified location in San Bernardino County in 1996. As a result of potential habitat within the Project area and potential transport to the Project area on recreational boats and equipment, this species has the potential to occur within the Project area.

[14] Photo from: <http://nas.er.usgs.gov/queries/factsheet.aspx?SpeciesID=1012>

Asian Clam[15]

The Asian clam (*Corbicula fluminea*) is a small freshwater mollusk, native to southern Asia, eastern Mediterranean and the Southeast Asian islands to Australia. The species was first located in the United States in 1938 in the Columbia River and is believed to have been brought over by immigrants as food. Bait buckets, aquaculture and intentional introductions for consumption are thought to be responsible for its spread (USGS 2015).

Asian clam is known to inhabit lakes, reservoirs and streams, often covering themselves in sandy sediments. These bivalves cause serious structural damage, weakening dams and related structures. The species has a low tolerance to cold water which causes fluctuations in population numbers. Additionally, the Asian clam exhibits sensitivity to salinity, drying, low pH and siltation (USGS 2015). Management methods include mechanical removal, barrier placement, and chemical and temperature alteration to water systems (USGS 2015).

The Asian clam is known to be present in Silverwood Lake (DWR 2016a).

Quagga Mussel[16]

The quagga mussel (*Dreissena rostriformis bugensis*) is a small freshwater mollusk native to the Dnieper River drainage of Ukraine and the Ponto-Caspian Sea. The discharge of ballast water from large ocean liners carried the mollusk to North America. Quagga mussels were first found in the United States in 1989 in the Great Lakes and have since spread west (USGS 2015). Larval drift and attachment to recreational and commercial boating have enabled their spread throughout other regions of the United States.

The quagga mussel inhabits lakes, reservoirs and rivers. It can colonize a variety of hard substrates and is capable of causing extensive damage to hydropower facilities, powerplants, and raw water conveyance systems by clogging small diameter pipes, intakes and fish screens, as well as interfering with recreational opportunities (Mackie and Claudi 2010). Ecological impacts associated with the quagga mussel are changes in the phytoplankton community due to filter feeding, increase in water clarity causing an increase in macrophyte growth and possibly harmful algal blooms, alterations of the benthic community, and biofouling of native mussels and clams (Mackie and Claudi 2010).

Quagga mussels cannot tolerate salinity over 10 ppt (Mackie and Claudi 2010). Studies and field surveys have demonstrated that if calcium levels are low (less than 12 mg/L),

[15] Photo from: <m.wxxi.org>
[16] Photo from: < http://www.100thmeridian.org/Images/Mead/quagga.jpg>

the adult quagga mussel will not survive and veligers (i.e. larvae) will not develop. Other parameters that inhibit its survival and development include pH, water hardness and temperature (Mackie and Claudi 2010). A vulnerability analysis concluded that the Project area provides suitable habitat for the quagga mussel (Claudi and Prescott 2011).

Research is being done on the management of quagga mussel; however, preclusion is currently the only effective approach (USGS 2015). Biological control research has concentrated on species that prey on veligers or attached mussels, predominantly birds and fish. Most of these predators do not occur in North America and comparable species have not been observed preying on dreissenids at levels that can limit populations of mussel species. In California, native and non-native predators include redear sunfish (*Lepomis microlophus*), smallmouth bass (*Micropterus dolomieu*), diving ducks (*Aythyinae* spp.), and crayfish (*Cambaridae* spp.) (Hoddle 2014).

Under 14 CCR § 671(c)(10), the quagga mussel is listed as a Restricted Species, which means it is "unlawful to import, transport, or possess live [quagga mussels]…except under permit issued by the department." Additionally, pursuant to this regulation, all species of *Dreissena* are termed detrimental, which means they pose a threat to native wildlife, the agricultural interests of the State, or to public health or safety.

In addition, FGC §§ 2301 and 2302 provide specific regulations on dreissenid mussels, including quagga and zebra mussels. FGC § 2301 states that nobody shall: "possess, import, ship, or transport in the state, or place, plant, or cause to be placed or planted in any water within the state, dreissenid mussels." This law gives the director of CDFW, or his/her designee, the right to conduct inspections of conveyances, order conveyances to be drained, impound or quarantine conveyances, and close or restrict access to conveyances to prevent the importation, shipment, or transport of dreissenid mussels. Additionally, FGC § 2301 requires a public or private agency that operates a water supply to prepare and implement a plan to control or eradicate dreissenid mussels if detected in their water system. This law also requires any entity which discovers dreissenid mussels to immediately report the finding to CDFW.

Pursuant to FGC § 2302, any person, or federal, State, or local agency, district, or authority that owns or manages a reservoir where recreational, boating, or fishing activities are permitted, shall: (1) assess the vulnerability of the reservoir for introduction of dreissenid mussels; and (2) develop and implement a program designed to prevent the introduction of dreissenid mussels. At a minimum, the prevention program shall include: public education, monitoring, and management of the recreational, boating, and fishing activities that are permitted. DWR completed this vulnerability assessment and implemented a prevention program in 2011.

Beginning in 2007, DWR began early detection monitoring, and developed and implemented the Quagga and Zebra Mussel Rapid Response Plan (DWR 2010). The purpose of this plan is to coordinate a rapid, effective, and efficient intra- and interagency response to a reported sighting of these mussels in order to delineate, contain, control and, when feasible, eradicate zebra and quagga mussel populations if they are introduced into or become established in SWP waters.

The plan outlines immediate actions necessary to respond to non-confirmed sightings and positively confirmed populations of quagga or zebra mussels. This plan describes methods to: determine the distribution of mussels in a SWP facility and/or waterbody; manage pathways (control water flow and other vectors); conduct short-and long-term monitoring; and apply appropriate and immediate control measures on new mussel populations within the SWP (DWR 2010).

DWR conducts early detection monitoring for veliger and adult quagga and zebra mussels. Larval vertical tow surveys are conducted twice monthly at the outlet tower in Silverwood Lake and larval vertical tow surveys are conducted twice monthly at the Devil Canyon First Afterbay (Figure 4.4-2) (DWR 2010).

In October 2008, a Silverwood Lake self-contained underwater breathing apparatus (SCUBA) inspection for quagga mussels was conducted by MWD (DWR 2010). A total of six locations were sampled throughout the reservoir. No quagga mussel detections were reported.

Additionally, DPR implemented a quagga and zebra mussel boat inspection program in 2009. DPR also provides public outreach and education regarding quagga and zebra mussels to Silverwood Lake visitors.

There was no evidence of quagga mussel in the Project area in 2015 (DWR internal data). The closest occurrence reported by NAS to the Project area was at Lake Mathews Reservoir in 2007, approximately 34 miles south of the Project area. As a result of potential habitat within the Project area and potential for transport on recreationists' boats this species has the potential to occur within the Project area.

Zebra Mussel[17]

The zebra mussel (*Dreissena polymorpha*) is a small freshwater mollusk, native to the Black, Caspian and Azov Seas. The discharge of ballast water from a single commercial cargo ship into the Great Lakes in 1988 is responsible for their introduction into the United States. Larval drift along with attachment to recreational and commercial boating vessels have enabled their spread. (USGS 2015).

Zebra mussels inhabit lakes, reservoirs and rivers. It can colonize a variety of hard substrates and is capable of causing extensive damage to hydropower facilities, pumping plants, and raw water conveyance systems by clogging small diameter pipes, intakes and fish screens, and interfering with recreational opportunities (Mackie and

[17] Photo from: <http://watrnews.com/2012/07/zebra-mussels-found-in-lake-ray-roberts/>

Claudi 2010). Ecological impacts associated with the zebra mussel are changes in the phytoplankton community due to filter feeding, increase in water clarity causing an increase in macrophyte growth and possibly harmful algal blooms, alteration of the benthic community, and biofouling of native mussels and clams (Mackie and Claudi 2010).

The zebra mussel can tolerate only very low salinity (less than 10 ppt). Additionally, data show that if calcium levels are low (less than 12 mg/L), adult mussels will not survive and veligers will not develop (Claudi and Mackie 2010, Claudi and Prescott 2011). Other parameters that hinder survival and development include pH, water hardness and temperature (Mackie and Claudi 2010). A vulnerability analysis concluded that the Project area provides suitable habitat for the zebra mussel (Claudi and Prescott 2011).

Extensive research is being conducted on post introduction management, and although there are promising leads, prevention is seen as the most effective strategy (USGS 2015). Research on biological control methods has focused on predators, particularly birds (i.e., 36 species) and fish (i.e., 53 species that eat veliger larvae and attached mussels). In California, native and non-native species predators include redear sunfish, smallmouth bass, diving ducks and crayfish (Hoddle 2014).

The Federal Lacey Act (18 USC 42) lists zebra mussels as injurious wildlife, whose importation, possession, and shipment within the United States is prohibited. If found, any zebra mussels brought into the United States will be promptly destroyed or exported by the USFWS at the cost of the importer. Similar to quagga mussels, zebra mussels are regulated under the CCR and FGC (see quagga mussel description above).

NAS reported two occurrences of zebra mussel in central California. The first occurrence was at San Justo Reservoir, San Benito County, in 2008, approximately 286 miles northwest of the Project. The second occurrence was reported in a pump in Hollister, San Benito County, at Ridgemark Golf Course in 2012, roughly 280 miles northwest of the Project area.

As described in detail above for quagga mussel, DWR began early detection monitoring in 2007, and developed and implemented the confidential Quagga and Zebra Mussel Rapid Response Plan (DWR 2010).

New Zealand Mudsnail[18]

New Zealand mudsnail (*Potamopyrgus antipodarum*) is a small freshwater mollusk native to the lakes and streams of New Zealand. Ballast water discharge from cargo ships into the Great Lakes is likely responsible for their introduction into the United States. Since then, attachments to recreational and commercial boating vessels have facilitated their spread (CDFW 2015a).

New Zealand mudsnails inhabit brackish lakes, reservoirs and streams. They can endure high siltation and benefit from disturbance and high nutrient flows. Individuals compete with other grazers, causing decreases in species richness. Declines in algal production can reduce food resources available to native species (CDFW 2015a).

Under 14 CCR § 671(c)(9)(A), New Zealand mudsnails are listed as a Restricted Species, which means it is "unlawful to import, transport, or possess live [New Zealand mudsnail]…except under permit issued by the department." Additionally, pursuant to this regulation, New Zealand mudsnails are termed "detrimental," which means they pose a threat to native wildlife, the agricultural interests of the State, or to public health or safety.

There are a few management strategies for New Zealand mudsnails, primarily for smaller water bodies that can be isolated. Methods include chemical control and draining water to allow temperature fluctuations to affect substrate temperatures. CDFW has recommended methods for decontaminating equipment and boats after using them in known infested waters (CDFW 2015a). Management in large water bodies is difficult, and research is ongoing.

The closest reported occurrence of the New Zealand mudsnail to the Project area by NAS was from a manmade channel in Anaheim in 2013, which is roughly 46 miles southwest of the Project area. As a result of potential habitat within the Project area and varying vectors of transport, this species has the potential to occur within the Project area.

[18] Photo from < http://www.seagrant.umn.edu/newsletter/2006/06/images/mudsnail.jpg>

Channeled Apple Snail[19]

Channeled apple snails (*Pomacea canaliculata*; CAS) are large, freshwater snails that grow to over 3 inches long. CAS possess both a gill and a lung, allowing them to respire both in and out of the water. The species lay egg masses, typically containing 200 to 600 eggs, on solid structures such as rocks, walls, logs, and vegetation above the water surface (CDFW 2015e).

These snails occur in reservoirs, ponds, rivers, ditches, wetlands, and agricultural areas. They are native to the Amazon and Plata basins of South America and, therefore, are well adapted to tropical climates and forbearing of an assortment of environmental conditions, including a range of salinity, oxygen depredation, and excess nutrients. Individuals stay inundated during the day, hidden within vegetation subsurface, and are active at night, leaving the water to feed (CDFW 2015e).

CAS have been observed in California since at least 1997 and are now present in Riverside, San Diego, Los Angeles, and Kern Counties (CDFW 2015e). The closest occurrence of the CAS was reported in Riverside County in a channel that runs into the Salton Sea in Mecca in 2007. This occurrence is roughly 125 miles southeast of the Project area (USGS 2015). As a result of potential habitat within the Project area and varying vectors of transport, this species has the potential to occur within the Project area.

Invasive Aquatic Plants and Algae

Cyanobacteria Species[20]

Cyanobacteria, often called blue-green algae, occur in most freshwater ecosystems. Cyanobacteria are photosynthetic, nitrogen fixers that convert atmospheric nitrogen into organic forms of nitrogen (i.e., nitrate or ammonia). Blooms of cyanobacteria occur as a result of excess nutrients, optimal temperature and light, and lack of water turbulence (USGS 2015).

Water quality issues are associated with cyanobacteria blooms. Cyanobacteria produce compounds including 2-methylisoborneol and geosmin that bring about unpleasant taste and odors in drinking water and make fish unpalatable (USGS 2015). In addition, some species of cyanobacteria produce toxins that have the potential to be harmful to human and animal life. The toxins, referred to as cyanotoxins, target fundamental cellular

[19] Photo from: CDFW Invasive Species Fact Sheet: Channeled apple snail: *Pomacea canaliculata*
[20] Photo from: http://ks.water.usgs.gov/cyanobacteria

processes. β-methylamino alanine, saxitoxin, anatoxinmicrocystin, and cylindrospermopsin are cyanotoxins associated with human illness.

In 2004, DWR was approved to treat several SWP water bodies with copper-based herbicides (DWR 2014a). Algal production in Silverwood Lake itself began in 2013, necessitating treatment of the lake. *Microcystis* spp. and *Woronichinia naegeliana* are among the invasive cyanobacteria present in Silverwood Lake. In 2015, Silverwood Lake experienced a bloom of *Microcystis* spp. that caused severe taste and odor problems, necessitating treatment of the lake with copper sulfate (DWR 2016).

DWR applied for a statewide general NPDES permit from the SWRCB to continue application of aquatic herbicides, when necessary, to SWP aqueducts, forebays, and reservoirs. DWR applies aquatic herbicides to control cyanobacteria that can produce taste, odor, and toxic compounds; and to control aquatic weeds and algae that can negatively influence water transmission for municipal, irrigation, and industrial purposes or clog filters at water treatment plants (DWR 2014a).

The application area for aquatic weeds is determined based on the results of vegetative surveys. The treatment area is variable and dependent on the location of aquatic invasive species. For each application, a map will be submitted in the annual report to the Lahontan RWQCB showing the application area, treatment area, immediately adjacent areas, and water bodies receiving treated water (where applicable). Alternative treatment options have been considered (i.e. biological, cultural, mechanical, and preventative measures), but were deemed infeasible by DWR (DWR 2014a).

Curly Leaf Pondweed[21]

The genus *Potamogeton* contains many species that are difficult to distinguish in the field (Cal-IPC 2015b). All are native to California, except curly leaf pondweed (*Potamogeton crispus*), which has the distinguishing characteristic of very wavy leaves (DiTomaso et al. 2013). The species is native to Eurasia, Africa and Australia. It can grow up to 7 feet in length and can be found in water as deep as 40 feet.

Most pondweeds reproduce vegetatively from rhizomes or stem fragments. Curly leaf pondweed flowers and fruits in late spring and early summer, at which time it also produces turions, a wintering bud resembling brown pinecones that become detached, remaining dormant at the bottom of the water column (Cal-IPC 2015b; DiTomaso et al. 2013). The plants become dormant over the summer and decay, contributing to eutrophic conditions, leaving only their fruits and turions in the waterbody. The turions germinate in late summer or fall, and the plants

[21] Photo from: http://nas.er.usgs.gov/queries/GreatLakes/SpeciesInfo.asp?NoCache=6%2F11%2F2010+12%3A45%3A18+PM&SpeciesID=1134&State=&HUCNumber=DGreatLakes/.

overwinter as small plants only a few inches in size. Growth then continues as the water begins to warm in the spring (DiTomaso et al. 2013).

Studies have found that germination is controlled by temperature, light intensity, and anoxic conditions. It grows in fine substrates and quiet, calcium-rich waters. The species prefers lakes, reservoirs, ponds, rivers, streams, and ditches. It can grow in clear to turbid and polluted waters, and in alkaline or brackish waters; and it is tolerant of significant nutrient pollution (Cal-IPC 2015b).

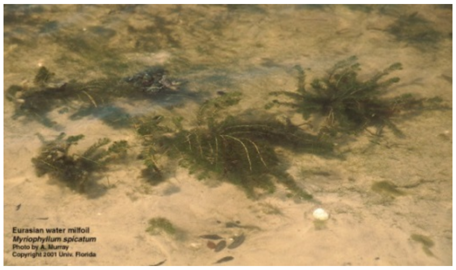
Curly leaf pondweed is widely distributed in California and found throughout the Central Valley. The plant's production of both seed and turions makes it resistant to disturbance. Their small size allows them to be easily transported attached to waterfowl, boats, or fishing gear (Cal-IPC 2015b).

Control of the species is difficult because of its vegetative reproduction. Mechanical removal can reduce stem density, but escaped fragments can drift and develop into new plants. Bottom barriers can be used to restrict infestations. Drawdowns can be used to suppress growth, but there is still a chance of resprout (DiTomaso et al. 2013). Triploid grass carp (*Ctenopharyngodon idella*) have also been used as a biological control mechanism. Grass carp do not feed selectively and a permit is required by CDFW for possession and use of these fish in California (Invasive Species Compendium 2014).

Curly leaf pondweed is rated as a "moderate" invasive plant by the California Invasive Plant Council (Cal-IPC), which means the "species has substantial and apparent – but generally not severe – ecological impacts on physical processes, plant and animal communities, and vegetation structure" (Cal-IPC 2015b).

Cal WeedMapper reported occurrences of curly leaf pond weed within the San Bernardino North and Lake Arrowhead quads (Cal-IPC 2015a). As a result of potential habitat within the Project area and varying vectors of transport, this species has the potential to occur within the Project area.

Eurasian Watermilfoil[22]



Eurasian watermilfoil (*Myriophyllum spicatum*) grows submerged, rooted in mud or sand, with branching stems 12 to 20 feet long. Its leaves are feather-like and whorled in groups of three to six around the stem (Cal-IPC 2015c; DiTomaso et al. 2013). In the early 1990s, it was present, but uncommon, in San Francisco Bay Area's ditches and lake margins, as well as in the Sacramento-San Joaquin Delta (SFEI 2014). Watermilfoil is now prevalent throughout California, including the Central Valley (Donaldson and Johnson 2002).

[22] Photo from http://www.sfei.org/nis/milfoil.html.

Establishment of Eurasian watermilfoil is dependent upon still water (Donaldson and Johnson 2002). Its reproduction is primarily vegetative via rhizomes, stem fragments, and axillary buds. The species can tolerate a range of environmental conditions, including low light, nutrient variations, and near-freezing water temperatures (Cal-IPC 2015b). The species is capable of creating its own habitat by trapping sediment and producing a favorable environment for further establishment (Cal-IPC 2015b). The species can grow on sandy, silty, or rocky substrates.

Transport via boating equipment plays the largest role in contaminating new water bodies. A single stem fragment on a boat or boat trailer can spread the plant from lake to lake (Donaldson and Johnson 2002). Some control techniques for this species includes mechanical removal, herbicide treatment, benthic barriers, and tillage (Invasive Species Compendium 2014). Mechanical removal can help remove stem densities, but escaped stem fragments can drift and develop into new individuals (DiTomaso et al. 2013). The most effective technique is to prevent its spread to and establishment in new water bodies.

Eurasian watermilfoil is given a "high" invasive plant rating by the Cal-IPC, meaning "the species has severe ecological impacts on physical processes, plant and animal communities, and vegetation structure" (Cal-IPC 2015b).

Cal WeedMapper reported occurrences of Eurasian water-milfoil in both San Bernardino North and Lake Arrowhead quads (Cal-IPC 2015a). As a result of potential habitat within the Project area and varying vectors of transport, this species has the potential to occur within the Project area.

Hydrilla[23]

Hydrilla (*Hydrilla verticillata*) is a small, submerged, aquatic perennial with spear-shaped leaves. Typically, it is found in shallow water, but if the water is clear enough, it may be found growing to depths of 48 feet (DiTomaso et al. 2013; Cal-IPC 2015b).

Hydrilla was imported into the United States from Asia in the late 1950s for aquarium use. In California, hydrilla was first found in Yuba County in 1976 (Cal-IPC 2015b) and has since been found in 17 of California's 58 counties.

Hydrilla grows in spring and summer, creating dense mats in freshwater lakes, ponds, and slow-moving waters. In spring, as water temperatures rise, hydrilla begins to grow, producing high biomass by early fall. Growth is heightened in water with agricultural runoff that increases nutrient levels (Cal-IPC 2015b). Hydrilla reproduces vegetatively via fragmentation of stems, rhizomes, root crowns, and by the production of turions. The species is spread when fragments are carried into new waterbodies by recreational

[23] Photo from http://www.sfei.org/nis/hydrilla.html.

watercraft or through water dispersal. Once established, it produces a bank of tubers and turions in the soil that may remain viable for 3 to 5 years (Cal-IPC 2015b).

The California Department of Food and Agriculture (CDFA) implements an eradication program for hydrilla. The CDFA has successfully eliminated hydrilla from 14 counties. Manual removal of hydrilla can be used for small infestations, but herbicides are usually necessary for large infestations (Cal-IPC 2015b).

Hydrilla is listed by the CDFA as an A-rated noxious weed, which means “a pest of known economic or environmental detriment and is either not known to be established in California or it is present in a limited distribution that allows for the possibility of eradication or successful containment (and is) subject to State enforced action involving eradication, quarantine regulation, containment, rejection, or other holding action” (CDFA 2015).

Cal-IPC gives hydrilla an invasive plant rating of “high,” meaning “the species has severe ecological impacts on physical processes, plant and animal communities, and vegetation structure” (Cal-IPC 2015b).

Cal WeedMapper did not report hydrilla within the Project vicinity. The closest reported occurrence was reported in the Barstow quad, approximately 45 miles north of the Project, but this population has reportedly been eradicated (CDFA 2013 annual hydrilla eradication report). As a result of potential habitat within the Project area and transport on boats, this species has the potential to occur within the Project area.

Water Hyacinth[24]

Water hyacinth (*Eichhornia crassipes*) is a free-floating perennial that has bushy, fibrous roots and is found in bulky mats on the water surface. Seedlings are most often rooted in mud along shorelines or on floating mats (DiTomaso et al. 2013; Cal-IPC 2015a).

Native to Central and South America, the water hyacinth was introduced into the United States in 1884 as an ornamental plant for water gardens. In California, water hyacinth typically is found below 660 feet elevation in the Central Valley, the San Francisco Bay Area, and the South Coast region (Cal-IPC 2015a).

Water hyacinth can be found in both natural and man-made freshwater systems. Water hyacinth obtains nutrients directly from the water and grows at a substantial pace, doubling in size every 10 days in warm weather. The species has the ability to alter water quality beneath its mats by lowering pH, dissolved oxygen and light levels, and increasing carbon dioxide and turbidity (Cal-IPC 2015a).

[24] Photo from: <http://www.sfei.org/nis/hyacinth.html>

Vegetative reproduction occurs from late spring through fall. Water hyacinth reproduces primarily from runners, and in as little as a week, the number of individuals can double. Plant fragments spread via a number of mechanisms, including the break off of daughter plants. Water hyacinth also reproduces by seed, which can spread by water flow and clinging to the feet or feathers of birds (Cal-IPC 2015a; DiTomaso et al. 2013).

At present, aquatic herbicides remain the primary tools available to control water hyacinth. Two weevils (*Neochetina eichhorniae* and *N. bruchi*) and a moth (*Sameodes albiguttalis*) have been introduced as biological controls, but have not demonstrated much success (Cal-IPC 2015a). DBW, the only entity in California authorized to treat for water hyacinth, conducts annual aquatic treatments as funding permits (DBW 2015).

The California Invasive Plant Council (Cal-IPC) gives water hyacinth a "high" invasive plant rating, meaning "the species has severe ecological impacts on physical processes, plant and animal communities, and vegetation structure" (Cal-IPC 2015a).

Cal WeedMapper reports the closest occurrence of water hyacinth in the Devore quad, southwest of the Project (Cal-IPC 2015a). As a result of potential habitat within the Project area, potential transport by avian species, and introduction by recreationists, this species has the potential to occur within the Project area.

Parrot's Feather Milfoil[25]

Parrot's feather milfoil (*Myriophyllum aquaticum*) is an aquatic perennial that forms dense mats of intertwined brownish rhizomes in the water column (Cal-IPC 2015a). Stems are submerged and can grow up to 16 feet long. The emerged leaves are light gray-green and resemble a bottlebrush which results from the whorled feather-like leaves (DiTomaso et al. 2013).

This species was thought to be introduced in the 1800's to early 1900's from South America as an aquarium plant and pond ornamental. In California, parrot's feather milfoil grows most rapidly from March until September. In spring, the shoots start to grow from overwintering rhizomes as water temperature surges (Cal-IPC 2015a).

Parrot's feather milfoil occurs in ponds, lakes, rivers, streams, canals, and ditches, typically in still or slow-moving water, but occasionally in faster-moving water (Cal-IPC 2015f). With its resilient rhizomes, parrot's feather milfoil can be transported long distances. Once rooted, new plants produce rhizomes that spread through sediments and stems that grow until they reach the water surface (Cal-IPC 2015a).

Biological, mechanical, and chemical controls have all been attempted. Of the available methods, chemical control seems to be the most likely for successful control. Biological

[25] Photo from http://www.ecy.wa.gov/programs/wq/plants/weeds/aqua003.html

control is largely unsuccessful, with many biological control foragers finding the plant unpalatable. Mechanical control is problematic due to this species' ability to regenerate from small fragments and its speedy growth rate. There are numerous chemical treatments that may work, but many do not specifically target milfoil and may damage native species as well (Invasive Species Compendium 2014).

Parrot's feather milfoil is given a "high" invasive plant rating by the Cal-IPC, meaning "the species has severe ecological impacts on physical processes, plant and animal communities, and vegetation structure" (Cal-IPC 2015a).

Parrot's feather milfoil was not reported within the Project area. The closest occurrences were reported in both the Big Bear Lake quad approximately 20 miles east of the Project area and the Yucaipa quad, approximately 24 miles southeast of the Project area (Cal-IPC 2015a). As a result of potential habitat within the Project area and varying vectors of transport, this species has the potential to occur within the Project area.

4.5.1.3 Algaecides and Aquatic Herbicides

As described in an April 25, 2014 NOI related to its NPDES Permit for Residual Aquatic Pesticide Discharges to Waters of the United States from Algae and Aquatic Weed Control Applications, DWR periodically treats algae and aquatic weeds in SWP aqueducts, reservoirs, and forebays. The DWR Aquatic Pesticides Application Plan associated with the NOI describes treatment areas, control tolerances, herbicide application and best management practices (BMP) implemented at the Project's Silverwood Lake, as described below.

Silverwood Lake

Aquatic herbicides are applied to Silverwood Lake to manage taste and odor problems associated with the growth of cyanobacteria. Additionally, some species of cyanobacteria produce toxins that are harmful to human and animal health. Species identified in SWP reservoirs of southern California have included *Microcystis* sp., *Gloeotrichia* sp., and *Anabaena* sp.

For aquatic weeds, the application area is determined yearly as a result of a vegetation survey and post analysis of impacts performed by DWR staff. The application area for aquatic algae is dependent on the source of taste and odor production, as determined by a Solid Phase Microextraction (SPME) analysis performed weekly by DWR staff, or by enzyme linked immunosorbent assay (ELISA) performed monthly to bi-weekly by a contract laboratory. For each application, a map is generated showing the treatment area, immediate adjacent areas, and water bodies receiving treated water.

In the summer of 2013, Silverwood Lake experienced a bloom of the species *A. lemmermannii* that caused taste and odor problems, necessitating treatment of the lake. Sensitive water customers can detect the taste and odor compounds 2-methylisoborneol at 5 ppt and geosmin at 10 ppt. Concentrations greater than the 5 and 10 ppt levels trigger complaints to the water agencies.

Chelated copper products (Komeen® or Nautique®), copper sulfate pentahydrate crystals, EarthTec®, Diquat, Endothall, Fluridone, Imazamox, Sodium carbonate peroxyhydrate, and Triclopyr have all been proven successful in treating algae or aquatic weed infestations. DWR's Southern Field Division (SFD) has two licensed Pest Control Advisors (PCA) and six to eight certified Qualified Applicators Certificate (QAC). These individuals are trained to ensure that applications are at rates consistent with label requirements, in a manner that avoids potential adverse effects, and to ensure proper storage and disposal practices are followed. The lake is closed for public access during treatment.

Appropriate parties are notified by email at least 48 hours prior to a treatment. The notification includes the treatment date and time, and the date and time when water releases will resume from Silverwood Lake. Notices are posted to inform the public of lake closures. Additionally, a PCA submits a written recommendation for use of the aquatic herbicide to the County Agricultural Commissioner.

The effectiveness of the treatment is assessed one week after the application. Water quality monitoring is conducted before, during, and after treatments. In addition, water quality is monitored quarterly, and the analytical results are available online through DWR's Water Data Library (DWR 2015a).

The use of herbicides is necessary where control of non-native vegetation is required within the bed, bank, or channel of the stream. If there is a possibility for the herbicides to come into contact with water, DWR employs only those herbicides, such as Rodeo® that are approved for aquatic use.

<u>Devil Canyon Powerplant</u>

To control invasive plant species (tree tobacco, *Nicotiana glauca*; salt cedar, *Tamarix* sp.; and Spanish broom, *Spartium junceum*) from the Devil Canyon Powerplant, penstocks, and afterbay areas, DWR periodically attempts to pull the plants from the ground with the root system intact. When pulling plants from the ground is impracticable, plants are cut as close to the ground as possible and Round-up® is applied to the cut areas.

4.5.1.4 Fish

<u>Upstream of Silverwood Lake</u>

There is limited information on fish and other aquatic resources residing or using the West Fork Mojave River or the East Fork of the West Fork Mojave River upstream of Silverwood Lake. Due to the ephemeral intermittent nature of the systems, the ability of fish species to inhabit these stream systems year round is speculative.

Historical information from the 1940's documented arroyo chub in the East Fork of the West Fork Mojave River (Hubbs and Miller 1943). For reference, the survey location was approximately the upper end of the Miller Canyon arm of Silverwood Lake. Hubbs and Miller suggest that previous to their surveys, fish in the Castomidae family (e.g., sucker) may have also inhabited the creeks in the area. It is also noteworthy that Hubbs and Miller state that rainbow trout (described by Hubbs and Miller as *Salmo gairdnerii irideus*) had been introduced into headwater areas, suggesting that rainbow trout may have been present in the West Fork Mojave River tributary system since that time.

Silverwood Lake

General Fish Community

The original intention of the 1968 California Aqueduct Fish and Wildlife Development Plan for Silverwood Lake was to enhance the regional fishery. At the time, CDFW believed there would be a growth in demand for fish and wildlife-based recreation from metropolitan Los Angeles-Long Beach and San Bernardino-Riverside-Ontario areas. The first fish stocking occurred in Silverwood Lake soon after it was filled in 1971. Four warm water and one cold water game fish species were planted in the reservoir for recreation purposes including: catfish (species unknown), largemouth bass, bluegill (*Lepomis macrochirus*), black crappie (*Pomoxis nigromaculatus*) and rainbow trout, respectively (CDFG 1968).

Since the original selection of game fish species, management goals and public recreation pressures have facilitated the targeted removal of some species and the addition of others. Based on the large number of seasonal, yearly or periodic creel census, seine and electrofishing studies that have been conducted by CDFW, or contracted by DWR and the yearly stocking records of rainbow trout, the historical and current species assemblage in Silverwood Lake is well documented.

Currently, the Silverwood Lake fishery is primarily managed as a warm water fishery consisting of largemouth bass, bluegill, black crappie, striped bass (*Morone saxatilis*), channel catfish (*Ictalurus punctatus*) and white catfish (*Ameiurus catus*). A cold-water fishery is maintained by stocking hatchery-raised rainbow trout (CDFW 2013).

Silverwood Lake fishery sampling studies from 1999 through 2003 were conducted by CDFW using the same methods (seven sites total) each year, although the fall 2003 sampling had an additional two sampling locations. Sampling from 2008 through 2010 were performed using different methods, but only six sites were surveyed. Catch per unit effort (CPUE) data from fall and spring surveys is provided to show changes in species abundance in Silverwood Lake.

In total, 18 different species have been observed or captured at Silverwood Lake during these sampling efforts. Differences in spring and fall CPUE values for game-fish (i.e., rainbow trout and largemouth bass) can be attributed to seasonal differences in habitat conditions (e.g., warmer water) in the fall than in the spring.

A summary of available electroshocking fish survey data at Silverwood Lake from surveys conducted by CDFW between 1999 and 2010 is provided in Table 4.5-3.

Table 4.5-3. Catch Per Unit Effort from CDFW Electroshocking Fish Surveys at Silverwood Lake from 1999 through 2010

Species	CPUE												
	Spring	Fall	Spring	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
	1999	1999	2000	2001	2001	2002	2003	2008	2008	2009	2009	2010	2010
Rainbow trout (*Oncorhynchus mykiss*)	0.86	0.01	0.15	0.67	-	1.11	0.01	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]
Largemouth bass (*Micropterus salmoides*)	1.45	3.16	3.21	3.00	14.2	3.73	17.57	1.71	11.50	1.40	5.21	1.38	17.2
Bluegill (*Lepomis macrochirus*)	0.47	0.17	0.91	0.50	0.51	0.71	0.38	0.44	0.47	0.18	0.07	0.12	0.10
Black crappie (*Pomoxis nigromaculatus*)	0.55	0.14	0.14	0.05	0.20	0.02	0.04	-	0.11	-	0.11	-	-
Striped bass (*Morone saxatilis*)	-	0.01	0.14	0.06	2.13	0.44	2.31	0.29	0.94	-	0.18	0.02	0.10
Hitch (*Lavinia exilicauda*)	1.14	0.98	1.47	0.82	0.66	2.12	0.14	0.31	0.05	0.27	0.03	0.20	-
Sacramento blackfish (*Orthodon microlepidotus*)	0.84	0.16	1.26	0.07	0.58	0.83	0.04	0.15	-	0.22	-	0.21	0.10
Carp (*Cyprinus spp.*)	0.43	0.15	0.26	0.08	0.12	0.09	0.05	0.02	0.02	0.02	0.05	0.08	0.10
Goldfish (*Carassius auratus*)	0.42	0.28	0.87	0.36	0.20	0.59	0.09	0.03	0.03	-	-	0.03	-
Golden shiner (*Notemigonus crysoleucas*)	-	0.01	-	-	-	-	-	-	-	-	-	-	-

Table 4.5-3. Catch Per Unit Effort from Electroshocking Fish Surveys at Silverwood Lake from 1999 through 2010 (continued)

Species	CPUE												
	Spring 1999	Fall 1999	Spring 2000	Spring 2001	Fall 2001	Spring 2002	Fall 2003	Spring 2008	Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010
Channel catfish (*Ictalurus punctatus*)	0.18	0.27	0.67	0.80	1.23	0.58	0.41	0.40	0.54	0.07	0.28	0.36	0.20
White catfish (*Ameiurus catus*)	0.17	0.06	0.10	0.20	0.15	0.08	0.14	0.11	0.10	0.02	0.05	0.07	0.10
Threadfin shad (*Dorosoma petenense*)	0.54	0.48	-[2]	-[2]	-[2]	-[2]	-[2]	-[2]	-[2]	-[2]	-[2]	-[2]	-[2]
Bigscale logperch (*Percina macrolepida*)	0.23	0.41	0.15	0.01	0.40	0.02	0.06	-	-	0.03	-	-	-
Inland silverside (*Menidia beryllina*)	0.02	0.54	-[2]	0.01	-[2]	-[2]	-[2]	-[2]	-[2]	-[2]	-[2]	-[2]	-[2]
Tule perch (*Hysterocarpus traskii*)	1.85	2.84	3.07	3.01	0.84	2.24	0.09	0.76	0.07	0.02	0.07	0.64	0.70
Prickly sculpin (*Cottus asper*)	0.04	0.03	-	0.06	0.08	0.12	0.07	0.32	0.02	0.33	0.02	0.05	0
Shimofuri goby (*Tridentiger bifasciatus*)	-	-	-	-	0.06	0.01	0.02	0.02	0.07	0.03	0.03	-	0

Sources: Sunada and Curtis 2000, Sunada et al. 2000, Sunada and Barbosa 2000a, 2000b, Sunada and Chmiel 2001a, 2001b, 2002, Sunada and Granfors 2005, Ewing 2010a, 2010b

Notes:

[1]Rainbow trout were not sampled in 2008, 2009, and 2010 because CDFW's stocking records provide sufficient data to estimate current population size (Ewing 2010).

[2]Forage fish, threadfin shad and inland silverside, were observed but not counted (Ewing 2010).

Key:

CPUE = catch per unit effort

- = Data not applicable or available.

<u>Stocking and Creel Census Survey Data</u>

As discussed above, both warm water and cold water species were originally planted in Silverwood Lake to develop a recreational fishery. After 1975, the California Aqueduct Fish and Wildlife Development Plan for Silverwood Lake called for the annual stocking of 330,000 catchable trout, 90,000 catchable catfish, and 150,000 various fingerlings in Silverwood Lake (CDFG 1968).

Upon issuance of the license in 1978, DWR was required to submit a revised Exhibit S with a more detailed fish and wildlife enhancement plan. In 1982, FERC approved a revised Exhibit S, which included modified fish stocking allocations based on anticipated recreation use.

CDFW began seeing a decline in trout fishing success, and it was thought to be due to predation from the presence of striped bass. In 1988, CDFW implemented a rainbow trout tagging program at Silverwood Lake to collect information regarding angler catch rates (Hoover 1989). In total, 500 rainbow trout were stocked in March, July, September, and December of 1988. As of February, 1989, 29 tags were returned. The 29 tags represented 5.8 percent of the tagged fish. Of the 29 returned tags, 58 percent were from the first round of fish stocking in March 1988 that were also the largest fish stocked that year (1.9 fish per pound). Results suggested that the largest fish were less likely to become prey for striped bass, largemouth bass, and channel catfish. Recommendations were made to stock Silverwood Lake with larger-sized rainbow trout weighing approximately 0.5 pounds each.

In 1998, as part of the mitigation plan for construction of the new San Bernardino Tunnel Intake Tower (described below), approximately 1,000 pounds of channel catfish were stocked in Silverwood Lake. The event was coordinated with CDFW (DWR 1998b).

In 1999, the Exhibit S was amended to include attainable trout stocking rates developed in consultation with CDFW. DWR began stocking 20,000 pounds of rainbow trout (about two fish per pound) in the lake again annually for 3 years. Although the current Exhibit S requires 20,000 pounds of catchable rainbow trout, about 30,000 pounds (one fish per pound) per year of trout have been stocked in Silverwood Lake since 2006. There are two survey periods. The fall-spring survey occurs October through May and co-occurs with the trout stocking period. The summer survey occurs June through September. Trout stocking usually does not occur during these months due to the warm water conditions; however, stocking has been extended into June in some years. CDFW fisheries biologists and hatchery managers determine the appropriate fish size and stocking schedules, and coordinate the stocking with DWR and DPR. CDFW has in the past used trout raised either at the Mojave Hatchery in Victorville, California, or the San Joaquin Hatchery in Friant, California, to stock Silverwood Lake. In addition, creel survey data has been collected since 2000. A summary of the creel survey data from 2006 through 2016 is provided below, as well as annual rainbow trout stocking numbers and weights (Table 4.5-4).

Table 4.5-4. Annual CDFW Rainbow Trout Stocking and Creel Survey Data for Silverwood Lake from 2000 through June 2016

Fiscal Year[2]	Number of Trout Stocked	Total Weight of Stocked Trout (pounds)	Angler Satisfaction[1]		
			Overall Experience (fall-spring/ summer)	Number of Fish Caught (fall-spring/ summer)	Size of Fish Caught (fall-spring/ summer)
2000	35,960	20,000	-	-	-
2001	40,098	20,775	-	-	-
2002	44,938	19,825	-	-	-
2003	29,217	14,500	-	-	-
2004	48,873	38,000	-	-	-
2005	33,001	35,600	-	-	-
2006-2007	25,006	30,000	2.72/-	1.92/-	2.11/-
2007-2008	21,344	30,000	2.45/-	2.36/-	2.44/-
2008-2009	29,618	28,200	2.53/2.34	2.48/2.33	2.82/2.68
2009-2010	26,820	30,000	2.54 /2.48	2.44/1.88	2.70/2.40
2010-2011	26,885/25,135[3]	31,750/30,000[3]	2.47/2.59	2.28/2.43	2.67/2.42
2011-2012	26,820/40,745[3]	30,000/30,000[3]	2.41 /2.8	2.25/1.9	2.24/1.9
2012-2013	31,682	31,875	2.8/3.0	2.0/2.5	1.9/2.5
2013-2014	30,967[4]	30,051	2.9/2.5	2.5/2.3	2.5/2.1
2014-2015	41,461	30,293	2.7/2.2	2.7/2.1	2.7/2.0
2015-2016	34,200	30,000	-	-	-

Sources: Graham 2002, Begley 2004, Veldhuizen and Worsley 2008a, 2008b, and Veldhuizen and Worsley 2014, and DWR 2015c
Notes:
[1]CDFW rated angler satisfaction at Silverwood Lake on a scale from 1 to 4; 1 = dissatisfied, 4 = satisfied
[2]Prior to 2006 stocking allotments were tracked on a calendar year basis. Beginning in 2006-2007, stocking was tracked based on the State fiscal year cycle from July 1 through June 30.
[3]The 2010-2012 stocking reports were first filed with FERC on January 30, 2013, but it was later revised to correct errors in the fiscal year timeframe and stocking quantities in Tables 1 and 2. The revised 2010-2012 stocking report was filed with FERC on June 2, 2014 and it reports the corrected stocking totals.
[4]The 2014-2016 biennial stocking report was issued on June 29, 2016. Creel census survey data was not reported for the 2015-2016 fiscal year as analysis of the data was not yet completed at the time of reporting.
Key:
- = Data not applicable or available.

As shown in Table 4.5-4, CDFW did not meet their objective of stocking Silverwood Lake with 20,000 pounds of fish per year in 2001, 2002, and 2003. Since 2006, CDFW has stocked the lake with the contracted 30,000 pounds of rainbow trout, with the exception of the 2008-2009 fiscal year, when the total weight of stocked fish was 28,200 pounds.

Angler satisfaction with the overall fishing experience at Silverwood Lake is neither “satisfied” nor “dissatisfied”; this can also be said for the number of fish caught and the size of fish caught. Fall-spring and summer ratings tend to be similar and are not significantly different, indicating that angler satisfaction at Silverwood Lake is consistent throughout the year.

During the creel surveys at Silverwood Lake from 2005 through 2013, anglers were surveyed on the type of fish species caught (Tables 4.5-5 and 4.5-6).

Table 4.5-5. Reported Number of Game Fish Caught by Anglers at Silverwood Lake during the Summers of 2005 through 2013

Fall - Spring[1]	Trout		Catfish		Black Crappie		Bluegill		Largemouth bass		Striped Bass		Total
	#	%	#	%	#	%	#	%	#	%	#	%	#
2005[2]	439	24	102	6	14	1	7	0	175	10	1,097	60	1,834
2006[2]	538	45	93	8	1	0	2	0	257	22	292	25	1,183
2007[2]	755	43	43	2	3	0	7	0	291	17	640	37	1,740
2008[2]	823	50	72	4	13	1	21	1	551	34	164	10	1,644
2009[2]	651	45	53	4	1	0	6	0	310	21	426	29	1,447
2010	691	74	43	5	1	0	8	1	109	12	86	9	938
2011	375	59	59	9	1	<1	2	<1	168	27	26	4	631
2012	729	35	197	9	197	9	109	5	624	30	223	11	2,079
2013	279	27	6	1	17	2	64	6	176	17	476	47	1,018

Source: Hemmert and Traver 2013a
Notes:
[1]October through May
[2]Data from 2005 through 2009 is currently under review and is subject to revision (3/30/2016)
Key:
% = percent
 # = pounds

Table 4.5-6. Reported Number of Game Fish Caught by Anglers at Silverwood Lake during the Summer Creel Surveys of 2005 through 2013

Summer[1]	Trout		Catfish		Black Crappie		Bluegill		Largemouth bass		Striped Bass		Total
	#	%	#	%	#	%	#	%	#	%	#	%	#
2005[2]	7	2	157	37	0	0	10	2	79	18	174	41	427
2006[2]	7	1	236	22	0	0	6	1	286	27	540	50	1075
2007[2]	23	2	158	14	0	0	15	1	105	10	790	72	1091
2008[2]	299	46	21	3	3	0	6	1	238	37	80	12	647
2009[2]	42	8	89	18	0	0	12	2	72	14	284	57	499
2010	10	10	47	48	3	3	9	9	17	18	11	11	97
2011	12	4	115	40	2	1	63	22	60	21	37	13	289
2012	3	1	14	4	9	3	8	2	107	31	209	60	350
2013	6	1	24	3	1	0	8	1	32	4	814	92	885

Source: Hemmert and Traver 2013b,
Notes:
[1]June through September
[2]Data from 2005-2009 is currently under review and subject to revision (3/30/16)
Key:
% = percent
 # = pounds

Silverwood Lake Outlet

In 1973, CDFW biologists were concerned that the Silverwood Lake Outlet, when in operation, was entraining fish into the San Bernardino Tunnel and trout plants were thought to be lost at a substantial rate (Baracco 1975). In order to determine if the water release through the outlet was having a significant effect on the rainbow trout population, one-day creel census were conducted at Silverwood Lake and Castaic Lake in both 1974 and 1975. Biologists believed if catch rates at Castaic Lake were comparable, then no significant loss of rainbow trout was occurring at Silverwood Lake. Results yielded similar catch rates thereby suggesting that loss of rainbow trout from Silverwood Lake Outlet were insignificant, and no action to alter loss rates was needed.

In March 1988, DWR conducted field investigations to determine the head losses through the intake tower as part of a study of the feasibility of increasing the energy available at the recently enlarged Devil Canyon Powerplant. Investigations during head loss tests showed that the San Bernardino Intake Tower did not meet acceptable seismic design standards; the structure could fail structurally if a moderate or large earthquake occurred (DWR 1994a). Instead of repairing the existing intake tower, DWR decided a new intake structure would result in a seismically superior design, reduce the degree and time of drawdown of the lake needed for construction, and cause less interruptions to downstream water deliveries.

In January 1989, DWR filed an application to amend the license to construct the Devil Canyon Second Afterbay and to enhance the enlargement of the powerplant (DWR

1994a). The new afterbay would hold 800 AF of water. Initial plans called for no change to the existing Silverwood Lake Outlet.

Fish screens were planned to be added to the six tiers of the Silverwood Lake Outlet as mitigation per an agreement between CDFW and DWR (White 1997). However, CDFW later confirmed with DWR that fish screens were not required on the new intake structure and that no fish screens were installed on the outlet structures in Pyramid Lake, Castaic Lake, Lake Perris, or other reservoirs in the Region 5 area (Worthley 1992).

For tunnel intake construction purposes, the reservoir was planned to be lowered 43 feet for 11 months and lowered an additional 50 feet for 4 more months (DWR 1994a). The construction project lowered the reservoir below its normal level for about 22 months. CDFW believed drawdown would reduce the amount of fish habitat in the lake and increase fish concentrations in the remaining pool, likely increasing predation. In addition, CDFW believed all riparian cover would be lost, a substantial portion of the reservoir would be exposed, and suitable spawning habitat for fish would be unavailable. It was believed that the Silverwood Lake fishery would gradually recover in about 3 to 5 years (DWR 1994a).

To mitigate the expected adverse impacts of drawing down the water level at Silverwood Lake, a Fishery Mitigation Plan was filed on May 15, 1995 (DWR 1995), with a revision filed on August 27, 1996 incorporating habitat improvement measures recommended by CDFW (DWR 1996). The mitigation included installing microhabitat (e.g., bushes, grasses, and willows), installing macrohabitat (e.g., rock, concrete rubble, and bundled pipe caves), restocking the reservoir with approved warm-water game species, monitoring the utilization of the newly installed habitat, and monitoring the survival and harvest of hatchery-reared fish. No fish screens were proposed as mitigation.

In 1995, the Southern California Bass Council (SCBC) filed a State court suit against DWR, raising issues under CEQA (Robinson 1999).The San Bernardino Superior Court ordered a committee, CDFW, DWR, and SCBC, to develop a supplemental fishery enhancement plan to increase the likelihood of successfully restoring the fishery from the drawdown.

In 1998, CDFW conducted sampling for entrained egg and larvae at the Devil Canyon Afterbay to assess the potential effect of entrainment on the Silverwood Lake fishery (Chun 1998, pers. comm., Giusti 2015)). Specific sampling methods were not disclosed. In the memorandum, computations were provided and entrainment estimates were reported for two sampling periods and a yearly total. For the March 9 to May 8 sampling period, the total estimated entrained larvae was 84.6 million, with 95 percent confidence intervals ranging from 63.6 million to 105.6 million. The May 9 to August 12 sampling period total estimated entrained larvae was 32.2 million with 95 percent confidence intervals ranging from 27.1 million to 37.3 million. The total season estimate of entrained larvae was calculated as 116.8 million, with 95 percent confidence intervals ranging from 95.2 million to 138.5 million.

As a result of the SCBC litigation, DWR amended its existing fishery mitigation plan to include the mitigation provisions for the drawdown required by the court's decision. The plan complemented the earlier approved mitigation plans and added the following objectives and procedures:

- Remove undesirable non-game fish (e.g. hitch, carp, goldfish and blackfish) from the lake by either electrofishing or trawling;
- Increase microcover for juvenile largemouth bass and other desirable game fish;
- Change the fishing regulations for Silverwood Lake to reduce the limit of largemouth bass to 2 per day with a minimum size limit of 15 inches;
- Enhance the largemouth bass population in the lake by planting 5,000 juvenile and 2,000 adult Florida-strain largemouth bass; and
- Include an optional provision for stocking Alabama spotted bass (*Micropterus punctulatus*) (CDFG 1999).

The proposed plan was finalized by CDFG and SCBC on May 24, 1999, and the San Bernardino County Superior Court ordered its implementation on June 11, 1999, with the stated goal to complete mitigation by 2002, at the latest.

To evaluate potential impacts to the legal-size largemouth bass population due to the lake drawdown, largemouth bass population surveys were conducted by CDFW pre- and post-drawdown. Legal-size largemouth bass are defined as greater than or equal to 12 inches in total length.

In 1995, the population estimate of legal-size largemouth bass at Silverwood Lake was 13,121. Population estimates from 1995 (after drawdown) to 1998 (after lake refilling in 1997) ranged from 3,819 to 5,327 individuals (Sunada et. al. 1999). The population increased about 15 percent between the 1997 to 1998 surveys, and the 2003 survey showed an increase in largemouth bass populations following bass stocking mitigation.

Population estimates of largemouth bass were derived using three recapture methods and three statistical methods. The three recapture methods included electrofishing, tournament sampling, and a combination of both electrofishing and tournament sampling. CDFW believes using both tournament fishing and electrofishing will have the potential to accurately estimate the population size at Silverwood Lake. Fish captured in tournaments are believed to be caught at greater depths than possible or effective with the electrofishing sampling techniques.

Ewing (2009) noted that comparing the reported largemouth bass population estimates is difficult due to differences in sampling techniques and number of individuals captured. In 2003 and 2009, the whole lake was sampled using electroshocking techniques, whereas only transects were sampled in other years. Ewing (2009) believed that the transect sampling underestimated the population and that the 2009 tournament population estimate was inaccurate due to a small sample size. Results from the surveys and population estimates are provided below in Table 4.5-7.

Table 4.5-7. Legal-size Largemouth Bass Population Estimates at Silverwood Lake

Year	Recapture Method	Population Estimate	95% C.I. Low	95% C.I. High	Statistical Method
1995[1]	Electrofishing	3,805	3,073	4,712	SM
1997[2]	Electrofishing	4,621	4,176	5,165	SEM
1998[2]	Electrofishing	5,327	3,783	7,503	SEM
2003[1]	Electrofishing	4,060	3,735	4,509	SEM
	Electrofishing	3,626	3,362	3,987	SM
2005[1]	Electrofishing	6,558	3,282	-	SEM
	Electrofishing	2,520	1,548	6,767	SM
2007[1]	Electrofishing	2,097	1,238	6,820	SEM
	Electrofishing	2,165	1,599	3,068	SM
2009[1]	Tournament & Electrofishing	3,825	3,405	4,363	SEM
	Tournament & Electrofishing	3,697	3,255	4,278	SM
	Tournament	7,773	2,075	11,772	PM
	Tournament	5,180	2,915	23,247	SEM
	Tournament	5,160	2,572	-	SM
	Electrofishing	3,797	3,148	4,783	SEM
	Electrofishing	3,652	3,142	4,359	SM

Sources: [1]Ewing 2009, [2]Sunada et al. 1999
Key:
- =Data not applicable or available
% = percent
C.I. = confidence interval
SEM = Schumachmeyer method
SM = Schnabel method

Downstream of Silverwood Lake

There is limited information describing the fish community in the West Fork Mojave River.

In a report on the Decline of Native Ranid Frogs in the Desert Southwest, Jennings and Hayes (1994) suggest that Threespine stickleback (*Gasterosteus aculeatus*), mosquitofish (*Gambusia affinis*), black bullhead (*Ameiurus melas*), green sunfish (*Lepomis cyanellus*), red shiner (*Cyprinella lutrensis*), striped bass, bigscale logpearch (*Percina macrolepida*), inland silversides (*Menidia beryllina*) and prickly sculpins (*Cottus asper*) may be present in the West Fork Mojave River downstream of Cedar Springs Dam through spills or water transfers from Silverwood Lake.

Swift et al. (1993) identified 14 species that have historically been observed or are currently present in the Mojave River system (including Silverwood Lake and Deep Creek): Mohave tui chub, arroyo chub, partially armored threespine stickleback (*Gasterosteus aculeatus microcephalus*), striped bass, bigscale logperch, tule perch (*Hysterocarpus traskii*), hitch, splittail, inland silverside, prickly sculpin, and brown trout (*Salmo trutta*).

In an examination of the Mojave River for potential reintroduction of the ESA-listed Mohave tui chub (the species is discussed in detail in Section 4.8), Henkanaththegedara et al. (2008) reported a total of 19 fish species, all of which were non-native. The data included fish sampling conducted in the Mojave River watershed, above Silverwood Lake (and including Silverwood Lake), and downstream of Cedar Springs Dam.

Devil Canyon Afterbay

The only available information for the Devil Canyon Afterbay was described in Section 4.5.1.3.

4.5.1.5 Amphibians and Semi-Aquatic Reptiles

Aquatic resources include amphibians, snakes and turtles that are closely associated with aquatic environments (Table 4.5-8). Western toad (*Anaxyrus boreas*), Baja California chorus frog (or treefrog) (*Pseudacris hypochondriaca*) (treated in older literature as Pacific chorus frog or treefrog, *Pseudacris regilla*), and California chorus frog (or treefrog) (*P. cadaverina*) were documented to occur in the Project vicinity north of Silverwood Lake by surveys performed for the Horsethief Creek Bridge Replacement Project in 2004 (Aspen Environmental Group and Hunt & Associates 2006) and more recently on the West Fork Mojave River and Grass Valley Creek by HELIX (2014). These three common species could also occur in the Project area, along with American bullfrog which is known to occur in the West Fork Mojave River downstream of Silverwood Lake and in beaver impoundments on the Los Flores Ranch north of Silverwood Lake. There are no confirmed records of western spadefoot in the Project vicinity and most sources do not include this area within the range of the species. However, Jennings and Hayes (1994) depict a verified, historical museum record of western spadefoot for southwest San Bernardino County. A call which may have been of this species was noted during the Horsethief Creek Bridge Replacement surveys (Aspen Environmental Group and Hunt & Associates 2005).

Table 4.5-8. Aquatic Amphibians, Semi-aquatic Snakes, and Turtles that are known to Occur or May Potentially Occur in the Vicinity of the Project

Species	Habitat Associations
Western spadefoot [SSC] (*Spea hammondii*)	Formerly widespread species, but likely extirpated from large parts of its historical range in the Central Valley, coastal plain, and foothills by intensive agricultural and urban development, and loss of vernal pool habitat. Occurs in grasslands, oak woodlands, and occasionally chaparral. Breeds in vernal pools and other ponds that dry seasonally (rarely in permanent ponds), and occasionally in intermittent streams. Survives dry seasons by burrowing deep into loose soil. Species is currently under review by USFWS to determine whether ESA listing is warranted. See Section 4.5.1.2.
Arroyo toad [FE, SSC] (*Anaxyrus* [*Bufo*] *californicus*)	See Section 4.8.2.2.
Western toad (*Anaxyrus* [*Bufo*] *boreas*)	Widespread species, breeding in ponds, lakes, and reservoir edges, and slow-moving or still sections of streams across a wide range of elevations and habitats, including woodlands, grasslands, and meadows. May be highly terrestrial outside of the breeding season, with females traveling farther from breeding sites than males, and often inhabiting existing burrows during periods of extreme temperatures. No conservation concerns have been documented for this species in California.
Baja California chorus frog (treefrog) (*Pseudacris hypochondriaca*)	The most common amphibian within its range, and as ecologically adaptable as its more northern-ranging sibling species, Sierra chorus frog (*P. sierra*) and Pacific chorus frog (*P. regilla*), from which it was separated by Recuero et al. (2006). Occurs over a wide range of elevations, and breeds in ponds, lakes and reservoir edges, ditches, slow-moving or still sections of streams, and opportunistically in small rainwater pools. Outside of the breeding season may be heard far from water.
California chorus frog (treefrog) (*Pseudacris cadaverina*)	Locally common species found from San Luis Obispo County south to Baja California, Mexico along coastal and desert slope drainages and in desert oases. Known from near sea level to 7,500 feet elevation. Breeds in pools in rocky, seasonally intermittent and perennial streams, with larvae metamorphosing in June to August. Although not aquatic outside of the breeding season, adults and juveniles usually remain close to stream courses during surface activity season, and it may retreat to rock crevices and rodent burrows during the driest periods.
California red-legged frog [FT, SSC] (*Rana draytonii*)	See Section 4.8.2.3.
Southern mountain yellow-legged frog [FE, SE] (*Rana muscosa*)	See Section 4.8.2.4.

Table 4.5-8. Aquatic Amphibians, Semi-aquatic Reptiles, and Turtles that are known to Occur or May Potentially Occur in the Vicinity of the Project (continued)

Species	Habitat Associations
American bullfrog (*Lithobates* [*Rana*] *catesbeianus*)	Introduced and now widespread species, well established in slow-moving streams, stock ponds, lakes, and reservoirs to at least 5,000 feet elevation. Highly aquatic and usually associated with permanent bodies of water with ample aquatic and emergent vegetation, but has successfully invaded rivers and reservoirs where vegetation is sparse. Larvae often overwinter before metamorphosis. The presence of bullfrogs may be associated with declines of other native frogs. See Section 4.5.1.2.
Two-striped garter snake (*Thamnophis hammondii*)	Occurs in coastal southern California to Baja California, from near sea level to 8,000 feet elevation. Common in suitable habitats, but has declined or disappeared in urbanized areas. Closely associated with areas of permanent water, especially in and along rocky streams. See Section 4.5.1.1.
Southern western pond turtle (*Actinemys* [*Emys*] *pallida*) [SSC]	Occurs in a wide variety of aquatic habitats across a broad range of elevations, particularly permanent ponds, lakes, side channels, backwaters, and pools of streams, but is uncommon in high-gradient streams. Often overwinters in forested habitats and oviposits in summer at upland sites as much as 1,200 feet from aquatic habitats. See Section 4.5.1.1.

Sources: Lannoo 2005, Jones et al. 2006, Stebbins and McGinnis 2012, California Herps 2015
Key:
ESA = Endangered Species Act
FE = federal endangered
FT = federal threatened
FSS = Forest Service sensitive
SE = California State endangered
SSC = California State species of special concern
USFWS = U.S. Fish and Wildlife Service

4.5.1.6 Aquatic Mollusks

DWR referred to the CDFW's CNDDB to determine if there were any recorded occurrences of aquatic mollusk species in the Project area. A query of the CNDDB was conducted within quadrangles located within the Project area. One mollusk, the westfork shoulderband (*Helminthoglypta taylori*), was reported in the Silverwood Lake quadrangle (CDFW 2015a). The westfork shoulderband falls on the CDFW Special Animals List and is ranked G1 S1 which translates to "critically imperiled in the state due to extreme rarity." Although this species is recognized on the Special Animals List, it is not considered special-status (CDFW 2015a).

Additionally, DWR accessed the California Environmental Data Exchange Network (CEDEN) to find data regarding mollusks in and around the Project area. A county-based query was run emphasizing select map stations with relevance to the Project. Data from two map stations, one upstream and one downstream of Silverwood Lake, that occurred closest to the Project area were examined: (1) Deep Creek approximately 0.8 miles above the Mojave River; and (2) Waterman Canyon Random Site 01783. The results of the query included seven samples identified by family as Planorbidae, Physidae and Sphaeriidae. The samples were further broken down into genus and included *Gyraulus*, *Helisoma*, *Physa* and *Pisidium* (CEDEN 2012).

4.5.1.7 Benthic Macroinvertebrates

In virtually all ecosystems, invertebrates comprise the vast majority of faunal taxa and biomass. Their significance as indicators of ecosystem health is indicative of their proximal relationship to environmental parameters and the reliance of higher animals upon them as prey items. In freshwater environments, the larger bottom-dwelling invertebrate species, or benthic macroinvertebrates (BMI), provide an essential trophic base for many vertebrate species. Yet, these organisms are a subject and resource that are seldom studied, and available information concerning BMI is primarily general in nature.

A biological reconnaissance survey covering most of Silverwood Lake, with particular emphasis placed on the Miller Canyon arm of the lake, was conducted by Pacific Southwest Biological Services, Inc. in August 1993 (CLAWA 1993). The study was conducted in support of an expansion of the CLAWA water treatment plant site. The survey objective was to evaluate the general area for sensitive biological resources and to make recommendations to avoid or minimize effects on these species. During this initial reconnaissance survey no aquatic invertebrates were noted (DWR 1994b).

DWR consulted the CEDEN to find data on benthic macroinvertebrates in the Project vicinity. A county-based query was run highlighting select map stations with relevance to the Project vicinity. Data from two map stations, one upstream and one downstream of Silverwood Lake, that occurred closest to the Project area were examined: (1) Deep Creek 0.8 miles above the Mojave River; and (2) Waterman Canyon - Random Site 01783. Orders and families of aquatic macroinvertebrates that were found at the two sampling locations are described in Table 4.5-9 (CEDEN 2012).

Table 4.5-9. Orders and Families of Aquatic Macroinvertebrates Found in Two Sampling Locations in the Project Vicinity

Order	Families
Basommatophora	Physidae, Planorbidae
Coleoptera	Dryopidae, Elmidae, Haliplidae
Diptera	Ceratopogonidae, Chironomidae, Empididae, Psychodidae, Simuliidae
Ephemeroptera	Baetidae, Ephemerellidae, Heptageniidae, Leptohyphidae
Odonata	Coenagrionidae, Libellulidae
Plecoptera	Nemouridae
Trichoptera	Brachycentridae, Hydropsychidae, Lepidostomatidae, Hydroptilidae, Psychomyiidae, Leptoceridae, Philopotamidae, Rhyacophilidae, Helicopsychidae
Trombidiformes	Lebertiidae, Sperchontidae, Hygrobatidae, Mideopsidae
Veneroida	Sphaeriidae

Source: CEDEN 2012

4.5.1.8 Algae and Cyanobacteria

Silverwood Lake experiences cyanobacteria (blue-green algae) blooms. DWR identified production of geosmin in Silverwood Lake during an algal bloom dominated by the cyanobacterium *Anabaena lemmermannii* in 2013 (DWR 2014f). An algal bloom dominated by *Anabaena spp.* also produced geosmin during 2014 (DWR 2015d). DWR began monitoring for cyanotoxins in Silverwood Lake in 2013. The cyanotoxin microcystin was detected during sampling events in 2013, 2014, and 2015 (DWR 2015d). Cyanobacteria species that dominated microcystin-producing algal blooms in the lake include *Microcystis* spp., *Woronichinia naegeliana, Limnoraphis birgei, Aphanizomenon* spp., *Anabaena* spp., and *Aphanocapsa* sp.

DWR queried the CEDEN to gather data regarding algae. A county-based query was run highlighting select map stations with relevance to the Project area. Data from two map stations, one upstream and one downstream of Silverwood Lake, that occurred closest to the Project area were examined: (1) Deep Creek approximately 0.8 miles above the Mojave River; and (2) Waterman Canyon Random SMC Site 01783. The orders of photosynthetic organisms and diatoms that were reported from the two sites were Achnanthales, Bacillariales, Chlorellales, Chroococcales, Cladophorales, Cymbellales, Euglenales, Fragilariales, Naviculales, Oocystales, Oscillatoriales, Pseudanabaenales, Rhopalodiales, Sphaeropleales, Thalassiophysales and Zygnematales (CEDEN 2012). Treatment of AIS plants, algae or algal blooms, aquatic or terrestrial, is discussed in Section 4.9.

4.6 BOTANICAL AND WILDLIFE RESOURCES

This Section provides information regarding existing botanical and wildlife resources. For the purpose of this PAD, botanical and wildlife resources include upland vegetation communities and plant species, and terrestrial wildlife. Aquatic or semi-aquatic amphibians, and reptiles are discussed in Section 4.5. Species listed as threatened or endangered under the ESA, or proposed or candidates for listing under the ESA, are addressed in Section 4.8. Besides this general introductory information, the Section is divided into seven main sub-sections: Section 4.6.1 describes the general distribution of vegetation from existing vegetation mapping in the Project area; Section 4.6.2 lists special-status botanical species; and Section 4.6.3 identifies non-native invasive plants (NNIP), known or with potential to occur in the Project area. For the purposes of botanical resources, the focus is the area within and immediately adjacent to the existing Project boundary. Sections 4.6.4 and 4.6.5 list and describe special-status wildlife species and commercially valuable wildlife species, respectively, which may occur in the Project vicinity, including their potential temporal and spatial distribution. Section 4.6.6 identifies designated special ecological areas. Section 4.6.7 describes existing, relevant and reasonably available information regarding wildlife species occurrences, including but not limited to special-status species, near above-ground Project facilities.

4.6.1 Vegetation Mapping

For the purposes of botanical resources, the focus is the area within and immediately adjacent to the existing Project boundary. USFS Classification and Assessment with Landsat of Visible Ecological Groupings (CalVeg) (USFS 2014) are available for the area within the Project boundary. CalVeg data classify and describe existing vegetation according to a hierarchical classification system. The data are created using automated, systematic procedures; remote sensing classification; photo editing; and field-based observations. CalVeg data have a minimum mapping unit of 2.5 acres, with the exception of lakes and conifer plantations, which have no minimum mapping unit. Where areas smaller than 2.5 acres occur in the data, these represent data which have been subsequently edited and finalized by USFS. Smaller units also occur in the project-specific data because the Project boundary may include only a small part of a mapped habitat polygon.

Digital CalVeg data files from USFS also provide mapping using the California Wildlife Habitat Relationships (WHR) classification system (Mayer and Laudenslayer, Jr. 1988). Table 4.6-1 provides the area of each WHR habitat types mapped within the Project boundary, along with the corresponding CalVeg classifications; individual WHR habitat types may encompass more than one CalVeg vegetation type, as shown in the table. Note that areas less than 2.5 acres may occur, because the Project boundary may include only a small part of a mapped habitat polygon.

The Project falls largely within the South Coast and Montane CalVeg zone (i.e., Zone 7), extending into the South Interior Zone (Zone 8) at the north end of Silverwood Lake. The area within the proposed Project boundary encompasses 2,070 acres. This area encompasses the entire proposed Project boundary, including buried features, such as the San Bernardino Tunnel, although no impacts would occur in these areas. Sixteen habitat types occur within the proposed Project boundary. Mixed Chaparral (20 percent) comprises the majority of land area. The acreages of WHR habitat types within the existing Project boundary are summarized in Table 4.6-1 and are shown in Figure 4.6-1.

Table 4.6-1. California Wildlife Habitat Relationship and CalVeg Classification Acreages Within the Project Boundary

California Wildlife Habitat Relationship Type[1]	Classification and Assessment with Landsat of Visible Ecological Groupings (CalVeg) Classification	Acreage[2]	Percentage of Study Area
Tree-Dominated Habitats			
Sierran Mixed Conifer	Bigcone Douglas-Fir, Mixed Conifer – Pine	13	1
Ponderosa Pine	Ponderosa Pine	1	<1
Montane Hardwood	Bigcone Douglas-Fir, Black Oak, Canyon Live Oak, Coulter Pine, Interior Mixed Hardwood, Mixed Conifer – Pine, Pondersa Pine	150	7
Montane Hardwood-Conifer	Bigcone Douglas-Fir, Coulter Pine, Douglas-Fir – Ponderosa Pine, Mixed Conifer - Pine, Ponderosa Pine	25	1
Coastal Oak Woodland	Interior Live Oak	4	<1
Valley Foothill Riparian	California Sycamore, Riparian Mixed Hardwood, Willow, Willow (Shrub)	51	2
Shrub-Dominated Habitats			
Sagebrush	Rabbitbrush	6	<1
Montane Chaparral	Great Basin – Mixed Chaparral Transition, Mixed Conifer – Pine	<1	<1
Mixed Chaparral	Buckwheat, Coulter Pine, Lower Montane Mixed Chaparral, Manzanita Chaparral, Scrub Oak, Semi-Desert Chaparral	407	20
Chamise-Redshank Chaparral	Chamise	58	3
Coastal Scrub	California Sagebrush, Coulter Pine, Soft Scrub Mixed Chaparral	99	5
Desert Wash	Riversidean Alluvial Scrub	44	2
Desert Scrub	Desert Buckwheat, Desert Mixed Shrub	24	1

Table 4.6-1. California Wildlife Habitat Relationship and CalVeg Classification Acreages Within the Project Boundary (continued)

California Wildlife Habitat Relationship Type[1]	Classification and Assessment with Landsat of Visible Ecological Groupings (CalVeg) Classification	Acreage[2]	Percentage of Study Area
Herbaceous-Dominated Habitats			
Annual Grassland	Annual Grasses and Forbs	13	1
Developed Habitats			
Urban	Urban/Developed (General)	128	6
Non-vegetated Habitats			
Barren	Barren, Urban-related Bare Soil	58	3
Lacustrine Habitats			
Water	Water	989	48
	Total:	2,070	100

Notes:
[1]Habitat type abbreviation (in parentheses) is provided for reference to abbreviations in Figure 4.6-1.
[2]Acreages include underground features.
Key:
CalVeg = USFS Classification and Assessment with Landsat of Visible Ecological Groupings
< = less than

The following discussion describes WHR mapped habitats within the existing Project boundary. The descriptions of habitat type structure and species composition are derived from generalized information in Mayer and Laudenslayer (1988) and Holland and Keil (1995), with Project area-specific information provided at the end of each habitat type description, if found in literature review.

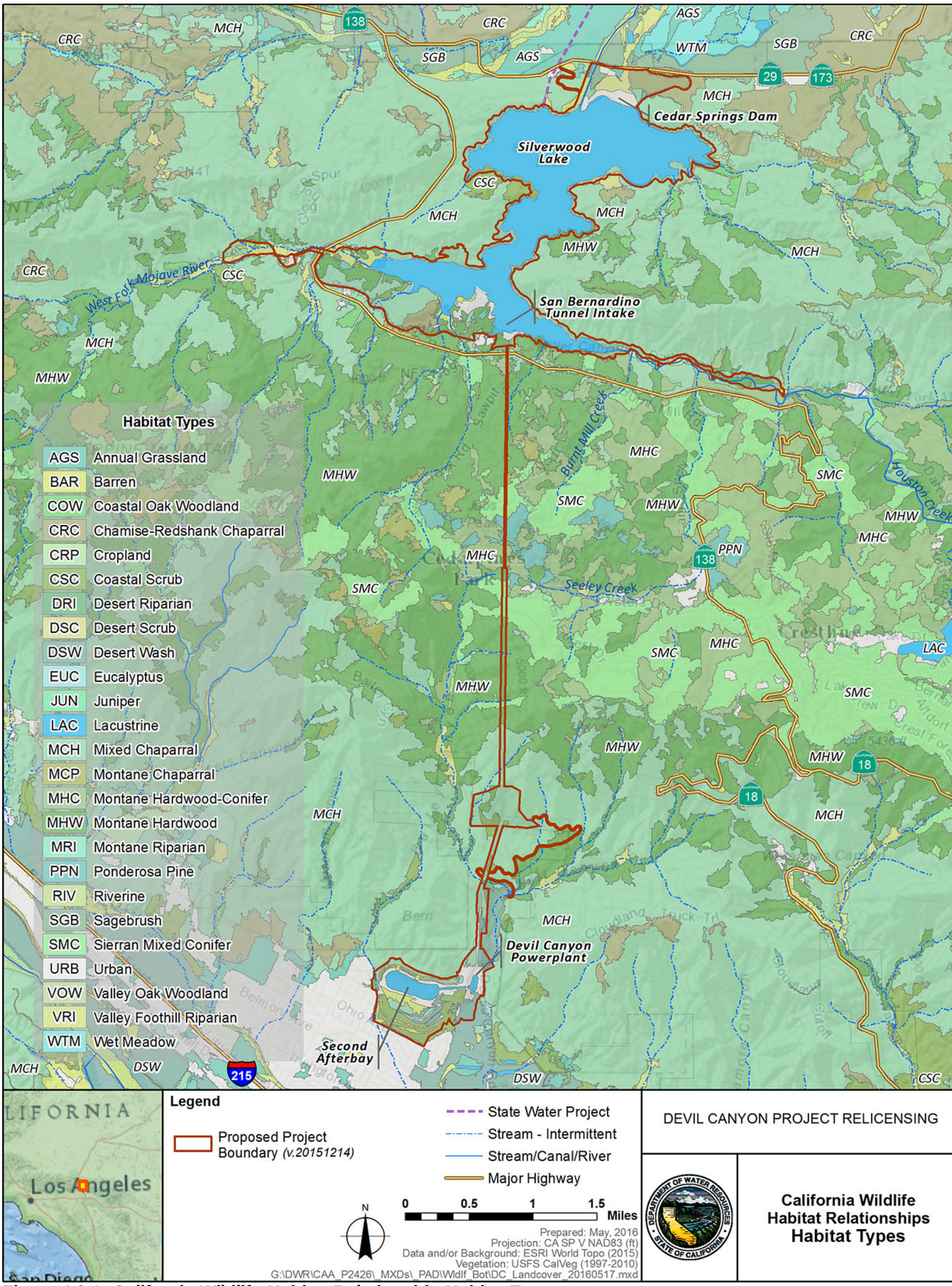


Figure 4.6-1. California Wildlife Habitat Relationship Habitat Types

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4.6.1.1 Tree-Dominated Habitats

Sierran Mixed Conifer

Sierran Mixed Coniferous forests are composed of multiple layers of conifer and hardwood species that form nearly 100 percent canopy cover. Trees include white fir (*Abies concolor*), Douglas-fir (*Pseudotsuga menziesii*), ponderosa pine (*Pinus ponderosa*), sugar pine (*Pinus lambertiana*), incense cedar (*Calocedrus decurrens*), and California black oak (*Quercus kelloggii*). White fir is generally the most common species, with ponderosa pine dominating at lower elevations and on south-facing slopes. Shrubs are common in understory openings and can include deerbrush (*Ceanothus integerrimus*), manzanitas (*Arctostaphylos* spp.), bush chinquapin (*Chrysolepis sempervirens*), tanoak (*Notholithocarpus densiflorus*), bitter cherry (*Prunus emarginata*), mountain whitethorn (*Ceanothus cordulatus*), gooseberries (*Ribes* spp.), and roses (*Rosa* spp.). Understory grasses and forbs include California bromegrass (*Bromus carinatus*), sedges (*Carex* spp.), bull thistle (*Cirsium vulgare*), irises (*Iris* spp.), rushes (*Juncus* spp.), and western needlegrass (*Stipa occidentalis*).

Within the proposed Project boundary, WHR maps Sierran Mixed Conifer habitat type in several patches south of Silverwood Lake and along the San Bernardino Tunnel corridor near Cedarpines Park.

Ponderosa Pine

Ponderosa Pine habitat is found on mountain and foothill sites throughout most of California. Structure and density vary; ponderosa pine can be the only canopy species, or other species, such as white fir, incense cedar, Coulter pine (*Pinus coulteri*), Jeffrey pine (*Pinus jeffreyi*), sugar pine, Douglas fir, bigcone Douglas-fir (*Pseudotsuga macrocarpa*), canyon live oak (*Quercus chrysolepis*), California black oak, Oregon white oak (*Quercus garryana*), Pacific madrone (*Arbutus menziesii*), and tanoak can also occur. If a shrub layer is present, it may include species such as manzanitas, ceanothus (*Ceanothus* spp.), Pacific dogwood (*Cornus nuttallii*), hairy yerba santa (*Eriodictyon trichocalyx*), ashy silktassel (*Garrya flavescens*), bitter cherry, California coffeeberry (*Frangula californica*), poison oak (*Toxicodendron diversilobum*), and Sierra gooseberry (*Ribes roezlii*). Some common grasses and forbs include California bromegrass, Orcutt's brome (*Bromus orcuttianus*), sedges (*Carex* spp.), smallflower melicgrass (*Melica imperfecta*), bluegrass (*Poa* spp.), squirreltail (*Elymus elymoides*), bedstraw (*Galium* spp.), hairy brackenfern (*Pteridium aquilinum* var. *pubescens*), chaparral false bindweed (*Calystegia occidentalis*), diamond clarkia (*Clarkia rhomboidea*), Child's blue eyed Mary (*Collinsia childii*), giant woollystar (*Eriastrum densifolium*), splendid woodland-gilia (*Saltugilia splendens*), rainbow iris (*Iris hartwegii*), whiskerbrush (*Leptosiphon ciliatus*), grape soda lupine (*Lupinus excubitus*), summer lupine (*Lupinus formosus*), chaparral nightshade (*Solanum xanti*), streptanthus (*Streptanthus* spp.), goosefoot violet (*Viola purpurea*), and iris.

Within the proposed Project boundary, Ponderosa Pine habitat type occurs only in a small area along the San Bernardino Tunnel corridor near Cedarpines Park.

Montane Hardwood-Conifer

Montane Hardwood-Confer forests occur on coarse, well-drained, mesic (moderately moist) soils, in mountainous terrain with narrow valleys. In this habitat type, deciduous and coniferous trees are present – both types make up a minimum of one third of the trees present. Species may include ponderosa pine, Douglas-fir, incense cedar, California black oak, tanoak, Pacific madrone, Oregon white oak, canyon live oak, and coast live oak (*Quercus agrifolia*). The understory is typically relatively sparse.

Canopy species include Jeffery pine, bigcone Douglas-fir, and incense cedar, with a subcanopy of California black oak, interior live oak (*Quercus wislizeni* var. *frutescens*), and California laurel (*Umbellularia californica*). Common shrub and herbaceous species in this area include hollyleaf redberry (*Rhamnus ilicifolia*), poison oak, western chokecherry (*Prunus virginiana* var. *demissa*), and poodle-dog bush (*Turricula parryi*) (California Watchable Wildlife 2015).

Within the proposed Project boundary, Montane Hardwood-Conifer habitat type makes up much of the vegetation along the East Fork of the West Fork Mojave River and also occurs in some areas along the San Bernardino Tunnel corridor.

Montane Hardwood

Montane Hardwood forests have a hardwood overstory of varying density, with sparser shrub and herbaceous layers. Trees at middle and higher elevations can include Jeffrey pine, ponderosa pine, sugar pine, incense cedar, California white fir, bigcone Douglas-fir, California black oak, and Coulter pine; lower elevation species include white alder (*Alnus rhombifolia*), coast live oak, bigleaf maple (*Acer macrophyllum*), California laurel, bigcone Douglas-fir, and occasionally valley oak (*Quercus lobata*), California foothill pine (*Pinus sabiniana*), and blue oak (*Quercus douglasii*). Understory shrubs can include manzanita, poison oak, California coffeeberry, gooseberries, and ceanothus.

Montane Hardwood habitat in the Silverwood Lake SRA occurs as enclaves within Montane Hardwood-Conifer stands. It is dominated by California black oak, with Jeffrey pine and interior live oak occurring in small numbers in the subcanopy. Shrub species are similar to those found in Montane-Hardwood Conifer in Silverwood Lake SRA (see above) (California Watchable Wildlife 2015). Environmental Science Associates (2014) surveyed the perimeter of Silverwood Lake in 2014 and found black oak occurring in one location on the southern perimeter of the reservoir on a north-facing slope. In this area, the canopy was entirely black oak, with a dense shrub layer of redheart (*Ceanothus spinosus*) and very little herbaceous vegetation (Environmental Science Associates 2014).

Montane Hardwood habitat type is common throughout within the proposed Project boundary. It occurs on the south side of Silverwood Lake, along the San Bernardino Tunnel corridor, and in the vicinity of Devil Canyon Powerplant.

Coastal Oak Woodland

Coastal Oak Woodland habitats are highly variable, typically including deciduous and evergreen hardwoods, generally oaks, occasionally with some conifers. Density and structure can vary between sparse, open areas, to dense, multilayer canopies. Coast live oak is often dominant and can co-occur in mesic sites with California laurel, Pacific madrone, tanoak, and canyon live oak. In drier areas, valley oak, blue oak, and California foothill pine may be found with coast live oak. Understory species can include California blackberry (*Rubus ursinus*), creeping snowberry (*Symphoricarpos mollis*), toyon (*Heteromeles arbutifolia*), and herbaceous plants such as western bracken fern (*Pteridium aquilinum*), California polypody (*Polypodium californicum*), fiestaflower (*Pholistoma* spp.), and springbeauty (*Claytonia* spp.).

Within the proposed Project boundary, Coastal Oak Woodlands habitat type is mapped along the West Fork Mojave River upstream of Silverwood Lake and in a few patches on the northeast side of Silverwood Lake.

Montane Riparian

Montane Riparian habitats are found in areas of montane lakes, ponds, seeps, bogs and meadows, rivers, streams, and springs. The composition of Montane Riparian varies in species and structure; it typically occurs in narrow patches of dense trees with a sparse understory, but shrubs may be more common at higher elevations. Overstory species may include white alder, Fremont cottonwood (*Populus fremontii*), Goodding's willow (*Salix gooddingii*), arroyo willow (*S. lasiolepis*), red willow (*S. laevigata*), narrowleaf willow (*S. exigua*), and California sycamore (*Platanus racemosa*). Understory species, when present, include willows (*Salix* spp.), mule-fat (*Baccharis salicifolia*), stinging nettle (*Urtica dioica ssp. holosericea*), poison hemlock (*Conium maculatum*), and Douglas' sagewort (*Artemisia douglasiana*).

Although not mapped by CalVeg as occurring within the proposed Project boundary, California Watchable Wildlife (2015) reports that this vegetation type occurs in the Silverwood Lake SRA.

Valley Foothill Riparian

Valley Foothill Riparian habitat occurs in valleys and foothills in areas of low velocity stream flows and gentle topography. This habitat type is generally dense and multilayered, with primarily deciduous trees, including Fremont cottonwood, California sycamore, and valley oak in the canopy. Subcanopy trees include white alder, boxelder (*Acer negundo*), and Oregon ash (*Fraxinus latifolia*). Shrub species include rose, California blackberry, blue elderberry (*Sambucus nigra* ssp. *caerulea*), poison oak, common buttonbush (*Cephalanthus occidentalis*), and willows. A variety of herbaceous species occur in the understory, including sedges, rushes (*Juncus* spp.), grasses, springbeauty, Douglas' sagewort, poison hemlock, and stinging nettle. Vines, typically California wild grape (*Vitis californica*), also occur.

Within the proposed Project boundary, Valley Foothill Riparian habitat type is mapped in a number of areas along West Fork Mojave River and East Fork of the West Fork Mojave River upstream of Silverwood Lake. In 2014, Environmental Science Associates observed riparian forested areas in various locations on the perimeter of Silverwood Lake and adjacent drainages. Canopies in these areas were dominated by Fremont cottonwood, California sycamore and arroyo willow, with understories of other willow species and mulefat. One location in the northwest portion of the reservoir was mapped as Southern Sycamore Alder Riparian Woodland based on the Holland (1986) classification, which is used in CNDDB. This is designated by CDFW as a sensitive natural community (Environmental Science Associates 2014). Environmental Science Associates determined all other riparian areas were either Southern Cottonwood Willow Riparian Forest or Southern Willow Scrub (under the Holland 1986 classification), which are also designated by the CDFW as sensitive natural communities (Environmental Science Associates 2014).

DWR planted native vegetation in the vicinity of Devil Canyon Second Afterbay in 2000 as part of a mitigation project at Bailey Creek. Species included riparian trees: California sycamore, Southern California walnut (*Juglans californica*), and birchleaf mountain mahogany (*Cercocarpus montanus* var. *glaber*). Some vegetation, particularly Southern California walnuts, was destroyed by wildfires in 2003 (Herzog 2004).

4.6.1.2 Shrub-Dominated Habitats

Sagebrush

Sagebrush habitat can be found at a wide range of middle and high elevations. Sagebrush community structure is typically open stands of sagebrush of similar heights, often monotypic stands of big sagebrush (*Artemisia tridentata*), but also along with other species of sagebrush (*Artemisia* spp.), yellow rabbitbrush (*Chrysothamnus viscidiflorus*), horsebrush (*Tetradymia* spp.), gooseberries, western chokecherry (*Prunus virginiana* var. *demissa*), curl-leaf mountain mahogany (*Cercocarpus ledifolius*), and antelope bitterbrush (*Purshia tridentata*). Less disturbed sites may have an understory of perennial grasses and forbs.

Within the proposed Project boundary, Sagebrush habitat type is mapped in one small area below Cedar Springs Dam.

Montane Chaparral

Montane Chaparral can be found in a wide variety of soil types and slopes. Species composition changes with elevation, soil type, and aspect, but usually include one or more of the following species: mountain whitethorn, snowbrush ceanothus (*Ceanothus velutinus*), greenleaf manzanita (*Arctostaphylos patula*), pinemat manzanita (*A. nevadensis*), hoary manzanita (*A. canescens*), bitter cherry, huckleberry oak (*Quercus vacciniifolia*), bush chinquapin, birchleaf mountain mahogany, toyon, sumac (*Rhus* spp.) and California coffeeberry. Mature Montane Chaparral can be very dense, with very little understory vegetation.

Within the proposed Project boundary, Montane Chaparral habitat type is mapped in only a few small isolated locations southwest of Silverwood Lake and along the San Bernardino Tunnel.

Mixed Chaparral

Mixed Chaparral generally occurs below 5,000 feet on steep slopes and ridges with relatively thin, well-drained soils. Mature Mixed Chaparral areas have dense (greater than 80 percent) canopy cover typically between 3 and 13 feet tall. Species generally include inland scrub oak (*Quercus berberidifolia*), ceanothus, and manzanita. Chamise (*Adenostoma fasciculatum*), birchleaf mountain mahogany, ashy silktassel, toyon, hairy yerba santa, California buckeye (*Aesculus californica*), poison oak, sumac, California coffeeberry, hollyleaf cherry (*Prunus ilicifolia*), and chaparral pea (*Pickeringia montana*) can also occur. Mixed and Chamise-Redshank Chaparral (see below) intergrade with Mixed Chaparral on low to middle elevation slopes at elevations below woodland and forest types. Compared to Chamise-Redshank Chaparral, Mixed Chaparral generally occupies more mesic sites at higher elevations or on north-facing slopes.

Mixed Chaparral habitat type is mapped throughout the Project area. It makes up large patches of vegetation on all sides of Silverwood Lake and Devil Canyon Powerplant. Mixed Chaparral species documented in the Silverwood Lake SRA include several species of ceanothus and manzanita, chamise, poison oak, laurel sumac (*Malosma laurina*), hollyleaf cherry, California coffeeberry, hairy yerba santa, and toyon (California Watchable Wildlife 2015). Environmental Science Associates (2014) reported that three species were dominant in this habitat type on the perimeter of Silverwood Lake: chamise, interior live oak, and redheart. Environmental Science Associates also observed bigpod ceanothus (*Ceanothus megacarpus* var. *megacarpus*), birchleaf mountain mahogany, and chaparral yucca (*Hesperoyucca whipplei*) (Environmental Science Associates 2014).

Chamise-Redshank Chaparral

Chamise-Redshank Chaparral habitat occurs on steep slopes and ridges in areas with thin soils and little accumulated organic matter. Chamise-Redshank Chaparral generally occurs below and intergrades with Mixed Chaparral (see above). Vegetative structure is similar to Mixed Chaparral, but species differ, with stands often being composed almost entirely of chamise or redshank. Other species that can occur include toyon, sugar sumac (*Rhus ovata*), poison oak, redshank (*Adenostoma sparsifolium*), California coffeeberry, ceanothus, manzanita, scrub oak, and laurel sumac. In southern California, white sage (*Salvia apiana*), black sage (*Salvia mellifera*), and Eastern Mojave buckwheat (*Eriogonum fasciculatum*) can be found in this habitat type at lower elevations and on recently disturbed sites.

Within the proposed Project boundary, Chamise-Redshank Chaparral habitat type is mapped in small patches above Silverwood Lake on the south and northeast sides.

Coastal Scrub

Coastal Scrub can be found in drier areas than other shrub habitats and commonly occurs on steep, south-facing slopes in sandy, mudstone, or shale soils. The southern sage scrub form of Coastal Scrub, found in southern California, is made up of a very dense shrub layer up to 7 feet tall. Southern sage scrub species can include black sage, purple sage (*Salvia dorii*), Eastern Mojave buckwheat, golden-yarrow (*Eriophyllum confertiflorum*), goldenbush (*Isocoma* spp.), orange bush monkeyflower (*Diplaucus aurantiacus*), California brittlebush (*Encelia californica*), and chaparral yucca.

Within the proposed Project boundary, Coastal Scrub habitat type is mapped in small patches above Silverwood Lake on the west and southwest sides. During surveys of the perimeter of Silverwood Lake in 2014, Environmental Science Associates found these areas to be dominated by California buckwheat and purple sage, with big sagebrush, chaparral yucca, white sage, and black sage occurring less frequently (Environmental Science Associates 2014).

DWR planted native vegetation in the vicinity of Devil Canyon Second Afterbay in 2000 as part of a mitigation project at Bailey Creek. Species identified during monitoring in this area include many found in Coastal Scrub habitat, including coast buckwheat (*Eriogonum latifolium*), Eastern Mojave buckwheat, coastal sagebrush (*Artemesia californica*), common deerweed (*Lotus scoparius*), black sage, white sage, mule-fat, Palmer's goldenbush (*Ericameria palmeri*), and telegraphweed (*Heterotheca grandiflora*). Some vegetation was destroyed by wildfires in 2003, but most of the planted shrubs, forbs, and grasses are fire-adapted and were expected to regenerate (Herzog 2004).

Desert Wash

Desert Wash habitats occur in association with canyons, arroyos, washes, and other areas that are at least seasonally wet, from the southeastern Mojave Desert south through the Sonoran Desert into Mexico. Elevation ranges between about 2,500 feet and 6,560 feet. Canopy species are generally taller and denser than in adjacent desert habitats and may include blue paloverde (*Parkinsonia florida*), yellow paloverde (*P. microphylla*), desert ironwood (*Olneya tesota*), smoketree (*Psorothamnus spinosus*), catclaw acacia (*Senegalia greggii)*, honey mesquite (*Prosopis glandulosa*), screwbean mesquite (*P. pubescens*), and tamarisk (*Tamarix* spp.). Subcanopy species can include desertbroom (*Baccharis sarothroides*), arrowweed (*Pluchea sericea*), sweetbush (*Bebbia juncea*), desert willow (*Chilopsis linearis*), burrobrush (*Hymenoclea salsola*), creosote bush (*Larrea tridentata*), and water jacket (*Lycium andersonii*). Understory species may include brittlebush (*Encelia farinosa*), prickypear (*Opuntia* spp.), snakeweed (*Gutierrezia* spp.), goldenbush, saltbush (*Atriplex* spp.), and a variety of forbs and grasses.

Within the proposed Project boundary, Desert Wash habitat type is mapped in several areas in the Devil Canyon Powerplant vicinity.

Desert Scrub

Desert Scrub habitats occur in valley floors and lower bajadas (alluvial fans at the base of mountains) with well-drained, coarse soils. Vegetation structure is typically open (canopy cover less than 50 percent), and includes scattered assemblages of broadleaved evergreen or deciduous small-leaved shrubs generally between 1.5 feet and 6.5 feet tall. Shrubs may include creosote bush, catclaw acacia, desert agave (*Agave deserti*), California brittlebush, burrobush (*Ambrosia dumosa),* cacti, and yellow rabbitbrush, along with a variety of forbs and grasses.

Within the proposed Project boundary, Desert Scrub habitat type is mapped in two patches near the north end of Silverwood Lake and adjacent to Cedar Springs Dam.

4.6.1.3 Herbaceous-Dominated Habitats

Annual Grassland

Annual Grasslands occurs in a variety of locations throughout the State and replace much of what were historically native perennial grasslands. These areas are now composed of a variety of predominantly non-native annual grasses, including oats (*Avena* spp.), soft brome (*Bromus hordeaceus*), ripgut brome (*Bromus diandrus*), compact brome (*Bromus madritensis*), barley (*Hordeum* spp.), and annual fescue (*Vulpia myuros*). A variety of native and non-native forbs also occur, including longbeak stork's bill (*Erodium botrys*), redstem stork's bill (*Erodium cicutarium*), dove weed (*Croton setiger*), clover (*Trifolium* spp.), burclover (*Medicago polymorpha*), and popcorn flower (*Plagiobothrys* spp.).

Within the proposed Project boundary, Annual Grassland habitat type is mapped in various small patches on the margins of Silverwood Lake and near Devil Canyon Powerplant.

Freshwater Emergent Wetland

Freshwater Emergent Wetland habitats occur in areas that are saturated or periodically flooded. They occur in a variety of locations, including grasslands, riparian areas, and the margins of rivers or lakes. Freshwater Emergent Wetland can support a variety of herbaceous species, including bigleaf sedge (*Carex amplifolia*), arctic rush (*Juncus arcticus*), and flatsedge (*Cyperus* spp.). Broadleaf cattail (*Typha latifolia*), California bulrush (*Schoenoplectus californicus*), river bulrush (*Bolboschoenus fluviatilis*), and arrowhead (*Sagittaria* spp.) may occur on wetter sites.

Freshwater Emergent Wetland habitat types are not mapped by CalVeg within the proposed Project boundary; however, Environmental Science Associates (2014) mapped cattail marsh along the perimeter of Silverwood Lake during 2014 surveys. These areas were reported to occur sporadically around the lake, generally transitioning to riparian forest upstream. Common reed (*Phragmites australis*) was interspersed with common cattail in the surveyed areas; low vegetation diversity was observed.

4.6.1.4 Developed Habitats

Urban

Vegetated Urban habitats include a wide variety of native and non-native species and are classified into five types of vegetative structure by WHR: tree grove, street strip, shade tree/lawn, lawn, and shrub cover. Tree groves occur in city parks, green belts, and cemeteries, and have a continuous canopy that varies in height, tree spacing, crown shape, and understory conditions. Street tree strips vary in spacing with both continuous and discontinuous canopies. Understories are typically grass or ground cover. Shade trees in lawns, which are typical in residential areas, have a structure similar to natural savannas. Lawns are the most structurally simple Urban habitat type, with only one uniform layer. Shrub cover is less common than other Urban habitat types, and includes hedges.

Within the proposed Project boundary, Urban habitat type is mapped in several areas on the margins of Silverwood Lake and around Devil Canyon Powerplant.

4.6.1.5 Non-Vegetated Habitats

Barren

Barren habitats are those that are generally devoid of vegetation and include rock outcrops, mudflats, beaches, pavement, and buildings.

Within the proposed Project boundary, Barren habitat type is mapped in various small patches on the margins of Silverwood Lake and near Devil Canyon Powerplant. These include boat ramps, parking lots, the dam and associated structures, and other cleared areas.

4.6.2 Special-Status Plants

For the purpose of this PAD, a special-status plant is defined as a vascular plant that meets one or more of the following criteria: (1) FSS; (2) listed under CESA as an endangered, threatened, or rare plant; (3) State-listed rare or endangered under the Native Species Plant Protection Act of 1977 (CDFW 2015a); or (4) listed by the California Native Plant Society (CNPS) on its Inventory of Rare and Endangered Plants (CNPS 2015). All special-status plant species that were evaluated for potential occurrence within the Project Boundary can be found in Table H1 in Appendix H. Federally listed species, candidates, or species proposed for listing are addressed in Section 4.8.

DWR compiled a list of special-status plants that are known or have potential to occur within the proposed Project boundary from queries of the CNDDB (2015) and the CNPS Inventory of Rare and Endangered Plants database (CNPS 2015) based on searches at the level of USGS 7.5-minute topographic quadrangles. These are summarized in Appendix H. Queries included all quadrangles that intersect the proposed Project boundary (i.e., Silverwood Lake and San Bernardino North quadrangles). DWR found no records of special-status plants within the proposed Project boundary; however, no comprehensive special-status plant surveys have been performed encompassing the entire Project area. Some species have been reported near, and have potential to occur within, the proposed Project boundary. These are discussed in Appendix H.

4.6.3 Non-Native Invasive Plants

For the purpose of this PAD, NNIP are defined as A-, B-,or C-listed species by CDFA, species identified as invasive by Cal-IPC, and species included on the SBNF's weed list that occur on NFS lands (USFS 2005b). A table of all non-native invasive plant species with known or potential occurrence within the Project boundary can be found in Table H-2 in Appendix H.

A list of NNIP that are known or suspected to occur within the proposed Project boundary was compiled by reviewing CalWeedMapper spatial data (Cal-IPC 2015a). Queries included all USGS quadrangles that intersect the proposed Project boundary. The results of the query are provided along with their Cal-IPC (2015a) and CDFA (2010) ratings in Appendix H.

DWR found no information on the occurrence of NNIP in the vicinity of Silverwood Lake. Review of other literature sources found reference to NNIP in the Devil Canyon Powerplant area. DWR documented removal of three invasive plant species from the Devil Canyon Powerplant area in May 2001: tree tobacco (*Nicotiana glauca*), salt cedar (*Tamarix ramosissima*), and Spanish broom (*Spartium junceum*) (DWR 2001b). Herzog (2004) reported black mustard (*Brassica nigra*) and horehound (*Marrubium vulgare*) in the vicinity of Devil Canyon Second Afterbay during vegetation monitoring surveys; however, he stated that "no invasive weed problem was observed" (Herzog 2004). DWR periodically removes NNIP manually in the area of the Devil Canyon Powerplant, penstocks, and Afterbays by pulling plants from the ground with root systems intact. When manual removal is impractical, DWR cuts plants as close to the ground as possible and applies Round-up®.

4.6.4 Special-Status Wildlife Species

For the purpose of this PAD, a special-status wildlife species meets at least one of the following criteria: (1) listed under CESA as threatened, endangered, or candidate, (2) classified as Fully Protected by the State of California; (3) SSC (CDFW 2015a); (4) FSS; or (5) formerly listed by USFWS as a Bird of Conservation Concern (BCC) or protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c). A list of all special-status wildlife species occurring or potentially occurring in the project boundary can be found in Table H-3 in Appendix H.

DWR developed the list of special-status wildlife species known, or with the potential to occur in the Project vicinity based on multiple sources of information. These sources included the Special Animals List maintained by the CDFW CNDDB (CDFW 2015a), which gives State-listed taxa, as well as species listed by other agencies as described above. DWR also queried the WHR database (CDFW 2015a) for a preliminary list of potentially occurring species using existing vegetation mapping data from the Project area. Because WHR results are derived from County species lists and do not differentiate sub-species or populations categorized as special-status from more widely occurring species, the list was further refined by reviewing WHR range maps for each special-status taxa and other sources as needed, including WHR and other life history accounts and range maps (e.g., Bolster 1998, Zeiner et al. 1988-2013; Shuford and Gardali 2008, IUCN Red List of threatened Species 2015; California Herps 2015).

On the basis of these analyses, DWR identified 56 wildlife special-status species, 23 of which are on more than one agency list, which could potentially be affected by the Project. Appendix H describes for each of the special-status wildlife species its listing status, expected habitat associations, and whether it has been documented or potentially occurs within the proposed Project boundary on the basis of potential habitat. The list of special-status species includes 2 terrestrial amphibians (salamanders), 9 reptiles, 27 birds, and 18 mammals. Three species are listed under the CESA: southern rubber boa (*Charina umbratica*) (threatened), bald eagle (*Haliaeetus leucocephalus*) (endangered), and Mohave ground squirrel (*Xerospermophilus mohavensis*) (threatened). Six of the identified species are listed as State Fully Protected: northern goshawk (*Accipiter gentilis*), white-tailed kite (*Elanus leucurus*), golden eagle (*Aquila chrysaetos*), American peregrine falcon (*Falco peregrinus anatum*), bald eagle, and ringtail (*Bassariscus astutus*). Forty-nine species are SSC, 14 are FSS, and 13 are on the BCC list.

Existing records for special-status wildlife species were identified from sources located during DWR's gathering of existing, relevant and reasonably available information and by a query of the CNDDB (CDFW 2015a) based on a search of the USGS 7.5-minute topographic quadrangles in which the proposed Project boundary is located (i.e., Silverwood Lake and San Bernardino North), and the adjacent quadrangles (i.e., Hesperia, Apple Valley South, Lake Arrowhead, Cajon, Harrison Mountain, and Devore) covering approximately 493 square miles and with an approximate minimum 5-mile buffer around the existing Project boundary (i.e., the same query used for Sections 4.5 and 4.8). The broad search area was used because of the limitations of the CNDDB. The CNDDB is a statewide inventory, managed by CDFW, and is continually updated with the locations and conditions of the State's rare and declining species. However, it is limited by where surveys have been performed and contains only those records that have been submitted to CDFW. In addition, the CNDDB typically limits records for special-status migratory bird species to evidence of nesting (i.e., documented nest sites or territorial behaviors) and, with few exceptions, does not track wintering or migratory occurrences. The results of the queries are discussed in Section 4.6.6, along with other information on wildlife occurrences, and summarized in Appendix H.

4.6.5 Commercially Valuable Wildlife Species

A commercially valuable wildlife species is any species listed as a "Harvest species" by CDFW. Per CDFW, a 'Harvest species' are 'Game Birds (FGC § 3500); Game Mammals (FGC § 3950) and Fur-bearing Mammals and Non-game animals as designated in the CCR (CDFW 2015a). The WHR identified 52 harvest wildlife species found in San Bernardino County associated with the WHR vegetation types mapped from the Project area (Table H-4, Appendix H). Note that inclusion on this list does not imply that all of these species occur in the Project area. The list includes 34 species of birds, primarily migratory waterfowl (i.e., 26 species of ducks, geese, and coots) and upland game birds (i.e., 5 gallinaceous species, such as quails and pheasant), and 18 species of mammals, ranging from rabbits and squirrels to mule deer (*Odocoileus hemionus*). All but four of these species (i.e., chukar [*Alectoris chukar*], ring-necked pheasant [*Phasianus colchicus*], Virginia opossum [*Didelphis virginiana*], and wild pig [*Sus scrofa*]) are native. Designated harvest species may be legally hunted under CDFW license regulations in California. However, hunting is not permitted within the Silverwood Lake SRA.

Six subspecies of mule deer occur in California. The subspecies occupying the Project area is the California mule deer (*O. hemionus californicus*), the second most abundant subspecies in the State (Higley 2002). CDFW estimated the population of deer in California at 443,289 individuals in 2014 (CDFW 2015f). Deer populations have been relatively steady since 2007, following a general decline from a record high in the 1960s, which has been attributed to loss and degradation of habitat (Higley 2002; CDFW 2015f). In 1976, CDFG prepared a deer management plan with the goal of restoring deer populations to previous levels (CDFG 2015f). The plan included habitat and population management goals for deer populations by “herd” units. The previous plan did not result in restoration of populations to the goal levels due to the magnitude of landscape changes required to provide suitable habitat and shifts in landscape management priorities since the plans were prepared (CDFW 2015f).

In 2015, CDFW prepared the California Deer Conservation and Management Plan to update the 1976 plan and to focus on conservation and management at a larger scale, outlining a landscape-level approach to deer planning within 10 Deer Conservation Unit’s (DCU). The objectives for each DCU are to characterize the current scientific, environmental, sociological, and economic conditions of the DCUs as they related to deer management; describe population estimation and monitoring measures; and to identify key habitat areas and strategies for restoration/enhancement.

The proposed Project boundary falls within the Transverse and Peninsular Ranges DCU. This DCU includes 9,426,348 acres of land that is approximately half publicly owned (52 percent) and half privately owned (48 percent). Mule deer in this area are primarily resident, but occasionally move from high to low elevations in winter, especially during years of heavy snow (CDFW 2015f). CDFW anticipated that plan development for this DCU would occur by November 2015, with implementation planned for March 2016. DWR was not able to obtain updates on the current schedule.

4.6.6 <u>Designated Special Ecological Areas</u>

The proposed Project boundary includes or abuts one designated special ecological area, a USFS Protected Activity Center (PAC) for California spotted owl. The PAC is located on NFS land along approximately 1.5 miles of the southern edge of Silverwood Lake, and along approximately 2 miles of the San Bernardino Tunnel (USFS 2006).

PACs are special management areas around nest or roost sites to protect critical habitat (Berigan et. al. 2013), in this case for California spotted owl. One of the protection measures utilized in PACs is Limited Operating Periods, which restrict activities that might disturb birds during the breeding season within a specific distance of a PAC. For spotted owls PACs, this distance often includes a 0.25-mile area during the breeding season of March 1 through August 15.

No other designated special ecological areas (e.g., Habitat Conservation Plans [HCP], Home Range Core Areas and Critical Biological Land Use Zones) occur within the proposed Project boundary. However, the Devil Canyon Powerplant is included in the study area for the proposed Upper Santa Ana River HCP (ICF 2016.) HCPs are planning documents required for actions that will necessitate an incidental take permit for species listed under the ESA, although a HCP often encompass impacts to multiple species. A HCP outlines the potential effects of the take, as well as ways to minimize and mitigate for those effects. They are normally written in collaboration between the USFWS and other, usually non-federal, parties (USFWS 2013c). Further, while not a designated special ecological area, some migratory birds along the Pacific Flyway use Silverwood Lake (California State Parks 2009).

4.6.7 Wildlife Occurrences

4.6.7.1 Amphibians[26]

Most amphibians are addressed in Section 4.5 as aquatic resources; however, completely terrestrial salamanders without free-living larval stages are treated here as terrestrial resources. Common, forest- and chaparral-dwelling terrestrial salamanders include Monterey ensatina (*Ensatina eschscholtzii eschscholtzii*), garden slender salamander (*Batrachoseps major*), black-bellied salamander (*B. nigriventris*), and arboreal salamander (*Aneides lugubris*). These are species generally associated with surface cover (e.g., under rocks, downed wood, bark slabs, or moist leaf litter) and subterranean retreats, including earthworm and termite tunnels and burrows. DWR found only one record or report of any of these species from the Project area. Monterey ensatina was documented by USGS surveys (Brown and Fisher 2002) in Miller Canyon, Cleghorn, and the southern part of the Silverwood Lake Recreation Area conducted in 2000-2001. The large-blotched ensatina (*E. klauberi*) (SSC and FSS) occurs primarily in the Peninsular Ranges, but extends into the eastern San Bernardino Mountains and intergrades with the more common Monterey ensatina in this area. The CNDDB (CDFW 2015a) includes occurrences of the San Gabriel slender salamander (*Batrachoseps gabrieli*), a talus-dwelling species, west of the Project (Devore quadrangle) south of Lytle Creek (and near Waterman Canyon approximately 4 miles

[26] Photo credit: San Gabriel slender salamander by Robert Goodman, USGS [public domain] [http://www.werc.usgs.gov/fieldguide/baga.htm], via Wikimedia Commons

east-southeast of the Devil Canyon Powerplant). This species could potentially occur in the vicinity of the San Bernardino Tunnel (an underground facility) and Devil Canyon Powerplant Penstocks.

4.6.7.2 Reptiles[27]

Three references available to DWR present information regarding terrestrial reptiles within the proposed Project boundary. USGS surveys (Brown and Fisher 2002) documented 11 species of reptiles in the Silverwood Lake State Recreation Area, including 6 species of lizards and 5 species of snakes. The most frequently found species were western fence lizard (*Elgaria multicarinatus*), striped racer (*Coluber lateralis*), and Pacific rattlesnake. Common side-blotched lizard and gopher snake (*Pituophis melanoleucus*) have also been reported from Silverwood Lake SRA (iNaturalist 2015).

Aspen Environmental Group (2006) also described western fence lizard and gopher snake as common species approximately 1 mile north of the Project in the vicinity of the Horsethief Creek Bridge Replacement Project. HELIX (2014) reported observations of ten species of terrestrial reptiles in the area of the proposed Tapestry development project, which extends north from the proposed Project boundary to Hesperia, including southern alligator lizard (*Elgaria multicarinata*), western fence lizard, coast horned lizard (*Phrynosoma blainvillii*), common side-blotched lizard (*Uta stansburiana*), and western whiptail (*Aspidoscelis tigris*), common kingsnake (*Lampropeltus getulus*), gopher snake, southern Pacific rattlesnake, and northern Mohave rattlesnake (*C. scutulatus*).

There are records for three species of special-status lizards and three species of special-status snakes in the CNDDB within the Project vicinity, but all outside of the proposed Project boundary (CDFW 2015a), which are summarized in Appendix H. Of these species, coast horned lizard was most widely reported and can be presumed to occur within or near the proposed Project boundary. Records of southern rubber boa are concentrated on the Harrison Mountain quadrangle southeast of Silverwood Lake. On September 18, 2015, USFWS published a 90-day finding (50 FR 56423) on a petition to list this taxon as endangered or threatened, concluding that the petition presented substantial information that listing may be warranted and beginning a 12-month review. Records of San Bernardino ring-necked snake (*Diadophis punctatus modestus*) associated with the dried, boulder-strewn bed of Grass Valley Creek east of the Project, suggest that this taxon may occur within the proposed Project boundary if similar habitats are present. Northern three-lined rosy boa (*Lichanura orcuttii* [*trivirgata*]) occurrences are also associated with dry, rocky stream beds, including a record from Kinley Creek, a tributary of Deep Creek east of Lake Silverwood. The only records for

[27] Photo credit: San Bernardino ring-necked snake by Mark Herr [Own work] [CC BY-SA 3.0 (http://creativecommons.org/licenses/by-sa/3.0)], via Wikimedia Commons

Southern California legless lizard (*Anniella stebbinsi*) and orange-throat whiptail (*Aspidoscelis hyperythra*) are from south and east of Devil Canyon Powerplant, consistent with expectations that these species are largely confined to the Coastal bioregion south of the Transverse Ranges (Zeiner et al. 1988-1990, and 2000, updated; Stebbins and McGinnis 2012; Papenfuss and Parham 2013).

4.6.7.3 Birds[28]

Silverwood Lake SRA reportedly harbors more than 130 species of birds, including wintering bald eagle and osprey, and numerous types of wintering waterfowl and other water birds (DWR 1994; California Watchable Wildlife 2015). Although these sources do not provide complete species lists, partial lists focus on species that are common and typically associated with certain habitats, as well as other notable species. Species associated with the lake include wintering Canada goose (*Branta canadensis*), common loon (*Gavia immer*), eared grebe (*Podiceps auritus*), western grebe (*Aechmophorus occidentalis*), American coot (*Fulica americana*), bufflehead (*Bucephala albeola*), mallard (*Anas platyrhynchos*), ruddy duck (*Oxyura jamaicensis*), common merganser (*Mergus merganser*), and other waterfowl, as well as great blue heron (*Ardea herodias*). Common forest and woodland species include acorn woodpecker (*Melanerpes formicivorus*), dark-eyed junco (*Junco hyemalis*), mountain chickadee (*Poecile gambeli*), Stellers's jay (*Cyanocitta stelleri*), western tanager (*Piranga ludoviciana*), black-headed grosbeak (*Pheucticus melanocephalus*), and mountain bluebird (*Sialia currucoides*). Mountain quail (*Oreortyx pictus*), California quail (*Callipepla californica*), spotted towhee (*Pipilo maculatus*), California towhee (*P. crissalis*), California thrasher (*Toxostoma redivivum*), and wrentit (*Chamaea fasciata*) are described as characteristic of chaparral and upland scrub habitats within the SRA. Red-tailed hawk (*Buteo jamaicensis*), red-shouldered hawk (*B. lineatus*), great horned owl (*Bubo virginianus*), and western screech owl (*Otus kennicottii*) are described as common. The presence of a great blue heron rookery on the south shore of the Miller Canyon Arm of Silverwood Lake was noted by Walton (2002). California Watchable Wildlife (2015) also indicates presence of a rookery, but do not specify the location. According to DWR (1994) California spotted owl occurs primarily in old-growth forests south of the SRA.

An information brochure for the SRA published by DPR also states:

> Water-oriented birds—great blue herons, snowy egrets, avocets, western grebes, loons, Canada geese, mergansers and several other varieties ofwaterfowl—are plentiful. Around Sawpit Canyon, birds of prey include red-tailed hawks, Cooper's hawks, ospreys and roadrunners. This area is also

[28] Photo credit: Bald eagle by Ken Thomas - KenThomas.us(personal website of photographer) [public domain], via Wikimedia Commons

home to Clark's nutcrackers, Steller's and scrub jays, rock wrens and mountain bluebirds.

Counts of bald eagles wintering at Silverwood Lake are performed annually by SBNF, supported by volunteers. Opportunities for recreational bald eagle viewing at Silverwood Lake include barge tours that occur once a week from January through March. USFWS (1994) indicated that as many as 10 bald eagles per year wintered at Silverwood Lake. DWR funded bald eagle studies for 4 years under the terms of the 1994 Biological Opinion issued by the USFWS for the San Bernardino Tunnel Intake Reconstruction Project, and monitored for possible disturbance of bald eagles during construction, with no evidence of significant effects (Walton et al. 2000).

A bald eagle territory management plan was developed for Silverwood Lake (Walton 2002), although no nesting attempts have been reported to the CNDDB since 1993 (CDFW 2015a). The management plan summarized information collected for DWR, including inspection of prey remains, annual monitoring results, and locations of areas frequented by bald eagles. These observations indicated that bald eagles arrived at the lake as early as October and departed no later than April each year. Prey of wintering bald eagles documented by Walton included fish (carp, goldfish, crappie, bass, and other species), American coot, western grebes, mallard, ground squirrels, and carrion, including fish and cattle. Communal roosts were located outside of the proposed Project boundary in forests south of the lake, in upper Miller Canyon east of the lake, and on the Los Flores Ranch north of the lake, whereas perch sites were more widely distributed within the proposed Project boundary along the shores, but concentrated on the south shore of the Miller Canyon Arm, the south side of the Cleghorn Arm, and the vicinity of Sycamore Landing (Walton 2002).

Aspen Environmental Group (2006) indicated that common bird species 1 mile north of the Project in the vicinity of the Horsethief Creek Bridge Replacement Project included mallard, killdeer (*Charadrius vociferus*), red-tailed hawk, Anna's hummingbird (*Calypte anna*), American crow (*Corvus brachyrhynchos*), western scrub-jay (*Aphelocoma californica*), and mourning dove (*Zenaida macroura*), and reported observations of at least 36 other species of birds, five of which are special-status species: northern harrier (*Circus cyaneus*), loggerhead shrike (*Lanius ludovicianus*), Le Conte's thrasher (*Toxostoma lecontei*), yellow warbler (*Setophaga petechia*), and Bell's sage sparrow (*Artemisiospiza belli belli*). Biological surveys for the proposed Tapestry development project, which extends north from the proposed Project boundary to Hesperia, documented 104 species of birds, including the following special-status species: golden eagle, bald eagle, prairie falcon (*Falco mexicanus*), loggerhead shrike, vermilion flycatcher (*Pyrocephalus rubinus*), and yellow warbler (HELIX 2014). Although not observed during surveys, HELIX (2014) concluded there was at least as moderate potential for gray vireo (*Vireo vicinior*) and Le Conte's thrasher to occur. Burrowing owl (*Athene cunicularia*) was also not detected, although suitable burrows were found.

There are CNDDB records for six species of special-status birds in the Project vicinity (CDFW 2015a), which are summarized in Appendix H. The only species with records from within the proposed Project boundary is bald eagle for an unsuccessful nesting attempt at Silverwood Lake in 1993, with other records from Summit Valley north of the proposed Project boundary, Lake Arrowhead, and Upper Miller Canyon, a site located between Arrowhead Lake and Silverwood Lake. Records for burrowing owl, Le Conte's thrasher, gray vireo, and yellow warbler are almost entirely from areas north of Silverwood Lake (Hesperia and Apple Valley South quadrangles) outside of the proposed Project boundary. A single record for Bell's sage sparrow is from the Lytle Creek watershed west of Devil Canyon Powerplant. As noted above, CNDDB records for migratory birds are often limited to evidence of nesting, and do not typically include wintering birds of these species, which may be abundant.

Based on this available information, special-status birds species most likely to occur within the proposed Project boundary include wintering common loon, golden eagle (although no nest sites have been reported to the CNDDB), wintering bald eagle, California spotted owl (nesting south of the Project), loggerhead shrike, and yellow warbler. Species that may be largely peripheral to the Project area, except in the transitional Sagebrush and Chamise-Redshank Chaparral habitats, which occur mostly north of Silverwood Lake, include Le Conte's thrasher, gray vireo, and Bell's sage sparrow.

4.6.7.4 Mammals[29]

Mammals reported by California Watchable Wildlife (2015) for the Silverwood Lake SRA include bats (species not indicated), California ground squirrel (*Otospermophilus beecheyi*), San Bernardino northern flying squirrel (*Glaucomys sabrinus californicus*), black bear (*Ursus americanus*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), and ringtail (*Bassariscus astutus*). DWR (1994) also lists occurrence of mule deer, western squirrel (*Sciurus griseus*), dusky-footed woodrat (*Neotoma fuscipes*), Merriam's chipmunk (*Tamias merriami*), long-tailed weasel (*Mustela frenata*), striped skunk (*Mephitis mephitis*), and raccoon (*Procyon lotor*) in the Silverwood Lake SRA.

San Bernardino northern flying squirrel (SSC and FSS) occurs in geographically isolated populations in high elevation forests of the San Bernardino and San Jacinto Mountains (possibly extirpated, 77 FR 4973). On February 1, 2012, USFWS published a 90-day finding (77 FR 4973) on a petition to list this taxon as endangered or threatened, concluding that the petition presented substantial information that listing may be warranted and beginning a 12-month review, which has not been completed to date.

An information brochure for the SRA published by DPR states:

> California mule deer are often seen in early morning and sometimes in the evenings. Night predators such as gray foxes, coyotes and (rarely) mountain

[29] Photo credit: Townsend's big-eared bat by USFWS Headquarters [CC BY 2.0 (http://creativecommons.org/licenses/by/2.0)], via Wikimedia Commons

> lions use the darkness to hunt cottontail and brush rabbits, black-tailed jackrabbit, western gray and ground squirrels, ringtails, chipmunks and wood rats. Black bears, bobcats and golden beavers may be seen along the Mojave River.

HELIX (2014) reported observations of at least 14 species of mammals in the area of the proposed Tapestry development project north of Silverwood Lake, which include some of the species listed above, as well as Botta pocket gopher (*Thomomys bottae*), antelope ground squirrel (*Ammospermophilus leucurus*), Merriam's chipmunk, striped skunk, and raccoon. Aspen Environmental Group (2006) also observed Virginia opossum (*Didelphis virginiana*) (a non-native species) and long-tailed weasel in the vicinity of the Horsethief Creek Bridge Replacement Project north of Silverwood Lake. North American beavers (*Castor canadensis*), not native to the Mojave River drainage, have modified habitats with a series of dams along the West Fork Mojave River downstream of Cedar Springs Dam and on Horsethief Creek, a tributary (Aspen Environmental Group 2006, HELIX 2014).

There are records for five species of special-status mammals in the CNDDB from the Project vicinity, but mostly outside of the proposed Project boundary (CDFW 2015a), which are summarized in Appendix H. Records for San Bernardino northern flying squirrel are distributed from Lake Arrowhead to Sawpit Canyon on the south side of Silverwood Lake within the proposed Project boundary. Records for white-eared pocket mouse (subspecies *Perognathus alticolus alticolus*) from the Strawberry Peak area south of Lake Arrowhead are not recent (i.e., 1920 to 1934) and may represent an isolated population that has been extirpated (Linzey and NatureServe 2008). CNDDB records for Mohave ground squirrel (*Xerospermophilus mohavensis*) are all from north of Silverwood Lake, consistent with expectations that this desert species is not found south of the town of Hesperia (Hafner and NatureServe 2008, HELIX 2014). There are also records for two species of bats, Townsend's big-eared bat (*Corynorhinus townsendii*) from north of the Project and western mastiff bat (*Eumops perotis*) from east of Silverwood Lake. However, the paucity of bat records may not be informative, because bats are rarely documented at the species level without special efforts, such as trapping or ultrasonic echolocation call monitoring equipment.

Based on this available information, special-status mammals most likely to occur within the proposed Project boundary include San Bernardino northern flying squirrel, ringtail, and special-status bats.

4.7 WETLANDS, RIPARIAN, AND LITTORAL HABITATS

This section provides information regarding existing wetlands, riparian, and littoral habitats. Besides this general introductory information, this Section includes three main sub-sections: Section 4.7.1 describes wetlands, including wetlands identified by USFWS in its National Wetlands Inventory (NWI) maps that may be affected by the Project; Section 4.7.2 describes riparian habitats that may be affected by the Project; and Section 4.7.3 describes littoral habitats that may be affected by the Project. Each of the Sections addresses these habitats associated with Project reservoirs and impoundments, and locations along the section of the West Fork Mojave River adjacent to Silverwood Lake that could potentially be affected by Project operation.

Wetlands, riparian areas, and littoral habitats occur within the proposed Project boundary adjacent to Project impoundments and along waterways, but no formal mapping or delineation of these habitats have been conducted in the Project area.

Waters of the United States are those that are regulated under the CWA, and include waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce; their tributaries; and adjacent waters, including wetlands, ponds, lakes, impoundments and similar waters (40 CFR 230.3). For rivers and streams, including those that are non-vegetated, the limit of jurisdiction is determined by the ordinary high water mark (OHWM), which is typically delineated in the field by evaluating field indicators. Evaluation of hydrological data also can provide additional information to assist in determination of the OHWM. Riparian areas that are not located within waters of the United States are not regulated under the CWA.

There are also a number of man-made water features in the Project area. Man-made water bodies may or may not be considered jurisdictional under the CWA. The jurisdictional determination of these features is typically made by considering wetland characteristics and hydrological connections to other waterways or wetlands. The USACE ultimately makes the final determination of jurisdictional status.

4.7.1 Wetlands

Wetlands are areas that meet the criteria for soils, hydrology, and vegetation as defined in the USACE Wetland Delineation Manual (USACE 1987). These areas are inundated or saturated by surface or groundwater at a duration and frequency sufficient to support vegetation typically adapted for saturated soil conditions. Wetland areas include marshes, shallow swamps, lakeshores, wet meadows, and riparian areas, and often occur along or adjacent to perennial or intermittent water bodies.

The USFWS' NWI data (USFWS 2010e) were the only data identified for wetlands mapping within the proposed Project boundary (Figure 4.7-1). NWI mapping provides preliminary data on potential location and type of wetlands. These data are based on aerial imagery, which is not typically ground-truthed, and likely do not capture some areas where wetlands may occur, such as locations adjacent to riparian areas. Additionally, no information is provided about vegetation, condition of the wetland, whether an area meets the USACE definition of wetland, or whether the area would be considered jurisdictional. NWI mapped features also include manmade impoundments and water conveyance features.

Environmental Science Associates performed vegetation surveys on the perimeter of Silverwood Lake in 2014 to evaluate the potential effects of the application of copper-based herbicides and algaecides to control aquatic weeds and algal blooms (Environmental Science Associates 2014). They found areas of cattail marsh occurring sporadically around the lake, generally transitioning to riparian forest upstream. These areas would be classified as Palustrine wetlands under the Cowardin system (Cowardin et al. 1979), but were not mapped in NWI data (see NWI Mapped Habitats section below). Common reed was interspersed with common cattail in the surveyed areas; low vegetation diversity was observed (Environmental Science Associates 2014).

No other wetland mapping or delineations have been performed within the proposed Project boundary; however, Aspen Environmental Group (2006) delineated wetlands along Horsethief Creek, north of Silverwood Lake. Horsethief Creek is a tributary to the Mojave River approximately 1.5 miles downstream of Cedar Springs Dam. Although this area is not within the proposed Project boundary, this information is presented here because DWR expects that wetland species found along Horsethief Creek would be similar to wetland species along small creeks within the Project boundary flowing into Silverwood Lake. Investigators found that open water locations in the Horsethief Creek area were fringed by wetland species, including panicled bulrush (*Scirpus microcarpus*), broadleaf cattail, rushes, spike rush (*Eleocharis* sp.), duckweed (*Lemna* sp.), European water plantain (*Alisma plantago-aquatica*), watercress (*Nasturtium offficinale*), knotgrass (*Paspalum distichum*), broadleaf lupine (*Lupinus latifolius*), juvenile willows, cocklebur, and emerging cottonwoods (Aspen Environmental 2006). NWI did not map any wetlands in this area of Aspen Environmental Group's delineation.

4.7.1.1 NWI Mapped Habitats

NWI areas are described using the Cowardin classification (Cowardin et al. 1979), a hierarchical system that defines wetlands and deepwater habitats according to their System, Subsystem, Class, Subclass, and, Modifiers. Mapped features are not always described using all categories, but typically are classified by System and Class, at a minimum.

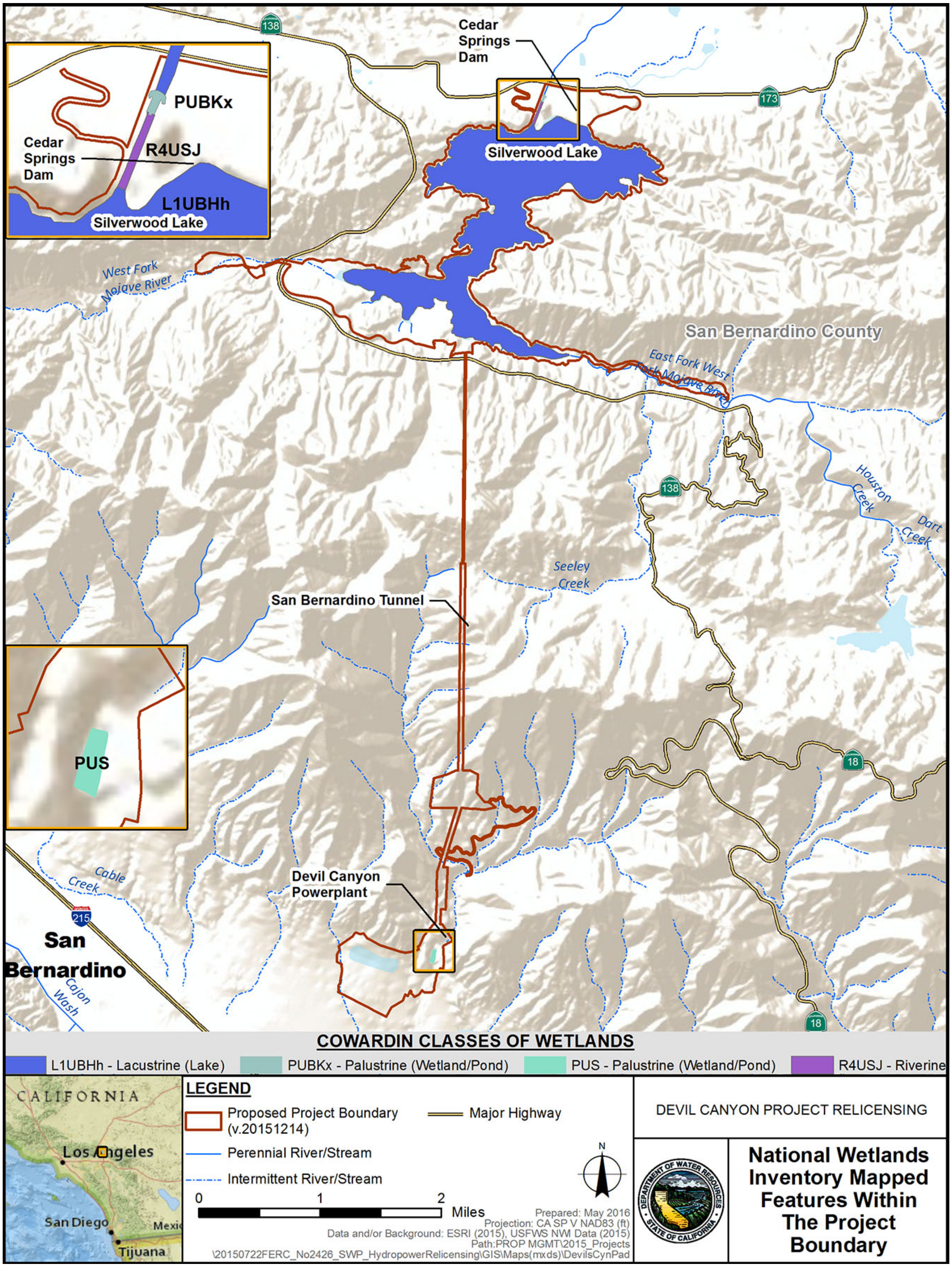

Figure 4.7-1. National Wetlands Inventory Mapped Features Within the Project Boundary

Three Cowardin Systems were mapped by NWI within the proposed Project boundary: Palustrine, Lacustrine, and Riverine. Palustrine wetlands include all non-tidal wetlands dominated by trees, shrubs, emergent plants, mosses or lichens. Lacustrine areas include wetlands and deepwater habitats that (1) are located in a topographic depression or a dammed river channel; (2) are lacking in trees, shrubs, persistent emergent plants, emergent mosses or lichens with greater than 30 percent areal coverage; and (3) are greater than 20 acres in area. Riverine Systems include habitats contained in natural or artificial channels periodically or continuously contain flowing water, or which form a connecting link between two bodies of standing water. Lacustrine and Riverine habitats are generally not considered wetlands, but they are included here for completeness in evaluating NWI data. Table 4.7-1 summarizes Cowardin classifications for the NWI features mapped within the proposed Project boundary.

Table 4.7-1. Cowardin Classifications for Features Within the Project Boundary

Cowardin Classifier	Abbreviation	Description
System		
Palustrine	P	Non-tidal wetlands dominated by trees, shrubs, emergent plants, mosses or lichens
Lacustrine	L	Wetlands and deepwater habitats that (1) are located in a topographic depression or a dammed river channel; (2) are lacking in trees, shrubs, persistent emergent plants, emergent mosses or lichens with greater than 30 percent areal coverage; and (3) are greater than 20 acres in area
Riverine	R	Habitats contained in natural or artificial channels with periodically or continuously flowing water, or which form a connecting link between two bodies of standing water
Subsystem--Riverine		
Intermittent	4	Describes channels that contain flowing water only part of the year, but may contain isolated pools when the flow stops
Subsystem--Lacustrine		
Limnetic	1	Extends outward from Littoral boundary and includes all deep-water habitats within the Lacustrine System
Class		
Unconsolidated Bottom	UB	Wetlands and deepwater habitats with at least 25 percent cover of particles smaller than stones (less than 6 to 7 cm) and a vegetative cover less than 30 percent
Unconsolidated Shore	US	Wetlands and deepwater habitats characterized by substrates lacking vegetation except for pioneer plants that become established during brief periods when growing conditions are favorable

Table 4.7-1. Cowardin Classifications for Features Within the Project Boundary (continued)

Cowardin Classifier	Abbreviation	Description
Emergent	EM	Wetlands characterized by erect, rooted, herbaceous hydrophytes (plants adapted to growing in wet conditions), excluding mosses and lichens; this vegetation is present for the majority of the growing season in most years, and most emergent wetlands are dominated by perennial plants
Modifiers		
Saturated	B	Wetlands in which the substrate is saturated to the surface for extended periods during the growing season, but surface water is seldom present
Intermittently Exposed	G	Areas in which surface water is present throughout the year, except in years of extreme drought
Permanently Flooded	H	Areas in which water covers the land surface throughout the year in all years
Intermittently Flooded	J	Riverine habitats in the arid western portions of the United States. Substrate is usually exposed, but surface water is present for variable periods without detectable seasonal periodicity. These habitats are very climate-dependent. Weeks or months or even years may intervene between periods of inundation. Flooding or inundation may come from spring snowmelt or sporadic summer thunderstorms. The dominant plant communities under this regime may change as soil moisture conditions change.
Artificially Flooded	K	Areas in which the amount and duration of flooding is controlled by means of pumps or siphons in combination with dikes or dams
Other Special Modifiers		
Excavated	x	Areas that occur in a basin or channel that have been dug, gouged, blasted, or suctioned through artificial means
Diked/ Impounded	h	Areas that have been created or modified by a man-made barrier or dam which obstructs the inflow or outflow of water

Source: Cowardin 1979

NWI wetland and other water types and specific features mapped within the proposed Project boundary are described below and depicted in Figure 4.7-1.

Palustrine

The following Palustrine areas are mapped by NWI within the proposed Project boundary:

- Palustrine, Unconsolidated Bottom, Artificially Flooded – One excavated wetland occurs in the West Fork Mojave River downstream of Cedar Springs Dam.

- Palustrine, Emergent, Intermittently Exposed – One excavated wetland occurs in the West Fork Mojave River downstream of Cedar Springs Dam.
- Palustrine, Unconsolidated Shore area – The Devil Canyon Second Afterbay is not mapped by NWI, but as noted above, NWI mapping typically does not accurately characterize all wetlands and deepwater habitats in a given area.

Lacustrine

Silverwood Lake is mapped as a Lacustrine, Unconsolidated Bottom, Permanently Flooded, Diked/Impounded area.

Riverine

A Riverine, Intermittent, Intermittently Flooded area is mapped within the proposed Project boundary in the West Fork Mojave River immediately downstream of Cedar Springs Dam.

4.7.2 Riparian Habitat

Riparian areas are vegetated zones that form a transition between permanently saturated areas and upland areas and that typically exhibit vegetation and physical characteristics associated with permanent sources of surface or groundwater (USACE 1987). These areas may or may not meet all three USACE criteria for wetlands.

In the Project area, the East Fork of the West Fork Mojave River flows from east to west through Miller Canyon into Silverwood Lake at its southeast corner, and the West Fork Mojave River continues to flow west to east out of the southwest corner of Silverwood Lake. Both streams are intermittent (do not flow year round). CalVeg data maps Valley Foothill Riparian habitat in patches along both drainages near Silverwood Lake, including areas within the proposed Project boundary, and also along the south-central portion of the reservoir at the confluence of the drainage in Sawpit Canyon with Silverwood Lake (USFS 2014; see Figure 4.6-1). NWI data also maps forested riparian vegetation as occurring along the East Fork of the West Fork Mojave River and the West Fork Mojave River upstream of Silverwood Lake within the proposed Project boundary (NWI 2014). Various other small areas of riparian vegetation are reported to occur within the proposed Project boundary along coves and at the confluence of tributaries on the east and west sides of Silverwood Lake in locations of sandy, alluvial deposition, including Cleghorn Creek (pers. comm., Mike Giusti, CDFW, October 15, 2015).

No complete mapping and assessment of riparian areas have occurred within the proposed Project boundary; however, in 2014, Environmental Science Associates mapped vegetation on the perimeter of Silverwood Lake and observed riparian forested areas in various locations around Silverwood Lake and adjacent drainages. Canopies in these areas were dominated by Fremont cottonwood, California sycamore, and arroyo willow, with understories of other willow species and mulefat. One location in the northwest portion of the reservoir was mapped as Southern Sycamore Alder Riparian

Woodland based on the Holland (1986) classification, which is used in CNDDB. This is designated by CDFW as a sensitive natural community. All other riparian areas were determined to be either Southern Cottonwood Willow Riparian Forest or Southern Willow Scrub (under the Holland 1986 classification), which are also designated by the CDFW as sensitive natural communities (Environmental Science Associates 2014).

Arroyo toad surveys of the West Fork Mojave River upstream of Silverwood Lake in 2004 observed that much of the vegetation in this area, including riparian vegetation, had burned in the 2003 Old Fire (Hunt & Associates Biological Consulting and Aspen Environmental Group 2004). Riparian species observed included California sycamore, Fremont cottonwood, white alder, and willow. Willow-alder-cottonwood riparian woodlands were documented along the lower approximately 0.75-mile stretch of the river, which had not burned; this area is located within the proposed Project boundary. Willow, sycamore, and oak (*Quercus* sp.) riparian woodlands occurred upstream in the burned area, grading into oak woodland on upper terraces; this includes some areas within the proposed Project boundary. Some tributary drainages in this area supported dense alder woodland (Hunt & Associates Biological Consulting and Aspen Environmental Group 2004). The exact locations of the tributary drainages evaluated were not specified, so it is unknown if they occur within the proposed Project boundary or in adjacent areas.

4.7.3 Littoral Habitats

In the Cowardin et al. (1979) classification, the Lacustrine System has two Subsystems: littoral (shallow water) and limnetic (deep water). Littoral areas per Cowardin et al. (1979) are those with standing water of depths less than 6.6 feet. These areas typically support aquatic bed or emergent vegetation and would likely meet wetland criteria. Unvegetated littoral areas (Unconsolidated Bottom, per Cowardin, et al. [1979]) also occur; these areas would not meet all three USACE wetland criteria, and therefore would not be considered wetlands.

Littoral habitats occur throughout the proposed Project boundary on the margins of Silverwood Lake; however, these areas have not been formally delineated or described. Emergent and aquatic bed vegetation were observed in Silverwood Lake at its confluence with West Fork Mojave River near the Cleghorn Day Use Area by a field team during a site visit in July 2015 (Pers comm. C Jones 2015). Other shallow water areas, such as the vicinity of the boat ramp approximately 1,000 feet east of the Cleghorn Day Use Area and the marina and swim beach at the south end of the lake, were observed to support little to no aquatic vegetation. Section 4.5.1.2 describes invasive aquatic plant species with potential to occur within the proposed Project boundary.

4.8 FEDERAL ENDANGERED SPECIES ACT LISTED AND CANDIDATE SPECIES

This Section provides information regarding species listed as endangered (FE), threatened (FT), candidates under review, and proposed for listing under the ESA known or with the potential to occur at the Project. Besides this general introductory information, this Section is divided into two main sub-sections: Section 4.8.1 details DWR's efforts to identify ESA-listed species potentially affected by the Project; and Section 4.8.2 describes, for each ESA-listed species potentially affected by the Project, a brief life history, its status, and any known occurrences and abundance within the Project vicinity.

4.8.1 <u>Identification of ESA-Listed Species</u>

DWR developed the list of ESA-listed species known, or with the potential to occur in the Project vicinity (Table H-5, Appendix H), by first querying the USFWS' online Information for Planning and Conservation (IPaC) to generate an unofficial list of federally listed and proposed endangered, threatened, and candidate species that should be considered as part of any future effects analysis for the Project (USFWS 2015). In addition, DWR accessed existing species records through the CNPS online Inventory of Rare and Endangered Vascular Plants of California (CNPS 2015); and the CDFW CNDDB (CDFW 2015a). Plant species records were also reviewed on the CalFlora website. The database queries were each based on a search of the USGS 7.5-minute topographic quadrangles in which the Project is located (i.e., Silverwood Lake and San Bernardino North), as well as the adjacent quadrangles (i.e., Hesperia, Apple Valley South, Lake Arrowhead, Cajon, Harrison Mountain, and Devore) covering approximately 493 square miles and with an approximate minimum five-mile buffer of the existing Project boundary. This is an area much larger than that potentially affected by the Project, but is intended to ensure a comprehensive initial list. Note that species for which NMFS and USFWS has been petitioned to list and that are under petition review or under 12-month status review after a substantial finding are not candidates and are therefore not discussed in this Section; such species are discussed, as appropriate, in Section 4.5 or 4.6.

The results of these queries included 25 species listed by IPaC (Appendix H). DWR then researched the known distribution, habitat associations and requirements of these species to exclude from further consideration species known to be endemic to restricted geographic areas and habitat types not found in the Project area, the results of which are summarized in Appendix H. Ten species listed by IPaC for which there were no known occurrences in the Project vicinity and for which the Project vicinity is not within the species known native range were thus excluded. In addition, Santa Ana sucker (*Catostomus santaanae*), which was identified by IPaC and is known to naturally occur within the Project vicinity, was excluded from further consideration because the Mojave River drainage is not within the species' range.

On the basis of this initial analysis summarized in Table 4.8.1, the following 12 ESA-listed species (1 fish, 3 amphibians, 4 birds, 1 mammal, and 3 plants) were identified as having the potential to be affected by the Project and are described in Section 4.8.2. No candidates or proposed species were identified.

- Mohave tui chub, *Siphateles* [formerly *Gila*] *bicolor mohavensis*
- Arroyo toad, *Anaxyrus* [formerly *Bufo*] *californicus*, and critical habitat
- California red-legged frog, *Rana draytonii*
- Southern mountain yellow-legged frog, Southern California Distinct Population Segment (DPS), *Rana muscosa*
- California condor, *Gymnogyps californianus*
- Coastal California gnatcatcher, *Polioptila californica californica*
- Least Bell's vireo, *Vireo bellii pusillus*
- Southwestern willow flycatcher, *Empidonax traillii extimus*, and critical habitat
- San Bernardino Merriam's kangaroo rat, *Dipodomys merriami parvus*, and critical habitat
- Slender-horned spineflower, *Dodecahema* [*Centrostegia*] *leptoceras*
- Nevin's barberry, *Berberis nevinii*
- Santa Ana River woolly-star, *Eriastrum densifolium* ssp. *sanctorum*
- Thread-leaved brodiaea, *Brodiaea filifolia*

Table 4.8-1. Identification of ESA-listed, Proposed, or Candidate Species Potentially Affected by the Project

Common Name	Scientific Name	Federal and State Status	Identified by IPaC	Known Occurrences in Project Vicinity	Project Vicinity Within Species Known Native Range	Other Considerations	Conclusion
Mohave tui chub	*Siphateles* [*Gila*] *bicolor mohavensis*	FE	Yes	Yes	Yes	--	Include
Arroyo toad	*Anaxyrus* [*Bufo*] *californicus*	FE, SSC	Yes	Yes	Yes	--	Include
California red-legged frog	*Rana draytonii*	FE, SSC	Yes	Yes	Yes	--	Include
Southern mountain yellow-legged frog, Southern California DPS	*Rana muscosa*	FE	Yes	Yes	Yes	--	Include
California condor	*Gymnogyps californianus*	FE, SE	Yes	No	Yes	California condors are wide ranging and the wild population is slowly increasing	Include
Coastal California gnatcatcher	*Polioptila californica californica*	FT, SSC	Yes	Yes	Yes	--	Include
Least Bell's vireo	*Vireo bellii pusillus*	FE, SE	Yes	Yes	Yes	--	Include
Southwestern willow flycatcher	*Empidonax traillii extimus*	FE, SE	Yes	Yes	Yes	--	Include
San Bernardino Merriam's kangaroo rat	*Dipodomys merriami parvus*	FE	Yes	Yes	Yes	--	Include
Slender-horned spineflower	*Dodecahema* [*Centrostegia*] *leptoceras*	FE, SE	Yes	Yes	Yes	--	Include
Nevin's barberry	*Berberis nevinii*	FE, SE	Yes	Yes	Uncertain	The only known occurrence in Project vicinity documented in 1966, but since extirpated, was a transplant outside of the species range	Include
Santa Ana River woolly-star	*Eriastrum densiflorum* ssp. *sanctorum*	FE	Yes	Yes	Yes	--	Include
Thread-leaved brodiaea	*Brodiaea filifolia*	FT	Yes	Yes	Yes	--	Include

Source: CDFW 2015a
Key:
FE = federal endangered
FT = federal threatened
IPaC = USFWS Online Information for Planning and Conservation
SE = California State endangered
SSC = California State species of special concern
ST = California State threatened

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4.8.2 Description of ESA-Listed Species

4.8.2.1 Mohave Tui Chub[30]

The Mohave tui chub (*Siphateles [formerly Gila] bicolor mohavensis*) was listed as endangered on October 13, 1970 (35 FR 16047). Critical Habitat has not been designated for this species. USFWS issued a Recovery Plan on September 12, 1984, and the results of a five-year review on February 4, 2009. No recovery actions specific to the Project or the Project area are identified in the Recovery Plan or five-year review.

Historically, the Mohave tui chub was the only fish species in the Mojave River, occurring in deep pools and sloughs. As a result of the introduction of the related arroyo chub, a competitor, and other predaceous fish species, and development of water projects which reduced flow in the Mojave River, the Mohave tui chub was extirpated from nearly all of its range by 1970. Most attempts to establish new populations, often in constructed ponds, have not been successful. All but one of the three known existing populations referenced in the five-year review (USFWS 2009f) represent introductions outside of the historical range. Few areas of the Mojave River remain suitable for the species.

The Mohave tui chub is a small fish that rarely exceeds 6.7 inches in length. The body is stocky with a large, slightly concave head and short, rounded fins. Mohave tui chubs spawn in March or April when the water warms to 64°F and may spawn again in the fall if conditions are ideal. The young form schools in shallow water, whereas adults are solitary and occur in deeper water. The species is capable of surviving low-oxygen, high-alkaline environments. Little is known about the feeding habits of the Mohave tui chub, but it is believed they eat plankton, insect larvae, smaller fish, and organic detritus (USFWS 2009f).

There are five records of Mohave tui chub from the Project vicinity (CDFW 2015a). Occurrences from the West Fork Mojave River at the present location of Silverwood Lake (1967), Mojave River Forks (1967) and Deep Creek 2 to 3 miles east of the Mojave River confluence (1931) are categorized as “extirpated.” Occurrences from an unnamed creek at Little Horsethief Ranch (1937) and Mojave River, 1 mile north of the State Fish Hatchery (1967), are “presumed extirpated.”

[30] Photo credit: National Park Service [public domain]

4.8.2.2 Arroyo Toad[31]

The arroyo toad (*Anaxyrus [Bufo] californicus*) was listed as endangered on December 16, 1994 (59 FR 64859). Critical habitat was designated on February 7, 2001 (66 FR 9414) with revisions on April 13, 2005, (70 FR 19562) and on February 9, 2011 (76 FR 7246). USFWS issued a Recovery Plan on July 24, 1999, and the results of a five-year review on August 17, 2009. On March 27, 2014, USFWS proposed to reclassify arroyo toad as threatened (79 FR 17106); however, USFWS later decided to withdraw its proposed rule on December 23, 2015 because the same types of threats that resulted in the original listing of the toad still exist and new threats were identified (80 FR 79805). USFWS has not yet issued a final rule to withdraw its proposal to declassify the arroyo toad; this species is still currently listed as endangered. No recovery actions specific to the Project or the Project area were identified in the Recovery Plan or five-year review.

Historically, arroyo toad populations occurred from Monterey County to Baja California, Mexico, mostly in coastal drainages, but also along inland draining streams (i.e., desert slopes) of the Transverse and Peninsular Ranges south of the Santa Clara River in Los Angeles County (USFWS 2009g). Known extant populations of arroyo toad occur within about 75 percent of the original range (USFWS 2009g), concentrated at elevations from about 975 to 3,250 feet (Sweet and Sullivan 2005).

Critical habitat for arroyo toad has been designated in Santa Barbara, Ventura, Los Angeles, San Bernardino, Riverside, Orange, and San Diego Counties. The Desert Slope Recovery Unit includes critical habitat Sub-Unit 22a, located approximately 0.4 miles downstream of Silverwood Lake, including parts of Horsethief Creek, Deep Creek, and the West Fork Mojave River (USFWS 2015). Sub-Unit 22c, originally included in the October 13, 2009, revised critical habitat rule (74 FR 52612) to cover the West Fork Mojave River upstream of Silverwood Lake, was removed in the final revised rule because habitat in the West Fork Mojave River upstream of Silverwood Lake lacks essential habitat elements and does not meet the definition of critical habitat for the arroyo toad (76 FR 7245).

Population loss has been largely attributed to the development of coastal areas, flood control projects, and other stream modifications, with declines likely exacerbated by introduced predatory fish and American bullfrog, as well as the spread of tamarisk (salt cedar) (*Tamarix ramosissima*) in riparian areas (59 FR 64859). Suitable aquatic and riparian habitat is maintained and supported by fluvial processes, including a natural flood regime or conditions similar to a natural regime. Within watersheds, the most robust arroyo toad populations may do best at the lower end of the upstream sections of third to sixth order streams (Sweet 1992, as cited by Sweet and Sullivan 2005). These

[31] Photo credit: USFWS [public domain], via Wikimedia Commons

are streams characterized by sand and gravel substrates, where flows are sufficient to suspend silt and clay. Periodic flooding is important to scour vegetation, redistribute fine sediments, and reform suitable, shallow pools. However, flood flows during the breeding season disrupt breeding and are a potential source of mortality to eggs and larvae. Existing populations of adult arroyo toads are relatively small compared to historical data (Sweet and Sullivan 2005). Identified threats to existing populations include off-road vehicle use and development. Populations in headwater areas upstream of reservoirs may be limited by marginal habitat conditions (Sweet and Sullivan 2005; USFWS 2009g).

The arroyo toad breeds in low-gradient, broad, open streams or low-gradient sections of streams, and is largely terrestrial outside of the breeding season. Breeding habitats are located in overflow pools, old flood channels, shallow pools, and margins with little or no flow. Substrates in breeding areas are usually sand or gravel with little or no emergent vegetation. Adult males in breeding condition typically call from suitable egg-laying sites almost every night during the breeding season, which can last from February to July, whereas females are present only when they are ready to breed. Breeding behavior may be interrupted by flooding, but typically resumes when flows are again favorable. Most streams supporting arroyo toads hold surface water for at least four to five months in most years; however, streams with water for as little as two months in the spring during most years (the minimum required for some larvae to complete metamorphosis) are considered suitable (76 FR 7245). Larvae may utilize areas with water velocities of up to 1.3 feet per second (Sweet 1992, as cited by Sweet and Sullivan 2005).

Arroyo toads are active from approximately February or March to July or August and inactive later in the year. Little is known regarding hibernation behavior. Populations studied by Sweet (1992; 1993, both as cited by Sweet and Sullivan 2005) exhibited high mortality during the hibernation period.

Adult females and large males are relatively sedentary during the active season, whereas smaller adult males and juveniles may undertake longer movements along streams. Daytime and dry-period retreats are shallow burrows in the riparian zone, usually in areas of sandy or other friable soils, with occasional use of existing small mammal burrows. Metamorphosed arroyo toads less than 1 inch in body length do not burrow and remain near the stream, often associated with damp substrates (Sweet and Sullivan 2005).

Riparian habitats are important to all post-metamorphic life stages. Favored riparian habitats include sand bars, alluvial terraces, and sparsely to moderately vegetated streamside benches. Typically, banks are vegetated with willows (*Salix* spp.) and mulefat (*Baccharis salicifolia*). Use of upland areas beyond the riparian zone also occurs, although this may vary by site or region. Radio-telemetry by Ramirez found that arroyo toads sometimes ventured as much as 650 feet into uplands, but that most tracked toads remained in riparian areas (Aspen Environmental Group 2006). Use of upland areas may occur more often in populations near the coast (Sweet and Sullivan 2005).

Eggs and small larvae may experience high mortality from stranding when water levels drop or displacement when flooding occurs. Other sources of larval mortality include predation by introduced fishes. Juvenile arroyo toads are vulnerable to predation by killdeer (*Charadrius vociferus*) and trampling by recreationists and cattle (Sweet 1992, as cited by Sweet and Sullivan 2005). Adult arroyo toads, especially calling males, may experience heavy predation by introduced American bullfrogs (USFWS 1999a).

There are 15 CNDDB records of arroyo toad in the Project vicinity on Silverwood Lake, Lake Arrowhead, and Cajon quadrangles (CDFW 2015a). These occurrences are associated with populations on the West Fork Mojave River and its tributaries, Horsethief Creek, Deep Creek and tributaries (Kinley Creek and Grass Valley Creek), and Cajon Creek. The arroyo toad was formerly common in the area where Silverwood Lake was created, at Cedar Springs and Miller Canyon, and was also common in Deep Creek and Forks of the Mojave downstream to Victorville, before the Mojave River Forks Dam was constructed (Jennings and Hayes 1994). Hitchcock and Fisher (2004) reported finding one adult arroyo toad in the Silverwood Lake SRA upstream of Silverwood Lake in 2003, but described a “large, healthy population” at Little Horsethief Canyon. USFWS (2015) listed the Mojave River Basin as one of many basins where arroyo toad is impacted by operations of dams and reservoirs, recreation activities, introduced predators, drought, and livestock grazing.

DWR engaged in USFWS ESA consultation associated with the Horsethief Creek Check 66 Access Road Bridge Project, located outside of the existing Project boundary, and implemented a series of protective mitigation measures for arroyo toad, including intensive arroyo toad surveys in advance of the project along Horsethief Creek and Check 66 Access Road; radio-telemetry of arroyo toads to better determine areas being used; exclusion fences of construction and staging areas, as needed; removal and relocation of arroyo toads from construction areas; and scheduling work for daylight hours outside of the breeding and larval rearing seasons (i.e., after August 15 and before February). In addition to replacing culverts with a bridge crossing, with expected benefits to arroyo toad habitat, mitigation also included efforts to control beavers (*Castor canadensis*) and American bullfrog. Suggested recommendations to minimize potential effects on arroyo toad in the future included scheduling aqueduct repairs to between September 1 to November 1, except during emergencies, and minimizing nighttime use of roads where arroyo toads may occur.

4.8.2.3 California Red-legged Frog[32]

The California red-legged frog (*Rana draytonii*; CRLF) was listed as a threatened species on May 23, 1996, (61 FR 25813) and final critical habitat was designated on March 13, 2001 (66 FR 14626) with revisions on April 13, 2006 (71 FR 19244) and on March 17, 2010 (75 FR 12816). USFWS issued a Recovery Plan on May 28, 2002. A five-year review was initiated on May 25, 2011 (76 FR 30377). No recovery actions specific to the Project or the Project area are identified in the Recovery Plan.

The historical range of the CRLF extends through Pacific slope drainages from Shasta County, California, to Baja California, Mexico, including the Coast Ranges and the west slope of the Sierra Nevada Range at elevations below 4,000 feet. The current range of this species is greatly reduced, with most remaining populations occurring along the coast from Marin County to Ventura County. Fellers (2005) indicated only two known extant populations in southern California, one in Riverside County on the Santa Rosa Plateau (Schaffer et al. 2004) and the other in Ventura County, both with few documented adults.

According to the Recovery Plan (USFWS 2002a), factors associated with declining populations of the CRLF include degradation and loss of its habitat through: (1) agriculture; (2) urbanization; (3) mining; (4) overgrazing; (5) recreation; (6) timber harvesting; (7) the introduction of non-native plants that affect the frog's habitat; (8) impoundments; (9) water diversions; (10) degraded water quality; (11) use of pesticides; and (12) introduced predators (e.g., American bullfrog, crayfish, and non-native predatory fish). Populations may have initially declined because of over-harvesting for food. Because populations have been extirpated from large portions of the species' historical range, the continued survival of isolated populations, some of which are not within dispersal distance of other suitable habitats, is uncertain. Other factors that may limit recovery include contamination from agrochemicals, which may become wind-borne over long distances (Davidson et al. 2001).

The CRLF is primarily associated with perennial ponds or pools and slow-moving perennial or seasonal streams or pools within streams where water remains continuously for a minimum of 20 weeks beginning in the spring (i.e., sufficiently long for breeding to occur and larvae to complete development) (Jennings and Hayes 1994; 71 FR 19244). Dense, shrubby riparian vegetation (e.g., willow and bulrush [*Schoenoplectus*] species), and bank overhangs typically occur in breeding habitats. Emergent vegetation, undercut banks, and semi-submerged root wads may provide hiding cover for larvae. Suitable aquatic habitats include natural and manmade ponds, backwaters within streams and creeks, marshes, lagoons, and dune ponds. Deep lacustrine habitats larger than 50 acres do not represent breeding or dispersal habitats

[32] Photo credit: US Army, California National Guard [public domain], via Wikimedia Commons

(75 FR 12816). At San Francisquito Creek in Los Angeles County, egg laying is estimated to have begun as early as February 5 and eggs hatched as late as March 20 in 3 years when eggs were found (Alvarez et al. 2013). The latter study also found that breeding occurred slightly later at four stream sites compared to four lotic sites, a behavior that may avoid disruption of breeding by high flows during winter. Egg masses are attached to emergent vegetation such as cattails (*Typha* spp.) and bulrushes. Larvae remain in these aquatic habitats until metamorphosis is complete. Increased siltation during the breeding season can cause asphyxiation of eggs and small larvae. Larvae typically metamorphose between July and September, and most likely feed on algae (Jennings and Hayes 1994).

Outside of breeding season, adults may disperse upstream, downstream, or upslope of a breeding habitat to forage and seek sheltering habitat, which may consist of small-mammal burrows, leaf litter, and other moist sites in or near (up to 200 feet from) riparian areas (Jennings and Hayes 1994; 71 FR 19244). During wet periods, long-distance dispersal of 1 mile or more may occur between aquatic habitats, including movement through upland habitats or ephemeral drainages (71 FR 19244). Seeps and springs in open grasslands can function as foraging habitat or refuges for dispersing frogs (USFWS 2005).

Suitable dispersal habitat consists of all upland and wetland habitats that connect two or more patches of suitable aquatic habitat within 1.25 miles of one another. Dispersal habitat must be at least 500 feet wide and free of such barriers as heavily traveled roads (roads with more than 30 cars per hour), moderate- to high-density urban or industrial developments, and large reservoirs (Allen and Tennant 2000).

Designated CRLF critical habitat units include one unit in Los Angeles County (LOS-1, San Francisquito Creek) and three in Ventura County: VEN-1 (San Antonio Creek), VEN-2 (Piru Creek), and VEN-3 (Upper Las Virgenes Creek). There is no designated critical habitat in San Bernardino County.

The CNDDB has two records of CRLF in the Project vicinity (CDFW 2015a). An old historical location (date unknown) is reported from the Mojave River Public Camp, 3 miles northeast of Silverwood Lake (Silverwood Lake and Lake Arrowhead quadrangles). An unknown number of CRLF were observed on West Fork City Creek (Harrison Mountain quadrangle) during a fish survey in 1982. Although both occurrences are described in the CNDDB report as “presumed extant,” there are no recent sightings in either area (USFWS 2002a).

4.8.2.4 Southern Mountain Yellow-legged Frog, Southern California DPS[33]

The Southern California DPS of mountain yellow-legged frog (*Rana muscosa*) was listed as endangered on July 2, 2002 (67 FR 44382). At the time of the listing, all mountain yellow-legged frogs were considered a single species, *Rana muscosa*. Subsequently, Vredenburg et al. (2007) determined that separation into at least two species was warranted. The southern mountain yellow-legged frog (SMYLF) (sometimes referred to as Sierra Madre yellow-legged frog), which retained the scientific name, *Rana muscosa*, comprises the original Southern California DPS, as well as populations of this species complex in the Sierra Nevada mountain range, within and south of the South Fork Kings River. Populations in the Sierra Nevada, north of the South Fork Kings River, are classified as *Rana sierrae* (Sierra Nevada yellow-legged frog). Critical habitat for the SMYLF Southern California DPS was designated on September 14, 2006 (71 FR 54344). USFWS issued the results of a five-year review on July 13, 2012. No recovery actions specific to the Project or the Project area are identified in the Recovery Plan or five-year review.

In southern California, the SMYLF occurred historically in the San Jacinto, San Bernardino, San Gabriel, and Palomar Mountains at elevations ranging from 1,200 to 7,500 feet. Populations occurred in shaded streams on coastal slopes, as well as inland (desert) slopes, characterized by cool water fed by springs or snowmelt. Currently, fewer than 10 small populations are known to persist in this region, all within the SBNF and ANF. Adult populations at most sites are precariously small (i.e., fewer than 5 and no more than 15 adults) (USFWS 2012). Only one population is known in the San Bernardino Mountains (East Fork City Creek), three in the San Jacinto Mountains (Fuller Mill Creek, Dark Canyon, and Tahquitz Creek) and five in the San Gabriel Mountains (Bear Gulch, Vincent Gulch, South Fork Big Rock Creek, Little Rock Creek, and Devil's Canyon). Although additional undiscovered populations are possible, the USGS performed surveys of more than 200 locations throughout the historical range between 1998 and 2012, including at least 13 sites in the Mojave River watershed (e.g., on the West Fork Mojave River, Deep Creek and tributaries, and tributaries of the East Fork of the West Fork Mojave River) and sites all along the coastal-facing slopes of the San Bernardino Mountains, finding only two populations not known at the time of listing (Backlin et al. 2003; USFWS 2012). Critical habitat has been designated in Los Angeles, San Bernardino, and Riverside Counties.

The principal factor in the decline of the SMYLF is the introduction of predatory fish, principally trout, into areas where they did not previously occur. Surviving populations have generally improved when the non-native trout were removed; however, fish continue to restrict SMYLF populations to headwaters of tributary streams, which may

[33] Photo credit: Chris Brown, USGS, Western Ecological Research Center [public domain], via Wikimedia Commons

represent marginal habitat (USFWS 2012). Other factors in the decline include habitat impacts associated with recreation and the effects of the disease called chytridiomycosis. This disease, associated with the chytrid fungus, Bd, has been identified as the likely agent in extirpation of populations of both species of mountain yellow-legged frog in the Sierra Nevada and may be limiting adult recruitment in surviving southern California populations of SMYLF.

All mountain yellow-legged frogs are highly aquatic, rarely found more than 3 feet from water (Stebbins and McGinnis 2012; USFWS 2012). As summarized in the five-year review (USFWS 2012), all of the known populations of SMYLF in southern California are associated with and breed in small streams. Egg masses, which are relatively small (i.e., 350 or fewer eggs) are deposited in shallow water attached or unattached to substrates. Populations may not be supported by streams too small to provide hibernation habitat or that dry before larvae metamorphose, which usually requires 2 years of growth. At lower elevations, the breeding period usually begins in April and continues for about one month, but begins later at higher elevations. Adult SMYLF that were implanted with passive integrated transponder (PIT) tags generally remained within relatively small home ranges during a 4-year period, with only two of 42 individuals traveling more than about 220 feet; however, these two frogs moved about 1,660 and 4,850 feet, respectively (USFWS 2012).

There are eight CNDDB records of SMYLF in the Project vicinity, including records from Silverwood Lake, Lake Arrowhead, San Bernardino North, Harrison Mountain, and Devore quadrangles (CDFW 2015a). The 1947 record from the Silverwood Lake quadrangle is described as West Fork Mojave River at Horsethief Canyon, near Silverwood Lake and Summit Valley; however, the exact location is unknown. This occurrence is described as "extirpated." A second record, also from 1947 and "possibly extirpated," is described as East Fork of the West Fork Mojave River, 1.25 miles east of Cedar Springs Camp (3,300 feet elevation). Other occurrences were reported from Deep Creek (3 miles east of Lake Arrowhead), and streams in the Santa Ana River drainage, including Lytle Creek and City Creek. As indicated above, recent surveys by USGS have failed to find SMYLF at any sites within the Mojave River drainage. There is no SMYLF critical habitat in San Bernardino County (USFWS 2015).

4.8.2.5 California Condor[34]

The California condor (*Gymnogyps californianus*) has been listed as an endangered species since 1967 (32 FR 4001). The introduced population in Arizona was categorized as "experimental, non-essential" on October 16, 1996 (61 FR 54044). Critical habitat was designated for California condor in 1976 (41 FR 41914) with a correction in 1977 (42 FR 47840). USFWS issued the third and most recent revision of the Recovery Plan on

[34] Photo credit: David Clendenen, USFWS [public domain], via Wikimedia Commons

April 25, 1996, and the results of the most recent five-year review on June 4, 2013. No recovery actions specific to the Project or the Project area are identified in the Recovery Plan or five-year review.

Historically, the California condor occurred from British Columbia, Canada, to Baja California, Mexico, and east to the Cascade and Sierra Nevada ranges, but the species' range had been reduced by the 1950s to a wishbone-shaped area within parts of the following ten California counties: Monterey, San Benito, Fresno, Kings, San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Kern, and Tulare.

At the time of listing and until the 1980s, the California condor was in steep decline and in imminent danger of extinction due to direct persecution, eggshell thinning as a result of secondary poisoning from the pesticide, dichlorodiphenyltrichloroethane (DDT) and its derivative dichlorodiphenyldichloroethylene (DDE), and possibly other factors. Critical habitat has been designated in Santa Barbara, San Luis Obispo, Ventura, Los Angeles, Kern, and Tulare counties.

Recovery of the California condor required removing surviving birds from the wild, captive breeding and subsequent and continuing release of captive-reared birds. As a result of these efforts, the free-flying population located in southern California, Arizona, and Baja California, Mexico, had increased to 268 by the end of 2015 (USFWS 2015). The wild populations are regularly monitored, including periodic trapping of birds lured by supplemental carrion (USFWS 2013). Natural reproduction remains insufficient to sustain or grow populations without captive breeding, primarily due to exposure to lead from lead ammunition in carrion. Ingestion of "microtrash" (i.e., small pieces of plastic, bottle caps, aluminum can tabs, broken glass, and other indigestible materials) is also a threat to the California condor, particularly nestlings fed microtrash brought back to the nest, causing impaction and often eventual death. Mortality from collisions with powerlines and electrocution of California condors perched on power-poles sometimes occurs (USFWS 2013a).

Available information indicates that California condors nested naturally in cavities on escarpments in steep mountainous or canyon terrain, and also utilized burnt-out hollows of large trees (e.g., old-growth sequoia and coastal redwood), cliff ledges, and rarely, the nests of other large birds (USFWS 1996). Nest site selection occurs in winter and a single egg clutch is laid between late January and early April. Eggs hatch within approximately 56 days. Young will fly at approximately five to six months, but are partially dependent on parents for up to a year. California condors become sexually mature at five to eight years, and are potentially long-lived (USFWS 2013a). Adults typically leave roosts three to five hours after sunrise, waiting for thermals to develop, and return two to five hours before sunset (San Diego Zoo 2009). California condors forage over open grasslands, foothill oak savannas, and coastal areas where they feed on carrion, including deer, elk, cattle, pronghorn antelope, marine mammals and birds, and fish. Individual California condors have been documented to travel more than 100 miles in a day, assisted by air currents (USFWS 2013a).

There are no CNDDB records of California condor in the Project vicinity, and there is no designated critical habitat in San Bernardino County. The critical habitat area located nearest to the Project is Sespe-Piru in the Los Padres National Forest in Ventura County, located more than 80 miles west (USFWS 2015).

4.8.2.6 Coastal California Gnatcatcher[35]

The coastal California gnatcatcher (*Polioptila californica californica*) was listed as threatened on March 30, 1993 (58 FR 16742). Critical habitat was first designated for this species on October 24, 2000 (65 FR 63680) and was revised on December 19, 2007 (72 FR 72010). A Recovery Plan has not been published. USFWS issued the results of a five-year review on September 29, 2010. No recovery actions specific to the Project or the Project area are identified in the five-year review. On December 31, 2014, USFWS found that delisting may be warranted, based on evidence that the coastal California gnatcatcher may not be a valid subspecies, and began a 12-month review (79 FR 78775).

The coastal California gnatcatcher is a small, non-migratory songbird, which occurs almost exclusively in certain sub-associations of coastal sage scrub plant communities and occasionally in chaparral (58 FR 16742). Almost all known occurrences (i.e., 99 percent of records) are below 2,000 feet elevation (USFWS 2010b). Breeding occurs from late February to July. Historically found in coastal southern California, from Ventura County south to Baja California, Mexico, the coastal California gnatcatcher has disappeared from much of its historical range because of widespread loss and fragmentation of habitat due to urban and agricultural development. According to the listing rule, the coastal California gnatcatcher had been extirpated in San Bernardino County, and only about 30 pairs were believed to still occur in Los Angeles County. However, subsequent to listing, breeding pairs of coastal California gnatcatcher were documented in San Bernardino County, near the Riverside County line, south of the San Bernardino Mountains. Records from the Santa Ana River drainage may represent a movement corridor (58 FR 16742).

The coastal California gnatcatcher generally breeds from late February through mid-July (USFWS 2010b). Nests are placed in California sagebrush (*Artemisia californica*) or other shrubs about 3 feet above the ground. The average clutch size is four eggs, and the eggs are incubated by both sexes for about 14 days. The nesting period is approximately 16 days. Breeding territories are between 2 and 14 acres. (USFWS 2010b).

There are six CNDDB records of this species in the Project vicinity on the San Bernardino North and Devore quadrangles (CDFW 2015a). The nearest critical habitat to the Project is located approximately 16 miles from Silverwood Lake and 13 miles

[35] Photo credit: USFWS [public domain]

from Devil Canyon Powerhouse, along the Santa Ana River in San Bernardino County (USFWS 2015). Available information, including query of the IPaC, indicates that this species does not occur near Silverwood Lake, but could occur in the vicinity of the Devil Canyon Powerplant, if there is suitable habitat.

4.8.2.7 Least Bell's Vireo[36]

The least Bell's vireo (*Vireo bellii pusillus*) was listed as endangered on May 2, 1986 (51 FR 16474). Critical habitat was designated for this species on February 2, 1994 (59 FR 4845). USFWS issued a draft Recovery Plan on May 6, 1998, and the results of a five-year review on September 26, 2006. No recovery actions specific to the Project or the Project area are identified in the Recovery Plan or five-year review.

This small, mostly migratory, insectivorous songbird is closely associated with dense, riparian habitat and adjacent chaparral in river valleys from interior northern California to northwestern Baja California, Mexico (USFWS 1998). Populations from the Sacramento and San Joaquin Valleys were considered extirpated at the time of listing, with almost all remaining occurrences concentrated in southern California (USFWS 2006). Critical habitat has been designated in Santa Barbara, Ventura, Los Angeles, San Bernardino, Riverside, and San Diego Counties.

Nesting occurs in dense riparian habitat dominated by willows. Nests are often placed in openings or near habitat edges in understory shrubs, including wild rose (*Rosa californica*) and mulefat beneath willows and cottonwoods (USFWS 1998). Wintering habitat includes arroyos with scrub vegetation, hedgerows, and other shrubby areas as far south as southern Baja California, Mexico (USFWS 2006). Clutch size is usually three or four eggs, with incubation by both sexes lasting 14 days. Nestlings fledge at 10 to 12 days. Some pairs may produce multiple broods annually; however, young are rarely fledged from more than two nests (USFWS 1998).

Loss and degradation of nesting habitat was the primary factor in the species decline, and nest parasitism by brown-headed cowbirds (*Molothrus ater*) threatens existing populations (USFWS 1998). Since listing, the number of known least Bell's vireo breeding territories has increased ten-fold, which USFWS (2006) attributed to measures to protect and enhance riparian habitat and control brown-headed cowbirds by trapping. Populations from the Sacramento and San Joaquin Valleys were considered extirpated at the time of listing, with almost all remaining occurrences concentrated in southern California (51 FR 16474). In San Bernardino County, the number of known least Bell's vireo territories increased from none between 1977 and 1985 to 87 between 2001 and 2005 (USFWS 2006).

[36] Photo by USFWS [public domain], via Wikimedia Commons

There are six CNDDB records of the least Bell's vireo in the Project vicinity on the San Bernardino North and Devore quadrangles, all from within the Santa Ana River drainage. Least Bell's vireo was not detected during surveys performed to evaluate potential effects of the Horsethief Creek Check 66 Access Road Bridge Project (Aspen Environmental Group 2006). There is no critical habitat in San Bernardino County. The nearest critical habitat is located approximately 17.5 miles from the Devil Canyon Powerplant along the Santa Ana River (USFWS 2015).

4.8.2.8 Southwestern Willow Flycatcher[37]

The southwestern willow flycatcher (*Empidonax traillii extimus*) was listed as endangered on February 27, 1995 (60 FR 10694). Critical habitat was first designated on July 22, 1997 (62 FR 39129) and was later revised on October 19, 2005 (70 FR 60886) and on January 3, 2013 (78 FR 344). USFWS issued a Recovery Plan on August 30, 2002, and made available the results of a five-year review (document dated August 15, 2014) and on September 4, 2014 published its August 15, 2014 report describing the results of a five-year review. No recovery actions specific to the Project or the Project area are identified in the Recovery Plan or five-year review.

This migratory, insectivorous songbird is found during the breeding season in dense, riparian habitat associated with low-gradient streams or lentic habitat from Kern County, California, south to northern Baja California, Mexico, east to southwest Colorado to southwest Texas. Historically, suitable riparian habitat within this mostly arid area often occurred in widely dispersed and isolated patches, which were further reduced by water development projects, agriculture, urbanization, and other factors. Critical habitat has been designated in New Mexico, Colorado, Utah, Nevada, Arizona, and California. In California, critical habitat is located in Santa Barbara, Inyo, Kern, Ventura, Los Angeles, San Bernardino, Riverside, and San Diego Counties.

The southwestern willow flycatcher nests in riparian thickets with the following attributes: canopy height may be as little as 6 feet at high elevation sites dominated by shrubs, to as much as 100 feet at lower elevation sites with distinct tree and shrub layers. Foliage is typically dense from the ground to approximately 13 feet high. Nesting habitat usually contains willows or tamarisk (USFWS 2002b). Other characteristic species include boxelder (*Acer negundo*), Russian olive (*Eleagnus angustifolia*), cottonwood (*Populus* spp.), ash (*Fraxinus* spp.), alder (*Alnus* spp.), and buttonbush (*Cephalanthus occidentalis*). Breeding territories may be as small as 0.25 acres, but most are at least 0.5 acres. Wintering habitat is Neotropical, with lowlands of Costa Rica and other parts of Central America probably most important (USFWS 2014).

[37] Photo credit: Jim Rorabaugh, USFWS [public domain], via Wikimedia Commons

There are five CNDDB records of the southwestern willow flycatcher in the Project vicinity on the Cajon and Harrison Mountain quadrangles (CDFW 2015a). Southwestern willow flycatcher was not detected during surveys performed to evaluate potential effects of the Horsethief Creek Check 66 Access Road Bridge Project (Aspen Environmental Group 2006). Designated critical habitat includes sections of the Mojave River and Deep Creek downstream of Mojave Forks (Mojave Management Unit) and sections of the Santa Ana River and Waterman Creek (Santa Ana Management Unit) (USFWS 2015). The nearest critical habitat is located in Unit 6 in the Mojave Management Unit north of Silverwood Lake. Deep Creek and West Fork Mojave River were characterized in the final rule (78 FR 344) as "not known to have been occupied at the time of listing" and with no breeding territories detected between 1991 and 2010.

4.8.2.9 San Bernardino Merriam's Kangaroo Rat[38]

The San Bernardino Merriam's kangaroo rat (*Dipodomys merriami parvus*) was listed as endangered under emergency rule on January 27, 1998 (63 FR 3835) that immediately followed by a final rule listing it as endangered on September 24, 1998 (63 FR 51005). Critical habitat was first designated for this species on April 23, 2002 (67 FR 19812) with revisions on October 17, 2008 (73 FR 61936). USFWS issued the results of a five-year review on August 14, 2009. No recovery actions specific to the Project or the Project area are identified in the five-year review.

Historically, the San Bernardino Merriam's kangaroo rat occurred in areas of suitable habitat from the San Bernardino Valley to Menifee Valley in Riverside County. However, much of this habitat has been lost, with remaining habitat widely scattered. Current distribution is primarily within the floodplains of the upper reaches of the Santa Ana River and parts of its tributaries, Lytle, Cajon and Cable Creeks, and the San Jacinto River and its tributary, Bautista Creek (USFWS 2009h). Elsewhere, known populations are small and isolated. Critical habitat has been designated in San Bernardino and Riverside Counties (73 FR 61936).

Suitable habitat is associated with alluvial scrub habitats with sandy loam soils, required for burrow excavation, and where vegetation is relatively open and shrub cover is low. Because periodic, infrequent flood events are important in maintaining these habitat conditions, populations are typically concentrated on the intermediate terraces along streams between the active channel and mature terraces, where habitat is less suitable.

San Bernardino Merriam's kangaroo rat burrow systems are not colonial (i.e., only one adult per burrow system); however, individual burrow systems are often clustered. The breeding period may be prolonged, but peaks in June and July. One or more litters of two to three young may be produced each year. Although San Bernardino Merriam's

[38] Photo credit: USFWS [public domain]

kangaroo rats are primarily seed-eaters, insects and green vegetation are seasonally important (USFWS 2009h).

There are 19 CNDDB records of this species in the Project vicinity. These records are from the Devore, San Bernardino North, and Harrison Mountain quadrangles, mostly associated with Lytle and Cajon Creeks (CDFW 2015a). The nearest critical habitat for the species is Unit 4 (Cable Creek Wash), a disjunct portion of which is located less than 0.5 miles south of the Devil Canyon Powerplant (USFWS 2015). The final rule (73 FR 61936) describes this Unit as extending from the mouth of Cable Creek to Interstate 215 and that the alluvial area retains necessary fluvial dynamic processes. The Unit was also described as occupied by a self-sustaining population of the species at the time critical habitat was designated. Available information, including query of the IPaC, indicate that San Bernardino Merriam's kangaroo rat does not occur near Silverwood Lake.

4.8.2.10 Slender-horned Spineflower[39]

The slender-horned spineflower (*Dodecahema [Centrostegia] leptoceras*) was listed as endangered on September 28, 1987 (52 FR 36265). Critical habitat has not been designated for this species. USFWS issued the results of a five-year review on October 1, 2010. No recovery actions specific to the Project or the Project area are identified in the five-year review.

Slender-horned spineflower is a small, rosette-forming annual of the buckwheat family (Polygonaceae) that is found on floodplain terraces and sandy benches, areas that flood infrequently (52 FR 36265). Germination is likely related to rainfall. Occurrences are associated with alluvial fan scrub vegetation. Slender-horned spineflower is a southwestern California endemic species, restricted to northern Los Angeles County east to San Bernardino County and south to southwestern Riverside County in the foothills of the Transverse and Peninsular Ranges. It has been found at elevations of about 660 to 2,300 feet (USFWS 2010f). At the time of listing, there were only five known extant populations. Current threats include changes in flood regimes from flood-control projects, continuing development, gravel-mining, agriculture, off-road vehicle use, and invasive non-native plants. (USFWS 2010f).

There are five CNDDB records of slender-horned spineflower in the Project vicinity, all from the Cajon and Harrison Mountain quadrangles (CDFW 2015a). There are no records of this species from the Mojave River drainage. Available information, including maps and records of documented occurrences, indicate this species has no potential to occur near Silverwood Lake, but could occur in the vicinity of the Devil Canyon Powerplant, if there is suitable habitat.

[39] Photo credit: Joe Decruyenaere (DSCN5846) [CC BY-SA 2.0 (http://creativecommons.org/licenses/by-sa/2.0)], via Wikimedia Commons

4.8.2.11 Nevin's Barberry[40]

Nevin's barberry (*Berberis nevinii*) was listed as endangered on October 13, 1998 (63 FR 54956). Critical habitat was designated for this species on February 13, 2008 (73 FR 8412). USFWS issued the results of a five-year review on August 14, 2009. No recovery actions specific to the Project or the Project area are identified in the five-year review.

Nevin's barberry is an evergreen, perennial shrub of the barberry family (Berberidaceae) that grows 3 to 12 feet tall and flowers in March and April. Individual plants have been reported to live more than 50 years, but may only produce fertile seed sporadically (USFWS 2009b). Endemic to southern California, Nevin's barberry has been documented at scattered locations, each representing small stands of fewer than 10 plants, in Los Angeles, San Bernardino, and Riverside Counties, and possibly San Diego County, at elevations mostly between 1,400 and 1,700 feet (USFWS 2009b). Most occurrences are concentrated near Vail Lake in southwestern Riverside County, where all designated critical habitat is located.

Habitat includes benches, terraces, canyon floors, and steep banks of drainages; margins of washes; and steep, rocky slopes and ridges. Nevin's barberry has been found in alluvial scrub, chaparral, coastal sage scrub, oak woodland, and riparian scrub or woodland (USFWS 2009b). Because Nevin's barberry has been introduced into the horticultural trade, some recent occurrences may not be native.

There is one CNDDB record for Nevin's barberry in the Project vicinity, from the Harrison Mountain quadrangle (CDFW 2015a), which is described as a transplant outside of the species' native range that was last observed in 1966, but was subsequently extirpated by road widening (USFWS 2009b).

4.8.2.12 *Santa Ana River Woolly-star*[41]

The Santa Ana River woolly-star (*Eriastrum densiflorum ssp. sanctorum*) was listed as endangered on September 28, 1987 (52 FR 36265). Critical habitat has not been designated for this species. USFWS issued the results of a five-year review on October 29, 2010. No recovery actions specific to the Project or the Project area are identified in the five-year review.

This perennial but short-lived, sub-shrub (10 to 30 inches tall) is a member of the phlox family (Polemoniaceae) that flowers from May to August. It is found within the

[40] Photo credit: Stan Shebs [GFDL (http://www.gnu.org/copyleft/fdl.html), CC BY-SA 3.0 (http://creativecommons.org/licenses/by-sa/3.0), via Wikimedia Commons
[41] Photo credit: Ken Corey, USFWS [public domain], via Wikimedia Commons

Riversidian Alluvial Fan Sage Scrub Plant Community on open, sandy, high-alluvial terraces subject to infrequent flooding and is almost entirely endemic to the Santa Ana River drainage. Seed dispersal is assisted by flooding. The known range extends from Redlands east to the mouth of the Santa Ana Canyon, with a disjunct population found on Lytle Creek in San Bernardino County (52 FR 36265). Historically, habitats suitable for Santa Ana River woolly-star have been eliminated or degraded by agricultural and urban development, gravel mining, and flood-control projects. Current threats include continuing urban development in the Santa Ana River floodplain (USFWS 2010a).

There are four CNDDB records of this species in the Project vicinity, all from the Devore quadrangle (CDFW 2015a). There are no records of this species from the Mojave River drainage. Available information, including query of the IPaC, indicates that this species does not occur near Silverwood Lake, but could occur in the vicinity of the Devil Canyon Powerplant, if there is suitable habitat.

4.8.2.13 Thread-leaved Brodiaea[42]

The thread-leaved brodiaea (*Brodiaea filifolia*) was listed as threatened on October 13, 1998 (63 FR 54975). Critical habitat was first designated for this species on December 13, 2005 (70 FR 73820) and was revised on February 8, 2011 (76 FR 6848). USFWS issued the results of a five-year review on August 13, 2009. No recovery actions specific to the Project or the Project area are identified in the Recovery Plan or five-year review.

Thread-leaved brodiaea is distributed from the foothills of the San Gabriel Mountains in Los Angeles County, east to the western foothills of the San Bernardino Mountains in San Bernardino County, and south through eastern Orange and western Riverside Counties to central coastal San Diego County, California (USFWS 2009c). Current threats include ongoing urban development, agricultural practices (e.g., discing and mowing), isolation of remaining populations, and, at some sites, alterations to natural flood regimes (USFWS 2009c). Critical habitat has been designated in Los Angeles, Orange, Riverside, San Bernardino, and San Diego Counties (76 FR 6848).

Thread-leaved brodiaea is a perennial, corm-forming herb of the family Themidaceae that flowers March to June. Existing plants are perpetuated by the corms (bulb-like structures) and smaller cormlets produced in each growing season. Very closely related plants are probably incapable of setting seed without pollen from a more distantly related plant (USFWS 2009c). Seeds are wind-dispersed. This species is associated with several very specific soil types and moisture regimes, which provide moderately wet to occasionally wet conditions in floodplains and vernal pools at elevations from 100

[42] Photo credit: Joe Decruyenaere (Flickr) [CC BY-SA 2.0 (http://creativecommons.org/licenses/by-sa/2.0)], via Wikimedia Commons

to 2,500 feet. Sites are typically characterized by herbaceous plant communities. Some occurrences are also found in narrow openings within coastal sage scrub plant communities (USFWS 2009c).

There are two CNDDB records of thread-leaved brodiaea in the Project vicinity, both from the San Bernardino North quadrangle (CDFW 2015a). There are no records of this species from the Mojave River drainage. The nearest critical habitat for the species is located near East Twin Creek, approximately 4 miles from Devil Canyon Powerplant (USFWS 2015). Available information, including query of the IPaC, indicates that this species does not occur near Silverwood Lake, but could occur in the vicinity of the Devil Canyon Powerplant, if there is suitable habitat.

4.9 RECREATION AND LAND USE

This Section provides information regarding existing recreation resources and land use. Besides this general introductory information describing the existing environment, this Section consists of four main sub-sections. Section 4.9.1 describes recreation opportunities associated with the Project and, for each Project developed recreation area, the location, number and types of facilities in the recreation area, as well as annual use levels and facility attendance (i.e. recreation day) rates. Section 4.9.2 lists recreational opportunities and identified recreation needs in the Project region. Section 4.9.3 discusses land use and management in the Project region, and identifies the nearest designated Wild and Scenic River, Wilderness Area, and other special land use designations. In addition, FEMA floodplains are identified. Section 4.9.4 focuses on the land use and management within the proposed Project boundary. Areas covered include: (1) land ownership; (2) land use and management; (3) Project-related land use permits and easements; (4) DWR's vehicular access routes to Project facilities; (5) known Project-related wildfires and DWR's policies regarding fire prevention and suppression; (6) public safety related to Project facilities; (7) law enforcement in the Project area; (8) restrictions to Project waters and lands; (9) use of herbicides and pesticides; and (10) DWR's policy regarding shoreline management.

The Project is within the overall boundaries of the SBNF, although NFS lands make up approximately 6 percent (i.e., 132 acres) of the proposed Project boundary. While the NFS lands make up only a small proportion of the lands within the proposed Project boundary, the National Forests are the largest recreation provider in the region and recreation trends on those forest lands are considered to be indicative of trends in the Project area.

Almost all visitations to southern California national forests are local in origin. These forests and their recreational amenities serve as very popular local day-use attractions, often for large, diverse urban groups of extended family and friends engaging in relaxing activities. (USFS 2005c).

Southern California national forest (i.e., Angeles, Cleveland, Los Padres, and San Bernardino national forests) visitation has increased over the past two decades because of the area's population growth. Driving for pleasure and viewing scenery have become some of the more popular national forest activities. Visitors expect a certain level of 'naturalness' in the recreation and tourism settings they pursue. Even individuals who have never visited these national forests expect a certain level of 'natural intactness' in these landscapes. This natural beauty contributes to their sense of well-being and quality of life. (USFS 2005c).

While some level of recreation activity occurs throughout southern California national forests, the majority of use is concentrated in a relatively small number of popular areas. These areas are often associated with developed facilities and are easily accessible by road. (Stephenson and Calcarone 1999 in USFS 2005c).

Recreation in southern California is a complex social activity, and constantly changing preferences and interest levels create increased challenges for agency managers. Some unique factors that affect the sustainability of recreation management within the southern California national forests are as follows:

- The national forests offer a unique niche of nature-based, day-use mountain recreation in southern California. Key attractions include scenic vistas, green forests, cool temperatures, lake and stream-based waterplay, picnicking, winter sports, wilderness areas and hundreds of miles of trail systems and motorized backcountry recreation routes. Visitors want to escape the stress of urban life, traffic and smog, and to relax in nearby mountain refuges.

- Intensive, all-season recreation uses can lead to resource and habitat impacts and a struggle for the USFS to maintain environmentally sustainable recreation opportunities. Competition for space, visitor group and community conflicts, and deterioration of facilities and areas occur in many parts of the southern California national forests.

- There is no off-season in southern California. Use is year-round, often spontaneous (for example, snowplay after major winter storms), and the daily site turnover rate is often high at some facilities.

- There is a lack of room to expand recreation facilities at some popular areas due to steep topography and limiting land boundaries.

- Rapid urban development is occurring adjacent to and within national forest boundaries, leading to use pressures (such as "social" trails) and resource impacts. Urban social problems are migrating to this nearby open space, leading to public safety concerns.

- Demographics are rapidly changing. Complex public information strategies are needed, based on urban orientations and many languages, cultures and class diversities.

- Visitor expectations are higher than in some parts of the country. More amenities are expected, such as recreational vehicle utility hook-ups, flush toilets and hot showers.

- Many new recreation activities originate or become popular in southern California and are first practiced in these urban national forests. They include mountain biking, hang-gliding, radio-controlled airplanes, geocaching, and paintball gaming. Development of these new technologies often changes or increases visitors' ability to access and use the national forests.

- There are increased opportunities for recreation and conservation education partnerships between the USFS and non-profit organizations, volunteers, and businesses.

- Recreation facilities, areas, and programs on national forests influence local economies by prompting tourism, business and residential sectors. (USFS 2005c).

4.9.1 Project Recreation Facilities and Use

Project recreation resources are focused on Silverwood Lake as there is no recreation use or public access at the Devil Canyon Powerplant and Afterbays. These Project recreation resources are described below and included in Figure 4-9.1 along with all facilities within the Silverwood Lake SRA. Project facilities are photographically documented at the end of this Section (Figure 4.9-10 through Figure 4.9-22).

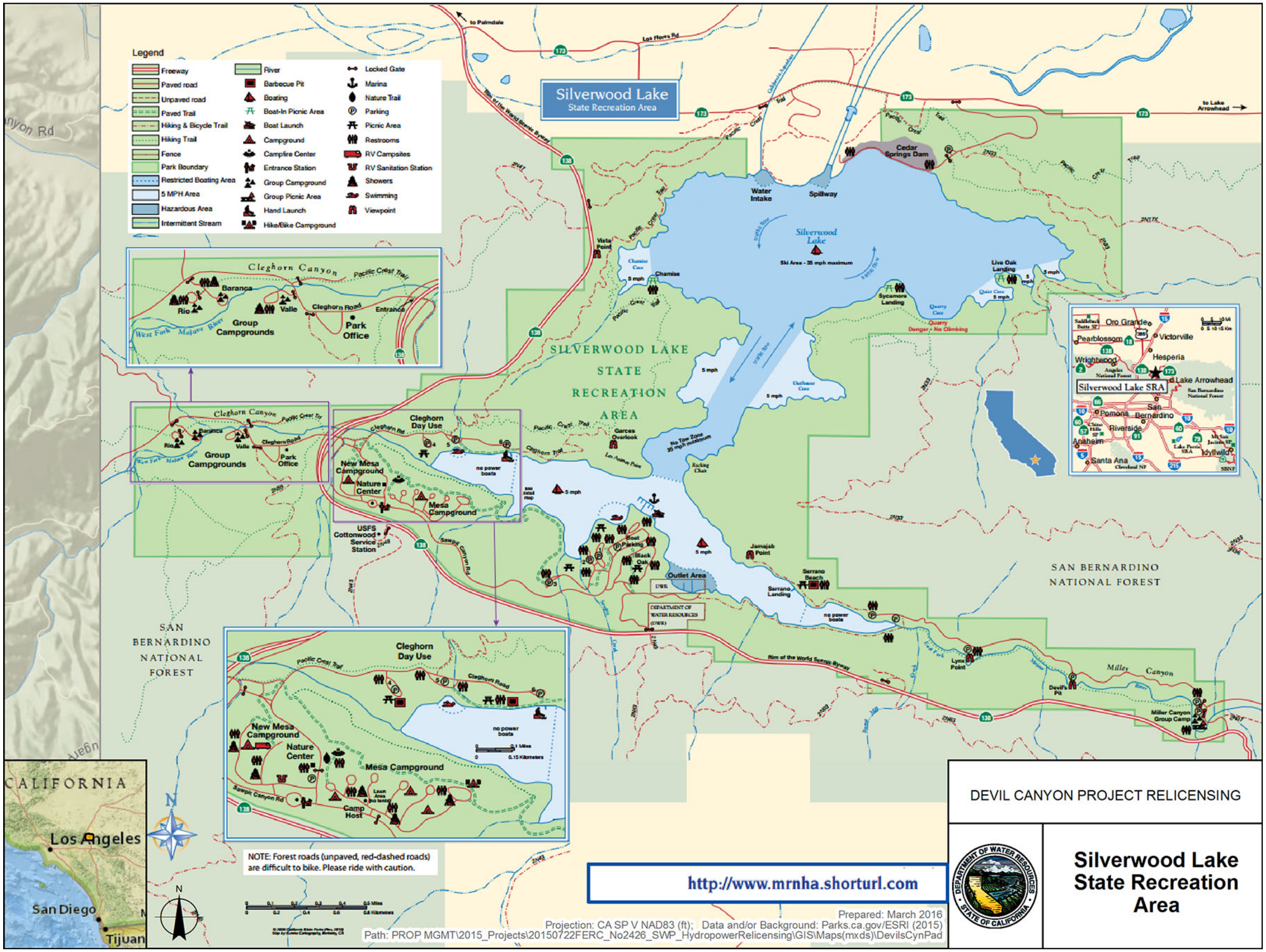

Figure 4.9-1. Silverwood Lake State Recreation Area

In addition to being popular with boaters and anglers, Silverwood Lake and its surrounding shoreline, which make up the Silverwood Lake SRA, are popular with swimmers, campers, hikers, and picnickers, particularly during the summer months. As described in detail below, Silverwood Lake SRA recreation facilities include: campgrounds, a nature center, picnic areas, boat launches, a marina, and swim beaches.

Silverwood Lake boating rules (DPR 2006) include:

- The direction of boat travel on the north part of the lake (water-ski area) is counter-clockwise, and the speed limit is 35 miles per hour (mph).
- Keep to the right in the channel (i.e., the area between the north and south parts of the lake). No water-skiing is allowed in the channel.
- The speed limit in the north part and channel coves is 5 mph, with the exception of Quarry Cover (north part), where it is 35 mph.
- The speed limit on the south part of the lake is 5 mph.
- No boats are allowed in the San Bernardino Tunnel Intake area or in swimming areas.
- No power boats are allowed in portions of the East Fork of the West Fork Mojave River arm and West Fork Mojave River arm.
- All boats must be off the lake by sunset.
- A properly fitting, U.S. Coast Guard-approved personal flotation device is required for every person on board and must be worn by children under 12 years of age.
- Boat operators must be at least 16 years old. Twelve to 15-year-olds may operate with an adult 18 years or older.
- Freestyle, wake jumping, or trick riding are prohibited. Jumping or attempting to jump the wake of another vessel within 100 feet of another vessel is prohibited by law.
- Do not ride on the bow, gunwale, or transom of any vessel.
- All vessels must carry a fire extinguisher (except outboard boats less than 26 feet in length without a permanently installed fuel tank).
- Fires, stoves, and barbeques are prohibited in coves and boat-in areas (described below).

- Buoys are for navigation and warning and cannot be used for slalom-style racing. No mooring or tying to buoys is allowed.
- Courtesy docks at boat launches are limited to 15 minutes loading and unloading times. No unattended vessels may be left at the courtesy docks.
- The Sawpit Canyon Marina is a no wake zone.
- Only commercially manufactured inflatable floats can be towed behind a boat or personal watercraft. Non-commercial devices such as rafts or inner tubes are not allowed. When passengers are on board, the float may be towed only in the waterski area; when no passengers are on board, it may be towed to and from the area.

Anglers 16 years and older must have a valid California State fishing license in their possession. Fishing is permitted in most areas of the lake; however, fishing at the inlet, spillway, outlet areas and from Cedar Springs Dam is not allowed. (DPR 2010).

Silverwood Lake is primarily a warm-water fishery, consisting of largemouth bass, bluegill, black crappie, striped bass, channel catfish, and white catfish. A cold-water fishery is maintained by stocking hatchery-raised rainbow trout.

Silverwood Lake SRA recreational areas, many of which are being improved by DPR are listed in Table 4.9-1. DWR recently submitted to FERC an update to its Recreation Plan including facility and amenity tables and updated recreation maps on May 20, 2016.

The Cleghorn Day Use Area (see Figures 4.9-10, 4.9-11 and 4.9-12) is located on the north shore of Silverwood Lake's West Fork Mojave River arm (south part). This day use area includes three parking areas, picnic tables, shade ramadas, a comfort station, restrooms, a swimming beach, and a boat launch. Additional information concerning Cleghorn Day Use Area recreational amenities (and other Project recreational amenities) is contained in Table 4.9-1.

Table 4.9-1. Project Recreation Facilities at Silverwood Lake

Recreation Area	Recreation Facilities
Black Oak Picnic Area 1	Typically 15-20 picnic tables, typically 10 ADA; typically 5-10 barbecues; parking for approximately 28-32 single vehicles; one restroom with flush toilets
Black Oak Picnic Area 2	Typically 15-20 picnic tables, typically 10 ADA; typically 5-10 barbecues; parking for approximately 28-32 single vehicles, 1 ADA; one ADA restroom with flush toilets
Black Oak Picnic Area 3	Typically 15-20 picnic tables, typically 10 ADA; typically 5-10 barbecues; parking for approximately 28-32 single vehicles
Black Oak Picnic Area 4	Typically 15-20 picnic tables, typically 10 ADA; typically 5-10 barbecues; parking for approximately 28-32 single vehicles; two restrooms with flush toilets
Cleghorn Picnic Area	Typically 85-95 picnic tables, typically 25-35 ADA; 2 large shade ramadas; 3 restrooms with flush toilets; typically 10 barbecues; parking for 165-175 vehicles, typically 11 ADA (under renovation); shoreline fishing; single-lane, non-motorized watercraft launch ramp; swim beach; 1 comfort station with 8 changing rooms and flush toilets; 0.46 miles of paved accessible trail and 0.33 inaccessible trail.
Cleghorn Swim Area	Swim beach; shoreline fishing; typically 8-10 picnic tables; restroom with flush toilets, 0.79 miles of trail Garces Overlook
Cleghorn Boat Launch	Single lane, non-motorized watercraft launch ramp; parking for approximately 8 single vehicles with trailer; parking for approximately 22-24 single vehicles
Devil's Pit	Overlook, hike-in site, biking, 0.54 miles of trail to Lynx Point
Garces Overlook	Overlook, hike-in site, biking
Jamajab Point	Overlook, hike-in site, biking
Live Oak	8 shade ramadas, typically 1 picnic table per ramada; 1 restroom with vault toilets; shoreline fishing
Lynx Point	Vista point, 1 restroom with vault toilets, hike-in site, biking, 0.46 miles of trail to Serrano Landing
Mesa Campground	95 campsites, 8 ADA; 3 comfort stations with flush toilets and showers (1 under renovation); parking for typically 13- 15 vehicles, 1 ADA (under renovation); hiking; biking; 6 hike-and-bike campsites; 1 interpretive display; Campfire Center with amphitheater; ADA restroom with flush toilet; ADA parking space (under renovation); 1.5 miles of bike trails
Miller Canyon Group Camp	Typically 40-45 picnic tables, 40-42 ADA; typically 2-3 large barbecues; typically 2-3 fire rings; 2 restrooms with vault toilets; parking for 45-50 vehicles; hiking biking; 0.26 miles of trail to Devil's Pit
Miller Canyon Picnic Area	1 restroom with vault toilet, typically 8-12 picnic tables, hiking, biking, 1.24 miles of miller Canyon Bike Trail to Black Oak Day Use Area
Nature Center	2,700 square-foot visitor building with exhibits and displays; paved parking for 30-35 vehicles, 2 ADA accessible; potable water; sanitary facilities; 1 interpretive Display
New Mesa Campground	40 campsites, 5 ADA (2 under renovation); 2 comfort stations with flush toilets and showers, ADA; RV dump station; hiking; biking; 1 interpretive display
Sawpit Canyon Boat Launch	7-lane boat launch ramp; 2 boat docks; parking for approximately 150-160 single vehicles with trailers, 5-7 ADA; fish cleaning station (under renovation)
Sawpit Canyon Marina	Marina operated by concessionaire under permit with typically 60-70 boat slips depending on demand and water levels; 3 floating restrooms, deployed on the lake as necessary; parking for approximately 70-75 single vehicles, typically 5 ADA; large ADA restroom complex with flush toilets (under renovation)
Sawpit Canyon Swim Area	Swim beach with concession building; comfort station with flush toilets, 8 changing rooms, and outdoor shower area; 25 shade ramadas with typically 1 picnic table and 1 barbecue per ramada; group picnic site with typically 3-4 picnic tables, typically 1-2 barbecues and a large group ramada ; typically 4-5 individual picnic tables with a barbecue; 2 restrooms with flush toilets; 1 interpretive display
Sawpit Canyon Picnic Area 1	Typically 25-30 picnic tables, most with barbecues; parking for approximately 270-280 single vehicles, typically 3 ADA; restroom with flush toilets
Sawpit Canyon Picnic Area 2	Typically 25-30 picnic tables, most with barbecues; parking for approximately 16-20 single vehicles, restroom with flush toilets
Sawpit Canyon Picnic Area 3	Typically 10-15 picnic tables, most with barbecues; parking for approximately 60-65 single vehicles, restroom with flush toilets; 0.46 miles of trail to Mesa Campground
Serrano Landing	Typically 3-6 picnic tables; 3 shade ramadas; 2 restrooms with vault toilets, ADA; boat dock; parking for approximately 10-12 vehicles; shoreline fishing; 0.27 miles of trail to Jamajab Point.
Silverwood Hike & Bike Trail Network	Approximately 5 miles of designated hiking and biking trail from Garces Overlook to Jamajab Point, with a branch of Miller Canyon Hiking Trail, approximately 1 mile long extending from near the Miller Canyon Picnic Area to Miller Canyon Group Camp
Sycamore Landing	12 shade ramadas, typically 1 picnic table per ramada; 1 restroom with vault toilet; shoreline fishing

Table 4.9-1. Project Recreation Facilities at Silverwood Lake (continued)

Recreation Area	Recreation Facilities
West Fork Group Camp (Rio, Valle, Barranca)	3 group sites with maximum occupancy of 100 people and parking for approximately 30-35 vehicles per site; 3 large shade ramadas per site, with typically 12-15 picnic tables per site, about 30-35 ADA total; 6 large barbecues typically 2 per site; typically 3 large fire rings, or one per site; 3 comfort stations with flush toilets and showers, ADA; hiking; biking; 1 interpretive display

Source: DWR 2016b
Key:
ADA = Americans with Disabilities Act of 1990 (US)

The New Mesa Campground (Figures 4.9-13 and 4.9-14) and Mesa Campground (Figure 4.9-15) are located on the south side of Silverwood Lake's West Fork Mojave River arm, just past the Silverwood Lake SRA entrance/pay station. Each campsite has a parking area and electrical service (except for the hike and bike sites at the Mesa Campground), table, barbeque grill, and fire ring. Comfort stations and showers are located throughout the campgrounds. Adjacent to these campgrounds are a campfire center (Figure 4.9-16), a nature center (Figure 4.9-17), a nature trail, and a recreational vehicle sanitation station.

The Nature Center is a 2,700 square-foot facility that provides interpretive displays and programs that demonstrate Silverwood Lake's resources and significance. It is located between Mesa and New Mesa Campgrounds and contains restrooms. This facility is maintained by DPR and operated by volunteers.

The Black Oak Picnic Area, located on the south part of the lake just west of the outlet area, includes four discrete areas each with parking, a restroom, picnic tables, grills, and an informational kiosk.

The Sawpit Canyon Day Use Area includes a boat launch, marina, and swim beach and is located on the south part of the lake, adjacent to the Black Oak Picnic Areas. Picnic tables, grills, shade ramadas, trailer and vehicle parking, boat docks, restrooms, a comfort station, with an outdoor shower area and changing rooms, and concessions are included (Figures 4.9-18, 4.9-19 and 4.9-20).

The Miller Canyon Group Camp, which was closed for renovation in 2004 through 2005, is located on the East Fork of the West Fork Mojave River upstream of Silverwood Lake. The Miller Canyon Day Use area is currently closed, and scheduled to reopen to the public later in 2016. It contains include tent campsites, picnic tables, barbeque grills, restrooms, and parking.

Miller Canyon Picnic Area is located in the western side of Miller Canyon and includes picnic tables and restrooms. This remote picnic area can be accessed from the bike path that runs between Sawpit and Miller Canyon Group Campground.

The Silverwood Hike and Bike Trail Network is approximately 5 miles of designated hiking and biking trail from Garces Overlook to Jamajab Point, with a branch of Miller Canyon Hiking Trail, approximately 1 mile long extending from near the Miller Canyon Picnic Area to Miller Canyon Group Camp.

Devil's Pit Overlook is located on the East Fork of the West Fork Mojave River upstream of Silverwood Lake and features a wooden bridge and overlook to view the canyon. Garces Overlook is a viewpoint with a bench, located east of the Cleghorn Day Use Area. It is accessible from the trail from Cleghorn, heading east to Las Animas Point.

Jamajab Point is located along the north side of the east fork of Silverwood Lake, and overlooks the San Bernardino Intake tower and the southeastern side of the lake. It is accessible from the hiking trail west of Serrano Landing.

Live Oak Boat-In Picnic Area is located on the peninsula east of Sycamore Landing and is adjacent to Quiet Cove and can only be accessed by boat. This site has shade ramadas, picnic tables, and a restroom.

A comfort station is included at Lynx Point, which is also located on the East Fork of the West Fork Mojave River upstream of Silverwood Lake. Parking is limited but this area can be reached via a road or a hiking trail.

The Serrano Landing Boat-in Picnic Area is located on the north shore of Silverwood Lake's East Fork of the West Fork Mojave River arm (south side). Picnic tables, shade ramadas, restrooms, and a boat dock are provided. Parking is provided for this area, which can be reached via a road or a hiking trail.

The Sycamore Landing Boat-in Picnic Area and the Live Oak Boat-in Picnic Area are located along the southeast shore of the northern part of the lake. Picnic tables, shade ramadas, and a restroom are provided at each location.

The Chamise Boat-in Picnic Area is located along the southwest shore of the lake's north side. Picnic tables, shade ramadas and a restroom are provided.

The West Fork Group Camp (Rio, Baranca, and Valle) are located west of the Rim of the World Scenic Byway (State Route 138), along the West Fork Mojave River. These areas include tent campsites, picnic tables, barbeque grills, fire rings, comfort stations with showers, shade ramadas, and parking areas (Figure 4.9-21).

In the past a parking area and potable restrooms were open to the public at Cedar Springs Dam accessed from the dam's right abutment parking area. From this parking area pedestrians could walk atop the dam and/or fish the lake. However, in May 2016 DWR proposed to FERC to close this area to public access because there has been recurring disturbance to the dam's rip rap that has created continual dam safety issues in addition to recurring vandalism and security concerns.

Dispersed recreation within the proposed Project boundary takes place in and around Silverwood Lake. Dispersed recreation at Silverwood Lake includes:

- Motorized and non-motorized boating, hiking and shoreline fishing.
- Hiking and sightseeing along USFS 2N33 Road, accessing the east side of Silverwood Lake's northern portion.

No dispersed recreation takes place on DWR or NFS lands within the Project boundary of the Devil Canyon Powerplant. Devil Canyon Road is gated with signage ("trespassing and loitering forbidden by law") approximately 0.5 miles north of the powerplant. The Powerplant, Afterbays, and related facilities are fenced with signage ("no trespassing").

4.9.1.1 Project Recreation Facilities Use

DWR is required by Exhibit S to stock rainbow trout in Silverwood Lake and conduct creel surveys to determine angler success and satisfaction rates for rainbow trout. These surveys occurred every year since 2005 and are conducted during both the fish stocking season (October through May) and summer (June through September). The most recent creel survey data available are based on surveys conducted October 2014 through May 2015; these surveys used roving survey methods with angler contact days selected by stratified random sampling of weekend and weekday days. During the most recent sampling period, approximately five weekend days (including holidays) and seven weekdays, on average, were sampled each month. Roving survey techniques consisted of angler interviews at areas accessible to the general public where fishing efforts were observed. Boat anglers were interviewed when they returned to the main launch ramp, immediately following their fishing efforts. Anglers were asked a range of questions, and the sampling effort required approximately two to three hours per survey day. Demographic data were also recorded to understand the characteristics of anglers. (CDFW 2015).

The most recent study showed that most anglers (50%) traveled between 20 and 50 miles to reach Silverwood Lake from October 2014 through May 2015, while 18 percent traveled less than 20 miles and 31 percent traveled greater than 50 miles. Angler satisfaction levels for “number of fish,” “size of fish,” and fishing experience all ranked 2.7 (on a scale of 4) in the October 2014-May 2015 creel survey. Summer creel surveys, conducted from June to September of the same year, were conducted under the previous methods, but had fewer angler contact days during the month, with approximately four weekend days (including holidays) and four weekdays, on average, sampled each month. The June-September 2015 survey had similar results for the distance-traveled category as the October/May surveys. In the last year’s survey, June through September 2015, anglers ranked number of fish as 2.1, size of fish as 2.0, and overall fishing experience as 2.2.

Additional information concerning Silverwood Lake creel surveys is contained in Section 4.5.1.4.

<u>2014 Recreation User Counts and Capacity Utilization</u>

In preparation for its 2015 FERC Form 80 (Recreation Report) filing, DWR conducted a user count and capacity utilization study for Project recreation facilities in 2014. DWR found that capacity ranged from a low of 25 percent for the “nature center” to a high of 84 percent for “picnic areas” (Table 4.9-2).

Table 4.9-2. Project Recreation Capacity, Use, and Capacity Utilization at Silverwood Lake, 2014

Amenity Type	Capacity (Daily)	Use (Average, Daily Non-Peak Weekend)	Capacity Utilization (percent)
Boat Launch Areas	159	114	76
Marina	100	60	60
Reservoir Fishing	160	80	63
Swim Areas	200	160	80
Trails	120	80	67
Picnic Areas	2,178	1,820	84
Nature Center	608	152	25
Campsites	135	98	73
Group Campsites	420	290	69

Source: DWR 2014h

4.9.2 <u>Recreation Opportunities and Needs in the Project Region</u>

Within 100 miles of Silverwood Lake is the newly designated Mojave Trails National Monument. The nearest federally-designated Wilderness Area is the Cucamonga Wilderness, located approximately 15 miles west of Silverwood Lake. Other nationally-recognized recreation areas in the region include the Pacific Crest National Scenic Trail that traverses through the Project area adjacent to Silverwood Lake (see Section 4.9.2.4).

4.9.2.1 Statewide Comprehensive Outdoor Recreation Plan

The California State Comprehensive Outdoor Recreation Plan (SCORP) serves as a statewide master plan for State and local parks and outdoor recreational open space areas. The SCORP also offers policy guidance to all outdoor recreation providers, including federal, State, local, and special district agencies throughout California.

The current (2015) SCORP is summarized below, along with the following key supporting documents: The Survey on Public Opinions and Attitudes on Outdoor Recreation in California (SOPA) 2012 and Outdoor Recreation in California's Regions 2013.

California State Parks' 2015 SCORP reflects the current and projected changes in California's population, trends and economy. This edition of the SCORP provides a strategy for statewide outdoor recreation leadership and action to meet the State's identified outdoor recreation needs. This SCORP establishes the following statewide actions to address California's park and recreation needs:

1. Inform decision-makers and communities of the importance of parks.
2. Improve the use, safety, and condition of existing parks.
3. Use Geographic Information System (GIS) mapping technology to identify park deficient communities and neighborhoods.
4. Increase park access for Californians including residents in underserved communities.
5. Share and distribute success stories to advance park and recreation services.

SOPA 2012 (DPR 2014) continues a process in place for over 25 years, to utilize applied research as a critical component of developing the SCORP. As noted in the SOPA, an understanding of the outdoor recreation demands, patterns, preferences, and behaviors of California residents is essential to develop policies, programs, services, access, and projections of future use.

The 2012 survey study included an adult telephone survey, adult online/mail-back survey, and online/mail-back youth survey to provide a comprehensive perspective of the outdoor recreation opinions and attitudes of Californians. Consistent with earlier studies, the 2012 adult surveys measured participation, latent demand, willingness to pay, importance and use of facilities, motivation, and opinions regarding privatization of services. The 2012 adult surveys, as in the 2008 survey, include measurement of physical activity in parks and constraints to physical activity. A new area of study for the current survey is an analysis of the quality of life relating to parks and communities. Comparisons on several variables by region and differences and similarities between Hispanics and non-Hispanics have been continued as a focus of investigation.

4.9.2.2 Park Visitation and Activity Participation

Findings from the 2012 adult surveys included:

- Nearly all respondents (91.6 percent) had visited a park within the past 12 months. The majority (71.5 percent) had visited a park within the past month.
- In the past 12 months, a majority of respondents visited highly developed parks and recreation areas, developed nature-oriented parks and recreation areas, historic or cultural buildings, sites, or areas, and natural and undeveloped areas.
- About three-quarters of Californians traveled to parks with family (52.5 percent) and friends (23.5 percent), while almost one-third went to parks with both family and friends.
- More than two-thirds of Californians reported spending the same (33.2 percent) or more time (35.2 percent) in outdoor recreation activities compared to 5 years ago.

- Californians who spend less time in outdoor activities then they did 5 years ago, do so because of time/work (25.7 percent), age (22.7 percent), and health/disability (16.4 percent).

- The majority of respondents participated in moderate (40.6 percent) to light levels (37.8 percent) of physical activity during park visits and spent less than three hours of time (46.1 percent) physically active in parks.

- During the past 12 months, Californians mostly participated in picnicking (70.4 percent), walking (63.8 percent), beach activities (52.8 percent), shopping at farmers' markets (49.5 percent), and swimming in a pool (48.2 percent).

- The respondents would like to participate more often in picnicking (55.1 percent), walking (37.4 percent), camping (35.1 percent), and beach activities (34.6 percent).

- Park visitor companions under the age of 18 mostly play (54.8 percent) and participate in sports (27.7 percent) when at parks.

- More than half of respondents utilized community facilities/buildings (65.4 percent), unpaved multiuse trails (60.2 percent), and picnic table/pavilion (56.6 percent) during their last park visit.

- Over a third (34.7 percent) of respondents reported utilizing an unpaved trail for hiking, biking, or horseback riding at least once or twice a month or more during the last 12 months. At the same time, 31 percent of respondents reported never using an unpaved trail.

- Few (7.9 percent) of the respondents reported engaging in off-road motor vehicle use once a month or more. Nearly 20 percent (18.2 percent) of respondents reported ever using an off road vehicle in the last 12 months.

- The most prevalent reasons the respondents participate in their favorite outdoor recreation activities included: to have fun, relax, view scenic beauty, be with family and friends, and keep fit and healthy.

Preferences and Priorities

- The most important facilities were wilderness type areas with no vehicles or development, play areas for children, areas for environmental and outdoor education, large group picnic sites, recreation facilities at lakes/rivers/ reservoirs, and single-use trails.

- More than 60 percent of Californians thought more emphasis should be placed on protecting natural resources, maintaining park and recreation areas, protecting historic resources, and cleaning up pollution of oceans, lakes, rivers, and streams in park and recreation areas. About one third of respondents felt that less emphasis should be placed on providing opportunities for motorized vehicle operation on dirt trails and roads.

- Most respondents strongly agreed or agreed that fees should be spent on the area where they are collected, recreation programs improve health, rules and regulations need enforcement, the availability of recreation areas and facilities attract tourists, and recreation programs help reduce crime and juvenile delinquency.

Satisfaction with Park Facilities

- Most respondents (72.8 percent) reported being satisfied or very satisfied with current facilities or outdoor recreation areas' conditions. Approximately 26 percent of the respondents answered that parks were better than 5 years ago and 26 percent answered that they were not as good as 5 years ago.

Park Fees

- The respondents were more willing to pay between $11 to $50 to picnic and camp than other activities.

Privatization Preferences

- The respondents more strongly supported privatization of food and beverage and rental services, sponsorships of events, and general maintenance. Respondents were less supportive of privatizing total operations, law enforcement, and educational activities.

Constraints to Park Use

- Fear of gang activity, use of alcohol and drugs, and poor maintenance were the biggest factors limiting the respondents' ability to engage in physical activities in parks.

Travel Times

- A majority of respondents (55.2 percent) reported spending between 5 and 10 minutes walking to the place they most often go to recreate. Meanwhile, a majority of respondents (54.5 percent) reported spending between 11 and 60 minutes driving there.

Quality of Life and Communities

- Californians rated clean air and water, prevention of crime, feeling safe, and having enough good jobs for residents as the most important factors for their personal quality of life. Respondents were not as satisfied with these factors in their community.

- Residents rated preservation of natural areas, the beauty of their community, and preservation of wildlife habitats as the community conditions most increased by parks and recreation in their community. Residents did not rate traffic control, a stable political environment, fair prices for goods and services, and good public transportation as being increased or decreased by parks and recreation.

As described in Outdoor Recreation in California's Regions 2013 (DPR 2013), California's diverse geography, demography, and economies present both opportunities and challenges to the State's outdoor recreation providers. A regional approach, which recognizes region differences and divides regions along county lines, can aid both State and local planning efforts.

The Project, which is located entirely within San Bernardino County, is located in the "Southern California" Planning Region. This region also includes the Counties of Imperial, Orange, Riverside, and San Diego. It does not include Los Angeles or Ventura Counties, which are in the "Los Angeles" Planning Region.

The number of acres of protected land per resident in the Southern California Planning Region is about equal to the statewide average. Accessibility to protected land (measured by the percentage of residents living within one-quarter mile of such land) is slightly lower than the statewide average. The number of miles of highway in the National Scenic Byways Program per 100 square miles is less than one-half the statewide average. The region has numerous trails in the California Recreational Trails System. Recreation facilities such as picnic/barbeque areas are generally proportional to the region's population percentage (about 30 percent).

About 57 percent of protected land in the Southern California Planning Region is federally protected land, much lower than the statewide average (86 percent). Percentages of State (21 percent), local (18 percent) and non-profit (4 percent) protected land are higher than statewide averages (6 percent, 6 percent and 4 percent, respectively).

Improving access to recreation was ranked as the "highest priority" in the Southern California Region. Specifically, funding incorporated area recreation facilities (ball fields, basketball courts, community centers, playgrounds, skate parks, and tennis/racquet courts) was encouraged.

4.9.2.3 San Bernardino County

As described in the San Bernardino County General Plan Environmental Impact Report (San Bernardino County 2007a), San Bernardino County has an abundance of outdoor recreational opportunities, including: water sports; hiking, bicycling, and equestrian activities; off-road vehicle recreation; fishing, camping and hunting; passive recreation and enjoyment of the natural setting; and developed parks. The major providers of outdoor recreation are BLM, USFS, DPR, NPS, the County Regional Parks Department, and local city parks departments.

There are nine regional parks in San Bernardino County. Regional parks generally encompass 100 or more acres and are designed to serve a population of 100,000 residents (see Figure 4.9-2). These regional parks offer a variety of recreational and entertainment opportunities. In addition to the regional parks, there are 17 community parks within the County. Community parks serve a 2- to 4-mile radius with a population of 50,000 to 80,000. The size of these parks is generally from 15 to 20 acres. Community, municipal and neighborhood park facilities are provided by self-governed park districts within the unincorporated portions of the County, and by cities and towns within the unincorporated areas. These facilities typically include playgrounds, sports fields, and senior citizen centers.

The County, as a whole, currently exceeds their stated standard of 2.5 acres of park area for each 1,000 persons. The County population total (incorporated and unincorporated) is approximately 1,716,166. Using the stated standard of 2.5 acres per 1,000 persons, San Bernardino County would need approximately 4,290 acres of parkland. The total parkland (including approximately 2,400 acres at Silverwood Lake SRA) is 9,647 acres. (San Bernardino County 2007a).

The San Bernardino County General Plan's (San Bernardino County 2007a) vision for the future, which may be used by DWR to evaluate potential Project recreation development, includes:

- Extension, enhancement, and increased connectivity of trail systems throughout the County (see Goals CI-6 and OS-2).
- Local parks and recreational amenities throughout the County (see Goal OS-1).
- Expansion of cultural and entertainment opportunities countywide (see Goals OS-4, CO-3).
- Recovery and maintenance of multi-use access to public lands, including regional parks, national parks, national forests, State parks, and BLM areas (see Goal OS-4).

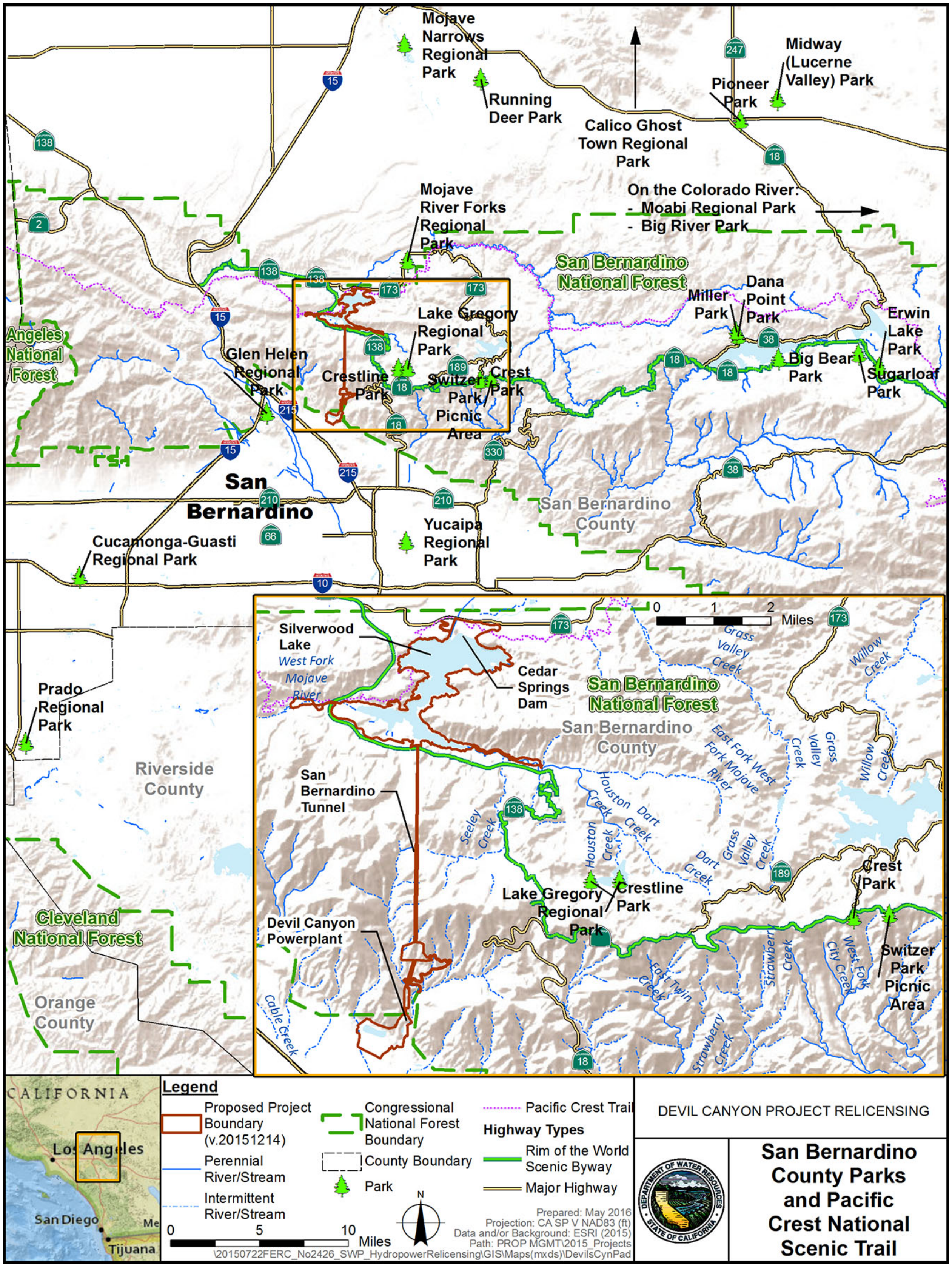

Figure 4.9-2. San Bernardino County Parks and Pacific Crest National Scenic Trail

The Andy Jackson Airpark is located about one mile southeast of the Devil Canyon Powerplant (see Figure 4.9-3).

In addition hang-gliders use the Crestline launch and Marshall Peak launch sites which are located about 2 miles north-northeast of the Andy Jackson Airpark (Figure 4.9-3).

4.9.2.4 Pacific Crest National Scenic Trail

The USFS manages the PCT, the only nationally designated trail in the Project area, in partnership with the National Park Service, BLM, DPR, and the Pacific Crest Trail Association. The PCT is a designated National Scenic Trail approximately 2,650 miles long running from Canada to Mexico. One hundred fifteen miles of the PCT runs through San Bernardino County. A portion of the PCT passes through the Silverwood Lake SRA. The trail (a non-Project facility) enters the Silverwood Lake SRA just north of Silverwood Lake's northern part; passes just north of Cedar Springs Dam; runs along State Route 178 (outside the Silverwood Lake SRA) in the vicinity of the dam's spillway and SWP water intake; follows the west shore of the lake's northern part; passes through the Cleghorn Day Use Area; and then exits the Silverwood Lake SRA near the West Fork Group Camps (Figure 4.9-22).

4.9.2.5 San Bernardino National Forest

Visitors to the SBNF choose specific settings for their activities to enjoy desired experiences. These settings vary by place and are further refined on NFS lands by the USFS recreation opportunity spectrum (ROS), a classification system that describes different settings across the national forests using five classes that range from highly modified and developed settings to primitive, undeveloped settings. These are:

- Primitive: Characterized by an essentially unmodified natural environment of fairly large size. Interaction between users is very low and evidence of other users is minimal. The area is managed to be essentially free of evidence of human-induced restrictions and controls. Motorized use within the area is not permitted. There are no developed facilities.

- Semi-primitive Non-motorized: Characterized by a predominantly natural or natural-appearing environment of moderate to large size. Interaction among users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but would be subtle. Motorized recreation is not permitted, but local roads used for other resource management activities may be present on a limited basis. Use of such roads is restricted to minimize impacts on recreation experience opportunities. A minimum of developed facilities, if any, are provided.

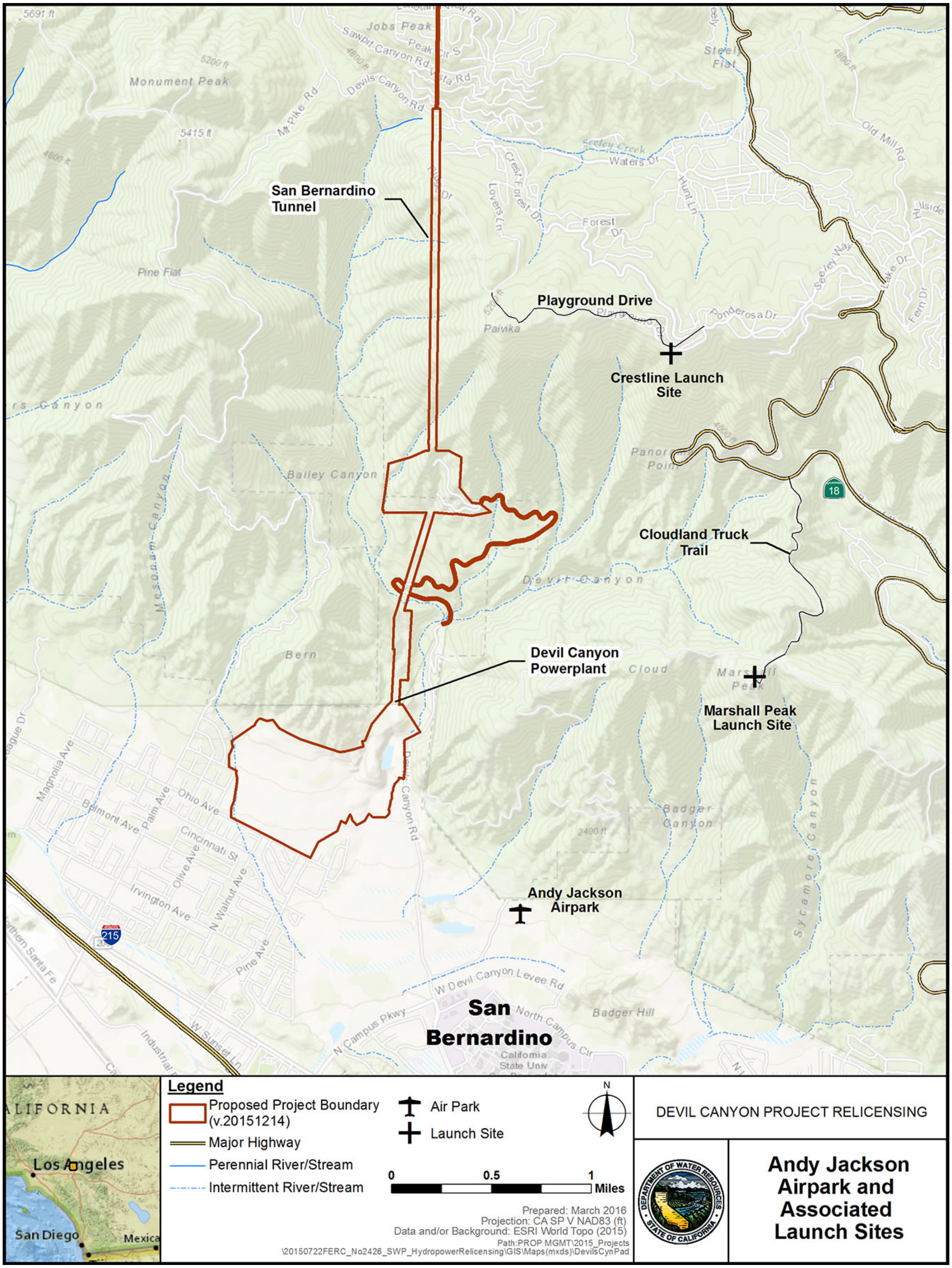

Figure 4.9-3. Andy Jackson Airpark and Associated Launch Sites

- Semi-primitive Motorized: Characterized by a predominantly natural or natural-appearing environment of moderate to large size. Concentration of users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present but would be subtle. Motorized use of local primitive or collector roads with predominantly natural surfaces and trails suitable for motorbikes is permitted. Developed facilities are present but are more rustic in nature.

- Roaded Natural: Characterized by predominantly natural-appearing environments with moderate evidence of the sights and sounds of people. Such evidence usually harmonizes with the natural environment. Interaction among users may be moderate to high, with evidence of other users prevalent. Resource modification and utilization practices are evident, but harmonize with the natural environment. Conventional motorized use is allowed and incorporated into construction standards and design of facilities, which are present and well defined.

- Rural: Characterized by a substantially developed environment and a background with natural-appearing elements. Moderate to high social encounters and interaction between users is typical. Renewable resource modification and utilization practices are used to enhance specific recreation activities. Sights and sounds of humans are predominant on the site and roads and motorized use is extensive. Facilities are more highly developed for user comfort with ample parking.

By describing existing recreation opportunities in each class, the ROS system helps match visitors to SBNF with their preferred recreation setting. The recreation opportunity spectrum can also be used to plan how areas should be managed for recreation on SBNF in the future (USFS 1986, in USFS 2005c). Changes in a national forest's mix of ROS classes affect the recreation opportunities offered.

As shown in Figure 4.9-4, the ROS settings for NFS lands within and around the proposed Project boundary, including Silverwood Lake and the Devil Canyon Powerplant are "semiprimitive non-motorized," "semi-primitive motorized," and "roaded natural."

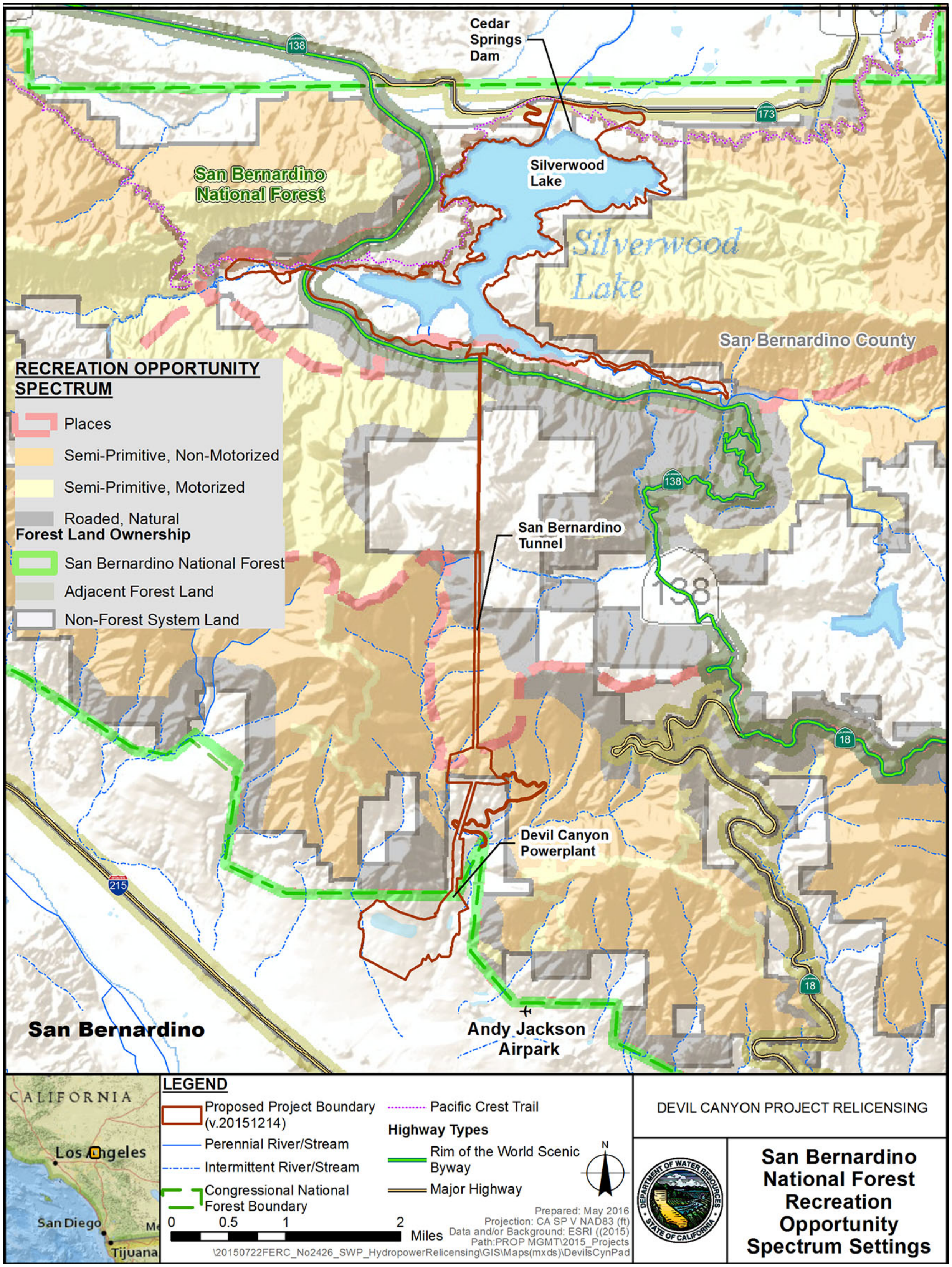

Figure 4.9-4. San Bernardino National Forest Recreation Opportunity Spectrum Settings in the Project Vicinity

4.9.3 Land Use and Management in the Project Region

4.9.3.1 San Bernardino County

The policies and programs of the San Bernardino County General Plan (San Bernardino County 2007) are intended to underlie most land use decisions. Preparing, adopting, implementing, and maintaining the general plan serves to:

- Identify the community's land use, transportation, environmental, economic, and social goals and policies as they relate to land use and development.
- Form the basis for local government decision-making, including decisions on proposed development.
- Provide residents with opportunities to participate in the planning and decision-making processes of their community.
- Inform residents, developers, decision makers, and other cities and counties of the rules that guide development within the community.

There are 18 land use zoning districts that apply only to privately owned lands in the County and not to the lands controlled by other jurisdictions, such as USFS or DWR. Privately owned lands in San Bernardino County are generally located to the north of Silverwood Lake and to the south of the Devil Canyon Powerplant. Privately owned lands adjacent to the proposed Project boundary are generally in the Resource Conservation, Rural Living, and Single Residential land use zoning districts (Figure 4.9-5).

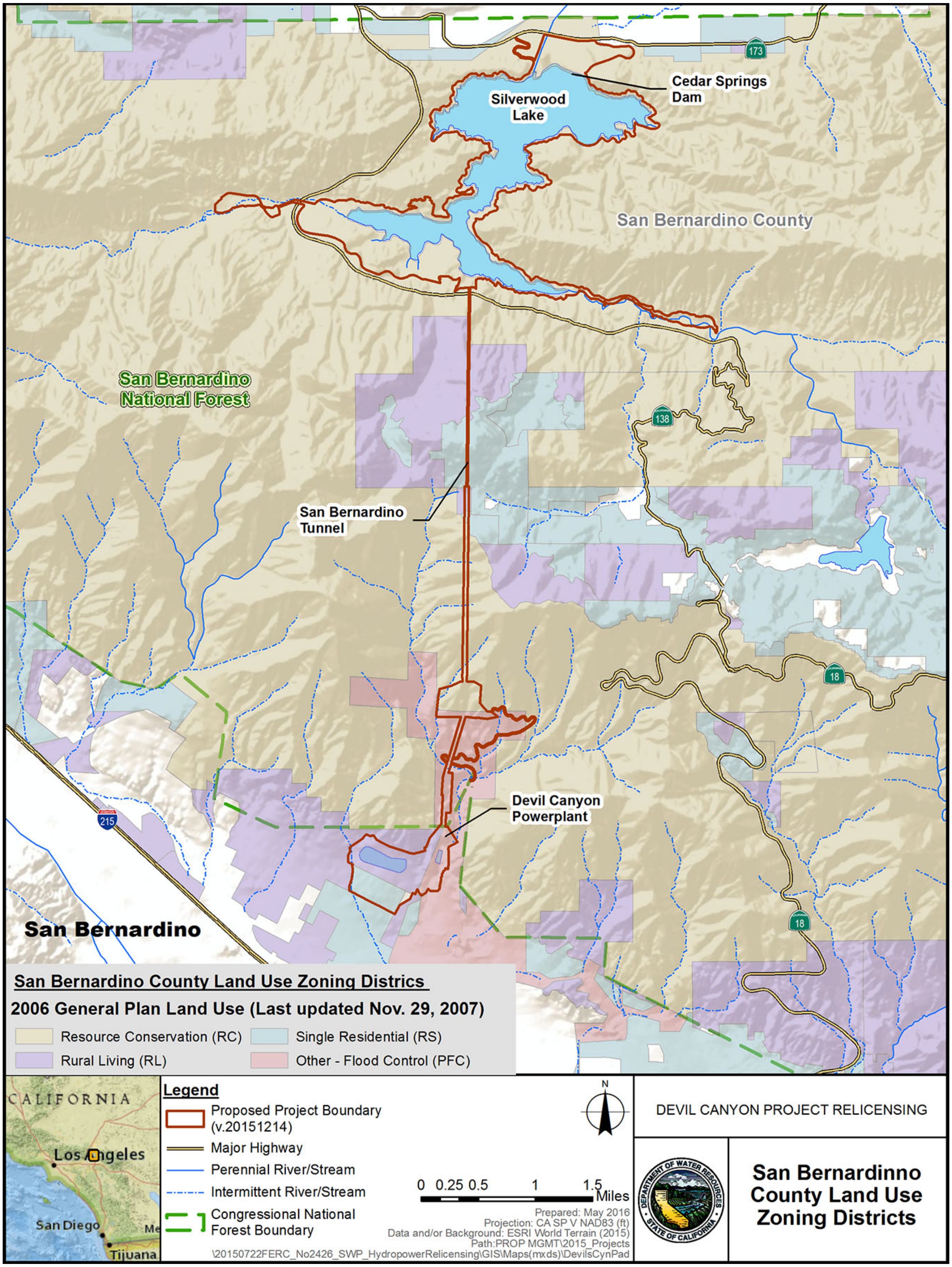

Figure 4.9-5. San Bernardino County Land Use Zoning Districts in the Project Vicinity

Resource Conservation

The purpose of the Resource Conservation Land Use Zoning District is:

- To encourage limited rural development that maximizes preservation of open space, watershed and wildlife habitat areas.
- To identify areas where rural residences may be established on lands with limited grazing potential but which have significant open space values.
- To prevent inappropriate urban population densities in remote and/or hazardous areas of the County.
- To establish areas where open space and non-agricultural activities are the primary use of the land, but where agriculture and compatible uses may co-exist.

Rural Living

The purpose of the Rural Living Land Use Zoning District is:

- To encourage appropriate rural development where single family residential use is primary.
- To identify areas where rural residences may be established and where associated related animal uses may be permitted.
- To prevent inappropriate demand for urban services.
- To establish areas where non-agricultural activities are the primary use of the land, but where agriculture and compatible uses may coexist.

Single Residential

The purpose of the Single Residential Land Use Zoning District is:

- To provide areas for single-family homes on individual lots.
- To provide areas for accessory and non-residential uses that complement single residential neighborhoods.
- To discourage incompatible non-residential uses in single-family residential neighborhoods.

4.9.3.2 San Bernardino National Forest

The revised land and resource management plans (forest plans) for the southern California national forests (i.e., Angeles, Cleveland, Los Padres, and San Bernardino national forests) describe the strategic direction at the broad program level for managing National Forest System lands and resources over the next 10 to 15 years.

The strategic direction was developed by an interdisciplinary planning team working with forest staff using extensive public involvement and the best science available. (USFS 2005b).

The forest plans were developed to implement Alternative 4a (selected). Alternative 4a represents the adjustment of the preferred alternatives identified in the draft environmental documents. The accompanying FEIS describes the analysis used in formulating the revised forest plans. (USFS 2005d).

<u>San Bernardino National Forest Land Use Zones</u>

As noted above, 132 acres (6 percent) of the area within the proposed Project boundary is on NFS lands. Most of the lands in the proposed Project boundary are State-owned and policies and programs associated with the SBNF apply only to NFS lands.

Across the whole of the SBNF, seven land use zones have been identified by the SBNF. These zones are applicable only to the NFS lands and in no way modify zoning applied to other ownerships by local government agencies. The zones, in order of decreasing land use intensity, are:

- Developed Area Interface
- Back Country
- Back Country Motorized Use Restricted
- Back Country Non-Motorized
- Critical Biological
- Recommended Wilderness
- Existing Wilderness

Only three of these seven zones are in or adjacent to Project Lands. These are: Developed Area Interface, Back Country, and Back Country Non-Motorized land use zones (see Figure 4.9-6).

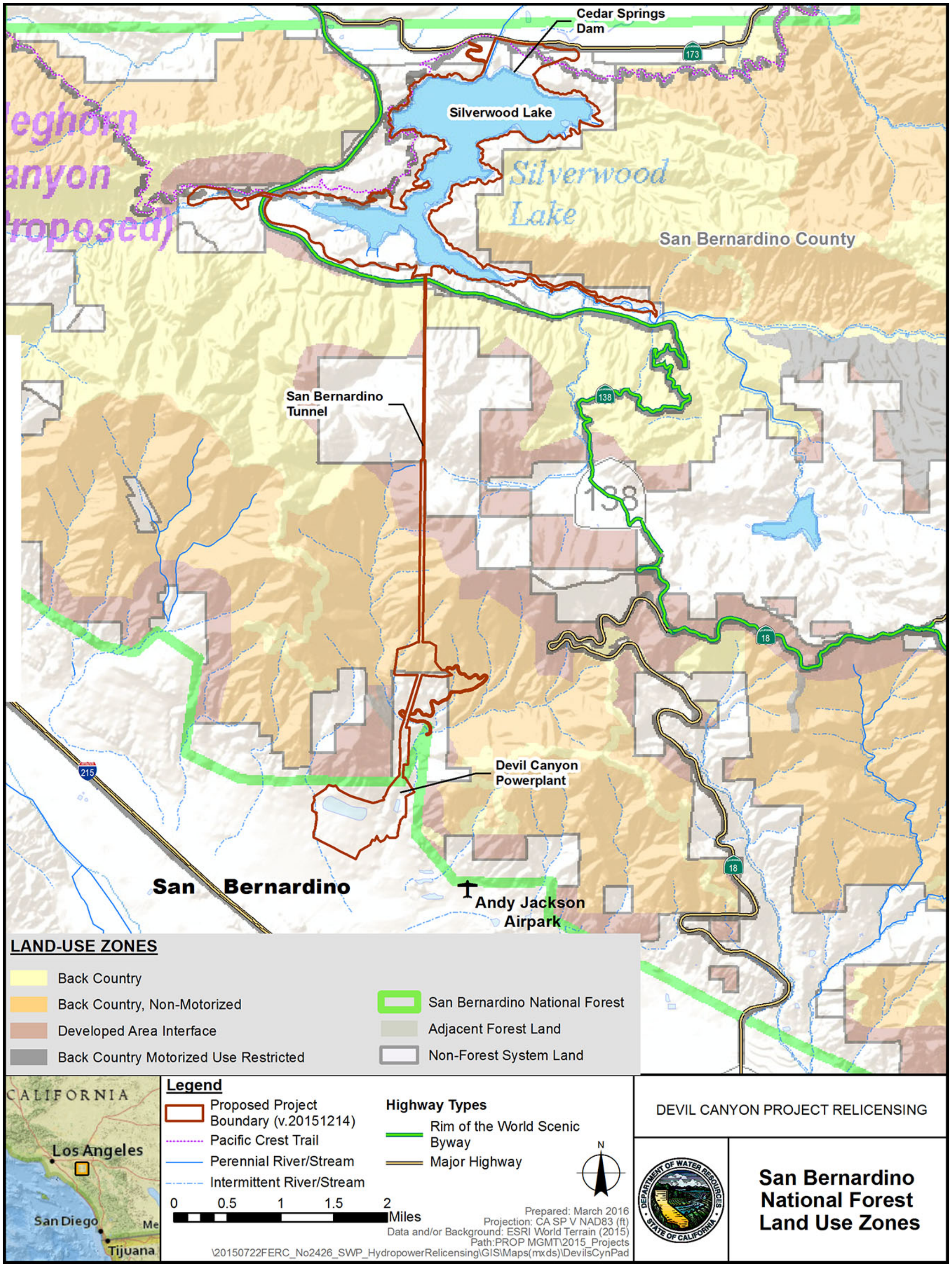

Figure 4.9-6. San Bernardino National Forest Land Use Zones in the Project Vicinity

The Developed Area Interface land use zone is generally found in areas adjacent to communities or concentrated use areas and developed sites with more scattered or isolated community infrastructure. The level of human use and infrastructure is typically higher than in other zones. Within and near the Project, the Developed Area Interface land use zone occupies the following areas:

- Small land areas adjacent to the proposed Project boundary on the western lobe of Silverwood Lake.
- Small portion of land above the San Bernardino Tunnel.

The Back Country Non-Motorized land use zone generally includes areas that are undeveloped with few, if any roads. The level of human use and infrastructure is low. The zone is managed for a range of non-motorized uses that include mechanized, equestrian and pedestrian public access. Administrative access (usually for community protection) is allowed by exception for emergency situations and for short duration management purposes (such as fuel treatment). The Back Country Non-Motorized land use zone occupies the following areas:

- The lower half of the San Bernardino Tunnel, Surge Chamber, and access road to its east.
- Small area adjoining Project lands in the Miller Canyon area.

The Back Country land use zone includes areas that are generally undeveloped with few roads. The level of human use and infrastructure is generally low to moderate. The zone is managed for motorized public access on designated roads and trails. Some roads within this zone may be closed to public access. Although, this zone generally allows a broad range of uses, the management intent is to retain the natural character inherent in this zone and limit the level and type of development. The Back Country land use zone occupies some lands outside the proposed Project boundary east of Silverwood Lake.

Wild and Scenic River, and Other Designations

No Wild and Scenic River, Wilderness, or other special land use designations occur in the vicinity of the Project. Deep Creek, located over 5 miles east of the Project, is Wild and Scenic River eligible; and the Cucamonga Wilderness and recommended wilderness areas are located over 15 miles west of the Project.

The recommended Cleghorn Canyon Research Natural Area is located approximately 4 miles west of the Project. The recommended natural area represents a mixture of natural communities and the most significant element is western sycamore-alder riparian forest.

As described above, the PCT (a non-Project facility) is located along the north and west shores of Silverwood Lake.

4.9.3.3 Floodplains

A search of the FEMA flood hazard mapping website (https://msc.fema.gov/portal) indicates that lands immediately adjacent to Silverwood Lake area are “special flood hazard areas subject to inundation by the 1 percent (100-year) annual chance flood” (Figure 4.9-7).

Similarly, areas upstream and downstream of the Devil Canyon Powerplant, Afterbays, penstocks, and associated facilities are “special flood hazard areas subject to inundation by the one percent annual chance flood” (Figure 4.9-8).

Zone “A” indicates areas subject to the 100-year annual flood chance, where no base flood elevations have been determined. Zone “X” indicates areas determined to be outside the 0.2 percent annual chance floodplain. Zone “D” indicates areas in which flood hazards are undetermined, but possible.

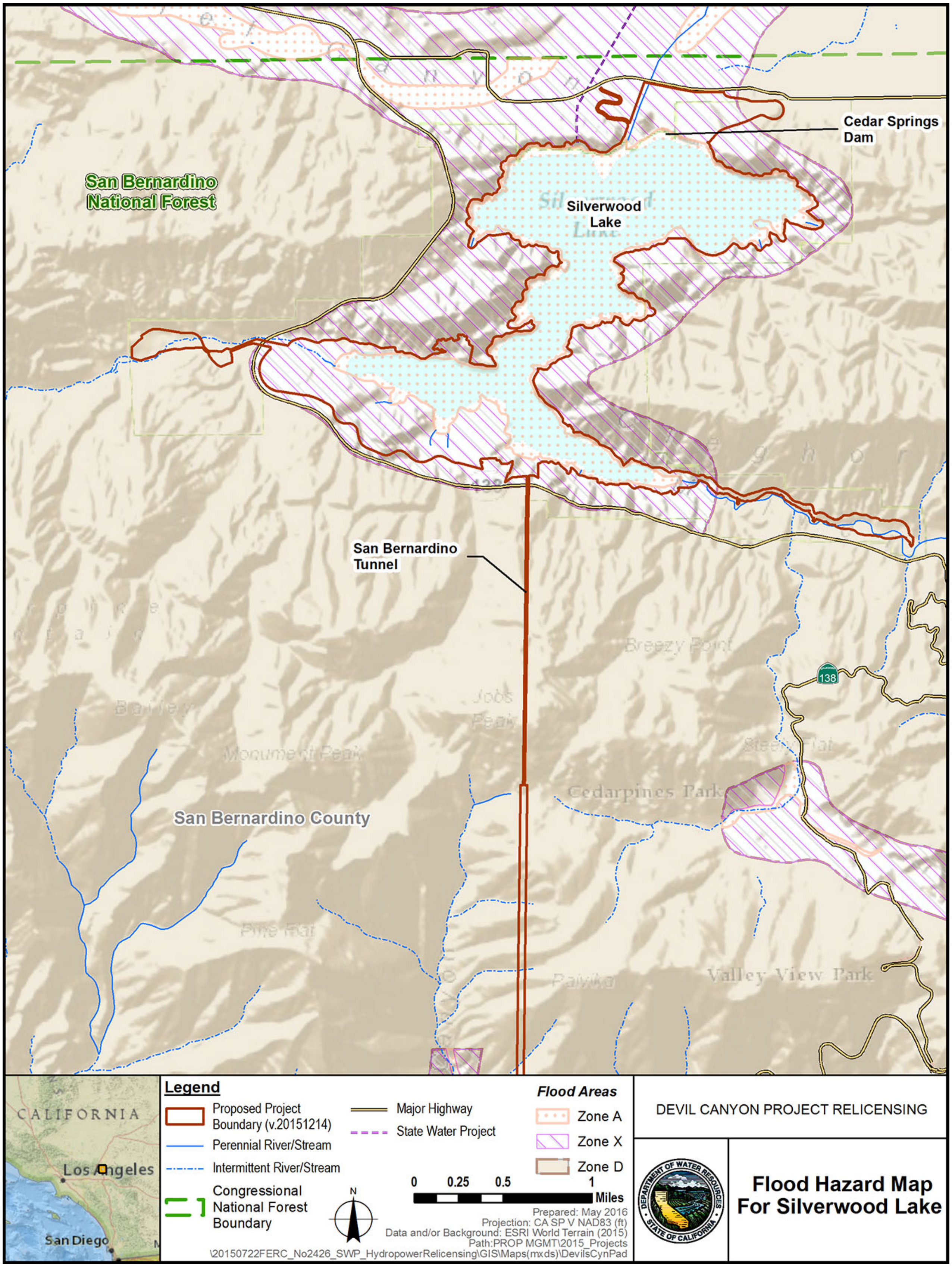

Figure 4.9-7. Flood Hazard Map for Silverwood Lake and Vicinity

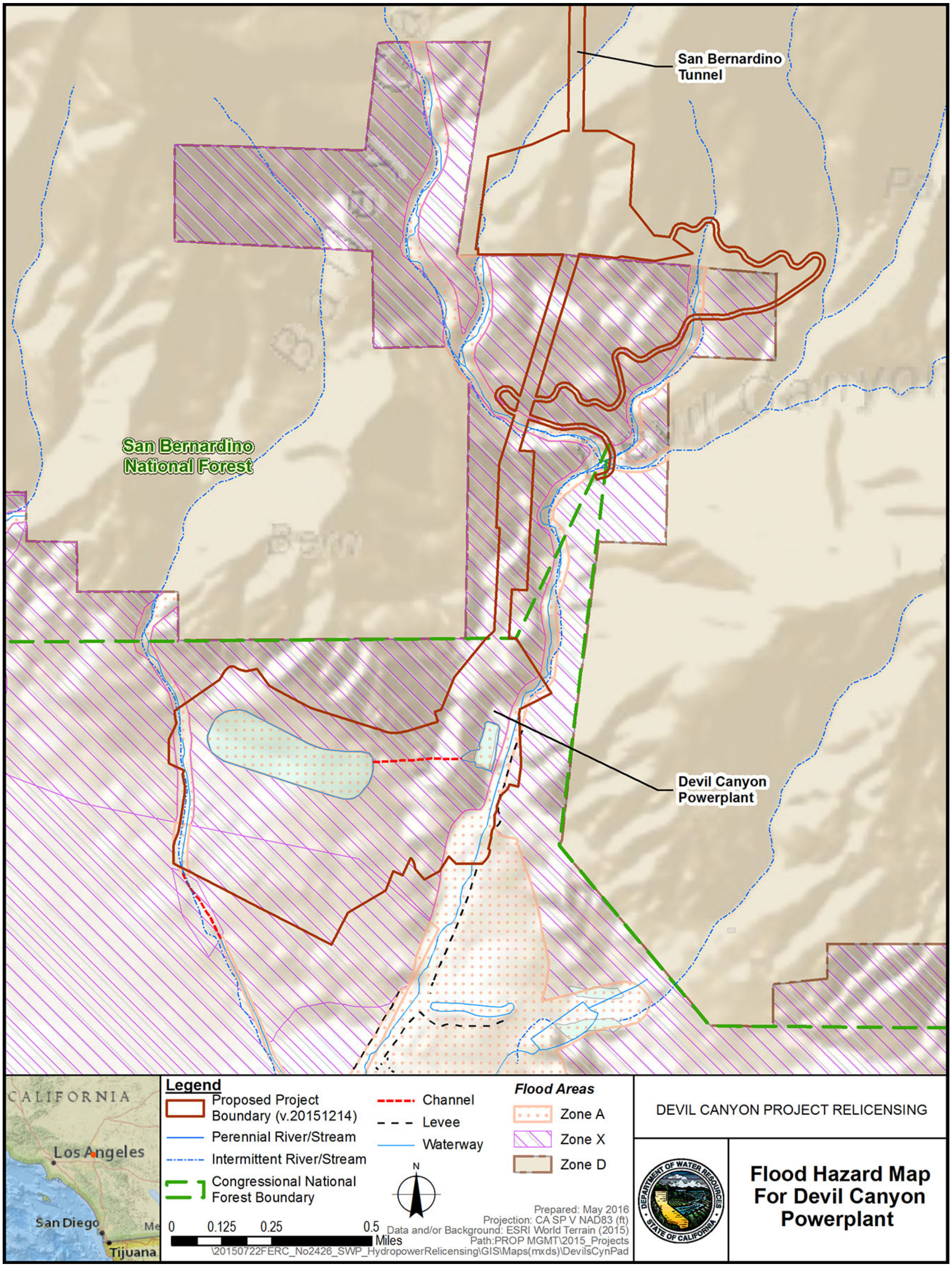

Figure 4.9-8. Flood Hazard Map for Devil Canyon Powerplant and Vicinity

4.9.4 Land Use and Management Within the Project Boundary

4.9.4.1 Land Ownership, Use and Management

As shown in Figure 4.9-9 and indicated in Table 4.9-3, the majority of land within the proposed Project boundary is owned through fee title by the State of California with DWR managing and operating the Project and DPR managing and operating the recreational facilities at Silverwood Lake SRA.

Table 4.9-3. Land Ownership Within the Proposed Project Boundary

Ownership	Acres	Percent of Total
State of California, DWR and DPR	1911	92.3
San Bernardino National Forest	132	6.4
City of San Bernardino	18	0.9
Private	9	0.4
Total	**2,070**	**100**

Source: DWR 2015g

The San Bernardino Tunnel right-of-way is located on lands managed by SBNF and lands owned by private parties. The tunnel is underground and contains no adits.

The Devil Canyon Powerplant penstocks, surge chamber, and other facility access roads are partially located on lands managed by the City of San Bernardino and SBNF. These roads are not open to the public.

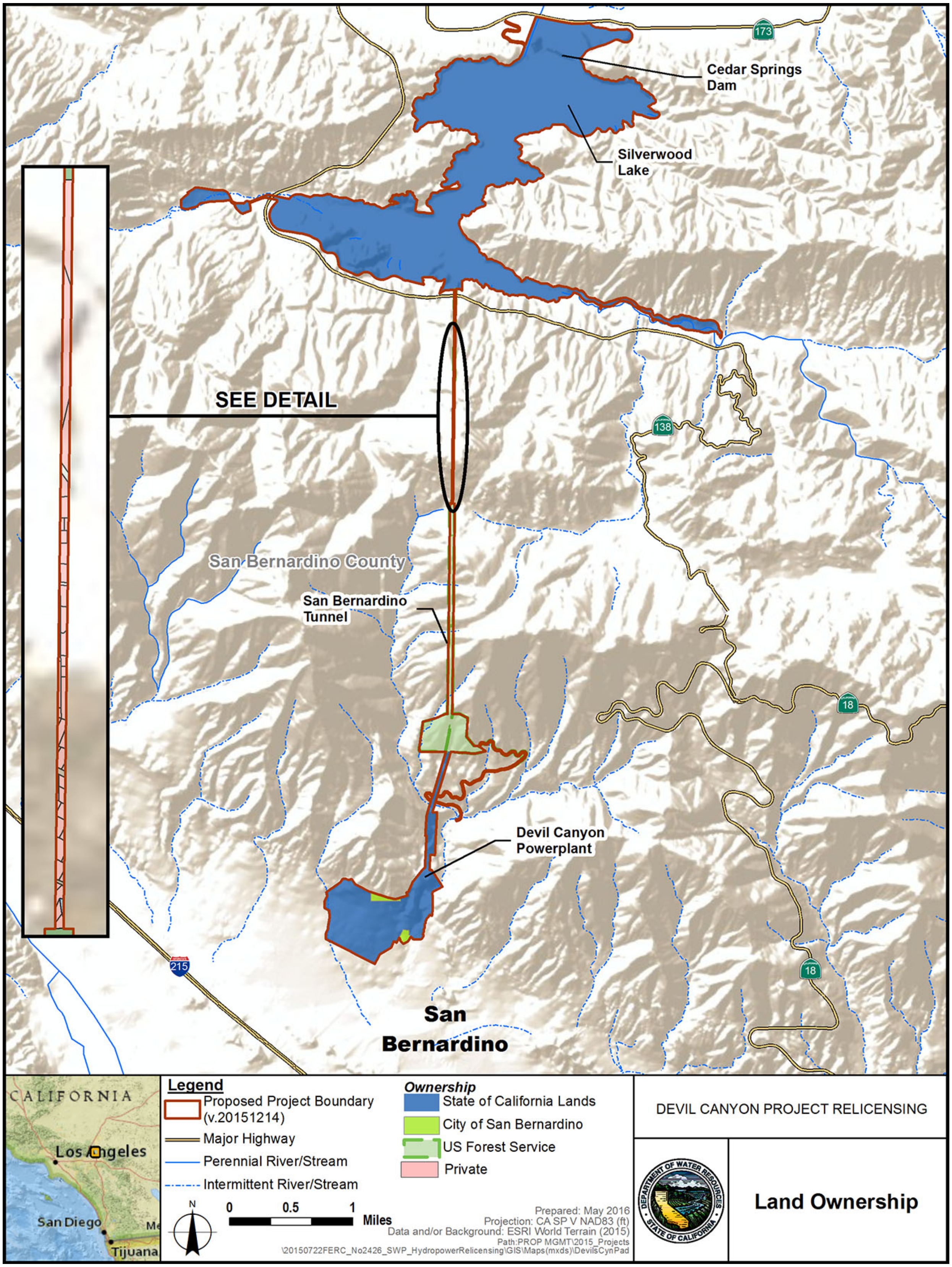

Figure 4.9-9. Land Ownership Within the Proposed Project Boundary Land Use Licenses, Easements and Permits

In 1968 (amended 1971), DWR and USFS entered into a memorandum of understanding (MOU) for construction, operation and maintenance of the SWP on the SBNF. This MOU facilitated development of Project facilities at Silverwood Lake and Devil Canyon.

In 1970, DWR executed an agreement for DWR owned property in and around Silverwood Lake to allow DPR to develop, operate, and maintain the Silverwood Lake SRA.

In 1971 (amended 1996), DWR issued a license to CLAWA for use of lands near the outlet of Silverwood Lake. These lands are used for non-Project water treatment facilities.

Other portions of Project land associated with the San Bernardino Tunnel and Devil Canyon Powerplant appurtenant facilities access roads occupy State lands using easement agreements from SBNF, the City of San Bernardino, and from private entities.

In 2004 (Stream Alteration Notification No. 2004-0154-R4), the CDFW and DWR entered into a permit delineating and defining routine maintenance activities within streams and lakes associated with SWP, DWR SFD. The permit identifies general and site-specific provisions and restrictions on DWR activities to prevent any substantial adverse impacts to fish and wildlife resources while permitting required maintenance activities to proceed. Activities as described in the permit are as follows:

- Removal of living and dead vegetation, sediment, and debris, from inside and upon structures, and immediately upon or adjacent to inflow/discharge aprons, basins, wing walls and dissipaters of existing bridges, culverts, diversions and flow control and measurement structures.
- Removal of living and dead vegetation, sediment, and debris from the channel bottom and the bottom one-half of the banks of miscellaneous streams that are an obstruction to flow.
- Removal of living and dead vegetation, emergent vegetation, sediment, and debris from seeps and ponds.
- Maintenance of existing structural and other flow and erosion control features to their original location and configuration.
- Maintenance of existing access routes to their original location and configuration.
- Maintenance activities authorized by Stream Alteration Notification No. 2004-0154-R4 shall be performed at a time and in a manner to minimize adverse impacts and provide for the protection of fish and wildlife resources, in part, as follows:
    - Routine maintenance work within the streams shall be completed when the area is dry, if possible.

- o Routine maintenance work shall be limited to periods when actively nesting birds are not present in the riparian area of the stream, when nearby actively nesting birds will not be adversely affected.
- o If routine maintenance work takes place during periods other than those described above, DWR shall consult with CDFW and all other appropriate agencies for approval.
- o Routine maintenance work within the streams may commence after all pertinent permits and authorizations from other agencies are secured.
- o This agreement is subject to renewal every 5 years.
- o Any oaks removed that are greater than 3 inches diameter at breast height shall be replaced in kind at specified replacement ratios.
- o Whenever possible, invasive species shall be removed and controlled in a legal manner that prevents seed dispersal.
- o Where control of non-native vegetation is required within the bed, bank, or channel of the stream, the use of herbicides is necessary, and where there is a possibility that the herbicides could come into contract with water, DWR shall employ only those herbicides, such as Rodeo®, which are approved for aquatic use.
- o Cleared or trimmed vegetation and woody debris shall be disposed of in a legal manner, and may be used as part of a bio-technical bank stabilization technique or used to enhance wildlife habitat.
- o Sand, silt, and sediment removal shall be generally limited to the stream bottom and no more than 200 linear feet upstream or downstream of the structure.
- o Cleared debris shall be removed from the stream zone and placed in an approved spoil site.
- o Clean natural boulders or “shot-rock” (not broken concrete) shall be used to replenish and maintain bank stability in previously rip-rapped areas.
- o Any temporary stream diversion shall be coordinated and approved by CDFW.
- o DWR’s ability to minimize turbidity, siltation, and erosion in a stream shall be subject to conditions of the Lahontan Regional Water Quality Control Board Basin Plan.

- o A DWR biologist shall review each routine maintenance work activity and shall issue a standard DWR environmental clearance (DWR Standard Form 77) for the subject activity.
- o This Agreement does not allow for the take, or incidental take, of any federal or State-listed special-status species.
- o In areas that potentially support special-status species, a qualified DWR biologist shall conduct pre-construction surveys and notify CDFW regarding the results of these surveys.
- o A qualified biologist shall be present during any routine maintenance work in areas where federal or State-listed special-status species are known to be present and are potentially at risk.
- o DWR assumes responsibility for the restoration of any fish and wildlife habitat that may be impaired or damaged either directly or incidental to the maintenance activity.
- o After routine maintenance work is completed, exposed areas shall be seeded, mulched, and fertilized with a blend of a minimum of three locally native grass species, with the mix submitted to CDFW prior to application.
- o Annual reports, summarizing the activities completed during the past year, shall be submitted by January 31 of each year.
- o DWR shall have primary responsibility for monitoring compliance with all protective measures included in the Agreement.

4.9.4.2 DWR Access Routes to Project Facilities

Public vehicular access to Project facilities at Silverwood Lake is provided by State Route 138 (Rim of the World Scenic Byway), State Route 173, Cleghorn Road, Sawpit Canyon Road and other roadways within the Silverwood Lake SRA, including Cedar Springs Dam Road (paved portion of USFS Road 2N33), and Pilot Rock Truck Trail (unpaved portion of USFS Road 2N33). Restricted (gated) vehicular access (official vehicles only) is provided to Cedar Springs Dam, the spillway, and water intake via State Route 173. Restricted vehicular access is also provided to the outlet area via State Route 138, to the north shore of the south side's East Fork of the West Fork Mojave River Arm (Miller Canyon Road), and to the west side of the Silverwood Lake SRA via an unnamed and unpaved road that links State Route 173 and Cleghorn Road (a portion of which overlaps with the PCT).

Public vehicular access to the Devil Canyon Powerplant is provided via Devil Canyon Road; however no public access is allowed to the Devil Canyon Powerplant, Afterbay, Second Afterbay, penstocks, or associated facilities. Devils Canyon Road is gated, and public access to the north prohibited, approximately one-half mile north of the powerplant entrance.

4.9.4.3 Wildfires and Fire Suppression and Prevention Policies

Fire suppression responsibility within the proposed Project boundary is the responsibility of three agencies. Fire suppression in the Silverwood Lake SRA is managed by the California Department of Forestry and Fire Protection (CAL FIRE), suppression on NFS lands is the responsibility of the USFS, and the Devil Canyon Powerplant and associated facilities are within the jurisdiction of the City of San Bernardino's Fire Department. (State of California 2012).

Vegetation in the Silverwood Lake SRA vicinity ranges from sparse creosote, chamise and California buckwheat at lower elevations to oak and pinyon woodland and scattered mixed conifer, including important bigcone Douglas-fir stands. There is a risk of catastrophic fire, because of forest densification and drought and insect damaged forest. Frequent wildland fires (typically caused by human activities) may result in type conversion from pinyon/juniper, Coulter pine and chaparral to grassland. Flooding and erosion that occurs when the vegetative cover has burned off usually follow wildland fires. Treating the watershed above Silverwood Lake was a high priority for USFS after the 2003 Old Fire (additional information provided below). (USFS 2005a).

Vegetation in the Devil Canyon Powerplant vicinity includes coastal sage scrub, mixed chaparral, and stands of bigcone Douglas-fir and canyon live oak and Coulter pine at the lower elevations. Jeffrey, ponderosa, sugar and knobcone pine, white fir and black and canyon live oak are present at the higher elevations. Frequent fires have converted coastal sage scrub and chaparral to non-native grasslands along the lower slopes. Noxious weeds are present.

Fire prevention, fuels reduction and fire suppression are the major components of the USFS Fire and Aviation program. When a wildland fire is reported, fire personnel are dispatched to the fire and also to other fire stations to provide assistance. Related actions including evacuations are then coordinated within the USFS and through adjoining Fire Department jurisdictions with various law enforcement agencies to keep people safely away from wildland fire. Fires are suppressed on the ground with engines, hand crews, and machinery and from the air with helicopters and air tankers. Physical barriers, such as hand and dozer lines and fire retardant drops are used to slow fire progress so that fires can be more effectively contained. Once a fire is contained, NFS lands damaged by fire suppression activities are evaluated and then rehabilitated. Effects of the fire and the potential for post-fire effects to life, property and natural resources are also evaluated and mitigated as needed by a team of resource specialists as part of the Burned Area Emergency Response. (USFS 2005a).

All wildland fires on NFS lands within SBNF are considered to be a potential threat to communities. The USFS Fire Management Program emphasizes preparation for aggressive fire suppression and implementing prevention strategies to achieve objectives including protecting life and property from wildland fire and subsequent floods. (USFS 2005a).

As described in a DWR letter to FERC dated January 8, 2004, the Grand Prix/Old/Padua fires burned over 170,000 acres in Los Angeles and San Bernardino counties in late October and early November 2003, including most of the land between Devil Canyon Powerplant and the Mojave Siphon Powerplant (a non-Project facility located just north of Silverwood Lake). The fire came within feet of both powerplants, but neither powerplant sustained structural damage. Various ancillary structures, including telephone poles and guard rail posts/blocks, were destroyed.

The fire burned approximately 75 percent of Silverwood Lake SRA, closing it for nearly eight months. Numerous picnic tables and other amenities, twelve campsites, several comfort stations, guardrail posts/blocks, safety railings, foot bridges, and signage were destroyed. Prior to re-opening in June 2004, Silverwood Lake SRA employees, contractors, and volunteers rebuilt recreational amenities, removed up to 6 feet of silt from roadways, chopped down hundreds of trees, and cleared debris from the lake. Silt was dredged from the West Fork Mojave River, and a stretch of Sawpit Creek was re-channeled. (Los Angeles Times 2004).

The fire also severely damaged the FERC-mandated revegetation project (implemented between 1991 and 2002) at the Devil Canyon Second Afterbay. Approximately 75 percent of the trees south of the cross canal between the Second Afterbay and the Powerplant were destroyed. Following the fire, DWR engaged in significant revegetation of the burned areas using native woody and herbaceous plant species (DWR, Ms. Bonnie Duecker, personal communication July 22, 2015).

As a result of the extreme danger caused by prolonged drought, DPR currently implements fire restrictions at Silverwood Lake SRA during peak fire season. Fire restrictions (DPR 2015a) include:

- Backcountry areas are closed to the public.
- Open fires, including campfires and barbecues, are prohibited. Portable propane or gas stoves are still permitted for cooking within designated campsites and day use areas.
- Fireworks are prohibited.
- Smoking is only permitted within designated areas of developed facilities or vehicles.

These Silverwood Lake SRA fire restrictions are in conjunction with similar restrictions put in place by USFS within the SBNF.

No unsupervised public access is permitted to the Devil Canyon Powerplant, Afterbay, Second Afterbay, or penstocks area. Therefore, no public use fire restrictions are required.

4.9.4.4 Public Safety in Project Area

As described in the South SWP Hydropower Project Public Safety Plan (DWR2014g), DWR has implemented many practices to ensure the safety of its employees and the public.

The DWR Water Safety web page (http://www.water.ca.gov/recreation/safety/) includes safety brochures and videos. The videos “Water Safe for Life” and “Come Back Alive!” are to educate and inform the public on SWP recreational facilities, and the brochures “SWP Water Safety” and “Water Safety Materials” provide information to help keep the public informed and safe.

DWR uses many warning devices, such as signs, buoy lines, and alarms to warn the public of any dangers or hazards. Many signs tell the public that the said area is dangerous and that their access is prohibited; some will tell the public that they can enter but only on foot, with no bicycles or vehicles; and some inform the public of extreme dangers such as high voltage power lines.

DWR uses many miles of restraining devices such as fences, gates, and boat barriers to keep the public out of unsafe areas. Almost all the facilities are surrounded by 6-foot-high chain link fence with three-strand barbed wire tops. Manually operated gates are locked with chains and special locks made solely for DWR staff. Electric gates require a specific key, or authorized security badge to get through, and each power plant has a security camera watching the front gate with an operator and security guard monitoring it 24 hours a day 7 days a week (24/7).

Procedures for safer project operations are continually evolving and expanding. DWR always puts safety first, and makes safety the premier aspect of all its operations. DWR currently has many safety standards set forth in dam specific FERC EAP, internal regulations and daily project operations. Daily patrols are conducted and all safety procedures and implementations are checked. If anything is damaged or needs replacement, a Trouble Report (TR) is generated immediately and action is taken to isolate the danger and to make the needed repair/replacement. All DWR buildings are locked at all times and all exterior doors to these facilities will alarm the plant operator and Area Control Center (ACC) if opened.

<u>Cedar Springs Dam</u>

Cedar Springs Dam is not currently accessible to public vehicular access. Dam safety concerns related to the public use of the reservoir are communicated through the use of signs, videos, and brochures; DWR educates the public on present dangers and how to avoid them.

Many signs indicate hazards. There are also signs that identify public access.

Buoy lines prevent boaters from getting too close to the dam’s emergency spillway. Public access is also prevented by gates and fences.

Cedar Springs Dam is inspected daily. A security camera at the dam is operated and monitored by the Security Control Room. All of the buildings on Cedar Springs Dam (except for the restrooms) are locked at all times and every exterior door will alarm to ACC if it is opened.

Silverwood Lake and San Bernardino Tunnel Intake Tower

The San Bernardino Tunnel Intake Tower is not a publically accessible facility. The intake tower and Silverwood Lake are included in the informational videos available at VDL and on the DWR website. The public is kept informed about the dangers at Silverwood Lake and the intake tower by the signage posted. Signs at the Sawpit Boat Launch on the south side of the lake inform boaters of hazards and boating rules. A map is posted, informational kiosks present, and trained staff available to inform the public.

Many signs and buoy lines warn the public of areas that are unsafe. Signs tell the public what is ahead, such as “AUTHORIZED VEHICLES ONLY” and others explain hazards. There are also signs with instructions, such as “NO BOATS WITHIN 500 FEET.” Buoy lines keep the public from getting too close to the San Bernardino Tunnel Intake Tower and from unseen hazards. The entire area around the intake tower is enclosed by a 6-foot-high chain link fence with a three-strand barbed wire top.

A security camera is operated and monitored by the Security Control Room. The grounds surrounding the intake tower facilities are monitored. Exterior lighting facilitates 24/7 monitoring. Gates and doors to the facilities are closed and locked. Intake tower doors are also set to alarm the ACC if they are opened. The San Bernardino Tunnel Intake Tower and Silverwood Lake are inspected daily.

Devil Canyon Powerplant

The Devil Canyon Powerplant is surrounded by a 6-foot-high chain link fence with a three-strand barbed wire top. Entrance gates are closed and locked at all times and can only be opened by specific keys or authorized ID badges. Signs advise the public that the area is closed to public access.

4.9.4.5 Law Enforcement

As described above, Silverwood Lake and the Silverwood Lake SRA are regulated by the DPR. State Park Peace Officer Rangers and Lifeguards provide not only public safety law enforcement and aquatic rescue services; they also provide public education through interpretation. State Park Communications Operators are a vital link in public safety and operate multi-frequency/channel radio systems giving support to California State Park Peace Officers, and providing dispatch services for the CDFW Wardens along with other enforcement and emergency services agencies (State of California 2015).

As described in the preceding Section, the Devil Canyon Powerplant, Afterbays, penstocks, and related facilities are not open to the public. Law enforcement at these facilities is the responsibility of the onsite security guards and California Highway Patrol.

4.9.4.6 Restrictions to Project Waters and Lands

Silverwood Lake SRA boating and fishing rules are described above. Additional restrictions to Project waters and lands at Silverwood Lake, also described above, address dispersed recreation, fire, and public safety.

Mandatory boat inspections for invasive Dreissenid mussels occur prior to launching in Silverwood Lake.

The Devil Canyon Powerplant, Afterbays, penstocks, and related facilities are not open to the public.

4.9.4.7 DWR Shoreline Management and Buffer Zone Policies

The Silverwood Lake shoreline is managed by DPR in accordance with the lake's designation as a SRA (i.e., the Silverwood Lake SRA) and with DWR public safety and operational restrictions at Cedar Springs Dam and at the San Bernardino Tunnel Intake area. Consistent management at Silverwood Lake has been effective in controlling shoreline uses, thus no specific shoreline buffer zone policy has been developed.

The Devil Canyon Powerplant, Afterbays, penstocks, and related facilities are not open to the public. Shoreline management of the Devil Canyon Afterbay and Devil Canyon Second Afterbay is the responsibility of DWR.

Figure 4.9-10. Cleghorn Swim Beach (2015)

Figure 4.9-11. Cleghorn Non-Motorized Boat Launch (2015)

Figure 4.9-12. Cleghorn Floating Restroom (2015)

Figure 4.9-13. New Mesa Campground (2015)

Figure 4.9-14. New Mesa Campground Comfort Station (2015)

Figure 4.9-15. Mesa Campground (2015)

Figure 4.9-16. Campfire Center (2015)

(Undergoing ADA renovation)

Figure 4.9-17. Nature Center (2015)

Figure 4.9-18. Sawpit Canyon Boat Launch (2015)

Figure 4.9-19. Sawpit Canyon Marina (2015)

Figure 4.9-20. Sawpit Canyon Parking Area (2015)

Figure 4.9-21. Rio Group Camp (2015)

Figure 4.9-22. Pacific Crest Trail at Rio Group Camp (2015)

4.10 AESTHETIC RESOURCES

This Section provides information regarding existing aesthetic resources, and known or potential Project impacts on aesthetic resources. Besides this general introductory information, this Section includes three main sub-sections: Section 4.10.1 characterizes aesthetic resources in the Project vicinity; Section 4.10.2 describes management plans that are pertinent to aesthetic resources potentially affected by the Project; and Section 4.10.3 describes the aesthetic character of each above-ground Project facility.

4.10.1 Aesthetic Character of Project Vicinity

Rising to the south of the desert communities of Victorville and Hesperia, chaparral-covered mountains gradually climb in elevation to form rounded summits with patches of montane conifer and narrow canyons with riparian habitat (USFS 2005d). Silverwood Lake is located in this area, where year-round recreational opportunities are enhanced by the diverse scenery.

The primary access to Silverwood Lake is via California State Route 138 (Rim of the World Scenic Byway) and California State Route 173. Both of these roads are designated San Bernardino County scenic highways (see additional discussion below) and designated by the California Department of Transportation (Caltrans) as State scenic highways (Caltrans 2013).

The PCT is one of 11 designated National Scenic Trails in the United States. The purpose of these trails is “to provide for maximum outdoor recreation potential and for the conservation and enjoyment of the nationally significant scenic, historic, natural, or cultural qualities” (American Trails 2015). Although the PCT is not a Project facility, it traverses through the proposed Project boundary and along the north and west shores of Silverwood Lake.

As described in the Silverwood Lake SRA General Development Plan (DPR 1972), the Silverwood Lake SRA is operated and maintained in accordance with policies, rules, regulations and orders of the California State Park and Recreation Commission and DPR. No policies, rules, regulations, or orders specific to Silverwood Lake SRA visual resources have been identified.

South of Silverwood Lake, the rugged forested landscape consists of prominent ridgelines and steep canyons interspersed with small, isolated communities. Vast undeveloped areas and undisturbed scenic vistas provide a significant scenic resource.

Located at the northern edge of the City of San Bernardino (Figure 1.2-1), the Devil Canyon Powerplant and associated facilities are located in a landscape that provides a scenic backdrop to the urban areas located immediately south. Steep, brush-covered mountains climb quickly in elevation. Coastal sage scrub, mixed chaparral, bigcone Douglas fir, canyon live oak, and Coulter pine are common at lower elevations. Pine trees, including Jeffrey, ponderosa, sugar, and knobcone, are common at higher elevations.

No designated wild and scenic rivers are located in the Project vicinity.

4.10.2 Pertinent Management Plans

4.10.2.1 San Bernardino County General Plan

The Project is located entirely within San Bernardino County, where the policies and programs of the San Bernardino County General Plan generally apply to privately owned lands. These policies and programs do not apply to Project lands or to other lands controlled by non-local government jurisdictions including the State and USFS.

The San Bernardino County General Plan states that a feature can be considered scenic if it provides a vista of undisturbed natural areas, includes a unique or unusual feature that comprises an important or dominant portion of the viewshed, or offers a distant vista that provides relief from less attractive views of nearby features (such as views of mountain backdrops from urban areas) (Open Space Element, Policy OS 5.1).

Primary scenic concerns of County residents include the preservation of scenic views and limits for development on ridge tops. Other localized concerns have been expressed by residents for mountain foothills (Conservation Element, Policy CO 11.2).

In addition, San Bernardino County is regulated by Ordinance No. 3900, which regulates glare, outdoor lighting, and night sky protection.

Many of the vistas that have been deemed by the County as "scenic" are located along roadways. To ensure the quality and character of these locations are not compromised through obtrusive development, improvements of any kind are subject to additional land use and aesthetic controls outlined under the County's Scenic Highway Overlay. These controls include, but are not limited to, the following:

- Review of proposed development along scenic highways to ensure preservation of scenic values for the traveling public and those seeking a recreational driving experience;
- Expanding the established right-of-way of a designated Scenic Corridor to extend 200 feet to either side, measured from the outside edge of the right-of-way;
- Required development along these corridors to demonstrate through visual analysis that proposed improvements are compatible with the scenic qualities present;
- More restrictive sign ordinance standards regarding visual quality and size;
- Requiring new development to provide ample recreation and scenic opportunities along Scenic Corridors;
- Restricting development along prominent ridgelines and hilltops;

- Reviewing site plans, specifically architectural design, landscaping and grading, to prevent obstruction of scenic views and to blend with the surrounding landscape; and
- Prohibiting off-site advertising signs (i.e., billboards) within and adjacent to all scenic corridors.

The County desires to retain the scenic character of visually important roadways. A “scenic route” is a roadway that has scenic vistas and other scenic and aesthetic qualities that over time have been found to add beauty to the County. The County designates scenic highways and applies all applicable policies to development on these routes (Open Space Element, Policy OS 5.3). Designated San Bernardino County scenic highways in the Project area and vicinity are as follows:

- Sawpit Canyon Road/Sawpit Creek Road
- California State Highway 138 from Crestline cutoff at State Highway 18 northwest to the Los Angeles County line
- California State Highway 173 from State Highway 18 northwest to Hesperia

4.10.2.2 San Bernardino National Forest Land Management Plan

The Project is within the overall boundaries of the SBNF, although NFS lands occupy little (5 percent of total) of the proposed Project boundary. Policies and programs associated with the SBNF apply only to NFS lands.

To ensure that scenic integrity of NFS land is maintained, the USFS has established five scenic integrity objectives, derived from the landscape's attractiveness and the public's expectations or concerns. Generally, landscapes that are most attractive and viewed from popular travel routes are assigned higher scenic integrity objectives. Each scenic integrity objective depicts a level of scenic integrity used to direct landscape management on NFS lands: very high (unaltered), high (appears unaltered), moderate (slightly altered), low (moderately altered), and very low (heavily altered).

As shown in Figure 4.10-1, the Scenic Integrity Objective for NFS lands within and around the Project boundary is “High.” Deviations from the natural landscape may be present, but must repeat the form, line, color, texture and pattern common to the landscape character so completely and at such a scale that they are not evident (USFS 2005c).

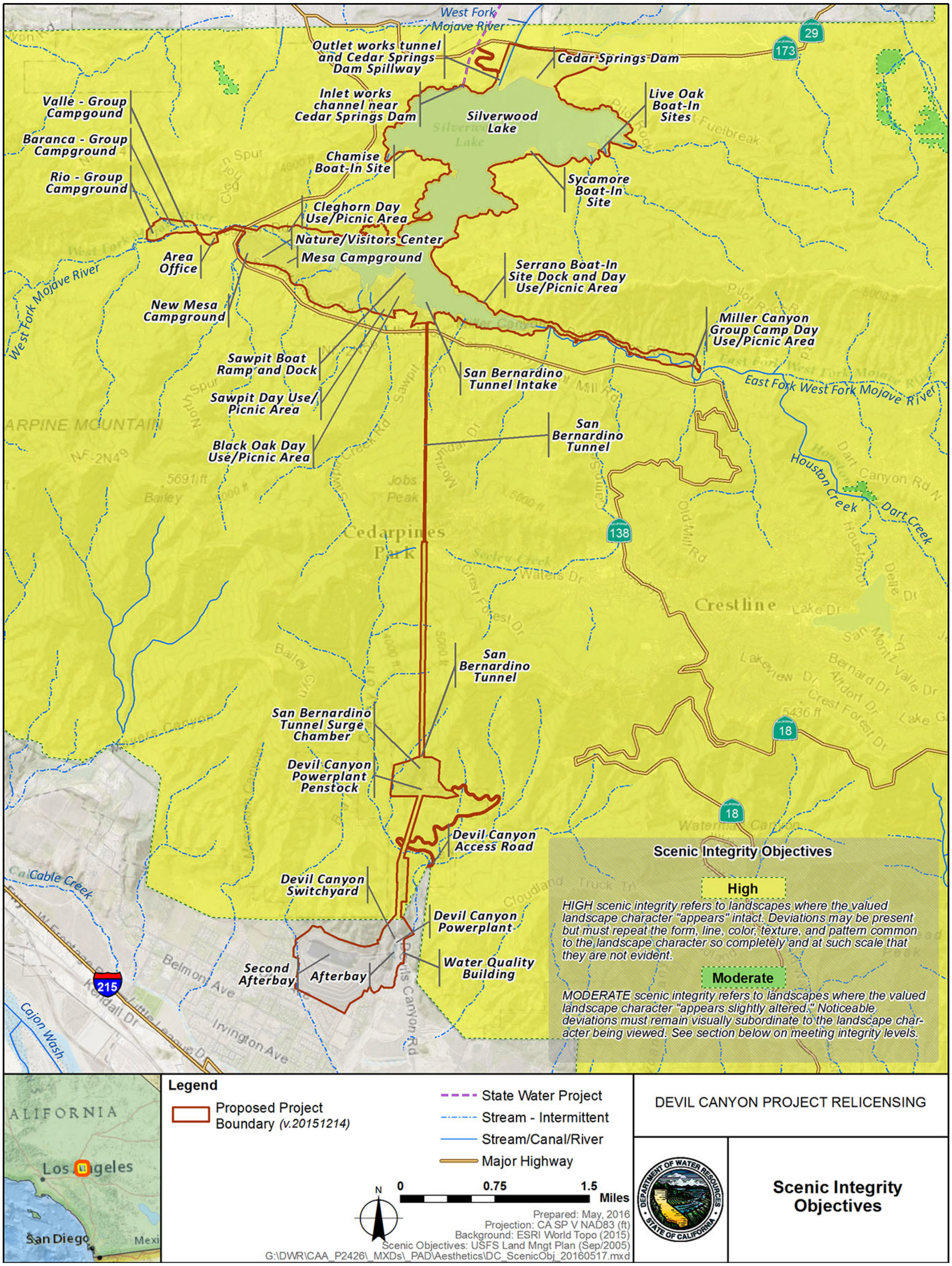

Figure 4.10-1. Scenic Integrity Objectives for NFS Lands within and Around the Project Boundary

4.10.2.3 State Water Project Architectural Motif

As described in Water Resources Engineering Memorandum No. 30a, dated March 15, 1984, DWR has established an architectural motif which, consistent with economy and operational efficiency, will be applied to all SWP facilities with the objective of creating an identifiable, aesthetically pleasing, and unifying appearance throughout the SWP. As described in the memorandum, the architectural motif is as follows:

1. The design shall be functional and shall meet applicable code requirements.
2. The design shall incorporate the use of basic building materials in a contemporary architectural expression which will accentuate basic structural configurations. The basic structural configurations must be simple, clear, and well proportioned.
3. The design shall take into consideration water and energy conservation measures.
4. For buildings and structures, neutral colors shall be used. Accent colors shall be predominantly blue and gold. Red may also be considered if the overall color effect is more compatible with red as an accent color. These colors are further defined as the following or equivalent:

Color	Fuller's Paint Co. Color Name & Number	Reflection Factor (percent)
Neutral	Cottonwood H59H	54
Blue	Belair Blue D126D	15
Gold	Ultra Gold A125A	29
Red	Flaming Bush C126C	17

Source: DWR 1984

5. Lighting shall be consistent with energy conservation, safety, and security. The lighting fixtures must be aesthetically pleasing.
6. Signs, emblems, plaques, and mountings shall conform to the Department's Sign Manual.
7. The natural environment shall be preserved whenever possible. Cut and fill slopes shall be planted or otherwise protected for erosion control, and to the extent practical shall be constructed to blend into the natural environment.
8. Landscaping is appropriate for:
   - enhancing the attractiveness of facilities,
   - controlling dust, mud, wind and unauthorized access,

- o reducing noise and glare,
- o screening of unsightly areas,
- o providing shade for buildings and equipment, and
- o establishing vehicular and pedestrian traffic patterns.

Irrigation systems and plantings shall be consistent with water conservation.

As a participant in the planning and design of new facilities, or the modification of existing facilities, the DWR Architectural Section shall be responsible for application of this motif consistent with site conditions. The Architectural Section will review contract drawings and specifications for conformity with the motif.

The DWR Division of Operations and Maintenance shall be responsible for application of this motif to existing facilities. Existing facilities requiring repainting shall be brought into compliance with this motif.

Upon the request of the Division of Operations and Maintenance, the Architectural Section will provide consultation, review, and make recommendations for any proposed modification of SWP buildings, provided that consideration of such modifications has prior approval by the appropriate DWR Deputy Director.

4.10.3 Aesthetic Resources at Project Facilities

Aesthetic resources within the Project area include those associated with the following Project facilities:

- Cedar Springs Dam, Silverwood Lake and associated recreation facilities
- Devil Canyon Powerplant and its penstocks, switchyard, transmission lines, and afterbays
- Appurtenant Project facilities, including Project roads

These aesthetic resources are described below and photographically documented at the end of this Section. Recreation facilities and roadways constitute key viewpoints from which the public may observe Project facilities and features.

4.10.3.1 Cedar Springs Dam, Silverwood Lake and Associated Recreation Facilities

As seen from Silverwood Lake, in the foreground and middleground distance zones, the uppermost portion of Cedar Springs Dam is visible (see Figure 4.10-2). The dam’s rock fill is light gray in color, contrasting with the greens and browns of the surrounding landscape and the blues of Silverwood Lake. To the west of the dam and also visible from California State Route 173 (middleground) are the Cedar Springs Dam spillway

(Figure 4.10-4) and SWP water intake structure. Figures 4.10-5 through 4.10-9 show the Cleghorn swim beach, Mesa Campground and Sawpit Canyon boat launch and swim beach.

Silverwood Lake and surrounding landscapes are visible from the many recreational areas and access roads that form the Silverwood Lake SRA (see Section 4.9).

Located along the southeast shore of Silverwood Lake, the gray, concrete outlet (to the San Bernardino Tunnel) structure and related facilities are visible in the middleground from the adjacent lake surface, Black Oak Picnic Area (Figure 4.10-10), Jamajab Point Overlook, and Serrano Beach Picnic Area.

Silverwood Lake is also visible from the PCT, surrounding hillsides and roads in the SBNF, and from California State Highway 138 (Rim of the World Scenic Byway, Figure 4.10-11). The Caltrans-managed Highway 138 Vista Point, high above Chamise Cove, provides spectacular views of the lake and dam to the east (Figure 4.10-12).

4.10.3.2 Devil Canyon Penstocks, Powerplant, Afterbays, Switchyard, Transmission Lines and Associated Facilities

The two Devil Canyon Powerplant penstocks are apparent in the middleground and background from the south, near the California State University San Bernardino (CSUSB) campus (Figure 4.10-14), and from the residential communities of Verdemont and University Heights. Public roads from which the penstocks are apparent in these areas include: Campus Parkway, Northpark Boulevard West, and University Parkway. The penstocks are white in color, 1.3 miles long (in two separate sections, divided by a natural appearing hillside), 10 to 12 feet in diameter, and surrounded by concrete that is gray in color. The penstocks and associated concrete contrast with the surrounding greens and browns of the landscape as they descend through Devil Canyon. To a lesser extent, the low-profile Devil Canyon Powerplant, which is also gray in color, surge tanks, afterbays, switchyard, transmission lines, and associated facilities are also visible from the south and from public use portions of Devil Canyon Road to the east and north. The afterbay embankments are vegetated with native chaparral/sage scrub plant species, and appear natural when viewed from the south in the middleground and background.

A portion of the University Heights residential community lies immediately west and south of the Devil Canyon Second Afterbay. Homes along North Melvin Avenue have views of the Second Afterbay and other Project structures in the foreground and middleground. Homes along Verdemont Drive, Olive Avenue, Ohio Avenue, Ashley Court, North Brenda Lane, and North Ventura Avenue have views of the Second Afterbay embankment and access roads in the foreground and middleground.

Figure 4.10-2. Cedar Springs Dam from Silverwood Lake (2015)

(Source: Google Maps. Accessed: May 24, 2016)

Figure 4.10-3. Cedar Springs Dam and Route 173 from Day Use Parking Area at East Dam Abutment (2015)

Figure 4.10-4. Silverwood Lake Spillway from Route 173 (2015)

Figure 4.10-5. Cleghorn Swim Beach, Looking Southeast (2015)

Figure 4.10-6. Cleghorn Boat Launch, Looking South (2015)

Figure 4.10-7. Mesa Campground, Looking Northeast (2015)

Figure 4.10-8. Sawpit Canyon Boat Launch and Marina, Looking Northeast (2015)

Figure 4.10-9. Sawpit Canyon Swim Beach, Looking Northwest (2015)

Figure 4.10-10. Silverwood Lake Outlet Area (2009)

Figure 4.10-11. Silverwood Lake from Route 138 Pull-Off, Looking Northwest (2015)

Figure 4.10-12. Route 138 (Caltrans) Vista Point, Looking Northeast (2015)

Figure 4.10-13. Devil Canyon Powerplant as seen from Devil Canyon Road (2015)

Figure 4.10-14. Devil Canyon Powerplant Penstocks from CSUSB Campus (2015)

4.11 CULTURAL RESOURCES

This Section provides information regarding existing cultural resources. For the purpose of this PAD, a cultural resource is any prehistoric or historic district, site, building, structure or object, regardless of its National Register of Historic Places (NRHP) eligibility. Besides this general introductory information, this Section includes seven main sub-sections: Section 4.11.1 describes the prehistory; Section 4.11.2 describes the ethnohistory; Section 4.11.3 describes the history of the Project vicinity; Section 4.11.4 describes the history of the development of the Project; Section 4.11.5 describes the previous cultural resources investigations; Section 4.11.6 describes the previously recorded cultural resources in the Project area; and Section 4.11.7 describes the potential historic cultural resources identified on historical maps. Traditional Cultural Properties (TCP) are discussed in Section 4.13.

The existing, relevant and reasonably available information focused on cultural resources within the existing Project boundary and a 0.25-mile-wide buffer around the boundary. The buffer was examined to provide information regarding cultural resources in the Project vicinity.

Many of these are records for the previously recorded cultural resources and are not listed specifically in this Section, but correspond to the cultural resources listed in this Section. Other documents are variously referenced below and include the following types of sources: cultural resources investigation reports, historic maps, newspaper articles, local and regional histories, journals, and other academic publications. Record searches were conducted that included a review of documents on file at DWR; the South Central Coastal Information Center (SCCIC) at California State University, Fullerton; the Los Angeles County Library; and various on-line repositories.

4.11.1 <u>Prehistory</u>

Understanding when, how, and why people occupied the California desert region and southern California during prehistoric times has been a work-in-progress for more than 60-years (Crabtree 1981; King 1976; Rogers 1939, 1945; Stickel et al. 1980; Wallace 1962; Warren and Crabtree 1972, etc.). Based on some of the more recent studies, the area Licensees examined for the records search is within the Mojave and Great Basin Desert Chronological Region (Moratto 1984:348-430; Sikes 2006: 2-21). This region is divided into five cultural complexes that use temporal periods based on years Before Present (B.P.); meaning the number of years prior to 1950. These include the Lake Mojave Complex (circa [ca.] 10,000-7000 B.P.), the Pinto Complex (ca. 7000-4000 B.P.), the Gypsum Complex (ca. 4000-1500 B.P.), and the Saratoga Springs Complex (ca. 1500-800 B.P.)

Some researchers have suggested categorizing local chronologies using the broader temporal periods discussed by Fredrickson to better reflect cultural traits found similarly throughout the State. These include the Paleoindian Period (ca. 10,950 through 7950 B.P.), the Archaic Period (ca. 7950 through 1450 B.P.), and the Emergent Period (ca. 1450 B.P. through Historic Contact). The discussion below provides a brief overview of these temporal periods and the Mojave and Great Basin Desert Regions' chronological complexes associated with each period. (Fredrickson 1973, 1974, 1994a, 1994b; Sikes 2006:2-22).

4.11.1.1 Paleoindian Period

Less is known about the Paleoindian Period than other periods, although significant initial human occupation in California has been identified with this period. The Paleoindian Period is generally associated with the presence of lanceolate and fluted lanceolate Lake Mojave, Clovis, Folsom and other types of projectile points. Crescents, leaf-shaped and stemmed or shouldered points, knives, scrapers, and other tools also characterize this period. The start of this period is associated with the end of the Pleistocene, a geologic epoch that corresponds to the last glacial period, which is typified by a cooler, moist climate supporting an environment conducive to larger animals such as mammoths, camels, and other large game. Human occupation during the late Pleistocene is characterized by a focus on large game hunting and gathering of other resources around the shores of old Pleistocene lakes, the dry lake beds of which now include several that occupy the arid portions of modern southern California. (Moratto 1984:523; Sikes 2006:2-22; Warren 1967:177).

The Lake Mojave Complex occurs during this period, with the majority of archaeological evidence found in the Mojave Desert and southwestern Great Basin. Artifact assemblages from this complex indicate that humans were very mobile at this time, traveling in small groups and exploiting plant and animal resources from early Holocene marshes and wetland environments. The Holocene is the current geologic epoch, which followed the Pleistocene, marking the start of the current warm period. The Lake Mojave Complex is one of several that have been grouped under the Western Pluvial Lakes Tradition (WPLT), associated with human exploitation of wet, grassland environments from as far north as Oregon to southern California, and along the Cascade and Sierra Nevada Ranges into the Great Basin. Hunting appears to have been the dominant source of food acquisition as milling equipment associated with the WPLT is sparse. However, Lake Mojave artifact assemblages differ somewhat from that of the typical WPLT assemblage in that large slabs and handstones have been found at Lake Mojave sites, indicating that vegetal resources were also incorporated into the regional diet. (Basgall and Hall 1993:19; Goldberg 2010:18; Moratto 1984:90).

4.11.1.2 Archaic Period

The Paleoindian Period concludes and the Archaic Period emerges around 6000 B.C. with the onset of a warmer, drier environment referred to as the Altithermal (Sikes 2006:2-23). It is during this timeframe that the pluvial lakes of the Great Basin dried up and desert biotic communities replaced wet marshlands (Moratto 1984:461). The Archaic Period is defined by three subdivisions, each of which is described below.

Lower Archaic Period (ca. 7950 through 4950 B.P.)

The first 3,000 years of the Archaic Period are referred to as the Lower Archaic and is represented by an increase in the number of archaeological sites found from this time period. Artifact assemblages include an increase in milling equipment and, therefore, an increase in the use of plant resources, the addition of seeds, the continuation of hunting, and the suggested scheduling of seasonal procurement activities. Tools associated with the Lower Archaic Period include large, side-notched points and large, simple core and flake tools. (Sikes 2006:2-24).

The Pinto Complex begins during the Lower Archaic Period but continues throughout the Middle Archaic Period described below. For the desert regions of southern California, the patterns of human occupation transitioned at this time in response to the aridity occurring in the deserts. The reliance on pluvial lakes changed to the use of seasonal water sources. The shift in climatic conditions further resulted in a transition to a more plant and seed resource base, the hunting of smaller game animals as opposed to the large game of the Lake Mojave Complex, but with a continued reliance on artiodactyls. Sites related to this complex tend to be small, surface sites, likely reflective of small groups of people. Artifact assemblages include Pinto series points (i.e., coarsely made points with indented bases and weak shoulders), leaf-shaped bifaces, domed and heavy-keeled scrapers, milling equipment, and cobble tools. (Goldberg 2010:18).

The Middle Archaic Period (4950 through 2950 B.P.)

The Middle Archaic Period is designated by a heavier reliance on local and regional resources, with an evolution in milling equipment from slab mortars and handstones to pestle and mortar technology. Middle Archaic Period artifact assemblages become more diverse and include large stemmed points, lanceolate and leaf-shaped forms, drills, larger knives, flake scrapers, and an increase in bone awls and other tools, suggestive of a more diversified use of resources. This period is also defined by an increase in population and non-utilitarian objects. (Sikes 2006:2-25).

The Gypsum Complex immediately follows the Pinto Complex, starting during the Middle Archaic Period and extending into the Upper Archaic Period described below. It is represented by an expansion of the artifact assemblage identified during the Pinto Complex, likely in response to an increase in wetter conditions that occurred about 3700 through 3500 B.P. (Goldberg 2010:18-19). The increase in moisture resulted in the appearance of perennial lakes. Large villages occur at this time, suggesting there was less reliance on seasonal forays for resource procurement and an increase in sedentism, likely to exploit the permanent water sources and related resource procurement opportunities. During this time, ritual practices and hunting petroglyphs appear, and artifact assemblages include any combination of Humboldt concave base, Gypsum Cave, and Elko series points, in addition to leaf shaped points, rectangular base knives, flake scrapers, and milling equipment, among other items (Moratto 1984:414-416). Perishable materials associated with this complex were recovered from a cave site near the area examined by DWR, and included tortoise-shell bowls, atlatl hooks, dart shafts and foreshafts, sandals, S-twist cordage, and other items that do not preserve in open air sites (Goldberg 2010:19; King and Blackburn 1978:536; Moratto 1984:416).

The Upper Archaic Period (ca. 2950 through 1450 B.P.)

The Upper Archaic Period is identified by an increase in the diversification of artifacts and features compared to Middle Archaic Period assemblages. This included the development of more permanent settlements, more complex societies, and wealth. Upper Archaic Period sites are associated with large contracting-stemmed and occasional concave base points, all types of milling equipment, stone effigies, stone pipes, charmstones, a variety of beads and bone tools, rock art, and items reflecting trade goods from long distances. Interment burials, sometimes under cairns, appear as the more common mortuary practice, with few cremations represented during this period. (Sikes 2006:2-27).

4.11.1.3 Emergent Period

The Emergent Period (ca. 1450 B.P. through Historic Contact) is defined by an even further expansion of the changes witnessed during the Upper Archaic Period, including increased social complexities, divisions of class, intensification of resource exploitation, and population growth and associated increases in the number and size of settlements. Ornamental objects and pottery begin to appear at this time in the archaeological record. (Sikes 2006:2-28 to 2-29).

The Saratoga Springs Complex dates to the Emergent Period and is represented by a similar material cultural to that of the Gypsum Period. This likely reflects similar climatic conditions that occurred for occupants associated with both complexes. However, the Saratoga Springs Complex is defined archaeologically by the intensification of permanent settlement patterns over those seen during the Gypsum Complex, with more focus on regional cultural developments, especially in the Mojave Desert. Anasazi and Hakataya groups move into southern California at this time, introducing Brown and Buff Ware pottery, and Cottonwood and Desert Side-notched points. Trade patterns emerge in the archaeological record based on the presence of coastal shell beads and steatite items, which may suggest advancing sedentary lifestyles with larger, permanent villages. (Goldberg 2010:20).

4.11.2 Ethnohistory

The Project falls within the ethnographic boundaries of the Serrano, as depicted by Bean and Smith (1978:570). The Serrano is a term not only used to describe the people, but it is also applied to a group of languages of similar dialect known as the Takic division of the Uto-Aztecan linguistic family (Bean and Smith 1978:570; Kroeber 1976 [1925]:615). The Uto-Aztecans are believed to have arrived in the Mojave Desert about 5000 years B.P., expanding their occupation in California about 3900 B.P., during the time the Gypsum Complex of the Middle Archaic Period appears in the archaeological record (Moratto 1984:559).

The Serrano name as applied to the people stems from the Spanish term for "mountaineer or highlander" (Bean and Smith 1978:570; Kroeber 1976 [1925]:615). Presumably the name is related to the mountain territory occupied by the Serrano, that included the San Bernardino Mountains north of the San Manuel Reservation, east of the San Gabriel Mission, and the San Gabriel Mountains (Sierra Madre) extending west to Mount San Antonio (Kroeber 1976 [1925]:615). The eastern portion of Serrano territory also encompassed the Mojave Desert, inclusive of what Kroeber (1976 [1925]:615) describes as "…an occasional water hole and two or three flowing springs." However, Serrano territory also included the stretch of Mojave River within the Project area. According to Bean and Smith (1978:570), the Serrano are generally believed to have lived in the San Bernardino Mountains to the east of Cajon Pass (Figure 4.3-2), in the desert at the base of the mountains near Victorville, and south and east to Yucaipa Valley and Twenty-nine Palms, respectively.

The Serrano were patrilineal and lived in exogamous clans associated with one of two moieties (Bean and Smith 1978:572). The clans included hereditary chiefs called *kika*, a term that Kroeber (1976 {1925]:618) indicates comes from the Shoshone word for "house" or "live." The *kika* was believed to possess psychic abilities and served as each clan's religious and ceremonial leader. Each *kika* was assisted with ceremonies by a hereditary *paha*' (assistant chief), whose duties included caring for sacred ceremony paraphernalia, notifying clan members of ceremonies, carrying ceremony-related shell money, and being present during the ceremonial dividing of money and food. (Bean and Smith 1978:572; Kroeber 1976 [1925]:618).

The Serrano hunted and gathered food resources, which they augmented with fishing. Women generally took charge of the gathering and the men were responsible for the hunting and fishing (Bean and Smith 1978:571). Vegetal and other collected foods were varied and, depending on where the gathering occurred (e.g., mountains and desert), included acorns, pine nuts, honey, mesquite, yucca roots, and cacti fruits, among other resources. The animals hunted included birds, deer, rabbits, mountain sheep, and antelope, in addition to small rodents. Hunting was accomplished using bows and arrows, snares and traps, and curved throwing sticks and deadfalls. Hunting and gathering was conducted alone and as a communal effort. Meats were baked, boiled, and parched, and both meat and vegetables were sun-dried. Vegetal materials were eaten raw or cooked, and the marrow from bones and the blood of the animals hunted were also consumed. Food was processed prior to cooking by grinding with metates or pounding with pestles and mortars. Utensils included stone, bone, and horn tools (i.e., knives, scrapers, spoons, stirrers); and pottery and basketry. (Bean and Smith 1978:571).

Serrano settlements were focused on water sources, resulting in smaller villages (Bean and Smith 1978:571). Family houses were usually circular and built from willow with domed thatched roofs that included outside ramadas that served as work areas. Villages included large ceremonial structures where the *kika* lived. Granaries and sweathouses were also part of the village composition, with sweathouses being constructed as large, semi-subterranean earthen domes with thatching on the roof.

Similar to neighboring tribes, the Serrano utilized sinew-backed bows, arrows and arrow straighteners, awls, fire drills, lavishly decorated baskets, pottery, and a variety of stone, wood, shell and bone implements. Other items included musical instruments, deer-hoof rattles, stone pipes, among other materials. (Bean and Smith 1978:571).

4.11.3 History

From the early seventeenth century up to the middle of the nineteenth century, Spanish and Mexican governments established colonies, towns, and religious centers throughout the northern borderlands of the Spanish colonial empire. Starting in 1769, a total of 21 missions were established along the California coastline from San Diego in the south to Sonoma in the north. (HARD Townsites Team 2007).

Spanish missionization, although mostly confined to the coastal regions of California, eventually led to European exploration and settlement of inland regions. In 1776, Father Francisco Garces crossed the Mojave Desert and the San Bernardino Mountains en route to San Gabriel Mission, founded in 1771 along the San Gabriel River in Los Angeles County, seeking converts among the Mojave Indians along the way (Haenszel 1982:27; Robinson 1993:366). Further missionization occurred when Father Francisco Dumetz set up an altar in the area in 1810 in the hopes of converting the native population, and named it San Bernardino after Saint Bernardino, the patron saint of the day the altar was established (City of San Bernardino 2015). In 1826, Jedediah Smith was the first American to enter the San Bernardino Valley, leading a company of fur trappers westward from Utah following the prehistoric Mohave Trail. This trail was also used by Garces on his mission (Cataldo 1991:3-4).

In addition to the lands controlled by the missions, large land grants and ranchos were gifted to individuals by the Spanish government. These ranchos came under the control of the Mexican government after Mexico won its independence from Spain in 1822. Many of the ranchos were then sold, some of which were purchased by residents of the United States. The Project falls within the Rancho Muscupiabe land grant, as indicated on historic BLM General Land Office (GLO) plats dated 1876, 1878, 1884, 1892, 1898, 1905, 1919, and 1930. This rancho was later granted to Michael White in 1843 by the Mexican government. White built a "fortress-home" at Cajon Pass in order to protect the valley residents from Indian raids, but abandoned it within a year after losing all of his livestock to the raids (Robinson 1993:374). The largest rancho in the region, Rancho San Bernardino, was established in 1819 to provide supplies to the nearby Mission San Gabriel. The rancho was granted to the Lugo family in 1842 by the Mexican government. This rancho was comprised of 37,700 acres, encompassing the entire San Bernardino Valley (San Bernardino County 2015). The ranchos relied heavily on cattle husbandry, which put them at threat for raids on their cattle and horses by the desert tribes.

The era of the ranchos ended with the start of the Mexican-American war in April of 1846. Numerous uprisings occurred in California by Americans who had moved to the Mexican territory and acquired land claims, protesting rule by the Mexican government, which threatened the validity of their claims. The American rebellion culminated in the Bear Flag Revolt in June of 1846, during which the American settlers took over the town of Sonoma and captured Mexican general Mariano Vallejo. The United States took advantage of the turmoil and unsuccessfully attempted to purchase the land comprising the California territory from the Mexican government. War was declared by the United States when the purchase fell through. The signing of the Treaty of Guadalupe Hidalgo in 1848 concluded this era of disputes by relinquishing Mexican control of the California territory to the United States (Newmark 1916:88; CNPS 2015; Robinson 1993). California officially became a State on September 9, 1850.

In 1851, a large group of about 500 Mormon settlers arrived in the San Bernardino area, settling at the mouth of Lytle Creek. The settlers purchased 35,000 acres of the San Bernardino Rancho for a price of $77,500. They built a stockade around the land for protection from Indian raids, and as a result, the rancho became known as Fort San Bernardino. The Mormon settlers brought with them agriculture practices for growing wheat and grain crops. They also established the foundations for the future City of San Bernardino (Figure 1.2-1), laying out the roads using a 1-square mile plat, establishing irrigation systems, mills, and civic institutions, such as the schools and a city government. The City of San Bernardino was incorporated in 1854 by the State legislature, and Amasa Lyman was appointed the first mayor (City of San Bernardino 2015; Robinson 1993:386-388; San Bernardino Daily Times 1979 [1876]). In addition to wheat and grain crops, viticulture was practiced in the region as early as 1840, and citrus trees were planted in San Bernardino starting in 1857 (San Bernardino County 2015).

The population of San Bernardino Valley dropped in 1857 when a large number of Mormons left after the Mormon leader Brigham Young recalled his followers to Salt Lake City (City of San Bernardino 2015). However, the discovery of mineral resources in the region provided a huge impetus for new population growth. A large number of settlers came to the region in 1860 after gold was discovered in both Holcomb Valley and Bear Valley, although these deposits were depleted by the influx of miners within a few years. Less significant gold deposits were also discovered in Lytle Creek, the Amargosa River, and the Leach Lake District (City of San Bernardino 2015; San Bernardino County 2015; Robinson 1993:393). Borax harvesting began at Searles Lake (formerly Borax Lake) in 1862. Silver mining began at Ivanpah in 1870 and also in the Providence Mountains during the 1870s, with the largest strikes being made in the Calico Mountains in the 1880s (Robinson 1993:394-398; San Bernardino County 2015). Lumber was another significant resource, the demand for which increased with the formation of mining towns. The Devil Canyon Toll Road, which accessed Devil Canyon and continued across the mountains to the desert, was constructed to transport lumber to a mill at Saw Pit Canyon, which was built in the 1870s. Numerous lime kilns, under the ownership of W. R. Higgens, also operated within Devil Canyon in the late nineteenth century (Cataldo 1986:35-37).

Further population growth was driven by the introduction of the railroads to San Bernardino in the 1880s. A land boom also occurred in the 1880s, driven by the decline of the Mexican rancho system and a move toward the ownership of smaller farms and homesteads (City of San Bernardino 2015; Dumke 1991:12). The population of San Bernardino increased from around 4,000 in 1870 to over 25,000 in 1890 (Dumke 1991:278).

4.11.4 Project History

Cedar Springs Dam and Silverwood Lake are located on the West Fork Mojave River, 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. Prior to construction of the dam and reservoir, the area was the site of the town of Cedar Springs, founded in the earlier twentieth century. The town was founded by approximately 100 families, and was known for growing strawberries. A tuberculosis sanitarium was built in the area by Seventh Day Adventists in the 1920s. The town was purchased by DWR in 1963. At the time, the town was home to 45 residents. Cedar Springs Dam was constructed from 1961 through 1971. Formally called Cedar Springs Reservoir, Silverwood Lake was re-named in 1968 after W.E. “Ted” Silverwood of Riverside County, a proponent of the SWP. The lake was filled in 1972, covering the former town site of Cedar Springs (Brewster 2012; Gilbert 2012).

The Devil Canyon Powerplant 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 San Bernardino Tunnel from Silverwood Lake to the Devil Canyon Powerplant turbines. Water from the Devil Canyon Powerplant flows to the off-stream Devil Canyon Afterbay that was constructed in 1974. Completed in 1995, the Devil Canyon Second Afterbay was added to the Project to increase the operational flexibility and capacity of the Devil Canyon Powerplant.

4.11.5 Previous Cultural Resources Investigations

DWR found 52 reports documenting cultural resources investigations, 11 lists of NRHP and California Register of Historical Resources (CRHR) listed or eligible properties, landmarks or points of historical interest, and determinations of NRHP eligibility; plus 23 various letters and communications regarding studies or related to specific cultural resources. Approximately 90 percent of the investigations occurred 10 or more years ago and were conducted for various DWR projects, private land developments, and transportation projects. Some are related to hazard tree removal and fire suppression activities. A table listing previous cultural resource investigations and other documents (Table H-6 in Appendix H) and maps depicting the previous survey coverage are provided in Appendix I which contains privileged information.

4.11.6 Previously Recorded Cultural Resources and NRHP and CRHR Eligibility

Since the first archaeological surveys were conducted during the early 1970s, 33 cultural resources have been documented in the area examined by DWR. The resource records collected during the data gathering indicate that five resources are prehistoric archaeological sites, 20 are historic archaeological sites, three are multicomponent archaeological sites, and five are historic built resources. The locations of these resources are depicted on the maps included in Appendix I, which contains privileged information.

Evaluations of resources for their potential eligibility to the NRHP or to the CRHR assist in determining whether significant resources are present in a project, and subsequently whether a project is having any effects on eligible properties. One resource in the area examined by DWR was evaluated for the CRHR as not eligible. Another resource is a California Historical Landmark (CHL); a designation that results in being automatically listed on the CRHR by the OHP. Four known resources have been evaluated for listing on the NRHP. Two of these were found to be eligible and one was determined not eligible for inclusion on the NRHP. Another resource was tested (i.e., evaluated using archaeological excavation) for its potential listing to the NRHP, but the results of the testing were not found during DWR's data gathering; neither in the reports, the OHP Archaeological Determinations of Eligibility (ADOE) list, nor on the NRHP.

4.11.6.1 Prehistoric Archaeological Sites

The documented prehistoric sites in the area examined by DWR represent Native American occupation in the Project vicinity prior to the presence of Euro-Americans. One site consists of a bedrock milling station and lithic scatter and the other four sites are lithic scatters, two of which contain midden deposits and two of which appear to be lithic processing locales (Table 4.11-1). Prehistoric site P-36-00174 was previously tested (i.e., evaluated through archaeological excavation) for its potential listing on the NRHP. A 1989 update to the 1940 site record and 1976 update, notes that the site was tested by William Orlin in about 1973, that there is no report for the testing, and that the artifacts were curated at the California Department of Parks and Recreation in Sacramento. A second note written on the 1989 update sheet states that Mark Sutton of California State University, Bakersfield provided a photocopy of Orlin's excavation notes and the artifact catalog on 5-9-1994, but it is unclear as to whom the photocopy was provided. Additional research is needed to determine whether P-36-00174 went through a NRHP evaluation following the excavation and, if so, whether the SHPO was provided the opportunity to concur with the finding. DWR's Division of Environmental Services staff recently re-surveyed site P-36-00174, and is preparing an updated record for submittal to South Central Coastal Information Center at California State University, Fullerton. P-36-08913 was evaluated as not eligible for listing on the NRHP by consensus between a federal agency and the SHPO (NRHP Status Code 6Y2), as detailed in the OHP Archaeological Determinations of Eligibility (12-18-2016). The other three prehistoric sites were not evaluated.

Table 4.11-1. Previously Recorded Prehistoric Archaeological Sites

Primary No.	Trinomial	USFS No.	Description	NRHP and CRHR Eligibility
P-36-00174	CA-SBR-0174	05-12-51-20	Bedrock milling station; lithic scatter (debitage, possible handstones)	Tested for the NRHP, status unknown.
P-36-01627	CA-SBR-1627	N/A	Prehistoric site with midden, mortar stone, and unspecified artifacts.	Unevaluated
P-36-03128	CA-SBR-3128	05-12-51-70	Lithic processing location with one core and three quartzite flakes	Unevaluated
P-36-08913	CA-SBR-8913	N/A	Prehistoric lithic processing site with quartzite and obsidian flaked, ground, and hammered stone tools and debitage; possible assayed cobbles.	NRHP Not Eligible
P-36-14904	CA-SBR-13142	05-12-51-246	Large prehistoric lithic scatter with quartzite and jasper flaked and ground stone tools and debitage; bivalve mollusk shell; dark midden soil.	Unevaluated

Source: SCCIC
Key:
CRHR = California Register of Historical Resources
NRHP = National Register of Historic Places
USFS = U.S. Forest Service
SCCIC= South Central Coastal Information Center

4.11.6.2 Historic Archaeological Sites

There are 20 historic sites in the area examined by DWR. These resources include homesteads or residential locations, can dumps, structural debris, a kiln, wells, and roads (Table H-7 in Appendix H). One additional resource (P-36-12199) that is not a CPHI has been evaluated for listing on the CRHR as not eligible, but is not evaluated for the NRHP. None of the other historic archaeological sites have been evaluated for the NRHP or the CRHR.

4.11.6.3 Multicomponent Archaeological Sites

There are three previously recorded multicomponent sites in the area examined by DWR (Table 4.11-2). These include: (1) the Old Mohave Road/Trail, used both prehistorically and historically; (2) a prehistoric bedrock milling station with associated lithic scatter, possible midden, and overlapping historic trash scatter; and (3) a prehistoric lithic scatter with an overlapping historic trash scatter. Based on the data gathered by DWR, two of these sites are not evaluated. However, the Old Mojave Trail (P-36-03033) is CHL No. 963 and as such, is automatically listed in the CRHP (e.g., CHLs numbered 700 or higher are automatically listed in the register by the OHP). The site record for the Old Mojave Trail has been updated multiple times over many years. Older recordings and updates to the P-36-03033 site record (i.e.,1995) have coded the NRHP status of the site as appearing to be eligible for separate listing on the NRHP based on field survey observations (NRHP status code 3S). Later updates to the site record (i.e., 2012) have coded the site as having been received by the SHPO for evaluation or action, but that the site remains unevaluated (NRHP status code 7J). Brewster (2012:10) states that the Old Mojave Trail has not been evaluated for the NRHP. The site is not listed on the NRHP, nor is it included in the OHP Archaeological Determinations of Eligibility (12-18-2016). As a result, it appears that P-36-03033 has not been evaluated for the NRHP.

Table 4.11-2. Previously Recorded Multicomponent Archaeological Sites

Primary No.	Trinomial	USFS No.	Other Designations	Description	NRHP and CRHR Eligibility
P-36-00501	CA-SBR-501/H	N/A	N/A	Bedrock milling station, "gamestone," painted conical mortar, possible midden, numerous lithic artifacts; historic trash (cans and glass).	Unevaluated
P-36-03033	CA-SBR-3033/H	N/A	CHL No. 963	Old Mojave Road; Mojave Trail; Old Government Road; Prehistoric route; Spanish missionaries; explorer Jedediah Smith; military wagon road, overland route up to ca. 1885; Sawpit Canyon Road.(PSBR-4-H).	CRHR Listed
P-36-04366	CA-SBR-4366/H	05-12-51-93	N/A	Prehistoric lithic scatter: scrapers, metavolcanic and quartzite flakes; Historic trash scatter: bed frame, car parts, metal, and glass.	Unevaluated

Source: SCCIC
Key:
CRHR = California Register of Historical Resources
NRHP = National Register of Historic Places
CHL = California Historical Landmark
SCCIC = South Central Coastal Information Center

4.11.6.4 Historic Built Resources

Five historic built resources have been previously recorded in the area examined by DWR (Table 4.11-3). Three of these have been evaluated as potentially eligible for listing on the NRHP. Included in these evaluations is the Cedar Springs Dam (P-36-25233) which has previously been determined by a consultant as potentially NRHP-eligible. The Tower Line transmission line (P-36-10316) was evaluated as eligible for separate listing on the NRHP by consensus between a federal agency and the SHPO (NRHP Status Code 2S2), as detailed in the OHP Archaeological Determinations of Eligibility (12-18-2016). In 2012, Brewster evaluated the Cedar Springs Dam (P-36-25233) as potentially eligible for listing on the NRHP, as a contributing element to the California Aqueduct water conveyance system, and on an individual basis (Brewster 2012:12). The dam is not listed on the NRHP or on the CRHR, and DWR will do further research to confirm the dam's status. The Historic Properties Management Plan to be developed for this relicensing will include appropriate management strategies for all sites within the Project APE confirmed to be eligible for listing in the NRHP. The Arrowhead-Calectric-Devil Canyon-Shandin Transmission Line (P-36-24800) is part of the NRHP-eligible historic Southern California Edison Boulder Dam-San Bernardino Transmission Line, built beginning in 1930 for the construction of Hoover Dam (Duke and Shattuck 2004:2). BLM evaluated the Boulder Dam-San Bernardino line in 1993, as provided by the Archaeological Information Center at San Bernardino Museum in 2004 for Duke and Shattuck's study (2012:Appendix C). In 1937, after Hoover Dam had been built, electricity was returned to San Bernardino over the same line. The current data gathering did not encounter information regarding the BLM NRHP evaluation and, therefore, did not locate any correspondence or other information regarding SHPO concurrence on the 1993 determination.

Table 4.11-3. Previously Recorded Historic Built Resources

Primary No.	Trinomial	USFS No.	Description	NRHP and CRHR Eligibility
P-36-10316	CA-SBR-0316H	N/A	The "Tower Line" transmission line: From Bishop to San Bernardino, ca. 1912. Part of Southern California Edison's Kramer-Victor 115 kV transmission line. Partially mitigated using Historic American Engineering Record documentation for El Dorado-Ivanpah Transmission Line Project.	NRHP Eligible
P-36-12952	N/A	N/A	Employee residential structure of wood frame construction with concrete footings, built in 1933 by the 16th San Bernardino Municipal Water Department.	Unevaluated
P-36-12953	N/A	N/A	Residential cabin of wood frame construction with concrete footings. Remodeled from an earlier structure in c. 1940 by the San Bernardino Municipal Water Department for employee housing. 1920s-1940s	Unevaluated
P-36-24800	CA-SBR-0841H	N/A	The Arrowhead-Calectric-Devil Canyon-Shandin Transmission Line – a portion of the historic Southern California Edison Boulder Dam-San Bernardino Transmission Line, constructed from 1931-1933 to present.	NRHP Eligible
P-36-25233	N/A	N/A	Cedar Springs Dam, an earth filled dam built between 1968-1972 to impound Silverwood Lake.	Potentially NRHP Eligible

Source: SCCIC
Key:
CRHR = California Register of Historic Resources
NRHP = National Register of Historic Places
USFS = U.S. Forest Service
SCCIC = South Central Coastal Information Center

4.11.7 Potential Cultural Resources

A review of 25 historical USGS topographic quadrangles and GLO plats of various dates identified multiple historic cultural features for which physical remains may still exist within the area examined by DWR (Table 4.11-4). Many of these potential resources are represented on more than one historic map, and others may also be shown on multiple maps but require further research to determine if that is the case. Thus, it is not possible to know at this stage of research exactly how many potential resources might still be present in the Project area. However, as with the previously identified archaeological sites listed above in Tables 4.11-1 to 4.11-2, cultural features identified on historic-era maps and other documents illustrate the breadth of historic-period activity in the region, along with identifying potential cultural resources that may as of yet still be unidentified and undocumented. The potential features identified on the historic maps include roads, trails, ditches, residential structures/cabins, cultivated fields, walls, a mine, a transmission line, a percolation basin, and a gaging station. The locations of these features are provided on the maps included in Appendix I, which contains privileged information.

Table 4.11-4. Historic Cultural Features Identified on Historic Maps

Data Source	Historic Cultural Features Identified Within the Area Examined by DWR
1876 GLO plat	"Sweatout Road," Rancho Muscupiabe
1878 GLO plat	Rancho Muscupiabe
1884 GLO plat	Rancho Muscupiabe
1885 GLO plat	"Burcham's ditch," 1 unnamed road, 1 unnamed ditch, "alfalfa field"
1886 GLO plat	"Road to Saw Mill," "Muscupiabe Road," "ditch," 1 unnamed trail, 6 unnamed roads, "Burcham's Irrigating Ditch"
1892 GLO plat	Rancho Muscupiabe
1896 USGS San Bernardino, CA 1:62500 Topographic Quadrangle	2 unnamed roads, 1 structure
1898 GLO plat	Rancho Muscupiabe, "stonewall," "ditch"
1898 USGS San Bernardino, CA 1:62500 Topographic Quadrangle	1 unnamed road, 1 structure
1901 USGS San Bernardino, CA 1:62500 Topographic Quadrangle	3 structures, 2 unnamed roads
1902 USGS Hesperia, CA 1:62500 Topographic Quadrangle	3 unnamed trails, 3 unnamed roads, 7 structures
1905 GLO plat	Rancho Muscupiabe, "old ditch," 4 unnamed roads, "W. Fence Field," "Field"
1905 GLO plat	3 unnamed roads, "old stone wall," "ditch"
1905 GLO plat	3 unnamed roads, "W. Fence," "old stone wall," 2 fields
1903 USGS Southern California, Sheet No. 1, 1:250,000	1 trail, 2 unnamed roads
1907 USGS Southern California, Sheet No. 1, 1:250,000	1 trail, 2 unnamed roads

Table 4.11-4. Historic Cultural Features Identified on Historic Maps (continued)

Data Source	Historic Cultural Features Identified Within the Area Examined by DWR
1919 GLO plat	Rancho Muscupiabe
1930 GLO plat	Rancho Muscupiabe
1936 USGS Arrowhead, CA 1:31,680 Topographic Quadrangle	4 unnamed dirt roads, structure, transmission line
1941 USGS Arrowhead, CA 1:31,680 Topographic Quadrangle	6 unnamed dirt roads, 3 structures, transmission line
1953 USGS San Bernardino, CA 1:250,000 Topographic Quadrangle	2 trails, two 3-4 lane roads (part of Road 18)
1954 USGS San Bernardino, CA 15-minute Topographic Quadrangle	5 unnamed dirt roads, 2 structures, transmission line
1956, photorevised 1968 and 1973, USGS Silverwood Lake, CA 7.5-minute Topographic Quadrangle	State Route 138, State Route 173, 11 unnamed dirt roads, 2 trails, 3 unnamed light duty roads, 3 transmission lines, 9 unnamed light duty roads (1968/1973), 3 unnamed dirt roads (1968/1973), 11 structures (1968/1973)
1966 USGS San Bernardino, CA 1:250,000 Topographic Quadrangle	"Percolation basin," Road 18
1967 USGS San Bernardino North, CA 7.5-minute Topographic Quadrangle	Unnamed dirt road, conveyor, unnamed light-duty road (1988), transmission line, gaging station (1988),

Source: SCCIC; BLM website (http://www.glorecords.blm.gov/default.aspx
Key:
CA = California
GLO = General Land Office
USGS = U.S. Geological Service
SCCIC = South Central Coastal Information Center
BLM = US Department of the Interior, Bureau of Land Management

4.12 SOCIOECONOMIC RESOURCES

This Section provides information about the socioeconomic resources and population characteristics in the Project vicinity. This Section is divided into two main subsections. The first subsection, 4.12.1, describes the socioeconomic resources in the area the Project is located. Subsection 4.12.1 is further divided into six subsections: Subsection 4.12.1.1 describes the population size; Subsection 4.12.1.2 describes the race and ethnicity; Subsection 4.12.1.3 housing and household characteristics; Subsection 4.12.1.4 describes the labor force and income; and Subsection 4.12.1.5 describes industries in the Project region. The second subsection, 4.12.2, provides Project-specific information and is further divided into two subsections: Subsection 4.12.2.1 describes the staffing and annual fees paid by DWR to local entities for the Silverwood Lake State Recreation Area; and Subsection 4.12.2.2 describes where and how the power and water is utilized.

4.12.1 Project Area

The Project area is located in southwest San Bernardino County, north of the City of San Bernardino and south of the City of Hesperia, California. The Project area is accessible via Interstate-15 near Cajon Junction and near the census designated place (CDP) of Muscoy via State Highway 18 through the CDP of Crestline. Of the 3,744 acres within the existing Project boundary, 220.98 acres are NFS lands managed by the USFS as part of the SBNF. Most of the federal land is located along the San Bernardino Tunnel and Surge Chamber and Devil Canyon Powerplant Penstock areas. San Bernardino County is located in southeastern California and has the largest size of any county in California, with an area of more than 20,000 square miles of land. This subsection describes the population size, race and ethnicity, education, housing and household characteristics, labor force and income, and industries for San Bernardino County.

4.12.1.1 Population

The population of San Bernardino County increased 19.1 percent between the years 2000 and 2010, from approximately 1.7 million people to 2.0 million people. California Department of Finance (CDOF) projections indicate that population growth in San Bernardino County is expected to continue increasing to over 2.5 million people by 2030 (Table 4.12-1). Population density in San Bernardino County is largely influenced by the county's large land area (20,057 square miles) and is projected to reach 125 persons per square mile of land by 2030. The county contains rural areas with sparse populations, and urban areas where population densities are much higher. Populations for populated places (CDPs and cities) within or near the existing Project boundary are presented below.

Table 4.12-1. Historic and Forecasted Population and Population Density

San Bernardino County	2000 Census	2010 Census	Percent Change (2000 through 2010)	2020 Projection	2030 Projection	Percent Change (2010 through 2030)
Population (people)	1,709,434	2,035,210	19.1	2,227,066	2,515,972	23.6
Population Density (people/square mile)[1]	85	101		111	125	

Sources: United States Census Bureau 2000, United States Census Bureau 2010, and CDOF 2014
Note:
[1]San Bernardino County projected population density calculated with 20,057 square mile land area

There are 24 cities and 30 unincorporated areas in San Bernardino County and the Project boundary is located within north portions of the City of San Bernardino. The City of San Bernardino is the most populous city in San Bernardino County, with a population of 209,924 in 2010. The City of Hesperia is directly north of the Project area, with a population of 90,173. A portion of Crestline (a CDP) is located within the Project boundary; it has a total population of 10,770. The CDP of Lake Arrowhead is located along the State Highway 18 corridor and is a popular visitor destination. The City of Fontana, located southwest of the Project boundary, has the most dense population of the urban communities in the project area. Table 4.12-2 provides populations and population densities for cities and CDPs with populations greater than 10,000 people within 10 miles of the Project boundary.

Table 4.12-2. Selected Cities and Census Designated Places with a Population of 10,000 or More Within 10 Miles of Project Boundary, 2010

Cities and Census Designated Places	Population	Proportion of San Bernardino County (percent)	Population Density (people per square mile)
San Bernardino (City)	209,924	10.3	3,546
Crestline (CDP)	10,770	0.5	778
Hesperia (City)	90,173	4.4	1,234
Muscoy (CDP)	10,644	0.5	3,387
Lake Arrowhead (CDP)	12,424	0.6	701
Rialto (City)	99,171	4.9	4,437
Fontana (City)	196,069	9.6	4,621
Highland (City)	53,104	2.6	2,832
Colton (City)	52,154	2.6	3,403
Phelan (CDP)	14,304	0.7	238
Rancho Cucamonga (City)	165,269	8.1	4,147
Bloomington (CDP)	23,851	1.2	3,984
Victorville (City)	115,903	5.7	1,584
Redlands (City)	68,747	3.4	1,903
Loma Linda (City)	23,261	1.1	3,095
Grand Terrace (City)	12,040	0.6	3,438

Source: United States Census Bureau 2010
Key:
CDP = census designated place

<u>Age</u>

Consistent with state trends, a shift in the age distribution of residents can be observed in San Bernardino County. As shown in Table 4.12-3, the greatest number of individuals in San Bernardino County, 62.5 percent, falls between the ages of 18 and 64, and the proportion of this age group has not changed significantly since 2010. However, the population of persons under 18 years old significantly decreased and the age group of 65 years and older significantly increased between 2010 and 2014. These age groups within San Bernardino County have a similar distribution as the state as a whole, although increases in persons 65 years old and over are more pronounced in San Bernardino County than in the state as a whole.

Table 4.12-3. San Bernardino County Age Groups, 2014

Population: Age	San Bernardino County		California	
	2014 (percent of population)	2010-2014 (percent change)	2014 (percent of population)	2010-2014 (percent change)
Persons under 5 years old	7.3	-6.4	6.5	-4.4
Persons 6 to 17 years old	19.9	-7.0	17.1	-6.0
Persons 18 to 64 years old	62.5	1.0	63.5	-0.2
Persons 65 years old and over	10.3	15.7	12.9	13.2

Source: United States Census Bureau 2015

4.12.1.2 Race and Ethnicity

The racial and ethnic makeup of San Bernardino County compared to the statewide makeup is presented in Table 4.12-4. The County's population is predominantly of Hispanic or Latino origin, and White Alone (not Hispanic or Latino) is the second largest group. In San Bernardino County, those of Hispanic or Latino origin make up a larger proportion of the population than in the state as a whole. Between 2010 and 2014, American Indians and Alaskan Natives had the largest percent increases in population (81.8 percent), followed by Native Hawaiian and Other Pacific Islanders (66.7 percent).

Table 4.12-4. Regional Race and Ethnicity, 2014

Race and Ethnicity	San Bernardino County		California	
	Population (percent)	Percent Change (2010-2014)	Population (percent)	Percent Change (2010-2014)
White alone, not Hispanic or Latino	30.6	-8.1	38.5	-4.0
Black or African American alone	9.5	6.7	6.5	4.8
American Indian and Alaska Native alone	2.0	81.8	1.7	70.0
Asian alone	7.3	15.9	14.4	10.8
Native Hawaiian and Other Pacific Islander alone	0.5	66.7	0.5	25.0
Hispanic or Latino	51.7	5.1	38.6	2.7

Source: United States Census Bureau 2015

Education

Education levels in San Bernardino County and the State are displayed in Table 4.12-5. The population above the age of 25 with a high school diploma is 78.2 percent in San Bernardino County, with 18.7 percent of the population having obtained a Bachelor's degree or higher. The high school education level in San Bernardino County is slightly lower but very close to the statewide average. The college educated population percentage, or percent of persons over the age of 25 with a bachelor's degree or higher, is significantly lower than the State as a whole (United States Census Bureau 2015).

Table 4.12-5. Regional Education, 2014

Education	San Bernardino County (percent)	California (percent)
High school graduate or higher (persons age 25 years and over)	78.2	81.2
Bachelor's degree or higher (persons age 25 years and over)	18.7	30.7

Source: United States Census Bureau 2015

4.12.1.3 Housing and Household Characteristics

Table 4.12-6 provides housing and household characteristics, including housing units, homeownership rate, median home value, and median household income for San Bernardino County and the State. San Bernardino County contains over 5 percent of the State's housing units and has lower median values and higher ownership rates than the State. The number of people per household is slightly larger in San Bernardino County and median household incomes are lower than the State.

Table 4.12-6. Summary of Housing Units and Household Characteristics – San Bernardino County/State Comparison, 2014

Housing/Household	San Bernardino County	California
Housing units	708,297	13,900,766
Housing units, percent change (2010-2014)	1.24	1.61
Homeownership rate, percent	61.9	55.3
Median value of owner-occupied housing units	$222,300	$366,400
Households	603,879	12,542,460
Persons per household	3.33	2.94
Median household income	$54,090	$61,094

Source: United States Census Bureau 2015

4.12.1.4 Labor Force and Income

Labor force and income characteristics for San Bernardino County and the State are provided in Table 4.12-7. San Bernardino County contains over 4.8 percent of the civilian labor force in the state. The unemployment rate in San Bernardino County was 8.0 percent during 2014, which is higher than the state's average of 7.5 percent (California Employment Development Department 2015a). San Bernardino County per capita income is less than per capita income in the State, while the percent of persons below poverty in San Bernardino County, as estimated by the United States Census Bureau in 2014, exceed the percent of persons below the statewide poverty level.

Table 4.12-7. Civilian Labor Force, Unemployment, Income, and Poverty – San Bernardino County and California, 2014

	San Bernardino County	California
Labor Force	911,400	18,811,400
Unemployment Rate, percent	8.0	7.5
Per capita income	$21,332	$29,527
Persons below poverty[1], percent	19.2	16.4

Sources: United States Census Bureau 2015; California Employment Development Department 2015a
Note:
[1]The Census Bureau uses a set of money income thresholds that vary by family size and composition to determine who is in poverty. If a family's total income is less than the family's threshold, then that family and every individual in it is considered in poverty. The official poverty thresholds do not vary geographically, but they are updated for inflation using the Consumer Price Index.

4.12.1.5 Industry

San Bernardino County includes goods-producing, service-providing, and government industry sectors. Table 4.12-8 summarizes the percent of labor force and earnings by industry in San Bernardino County. Service-providing industries support the majority of the labor force within San Bernardino County (70.6 percent), while government and goods-producing industries comprise 16.9 and 12.5 percent of the labor force, respectively.

Table 4.12-8. Summary of San Bernardino County Industry Labor Force and Earnings, 2014

Industry	Labor Force (percent)	Earnings ($ millions)
Goods-Producing	12.5	4,137.6
Natural Resources and Mining	0.5	131.9
Construction	4.5	1,565.0
Manufacturing	7.5	2,440.7
Service-Providing	70.6	17,495.8
Trade, Transportation, and Utilities	26.6	6,922.4
Information	0.7	287.3
Financial Activities	3.4	1,136.0
Professional and Business Services	11.9	3,020.6
Education and Health Services	15.2	4,441.0
Leisure and Hospitality	9.7	1,055.7
Other Services	2.8	577.6
Unclassified	0.3	55.2
Government	16.9	6,077.6

Source: California Employment Development Department 2015b

4.12.2 Project-Specific Socioeconomic Information

As part of the Project, Silverwood Lake SRA and SWP reaches within the Project boundary contribute to the national and local economies. Revenues and expenditures for Silverwood Lake SRA and SWP reaches within the Project boundary are summarized below.

4.12.2.1 Silverwood Lake State Recreation Area

Silverwood Lake SRA annual attendance totaled 409,809 (339,772 day use and 70,037 night use) in 2014 (DWR 2014a), and 306,296 visitors (283,886 paid day use and 222,410 free day use) in 2008 (DWR 2015e). The Silverwood Lake SRA is managed by DPR Tehachapi District, in accordance with the California Davis-Dolwig Act of 1961. This Act designates DPR as the agency with the responsibility to design, construct, operate, and maintain recreation facilities associated with the SWP. Fee collection, daily operations, and routine maintenance activities are carried out by DPR. In 2008, recreation revenue sources were entrance fees, boat launching fees, camping fees, annual pass sales, special event fees, and the concessionaire permit fee. Recreation revenues totaled $954,073. The 2008 recreation fees and revenues are itemized in Table 4.12-9. DWR received no revenues.

Table 4.12-9. Recreation Revenue for Silverwood Lake State Recreation Area, 2008

Recreation Revenue Items	Recreation Fees ($)	California Department of Parks and Recreation Revenue ($)
Day Use	8.00	591,486
Boat Launch	8.00	167,134
Camping	25.00-200.00	112,836
Annual Pass	Not Reported	36,972
Special Event		3,987
Concession Permit Fee		41,656
Total Revenue		954,073

Source: DWR 2015e

Table 4.12-10 presents operating expenses for DPR in 2008. The expenses incurred by DPR in 2008 for staff wages, operations, and routine maintenance totaled $2,917,199. Nearly two-thirds of the total expenditures were for staffing costs, totaling $1,981,319. General operating and equipment expenses totaled $773,748, and facility and grounds maintenance was $162,132. DWR expenses at Silverwood Lake SRA, for general operating and maintenance expenses, totaled $10,824 in 2008.

Table 4.12-10. California Department of Parks and Recreation Operating Expenses at Silverwood Lake State Recreation Area, 2008

Operating Cost Items	California Department of Parks and Recreation Expenses ($)
Salaries, Wages & Benefits	1,981,319
General Operations and Equipment Expense	773,748
Facility and Grounds Maintenance	162,132
Total DPR Expenditures	2,917,199

Source: DWR 2015e

4.12.2.2 Use of Project Power and Water

Project power generation and local water deliveries contribute to socioeconomic resources by providing energy and water for local use. In addition, Silverwood Lake regulates SWP water that is delivered to various SWP contractors within and downstream of the Project. Project power generation and local water deliveries are discussed below.

Power Generation

The Devil Canyon Powerplant is primarily operated as an energy-recovery plant, and the quantity of power generation within a given year ties directly to the quantity of water deliveries within that year. The Devil Canyon Powerplant generated 217 GWh in 2014 and generated an annual average of 946 GWh from 2000 through 2014 (Table 3.6-1).

Local Water Deliveries

The large majority of outflows from Silverwood Lake are released into the San Bernardino Tunnel, where they are conveyed to the Devil Canyon Powerplant, then to SWP contractors. Local diversions include delivery to CLAWA (local water right diversions [including delivery to the Silverwood Lake SRA] and SWP contract delivery, combined) and MWA (SWP contract delivery). MWA also has the capacity to receive a portion of its deliveries of SWP water from the Mojave River, downstream of Silverwood Lake, via water released from Silverwood Lake through the Cedar Springs Dam. Table 3.2-1 shows annual project deliveries from Silverwood Lake to local water users for calendar years 2000 through 2014, see Section 3.0 for additional information.

4.13 TRIBAL RESOURCES

This Section provides information regarding existing tribal resources. Besides this general introductory information, this Section includes two main sub-sections. Sub-section 4.13.1 describes known or potential Project effects on Native American Tribes and Sacred Lands. Sub-section 4.13.2 describes existing, relevant and reasonably available information found by DWR regarding Indian Trust Assets (ITAs), TCPs, and agreements within the existing Project boundary and a 0.25-mile-wide buffer around the boundary. The buffer was examined to provide information regarding tribal resources in the general vicinity of the Project boundary and to allow for flexibility in Project planning.

Tribal resources are primarily ITAs, TCPs, and agreements that may exist between tribes and other entities. ITAs are legal interests in property held in trust by the United States for Indian tribes or individual Native Americans. The U.S. Secretary of the Interior, acting as the trustee, holds many assets in trust. ITAs can be real property, physical assets, or intangible property rights. Examples of ITAs are lands, including reservations and public domain allotments; minerals; water rights; hunting and fishing rights; other natural resources; and money or claims. While most ITAs are on reservations, they may also be found off-reservation. A characteristic of an ITA is that it cannot be sold, leased, or otherwise alienated without the United States government's approval. ITAs do not include things in which a tribe, or an individual, does not have legal interests. For example, off-reservation sacred lands or archaeological sites in which a tribe has no legal interest are not ITAs.

TCPs are explained and defined in Parker and King (1998:1) as follows:

> One kind of cultural significance a property may possess, and that may make it eligible for inclusion in the [National] Register, is traditional cultural significance. "Traditional" in this context refers to those beliefs, customs, and practices of a living community of people that have been passed down through the generations, usually orally or through practice. The traditional cultural significance of a historic property, then, is significance derived from the role the property plays in a community's historically rooted beliefs,

customs, and practices. Examples of properties possessing such significance include:

- A location associated with the traditional beliefs of a Native American group about its origins, its cultural history, or the nature of the world;
- A rural community whose organization, buildings and structures, or patterns of land use reflect the cultural traditions valued by its long-term residents;
- An urban neighborhood that is the traditional home of a particular cultural group, and that reflects its beliefs and practices;
- A location where Native American religious practitioners have historically gone, and are known or thought to go today, to perform ceremonial activities in accordance with traditional cultural rules of practice; and
- A location where a community has traditionally carried out economic, artistic, or other cultural practices important in maintaining its historic identity.

A TCP, then, can be defined generally as one that is eligible for inclusion in the NRHP because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community.

Agreements are contracts between a tribe and private land owner or land-managing agency that provide tribes with access to a landowner or agency's property for fishing, gathering of traditional plants, or other tribal practices.

4.13.1 <u>Potentially-Affected Native American Tribes and Sacred Lands</u>

DWR contacted the NAHC on June 1, 2015 to obtain a list of tribes and individual tribal members who may have an interest in the Project, and to request a search of the NAHC's files for a list of any known sacred lands that may be within the Project boundary or buffer. The NAHC provided the tribal contacts listed in Table 4.13-1 in a letter dated July 17, 2015.

Table 4.13-1. Tribal Contacts Provided by the Native American Heritage Commission

Gabrieleno Band of Mission Indians - Kizh Nation Andrew Salas, Chairperson P.O. Box 393 Covina, CA 91723	Gabrielino/Tongva Nation Sam Dunlap, Cultural Resources Director P.O. Box 86908 Los Angeles, CA 90086
Gabrielino/Tongva Nation Sandonne Goad, Chairperson 106 1 /2 Judge John Aiso Street Los Angeles, CA 90012	Gabrielino/Tongva San Gabriel Band of Mission Indian Anthony Morales, Chairperson P.O. Box 693 San Gabriel, CA 91778
Morongo Band of Mission Indians Robert Martin, Chairperson 12700 Pumarra Road Banning, CA 92220	Morongo Band of Mission Indians Ernest H. Siva, Tribal Elder 9570 Mias Canyon Road Banning, CA 92220
Morongo Band of Mission Indians Denisa Torres, Cultural Resources Manager 12700 Pumarra Road Banning, CA 92220	San Fernando Band of Mission Indians John Valenzuela, Chairperson P.O. Box 221838 Newhall, CA 91322
San Manuel Band of Mission Indians Daniel McCarthy, M.S., Director-CRM Dept. 26569 Community Center Drive Highland, CA 92346	San Manuel Band of Mission Indians Lynn Valbuena, Chairwoman 26569 Community Center Highland, CA 92346
Serrano Nation of Mission Indians Goldie Walker, Chairwoman P.O. Box 343 Patton, CA 92369	

Source: NAHC 2015.

In July 2015, all individuals and organizations included on the NAHC list were mailed letters of introduction to the Project and relicensing, and questionnaires to solicit information and concerns about the Project (Appendix B). DWR is not aware of any other tribes or tribal members that may be interested in the Project relicensing.

The NAHC stated that there are no known sacred lands listed in their files within the existing Project boundary or buffer area.

4.13.2 Known Indian Trust Assets, TCPs, and Agreements

Research on tribal resources was conducted by DWR between June 23, 2015 and July 29, 2015. This included a records search at the SCCIC at California State University Fullerton, as detailed in Section 4.11. DWR reviewed cultural resources records, site location maps, General Land Office plats, NRHP listings including Determination of Eligibility lists, CRHR listings, OHP Historic Property Directory, and the list of DPR holdings for San Bernardino County, California.

Additional research was conducted at the San Bernardino County Library and the BIA's GIS database to review any references or data relevant to the history, tribal occupation, tribal lands, or other ITAs within the Project boundary and buffer. Although DWR found numerous source documents regarding prehistoric tribal occupation and prehistoric archaeological resources, no documents were encountered that identified known or potential ITAs, TCPs, or agreements as defined above.