5.0 ENVIRONMENTAL ANALYSIS INTRODUCTION

This section addresses 14 environmental resource areas, and for each describes: (1) existing Project conditions, which represent the baseline against which to compare the effects of DWR's Proposal; (2) the potential effects of DWR's Proposal on environmental resources, and (as applicable) any PM&E measures to mitigate or eliminate the potential adverse effects of DWR's Proposal on those resources; and (3) unavoidable adverse effects, if any, that would result from DWR's Proposal, including whether the effect is short- or long-term, minor or major, and cumulative or site-specific.

To develop this section, DWR used existing and relevant information included in its PAD or that has become available since the PAD was issued, information derived from DWR's FERC-approved studies, and other information otherwise obtained or developed by DWR.

Section 5.0 is subdivided into the following resource areas:

- Geology and Soils (Section 5.1)
- Water Resources (Section 5.2)
- Fish and Aquatic Resources (Section 5.3)
- Terrestrial Resources (Section 5.4)
    - Botanical and Wildlife Resources (Section 5.4.1)
    - Wetlands, Riparian, and Littoral Resources (Section 5.4.2)
    - Federal ESA [Endangered Species Act], Listed and Candidate Species (Section 5.4.3)
- Recreation Resources (Section 5.5)
- Land Use and Management (Section 5.6)
- Aesthetic Resources (Section 5.7)
- Cultural and Tribal Resources (Section 5.8)
- Socioeconomics (Section 5.9)
- Air Quality (Section 5.10)
- Noise (Section 5.11)

A full list of references cited in each of the 14 subsections is included at the end of this exhibit.

5.1 GEOLOGY AND SOILS

This discussion of geology and soils is presented in three sections: Section 5.1.1 discusses the existing Project environment. Section 5.1.2 addresses the effects of DWR's Proposal and DWR's PM&E measures. Section 5.1.3 describes any unavoidable Project effects. DWR did not conduct any studies related to geology and soils because DWR has determined that existing, relevant, and reasonably available information is sufficient to determine the potential effects of the Project on geology and soils, and to inform any relevant requirements for the new license.

5.1.1 Existing Environment

The following discusses existing conditions relating to the Project's regional geologic setting.

5.1.1.1 Tectonic History

Southern California's current geologic features are a product of long-term tectonic activity associated with episodic subduction, which lasted from about 438 million years ago (mya) to about 144 mya (Paleozoic to the Mesozoic eras) (Atwater 2000). Formation of California's geologic features and present-day landscape is the result of a myriad of tectonic forces, including the accretion of seafloor crust, oceanic sediments and island arcs along the western margin of the North American continent, their subsequent uplift, intrusion by granitic batholiths, periods of volcanism, horizontal translational displacement and concurrent erosion (DWR 2009).

During the late Precambrian Era (approximately 700 mya), the basement rock of the North American continent rifted away from the Rodinia supercontinent, exposing the west coast of North America to the world's oceans. During the Mesozoic Era (about 252 to 66 mya), the ancestral southern California coast lay along a subduction zone of island arcs and volcanoes, similar to that currently along southern Alaska or north of Australia. Much of the bedrock of California formed during Mesozoic 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), California's continental margin was exposed, and a lowland of meandering rivers and floodplains developed. By early Miocene (about 23 mya), sea levels rose again, covering the continental margin, and marine sediments were again deposited. The region's geologic features were then further altered by transform (strike-slip) movement along the Pacific and North American Plate boundary, (i.e., along the proto-San Andreas fault). Starting about 20 mya, the subduction fault system between the Pacific and North American Plates was gradually replaced by the transform motion along 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, the Transverse Ranges, became trapped in the shear between the North American and Pacific plates. This slice of 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 along the San Andreas fault, causing the ongoing tilting, folding and relatively rapid 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.

5.1.1.2 Geomorphic Setting

Geomorphology is the study of the physical features of the Earth's surface and their relationship with underlying geological structures. Ground surface characteristics of the Project region are strongly influenced by the regional geology.

The Project is located in the western end of the San Bernardino Mountains, approximately 5 to 10 miles east of Cajon Pass. The San Bernardino Mountains comprise the eastern portion of the Transverse Ranges Geomorphic Province (Figure 5.1-1), a geologically complex region of southern California. The Transverse Ranges are characterized by east-west oriented mountain ranges (e.g., the San Gabriel and San Bernardino mountains) and valleys. This orientation is in sharp contrast to the northwest-trending mountains and valleys typical of the Coast Range, Peninsular Range, and Sierra Nevada provinces and much of the rest of the State.

The Transverse Ranges are divided into western and eastern ranges by the northwest-trending San Andreas fault and resultant Cajon Valley. The Project is located approximately 5 to 10 miles east of Cajon Valley, in the western portion of the San Bernardino Mountains. To the north of the Transverse Ranges are the Coast Ranges and the Mojave Desert provinces, including Antelope and Summit valleys immediately adjacent to the Project area. To the south is the Peninsular Ranges province that includes the San Bernardino Valley.

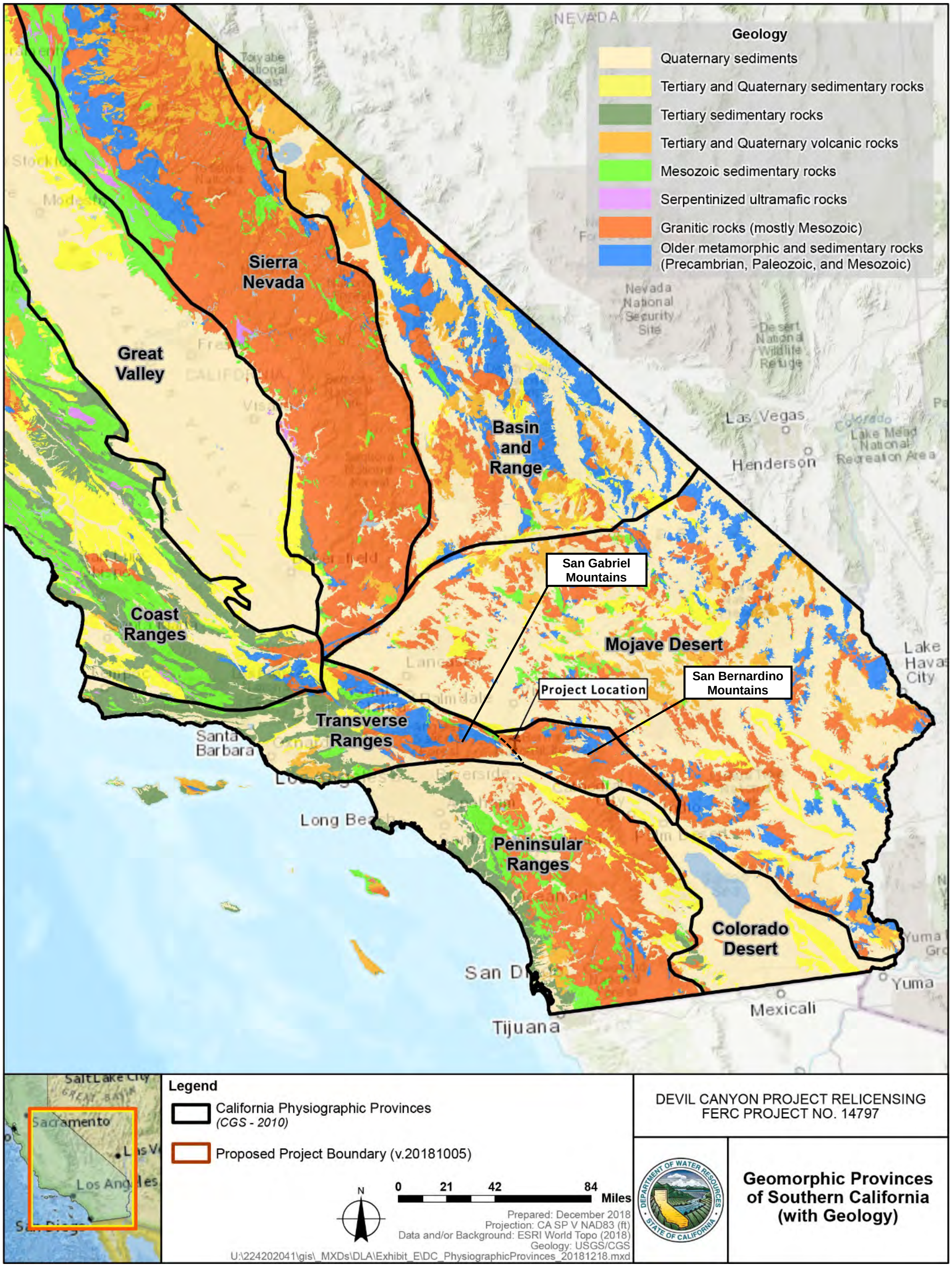


Figure 5.1-1. Geomorphic Provinces of Southern California (with Geology)

5.1.1.3 Seismic Setting

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.

The most prominent tectonic feature associated with the Project is the San Andreas Fault Zone. Segments of the main trace of the San Andreas fault pass through the southernmost portion of the Project alignment and divide the Transverse Ranges province (see Figure 5.1-2). This fault is a right-lateral strike-slip (transform) structure 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 its termination at the Mendocino triple-junction, marking the boundary between the North American and Pacific Ocean tectonic plates.

Ongoing intense north-south compressional tectonic forces associated with the “Big Bend” of the San Andreas fault are causing relatively fast uplift of the Transverse Ranges’ mountain blocks, and as a result have developed the characteristically steep terrain of this province (California Geological Society 2002a as cited in DWR 2009).

Significant earthquakes (magnitude [M] 6.0 or greater on the Richter scale) within 62 miles of the Project have occurred historically on the six faults described in the following paragraphs and are summarized in Table 5.1-1. Of note, the 1994, M 6.4 Northridge earthquake occurred on a “blind thrust” fault, which is a reverse fault not visible at the ground surface, beneath the San Fernando Valley, approximately 70 miles west of the Project.

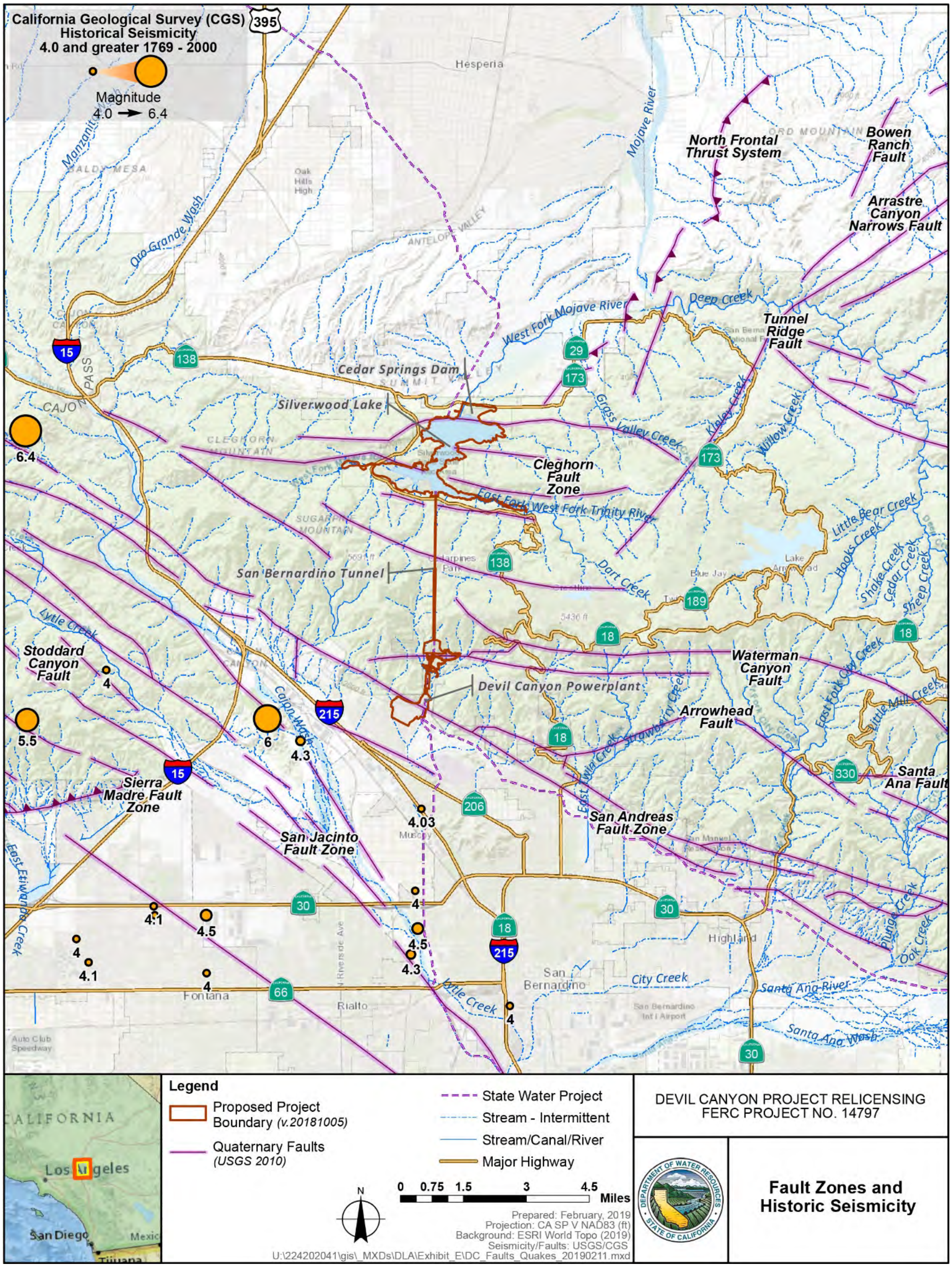


Figure 5.1-2. Fault Zones and Historic Seismicity in the Project Vicinity

Table 5.1-1. Historic Significant (≥M 6.0) Earthquakes in Southern California

Fault Name	Distance (miles) / Direction from Project	Historic Event Date	Historic Event Magnitude	Comments
San Andreas	0	1857	M 7.9	Fort Tejon earthquake caused a 225-mile-long rupture from Parkfield to at least Cajon Pass
San Jacinto	5 / SW	1899 1918 1968 1987	M 6.7 (est.) M 6.8 (est.) M 6.4 M 6.6	Fault merges with San Andreas in Cajon Pass; most seismically active fault in southern California.
San Fernando	55 / W	1971	M 6.6	Fault is a segment of the Sierra Madre-Cucamonga fault that comes within about 10 miles of the Project
Whittier-Elsinore	25 / SW	1910	M 6.0 (est.)	One of longest, but least active faults in southern California
Newport-Inglewood	50 / SW	1934	M 6.4	Fault extends to San Diego after merging with Rose Canyon fault south and offshore of Newport Beach.
Faults of the Mojave Desert	45-60 / NE	1992	M 7.3	--

Source: SCEDC 2015
Key:
≥ = greater than or equal to
est. = estimated
M = magnitude
NE = northeast
SW = southwest
W = west

San Andreas Fault Zone

The San Andreas fault passes through the Project area along the southern base of the San Bernardino Mountains. Segments of the fault pass through the Powerplant and Afterbay area. The largest historic earthquake to affect southern California was the estimated M 7.9 Fort Tejon earthquake of 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 5.1-2), northwest of the City of San Bernardino and approximately 6 miles from the Project. The 1857 M 7.9 earthquake, along with the 1906 San Francisco M 7.9 earthquake of northern California are the two largest fault ruptures in California history (SCEDC 2015).

San Jacinto Fault

The San Jacinto fault, located less than 5 miles southwest of the Project (Figure 5.1-2), merges with the San Andreas fault in the vicinity of Cajon Pass. Though not as prominent relative to the Project, it 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).

San Fernando Fault

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 system is located about 55 miles west of the Project area; however, the Cucamonga segment of the Sierra Madre-Cucamonga fault is located less than 10 miles from the Project (SCEDC 2015).

Whittier-Elsinore Fault

The Whittier-Elsinore fault is located approximately 25 miles southwest of the Project (outside area shown in Figure 5.1-2). Though it is one of the largest fault zones in southern California, extending about 135 miles, it is one of the least active historically. Historical records indicate that an estimated M 6.0 occurred on the Elsinore fault in 1910 (SCEDC 2015).

Newport-Inglewood-Rose Canyon Fault

The Newport-Inglewood-Rose Canyon fault is located about 50 miles southwest of the Project (outside area shown in Figure 5.1-2). 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).

Faults of the Mojave Desert

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 about 45 to 60 miles northeast of the Project (outside area shown in Figure 5.1-2) (SCEDC 2015).

5.1.1.4 Local Geologic Setting

The Project is located within the San Bernardino Mountains, a range that comprises mainly granitic and metamorphic rocks of Mesozoic age. Tertiary to Quaternary continental sediments along with older (Pleistocene) and younger (Holocene) alluvium are found locally within structural troughs and underlying valley floors of the mountain range (Figure 5.1-3) (DWR 1994). 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 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. The San Bernardino Mountain block has been uplifted along a system of high-angle reverse and normal faults that are subparallel to the San Andreas fault. In a broad sense, the mountain mass appears to have a northward tilt toward the bordering Mojave Desert province (DWR 1994). Rugged mountain terrain with steeply sloped valley walls characterizes the largest part 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. While the deposits consist primarily of sandy gravel, boulders up to 15 feet in diameter and larger are present. Individual clasts are usually unweathered, hard, and strong. These relatively young alluvial materials are usually unconsolidated and highly permeable (DWR 1995).

On the north side of the Project, the mountain slope rises abruptly to an elevation of 3,620 feet at Cleghorn Ridge. Steep cobble-filled channels dissect rocky slopes rising from the West Fork Mojave River 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. Holocene alluvium that underlies the nearly level Mojave River floodplain is estimated to be 20 feet deep at the former site of the town of Cedar Springs. The floodplain alluvium is composed of easily eroded sands with interbedded colluvium and 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. Patches of shallow residual soil with intermingled boulders and disjointed rock outcrops characterize the slopes. Localized slope failures are common (DWR 1995).

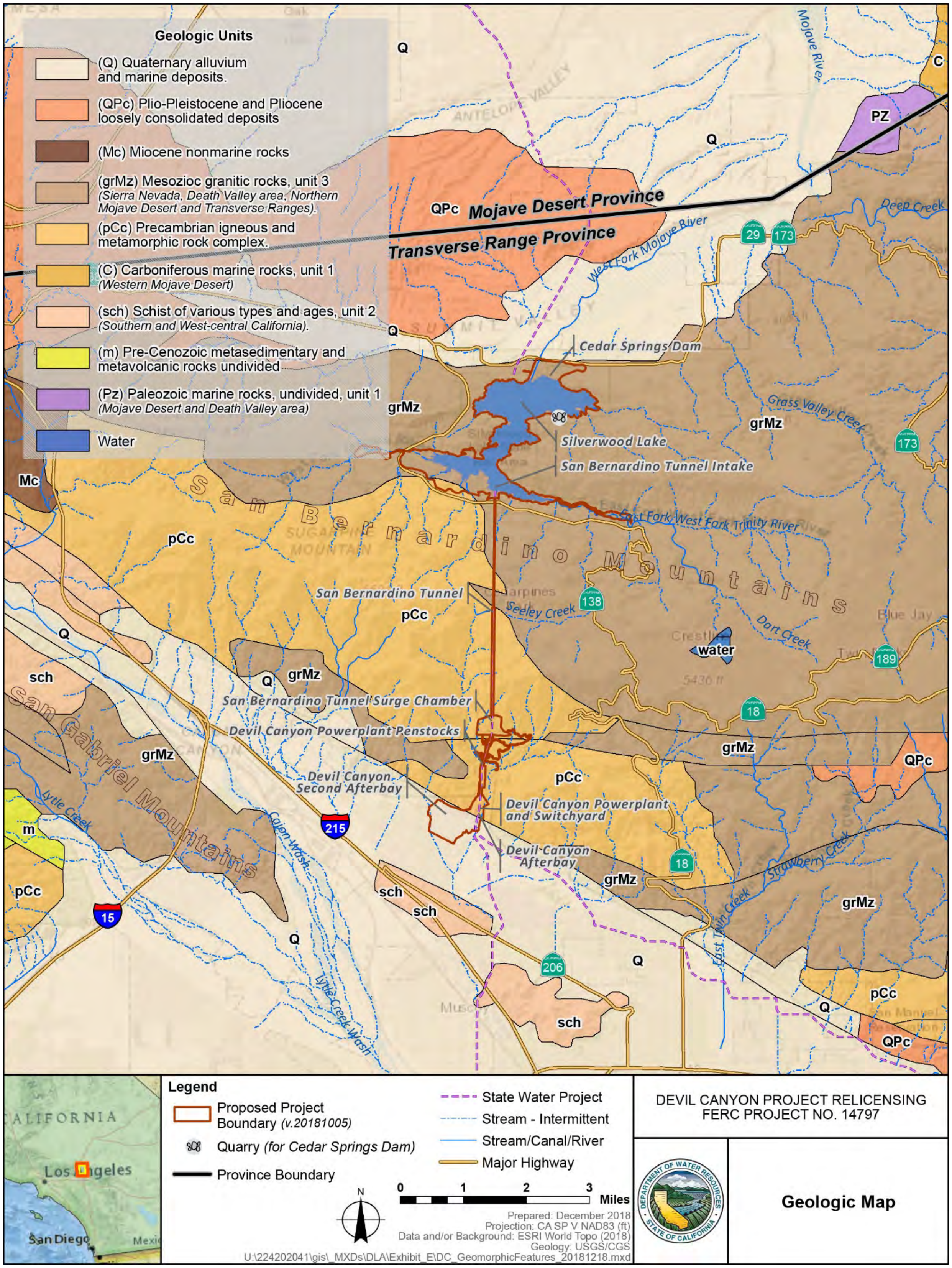


Figure 5.1-3. Geologic Map of the Project Area

On the south side of the San Bernardino Mountains, residual soils, stream gravels, and fanglomerates occur as irregular caps on ridges, or form terraces and benches adjacent to ephemeral streams. Older residual soils occur in areas of slight erosion and commonly consist of silty or clayey sands that usually grade into deeply weathered gravels and sands. These soils are typically found in 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 in diameter and larger 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).

General Bedrock Conditions

Geologic materials that comprise the San Bernardino Mountains (Figure 5.1-3) consist of Precambrian rocks that were intruded during Paleozoic to Mesozoic time and metamorphose by granitic igneous rocks that have subsequently been uplifted to their current elevations primarily during Cenozoic time. The metamorphic rocks of the area 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.

Paleozoic to Mesozoic gneissic and granitic (granodiorite and quartz monzonite) bedrock (Figure 5.1-3) scattered throughout the granite-gneiss complex are pods of late Paleozoic marble (DWR 1974). 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. The granitic rock units range from light-gray quartz monzonite to darker-colored quartz diorite with a poorly to moderately well-developed foliation. When fresh, the bedrock is white or pink to nearly black. Pegmatite dikes and sills occur frequently throughout the unit.

The near-surface bedrock formations 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 below ground surface. Though hard and strong when massive and unweathered, the many joints and shears present in the rocks of the area contribute to the degree of weathering and significantly reduce the overall rock strength. Rock adjacent to and within fault zones may be sheared, crushed, and is commonly deeply weathered (DWR 1995).

Surface Deposits

In the Cedar Springs Dam – Silverwood Lake areas of the northern portion of the Project area, Tertiary to Quaternary period continental (non-marine) sediments are found in fault-bound structural troughs and beneath the valley floors (Figure 5.1-3) (Glick 2010). In the Project area, these sediments include the Crowder Formation, and older and recent alluvium.

The Plio-Pleistocene age Crowder Formation is white to slightly pinkish, poorly indurated and well-bedded, arkosic sandstone with interbedded pebble to cobble conglomerate derived from the distinctive Mesozoic Sidewinder Volcanics and a Paleozoic quartzite derived from the north (Barry 2012).

Older stream deposits and fanglomerates of boulders, gravels, and sands are typically found topographically higher than present stream deposits as the older deposits have been eroded by more recent stream flows. These deposits are generally classified as gravels with minor silt or clay; however, boulders 4 to 8 feet in diameter and larger are present. Individual clasts are commonly weathered and occasionally decomposed. Depending on the age of the deposit, these deposits vary from being unconsolidated to well consolidated (Miller 2001). Banks of some of these deposits have been observed to stand as slopes up to 37 degrees, indicating that they are relatively well consolidated (Martinez 2014).

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

In the vicinity of Cedar Springs Dam, two Quaternary units overlie the bedrock and Crowder Formation deposits. The higher of the two Quaternary units is the oldest (about 500,000 years old) and therefore has been overturned. It is distinguished by its deeply incised geomorphic surface, and bright red soils on remnants of a preserved stable surface. 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 on the south side of the San Bernardino Mountains, surficial alluvial deposits are generally restricted to natural drainage channels, to the vicinity of the Devil Canyon Second Afterbay, and the alluvial fan apron at the base of the mountain front (DWR 1995).

<u>Soil Types</u>

Residual soils, stream gravels, and fanglomerates are found as irregular cappings on the ground surfaces. These deposits form terraces and benches adjacent to active streams, or fan-shaped deposits at the mouth of mountain canyons. Residual soils form in-place by the weathering of the underlying bedrock. Such soils are typically found in areas of slight erosion. They consist commonly of silty or clayey sands that grade downward to deeply weathered bedrock.

In general, soils derived from the weathering of the granitic and metamorphic 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.

Paleontology

The bedrock units associated with the Project area are intrusive igneous and metamorphic 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).

5.1.1.5 Cedar Springs Dam and Silverwood Lake Area

Bedrock, Surface Deposits and Soil Types

Bedrock

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 5.1-3). Bedrock foliation in the region strikes 70 degrees west of north and dips 5 to 15 degrees to the northeast, 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 slightly weathered to fresh rock is at a depth of only 4 feet (Glick 2010).

The granitic rock units range from light-gray quartz monzonite to darker-colored quartz diorite. Weathering depths vary from shallow on steep slopes to relatively deep in the river 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 5.1-3). The quarry wall, with a maximum of 10, 20-foot-wide benches, appears in aerial photographs to be stable and not eroding (Barry 2011).

Surface Deposits

In the Cedar Springs Dam area and around Silverwood Lake is the Plio-Pleistocene time 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 that contains Silverwood Lake, the Crowder Formation dips steeply southward and is overturned against a high-angle fault 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 primarily of sandy gravel to gravelly sand and colluvium deposits that cumulatively average about 30 feet thick; however, these deposits were found to be as much as 50 feet thick near the base of the dam abutments (Glick 2010).

Older (Pleistocene) alluvium deposits along the former banks of the Mojave River are remnants of river terraces formed during wetter times. 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).

Soil Types

Soil survey data indicate that most of the soils around Cedar Springs Dam and Silverwood Lake are derived primarily from the weathering of the granitic bedrock and alluvium. Bedrock-derived soils consist generally 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 stratified well-drained to excessively drained 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/alluvial soils of silty, sandy, and gravelly alluvium lie in the submerged bed of the Mojave River (USDA 2018).

A U.S. Department of Agriculture (USDA)-National Resources Conservation Service (NRCS) Custom Soil Resource Report of the Silverwood area is presented in Appendix B. The soil series units found around Cedar Springs Dam and Silverwood Lake are summarized in Table 5.1-2. Figure 5.1-4 illustrates the higher order grouping of the soil families discussed.

Table 5.1-2. Soil Types Mapped Adjacent to Cedar Springs Dam and Silverwood Lake

Soil Family (symbol)	Parent Material	Geomorphic Position	Slope (%)	Elevation (feet)	Mean Annual Precipitation (inches)	Mean Annual Temperature (°F)	Drainage
Modesto-Osito (CmE)	Granodiorite	Slopes	15-30	1,800-2,400	15-25	55-64	Well drained
Osito-Modesto (CmF)	Sandstone-Granite	Slopes	30-50	1,800-4,200	15-25	55-64	Well drained
Pacifico-Wapi Complex (DaF)	Granodiorite	Mountain flank	30-50	5,000-8,000	20-35	46-54	Somewhat excessively drained
Pacifico-Wapi – Rock Outcrop Complex (DaG)	Granodiorite	Mountain flank	50-70	4,000-7,800	20-35	46-54	Somewhat excessively drained
Trigo – Warm Complex (DnF)	Granodiorite	Slopes	30-50	1,790-6,400	10-20	55-64	Somewhat excessively drained
Trigo – Warm Complex (DnG)	Granodiorite	Slopes	50-75	1,790-6,400	10-20	55-64	Somewhat excessively drained
Avawatz-Oak Glen – Dry (PsD)	Alluvium	Toe slope	2-15	3,200-6,000	10-20	55-64	Excessively drained

Source: USDA 2018
Key:
% = percent
°F = degrees Fahrenheit

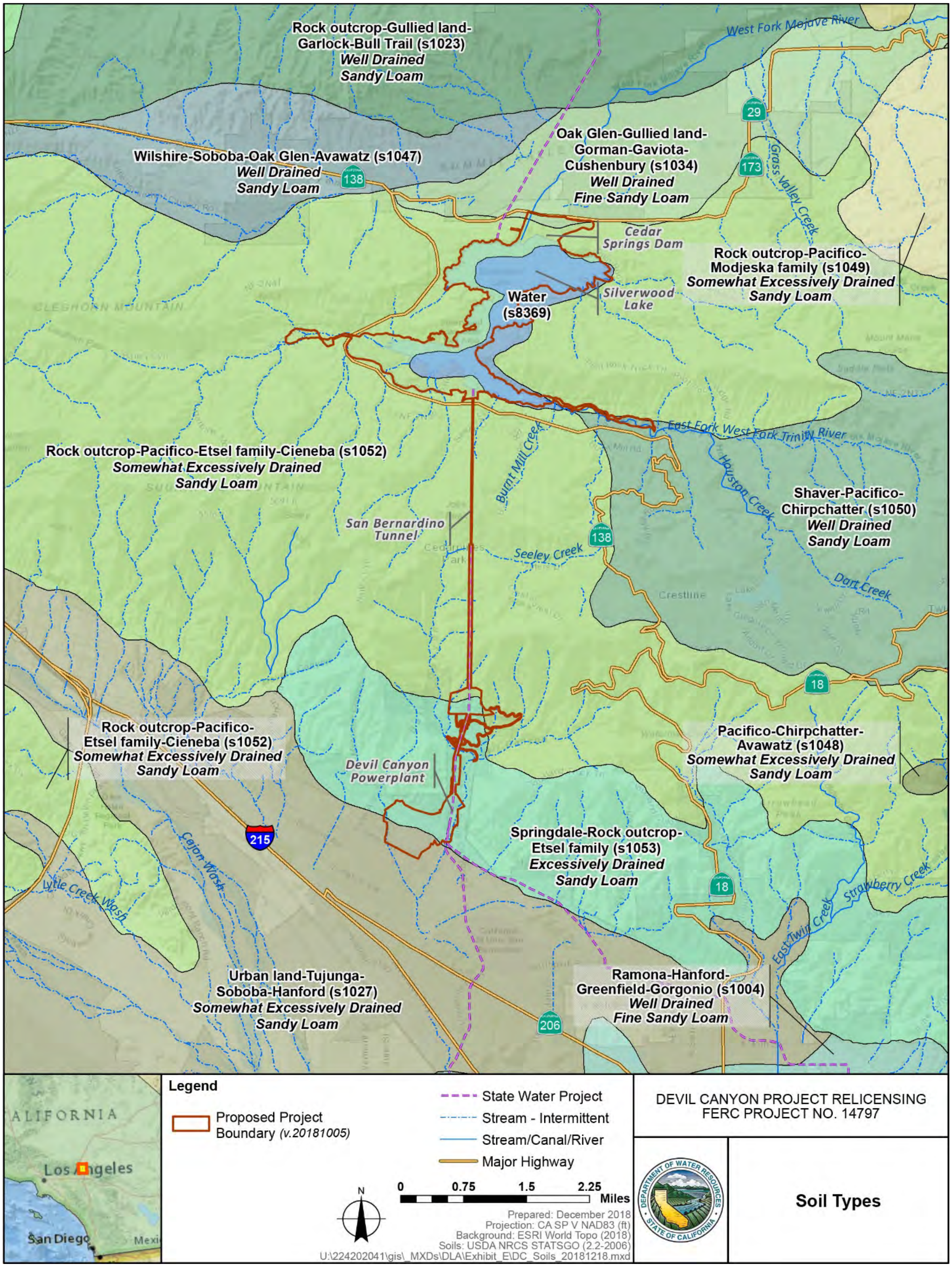


Figure 5.1-4. Soils Types of the Project Area

Faulting and Seismic Considerations

In the Cedar Springs Dam area, the structural bedrock fabric 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 considered a critical structure to Cedar Springs Dam. The WSLFZ 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 status of the east strand of the WSLFZ is less clear 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 appear to juxtapose different rock types, it is difficult to determine if this connection exists (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 5.1-2). The Cleghorn Fault Zone is considered to be the most recently active fault within the vicinity of the reservoir, with displacement appearing 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. It appears that late Pleistocene left-lateral slip has occurred along this structure. This sense of motion is consistent with its trend, which is parallel to the left-lateral Cleghorn fault; however, stratigraphic and possible geomorphic offsets near Cedar Springs Dam have been interpreted to be consistent with either right- or left-lateral activity. Based on 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 periodically 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 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 summarizing their safety evaluations for each dam along with recommendations for further study, as needed. Based on these recommendations, DWR prepares and implements action plans to address any potential safety concerns.

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

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 review of Project documents and visual reconnaissance of site conditions to develop a comprehensive list of potential failure modes at the dam. The PFMA for Cedar Springs Dam was most recently conducted in 2014.

From the FERC review process, three main documents are generated: the FERC Part 12D Safety Inspection Report; the PFMA report; and the Supporting Technical Information Document (STID). The STID 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. This information is filed with FERC and is considered Critical Energy/Electric Infrastructure Information (CEII).

Erosion and Sedimentation

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

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.

Silverwood Lake 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 (Exhibit B, Project Operations and Resource Utilization: Cedar Springs Dam and Silverwood Lake) (DWR 2006).

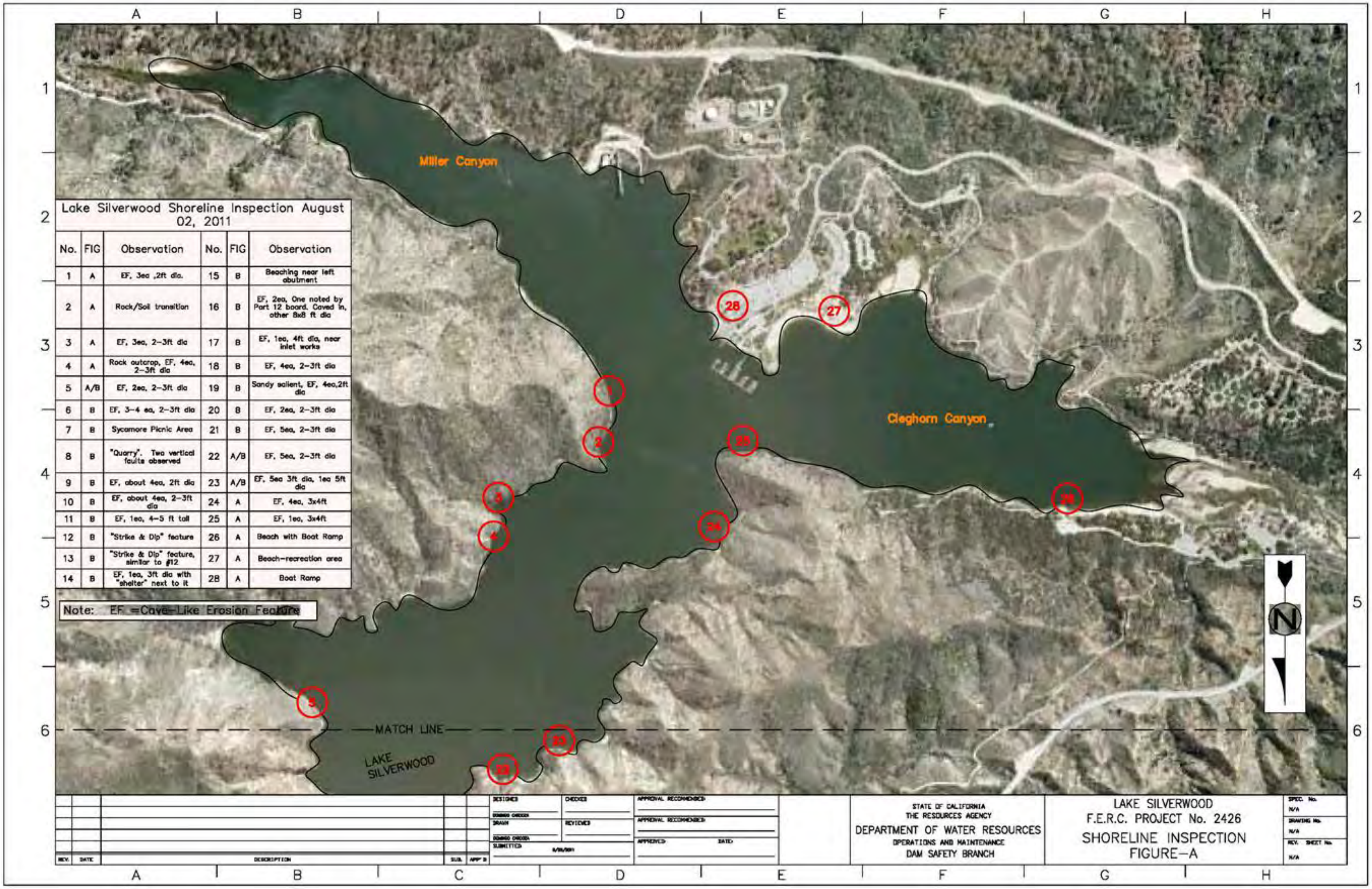
In some areas of the lake shoreline, wave erosion has locally removed top soil, slopewash, and/or colluvium, exposing the underlying bedrock (DWR 2006). On August 2, 2011, DWR conducted a shoreline geologic inspection by boat and by foot to assess overall shoreline stability and local erosion conditions 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 5.1-5 through 5.1-7.

The geologic inspection 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 alluvial Crowder Formation, none of which generally experiences 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 was 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 steeply 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 inspection 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). Areas of significant erosion located near the left abutment of the dam during the inspection were repaired and stabilized in November 2015 (Figure 5.1-7).

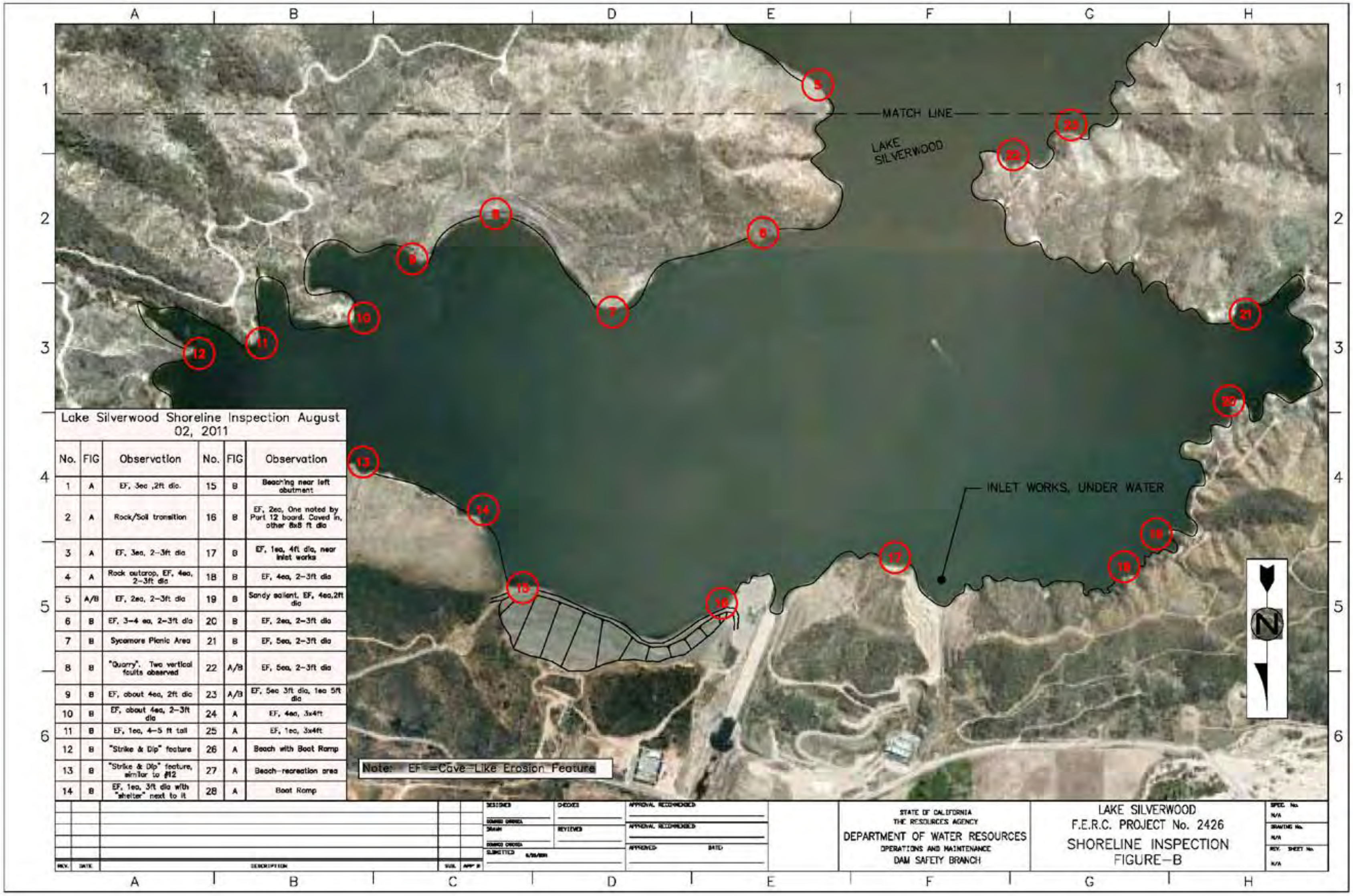
On November 20, 2014, a visual site inspection of the Cedar Springs Dam along with its appurtenant structures was performed as part of the Eighth Five-Year Part 12D Safety Inspection. As noted in the subsequent report, the field inspection team concluded that the reservoir rim appears to be in satisfactory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



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 5.1-5. Silverwood Lake Shoreline Inspection (Map 1 of 2)



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 Port 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 5.1-6. Silverwood Lake Shoreline Inspection (Map 2 of 2)

Figure 5.1-7. 2015 Erosion and Stabilization Repair of Silverwood Lake Shoreline

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

There currently is no available record of sedimentation rates at Silverwood Lake. Where streams and creeks enter the lake, deltaic deposits of sand and gravel accumulate. A considerable amount of vegetation debris was carried into Silverwood Lake during the winter 2005-2006 storm events, which led to a temporary closure of the lake to recreational activities. In conjunction with the Federal Emergency Management Agency (FEMA), DWR took emergency protective measures to secure Silverwood Lake SRA facilities and mitigate the potential effects of those storm events on public safety, water quality, and operations and maintenance.

5.1.1.6 San Bernardino Tunnel, Intake, and Surge Chamber

Bedrock, Surface Deposits and Soil Types

Bedrock

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 5.1-3). Scattered throughout the granite-gneiss complex are pods of late Paleozoic marble (DWR 1974). 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 to severely weathered, weak, and friable. At depth and away from fracture zones, the rock is fresh, hard, strong, and well jointed to blocky. The marble is commonly moderately weathered, hard and blocky (DWR 1974).

Surface Soils and Soil Types

Given the subterranean nature of the tunnel, intake and surge chamber, surface deposits and soil types are not applicable.

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. Generally east-west trending and steeply north dipping faults cross the tunnel alignment and juxtapose the granite-gneiss complex against the marble (DWR 1974).

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 and sedimentation, which at times is exacerbated by heavy rains and loss of vegetation due to fire.

Given the subterranean nature of the tunnel and surge chamber, erosion and sedimentation issues are not applicable. Sedimentation in Silverwood Lake in the area around the intake tower should be monitored to ensure proper operation of the intake mechanisms. Project roads in the Silverwood Lake area are subject to short- and long-term maintenance. Short-term maintenance activities are conducted annually, periodically or seasonally, as needed to address potential erosional issues. Long-term maintenance activities addressing more significant erosional issues are typically undertaken in addition to short-term activities (DWR, 2018).

5.1.1.7 Devil Canyon Penstocks, Powerplant and Afterbays

Bedrock, Surface Deposits, and Soil Types

Bedrock

Bedrock along the penstocks consists primarily of moderately to deeply weathered meta-diorite of the granite-gneiss complex and marble (Figure 5.1-3). 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 5.1-2). Rock in the fault zone consists of crushed granite-gneiss, marble, serpentine, clay gouge, 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 2014a). It ranges in color from pinkish white to rusty brown, is 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 1995 and 2001).

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 1995 and 2001).

The late Paleozoic (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 tends to break down when handled by equipment (DWR 1995 and 2001).

Surface Materials

Older alluvium (Pleistocene) 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 ranges from intensely weathered/decomposed rock to fresh and hard rock (DWR 1995 and 2001).

Young alluvium (early to late Holocene) 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 1995 and 2001).

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 1995 and 2001).

Soil Types

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 (USDA 2015). 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 Devil Canyon Powerplant and Devil Canyon 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 C (USDA 2015). A map showing the soil series around the Devil Canyon facilities is shown in Figure 5.1-4 illustrates the higher order grouping of the soil families discussed and data are summarized in Table 5.1-3.

Table 5.1-3. Soil Types Mapped Adjacent to the Devil Canyon Penstocks, Powerplant, and Afterbays

Soil Family (symbol)	Parent Material	Geomorphic Position	Slope (%)	Elevation (feet)	Mean Annual Precipitation (inches)	Mean Annual Temperature (°F)	Drainage
Cieneba – Rock Outcrop Complex (Cr)	Granite	Mountain slopes	30-50	500-5,500	10-39	45-64	Somewhat excessively drained
Osito-Modesto (CmF)	Sandstone	Slopes	30-50	1,800-4,200	15-25	55-64	Well drained
Trigo – Warm Complex (DnG)	Granodiorite	Slopes	50-75	1,790-6,400	10-20	55-64	Somewhat excessively drained
Riverwash-Soboba (EsD)	Alluvium	Alluvial flats	2-15	1,600-4,000	15-25	55-64	Excessively drained
Springdale (FLG)	Granite	Mountain flanks	50-75	3,000-7,000	15-25	46-54	Somewhat excessively drained
Hanford (HaC)	Alluvium from granite	Alluvial fans	2-9	150-900	10-20	63	Well drained
Hanford (HaD)	Alluvium from granite	Alluvial fans	9-15	150-900	10-20	63	Well drained
Soboba (SoC)	Alluvium from granite	Alluvial fans	0-9	30-4,200	10-20	61-63	Excessively drained
Soboba (SpC)	Alluvium from granite	Alluvial fans	0-9	10-4,200	10-25	59-64	Excessively drained
Tujunga (TvC)	Alluvium from granite	Alluvial fans	0-9	10-1,500	10-25	59-64	Somewhat excessively drained

Source: USDA 2018
Key:
% = percent
°F = degrees Fahrenheit

Faulting and Seismic Considerations

The Devil Canyon facilities are located in an area of high seismicity. The facilities are located within the San Andreas Fault Zone, about 3.7 miles southeast of its intersection with the San Jacinto fault (Figure 5.1-2). The Devil Canyon Powerplant area is crossed by active traces of the approximately 1-mile-wide fault zone. The northernmost trace of the fault zone passes through the afterbay areas just south of the powerplant (DWR 1975), approximately 300 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 fault and capable of surface displacement (DWR 2001).

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). The west-northwest-trending fault trace borders the north side of the Second Afterbay, crosses the cross channel between the two afterbays, and passes to the south of the powerplant. Another trace of the San Andreas fault is shown passing near the side channel spillway of the Devil Canyon Afterbay; however, no fault trace was found during construction of the Devil Canyon Second Afterbay (DWR 2014b).

Designers of the Devil Canyon Second Afterbay and cross channel from the Devil Canyon Afterbay anticipated potential adverse seismic 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 2014b).

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

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 and sedimentation, which at times is exacerbated by heavy rains and loss of vegetation due to fire.

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

Project roads associated with the Devil Canyon penstocks, powerhouse and afterbay areas are subject to short- and long-term maintenance. Short-term maintenance activities are conducted annually, periodically or seasonally, as needed to address potential erosional issues. Long-term maintenance activities addressing more significant erosional issues are typically undertaken in addition to short-term activities (DWR, 2018).

5.1.1.8 West Fork Mojave River Downstream of Cedar Springs Dam

Bedrock, Surface Materials and Soil Types

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 that is described in Section 5.1.1.5 of this document for Cedar Springs Dam and Silverwood Lake.

Surface Materials

The West Fork Mojave River downstream of Cedar Springs Dam is largely cut into Crowder Formation deposits.

Soils Types

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 B (USDA 2018). A map showing the soil series around the West Fork Mojave River is shown in Figure 5.1-4 and data are summarized in Table 5.1-4.

Table 5.1-4. Soil Types Mapped Adjacent to the West Fork Mojave River Downstream of Cedar Springs Dam

Soil Family (symbol)	Parent Material	Geomorphic Position	Slope (%)	Elevation (feet)	Mean Annual Precipitation (inches)	Mean Annual Temperature (°F)	Drainage
Avawatz-Oak Glen (102)	Alluvium derived from granite	Alluvial fans	2-9	3,400-5,200	6-9	57-61	Somewhat excessively drained
Haplargids-Calciorthids (130)	Alluvium derived from granite	Alluvial fan remnants	15-50	---	3-6	59-63	Somewhat excessively drained
Riverwash (157)	---	Channels	---	650-4,000	3-6	59-66	---

Source: USDA 2018
Key:
% = percent
°F = degrees Fahrenheit

<u>Faulting and Seismic Considerations</u>

The North Frontal Fault Zone (NFFZ) is a well-recognized active fault zone northeast of Cedar Springs Dam and Silverwood Lake (Figure 5.1-2). It was once assumed that the Cleghorn fault connected to the NFFZ via unnamed faults in Summit Valley and WSLFZ. Recent investigation, however, found no evidence of recent movement of the NFFZ south of the Mojave River and, as such, there is no apparent connection with the Cleghorn fault (Barry 2012).

<u>Erosion Potential and Sedimentation</u>

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.

5.1.1.9 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 5.1-8). Most claims involved placer operations, though a few involved possible lode 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 site was a surficial limestone claim located in the western portion of the basin, approximately 2 miles from the western extent of the Project. No reported 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.

Another 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.

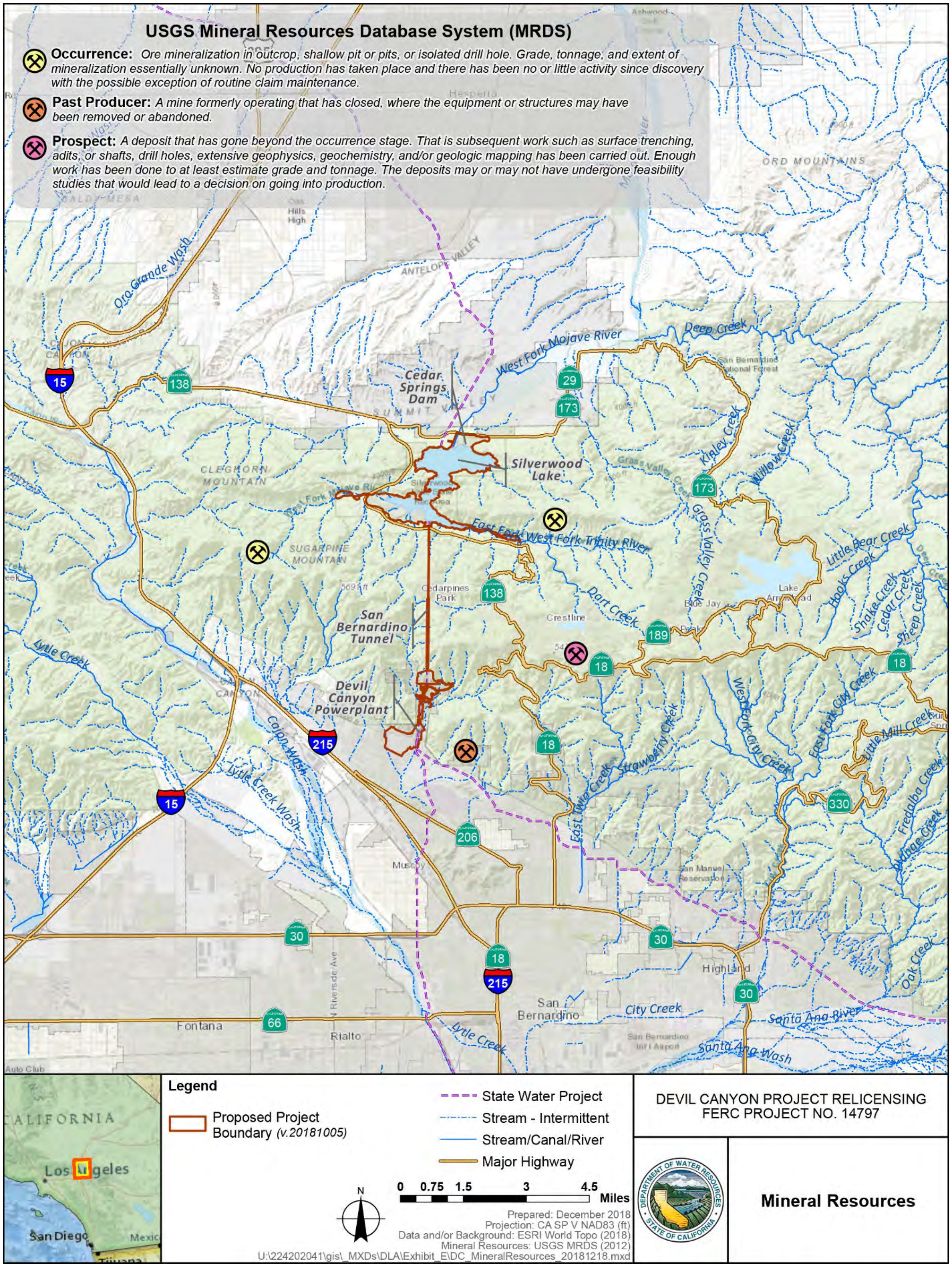


Figure 5.1-8. Mineral Resources in the Project Area

5.1.2 Effects of DWR's Proposal

5.1.2.1 Sediment Depletion of West Fork Mojave

Sediment depletion of West Fork Mojave River downstream of Cedar Springs Dam could potentially result in headward streambed erosion and streambank erosion. Erosion is an ongoing natural process, making the influence of the existing Project difficult to determine. Importantly however, DWR's Proposal does not include any changes, as compared to the existing Project, that would accelerate or intensify the currently occurring sedimentation and erosion processes over the life of the new license.

5.1.2.2 Erosion of the Silverwood Lake Shoreline

Erosion of the Silverwood Lake shoreline was assessed in 2011 as part of the Seventh Five-Year FERC Part 12D Site Inspection and recommendations regarding shoreline erosion were implemented by November 2015. The shoreline was visually inspected in November 2014 during the Eighth Five-Year FERC Part 12D Site Inspection and was found to be satisfactory. The Project does not include any changes, as compared to the existing Project, that would accelerate or intensify the currently occurring sedimentation and erosion processes. Continued annual inspections will continue to be performed and erosion susceptible-shoreline conditions will be addressed as needed.

5.1.2.3 Failure of the Second Afterbay

Failure of the Devil Canyon Second Afterbay (with or without seismicity) could result in flooding of downstream areas. The afterbay is inspected daily, as part of regular, ongoing safety inspections (consistent with Title 18 of the CFR Part 12D). As part of the reporting requirements, the most recent inspection report (May 2015) concluded that the afterbay was suitable for continued safe and reliable operation. The Second Afterbay will continue to be monitored regularly as part of the ongoing inspection and reporting process. DWR's Proposal does not include any changes, as compared to the existing Project, that would increase the risk of failure. With continuing monitoring and inspection, the risk of such failure continues to remain low.

5.1.2.4 Rupture of Penstocks

While penstock rupture (with or without seismicity) could result in flooding of downstream areas, there is no evidence of such potential failure. The same potential for Project effects that exist now are expected to continue for the life of the new license. As such, no substantial change in conditions affecting the integrity of the penstocks are expected to occur.

The penstocks are monitored as part of the ongoing FERC Part 12D inspection and reporting process. With this continuing monitoring and inspection, the risk of penstock rupture will continue to remain low.

5.1.3 Unavoidable Adverse Effects

No unavoidable adverse effects associated with soils and geology have been identified. Silverwood Lake will continue to capture sediments; however, there is no evidence to-date of any adverse effects as a result of this condition. The same Project effects that exist now are expected to continue for the life of the new license. As such, no substantial change in lakeside erosion conditions are expected to occur and, therefore, continued operation under a new license will have no significant adverse effects.

Silverwood Lake is kept at a relatively constant level; therefore, shoreline wave effects are concentrated on the same shoreline level which would result in easily identifiable locations of shoreline erosion. Erosion of the Silverwood Lake shoreline was assessed in 2011 as part of the Seventh Five-Year FERC Part 12D site inspection.

Recommendations for mitigation of shoreline erosion were implemented by November 2015. The shoreline was visually inspected again in November 2014 as part of the Eighth FERC Part 12D inspection and was found to be satisfactory. Continued annual inspections will be performed and erosion susceptible-shoreline conditions will be addressed as needed.

The Second Afterbay and Devil Canyon Penstocks are under the jurisdiction of FERC and will continue to be inspected as required by FERC.

5.2 WATER RESOURCES

This discussion of water resources is divided into three sections. Section 5.2.1 describes the existing Project environment and includes two main subsections: water quantity and water quality. Water quantity includes an overview, a description of potentially affected water rights and water contracts, and Project hydrology. Water quality includes information regarding relevant plans and regulations, and existing water quality in the Project area. Section 5.2.2 addresses the effects of DWR's Proposal and DWR's proposed PM&E measures. Section 5.2.3 describes any unavoidable Project effects.

DWR augmented existing, relevant, and reasonably available information relative to water resources by conducting the *Water Quality and Temperature Study Approach*. The results of this study are incorporated into this section. Refer to the Devil Canyon Project Relicensing Website at http://devil-canyon-project-relicensing.com/studies/ for the detailed study approach, study summary, and detailed study data.

5.2.1 Existing Environment

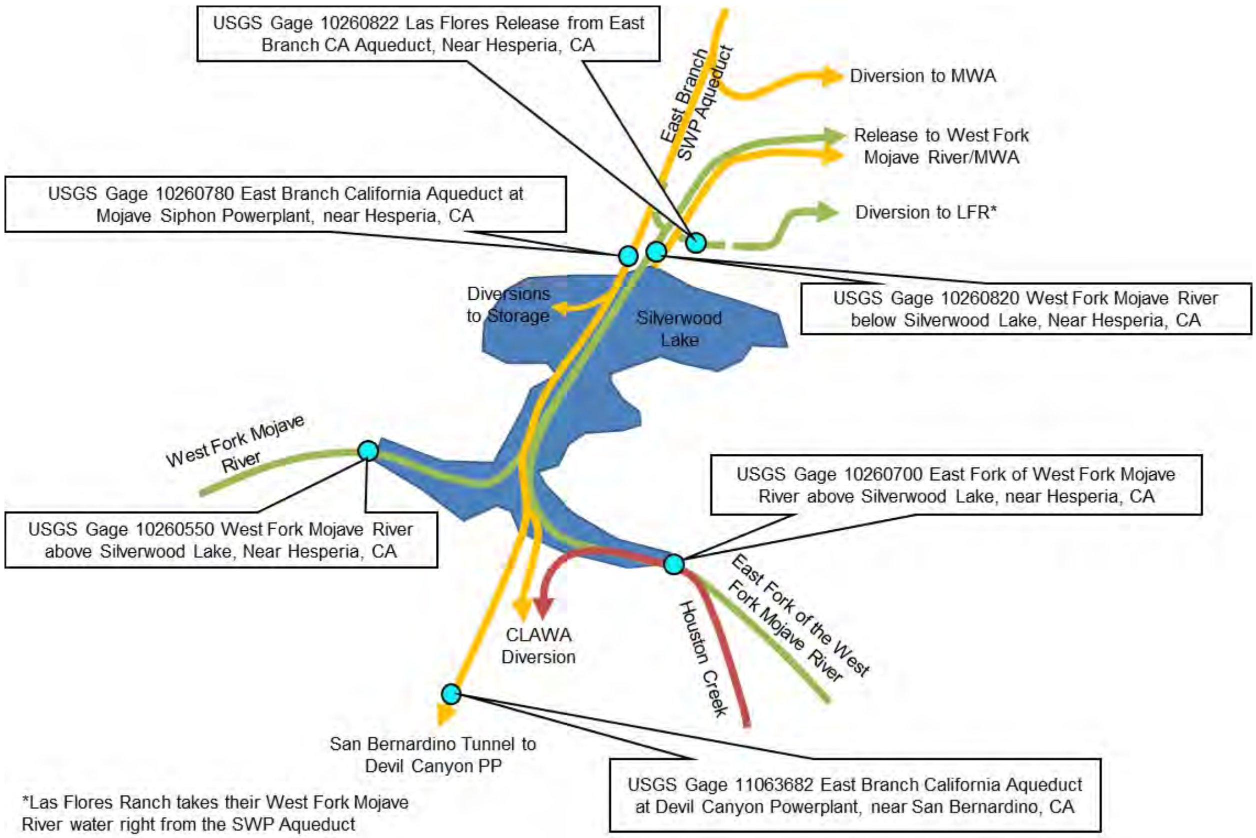
5.2.1.1 Water Quantity

Overview

The Project is an energy recovery project that generates electricity using SWP water as it is delivered to water customers in southern California. SWP water enters the uppermost Project facility, Silverwood Lake, from the SWP aqueduct, which is not a Project facility. In Silverwood Lake, the SWP water mixes with the natural flow in the West Fork Mojave River, the East Fork of the West Fork Mojave River, and local runoff. The SWP water then passes through the San Bernardino Tunnel and Devil Canyon Powerplant, where it generates electricity. The SWP water flows into the Devil Canyon Afterbay and Devil Canyon Second Afterbay; neither afterbay intercepts local surface water. The SWP water is released from the afterbays through one of the following five pipelines, each of which provides SWP water to downstream consumptive water users: (1) San Bernardino Pipeline; (2) Santa Ana Pipeline; (3) Azusa Pipeline; (4) Rialto Pipeline; and (5) Inland Feeder Pipeline. The valves, turnouts, meters, and connections for these pipelines are not part of the Project facilities.

The Project does not use any local surface water, including natural flow into Silverwood Lake, for electricity generation; nor does the Project have discretion over releases from Silverwood Lake into the West Fork Mojave River. Releases of local surface water from Silverwood Lake into the West Fork Mojave River are made in accordance with existing water rights and water delivery agreements that are not related to electricity generation. Figure 5.2-1 depicts the Silverwood Lake hydrologic balance.

The Project does not have discretion over releases into the non-Project pipelines at the Devil Canyon Afterbay and at the Devil Canyon Second Afterbay; releases are made into the pipelines based on downstream water contracts.



Key:
CA = California
CLAWA = Crestline-Lake Arrowhead Water Agency
LFR = Las Flores Ranch
MWA = Mojave Water Agency
PP= Powerplant
SWP = State Water Project
USGS = United States Geologcial Survey

Figure 5.2-1. Schematic of Silverwood Lake Hydrologic Balance

Potentially Affected Water Rights, Agreements and Water Contracts

The water rights, agreements, and water contracts potentially affected by the project can be split into two primary operational categories, deliveries to SWP contractors and deliveries of natural inflow to the Mojave River basin. Delivery of SWP water is covered by SWP water rights which allow for storage of water in Silverwood Lake and include the beneficial use of power generation with a point of use at the Devil Canyon Powerplant. Note that in this Application for New License, “store” means hold water in storage for 30 days or more. The delivery of natural inflow is covered by the Mojave River Adjudication Decree issued by the Riverside County Superior Court in 1996.

The Mojave River basin has been known to be in a state of significant overdraft since the 1950’s. State laws passed in 1959 to help facilitate development of the SWP also allowed regions around the State to form water agencies to responsibly manage their water supplies and make use of SWP water. Because of this, the MWA was formed to help bring SWP water to the Mojave River basin to help supplement what was naturally available. As management of water supplies in the basin expanded, the need to determine the water rights of users in the basin became necessary. An initial attempt to adjudicate the basin was made in 1964. A second, more successful attempt was made in 1990 when many parties filed lawsuits in Riverside County seeking guaranteed amounts of water. The result of the court proceedings was the Mojave River Decree, which adjudicated the rights of all users of water within the Mojave River basin. Due to the statutory authority granted to MWA by the California Legislature in 1959, the Court decided that MWA should be the Watermaster in charge of administering the Decree. In its role as watermaster, MWA is responsible for managing the water supplies released from Silverwood Lake for use downstream. DWR manages releases from Silverwood Lake per its agreements with MWA and LFR, which assist with Decree management. The Project has no discretion on releases of natural flow from Silverwood Lake and currently the Watermaster notes that it is critical that DWR's current management of natural inflow and releases from Silverwood Lake remains unchanged in order to meet the needs of downstream water right holders identified in the Decree.

DWR also holds water rights for diversion from the West Fork Mojave River. The water rights were initially issued to CLAWA, and transferred to DWR per the 1989 agreement, discussed below. These rights were the last surface water rights issued for the Mojave River basin. The Mojave River watershed was declared fully appropriated by the SWRCB in its Decision 1619 issued in 1988. The SWRCB issued these water rights with the understanding that there would be no net effect to the watershed from CLAWA's diversion due to the fact that the Crestline Sanitation District essentially returns all water diverted back to the watershed through the discharge of treated effluent downstream of Cedar Springs Dam. The water rights held by DWR for CLAWA's use allow for the diversion and storage of water from Houston Creek in Silverwood Lake as long as the amount diverted does not exceed the amount of return flows for that year, up to a maximum of 1,302 acre-feet.

The following paragraphs describe agreements and water contracts as they relate to the Project.

CLAWA, DWR 1989 Agreement and CLAWA's SWP Water Supply Contract

As mentioned above, CLAWA was issued two water rights permits, issued in 1990 for Houston Creek, a tributary to the East Fork of the West Fork Mojave River, with a combined diversion limitation of up to 3.37 cfs and a total annual volume of up to 1,302 AF of storage in Silverwood Lake. Per the decision by the SWRCB that issued permits to CLAWA, return flows discharged from the wastewater treatment plants in the Crestline Sanitation District's system are released via a pipeline that follows State Highway 138 and discharges downstream from Cedar Springs Dam onto LFR's land where they contribute to the recharge of the Upper Mojave River Valley groundwater basin.

Per the 1989 agreement between DWR and CLAWA, CLAWA assigned to DWR its combined water rights for Houston Creek. Actual diversion quantities vary depending upon annual amounts of precipitation and are limited according to the amount of return flow to the Mojave River watershed each water year (WY).

As outlined in the agreement, in exchange for CLAWA's assignment of Houston Creek water rights to DWR, CLAWA is able to take a like amount of water from Silverwood Lake via CLAWA's diversion structure. The diversion structure is located on the south shore of Silverwood Lake, near CLAWA's water treatment plant, off of State Highway 138, near the Silverwood Lake Marina. CLAWA is responsible for reporting Houston Creek flows to DWR, measured at a gaging station below Crest Forest County Water District's Lake Gregory spillway. DWR adjusts the reported Houston Creek flow measurements to account for losses such as evapotranspiration and percolation between the gaging station and Silverwood Lake, for concurrence by CLAWA. In the event that the Lake Gregory gaging station becomes inoperable, the Houston Creek flow is determined by records of Lake Gregory storage change plus measured Lake Gregory inflow. Both DWR and CLAWA record and share their respective operations at Silverwood Lake and their measurements and computations of local water flowing into, stored in, released, and pumped from Silverwood Lake.

In addition to the local water from Houston Creek appropriated by DWR for CLAWA, CLAWA has a separate SWP water supply contract for 5,800 AF per WY taken from CLAWA's intake as described above. All of CLAWA diversions from Silverwood Lake are measured together, and the portion of its diversion representing its Houston Creek water supplies is computed based on CLAWA's agreement with DWR. CLAWA's diversions are prioritized as follows:

- Non-Project water (i.e., per its 1989 Houston Creek agreement)
- Non-Project water previously held in Silverwood Lake
- Project water (i.e., SWP contract supplies)

LFR and DWR 1980 Agreement

LFR has a pre-1914 (1882) water right to divert from the West Fork Mojave River as confirmed by the Mojave River Decree. During the construction of Cedar Springs Dam, DWR removed stream diversion works owned and operated by LFR. As a replacement for the removed LFR diversions, DWR built new diversion works within the DWR right-of-way of the non-Project Mojave Siphon, located north from Silverwood Lake. The new diversion works includes a 30-inch cone valve with a 23 cfs capacity, the maximum amount LFR can divert under its water right. Diversions to LFR do not come from Silverwood Lake storage; instead, LFR diverts SWP water in exchange for West Fork Mojave River water supplies. Since LFR diverted from the West Fork Mojave River prior to the construction of Silverwood Lake, LFR's diversions off the Mojave Siphon are based on computed Silverwood Lake inflow. Since LFR has one of the most senior water rights in the basin, DWR's agreement with LFR requires all inflow to Silverwood Lake that is less than or equal to 23 cfs to be delivered through exchange off the

Mojave Siphon to LFR prior to any other releases of natural inflow. Any flow not used by LFR is returned to the West Fork Mojave River.

The 1980 agreement between DWR and LFR outlines the methodology for determining the amount of flow that would have been available for LFR diversion. This computation is based on the combined gaged inflow at the two USGS gaging stations above Cedar Springs Dam (USGS Gages 10260700 and 10260550). Exhibit A of the 1980 agreement provides a synthetic flow based on the inflow at these two gaging stations. When the combined gaged inflow is more than 300 cfs, Exhibit A of the 1980 agreement stipulates that the change in storage method for determining natural outflow will be used.

MWA and DWR 1982 Water Agreement

A 1996 Court Decree issued by the Riverside County Superior Court names MWA the Watermaster responsible for the administration of the decree. As Watermaster, MWA is authorized to manage natural flows from the West Fork Mojave River and its agreement with DWR aides in management of the Decree.

MWA's 1982 agreement with DWR states:

> Current operation of Cedar Springs Dam provides for the release of water, which originates in the watershed tributary thereto, from the dam at the same rate as the inflow to Silverwood Lake.

MWA's agreement allows MWA to hold inflow to Silverwood Lake for subsequent release (within 30 days of inflow) at MWA's request. The agreement outlines the relationship for determining the amount of natural outflow from Cedar Springs Dam that would otherwise have occurred if DWR had not held the water in Silverwood Lake and the corresponding volume of water held in Silverwood Lake. The relationship and computation method for the total combined inflow are identical to those in DWR's 1980 agreement with the LFR. DWR maintains an accounting of water held in Silverwood Lake at MWA's request.

MWA also has a SWP Water Supply Contract with DWR and typically takes delivery of SWP water from the East Branch of the SWP aqueduct upstream from the Mojave Siphon. However, in the case of an outage of the East Branch of the SWP aqueduct, or other restrictions on deliveries, MWA could receive SWP supplies by release from Silverwood Lake. DWR also facilitates exchanges of SWP water between MWD and MWA. These exchanges of SWP water can occur either from turnouts on the East Branch of the SWP aqueduct or by release from Silverwood Lake.

DWR tracks releases from Silverwood Lake made for MWA's SWP contract deliveries in DWR's monthly operations reports in addition to releases for natural Mojave River flows. USGS gage 10260820, West Fork Mojave River below Silverwood Lake, CA, reflects releases for these combined purposes.

Water Supply Contracts Downstream of the Project

The Project is operated to deliver SWP water to various contractors in southern California who have long-term water supply contracts with DWR. Table 5.2-1 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 5.2-1. SWP Contractors Served by the East Branch of the SWP Downstream of the Project

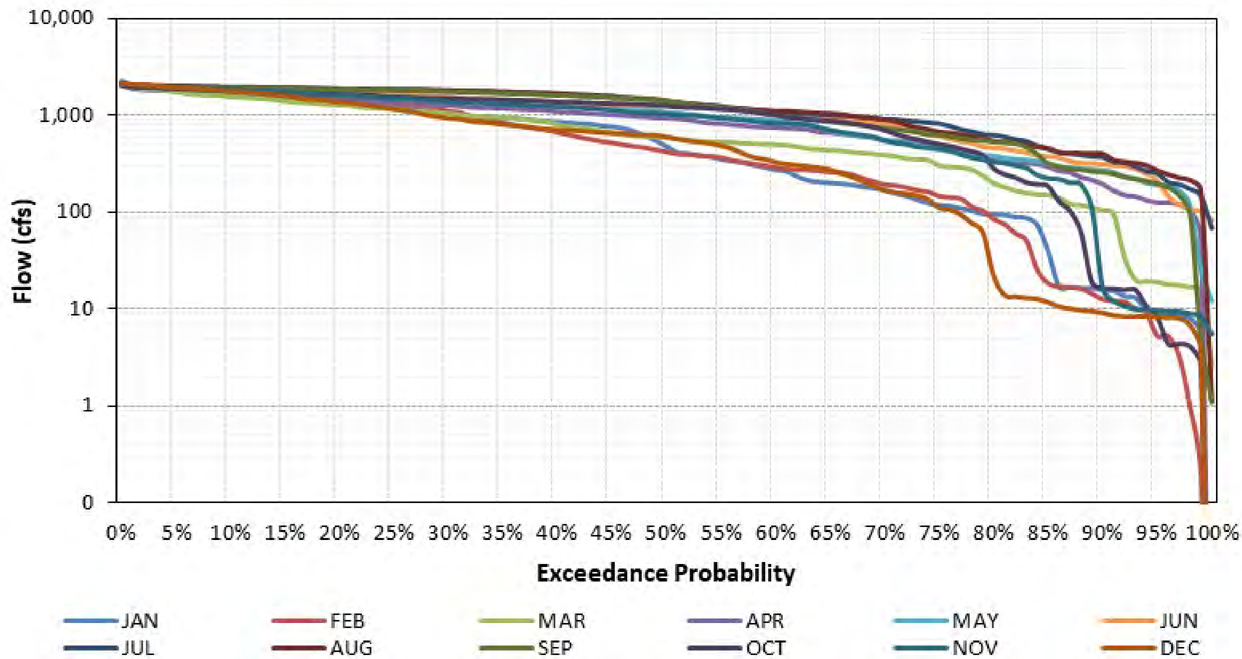
SWP Contractor	Annual Maximum SWP Water Delivery Amount (AF)
San Gabriel Valley Municipal Water District	28,800
San Bernardino Valley Municipal Water District	102,600
San Gorgonio Pass Water Agency	17,300
Coachella Valley Water District	138,350
Desert Water Agency	55,750
Metropolitan Water District of Southern California[1]	1,911,500
Total	**2,254,300**

Source: The State Water Project 2015 Draft Delivery Capability Report April 2015
Note:
[1]Metropolitan Water District of Southern California is served by both the East and West Branches of the SWP
Key:
AF = acre-feet

Project Hydrology

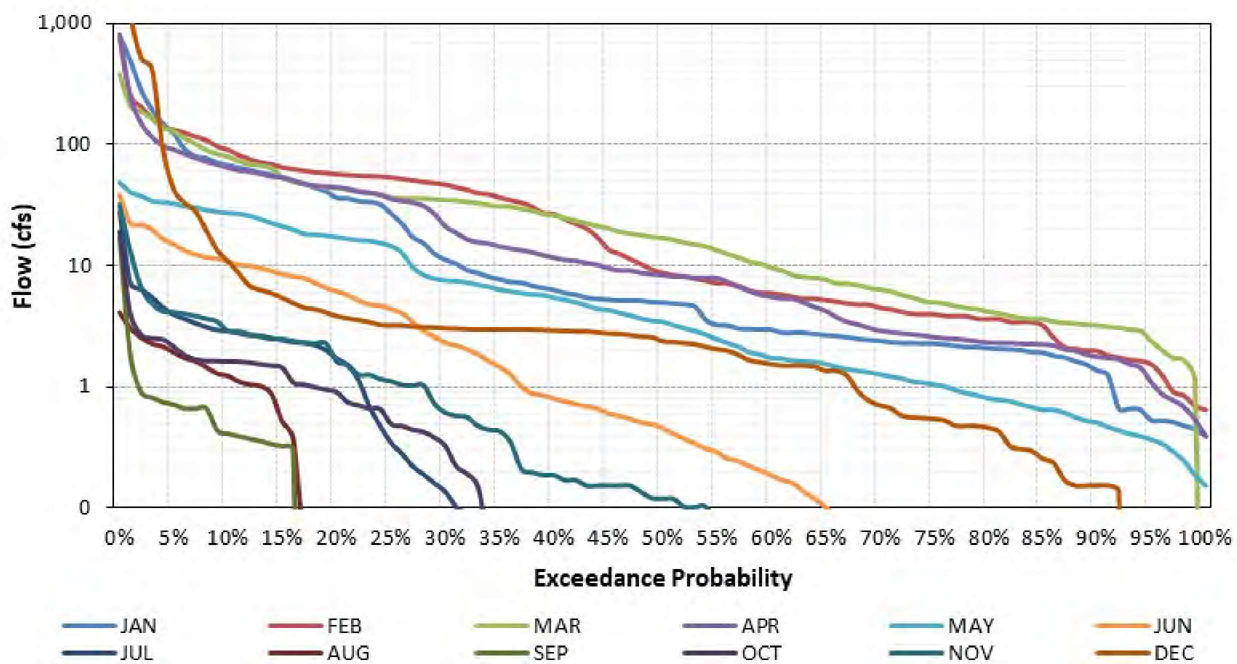
Inflow into Silverwood Lake

Figures 5.2-2, 5.2-3, and 5.2-4 provide monthly flow duration curves for inflow into Silverwood Lake from: (1) the SWP; (2) natural flow; and (3) the combination of SWP and natural inflow, respectively. The period covered in these figures is WY 2006 through WY 2017. Appendix A to Exhibit B of this Application for New License includes detailed hydrologic data used to develop Figures 5.2-2, 5.2-3, 5.2-4, and 5.2-5 as well as other hydrologic data cited in this exhibit. The data in Appendix A is presented in Microsoft™ Excel format and in USACE, Hydrologic Engineering Center Data Storage System file format. The SWP inflow in Figure 5.2-2 is from SWP aqueduct inflow measured by USGS gage 10260780, and a volume of West Fork Mojave River inflow equivalent to the 1980 LFR and DWR Agreement. In Figure 5.2-3, the natural inflow includes the sum of USGS Gage 10260550, USGS Gage 10260700, and the LFR and DWR agreement-derived ungaged flow. Figures 5.2-4 and 5.2-5 are based on the same data as Figures 5.2-3 and 5.2-4.



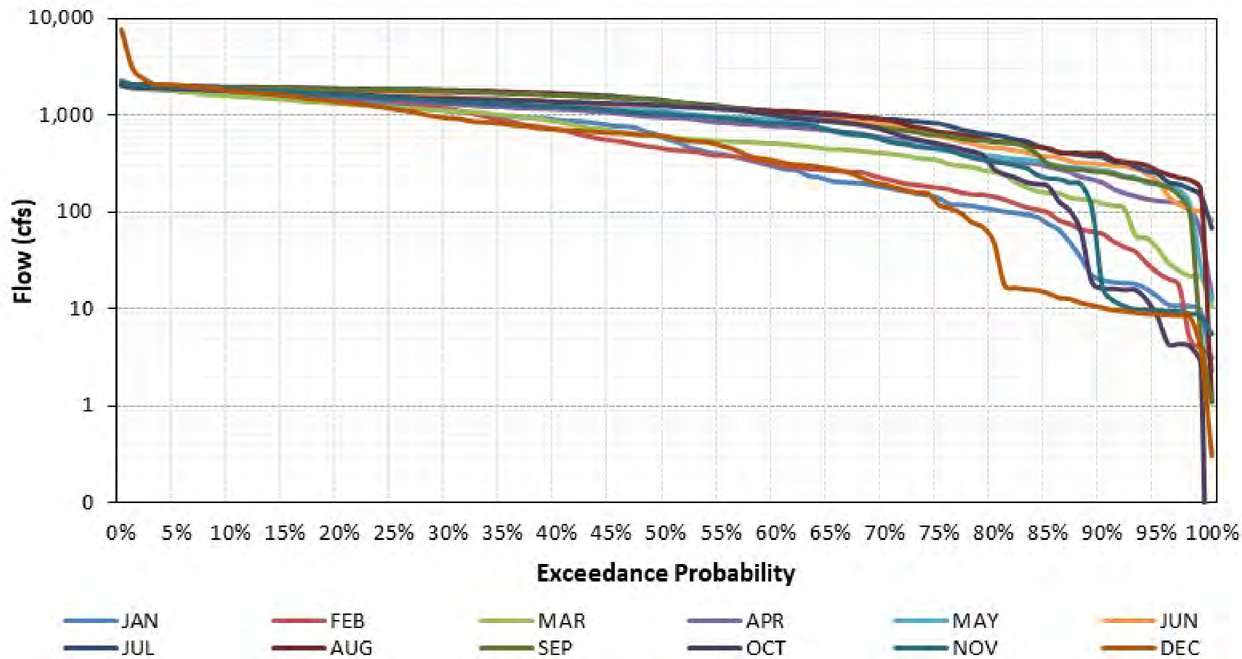
Key:
% = percent
cfs = cubic feet per second

Figure 5.2-2. Monthly Flow Duration Curves, Derived from Average Daily Flows, for SWP Inflow to Silverwood Lake from Water Years 2006 through 2017



Key:
% = percent
cfs = cubic feet per second

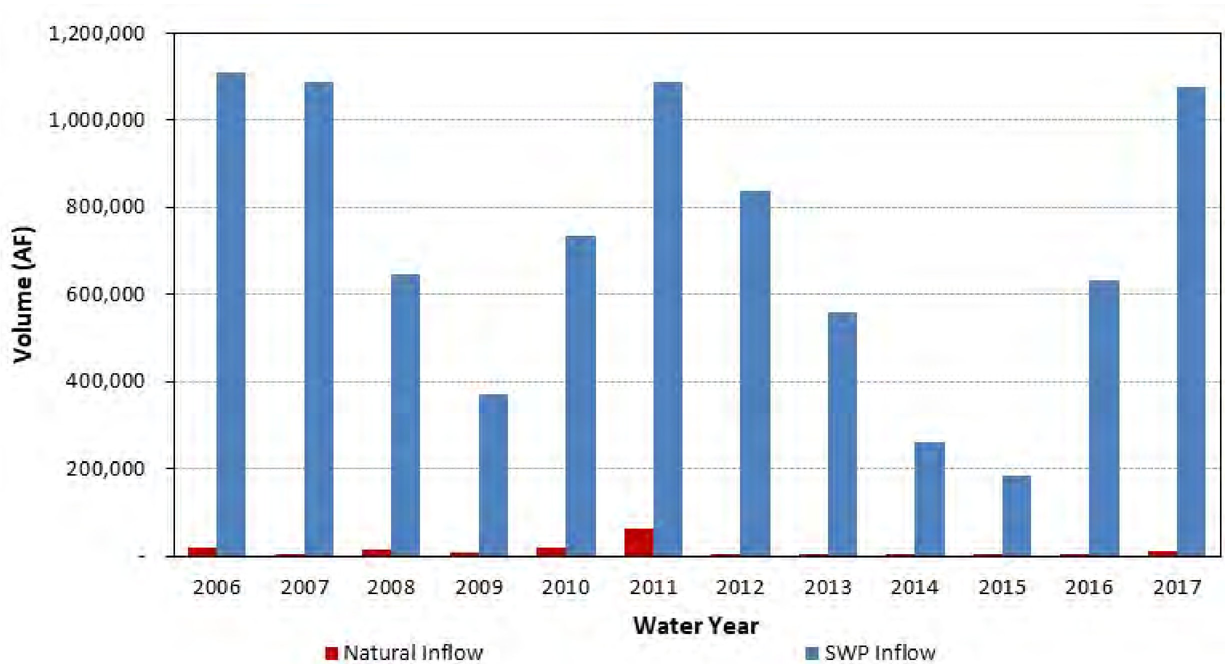
Figure 5.2-3. Monthly Flow Duration Curves, Derived from Average Daily Flows, for Natural Inflow to Silverwood Lake from Water Years 2006 through 2017



Key:
% = percent
cfs = cubic feet per second

Figure 5.2-4. Monthly Flow Duration Curves, Derived from Average Daily Flows, for Total Inflow to Silverwood Lake from Water Years 2006 through 2017

Figure 5.2-5 shows the relative contribution of the natural inflow and SWP inflow. Annual volume of natural inflow is rarely noticeable compared to the volume of SWP inflow into Silverwood Lake. The greatest difference between the two volumes of 1,091,276 AF occurred in WY 2006, and the smallest difference between the two volumes of 182,423 AF occurred in WY 2015.



Source: USGS gages 10260550, 10260700, and 10260780
Key:
AF = acre-feet
SWP = State Water Project

Figure 5.2-5. Relative Contribution of Natural Inflow and SWP Inflow to Silverwood Lake from Water Years 2006 through 2017

Silverwood Lake Storage and Morphometric Information

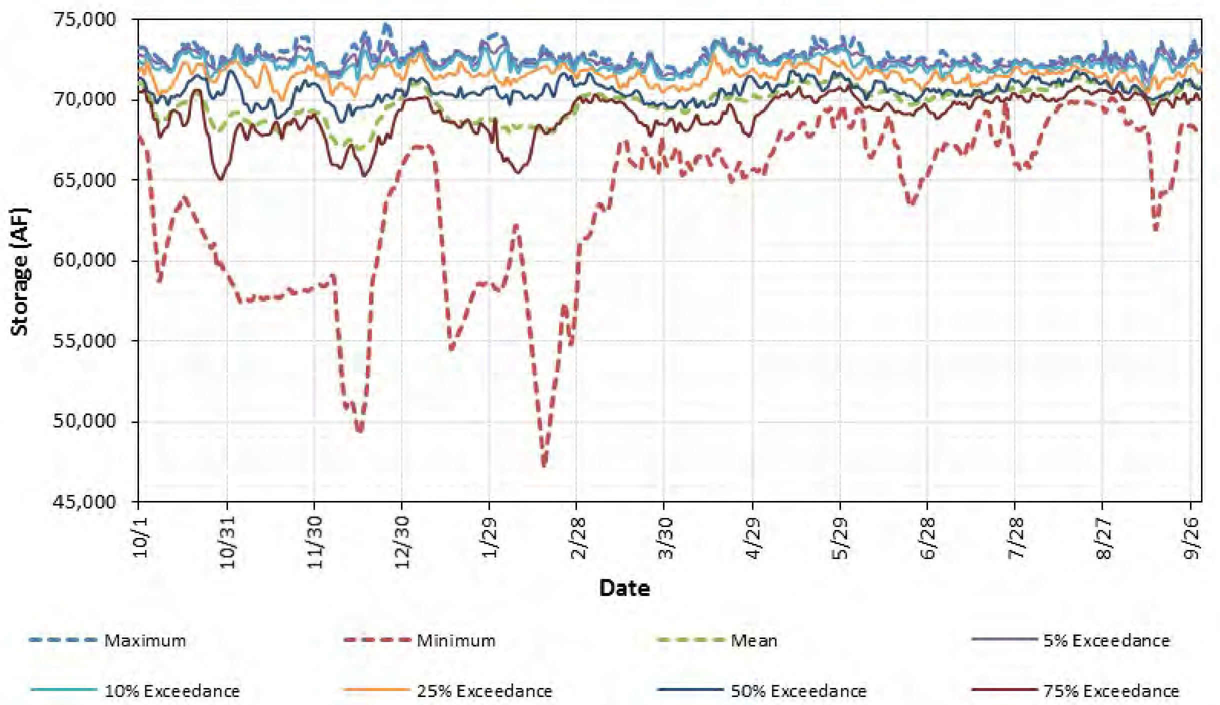
Silverwood Lake is the principal storage facility for the Project. Table 5.2-2 summarizes relevant morphometric characteristics of Silverwood Lake. The reservoir does not have a regulatory minimum pool requirement or any flood pool restrictions. Article 58 in the existing FERC license and existing DWR agreements with USFS and CDFW set limits on reservoir fluctuations from around March through mid-September.

Table 5.2-2 Summary of Morphometric Characteristics of Silverwood Lake

Morphometric Characteristics	Silverwood Lake
NMWSE	3,355
Surface Area (acres)[1]	995
Gross Storage Capacity (AF)[2]	75,000
Usable Storage (AF)[3]	33,820
Flushing Rate (days)[4]	32.4
Shoreline Length (miles)[1]	13

Sources: [a]DWR 2014a, [c]DWR 2014b, [b]DWR 2018a
Notes:
[1]At NMWSE
[2]Storage between NMWSE and the bottom of the reservoir.
[3]Storage between NMWSE and the invert of the San Bernardino Tunnel outlet structure at elevation 3,311 feet and a storage of 39,211 AF.
[4]Average flushing rate, calculated using the average daily storage divided by the average daily outflow.
Key:
AF = acre-feet
NMWSE = normal maximum water surface elevation

Figure 5.2-6. Shows Average Daily storage in Silverwood Lake, as well as maximum and minimum daily storages and various percent exceedance levels of daily storage.



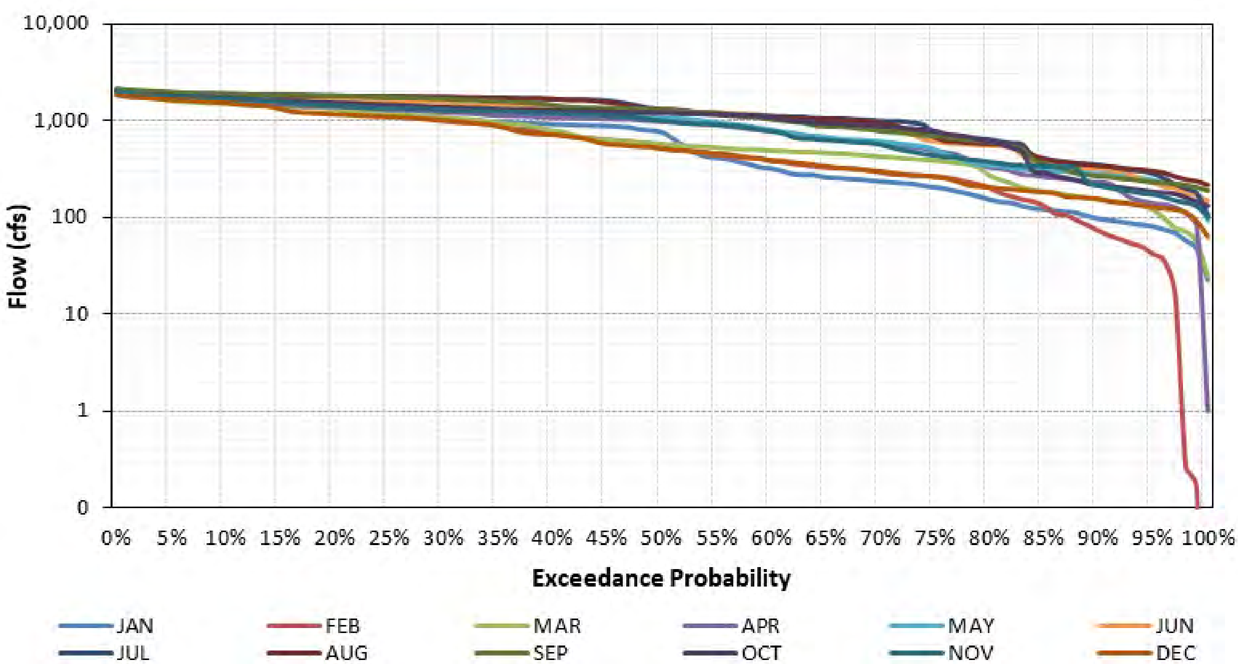
Source: USGS gage 10260790
Key:
% = percent
AF = acre-feet

Figure 5.2-6. Daily Storage Statistics for Silverwood Lake from Water Years 2006 through 2017

Figure 5.2-6 shows daily storages based on statistics applied to historical data for WY 2006 through 2017. The figure shows that storage is in the range of 65,000 AF to 75,000 AF more than 75 percent of the time. However, there are a few instances of low storage. In 4 of the 12 WYs (i.e., 2007, 2010, 2011 and 2016), storage dropped below 55,000 AF. The lowest storage value of 47,100 AF occurred on February 17, 2007, which occurred because, over the span of about eight days, the reservoir experienced no inflow from the East Branch of the SWP aqueduct, while the Devil Canyon Powerplant was operating at a daily average of approximately 800 cfs.

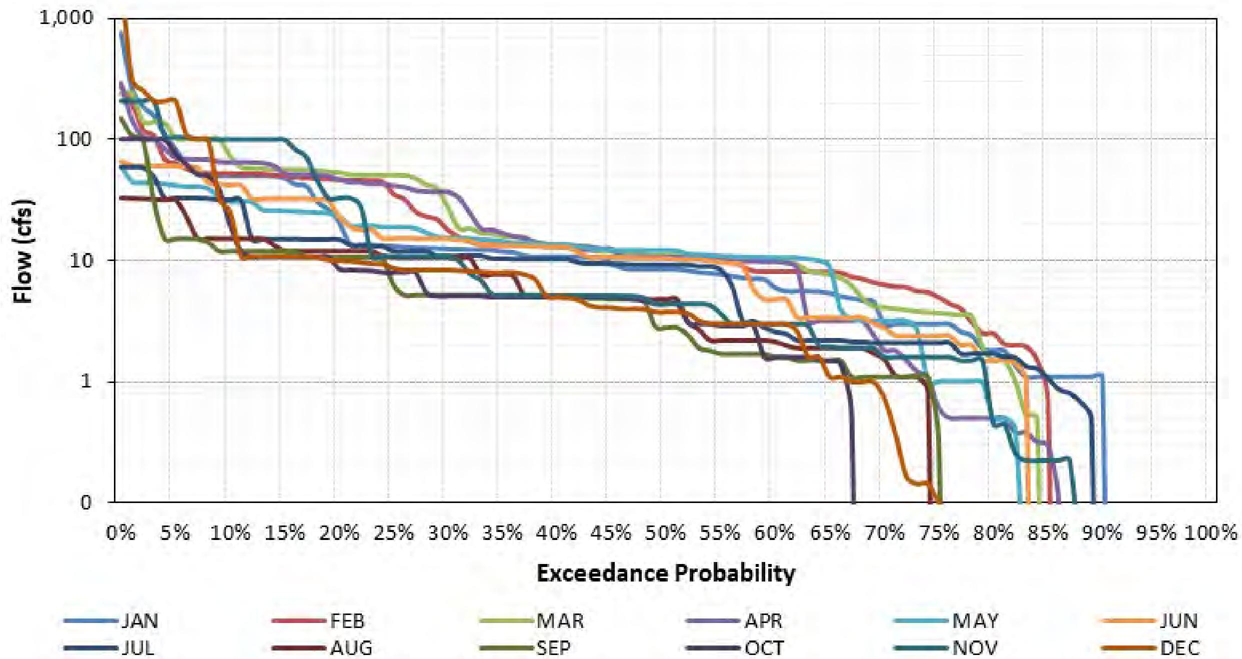
Outflow from Silverwood Lake

Figures 5.2-7, 5.2-8, and 5.2-9 provide monthly flow duration curves for outflow from Silverwood Lake from: (1) the SWP; (2) natural flow; and (3) the combination of SWP and natural outflow, respectively. The SWP outflow is the sum of San Bernardino Tunnel outflow measured by USGS gage 11063682 and CLAWA SWP diversions. The natural flow includes the sum of USGS Gage 10260820, USGS Gage 10260822, and CLAWA's water rights diversions.



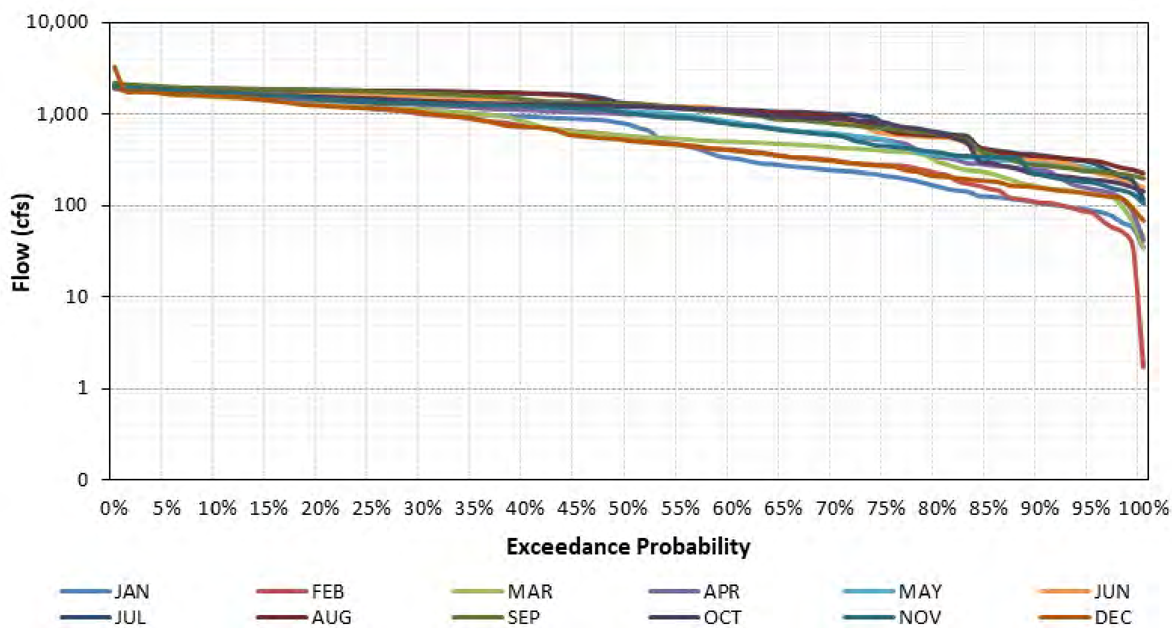
Key:
% = percent
cfs = cubic feet per second

Figure 5.2-7. Monthly Flow Duration Curves, Derived from Average Daily Flows, for SWP Outflow from Silverwood Lake via the San Bernardino Tunnel from Water Years 2006 through 2017



Key:
% = percent
cfs = cubic feet per second

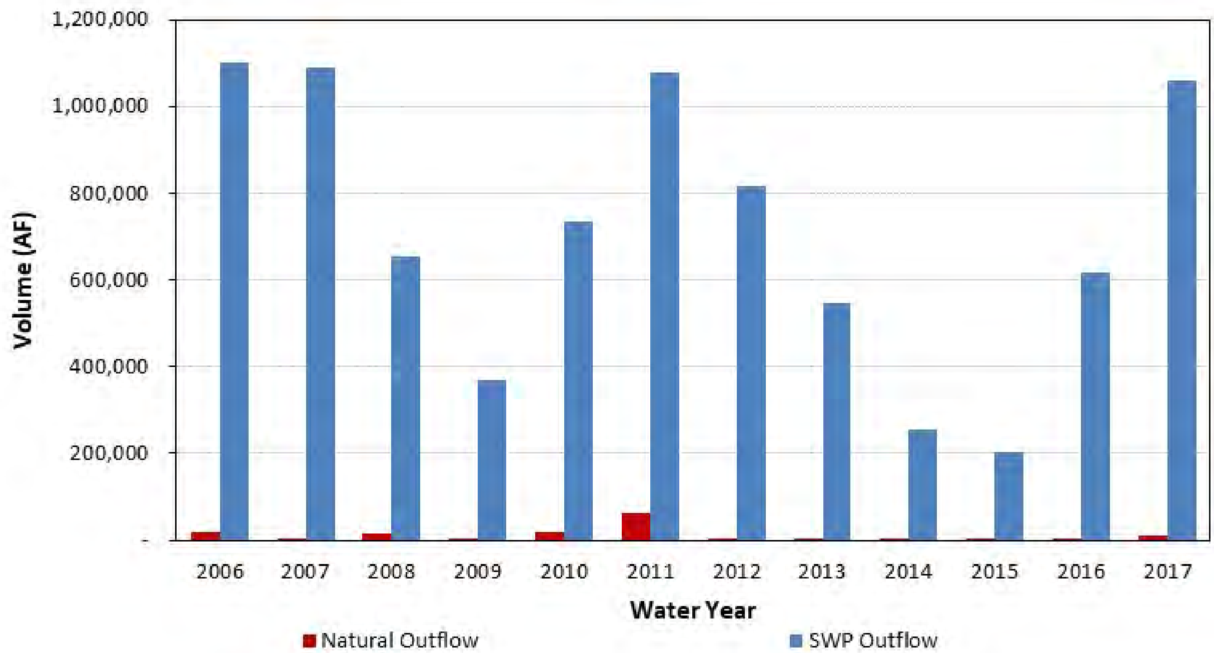
Figure 5.2-8. Monthly Flow Duration Curves, Derived from Average Daily Flows, for Natural Outflow from Silverwood Lake to the West Fork Mojave River from Water Years 2006 through 2017



Key:
% = percent
cfs = cubic feet per second

Figure 5.2-9. Monthly Flow Duration Curves, Derived from Average Daily Flows, for Total Outflow from Silverwood Lake from Water Years 2006 through 2017

Figure 5.2-10 shows the relative contribution of the natural outflow and SWP outflow for each year of the period of record. The annual volume of natural outflow is rarely noticeable compared to the volume of SWP outflow. The greatest difference between the two volumes of 1,088,818 AF occurred in WY 2007, and the smallest difference between the two volumes of 202,317 AF occurred in WY 2015.



Source: USGS gages 10260820, 10260822, and 11063682
Key:
AF = acre-feet
SWP = State Water Project

Figure 5.2-10. Relative Contribution of Natural Outflow and SWP Outflow from Silverwood Lake from Water Years 2006 through 2017

Devil Canyon Afterbay and Devil Canyon Second Afterbay

Devil Canyon Afterbay and Devil Canyon Second Afterbay are primarily used as regulating afterbays to match the Devil Canyon Powerplant's outflow to the different pipelines for SWP water deliveries. The afterbays are engineered water bodies that do not store natural flows from the basin and do not discharge into surface waters.

5.2.1.2 Water Quality

Relevant Water Quality Plans and Regulations

Basin Plan Designated Beneficial Uses

Table 5.2-3 presents Lahontan Regional Water Quality Control Board (RWQCB) Basin Plan definitions of beneficial uses and summarizes the designated beneficial uses of Silverwood Lake and the West Fork Mojave River. The Basin Plan also lists beneficial uses for the East Fork of the West Fork Mojave River but those are not discussed here since there is no Project nexus. Devil Canyon Afterbay and Devil Canyon Second Afterbay are located in the Sana Ana RWQCB region; however, no beneficial uses are identified (California RWQCB Santa Ana Region 2016). 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 groundwater 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). As part of the Mojave River Basin Plan Amendment and as identified in the 2018 triennial review of the basin plan, the Lahontan RWQCB is proposing to amend the basin plan by adding two beneficial uses for specific reaches of the Mojave River: (1) preservation of biological habitats of special significance (BIOL) and (2) preservation of rare and endangered species (RARE). The amendment also includes removing the cold freshwater habitat (COLD) for portions of the river. The Lahontan RWQCB expects to bring these amendments for adoption in 2019 (California RWQCB Lahontan Region 2018).

Table 5.2-3. 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 (AGR)	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
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

Table 5.2-3. 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
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 2016
Key:
HU = Hydrologic Unit
N/A = beneficial use not designated for this water body

Lahontan RWQCB Basin Plan Water Quality Objectives

The Lahontan RWQCB Basin Plan presents 20 water quality objectives (WQO) designed to protect designated beneficial uses of inland surface waters (Table 5.2-4). Nine of the WQOs are qualitative (i.e., no numerical limits established). These include the Non-degradation Objective, Biostimulatory Substances, Color, Floating Material, Oil and Grease, Non-degradation of Aquatic Communities and Populations, Sediment, Taste and Odor, and Toxicity. Consistency with these WQOs can only be qualitative. An additional four WQOs set numerical limits in relation to changes in "ambient conditions," or raising levels as compared to an undefined baseline. These are pH, Settleable Materials, Suspended Materials, Temperature and Turbidity. Consistency with these WQOs is problematic since the baseline comparison condition is not known. The remaining eight WQOs are numerical.

In addition to the general WQOs, the Lahontan RWQCB Basin Plan establishes three numerical waterbody-specific objectives for Silverwood Lake and four numerical objectives for the West Fork Mojave River downstream of Cedar Springs Dam. These objectives are provided in Table 5.2-5.

Table 5.2-4. 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.
Dissolved Oxygen	The DO concentration, as percent saturation, shall not be depressed by more than 10 percent, nor shall the minimum DO 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 DO 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 and no instantaneous values (one day minimum) below 4.0 mg/L; for Warm Freshwater Habitat, the minimum 30-day mean shall be at 5.5 mg/L and no instantaneous values (one day minimum) below 3.0 mg/L (Lahontan RWQCB Basin Plan Table 3-6).

Table 5.2-4. Summary of Water Quality Objectives for Inland Surface Waters in the Lahontan Region (continued)

Parameter	Summary of Water Quality Objectives
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.
Non-degradation 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.
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.

Table 5.2-4. Summary of Water Quality Objectives for Inland Surface Waters in the Lahontan Region (continued)

Parameter	Summary of Water Quality Objectives
Taste and Odor Suspended Materials	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.
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 2016
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 5.2-5. Numerical Objectives for Silverwood Lake and West Fork Mojave River

Surface Water	Objectives (dissolved 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 USACE's Mojave Forks Dam, approximately 4.5 miles downstream of Cedar Springs Dam)								
Annual Average Value	--	55	35	1.5	0.2	--	--	--
90th Percentile Value	--	100	100	2.5	0.3	--	--	--

Source: California RWQCB Lahontan Region 2016
Key:
B = Boron
Cl = Chloride
F = Fluoride
PO_4 = Orthophosphate, Dissolved
mg/L = milligram per liter
N = Nitrogen, total
NO_3-N = Nitrate as Nitrogen
SO_4 = Sulfate
TDS = Total Dissolved Solids (total filterable residue)
USACE = U.S. Army Corps of Engineers

National Toxics Rule and California Toxics Rule

In addition to state standards in the Lahontan RWQCB 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 U.S. Environmental Protection Agency (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 Clean Water Act (CWA). For a few states, EPA promulgated a limited number of criteria that 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 CWA 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).

Total Maximum Daily Loads

The nine RWQCBs are each responsible for implementing provisions and pollution control requirements that the federal CWA specifies for surface waters of the United States within their respective 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 inconsistent with WQOs). 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 WQOs).

The 2012 303(d) list included Silverwood Lake for mercury and polychlorinated biphenyls (PCB) (SWRCB 2015) and the 2016 303(d) list continued those listings. According to the RWQCB, at least one use is not supported and a TMDL is needed; the expected TMDL completion year is 2025 (SWRCB 2016). According to the California Office of Environmental Health Hazard Assessment (OEHHA), the sources of these compounds in the reservoir are not known (OEHHA 2013).

Applicability of Clean Water Act Section 401

A water quality certification from the SWRCB under Section 401 of the CWA is required when an applicant for a FERC license proposes an activity which may result in a discharge into navigable waters. Under the Clean Water Act, "navigable waters" is defined as "waters of the United States." The meaning of "waters of the United States" is currently in flux. As a result of court rulings that could be overturned, California is presently subject to a 2015 federal rule defining "waters of the United States." However, federal agencies have proposed a new rule that could replace the 2015 rule; and continued litigation on this issue is a virtual certainty.

DWR has prepared this Draft License Application under a presumption that the Project includes at least one discharge into waters of the United States. If that presumption is rebutted as a result of further investigations, court rulings, federal agency actions, and/or legislation, DWR will file supplemental materials clarifying its position on the applicability of CWA Section 401 certification.

Existing Water Quality

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. These data are collected outside of the existing FERC license, under the existing SWC contracts and other requirements to ensure WQOs are being met. The monitoring program consists of collection, analysis, data archiving, and dissemination of data. Phytoplankton data are provided to the SWC, Methyl Tert-butyl Ether (MTBE) data are collected as part of DWR's routine SWP pesticides and organics sampling, and reservoir profile data are provided to MWD. The frequency of monitoring by parameter is summarized in Tables 5.2-6 and 5.2-7. Results of water quality analyses are also summarized below.

In addition to historical data collected by DWR and MWD at Silverwood Lake and at the afterbays, DWR performed a relicensing water quality study at Silverwood Lake in 2017 and 2018. Reservoir profiles were collected at three locations quarterly between May 2017 and February 2018, and water quality samples were collected for laboratory analysis in August 2017. Sampling occurred near the two locations where DWR has sampled in the past at Silverwood Lake; Stations SI001000 and SI002000 (Figure 5.2-11). DWR's water quality study also included a third monitoring location in Silverwood Lake approximately equidistant from the two historical sampling locations. Grab samples for laboratory analysis were collected from two depths at each location: near the surface and approximately 10 feet from the bottom.

Silverwood Lake

General Water Quality

As described in Table 5.2-5, above, the Lahontan RWQCB Basin Plan sets numerical WQOs for total dissolved solids (TDS), chloride and sulfate in Silverwood Lake. Table 5.2-8, below, presents the results of DWR's sampling for these constituents as well as other water quality parameters. For the approximately 60 samples collected by DWR in Silverwood Lake from 2010 through 2017, TDS concentrations ranged from 110 milligrams per liter (mg/L) to 378 mg/L, dissolved chloride concentrations ranged from 19 mg/L to 107 mg/L, and dissolved sulfate concentrations ranged from 14 mg/L to 76 mg/L. During DWR's 2017 relicensing study, TDS concentrations ranged from 111 mg/L to 168 mg/L, dissolved chloride concentrations ranged from 25 mg/L to 32 mg/L, and dissolved sulfate concentrations ranged from 14 mg/L to 19 mg/L.

Table 5.2-6. 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[1], 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 2018a
Notes:
Fluoride is no longer sampled for by DWR although historical data is discussed below.

Table 5.2-7. 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 via the Devil Canyon afterbays at North Park valve.
Key:
MWD = Metropolitan Water District of Southern California

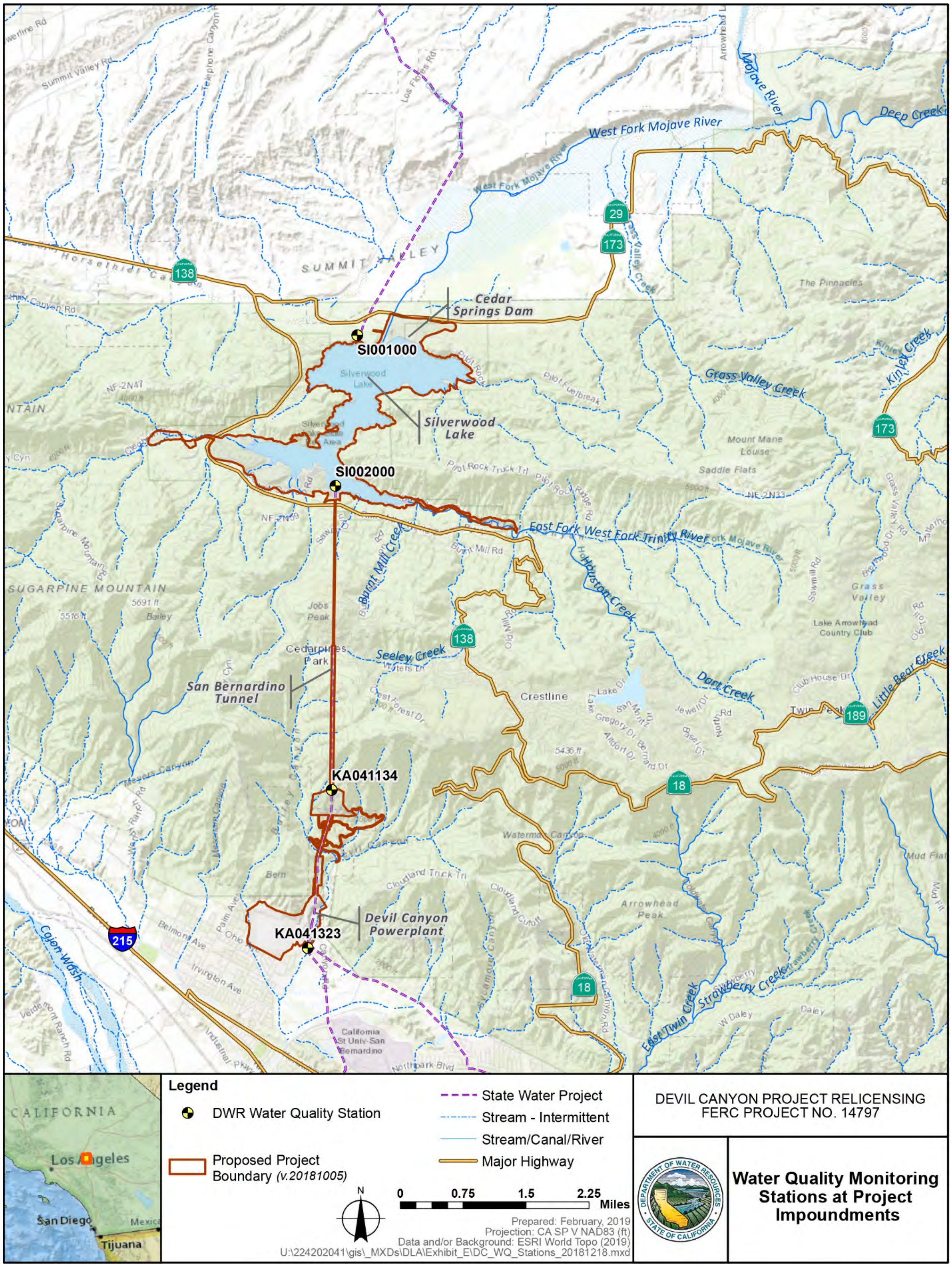


Figure 5.2-11. Water Quality Monitoring Stations at Project Impoundments

Table 5.2-8. Summary of DWR Water Quality Data for Silverwood Lake – General Parameters, January 2010 through December 2017

Parameter	Units	Laboratory Method Reporting Limit	2017 Study Result Range[2]	2010 through 2017 Minimum	2010 through 2017 Maximum	2010 through 2017 Average[3]	Number of Samples
Total Dissolved Solids	mg/L	1	111 - 168	110	378	249	59
Dissolved Chloride	mg/L	0.1	25 - 32	19	107	64	57
Dissolved Sulfate	mg/L	1	14 - 19	14	76	40	57
Total Alkalinity	mg/L as $CaCO_3$	1	40 - 78	39	89	70	59
Dissolved Bromide	mg/L as $CaCO_3$	0.01	--	0.04	1	0.23	68
Dissolved Calcium	mg/L	1	11 - 19	11	31	21	59
Hardness	mg/L as $CaCO_3$	1	52 - 82	45	123	95	55
Dissolved Magnesium	mg/L	1	6 - 8	5	14	10	56
Dissolved Sodium	mg/L	1	19 - 26	16	84	52	56
Turbidity	NTU	0.1	0 - 4.5	ND	4	1.4	24

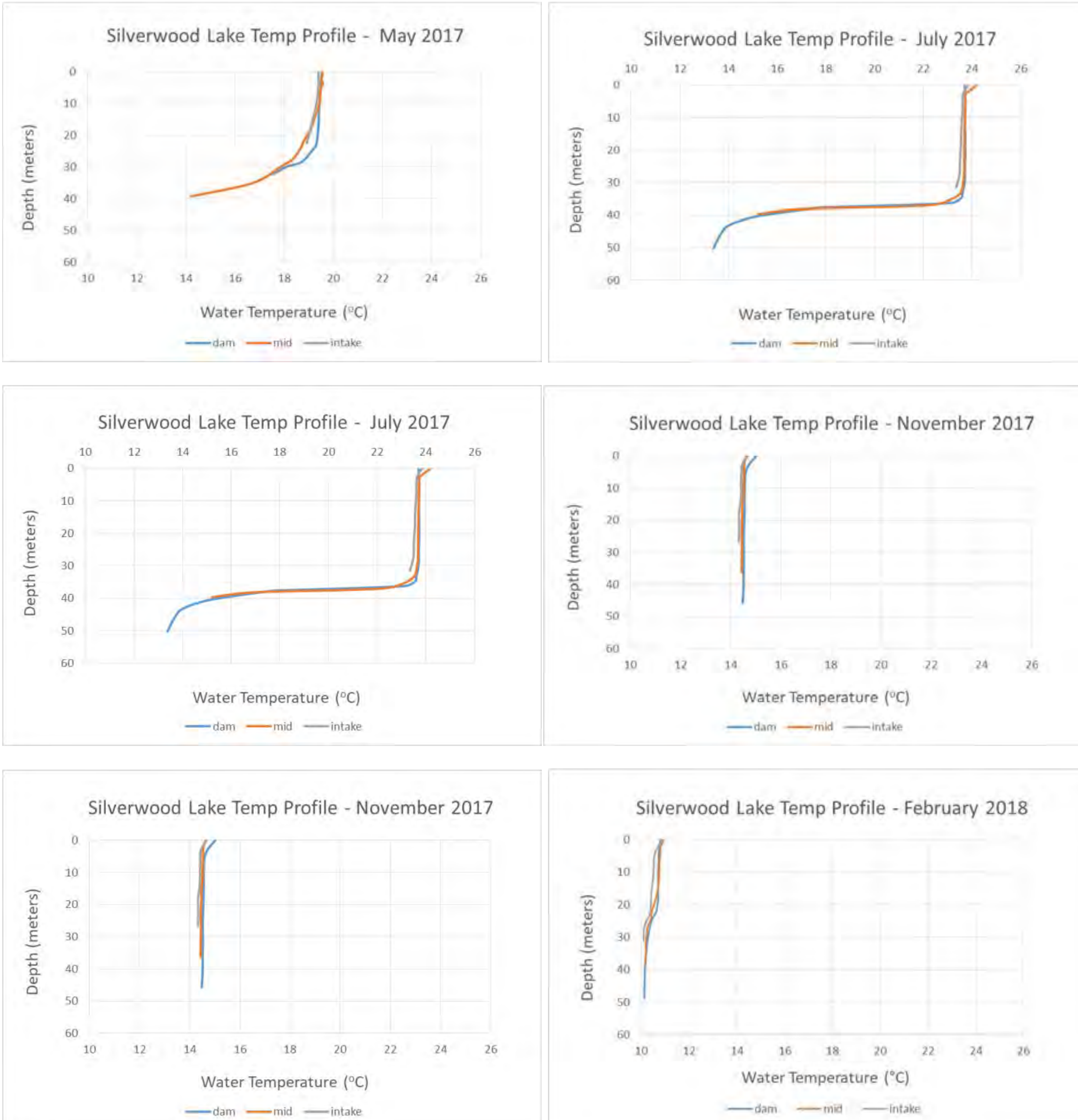
Source: DWR 2010 through 2017, Station SI002000
Notes:
[1]The Lahontan RWQCB Basin Plan Water Quality Objective establishes 90th percentile values (California RWQCB Lahontan Region 2016)
[2]There were six total samples collected for each parameter for the 2017 water quality study; three near the surface and three near the bottom of the lake.
[3]Half the reporting limit value used for averaging where applicable.
Key:
$CaCO_3$ = calcium carbonate
DWR = California Department of Water Resources
mg/L = milligram per liter
ND = non detection
NTU = Nephelometric Turbidity Unit
-- = not sampled

Field Measurements

DWR has collected reservoir profiles in Silverwood Lake at various intervals since 2005 at two locations, stations SI001000 and SI002000 (Table 5.2-6; Figure 5.2-11). These profiles include the collection of water temperature, conductivity, dissolved oxygen (DO), and pH at approximately 1-meter (m) intervals from near the surface to near the bottom. Tables 5.2-9 and 5.2-10 summarize data collected near the surface and near the bottom (approximately 100 feet deep) from January 2005 through January 2018 at stations SI001000 and SI002000. In total, 739 reservoir profiles were taken between the two stations during this period. Secchi depths were collected during these periods and ranged from 0.1 m to 10.8 m, with an average of 4.1 m.

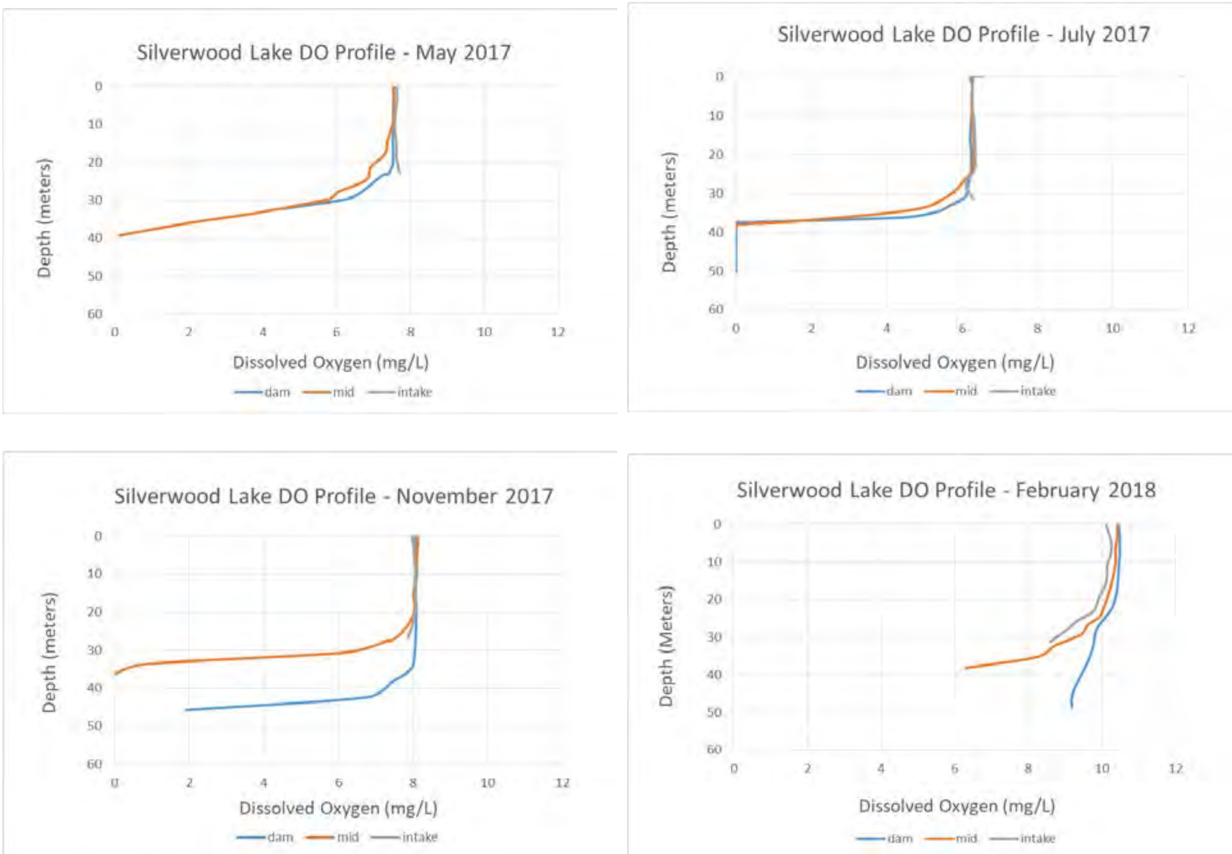
DO concentrations measured near the surface at stations SI001000 and SI002000 (approximately 0.3 m depth) ranged from 5.1 mg/L to 11.7 mg/L over 739 sampling events (Table 5.2-9). The Lahontan RWQCB Basin Plan WQO for DO in waters designated as COLD is that no instantaneous values (one day minimum) should be below 4.0 mg/L. The concentrations below the Basin Plan WQO were in the deeper portions of Silverwood Lake in the summer when the lake was stratified. Of the 739 readings taken near the bottom of the reservoir, usually around 100 feet deep, 315 were below the Basin Plan WQO. Dissolved oxygen concentrations ranged between 0.0 mg/L and 11.9 mg/L (Table 5.2-10). Reservoir profiles collected as part of DWR's *Water Quality and Temperature Study Approach* showed similar patterns in DO concentrations with anoxic conditions present at deeper depths during May, August, and November profiles. Figure 5.2-15 shows changes in DO concentrations during the same period. The clinograde oxygen profiles in warmer weather reflect an excess of oxygen consumption in the hypolimnion. Low oxygen conditions were present in profiles collected in 2017 at Station SI002000 from April through September, which corresponded to when a thermocline was present. As part of DWR's *Water Quality and Temperature Study Approach*, reservoir profiles were taken once per quarter from May 2017 to February 2018 at the same locations, as well as a third location approximately equidistant from the other two stations. Results of these reservoir profiles were similar to historical data collected by DWR (Figure 5.2-13).

The stratification observed in Silverwood Lake is typical of a warm monomictic lake with one mixing in the winter; the lake does not freeze. Monthly profiles collected at stations SI001000 and SI002000 from 2005 to 2018 show a similar pattern in water temperature each year; a thermocline begins to develop in the spring, maintains through the summer, and mixes during the fall and winter. Figure 5.2-14 shows how water temperature changes throughout the year at both sampling locations in Silverwood Lake, using 2017 as an example. Surface water temperatures ranged from 6.5 degrees Celsius (°C) to 25.6°C over the 739 surface readings recorded. As expected, temperatures were cold in the winter months, warmed through the spring into summer and decreased in fall. Water temperatures observed near the bottom varied between 6.4°C and 24.8°C over all readings (Table 5.2-9). As part of DWR's *Water Quality and Temperature Study Approach*, reservoir profiles were taken once per quarter from May 2017 to February 2018 at the same locations, as well as a third location approximately equidistant from the other two stations. Results of these reservoir profiles were similar to historical data collected by DWR (Figure 5.2-12).



Source: DWR 2017
Key:
°C= degrees Celsius

Figure 5.2-12. Water Temperature Profiles for DWR's Water Quality and Temperature Study Approach



Source: DWR 2017
Key:
mg/L = milligram per liter

Figure 5.2-13. Dissolved Oxygen Profiles for DWR's Water Quality and Temperature Study Approach

Table 5.2-9. Summary of DWR Water Quality Data for Silverwood Lake – Field Parameters, January 2005 through January 2018, SI001000 and SI002000 Near the Surface

Month	# samples	Monthly Values near Surface											
		Temperature (°C)			Conductivity (uS/cm)			Dissolved Oxygen (mg/L)			pH (standard units)		
		Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max
January	40	6.5	8.4	10.3	309.0	454.5	581.0	8.5	9.8	11.5	7.8	8.2	8.7
February	24	7.7	9.1	10.9	342.0	462.5	621.0	9.1	9.6	10.6	7.8	8.2	8.6
March	49	8.9	11.5	14.5	271.0	451.2	615.0	8.5	9.6	11.7	7.7	8.4	9.0
April	78	11.6	14.7	17.4	208.0	443.0	550.0	7.7	8.8	10.5	7.8	8.5	9.3
May	74	15.3	18.0	21.0	179.0	413.4	568.0	6.9	8.0	9.0	7.8	8.4	9.3
June	86	17.8	20.8	23.4	172.0	427.3	618.0	6.5	7.5	9.0	7.7	8.4	9.2
July	91	21.6	23.3	25.5	142.0	426.0	589.0	6.1	7.3	10.5	7.7	8.4	9.3
August	91	21.7	23.5	25.6	171.0	373.4	600.0	5.1	6.7	8.1	7.6	8.3	9.1
September	87	20.0	22.4	24.4	211.0	417.7	619.0	5.2	6.6	9.4	7.1	8.4	9.2
October	59	16.3	19.4	22.2	232.0	450.6	617.0	5.7	6.8	9.6	7.5	8.3	9.1
November	30	13.8	15.2	17.7	221.0	444.5	607.0	5.2	7.3	8.8	6.3	8.0	8.7
December	34	8.5	11.0	13.1	292.0	452.0	628.0	7.2	8.6	10.2	7.6	8.1	8.5
Average	**62**	**14.1**	**16.4**	**18.8**	**229.2**	**434.7**	**601.1**	**6.8**	**8.1**	**9.9**	**7.5**	**8.3**	**9.0**
Minimum	**24**	**6.5**	**8.4**	**10.3**	**142.0**	**373.4**	**550.0**	**5.1**	**6.6**	**8.1**	**6.3**	**8.0**	**8.5**
Maximum	**91**	**21.7**	**23.5**	**25.6**	**342.0**	**462.5**	**628.0**	**9.1**	**9.8**	**11.7**	**7.8**	**8.5**	**9.3**

Source: DWR 2005 through 2018, Station SI001000 and SI002000
Key:
°C = degrees Celsius
Avg = average
DWR = California Department of Water Resources
Max = maximum
mg/L = milligram per liter
Min = minimum
µS/cm = microsiemens per centimeter

Table 5.2-10. Summary of DWR Water Quality Data for Silverwood Lake – Field Parameters, January 2005 through January 2018, Station SI001000 and SI002000 Near the Bottom

Month	# samples	Monthly Values at about 100-Foot Depth											
		Temperature (°C)			Conductivity (uS/cm)			Dissolved Oxygen (mg/L)			pH (standard units)		
		Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max
January	39	6.4	8.3	9.9	308.0	456.4	584.0	8.0	9.5	11.9	7.9	8.2	8.7
February	24	7.8	8.9	10.5	353.0	481.1	619.0	8.2	9.1	10.2	7.3	8.1	8.5
March	49	8.0	9.7	12.6	255.0	466.6	618.0	3.8	7.9	9.4	7.7	8.1	8.6
April	78	8.8	11.0	15.5	214.0	459.9	617.0	0.0	5.5	8.7	7.1	7.9	8.8
May	74	10.0	12.9	18.5	218.0	452.4	654.0	0.0	3.4	8.0	7.2	7.8	8.6
June	86	10.8	14.2	20.7	204.0	435.5	626.0	0.0	1.9	7.1	6.9	7.6	8.5
July	91	11.3	15.2	24.0	163.0	457.4	637.0	0.0	1.2	6.5	7.0	7.6	8.2
August	91	12.0	19.1	24.8	169.0	400.0	642.0	0.0	3.1	8.1	7.0	7.7	8.8
September	86	12.1	18.9	24.1	211.0	426.0	572.0	0.0	3.3	6.7	7.0	7.7	8.6
October	58	12.5	18.1	22.2	232.0	436.3	589.0	0.0	5.3	8.5	7.1	8.0	8.7
November	30	13.7	15.0	16.4	221.0	434.7	554.0	2.2	6.9	8.4	6.7	7.9	8.5
December	33	8.4	11.0	13.0	293.0	437.0	628.0	7.0	8.5	10.4	7.8	8.1	8.5
Average	**62**	**10.2**	**13.5**	**17.7**	**236.8**	**445.3**	**611.7**	**2.4**	**5.5**	**8.7**	**7.2**	**7.9**	**8.6**
Minimum	**24**	**6.4**	**8.3**	**9.9**	**163.0**	**400.0**	**554.0**	**0.0**	**1.2**	**6.5**	**6.7**	**7.6**	**8.2**
Maximum	**91**	**13.7**	**19.1**	**24.8**	**353.0**	**481.1**	**654.0**	**8.2**	**9.5**	**11.9**	**7.9**	**8.2**	**8.8**

Source: DWR 2005 through 2018, Station SI002000
Key:
µS/cm = microsiemens per centimeter
°C = degrees Celsius
Avg = average
DWR = California Department of Water Resources
Max = maximum
mg/L = milligram per liter
Min = minimum

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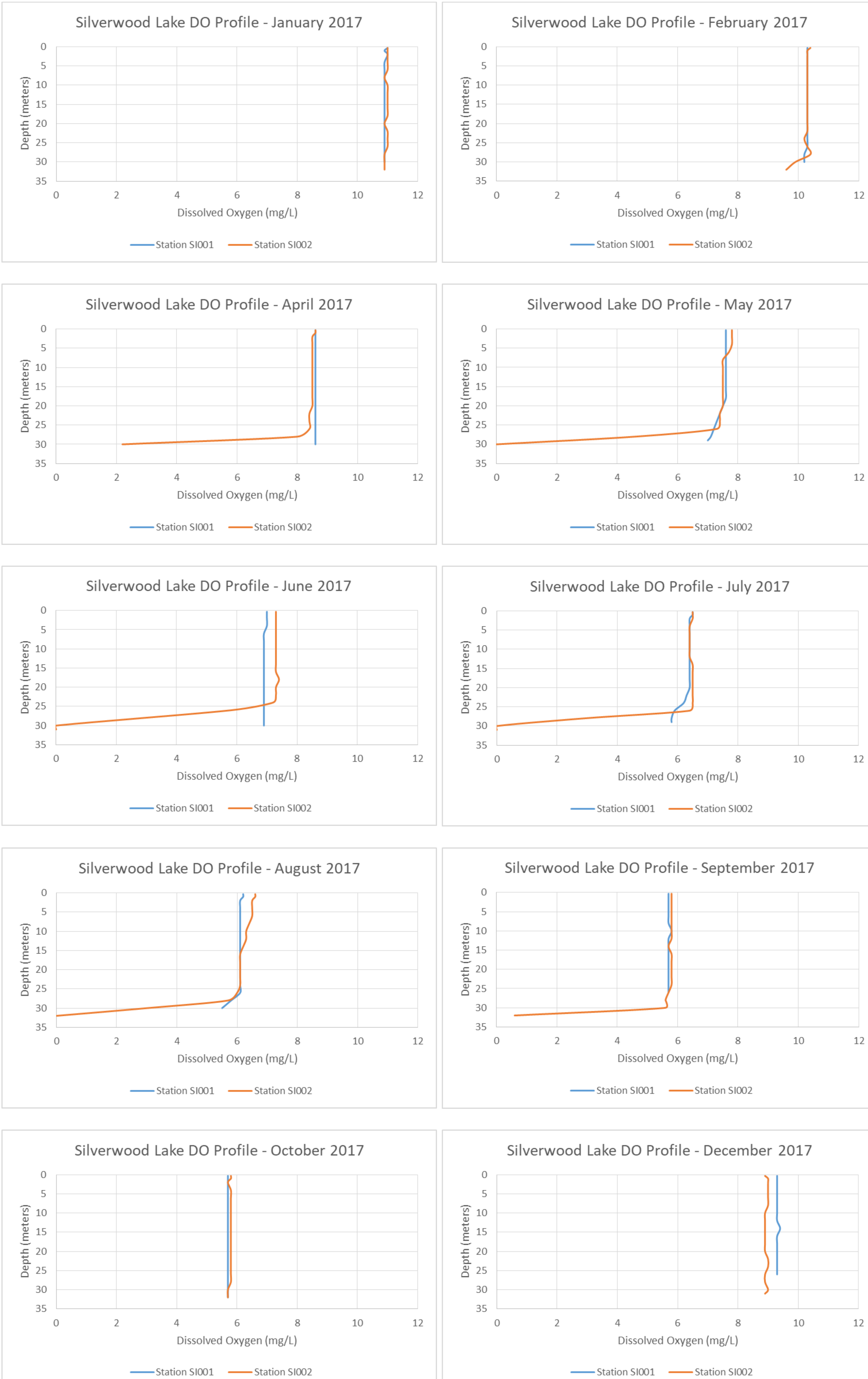
Source: DWR 2017
Key:
°C= degrees Celsius

Figure 5.2-14. Water Temperature Profiles for 10 Months During 2017 at Stations SI001000 and SI002000



Source: DWR 2017
Key:
mg/L = milligram per liter

Figure 5.2-15. Dissolved Oxygen Profiles for 10 Months During 2017 at Stations SI001000 and SI002000

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 5.2-11 summarizes Silverwood Lake nutrient data from January 2010 through December 2017.

Table 5.2-11. Summary of DWR Water Quality Data for Silverwood Lake – Nutrients, January 2010 through December 2017

Parameter	Units	Laboratory Method Reporting Limit	2017 Study Result Range[1]	2010 through 2017 Minimum	2010 through 2017 Maximum	2010 through 2017 Average[2]	Number of Samples
Dissolved Ammonia	mg/L as N	0.01	0.02 – 1.6	ND	0.28	0.06	165
Dissolved Nitrate	mg/L	0.1[3]	--	ND	5.7 (0.99 NO_3-N)	2.14 (0.41 NO_3-N)	57
Dissolved Nitrate + Nitrite	mg/L as N	0.01	0.01 – 0.22	ND	1.4	0.48	167
Total Kjeldahl Nitrogen	mg/L as N	0.1	0.2 – 0.7	0.1	4.4	0.46	157
Dissolved Ortho-phosphate	mg/L as P	0.01	0.09 – 0.46	ND	0.13	0.05	167
Total Phosphorus	mg/L as P	0.01	0.1 – 0.48	0.01	0.43	0.07	157

Source: DWR 2010 through 2017, Station SI002000
Notes:
[1]There were six total samples collected for each parameter for the 2017 water quality study; three near the surface and three near the bottom of the lake.
[2]Half the reporting limit value used for averaging where applicable.
[3]Three samples with reporting limits greater than 0.1 mg/L
Key:
DWR = California Department of Water Resources
mg/L = milligram per liter
N = Nitrogen
ND = non detection
NO_3-N = Nitrate as Nitrogen
P = Phosphorus
-- = not sampled

To prevent the development of biological nuisances, and to control accelerated or 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 RWQCB Basin Plan for Silverwood Lake (California RWQCB Lahontan Region 2016). The source of elevated phosphorus concentrations in Silverwood Lake is unknown; however, the Project has no activities that would increase phosphorus concentrations. The Lahontan RWQCB 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 seven-year data period (January 2010 through December 2017) the highest observed dissolved ammonia nitrogen value of 0.28 mg/L occurred on December 15, 2015. With a pH of 8.2 and water temperature of 11.4°C on that date, the four-day average concentration for the 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 2016).

Trace Elements

Results of analyses for trace elements in Silverwood Lake water are presented in Table 5.2-12. Of the 16 parameters tested, four parameters were not detected across all samples (dissolved beryllium, cadmium, lead, and silver). Samples collected during DWR's relicensing study in 2017 showed similar results to those collected historically.

Table 5.2-12. Summary of DWR Water Quality Data for Silverwood Lake – Trace Elements, January 2010 through November 2017

Parameter	Units	Laboratory Method Reporting Limit	2017 Study Result Range[1]	2010 through 2017 Minimum	2010 through 2017 Maximum	2010 through 2017 Average[2]	Number of Samples
Dissolved Aluminum	mg/L	0.01	ND	ND	0.01	ND	54
Dissolved Arsenic	mg/L	0.001	0.002 – 0.009	0.001	0.006	0.0029	54
Dissolved Barium	mg/L	0.05-0.005	--	ND	0.046	0.033	54
Dissolved Beryllium	mg/L	0.001	--	ND	ND	ND	54
Dissolved Boron	mg/L	0.1	--	0.1	0.3	0.1636	22
Dissolved Cadmium	mg/L	0.001	ND	ND	ND	ND	54
Dissolved Chromium	mg/L	0.001	ND	ND	0.003	ND	54
Dissolved Copper	mg/L	0.001	0.001 – 0.002	0.001	0.006	0.002	54
Dissolved Iron	mg/L	0.005	0.005 – 0.008	ND	0.029	0.013	54
Dissolved Lead	mg/L	0.001	ND	ND	ND	ND	54
Dissolved Manganese	mg/L	0.005	ND	ND	0.086	0.02	54
Dissolved Mercury	mg/L	0.0002	ND	ND	0.0007	ND	53
Dissolved Nickel	mg/L	0.001	0.001 – 0.002	ND	0.002	0.001	54
Dissolved Selenium	mg/L	0.001	ND	ND	0.002	0.001	54
Dissolved Silver	mg/L	0.001	ND	ND	ND	ND.	54
Dissolved Zinc	mg/L	0.005	ND	ND	0.027	0.015	54

Source: DWR 2010 through 2017, Station SI002000
Notes:
[1]There were six total samples collected for each parameter for the 2017 water quality study; three near the surface and three near the bottom of the lake.
[2]Half the reporting limit value used for averaging where applicable.
Key:
-- = not sampled
DWR = California Department of Water Resources
mg/L = milligram per liter
ND = non detection

Dissolved copper levels in water samples from Silverwood Lake (2010 through 2017 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 five years of data (January 1997 through May 2002) from station SI002000 (Figure 5.2-2), most organic chemicals were not detected above the laboratory's method reporting limit in Silverwood Lake water (Table 5.2-13). Of the 64 compounds tested, all were below the primary drinking water maximum contaminant levels (MCL):

- 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 (FR Vol. 54, No. 97, pp. 22138, 22139) and below the Public Health Goal (PHG) of 150 µg/L (OEHHA 2001).

- 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 drinking water MCL and PHG of 13 µg/L (OEHHA 2001), but above the secondary drinking water MCL for taste and odor of 5 µg/L. MTBE concentrations in more recent samples in Silverwood Lake (2002) were below primary and secondary MCLs for finished drinking water.

- 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. Water quality standards are for the sum of both isomers: the California Primary MCL is 1,750 µg/L and California PHG (OEHHA 2001) is 1,800 µg/L. The taste and odor standard is 17 µg/L (FR Vol. 54, No. 97, pp. 22138,22139). No samples collected in Silverwood Lake exceeded the MCLs. 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.

Table 5.2-13. Summary of DWR Water Quality Data for Silverwood Lake – Organic Chemicals, January 1997 through May 2002

Parameter	Units	Laboratory Method Detection Limit	1997- 2002 Minimum	1997- 2002 Maximum	Number of Samples
1,1,1,2-Tetrachloroethane	µg/L	0.5	ND	ND	73
1,1,1-Trichloroethane	µg/L	0.5	ND	ND	73
1,1,2,2-Tetrachloroethane	µg/L	0.5	ND	ND	73
1,1,2-Trichloroethane	µg/L	0.5	ND	ND	40
1,1-Dichloroethane	µg/L	0.5	ND	ND	73
1,1-Dichloroethene	µg/L	0.5	ND	ND	73
1,1-Dichloropropene	µg/L	0.5	ND	ND	73
1,2,3-Trichlorobenzene	µg/L	0.5	ND	ND	73
1,2,3-Trichloropropane	µg/L	0.5	ND	ND	73
1,2,4-Trichlorobenzene	µg/L	0.5	ND	ND	73
1,2,4-Trimethylbenzene	µg/L	0.5	ND	0.65	73
1,2-Dibromo-3-chloropropane (DBCP)	µg/L	0.5	ND	ND	73
1,2-Dibromoethane (EDB)	µg/L	0.5	ND	ND	40
1,2-Dichlorobenzene	µg/L	0.5	ND	ND	73
1,2-Dichloroethane	µg/L	0.5	ND	ND	73
1,2-Dichloropropane	µg/L	0.5	ND	ND	73
1,3,5-Trimethylbenzene	µg/L	0.5	ND	ND	73
1,3-Dichlorobenzene	µg/L	0.5	ND	ND	73
1,3-Dichloropropane	µg/L	0.5	ND	ND	73
1,4-Dichlorobenzene	µg/L	0.5	ND	ND	73
2,2-Dichloropropane	µg/L	0.5	ND	ND	73
2-Chlorotoluene	µg/L	0.5	ND	ND	73
4-Chlorotoluene	µg/L	0.5	ND	ND	73
4-Isopropyltoluene	µg/L	0.5	ND	ND	73
Benzene	µg/L	0.5	ND	ND	73
Bromobenzene	µg/L	0.5	ND	ND	73
Bromochloromethane	µg/L	0.5	ND	ND	73
Bromodichloromethane	µg/L	0.5	ND	ND	73
Bromoform	µg/L	0.5	ND	ND	73

Table 5.2-13. Summary of DWR Water Quality Data for Silverwood Lake – Organic Chemicals, January 1997 through May 2002 (continued)

Parameter	Units	Laboratory Method Detection Limit	1997- 2002 Minimum	1997- 2002 Maximum	Number of Samples
Bromomethane	µg/L	0.5	ND	ND	73
Carbon tetrachloride	µg/L	0.5	ND	ND	73
Chlorobenzene	µg/L	0.5	ND	ND	40
Chloroethane	µg/L	0.5	ND	ND	73
Chloroform	µg/L	0.5	ND	ND	73
Chloromethane	µg/L	0.5	ND	ND	73
Dibromochloromethane	µg/L	0.5	ND	ND	73
Dibormomethane	µg/L	0.5	ND	ND	73
Dichlorodifluoromethane	µg/L	0.5	ND	ND	73
Ethyl benzene	µg/L	0.5	ND	ND	73
Ethylene Dibromide	µg/L	0.5	ND	ND	34
Hexachlorobutadiene	µg/L	0.5	ND	ND	73
Isopropylbenzene	µg/L	0.5	ND	ND	73
Methyl tert-butyl ether (MTBE)	µg/L	1	ND	12	73
Methylene chloride	µg/L	0.5	ND	ND	73
Naphthalene	µg/L	0.5	ND	ND	73
Styrene	µg/L	0.5	ND	ND	73
Tetrachloroethene	µg/L	0.5	ND	ND	73
Toluene	µg/L	0.5	ND	2.5	73
Trichloroethene	µg/L	0.5	ND	ND	73
Trichlorofluoromethane	µg/L	0.5	ND	ND	73
Vinyl chloride	µg/L	0.5	ND	ND	73
cis-1,2-Dichloroethene	µg/L	0.5	ND	ND	73
cis-1,3-Dichloropropene	µg/L	0.5	ND	ND	73
m + p Xylene	µg/L	0.5	ND	ND	39
m-Xylene	µg/L	0.5	ND	1.9	37
n-Butylbenzene	µg/L	0.5	ND	ND	73
n-Propylbenzene	µg/L	0.5	ND	ND	73
o-Xylene	µg/L	0.5	ND	0.97	73
p-Xylene	µg/L	0.5	ND	ND	30

Table 5.2-13. Summary of DWR Water Quality Data for Silverwood Lake – Organic Chemicals, January 1997 through May 2002 (continued)

Parameter	Units	Laboratory Method Detection Limit	1997-2002 Minimum	1997- 2002 Maximum	Number of Samples
sec-Butylbenzene	µg/L	0.5	ND	ND	73
tert-Butylbenzene	µg/L	0.5	ND	ND	73
trans-1,2-Dichloroethene	µg/L	0.5	ND	ND	73
trans-1,3-Dichloropropene	µg/L	0.5	ND	ND	73

Source: DWR 1997 through 2002, Station SI002000
Key:
DWR = California Department of Water Resources
ND = non detection
µg/L = micrograms per liter

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 SWRCB's 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 millimeters; fillet wet weight) is 0.20 milligrams per kilogram. 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 establish a maximum total PCB concentration of 500 micrograms per kilogram (wet weight) in tissue samples for the protection of aquatic life from bioaccumulation of toxic substances (National Academy of Sciences 1973). 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). In comparison, fish tissue results for PCBs published in the 2013 OEHHA Health Advisory Report for Silverwood Lake ranged from 4 ppb in rainbow trout to 1,250 ppb in blackfish and Tui chub.

In the water phase, the maximum dissolved mercury value from samples collected between 2010 and 2017 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 five 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."

West Fork Mojave River Downstream of Cedar Springs Dam

Limited water quality data exists for the West Fork Mojave River downstream of Cedar Springs Dam. The only source of basic water quality information that DWR was able to locate was data collected at USGS gage 10260950, located upstream of USACE's Mojave River Forks Dam and approximately 4.5 miles downstream of Cedar Springs Dam. Discharge, water temperature, specific conductivity and pH at this location are summarized in Table 5.2-14.

Additional water quality parameters were sampled less frequently at USGS Gage 10260950 between April 2007 and October 2017. These data are summarized in Table 5.2-15.

Devil Canyon Afterbay and Devil Canyon Second Afterbay

DWR collects water samples for analysis at Station KA041134 and Station KA041323 (Figure 5.2-11).

General Water Quality

Water quality from January 2010 through December 2017 for general parameters is summarized in Table 5.2-16.

Nutrients

Nitrogen and phosphorus levels in Devil Canyon Second Afterbay are presented in Table 5.2-17.

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 5.2-18).

Table 5.2-14. General Water Quality in the West Form Mojave River Measured at USGS Gage 10260950 near USACE's Mojave River Forks Dam

Month	# of Daily Water Quality Observations[1]	Average Monthly Discharge (cfs)	Temperature (°C)		Conductivity (µS/cm)		pH (units)	
			Max	Min	Max	Min	Max	Min
January	143	37.0	11.6	5.0	519	454	8.6	7.9
February	208	39.2	14.5	6.2	482	437	9.0	7.8
March	221	31.7	18.3	8.1	470	441	9.1	7.8
April	142	17.9	21.0	9.7	451	426	9.0	7.8
May	111	7.5	24.8	12.3	351	326	9.3	7.6
June	111	4.4	28.8	15.2	353	330	9.3	7.6
July	89	1.7	30.9	18.7	344	313	9.6	7.6
August	39	0.8	29.5	18.9	351	314	9.4	7.5
September	39	3.3	29.3	14.5	272	259	8.6	7.6
October	46	20.1	22.8	14.6	365	353	8.6	7.7
November	105	37.5	15.9	10.4	470	456	8.5	7.8
December	99	51.7	11.9	5.8	533	505	8.8	7.8
Average	**113**	**21.1**	**21.6**	**11.6**	**413**	**385**	**9.0**	**7.7**
Maximum	**221**	**51.7**	**30.9**	**18.9**	**533**	**505**	**9.6**	**7.9**
Minimum	**39**	**0.8**	**11.6**	**5.0**	**272**	**259**	**8.5**	**7.5**

Note:
[1]Period of record for USGS Gage 10260950 is February 28, 2007 through March 24, 2018. There is no water quality data available when flow is zero.
Key:
°C = degrees Celsius
Avg = average
cfs = cubic feet per second
Max = maximum
Min = minimum
µS/cm = micro-Siemens per centimeter
USACE = U.S. Army Corps of Engineers
USGS = U.S. Geological Survey

Table 5.2-15. Additional Water Quality Results in the West Form Mojave River Measured at USGS Gage 10260950 near the Mojave River Forks Reservoir Between April 2007 and October 2017

Parameter	Units	Average	Minimum	Maximum	Number of Samples
Ammonia (NH3 + NH4+)	mg/L as N	0.03	0.01	0.21	34
Nitrite	mg/L as N	0.02	0.001	0.097	34
Nitrate	mg/L as N	0.45	0.027	1.6	34
Nitrate plus nitrite	mg/L as N	0.46	0.04	1.61	34
Orthophosphate	mg/L as PO_4	0.22	0.013	0.966	34
Orthophosphate	mg/L as P	0.07	0.004	0.315	34
Hardness	mg/L as $CaCO_3$	103.92	54.2	151	34
Calcium	mg/L	26.79	14.2	41.6	34
Magnesium	mg/L	9.00	4.56	13.3	34
Sodium	mg/L	51.82	19.1	85.5	34
Potassium	mg/L	2.47	1.47	4.95	34
Chloride	mg/L	63.89	21.5	108	34
Sulfate	mg/L	42.96	14.2	80.7	34
Fluoride	mg/L	0.16	0.06	0.42	34
Arsenic	mg/L	0.0019	0.0005	0.0038	34
Boron	mg/L	0.138	0.056	0.254	34
Chromium	mg/L	0.031	0.004	0.104	34
Iron	mg/L	0.007	0.001	0.039	34
Manganese	mg/L	0.085	0.053	0.113	34
Vanadium	mg/L	0.001	0.000	0.008	35
Alkalinity	mg/L as $CaCO_3$	80.66	50.5	110	34
Dissolved solids	mg/L	35.50	10	180	40

Key:
$CaCO_3$ = Calcium Carbonate
mg/L = milligrams per liter
µg/L = microgram per liter
N = Nitrogen
NH_3 = Ammonia
NH_4 = Ammonium
P = Phosphorus
$P0_4$ = Phosphate
USGS = U.S. Geological Survey

Table 5.2-16. Summary of DWR Water Quality Data for Station KA041134 and Station KA041323 – General Parameters, January 2010 through December 2017

Parameter	Units	Laboratory Detection Limit	2010 through 2017 Minimum	2010 through 2017 Maximum	2010 through 2017 Average[1]	Number of Samples
Alkalinity	mg/L as $CaCO_3$	1	34	89	70	92
Bromide	mg/L	0.01	ND	0.35	0.23	70
Calcium	mg/L	1	9	31	21	93
Chloride	mg/L	1	19	103	66	70
Hardness	mg/L as $CaCO_3$	1	49	128	93	66
Magnesium	mg/L	1	2	16	10	93
Sodium	mg/L	1	13	84	53	92
Specific Conductance	µS/cm	1	150	645	451	91
Sulfate	mg/L	1	11	82	42	91
Total Dissolved Solids	mg/L	1	83	1184	264	93
Turbidity	NTU	1	ND	18	2	90

Source: DWR January 2010 through March 2011, Station KA041134; DWR April 2011 through December 2017, Station KA041323
Note:
[1]Half the laboratory reporting limit value used for averaging where applicable.
Key:
$CaCO_3$ = calcium carbonate
DWR = California Department of Water Resources
mg/L = milligram per liter
µS/cm = microsiemens per centimeter
NTU = Nephelometric Turbidity Unit

Table 5.2-17. Summary of DWR Water Quality Data for Station KA041323 and Station KA041134 – Nutrients, January 2010 through December 2017

Parameter	Units	Laboratory Reporting Limit	2010 through 2017 Minimum	2010 through 2017 Maximum	2010 through 2017 Average[1]	Number of Samples
Nitrite + Nitrate	mg/L as Nitrogen	0.01	0.05	1.10	0.44	93
Organic Carbon Dissolved	mg/L as Carbon	0.5	ND	5.70	2.97	92
Organic Carbon, Total	mg/L as Carbon	0.5	1.10	5.80	3.15	92
Ortho Phosphate	mg/L as Phosphorus	0.01	ND	0.12	0.05	86
Total Phosphorus	mg/L	0.01	0.01	0.16	0.07	92

Source: DWR 2010 through March 2011, Station KA041134; DWR April 2011 through December 2017, Station KA041323
Note:
[1]Half the laboratory reporting limit value used for averaging where applicable.
Key:
DWR = California Department of Water Resources
DLR = Laboratory Detection Limits for Purposes of Reporting
ND = non detection
mg/L = milligram per liter

Table 5.2-18. Summary of DWR Water Quality Data for Station KA041134 and Station KA041323 – Trace Elements, January 2010 through December 2017

Parameter	Units	Laboratory Method Detection Reporting Limit	2010 through 2017 Minimum	2010 through 2017 Maximum	2010 through 2017 Average[1]	Number of Samples
Antimony	mg/L	0.001	ND	ND	ND	43
Arsenic	mg/L	0.001	ND	0.006	0.003	93
Beryllium	mg/L	0.001	ND	ND	ND	93
Boron	mg/L	0.1	0.10	0.30	0.15	86
Chromium	mg/L	0.001	ND	0.001	ND	93
Copper	mg/L	0.001	ND	0.004	0.001	93
Iron	mg/L	0.005	ND	0.056	0.008	93
Lead	mg/L	0.001	ND	ND	ND.	93
Manganese[2]	mg/L	0.005	ND	0.119	ND	93
Selenium	mg/L	0.001	ND	0.002	ND	93
Zinc	mg/L	0.005	ND	ND	ND	92

Source: DWR 2010 through March 2011, Station KA041134; DWR April 2011 through December 2017, Station KA041323
Notes:
[1]Half the laboratory reporting limit value used for averaging where applicable.
[2]The majority of manganese samples were non-detectible; 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:
DLR = Laboratory Detection Limits for Purposes of Reporting
DWR = California Department of Water Resources
mg/L = milligram per liter
ND = non detection

Pesticides

Based on sampling from 2010 through 2014 at DWR Stations KA041323 and KA041134, there were no exceedances of any drinking water MCL or other MCL for pesticides, herbicides, and volatile organics in samples collected in the Devil Canyon Second Afterbay. Low levels of pesticides were measured in eight samples between 2010 and 2014, but all were below any MCL values (if established):

- 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.

Dimethyl tetrachloroterephthalate (Dacthal) (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).

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.

Radiological Compounds

MWD conducts analytical tests on samples from MWD's distribution and surface waters. Radiological compounds were tested in 2014 from the Devil Canyon Second Afterbay (Table 5.2-19). Observed values were below MCLs.

Table 5.2-19. Summary of MWD Water Quality Data for Silverwood Lake at Devil Canyon Radiological Parameters for Four Consecutive Quarters in 2014

Parameter	Units	Laboratory Method Reporting Limit	Silverwood Lake	Maximum Contaminant Level
Gross Alpha	picoCuries/Liter	3	ND-4	15
Gross Beta[1]		4	ND-4	50
Combined Radium[2]		1	ND	5
Strontium		2	ND	8
Tritium		1,000	ND	20,000
Uranium		1	2-4	20

Source: MWD 2017
Notes:
[1]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 picoCuries per liter.
[2]Standard is for radium 226 and radium 228 combined.
[3]To date, there has been no significant regulatory action on the proposed federal standards.
Key:
MWD = Metropolitan Water District of Southern California
ND = non detection

5.2.2 Effects of DWR's Proposal

This section discusses the potential environmental effects of DWR's Proposal. For the reasons stated below, DWR has not proposed any specific measures related to water quantity and water quality other than: (1) a continuation of water surface elevation limitations described in the 1968 USFS MOU, as amended, and 2003 CDFW MOU, and (2) implementation of a Hazardous Materials Management Plan. DWR anticipates it would continue to operate Silverwood Lake consistent with the minimum pool conditions in DWR's 1968 Agreement with USFS and in DWR's 2003 Agreement with CDFW; these agreements have no termination date (i.e., they will continue to dictate minimum pool requirements in Silverwood Lake through the term of the new license).

5.2.2.1 Water Quantity

DWR proposes no changes to existing Project operations that would affect water quantity. The Project would continue to generate electricity using SWP water as it is delivered to DWR's water customers in southern California. No local surface water would be used for electricity generation. The fully appropriated natural flow entering Silverwood Lake would continue to be delivered downstream as directed by the Mojave River Decree Watermaster. Continuation of water surface elevation limitations described in the 1968 USFS MOU, as amended, and 2003 CDFW MOU, will assure recent reservoir operations will continue.

DWR has not proposed minimum flow measures from Silverwood Lake into the West Fork Mojave River because the Project has no water for such releases. As stated above, the SWP water is fully allocated for delivery to southern California water users, the natural flow entering Silverwood Lake is fully appropriated, and the magnitude and timing of the water's delivery is dictated by the basin's Watermaster. DWR has no rights to that water, nor is any of the local water available since the basin has been declared fully appropriated and it has been adjudicated by the Court.

Similarly, DWR has not proposed minimum flow measures from the Devil Canyon Afterbay and Devil Canyon Second Afterbay because the afterbays are off-stream, engineered impoundments that do not intercept any surface waters.

5.2.2.2 Water Quality

Silverwood Lake

DWR proposes no changes to existing Project operations or new work (e.g., dredging that would disturb bottom sediments) that would incrementally affect existing water quality in Silverwood Lake or lead to a degradation in existing water quality. DWR's Proposal is generally consistent with the Lahontan RWQCB Basin Plan standards, though the SWRCB will make that final determination. DWR's Proposal does not add any nutrients, organic chemicals, metals, or other potential pollutants to Silverwood Lake. Recreational boating could result in oil and grease issues, but DWR is unaware of any reports that oil and grease have affected beneficial uses or resulted in a nuisance.

Additionally, recreation use could result in unsafe *E. coli* concentrations; however, data collected from the North Park valve off of the Santa Ana pipeline, downstream of Silverwood Lake, showed an average of 2 colony-forming units/100 milliliters E.*Coli* (MWD 2018). Occasional blooms of algae and cyanobacteria have resulted in the degradation of drinking water aesthetics through the production of taste and odor compounds, and potential health risks associated with the production of cyanotoxins; however, DWR manages these instances through an SWRCB-approved and permitted program and will continue to do so in the future. During periods of lake stratification, DO at the bottom of the lake is relatively low. This is a normal and natural occurrence in stratified reservoirs and lakes, and does not affect aquatic resources in the reservoir. Most fish and aquatic organisms generally utilize the upper portions of the reservoir where DO levels are typically consistent with the Lahontan RWQCB Basin Plan WQOs.

The most recent CWA Section 303(d) list includes mercury and PCBs in Silverwood Lake, citing fish tissue concentrations, not surface water concentrations, to support the listing. Mercury concentrations measured by DWR do not exceed the MCL target; and while PCBs have not been tested for in Silverwood Lake, there have been no detections of PCBs in the last five years at the Devil Canyon Second Afterbay, which receives water from Silverwood Lake. DWR's Proposal does not introduce any mercury or PCBs into Silverwood Lake that could be bioaccumulated, and DWR does not propose any activities that could disturb bottom sediments where mercury or PCBs may occur. OEHHA has already published Safe Eating Guidelines for Silverwood Lake that recommended anglers consume only rainbow trout and avoid eating most other fish species from the lake due to contamination by mercury. Additionally, implementation of DWR's Hazardous Materials Management Plan will assure the responsible management of Project hazardous materials, including response and clean-up of hazardous materials spills.

For the above reasons, DWR has not proposed water quality measures for Silverwood Lake. Further, DWR has not proposed additional water quality monitoring in Silverwood Lake because there are no indications that water quality is an issue of concern – other than for algae and cyanobacteria blooms that is addressed under a SWRCB-approved program and permit that includes monitoring – and DWR's Proposal does not include any mechanisms that would result in impaired water quality in Silverwood Lake or result in the degradation of existing water quality conditions. DWR will continue to collect water quality data in Silverwood Lake consistent with its existing aquatic herbicide NPDES permit, as may be amended, related to algal bloom control in the lake and its SWC contract (Provision 19) that requires certain water quality criteria are met.

<u>West Fork Mojave River</u>

The Project has no effect on water quantity in the West Fork Mojave River downstream of Cedar Springs Dam, as discussed in Section 5.2.2.1 Even though water releases downstream of Cedar Springs Dam is a mix of SWP water and local watersheds, the timing and magnitude of releases should not create impacts on water quality in the West Fork Mojave River. As context, Figure 5.2-8 shows that, in all months, flows in the West

Fork Mojave River downstream of Cedar Springs Dam are less than 10 cfs about 50 percent of the time, and there is no flow in the river for extended periods of time. Since DWR proposes no changes to Project operations, there should continue to be no effect on water quantity or quality in the West Fork Mojave River downstream of Cedar Springs Dam.

Devil Canyon Afterbay and Devil Canyon Second Afterbay

The Devil Canyon Afterbay and Devil Canyon Second Afterbay are off-stream engineered impoundments that do not intercept any surface waters; nor does the Project release water from the afterbays to local surface waters. Further, the afterbays are closed to the public for safety reasons, so there is no bodily contact with the afterbay waters. Water quality data demonstrate all potential contaminants are below the existing drinking water MCLs or Santa Ana RWQCB Basin Plan objectives. DWR's Proposal does not include any mechanism that would reasonably change or degrade the water quality in these off-stream engineered impoundments. For these reasons, DWR does not propose water quality measures related to the Devil Canyon Afterbay or Devil Canyon Second Afterbay.

5.2.3 Unavoidable Adverse Effects

Operating and maintaining the Project under DWR's Proposal would not create any significant and unavoidable adverse effects. DWR's Proposal does not divert or store any local surface water; water in the Mojave River Basin has been fully adjudicated by the Court and the magnitude and timing of releases from Silverwood Lake to the West Fork Mojave River are under the management of MWA, the Mojave River Decree Watermaster. The Devil Canyon Afterbay and Devil Canyon Second Afterbay do not intercept any local surface water.

Some Lahontan RWQCB Basin Plan WQOs are not met in Silverwood Lake now and cannot be met in the future, for the reasons previously given. However, as discussed above, these inconsistencies with the Lahontan RWQCB Basin Plan WQOs do not affect designated beneficial uses. For this reason, the inconsistencies with the Lahontan RWQCB Basin Plan are considered minor. In addition, some Lahontan RWQCB Basin Plan WQOs are not met in the West Fork Mojave River downstream of Silverwood Lake now and cannot be met in the future, for the reasons previously given. However, as discussed above, these inconsistencies with the Lahontan RWQCB Basin Plan WQOs are considered minor in this section of river because it is often dry.

5.3 FISH AND AQUATIC RESOURCES

This discussion of fish and aquatic resources is divided into three sections. Section 5.3.1 describes Project conditions, and includes eight main subsections: (1) special-status aquatic species, (2) aquatic invasive species, (3) algaecides and aquatic herbicides, (4) fish, (5) amphibians and semi-aquatic reptiles, (6) native aquatic mollusks, (7) benthic macroinvertebrates (BMI), and (8) algae. Potential environmental effects of DWR's Proposal are described in Section 5.3.2, and Section 5.3.3 describes any unavoidable adverse effects.

DWR augmented existing, relevant, and reasonably available information relative to fish and aquatic resources by conducting the Aquatic Invasive Species Study Approach. Refer to the Devil Canyon Project Relicensing Website at http://devil-canyon-project-relicensing.com/studies/ for the detailed study approach, study summary, and detailed study data. The results of the study are incorporated into this section.

5.3.1 <u>Existing Environment</u>

Provided below is a summary of existing conditions for aquatic resources in the Project area.

5.3.1.1 Special-Status Aquatic Species

For the purpose of this Application for New License, a special-status aquatic species is considered an aquatic species that is: (1) found on NFS land and listed by USFS as Sensitive (FSS); (2) listed by CDFW as a Species of Special Concern (SSC); or (3) 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 5.4.

DWR developed the list of aquatic special-status species known or with the potential to occur in the Project vicinity by first reviewing CDFW's website that lists SSC, as well as species listed by other agencies (CDFW 2018f). DWR conducted an initial query of CDFW's California Natural Diversity Database (CNDDB) for the PAD in 2015 and performed an additional query of CDFW's CNDDB on February 16, 2018 (CDFW 2018e), 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, Apple 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 of aquatic special-status species potentially affected by DWR's Proposal.

On the basis of those queries and additional literature and information searches, DWR determined that four native aquatic special-status species have records of occurrence in the Project vicinity, including one fish, one amphibian, one semi-aquatic snake, and one turtle species. An additional species (also a semi-aquatic snake) has the potential to occur. 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. Species occurrence and habitat analysis determined that the Santa Ana speckled dace, which is an undescribed form of the widespread speckled dace (*Rhinichthys osculus*), is restricted to the headwaters of the Santa Ana River and the San Gabriel River drainages. The CNDDB database also documented the Santa Ana speckled dace in Lytle Creek, Cajon Creek, and City Creek, which all are located within the Santa Ana River drainage to which the Project has no aquatic connection. Although a short section of Devil Canyon Creek lies within the proposed Project boundary, the Project has no effect on flows or habitat conditions within Devil Canyon Creek, and therefore no effect on fish which may reside in this small stream. Another species, “South Coast garter snake,” an undescribed form of common garter snake (*Thamnophis sirtalis*) that is classified as an SSC, was also excluded on the basis of multiple considerations. South Coast garter snake does not occur in the Mojave River drainage; however, it is found at scattered locations on the southern California coastal plain from the Santa Clara River drainage south to San Diego County, including one verified record from the Santa Ana River drainage, with the population described as “extinct” (Jennings and Hayes 1994). The small part of the Project area adjacent to Devil Canyon Creek in the Santa Ana River drainage does not support the marshy habitat preferred by South Coast garter snake.

Introduced fish species not native to the Mojave River drainage are not treated here as aquatic special-status species. The arroyo chub (*Gila orcutti*) is native to coastal drainages of the Los Angeles plain, but was inadvertently or intentionally introduced into 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*), through competition and hybridization (Hubbs and Miller 1943; Miller 1946, 1968; Swift et al. 1993). 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). Sacramento hitch (*Lavinia exilicauda*), a species native to central California, was also introduced into the Mojave River. There are documented occurrences of this species from Silverwood Lake in 1988 (Swift 1993; Moyle 2002) and in the Mojave River (Henkanaththegedara et al. 2008).

Based on DWR’s review, 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 an SSC, are the only special-status aquatic species that may potentially occur in the Project area or otherwise be affected by DWR’s Proposal. No FSS species were identified. A summary is provided in Table 5.3-1.

Table 5.3-1. Aquatic Special-Status Species Potentially Affected by the Project

Common Name (Scientific Name)	Status	Habitat Associations	Known Historical or Recent Occurrences in Project Vicinity Quadrangles
Western spadefoot (*Spea hammondii*)	SSC	Breeds in seasonal pools, ponds, and intermittent streams within grasslands, oak woodlands, and occasionally chaparral.	SBN quadrangle
Two-striped garter snake (*Thamnophis hammondii*)	SSC	Highly aquatic and mostly associated with rocky streams (sometimes at ponds) with dense riparian vegetation from near sea level to 8,000 ft elevation.	CAJ, HAM, LAR, SBN, and SWL quadrangles
Southern western (or western) pond turtle (*Actinemys* [*Emys*] *pallida* [or *marmorata pallida*])	SSC	Found in permanent ponds, lakes, side channels, backwaters, and pools of streams. May spend long periods aestivating and over-wintering in terrestrial habitats.	SWL quadrangle

Source: CDFW 2018e
Key:
SSC = California State Species of Special Concern
Quadrangles: CAJ = Cajon; HAM = Harrison Mountain; LAR = Lake Arrowhead; SBN = San Bernardino North; SWL = Silverwood Lake

SSC is a State administrative designation and carries no formal legal status or protection for any SSC-listed species. An aquatic SSC species, subspecies, or distinct population native to California satisfies one or more of the following criteria: is extirpated from the State; except for fishes, is listed under the ESA, but not the California Endangered Species Act (CESA), as threatened or endangered; meets the CESA definition of threatened or endangered, but has not formally been listed; is experiencing, or formerly experienced, serious (noncyclical) population declines or range retractions (not reversed) that, if continued or resumed, could qualify it for CESA listing; and has naturally small populations exhibiting high susceptibility to risk from any factor(s), that if realized, could lead to declines that would qualify it for State threatened or endangered status. A description of each of the three potentially affected aquatic SSC, including recorded occurrences in or near the Project area, is provided below.

Western Spadefoot[19] (SSC)

The western spadefoot range is located throughout the Central Valley and adjacent foothills. This species 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 to occur 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 37568), 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 under ESA 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 distribution 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

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

Biological Consulting (2005) reported hearing a call which may have been of this species during the Horsethief Creek Bridge Replacement Surveys, but no verifying information was collected. The CNDDB (CDFW 2018e) includes an occurrence with multiple records of adult and juvenile western spadefoot on Devil's Canyon Road in the City of San Bernardino since 2011. These records are evidently associated with western spadefoot crossing the road to and from percolation basins which provide breeding habitat. These basins are about one mile south and south-southeast of the Devil Canyon Powerplant and are not part of or affected by the Project. No incidental sightings of western spadefoot were recorded during the Devil Canyon Project relicensing studies.

Two-striped Garter Snake[20] (SSC)

The two-striped garter snake is a highly aquatic snake found from Monterey and San Benito counties, California, 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 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 eight 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 2018e). A two-striped garter snake was observed during surveys for the Horsethief Creek Bridge Replacement Project (Aspen

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

Environmental Group and Hunt & Associates Biological Consulting 2005). No incidental sightings of two-striped garter snake were recorded during the Devil Canyon Project relicensing studies.

Southern Western Pond Turtle[21] (SSC)

Long considered a single species, the two subspecies of western pond turtle, 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. Much of the published information on western pond turtles is derived from studies of northern western pond turtle. Therefore, our understanding of southern western pond turtle, which is summarized below, is based primarily on the information about northern western pond turtle and for this reason may be incomplete or not 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, 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 an 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 seven 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.

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

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 (i.e., dormancy in response to high temperatures and arid conditions) and nesting, with long-range movements to aestivation sites averaging about 820 feet, and nesting movements averaging 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 2018e). Aspen Environmental Group and Hunt & Associates Biological Consulting (2005) 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. An incidental sighting of an adult female southern western pond turtle was recorded during a relicensing botanical survey for the Devil Canyon Project in 2017. The turtle was observed with binoculars basking along the south-facing shore near Jamajab Point.

5.3.1.2 Aquatic Invasive Species

The USFWS Fisheries Program defines aquatic invasive species (or AIS) as “aquatic organisms that invade ecosystems beyond their natural, historic range and may harm native ecosystems or commercial, agricultural, or recreational activities.”[22] Although most AIS are nonindigenous (i.e., exotic or non-native in origin), also included in this category are native species that grow out of control in their natural habitats due to excessive nutrients, warmer waters, or other factors. The USGS maintains a list of aquatic invasive species (AIS), including reported geographical locations (USGS 2018). This was the primary source DWR used to identify aquatic AIS occurring, or with the potential to occur, in the Project area. Table 5.3-2 lists the 10 AIS known to occur in the Project vicinity and the 10 AIS that DWR concluded have a potential to occur within the proposed Project boundary, based on presence in the Project vicinity.

[22] Available online: https://www.fws.gov/fisheries/ans/index.html

Table 5.3-2. 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	Presence in Project or in Project Vicinity[1] (including 2017 Surveys)
KNOWN TO OCCUR			
Red-eared slider (*Trachemys scripta elegans*)	--	Freshwater bodies ranging in size from lakes to ponds and river to creeks with preference for slower moving waters and basking areas	Yes, observed in Silverwood Lake during 2017 surveys.
Shimofuri goby (*Tridentiger bifasciatus*)	--	Fresh and brackish water bodies, wide tolerances for salinity and temperature	Yes, observed in Silverwood Lake during CDFW electrofishing surveys between 2001 and 2009, 2016, and 2017.
Inland silverside (*Menidia beryllina*)	--	Fresh and brackish water bodies, wide tolerances for salinity and temperature	Yes, observed in Silverwood Lake during CDFW electrofishing surveys between 1999 and 2001, and 2016.
Asian clam (*Corbicula fluminea*)	--	Freshwater lakes, reservoirs and streams, especially with sandy, bottom sediments (USGS 2018)	Yes, observed in Silverwood Lake during 2017 surveys.
Channeled apple snail (*Pomacea canaliculata*)	(1) 14 CCR § 671(c)(9), Restricted Species	Warm freshwater habitats: reservoirs, ponds, rivers, ditches, wetlands; agricultural areas, such as rice and taro fields (Daniel 2018)	Yes, observed in Silverwood Lake during 2017 surveys.
Curly leaf pondweed (*Potamogeton crispus*)	(4) Cal-IPC ‘moderate’	Various depths and light levels in freshwater habitats (Thayer 2018)	Yes, observed in Silverwood Lake during 2017 surveys.
Eurasian watermilfoil (*Myriophyllum spicatum*)	(4) Cal-IPC ‘high’	Surface of freshwater lakes, ponds, and slow-moving waters (Cal-IPC 2018)	Yes, observed in Silverwood Lake during 2017 surveys.
Coontail (*Ceratophyllum demersum*)	--	Nutrient-rich, warm, and large freshwater bodies (CNPS 2018)	Yes, observed in Silverwood Lake during 2017 surveys.

Table 5.3-2. Aquatic Invasive Species Known to Occur or with the Potential to Occur in the Project Vicinity (continued)

Species	Status or Listing: (1) CCR, (2) FGC, (3) Lacey Act, (4) Cal-IPC, (5) CDFA	Habitat Requirements	Presence in Project or in Project Vicinity[1] (including 2017 Surveys)
Sago pondweed (*Potamogeton pectinatus*)	--	Submerged in waters less than 8 feet deep in nearly all types of substrates and in various environmental conditions (Casey 2010)	Yes, observed in Silverwood Lake during 2017 surveys.
Cyanobacteria species	--	Freshwater bodies (USGS 2018)	Yes, known to occur in Silverwood Lake (DWR 2017).
POTENTIAL TO OCCUR			
American bullfrog (*Lithobates catesbeianus*)	--	Natural and man-made aquatic habitats; slow, stagnant waters with abundant vegetation (McKercher and Gregoire 2018)	Yes. Mojave Forks Regional County Park (1989) and Deep Creek at the Mojave River Flood Control Dam (1989); and in Horsethief Creek and West Fork Mojave River downstream of Cedar Springs Dam (Aspen Environmental Group and Hunt & Associates Biological Consulting 2005)
African clawed frog (*Xenopus laevis*)	(1) 14 CCR § 671(c)(3), Restricted Species	Natural or man-made water habitats; tolerates lower temperatures and sewage (Somma 2018)	No. The closest reported occurrence was in the City of Riverside in 1996, about 24 miles south of the Project.
Red swamp crayfish (*Procambarus clarkii*)	--	Warm freshwater with mud, sandy bottoms, or organic debris, such as lakes, ponds, streams, canals, seasonal swamps, and marshes (Nagy 2018)	No. The closest reported occurrence was in Lake Arrowhead, San Bernardino County, in 1959, about 6 miles east of the Project.
European ear snail (*Radix auricularia*)	--	Freshwater aquatic habitats with silt or mud substrate (Kipp et al. 2018)	No. The closest reported occurrence was in an unspecified location in San Bernardino County in 1996.

Table 5.3-2. Aquatic Invasive Species Known to Occur or with the Potential to Occur in the Project Vicinity (continued)

Species	Status or Listing: (1) CCR, (2) FGC, (3) Lacey Act, (4) Cal-IPC, (5) CDFA	Habitat Requirements	Presence in Project or in Project Vicinity[1] (including 2017 Surveys)
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 hard substrates (Benson et al. 2018a)	No. The closest confirmed occurrence was in Lake Mathews, about 52 miles away from Silverwood Lake.
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 hard substrates (Benson et al. 2018b)	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 with silt or organic substrate (Benson et al 2018c)	No. The closest reported occurrence was in a constructed channel in Anaheim in 2013, roughly 46 miles south of the Project.
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 2018)	No. The closest reported occurrence was reported in Barstow quadrangle (Kratville 2013; population was eradicated). The closest extant reported occurrence is Clear Lake, Lake County.
Water hyacinth (*Eichhornia crassipes*)	(4) Cal-IPC 'high'	Both natural and man-made freshwater systems (e.g., ponds, sloughs and rivers) (Cal-IPC 2018)	No. The closest reported occurrence was reported in Devore quadrangle.

Table 5.3-2. Aquatic Invasive Species Known to Occur or with the Potential to Occur in the Project Vicinity (continued)

Species	Status or Listing: (1) CCR, (2) FGC, (3) Lacey Act, (4) Cal-IPC, (5) CDFA	Habitat Requirements	Presence in Project or in Project Vicinity[1] (including 2017 Surveys)
Parrot's feather (*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 2018)	No. The closest reported occurrence was reported in both Big Bear Lake and Yucaipa quadrangles.

[1]Sources: USGS 2018; Aspen Environmental Group and Hunt & Associates Biological Consulting 2005; California Invasive Plant Inventory Database (Cal-IPC) 2018; DWR 2014a; Kratville 2013
Key:
-- = None
§ = Section
Cal-IPC = California Invasive Plant Council
CCR = California Code of Regulations
CDFA = California Department of Food and Agriculture
CDFW = California Department of Fish and Wildlife
FGC = Fish and Game Code
Lacey Act (16 United States Code §§ 3371–3378) = federal law, as amended in 2008, prohibiting traffic in certain fish, wildlife and plant species

In addition to the 10 AIS known to occur, the following 11 species of non-native fish are reported to occur in Silverwood Lake: (1) largemouth bass (*Micropterus salmoides*); (2) bluegill (*Lepomis macrochirus*); (3) black crappie (*Pomoxis nigromaculatus*); (4) striped bass (*Morone saxatilis*); (5) channel catfish (*Ictalurus punctatus*); (6) white catfish (*Ameiurus catus*); (7) American shad (*Alosa sapidissima*); (8) threadfin shad (*Dorosoma petenense*); (9) Sacramento blackfish (*Orthodon microlepidotus*); (10) hitch (*Lavinia exilicauda*); and (11) tule perch (*Hysterocarpus traskii*). In addition, CDFW has stocked non-native rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*) in the reservoir. For the purpose of this Application for New License, these non-native fishes are not considered AIS because they are not invasive.

The list of known AIS in the proposed Project boundary is based on DWR's ongoing surveys for quagga and zebra mussels and fish creel surveys; routine monitoring and early detection for algae and cyanobacteria; CDFW's fish surveys; and DWR's relicensing study, each of which is described below.

DWR's Ongoing Quagga and Zebra Mussels Surveys

DWR conducts an Early Detection Monitoring Program throughout the SWP for planktonic veligers (larval life stage of mussels) and adult quagga and zebra mussels. DWR's Early Detection Mussel Monitoring Program is described in the Quagga and Zebra Mussel Rapid Response Plan for the SWP (DWR 2010). The specific details of the plan are confidential, privileged, and contain critical energy infrastructure information.

Briefly, the Early Detection Monitoring Program involves ongoing monitoring through routine sampling at set intervals and at predetermined sites that are selected based on specified criteria. The Early Detection Monitoring Program allows adaptability in the selection of monitoring sites such that the monitoring sites can be relocated based on current information. Refer to Figures 5.3-1 and 5.3-2 for current monitoring sites.

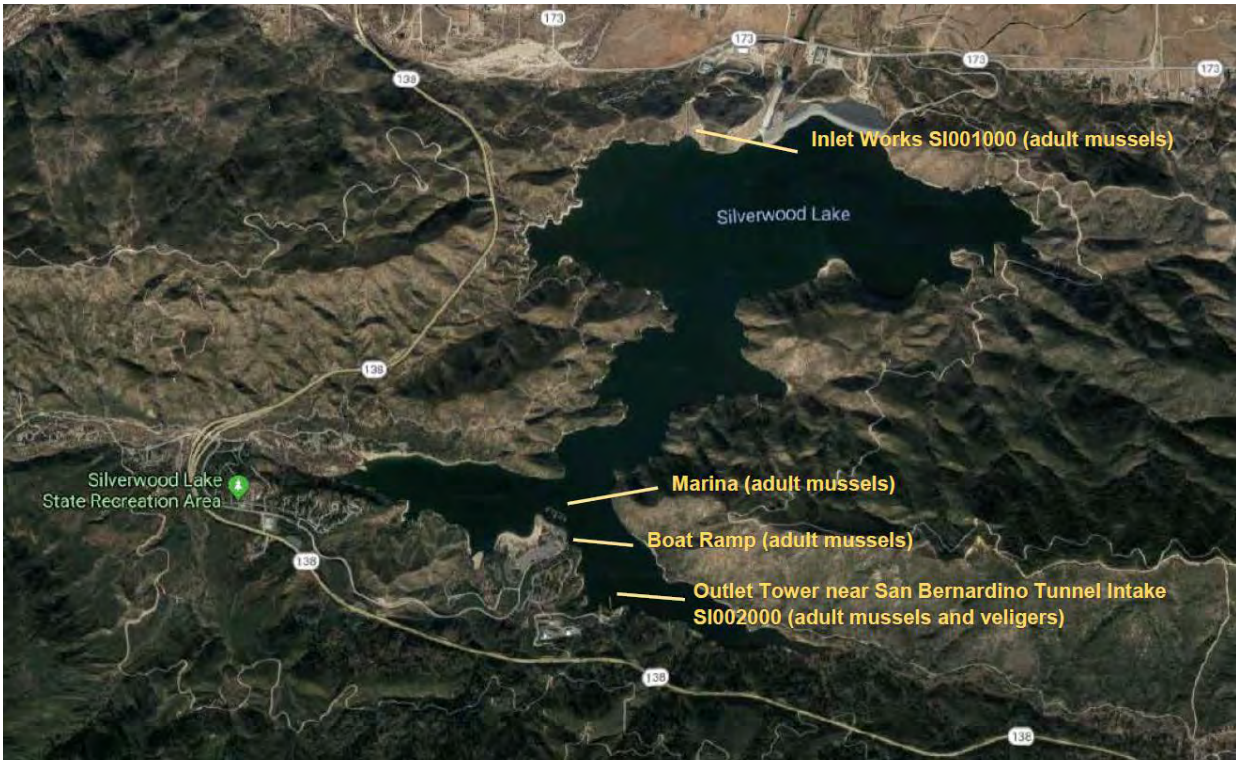


Figure 5.3-1. Veliger and Adult Quagga and Zebra Mussel Monitoring Sites in Silverwood Lake

Figure 5.3-2. Veliger Quagga and Zebra Mussel Monitoring Site at the Devil Canyon Afterbay

For detecting planktonic veligers, a vertical plankton net tow is run through the water column from 1 m above the bottom and up to the surface, at a target depth of 40m and a target distance of 40m (DWR 2010). The sampling occurs year-round on a monthly basis at the outlet works in Silverwood Lake near the San Bernardino Tunnel Intake, and as needed at the inlet works and marina boat ramp (DWR 2010). Larval vertical tow surveys also are conducted year-round on a monthly basis at the Devil Canyon Afterbay (DWR 2010). The filtrate is stored in a sample bottle on ice in the field and is sent overnight to the laboratory for analysis. Samples are analyzed either by amplifying the deoxyribonucleic acid (DNA) in the filtrate through polymerase chain reaction methodology to detect the presence or absence of mussel DNA or viewing the sample under cross-polarized light microscopy to confirm the presence or absence of veligers and to quantify the veliger density (DWR 2010).

DWR uses artificial substrates (i.e., settlement plates) to detect adult mussels. Settlement plate samplers are situated at different depths near the San Bernardino Tunnel Intake Tower in Silverwood Lake. The settlement plate samplers consist of polyvinylchloride plates that are stacked and spaced two inches apart with a plastic-coated cable running through the center of each plate. If present, adult mussels will settle, attach, and grow on the settlement plates. DWR staff who are experienced in identifying adult mussels conduct seasonal visual inspections of the settlement plate samplers. If present, specimens are photographed, collected and stored in a labeled jar containing 70 percent ethanol or in a sealed bag, and submitted to the laboratory for DNA analysis to confirm the species identification (DWR 2010).

If a positive result from a sample occurs as part of the Early Detection Mussel Monitoring Program, it is initially considered a preliminary positive result and must undergo further investigation to validate and reclassify as a confirmed positive result. DWR will increase the frequency and coverage of early detection monitoring efforts, as well as implement additional surveying methods and other procedures and management actions, following any positively confirmed results (DWR 2010).

Field equipment is decontaminated following each sampling event. The same equipment is never used or transported to another monitoring site to prevent cross-contamination in the samples and the spread of mussels (DWR 2010). In addition to these formal monitoring procedures, all DWR field staff are trained in quagga and zebra mussel identification and are instructed to look for mussels during their regular field work and during routine maintenance activities.

DWR's ongoing quagga and zebra mussel surveys have not recorded either mussel in Project impoundments.

DWR's Ongoing Taste and Odor (Algae) Surveys

Algae can produce compounds that cause unpleasant taste and odors in finished drinking water. In cooperation with DWR, MWD routinely monitors taste and odor compounds (i.e., geosmin and 2-Methylisoborneol [MIB]) produced by algae through chemical analysis of water samples. When sampling results indicate that concentrations of taste and odor compounds exceed a pre-determined level, MWD determines the source and requests DWR to manage the algal bloom and prevent further production of geosmin and MIB compounds. If an algal source is identified, DWR staff develop a plan for applying aquatic herbicides to control the specific algae associated with elevated taste and odor compound concentrations. Control measures include the application of aquatic herbicides as approved by the Lahontan RWQCB and the SWRCB and as outlined in the Aquatic Pesticides Application Plan for the SWP (DWR 2014b).

DWR's Ongoing Cyanobacteria Surveys

Cyanobacteria are distributed worldwide and are prevalent throughout California in many types of freshwater waterbodies (e.g., lakes, rivers, streams, wetlands, estuaries). Certain species of cyanobacteria can produce toxins that are potentially harmful to human health if present in high concentrations. While cyanobacteria are not introduced species, cyanobacteria can become nuisance species when present in high abundance and form harmful algal blooms.

DWR routinely monitors for cyanotoxins produced by cyanobacteria through microscopic examination and chemical analysis of water samples. Samples are collected in the lake on a monthly basis from spring through fall. When sampling results indicate that concentrations of cyanotoxins are at or reaching a level of concern, DWR water quality staff determine the location of the source (i.e., in-lake production versus upstream production) and feasibility of control. If the location of the algal source is identified and cyanotoxin levels threaten water supply safety, DWR staff develop a plan for applying aquatic herbicides to control the harmful algal bloom. The control plan would be in compliance with the Aquatic Pesticide Application Plan for the SWP, as approved by the Lahontan RWQCB and the SWRCB.

DWR's Ongoing Creel Surveys

DWR has performed creel surveys from 2000 to present at Silverwood Lake, and will continue to perform them in the future as a biennial compliance requirement from FERC. There are two survey periods evaluated; fall-spring (October through May) and summer (June through September). Beginning in 2006, DWR transitioned from a calendar year to a State fiscal year (July 1 through June 30) reporting period. The creel surveys are conducted in order to evaluate and assess the recreational fishery, the trout stocking program, and angler satisfaction. While these surveys target game fish specifically, they have the potential to provide information regarding two invasive species: inland silverside (*Menidia beryllina*) and shimofuri goby (*Tridentiger bifasciatus*). However, the likelihood of anglers catching and reporting these non-game species is low, and neither of these species were observed in any creel surveys. Detailed information on the annual stocking program and creel surveys can be found below, in section 5.3.1.4.

CDFW's Silverwood Lake Fish Surveys

CDFW also conducts regular fish surveys at Silverwood Lake using boat-based electrofishing and documents the species collected. Results of these surveys, including invasive species, are provided in Section 5.3.1.4.

There were two invasive fish species captured during electrofishing surveys conducted within Silverwood Lake by CDFW between 1999 and 2018, inland silverside and shimofuri goby. CDFW conducts population surveys of Silverwood Lake, "…to monitor species diversity, abundance, size, and the general condition of the Lake Silverwood fishery" (CDFW 2018g). Inland silversides were found in all years of the surveys, while shimofuri goby were found in only some years. Section 5.3.1.4 provides more detailed results regarding these fishes.

DWR's Relicensing Aquatic Invasive Species Study

DWR conducted AIS invertebrate surveys from September 5, 2017 through September 8, 2017, as part of its relicensing *Aquatic Invasive Species Study Approach*. Surveys for aquatic invasive snails and clams were performed at 12 locations in Silverwood Lake: Serrano Landing shoreline; three sites at Quarry Cove; near the Cedar Springs Dam face; Chamise Cove; Sawpit Canyon Marina; the San Bernardino Tunnel Intake area; and three additional unnamed coves (Figure 5.3-3). Survey sites were located in areas where AIS were more likely to be introduced or with potential habitat for AIS snails and/or clams present. In general, areas with silt, sand, or gravel substrate and a relatively low gradient were targeted for the focused surveys.

At each focused survey site, surveyors established a 320-foot transect along the shoreline. DWR collected general site information, including the geographical extent of the site (using a map grade Global Positioning System [GPS] unit), the date and time of the survey, field crew present, and general characterization of the weather. Representative photographs of each site were taken.

At each focused survey location, the presence or absence of Asian clam, European ear snail, New Zealand mudsnail, and channeled apple snail was evaluated using two methods: visual surveys and a sediment sieve.

First, a visual inspection of the shoreline aquatic vegetation and immediate shallow water was performed at each survey site to determine the presence of snails, clams, or other mollusks. Depending on gradient, water level, and clarity, staff also visually inspected the area of the shoreline up to 33 feet from the wetted edge.

Additionally, up to 10 unique sediment samples were collected and sieved within each focused site. Five samples were collected along the shoreline (approximately 66 feet apart), and five more were collected approximately 33 feet offshore following the same spacing as the onshore samples (Grohs and Klumb 2010). The samples collected along the shoreline, not underwater, involved shoveling substrate directly into a 5-gallon bucket with a stainless steel wire cloth affixed to the bottom. Each sample consisted of enough sediment to fill the bucket to a predetermined volume (approximately two to three shovelfuls). The substrate sample was rinsed to remove the fine sediment and staff noted the presence or absence of snails and clams of interest in each subsample. Other mollusks were identified to the extent possible. Samples taken in open water were collected using an Ekman dredge and followed the same process described above.

To document the presence of open water AIS plants, DWR surveyed the portions of the reservoir open to motorized boats, following pre-established survey transects spaced approximately 96 feet apart from August 28, 2017 to September 1, 2017. The water surface was surveyed for aquatic plants. In addition to the boat driver, there were two surveyors, one on each side of the boat, each scanning an approximately 48-foot-wide area. All aquatic plant species documented during the open water surveys were identified to species level, if possible. If necessary for identification, plants were collected and keyed using the Jepson Manual (Baldwin et al. 2012).

There were 21 occurrences of two of the four targeted AIS invertebrate species located during surveys: 9 occurrences of Asian clam and 12 occurrences of channeled apple snail. No New Zealand mudsnails or European ear snails were observed. There were 193 occurrences of AIS plant species: 25 occurrences of curly leaf pondweed, 45 occurrences of Eurasian watermilfoil, 79 occurrences of coontail, and 44 occurrences of sago pondweed.

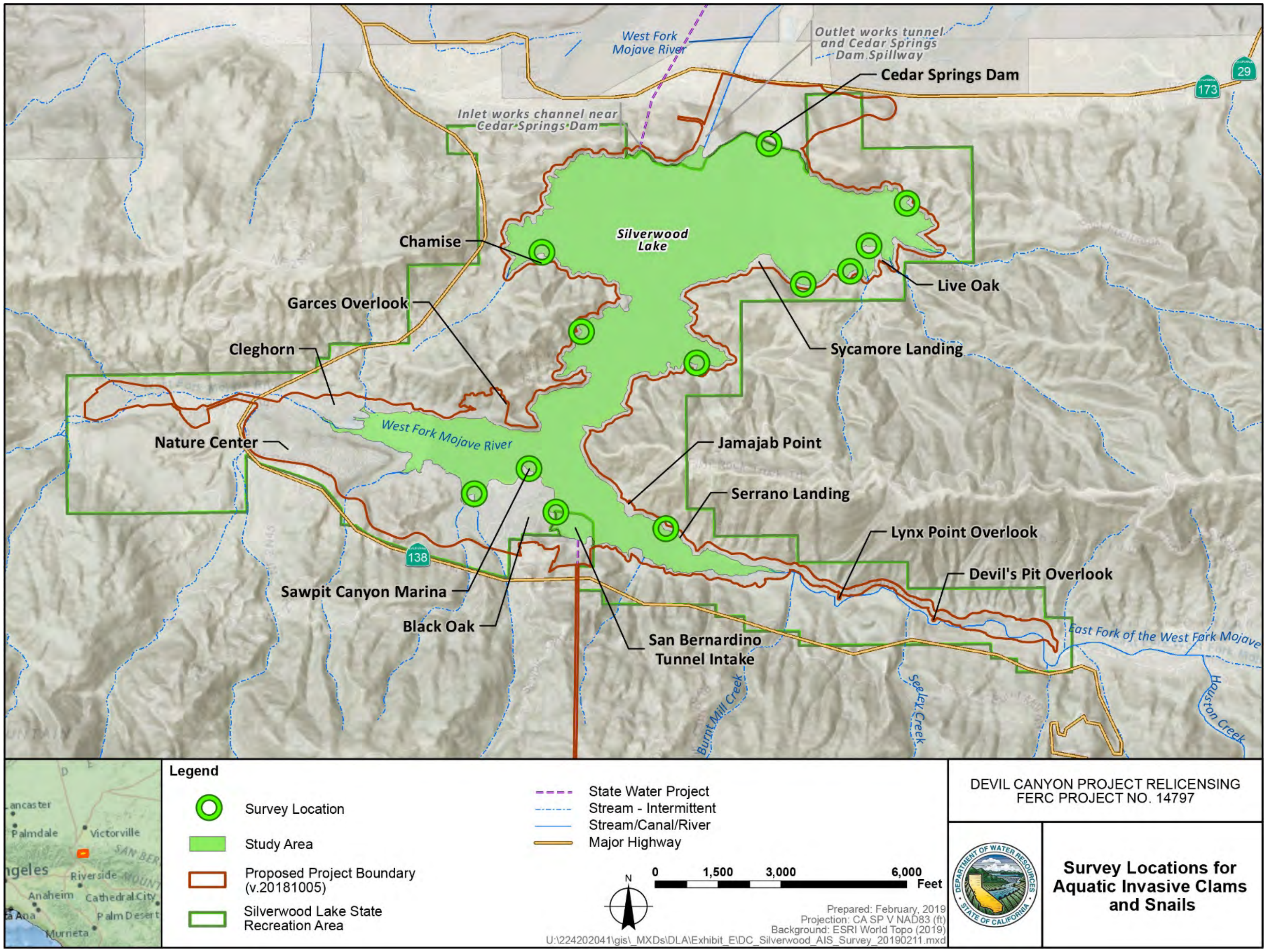


Figure 5.3-3. Map of Focused Survey Locations for Aquatic Invasive Clams and Snails

A description of each of the AIS known or with the potential to occur at the Project, including recorded occurrences, is below.

Species Known to Occur at the Project

Red-Eared Slider[23]

The red-eared slider (RES) is a medium-sized turtle, ranging in length from 5 to 11 inches. The RES is usually distinguished by a red or orange stripe above each eye. Other key characteristics include large, rough-looking shell plates at the top of their dark-colored notched-edged shells. The top part of the carapace is typically dark colored and the bottom shell is typically yellow or brownish-orange (CDFW 2018d).

The RES is native to the south-central United States, but it is an introduced species in California, where it outcompetes the native western pond turtle for habitat and food. The RES prefers areas with slow-moving freshwater with soft substrate, but it is also highly adaptable, and can be found in both natural and man-made habitats with basking areas and aquatic vegetation (CDFW 2018d).

The RES is a common pet, and RES owners have knowingly or accidentally released RES into the wild. These once-domesticated pet turtles have been known to carry diseases and parasites to native animal species, as well as humans. They are also known to be prolific, with females that can produce a large number of eggs several times per year (CDFW 2018d). The main control for RES is through trapping, such as the use of cathedral traps and seines, as well as collecting any eggs (Burger 2009; Columbia University 2002). Eradication of this species is possible, but may require substantial effort and monitoring.

Incidental observations of RES were recorded at various locations around Silverwood Lake during DWR's 2017 relicensing studies (pers. comm., Maldonado 2018).

[23] Picture by Greg Hume (usgs.gov)

Shimofuri Goby[24]

The shimofuri goby is native to estuaries around the Sea of Japan. The exact method and timing of introduction into California waters is unknown, but it is thought that shimofuri goby were introduced into the San Francisco Bay through ship ballast water prior to 1985, when they were first collected in Suisun Marsh. Populations of shimofuri goby expanded rapidly in the upper San Francisco estuary, and then expanded to reservoirs in southern California by transmission of larvae through the California Aqueduct (Moyle 2002; Howard and Booth 2016). Shimofuri goby are commonly found in brackish water habitats that have high levels of habitat complexity, but are also able to thrive in freshwater habitats. Shimofuri goby can tolerate broad ranges of temperature (up to 37°C in laboratory studies), and feed extensively on benthic food items such as attached hydroids and small crustaceans. The life cycle of the shimofuri goby rarely exceeds two years, and breeding occurs repeatedly between March and August. Shimofuri goby are aggressive occupants of their habitats, often dominating interactions with other inhabitants to the point of exclusion (Moyle 2002).

Shimofuri goby were collected in Silverwood Lake during electrofishing surveys conducted by CDFW in 2001, 2002, 2003, 2008, 2009, and 2016. There are no effective management strategies to remove shimofuri goby once they are present. The fish is not a game species and has become established in Silverwood Lake and other southern California reservoirs and waterways (Howard and Booth 2016).

Inland Silverside[25]

Inland silversides are native to estuaries and brackish lower segments of coastal streams along the Atlantic and Gulf Coasts. Originally introduced in California to Blue Lakes and Clear Lake (Lake County) in 1967, the introduced population thrived in Clear Lake and spread to the Sacramento-San Joaquin river systems through the lake’s outlet stream, Cache Creek. Inland silversides were further distributed via the California Aqueduct to reservoirs in Southern California (Moyle 2002).

Inland silversides thrive in shallow, near-shore habitats within warm reservoirs and streams which have sand- or gravel-dominated substrates. The diet of the inland silverside is predominantly composed of zooplankton, such as copepods and planktonic instars of aquatic macroinvertebrates. Temperature and salinity tolerances are wide

[24] Picture by Dave Giordano (calfish.ucdavis.edu)
[25] Picture by Dan Worth (calfish.ucdavis.edu)

ranging for inland silversides, though optimal ranges are 20-25°C and 0-15 mg/L), respectively. Inland silversides are popular prey items for almost all predatory fish species with which they coexist. However, the life cycle of the inland silverside is short, growth rates are relatively fast, and reproduction usually happens within the first or second year, meaning the potential for explosive population growth exists even in the face of predation mortality. Large populations of inland silversides can change fish community structures by outcompeting native fishes for planktonic food resources (Moyle 2002).

Inland silversides were collected in Silverwood Lake during electrofishing surveys conducted by CDFW in 1999, 2000, 2001, 2002, 2003, 2008, 2009, and 2010. There are no effective management strategies to remove inland silversides once they are present. The fish is not a game species and has become well established in Silverwood Lake and other southern California reservoirs and waterways.

<u>Asian Clam</u>

The Asian clam is a small freshwater mollusk, native to southern Asia, the eastern Mediterranean and the Southeast Asian islands to Australia. The species was first observed 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 2018).

Asian clam is known to inhabit lakes, reservoirs and streams, often covering themselves in sandy sediments. These bivalves can 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 2018). Treatment methods include mechanical removal, barrier placement, and chemical and temperature alteration to water systems, although the effectiveness of these methods is still being tested (USGS 2018).

The Asian clam is known to be present in Silverwood Lake (DWR 2016a). DWR recorded nine occurrences of Asian clam at survey locations in Silverwood Lake during the 2017 AIS surveys: near the San Bernardino Tunnel Intake and the northeast area of Silverwood Lake (Figure 5.3-1).

Channeled Apple Snail

Channeled apple snails (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 2018c).

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 2018c).

CAS have been observed in California since at least 1997, and may have originally been introduced as part of the aquarium trade as aquarium snails or as stowaways attached to aquarium plants and, as a result, may have accidentally been released into open waters. The best management strategy for channeled apple snails is prevention, but intensive hand removal and egg mass suppression efforts may provide some control. However, established populations are unlikely to be eradicated (CDFW 2018c).

Twelve occurrences of CAS were recorded in Silverwood Lake during DWR's 2017 relicensing AIS Study: near the San Bernardino Tunnel Intake site, near the Sawpit Canyon Marina, near Chamise Cove, in Quiet Cove, and in the cove northeast of Live Oak Landing.

Curly Leaf Pondweed

The genus *Potamogeton* contains many species that are difficult to differentiate in the field (Cal-IPC 2018). All are native to California, except curly leaf pondweed, 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 2018; 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 water body. The turions germinate in late summer or fall, and the plants 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).

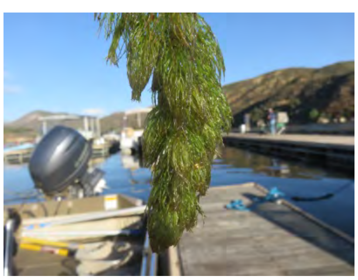
Studies have found that germination is controlled by temperature, light intensity, and anoxic conditions. It grows in fine substrates and quiet, calcium-rich waters. The species prefers lakes, reservoirs, ponds, rivers, streams, and ditches. It can grow in clear to turbid and polluted waters, and in alkaline or brackish waters; and it is tolerant of significant nutrient pollution (Cal-IPC 2018).

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 2018).

Treatment 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. However, 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 2018). DWR recorded 25 occurrences of curly leaf pondweed around the edges of Silverwood Lake during its 2017 AIS Study.

<u>Eurasian Watermilfoil</u>



Eurasian watermilfoil 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 2018; DiTomaso et al. 2013). In the early 1990s, it was present, but uncommon, in San Francisco Bay area 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).

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 2018). The species is capable of creating its own habitat by trapping sediment and producing a favorable environment for further establishment (Cal-IPC 2018). 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 treatment 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 2018).

Forty-five occurrences of Eurasian watermilfoil were recorded in Silverwood Lake by DWR during its 2017 AIS Study.

<u>Coontail</u>

Coontail is a submerged or floating aquatic perennial plant found in sandy or silty substrates of ponds, lakes, and waterways, often out-competing other plants when nutrients are high. This invasive plant has a long bottlebrush appearance with forked leaves in a whorled pattern and stems growing up to 8 feet long (DiTomaso et al. 2013).

It is a popular aquarium plant that possibly spread because of aquarium content releases. Use of recreational vehicles (RV) on different bodies of water without inspection for plant material may also spread these invasive plants. Fragments of the plant can survive for long periods of time and are highly adaptable to various environments. Although coontail may provide shelter for aquatic organisms, dense mats of vegetation may block water flow and hamper recreational activities.

Management for coontail includes raking or seining from waters, using carp or applying herbicides. All of these treatments require long-term application, and only herbicides have the potential to completely eradicate a population, although application at high herbicide concentrations may be required (Texas A&M 2018).

Seventy-nine occurrences of coontail were recorded in Silverwood Lake during DWR’s 2017 AIS Study.

Sago Pondweed

Sago pondweed is a submerged grass-like aquatic plant with numerous branches that can grow up to 3 feet tall in various types of substrates. The plant's multiple long, flexible stems and narrow, pointed leaves form masses on the water's surface and dense stands underwater. The sago pondweed flowers are small and green, forming a whorl pattern on the flower spike.

Many types of waterfowl use this plant for food and it provides shelter for fish. The plant has also been intentionally planted for use as erosion control near shores and dams, due to its wave dampening properties; however, dense populations of the plant become invasive when it is not properly managed in recreation and irrigation areas. Management for sago pondweed is similar to that for coontail (Texas A&M 2018).

Forty-four occurrences of sago pondweed were recorded in Silverwood Lake during DWR's 2017 AIS Study.

Cyanobacteria Species

Cyanobacteria, often called blue-green algae, occur in most freshwater ecosystems. Cyanobacteria are photosynthetic. Some species are 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 2018).

Water quality issues are associated with cyanobacteria blooms. Cyanobacteria produce compounds that have the potential to be harmful to human and animal life. The toxins, referred to as cyanotoxins, target fundamental cellular processes. β-methylamino alanine, saxitoxin, anatoxin, microcystin, 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 cyanobacteria present in Silverwood Lake. In 2015, Silverwood Lake experienced a bloom of *Microcystis* spp. that caused taste and odor problems, necessitating treatment of the lake with copper sulfate (DWR 2016a). In 2016, DWR again treated Silverwood Lake with copper sulfate. On August 4, 2016, some 6,000 pounds of copper sulfate was applied to a volume of 7,125 AF. The treatment was considered successful (DWR 2018d). On July 21, 2017, copper sulfate was applied to Silverwood Lake – some 6,000 pounds was applied to a volume of 6,750 AF. This treatment was also considered successful (DWR 2018e).

DWR has coverage under the statewide general NPDES permit from the SWRCB to apply aquatic herbicides, when necessary, to SWP aqueducts, forebays, and reservoirs. DWR applies aquatic herbicides to control cyanobacteria that produce toxic compounds in Silverwood Lake (DWR 2014a).

The application area is determined based on the results of cyanotoxin and phytoplankton monitoring surveys. For each application, the treatment area is delineated, and herbicide concentration and water quality are monitored within and adjacent to the treatment area before, during, and after the treatment. All treatments are prescribed and monitored by a licensed pesticide advisor, conducted with certified pesticide applicators, and reported to the County Agricultural Commissioner and SWRCB. Detailed treatment information is provided in the annual report to the SWRCB. Alternative treatment options were considered (i.e. biological, cultural, mechanical, and preventative measures), but deemed infeasible by DWR (DWR 2014a).

Based on 2014-2017 data, detectable levels of microcystins have been found in Silverwood Lake since 2014 (DWR 2018a). The samples collected for Silverwood Lake were not uniform based on site locations; however, based on the 2014-2017 data provided (DWR 2018a), the trend for detectable levels of microcystins at Silverwood Lake generally start to appear at the start of summer (June to July) and are no longer detectable in the early to mid-fall (August to October). Detectable levels of Aphanizomenon were also present in summer 2017 (May-June) samples.

Species with the Potential to Occur Within the Proposed Project Boundary

American Bullfrog

The American bullfrog 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 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 2018a). 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 American 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 by 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 2018a). American bullfrog has also been implicated in the spread of the chytrid fungus (*Batrachochytrium dendrobatidis*), 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; Fellers et al. 2011).

Treatment 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).

American bullfrog has not been reported in project impoundments. The USGS location database, Nonindigenous Aquatic Species (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 downstream of 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 2018). 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 (Aspen Environmental Group and Hunt & Associates Biological Consulting 2005). HELIX (2014) reports the continued presence of American bullfrog on the West Fork Mojave River downstream of the Project on the West Fork Mojave River and in Horsethief Creek, presumably due to beavers creating deep pools that provide habitat for bullfrogs, nonnative fish, and crayfish in Horsethief Creek and the West Fork Mojave River (USFWS 2014).

African Clawed Frog

The African clawed frog 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 was widely used as a standard laboratory animal/human pregnancy test animal and sold in the pet trade (California Herps 2018).

African clawed frog is classified as a “restricted detrimental animal” because, among other things, this species poses a threat to native wildlife (14 CCR § 671; California Fish and Game Code [FGC] § 2118). As such, it is illegal to import, transport, or possess live animals of this species, except under a 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 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.

African clawed frog has not been reported to occur within the existing Project boundary. NAS reported one occurrence of the African clawed frog in the City of Riverside in 1996, approximately 25 miles from the Project area. Considering the potential habitat available within the Project area and varying vectors of transport, this species has the potential to occur within the Project area.

Red Swamp Crayfish

The red swamp crayfish 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 2018).

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 2018).

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 parts per thousand (ppt), pH from 5.8 to10, DO levels greater than 3 parts per million, variable water temperatures, and variable pollution levels (USGS 2018).

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, community dominance, modification of physical-chemical habitat properties, consumption of native plants and algae, and predation on native species (USGS 2018). Management of this species includes draining small bodies of water, trapping, and the use of biocontrols. However, for larger populations, these methods can be expensive and unlikely to fully eradicate the species (Loureiro et. al. 2015).

Red swamp crayfish has not been reported to occur within the existing Project boundary. NAS reported an occurrence in Lake Arrowhead, San Bernardino County, in 1959, roughly 7 miles from the Project area in the Willow Creek/Deep Creek watershed. Considering the potential habitat available within the Project area, a known nearby occurrence, and multiple vectors of transport, this species has the potential to occur within the Project area. No individual red swamp crayfish were observed during DWR's 2017 AIS Study.

European Ear Snail

The European ear snail 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 2018). 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 effects on 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).

European ear snail has not been reported to occur within the existing Project boundary. NAS reported one occurrence in an unspecified location in San Bernardino County in 1996. Considering the potential habitat available 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. No individual European ear snails were observed during DWR's 2017 AIS Study.

Quagga Mussel

The quagga mussel 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 2018). Larval drift and attachment to recreational and commercial vessels have enabled its 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), 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 2018). 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 dreissenid mussels 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).

The Federal Lacey Act lists quagga mussels as injurious wildlife, whose importation, possession, and shipment within the United States are prohibited. If found, any quagga mussels brought into the United States will be promptly destroyed or exported by the USFWS at the cost of the importer or consignee. Quagga mussels are also regulated under the 1996 National Invasive Species Act, which stipulates nationwide controls for ballast water management and established a series of task forces to combat AIS.

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 [CDFW].” Additionally, pursuant to this regulation, all species of *Dreissena* are termed “detrimental animals”, 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 system 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.

DPR implemented a quagga and zebra mussel boat inspection program at Silverwood Lake SRA in 2009. All water vessels must undergo mandatory quagga and zebra mussel inspection and must pass this inspection prior to entering the Silverwood Lake SRA. Boats must be free of mussels, clean, drained of water, and dry. Water vessels that do not pass the inspection are denied launching into the lake and are not allowed to launch for seven days. DPR also provides public outreach and education regarding quagga and zebra mussels to Silverwood Lake visitors.

Quagga mussel has not been reported to occur within the existing Project boundary. There was no evidence of quagga mussel in the Project area in 2017 (DWR internal data). The closest confirmed occurrence reported by NAS to the Project area was at Lake Mathews Reservoir in 2007, approximately 52 miles south of the Project area.

<u>Zebra Mussel</u>

The zebra mussel 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 its introduction into the United States. Larval drift along with attachment to recreational and commercial boating vessels have enabled further spread (USGS 2018).

Zebra mussels inhabit lakes, reservoirs, and rivers and can colonize a variety of hard substrates, 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 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. Although there are promising leads, prevention is seen as the most effective strategy (USGS 2018). 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 predators include redear sunfish, smallmouth bass, diving ducks and crayfish (Hoddle 2014).

The federal Lacey Act lists zebra mussels as injurious wildlife, whose importation, possession, and shipment within the United States are 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 or cosignee. Zebra mussels are also regulated under the 1996 National Invasive Species Act, which stipulates nationwide controls for ballast water management and established a series of task forces to combat AIS. Similar to quagga mussels, zebra mussels are regulated under the CCR and FGC (see quagga mussel description above). Management for zebra mussel is similar to quagga mussels.

Zebra mussel has not been reported to occur within the existing Project boundary. 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.

<u>New Zealand Mudsnail</u>

New Zealand mudsnail 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 its introduction into the United States. Since then, attachments to recreational and commercial boating vessels have facilitated its 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 [CDFW]." Additionally, pursuant to this regulation, New Zealand mudsnails are considered "detrimental animals", 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.

New Zealand mudsnail has not been reported to occur within the existing Project boundary. 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.

<u>Hydrilla</u>

Hydrilla is a small, submerged, aquatic perennial plant 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 2018). 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 2018) and was found in 17 of California's 58 counties. Hydrilla was successfully eradicated from 15 of the 17 counties. Remaining populations occur in Lake County and Nevada County.

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 2018). 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 watercraft or through water dispersal. Once established, it produces a bank of tubers and turions in the soil that may remain viable for three to five years (Cal-IPC 2018).

The California Department of Food and Agriculture (CDFA) implements an eradication program for hydrilla. The CDFA has successfully eliminated hydrilla from 15 counties. Manual removal of hydrilla can be used for small infestations, but herbicides are usually necessary for large infestations (Cal-IPC 2018).

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" (Cal-IPC 2018). Cal-IPC gives hydrilla an invasive plant rating of "high" (Cal-IPC 2018).

Hydrilla has not been reported to occur within the existing Project boundary. The closest reported occurrence is in Clear Lake, Lake County, California.

Water Hyacinth

Water hyacinth is a free-floating perennial plant 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 2018). Native to Central and South America, the water hyacinth was introduced into the United States in 1884 as an ornamental plant for water gardens. It will not tolerate brackish or saline water with salinity concentrations above 1.8 percent. 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 2018).

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, DO and light levels, and increasing carbon dioxide and turbidity (Cal-IPC 2018).

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 2018; 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). DPR-Division of Boating and Waterways, the only entity in California authorized to treat for water hyacinth in the Sacramento-San Joaquin Delta, conducts annual aquatic treatments as funding permits (DBW 2015). The Cal-IPC gives water hyacinth a "high" invasive plant rating (Cal-IPC 2018).

Water hyacinth has not been reported to occur within the existing Project boundary. Cal WeedMapper reports the closest occurrence of water hyacinth in the Devore quadrangle, approximately 4 miles southwest of the Project (Cal-IPC 2018). Silverwood Lakes elevation (at 3,356 feet, well above 660 feet elevation) makes it less likely to become infested with water hyacinth.

<u>Parrot's Feather</u>

Parrot's feather is an aquatic perennial plant that forms dense mats of intertwined brownish rhizomes in the water column (Cal-IPC 2018). It is a member of the watermilfoil family. 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 grows most rapidly from March until September. In spring, the shoots start to grow from overwintering rhizomes as water temperature surges (Cal-IPC 2018).

Parrot's feather 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 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 2018).

Biological, mechanical, and chemical controls have all been attempted to control parrot's feather. Of the available methods, chemical control seems to be the most likely for successful control. Biological 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 members of the watermilfoil family, such as parrot's feather, and may damage native species as well (Invasive Species Compendium 2014). Parrot's feather is given a "high" invasive plant rating by the Cal-IPC (Cal-IPC 2018).

Parrot's feather has not been reported to occur within the existing Project boundary. The closest occurrences were reported in both the Big Bear Lake quadrangle approximately 20 miles east of the Project area and the Yucaipa quadrangle, approximately 24 miles southeast of the Project area (Cal-IPC 2018).

5.3.1.3 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). At Silverwood Lake, DWR applies aquatic herbicides to manage taste and odor problems and increasing levels of cyanotoxins associated with high abundance of algae and cyanobacteria. Species identified in SWP reservoirs of southern California have included *Microcystis* sp., *Gloeotrichia* sp., and *Anabaena* sp.

The application area for algal blooms is dependent on the source of taste and odor production, as determined by a Solid Phase Microextraction analysis performed weekly by DWR staff, or by enzyme linked immunosorbent assay 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 summer 2013, Silverwood Lake experienced a bloom of the species *Anabaena lemmermannii* that caused taste and odor problems, necessitating treatment of the reservoir. 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, copper sulfate pentahydrate crystals, and sodium carbonate peroxyhydrate have all been proven successful in treating algal blooms. All applications are conducted under the recommendation and oversight of a Certified Pesticide Advisor (PCA) and the herbicide is applied by Certified Qualified Applicators. 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 reporting, storage and disposal practices are followed. The reservoir 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 2017).

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.

5.3.1.4 Fish

<u>Upstream of Silverwood Lake</u>

Mohave tui chub is the only fish species native to the Mojave River drainage (see Section 5.4.3); all other fish occurrences are the result of deliberate or unintentional introductions. There is limited information on fish using the West Fork Mojave River or the East Fork of the West Fork Mojave River upstream of Silverwood Lake. Due to the seasonal nature of these streams, the ability of fish species to inhabit these stream systems year-round is speculative.

Historical information from the 1940s 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 (1943) suggest that, previous to their surveys, fish in the Catostomidae family (e.g., suckers) may have also inhabited the creeks in the area. It is also noteworthy that Hubbs and Miller state in their 1943 publication 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, prior to the construction of Silverwood Lake.

<u>Silverwood Lake</u>

<u>General Fish Community</u>

The original intention of CDFW’s 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 the 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 warmwater and one coldwater 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. There are also multiple annual bass tournaments including the California Bass Contenders and Riverside Point Seekers events.[26]

[26] Approved tournament list: https://nrm.dfg.ca.gov/FishingContests/default.aspx

Currently, the Silverwood Lake fishery is composed entirely of non-native fishes, and primarily managed as a warmwater fishery consisting of largemouth bass, bluegill, black crappie, striped bass, channel catfish and white catfish. A put-and-take coldwater fishery is maintained by stocking hatchery-raised rainbow trout (Hemmert and Traver 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 was 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, all non-native, have been observed or captured at Silverwood Lake during these sampling efforts. Differences in spring and fall CPUE values for gamefish (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). In addition, CDFW provided evidence of American shad captured during surveys in 2014 and 2018 (Gibson 2018).

A summary of available electroshocking fish survey data at Silverwood Lake from surveys conducted by CDFW between 1999 through 2018 is provided in Table 5.3-3.

CDFW states that Silverwood Lake is a healthy fishery (Granfors and Hall 2017) and perhaps the most diverse fishery in the region (Granfors and Parker 2018).

The population trend from survey data indicates a robust diversity of size class for largemouth bass at relatively healthy weights (CDFW 2018g). The bass reflect both juvenile and adult size classes, which indicates reproduction. The CPUE in 2017 was relatively high (12.6) for largemouth bass, many of which were juveniles (CDFW 2017). Length-frequency data provided in the 2018 report show many of those juveniles were represented in larger size classes, indicating survival and population resilience (Figure 5.3-4).

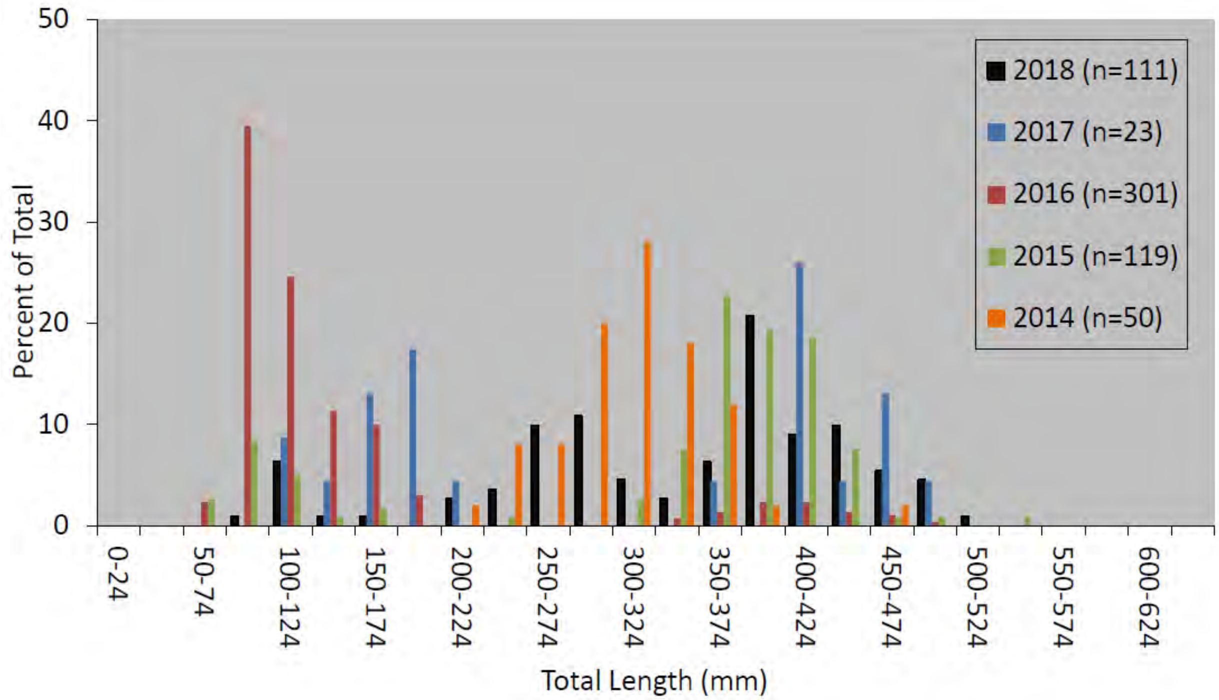
Table 5.3-3. Catch Per Unit Effort from CDFW Electroshocking Fish Surveys at Silverwood Lake from 1999 through 2018

Species	Catch per Unit Effort														
	1999		2000	2001		2002	2003	2008		2009		2010		2017	2018
	Spring	Fall	Spring	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Fall	Spring
Rainbow trout (*Oncorhynchus mykiss*)	0.86	0.01	0.15	0.67	-	1.11	0.01	-[1]	-[1]	-[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	12.6	1.83
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	1.0	0.31
Black crappie (*Pomoxis nigromaculatus*)	0.55	0.14	0.14	0.05	0.20	0.02	0.04	-	0.11	-	0.11	-	-	0.13	-
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	0.75	0.53
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	-	0.02	0.13
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	-	0.07
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	0.11	0.15
Goldfish (*Carassius auratus*)	0.42	0.28	0.87	0.36	0.20	0.59	0.09	0.03	0.03	-	-	0.03	-	-	0.02
Golden shiner (*Notemigonus crysoleucas*)	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-
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	0.23	0.08
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	0.13	0.02

Table 5.3-3. Catch Per Unit Effort from CDFW Electroshocking Fish Surveys at Silverwood Lake from 1999 through 2018 (continued)

Species	Catch per Unit Effort														
	1999		2000	2001		2002	2003	2008		2009		2010		2017	2018
	Spring	Fall	Spring	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Fall	Spring
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	0.20	0.23
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	0.10	0.05
Shimofuri goby (*Tridentiger bifasciatus*)	-	-	-	-	0.06	0.01	0.02	0.02	0.07	0.03	0.03	-	0	0.02	

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; Granfors and Hall 2017; Granfors and Parker 2018
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 2010a).*
[2]*Forage fish, threadfin shad and inland silverside, were observed but not counted (Ewing 2010a).*
Key:
- = Data not applicable or available
CDFW = California Department of Fish and Wildlife



Source: CDFW 2018g
Key:
mm = millimeters

Figure 5.3-4. Length-Frequency of Largemouth Bass Sampled from Silverwood Lake from 2014 to 2018, Re-Presented from CDFW

Stocking and Creel Census Survey Data

As discussed earlier, both warmwater and coldwater 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 Project 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 1988. As of February 1989, 29 tags were returned, which represented 5.8 percent of the total of 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), CDFW stocked approximately 1,000 pounds of channel catfish in Silverwood Lake (DWR 1998a and 1998b).

In 1999, 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 three years. Although the current Exhibit S requires 20,000 pounds of catchable rainbow trout, generally 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 Fillmore Trout Hatchery in Fillmore, 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 2018 is provided below, as well as annual trout stocking numbers and weights (Table 5.3-4).

As shown in Table 5.3-4, CDFW did not meet its objective of stocking Silverwood Lake with 20,000 pounds of fish per year in 2002, and 2003. Since 2006, CDFW has stocked the reservoir with the contracted 30,000 pounds of trout, with the exception of the 2008-2009 fiscal year, when the total weight of stocked fish was 28,200 pounds. Fewer trout (23,950 pounds) were stocked in Silverwood Lake in 2017-2018 and were brown trout, not the usual rainbow trout, due to limited availability of plantable rainbow trout, according to CDFW.

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 2017, anglers were surveyed on the type of fish species caught (Tables 5.3-5 and 5.3-6).

Table 5.3-4. Annual CDFW Trout Stocking and Creel Survey Data for Silverwood Lake from 2000 through May 2018

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	21./2.2	2.4/2.3	2.3/2.0
2016-2017	81,963	39,053	2.4/2.8	2.6/2.7	2.2/2.1
2017-2018	30,225	23,950[6]	-	-	-

Sources: DWR (2002, 2004, 2006, 2013, 2014c, 2016b, 2018c)
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.
[5]The 2016-2018 biennial stocking report was issued on June 28, 2018.
[6]The trout stocked in Silverwood Lake in 2017-2018 were brown trout not the usual rainbow trout due to limited availability of plantable rainbow trout.
Key:
- = Data not applicable or available
CDFW = California Department of Fish and Wildlife

Table 5.3-5. Reported Number of Game Fish Caught by Anglers at Silverwood Lake During the Fall – Spring of 2005 through 2017

Fall – Spring[1]	Trout		Catfish		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
2014	237	25	22	2	17	2	3	0	106	12	557	59	942
2015	573	43	90	7	4	0	18	1	181	13	485	36	1,351
2016	781	44	151	8	6	0	1	0	304	17	560	31	1,803
2017	1,179	50	98	4	1	0	3	0	549	23	545	23	2,375

Source: CDFW (2013, 2018g); DWR (2002, 2004, 2006, 2013, 2014c, 2016b, 2018c)
Notes:
[1]October through May
[2]Data from 2005 through 2009 is currently under review and is subject to revision (March 30, 2016)
Key:
% = percent
 # = pounds

Table 5.3-6. Reported Number of Game Fish Caught by Anglers at Silverwood Lake During the Summer Creel Surveys of 2005 through 2017

Summer[1]	Trout		Catfish		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
2014	39	5	47	6	2	0	3	0	56	8	601	81	748
2015	0	0	88	16	0	0	4	0	66	12	400	72	558
2016	21	5	31	8	0	0	4	1	53	14	284	72	393
2017	6	1	107	9	3	0	11	1	281	23	805	66	1,213

Source: CDFW (2013, 2018g); DWR (2002, 2004, 2006, 2013, 2014c, 2016b, 2018c)
Notes:
[1]*June through September*
[2]*Data from 2005-2009 is currently under review and subject to revision (3/30/16)*
Key:
% = percent
 # = pounds

San Bernardino Tunnel Intake

In 1973 and prior to the construction of the existing San Bernardino Tunnel Intake Tower, CDFW biologists were concerned that the old intake tower, when operating, 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 stocking, a one-day creel census was 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 the old intake tower were insignificant, and no action to alter loss rates was needed (Baracco 1975).

In March 1988, DWR conducted field investigations to determine the head losses through the old intake tower as part of a study of the feasibility of increasing the energy production available at the enlarged Devil Canyon Powerplant. Investigations during head loss tests showed that the San Bernardino Tunnel Intake Tower did not meet acceptable seismic design standards; the structure could potentially fail structurally if a moderate or large earthquake occurred (DWR 1994a). Instead of repairing the existing intake tower, DWR decided a new intake structure (i.e., San Bernardino Tunnel Intake Tower) 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). FERC approved the license amendment in a 1990 FERC order. The new afterbay would hold 800 AF of water. No changes were proposed to the existing old intake tower other than the installation of fish screens on all 6 tiers with 0.5-inch screens.

However, a license amendment application to construct a new San Bernardino Tunnel Intake Tower to replace the old intake tower due to seismic concerns was subsequently approved by FERC in a 1995 order that superseded the 1990 FERC order. At that time, DWR consulted with CDFW that determined fish screens were not required (Worthey 1992). CDFW later again confirmed with DWR that fish screens were not required on the new San Bernardino Tunnel Intake Tower (White 1997). This information was provided to FERC in 1997.

For tunnel intake construction purposes, the reservoir was planned to be lowered about 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 Silverwood 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 three to five 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 consisting of CDFW, DWR, and SCBC to develop a supplemental fishery enhancement plan to increase the likelihood of successfully restoring the fishery from the drawdown.

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 CDFW 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. As a result of this litigation, CDFW and DWR developed a MOU in which DWR agreed to "operate Silverwood Lake relative to lake even fluctuation in a manner similar to 2001 and 2002 during the period of April 1 to June 30 to help protect spawning bass" (DWR and CDFG 2003).

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 5.3-7.

Table 5.3-7. 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 logperch (*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 12 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, brown trout (*Salmo trutta*) and unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*).

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 5.4.3), 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

All available information for the Devil Canyon Afterbay is described above as it relates to the San Bernardino Tunnel Intake Tower entrainment discussion.

5.3.1.5 Amphibians and Semi-Aquatic Reptiles

Aquatic resources include amphibians, snakes and turtles that are closely associated with aquatic environments (Table 5.3-8). 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. adaverine*) 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 Biological Consulting 2005) 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 Las Flores Ranch north of Silverwood Lake. Red-eared sliders were observed during field work on Silverwood Lake and on the north shore of the East Fork of West Fork Mojave River in

2017, when a single incidental observation of a southern western pond turtle was also recorded at Silverwood Lake. The only confirmed recent records of western spadefoot in the Project vicinity are reported in the CNDDB (CDFW 2018e) near percolation basins in the City of San Bernardino about 0.7 to 1.0 mile south and south-southeast of the Devil Canyon Powerplant. Jennings and Hayes (1994) also 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 Biological Consulting 2005).

5.3.1.6 Native Aquatic Mollusks

No mollusk species listed as special-status are known to occur in the Project vicinity. However, the Westfork shoulderband (*Helminthoglypta taylori*), ranked by the CNDDB as G1 S1 (i.e., “critically imperiled in the state due to extreme rarity”) as reported in the Silverwood Lake quadrangle (CDFW 2018e).

DWR accessed the California Environmental Data Exchange Network (CEDEN) to find data regarding mollusks within the Project vicinity. A county-based query was run emphasizing select map stations with relevance to the Project. The database included no information from within the proposed Project boundary. 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. Genera of mollusks within the samples included *Gyraulus*, *Helisoma*, *Physa*, and *Pisidium* (CEDEN 2012).

Table 5.3-8. Aquatic Amphibians, Semi-aquatic Snakes, and Turtles Known to Occur or May Potentially Occur in the Vicinity of the Project

Species	Habitat Associations
Western spadefoot [SSC] (*Spea hammondii*)	See Section 5.3.1.1.1 (Special-Status Species). 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.
Arroyo toad [FE, SSC] (*Anaxyrus* [=*Bufo*] *californicus*)	See Section 5.4.3.
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 adaverine*)	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 5.4.3.
Southern mountain yellow-legged frog [FE, SE] (*Rana muscosa*)	See Section 5.4.3.

Table 5.3-8. Aquatic Amphibians, Semi-aquatic Snakes, and Turtles Known to Occur or May Potentially Occur in the Vicinity of the Project (continued)

Species	Habitat Associations
American bullfrog (*Lithobates* [*Rana*] *catesbeianus*)	See Section 5.3.1.1.2 (AIS). 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.
Two-striped garter snake (*Thamnophis hammondii*)	See Section 5.3.1.1.1 (Special-Status Species). 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 5.3.1.1.1.
Southern western pond turtle (*Actinemys* [*Emys*] *pallida*) SSC	See Section 5.3.1.1.1 (Special-Status Species). 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 oviposit in summer at upland sites as much as 1,200 feet from aquatic habitats.
Red-eared slider (*Trachemys scripta elegans*)	See Section 5.3.1.1.2 (AIS). Introduced highly aquatic turtle, with a mostly scattered distribution in California in ponds, lakes, reservoirs, marshes, canals, and slow-moving streams; most often where aquatic vegetation is abundant. Widely kept as a pet and often deliberately released. Basks out of the water and oviposit at upland sites.

Sources: Lannoo 2005; Jones et al. 2005; Stebbins and McGinnis 2012; California Herps 2018
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

5.3.1.7 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 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. 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 special-status aquatic invertebrates were found (DWR 1994b).

DWR consulted the CEDEN to find data on BMI 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 5.3-9 (CEDEN 2012).

Table 5.3-9. Orders and Families of Aquatic Benthic 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

5.3.1.8 Algae

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).

5.3.2 Effects of DWR's Proposal

This section discusses the potential environmental effects of DWR's Project on fish and aquatic resources. For the reasons stated below, DWR has proposed four specific measures related to fish and aquatic resources: (1) Measure WR1, a continuation of water surface elevation limitations described in the 1968 USFS MOU, as amended, and 2003 CDFW MOU; (2) Measure AR1, which implements a Silverwood Lake Fish Stocking Measure that includes angler surveys; (3) Measure AR2, which implements an Aquatic Invasive Species Management Plan; and (4) Measure TR1, which implements an Integrated Vegetation Management Plan (IVMP) that addresses vegetation management and herbicide use. In addition, DWR anticipates the following ongoing actions will continue:

- Adherence to DWR's Quagga and Zebra Mussel Rapid Response Plan (DWR 2010), which requires ongoing monitoring in Silverwood Lake. This plan pertains to the entire SWP, of which the Project is only one part.

- Continuation of DPR's program of inspection of boats intending to use Silverwood Lake to prevent the introduction of zebra and quagga mussels per California regulations.

- Adherence to DWR's NPDES Permit for Residual Aquatic Pesticide Discharges to Waters of the United States from Algae and Aquatic Weed Control Applications, which requires monitoring and applies to treatment of algae and cyanobacteria in Silverwood Lake. This NPDES pertains to the entire SWP, of which the Project is only one part.

5.3.2.1 Effects on Special-Status Species at Project

As described above, DWR's Proposal has a potential to affect three aquatic special-status species: two-striped garter snake, western spadefoot, and southern western pond turtle. Two-striped garter snake and western spadefoot have not been reported to occur within the proposed Project boundary and are unlikely to use Silverwood Lake or the other Project impoundments. In contrast, southern western pond turtle has been observed to occur in Silverwood Lake. Limitation of Silverwood Lake fluctuation by Measure WR1 would mitigate any effects due to reservoir fluctuations on southern western pond turtle. Further, implementation of Measure TR1 would assure that vegetation management, including herbicide use, minimizes potential effects to these species.

5.3.2.2 Effects on Silverwood Lake Fishery

As described above, the Silverwood Lake fishery is composed entirely of non-native fishes, and managed by CDFW as a warmwater fishery consisting of largemouth bass, bluegill, black crappie, striped bass, channel catfish and white catfish, and a put-and-take coldwater fishery for trout maintained by stocking hatchery-raised fish. CDFW characterizes the Silverwood Lake fishery as healthy (Granfors and Hall 2017) and perhaps the most diverse fishery in the region (Granfors and Parker 2018). DWR's Proposal could affect this fishery in six ways: (1) changes in reservoir water level fluctuations; (2) changes in fish stocking and fishing pressure; (3) fish entrainment into Project intakes; (4) bioaccumulation of metals; (5) water temperature and DO; and (6) habitat degradation due to AIS. Each of these potential effects is discussed below.

Changes in Reservoir Operations, Especially Water Level Fluctuations

Changes in Silverwood Lake water level fluctuations could affect the amount of habitat in the reservoir for bass production. DWR's Measure WR1 would assure that Silverwood Lake water level fluctuations are protective of the existing bass fishery. In particular, the measure is designed specifically to protect bass spawning by reducing egg stranding. The measure stipulates that on April 1 each year, DWR reports the Silverwood Lake water level to CDFW; and during the period of April 1 to June 30 each year, DWR manages the lake such that the lake is not lowered more than 3 feet from the April 1 reported level.

Changes in Fish Stocking and Fishing Pressure

Changes in fish stocking or fishing pressure could affect the existing Silverwood Lake put-and-take trout fishery. DWR's Measure AR1 is, in effect, a continuation of the fish stocking measure in Article 51 of the existing Project license. Measure AR1 would provide that DWR continue annually stocking Silverwood Lake with trout at the current stocking level in the existing license and provide for periodic angler surveys. The stocking data would be reported to FERC, and DWR would consult with CDFW after each angler survey to determine if any changes in stocking program are warranted. If so, DWR would file with FERC a revised stocking program for approval. In this way, Measure AR1 would assure a continuation of the high quality trout fishery in Silverwood Lake.

Fish Entrainment

Fish entrainment, especially of game species, into the San Bernardino Tunnel could affect the existing Silverwood Lake fishery. Entrainment effects on the Silverwood Lake fishery are not anticipated at the outlet of Cedar Springs Dam due to the low frequency of water releases, absence of proximal usable habitat, and relatively consistent depth of the intake.

The structural characteristics of the San Bernardino Tunnel represent a low likelihood of entrainment for trout or largemouth bass. The San Bernardino Tunnel is 3.81 miles long, concrete-lined, 12.75 feet in diameter, 127.7 square feet in area, and has a design capacity of 2,811 cfs. The tunnel intake is 71 feet tall ranging in elevation from 3,336 feet to 3,265 feet, and has 12 rectangular openings, each approximately 13.8 feet by 14.9 feet, divided by cement support beams with a trashrack in front of each. The total intake area is approximately 2,467 square feet. The maximum operating water stage is 3,353 feet, 17 feet above the entry point of the trash rack. The intake is located on a steep rock bank, which does not provide any habitat to local game fish, and the intake openings represent less than 0.01 percent of the total reservoir lake perimeter.

Operations at the intake most frequently result in low approach velocities (less than 1 foot per second [fps]) and intake depths at 16 feet. Minimum and maximum monthly operational exceedance calculations at the intake (2005 through 2017) ranged from 72.5 to 350 cfs (90 percent) and 1,510 to 1,890 cfs (10 percent). These values translated to average intake approach velocities[27] of 0.03 to 0.14 fps (90 percent monthly exceedance) and 0.61 to 0.76 fps (10 percent monthly exceedance). Daily reservoir storage from October 1995 through 2017 reflected a 90 percent exceedance of 72,420 AF (approximate reservoir stage of 3,352 feet) to a 10 percent exceedance of 58,938 AF (approximate reservoir stage of 3,332 feet). Maximum pool is set to a reservoir stage of 3,353 feet and the minimum power pool is at 3,312 feet. Based on these storage frequencies, the top of the intake tunnel would be submerged to 16 feet at a 90 percent daily exceedance value and the diversion intake would be partially exposed at a 10 percent daily exceedance value. Movable panels can be placed on the upper two intakes to deepen the intake level to 3,299 feet as well.

The potential for fish to be entrained by the intake is influenced by several factors that include the potential to interact with the intake and the ability to escape entraining (approach flows). Generally, young fish tend to occupy shallower littoral water and then occupy greater pelagic depths as they mature. Warner and Quinn (1995) tracked six adult rainbow trout in Lake Washington during the summer and fall of 1989 with ultrasonic transmitters for 349 hours. The lake thermocline ranged from 49 to 66 feet during the tracking periods. They found that fish movements were slow and close to

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[27] Average approach velocity calculated by discharge rate divided by intake area. Example: 350 cfs divided by the intake area of 2,467 square feet results in an average approach velocity of 0.14 feet per second.

shore. Rainbow trout were surface oriented, spending over 90 percent of their time in the top 10 feet of the lake and occasionally making brief dives to depths of 16 to 33 feet for about 2 to 3 minutes. Adult bass generally remain proximally above the thermocline at depths ranging from 3 to 13 feet (Moyle 2002). Young of the year and yearling bass tend to stay close to shore and congregate in schools as they swim near or above beds of aquatic plants (Moyle 2002). Juvenile largemouth bass also prefer warm shallow waters (30-32°C) where forage is prevalent to ensure rapid growth (Moyle 2002). These studies indicate that adult bass and trout may infrequently travel to the depth of the San Bernardino Tunnel intake (generally near 16 feet of depth). Infrequently (10 percent exceedance), the intake may become shallow as well. However, the poor surrounding habitat and small intake opening relative to the reservoir circumference would reduce the potential for adult or juvenile fish presence near the intake.

Fish entrainment is generally a result of approach flows exceeding the swimming ability of the fish present. Swim speeds are generally measured in laboratory environments and characterized by life stage and swimming type (i.e., burst and sustained). Burst swimming offers greater speed for a shorter period of time and would be applicable for moving away from the intake. Researchers have developed a general fish length-swim speed relationship, which states that a fish is able to maintain a sustained speed equal to about four fish-lengths per second for long periods, and speeds of about 10 fish-lengths per second for brief intervals or bursts (Alexander 1967; Clay 1961). Therefore, larger fish are able to swim at quicker speeds than smaller fish. For example, a 3-inch long trout would be capable of a cruising speed of about 1 fps and a burst speed of about 2.5 fps, while a 6-inch trout could maintain a cruising speed of 2 fps and a burst speed of 5 fps. Bell (1986) found adult trout burst swim speeds ranging from 6.4 to 13.5 fps and Beamish (1978) documented adult largemouth bass burst swim speeds greater than 4.34 fps (Beamish 1978). Based on these findings, if an adult or juvenile trout or bass was in proximity of the intake, it should easily be able to avoid entraining flow.

In 1998, an internal CDFW (formerly CDFG) memorandum provided estimates of larval fish entrainment into the "Devil's Canyon Canal" (i.e., San Bernardino Tunnel) ranging from 95.2 million to 138.5 million larvae for the period of March 9 to August 12, 1998, including 63.6 million to 105.6 million larvae between March 9 to May 8 (Chun 1998). The memorandum includes only the formulas used to calculate the estimates and the resulting numbers. The sampling methods (e.g., the number and frequency of samples, number of replicate samples, the volume of water represented by each sample) and assumptions for the estimates are not described, without which the accuracy of the estimates cannot be evaluated. However, the calculated entrainment numbers are almost certainly much larger than the actual numbers for the following reason. To be accurate, the estimates would require adult fish populations far in excess of contemporaneous fish population estimates in order to produce the number of entrained larvae and to sustain this high rate of entrainment without collapsing.

Another side-effect of high entrainment is a reduction of available food resources and an overall indicator of poor fish health. CDFW conducted length-weight analyses on largemouth bass over multiple years and showed that, "Overall, the [relative weight] values are mostly close to 100 indicating the [largemouth bass] are in a healthy condition" (CDFW 2018g). CDFW does not report on stocked trout as it is expected for the fishery to be maintained by stocking and not natural production. CDFW (2017) stated, "Since these trout [rainbow trout] are raised to a particular stock size by CDFW and the number and weight is calculated for all trout stocked into public waters, rainbow trout were not captured or counted during the general fish survey."

For these reasons and the fact that CDFW considers the existing Silverwood Lake fishery to be healthy and diverse, fish entrainment into San Bernardino Tunnel, regardless of the magnitude, does not appear to have a significant effect on the Silverwood Lake fishery. Further, DWR's Measure AR1 would assure that any changes to the trout fishery are identified and, if appropriate, the stocking program is modified to maintain the fishery.

Bioaccumulation of Metals

The OEHHA monitors fish in Silverwood Lake and has published Safe Eating Guidelines for Silverwood Lake that indicate anglers may safely consume rainbow trout, but should avoid eating most other fish species from the lake due to contamination by mercury and PCBs. DWR's Proposal could affect the Silverwood Lake fishery if it included any mechanisms (e.g., disturbing bottom sediments) to increase metals bioaccumulation in fish, but it does not. Further, FERC has already stated that there is no Project nexus between the existence of an impoundment and mercury bioaccumulation. In its September 14, 2009 Study Plan Determination for the Merced River Hydroelectric Project (FERC Project No. 2179), FERC stated:

> "…because MID [Merced Irrigation District, the applicant] is not proposing to alter project operations to increase water fluctuations or mobilize substrates, we find the study is not necessary. In their August filing, the Resource Agencies and Conservation Groups suggest that the existence of Project impoundments provides a nexus between the Project and mercury bioaccumulation. We note that the baseline for the NEPA analysis of the Project is existing conditions, not the original construction of the Project reservoirs. Due to the lack of a nexus between Project operation and the resource to be studied, and because the proposed study would not inform the development of license requirements (Criterion 5), we do not adopt this requested study."

Bioaccumulation in Silverwood Lake is also discussed in the Cumulative Effects section below.

Water Temperature and Dissolved Oxygen

Changes in Project operations could affect water temperature or DO in Silverwood Lake, which in turn could affect the Silverwood Lake fishery. However, DWR proposes to operate the Project as it has been operated historically. Section 5.2 describes existing water temperature and DO conditions, which are adequate to support the Silverwood Lake fishery as evidenced by the healthy condition of the existing fishery.

Habitat Degradation Due to AIS

AIS may affect native and desired introduced species through competition, predation, and changes in habitat conditions. Invasive crayfish, which have the potential to occur within the proposed Project boundary, can reduce fish populations. Quagga and zebra mussels consume phytoplankton and change the physical structure of hard substrates and benthic habitat through biofouling and shell accumulation, resulting in increased water clarity and altered habitat structure, ultimately, affecting the entire ecosystem. Aquatic weeds alter habitat structure and turbidity. However, AIS are not currently known to negatively affect the fishery as a whole, given its current healthy condition. Continued implementation of boat inspections, AIS monitoring and cyanobacteria treatments, as well as implementing the proposed Measure AR2, will help protect the fishery from negative effects due to AIS.

5.3.2.3 Effects of AIS

As described above, 10 AIS are currently known to occur in Silverwood Lake and there is the potential for other AIS species to be introduced in the future. Recreation activities pose the highest risk for introducing new AIS to the Project area, and for spreading existing AIS to additional areas of Silverwood Lake and carrying them off-Project to other sites. This includes unintentional introductions from contaminated boats and other equipment used by visitors, as well as intentional introductions (e.g., release of unwanted petaquatic pets or by malicious intent). Secondarily, use of boats or other equipment by DWR within Silverwood Lake associated with Project O&M (e.g., boat-based water quality sampling and application of algaecides) could inadvertently facilitate spread of AIS within the lake. The majority of known AIS within Silverwood Lake (i.e., channeled apple snail, Asian clam, curly pondweed, Eurasian water milfoil, coontail, and sago pondweed) can all be spread via uncleaned boats and equipment.

Recreation activities at Silverwood Lake that have the potential to spread AIS include: boating, waterskiing, swimming, and fishing. Materials and equipment by which AIS are known to be introduced or dispersed within a site include live bait, fishing gear, boats, dry docks, navigation buoys, and marina floats, if these structures are moved between locations within a site (CDFG 2008).

Two of the AIS of concern, quagga and zebra mussels, would be addressed by continuation of DWR's SWP Quagga and Zebra Mussel Rapid Response Plan (DWR 2010), which requires ongoing monitoring in Silverwood Lake, reporting to CDFW, and consultation with CDFW should quagga or zebra mussels be detected at the Project. In addition, continued support of DPR's program of inspection of boats entering Silverwood Lake, as mandated per California regulation, would protect against the introduction of quagga and zebra mussels, as well as other AIS, from this source.

Treatment for cyanobacteria is implemented through DWR's NPDES permit for Residual Aquatic Pesticide Discharges to Waters of the United States from Algae and Aquatic Weed Control Applications, which necessitates monitoring and applies to treatment of cyanobacteria in Silverwood Lake.

As discussed in Section 5.3.1.2, most of the documented AIS at Silverwood Lake and others that have not been introduced are difficult or impossible to eliminate once established. Therefore, Measure AR2 will include measures to prevent the introduction and spread of AIS as the most effective means of management currently available. This will include monitoring for zebra and quagga mussels and implementing BMPs during Project activities.

5.3.2.4 Effects on Tributaries to Silverwood Lake

During the course of relicensing, the SBNF expressed a concern that AIS and non-native fish in Silverwood Lake might ascend tributaries to the lake and have an adverse effect on SBNF resources. These tributaries are relatively small, provide minimal flow to attract fish, and likely offer small windows for uninterrupted upstream passage because they often experience little if any flow. As described above and in Section 5.4.3, Mohave tui chub is the only fish species believed to be native to the Mojave River drainage, but has been extirpated in nearly all of its range and does not occur in Silverwood Lake or its tributaries. In addition, DWR is unaware of any aquatic special-status species in the tributaries. Regardless, many of the non-native fishes in Silverwood Lake do not have adfluvial life histories, other than potentially rainbow trout (a stocked fish), and historical information indicates that rainbow trout were planted in these streams prior to the Project. Species such as striped bass can exhibit adfluvial life histories, but the life history expression is generally within much larger, stable, systems and would not be expected in Silverwood Lake and its tributaries. For these reasons, it is unlikely that non-native fishes and AIS have a significant effect on resources in the SBNF.

5.3.2.5 Effects on Aquatic Amphibian and Semi-Aquatic Reptiles

The Project has limited potential to affect native aquatic amphibians, semi-aquatic snakes, and turtles, two of which, two-striped garter snake and southern western pond turtle, are special-status species discussed in Section 5.3.2.1. Western toad, Baja California chorus frog, and California chorus frog are aquatic-breeding amphibians that may occur within the proposed Project boundary, primarily in tributaries of Silverwood Lake if suitable intermittent pool habitat exists, or in shallow, vegetated margins of Silverwood Lake, although these relatively common species are generally infrequent in large reservoirs because of wave action and the presence of predatory fish.

5.3.2.6 Effects on Benthic Macroinvertebrates

DWR's Proposal has the potential to affect BMI in Silverwood Lake by providing habitat for non-native fish species (which are the only species present in the lake) and other AIS. Water quality, especially water temperature and DO, can affect BMI communities, especially those species with lower tolerance to warmer, less oxygenated water (e.g., caddis flies and stones flies). These effects are likely limited in Silverwood Lake, because those species which prefer colder, more oxygenated water also rely on gravel and cobble as their preferred habitat substrate, a habitat that is likely infrequent in Silverwood Lake. Because DWR's Proposal does not change operations, water quality conditions should also remain unchanged; therefore, no changes to the established BMI community are anticipated. Fish collected from Silverwood Lake were shown to be in good condition (CDFW 2017), which is evidence of ample food resources and usually indicative of abundant BMI. Silverwood Lake's fish population is made up entirely of non-native fish. These fish likely rely, at least partly, on BMI as a food source.

AIS, especially invertebrates, have the potential to be introduced or spread due to DWR's Proposal. These AIS could affect native BMI populations by competing for local resources including food and habitat. Some of these species are already present in Silverwood Lake and the precise effects to BMI are unknown; however, DWR is not aware of any specific issues. Implementation of Measure AR2 is intended to minimize future reintroductions of AIS.

5.3.2.7 Cumulative Effects

The defined geographic extent of cumulative effects on aquatic resources encompasses the headwaters of the West Fork Mojave River and the East Fork of the West Fork Mojave River and other tributaries of Silverwood Lake, Silverwood Lake itself, and downstream to the NMWSE of the Mojave River Dam.

The earliest cumulative effects that are still observed today are the result of historical mining. Specifically, mercury used historically in gold mining, which slowly degrades, remains at moderate levels in fish at Silverwood Lake (other than rainbow trout), a condition evident in many lacustrine fish populations throughout California due to bioaccumulation. CDFW[28] conducts monitoring to determine safe consumption levels, and DWR's Proposal will not add to the existing mercury load trapped in sediment. There are no planned or foreseeable activities which could disturb mercury trapped in sediment. If such activities are proposed in the future, environmental review, permitting and mitigation would be required.

Introduction of non-native fish is also a cumulative effect, with deliberate releases of gamefish and escape of bait fish, such as arroyo chub, likely beginning early in the twentieth century and eventually leading to extirpation of the native Mohave tui chub and affecting native amphibians.

Past and present cumulative actions are primarily associated with the construction and operation of the SWP, including Silverwood Lake, as a water delivery project. This large project representing 700 miles of canal and aqueducts, 34 storage facilities, and 21

[28] Latest sampling effort available at: https://www.waterboards.ca.gov/water_issues/programs/swamp/lakes_study.html

dams is outside of the discretion of FERC, with the exception of electricity generating facilities associated with the SWP. In addition, the operation of Silverwood Lake is influenced by the SWP, due to its connectivity with transferred water from the Sacramento-San Joaquin Delta through aqueducts. Introduced species from the Delta, may potentially represent long-term biological effects. These introductions may also affect water quality and aquatic resources in the West Fork Mojave River downstream of Cedar Springs Dam through increased predation and competition, and some of the species may increase water turbidity (e.g., common carp). Because the West Fork Mojave River below Horsethief Creek dries seasonally, non-native aquatic species may not be persistent after each introduction.

Another significant past and present action is the implementation of DWR's water agreements with CLAWA, LFR, and MWA. Under these agreements, the natural inflow of water into Silverwood Lake and out of the lake into the West Fork Mojave River is altered. These parties may request that DWR retain for brief periods some of their allocated water in Silverwood Lake, and provide that water to them upon request at a later date. These water resource effects could affect both aquatic resources in the lake and aquatic resources in the West Fork Mojave River below Cedar Springs Dam. Similarly, the Crest Forest County Water District's Lake Gregory and associated regional park on Houston Creek and the Crestline Sanitation District's Cleghorn Wastewater Treatment Plant, which are both upstream of Silverwood Lake, have the potential for similar effects.

Recreation, including OHV use, and road use and maintenance on the SBNF and on the non-Project portions of the Silverwood Lake SRA also represent long-term past and present cumulative actions. These activities can affect water quality.

Future cumulative effects include the Tapestry housing and community development project in Hesperia, which is a phased development north of the Project that includes planned construction over the next 30 years. There are currently 15,663 dwelling units, or homes, proposed in the Tapestry Project Specific Plan, and over 350.0 acres in parks and recreation development. Mitigation measures detailed in the Settlement and General Release Agreement associated with the development that address effects to aquatic resources, as well as arroyo toad (discussed in Section 5.4.3) include arroyo toad habitat preservation, an arroyo toad habitat management plan, a non-native predator plan, a bullfrog plan, an open space area, restricted cattle grazing, and restricted OHV use. The project is expected to break ground in 2019.

Overall, the incremental effects of DWR's Proposal will not significantly add to these cumulative effects.

5.3.3 Unavoidable Adverse Effects

Operating and maintaining the Project would not create any significant and unavoidable adverse effects to fish and aquatic resources. The aquatic community is well established in Silverwood Lake, does not contain native fish species, and is supplemented by a robust trout stocking program. Bioaccumulation in fish is largely a result of historical mining practices and not due to Project activity. OHHEA has already issued fish consumption advisories. The current presence of AIS at Silverwood Lake is not known to be associated with Project O&M or recreation activities, and has not evidently impaired other resources, such as fish or water quality. Reducing the potential for future introduction and spread of AIS, as well as monitoring and treatment provisions, are addressed in DWR's Measure AR2.

5.4 TERRESTRIAL RESOURCES

5.4.1 Botanical and Terrestrial Wildlife

This discussion of existing botanical and terrestrial wildlife is divided into three sections. Section 5.4.1.1 describes the existing Project environment, including: the general distribution of vegetation from updated vegetation mapping within the proposed Project boundary; special-status botanical species and Non-Native Invasive Plants (NNIP) known to occur within the proposed Project boundary; special-status wildlife species known or with the potential to occur within the proposed Project boundary; occurrences and potential distribution of commercially valuable wildlife species within the proposed Project boundary and surrounding area; and designated special ecological areas. Potential effects of the Project on botanical and terrestrial wildlife resources, and DWR's proposed PM&E measures are described in Section 5.4.1.2. Section 5.4.1.3 addresses any unavoidable adverse effects to botanical and terrestrial wildlife resources.

DWR augmented existing, relevant, and reasonably available information relative to botanical and terrestrial wildlife by conducting the following three studies: (1) Botanical Resources; (2) NNIP; and (3) Special-Status Terrestrial Wildlife Species – California Wildlife Habitat Relationships. The results of these studies are incorporated into this section. Refer to the Devil Canyon Project Relicensing Website (http://devil-canyon-project-relicensing.com/studies/) for detailed study approaches, study summaries, and detailed study data. Refer to Section 5.4.3 for a discussion of ESA-listed botanical and terrestrial wildlife resources.

5.4.1.1 Existing Environment

Vegetation Mapping

For the purposes of assessing the suitability of habitat for botanical and terrestrial wildlife, existing vegetation community mapping within and immediately adjacent to the proposed Project boundary was used. USFS Classification and Assessment with Landsat of Visible Ecological Groupings (CalVeg) data are available for the area within the proposed Project boundary (USFS 2017). 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 proposed 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 (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 approximately 2,070 acres. However, about 55.0 acres of the 2,070.0 acres are located above buried Project features, such as the San Bernardino Tunnel. Because the Project does not affect these areas as no Project O&M is performed in these areas, they are excluded from the survey area, leaving a total of approximately 2,015.0 acres.

CalVeg can be crosswalked with CDFW's California Wildlife Habitat Relationships (CWHR) classification system (Mayer and Laudenslayer, Jr. 1988), which is the system that DWR used to describe vegetation community types for the proposed Project boundary. DWR's *Special-Status Terrestrial Wildlife Species Study – California Wildlife Habitat Relationships Study* was conducted from May 17, 2017 through July 19, 2017 to ground truth the accuracy of the initial CWHR vegetation community maps. A total of 30 sampling points representing 15 vegetation communities were randomly selected using the Geographic Information System (GIS): one Annual Grassland, two Barren, two Chamise-Redshank Chaparral, one Coastal Oak Woodland, two Coastal Scrub, two Desert Scrub, two Desert Wash, five Mixed Chaparral, one Montane Chaparral, two Montane Hardwood-Conifer, two Montane Hardwood, one Ponderosa Pine, one Sagebrush, one Sierran Mixed Conifer, two Urban, and three Valley Foothill Riparian. More sampling points were selected in vegetation communities that have a greater potential for special-status wildlife or more acreage inside the proposed Project boundary. Any points that were initially in inaccessible areas were re-generated until all sampling points were located in accessible areas. The sampling locations are shown in Figures 5.4.1-1 and 5.4.1-2.

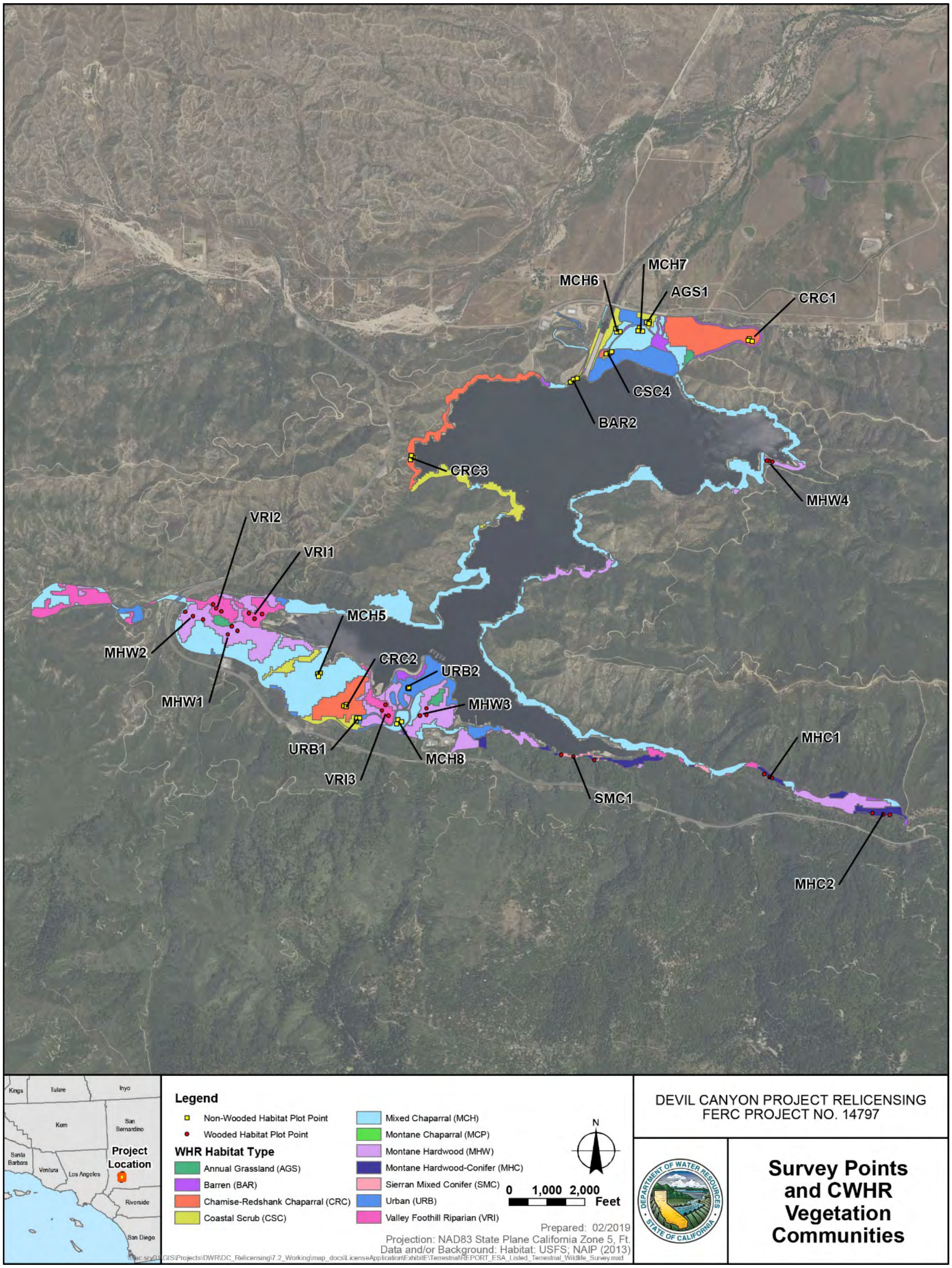

Figure 5.4.1-1. Survey Points and California Wildlife Habitat Relationship Vegetation Communities

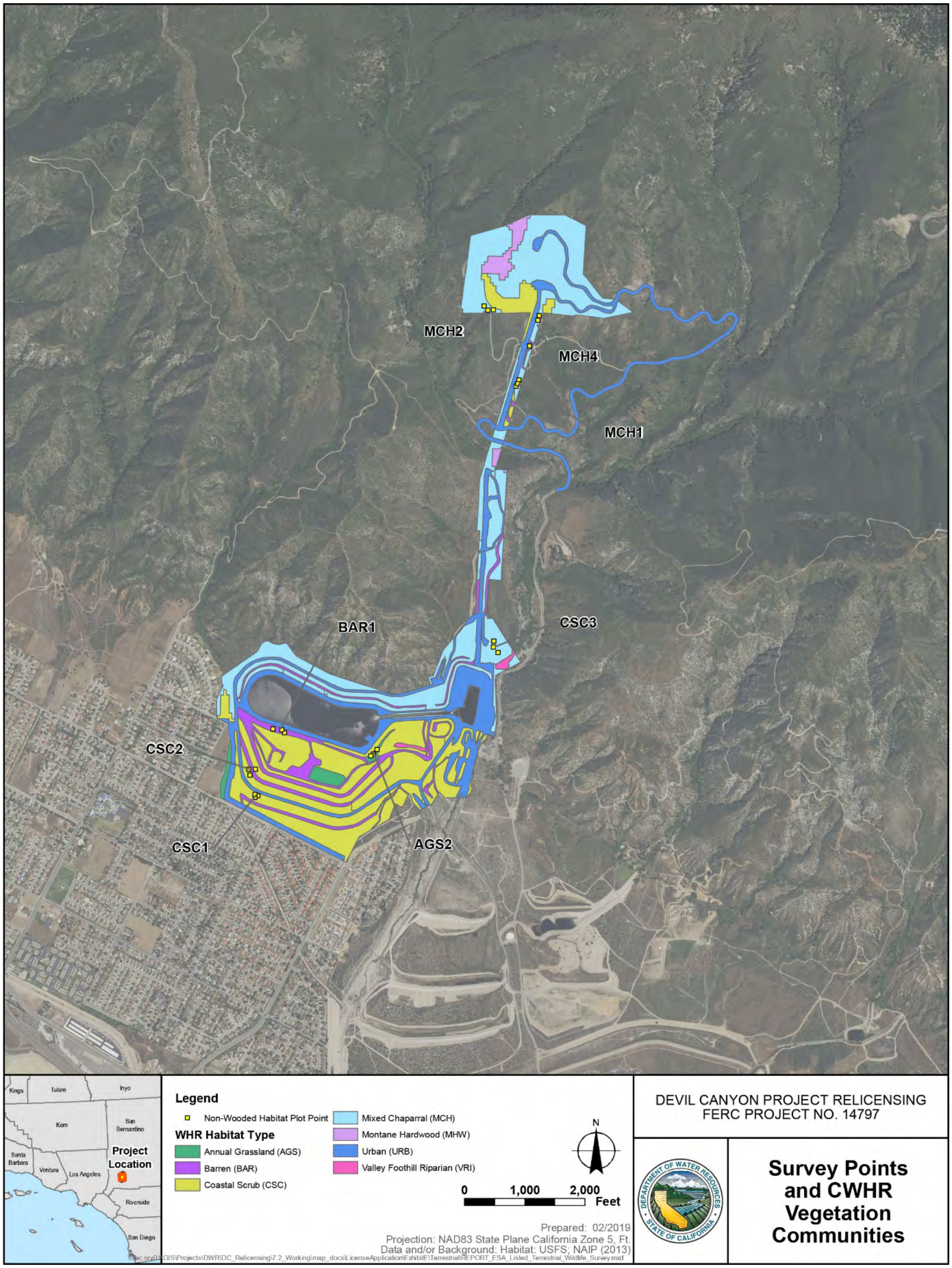

Figure 5.4.1-2. Survey Points and California Wildlife Habitat Relationship Vegetation Communities

At each representative sampling location, three plots were selected to conduct field habitat assessments and characterizations, using the CWHR data forms for wooded and non-wooded habitats (CDFW 2016).

If the mapped vegetation type did not match the actual habitat type found at a sampling point, a correction was made to the vegetation community type at that location and changes in the vegetation community boundaries were recorded using the iPad data collector. Corrections were made to six CWHR types: (1) the Coastal Oak Woodland areas were determined to be Montane Hardwood; (2) Desert Scrub and Desert Wash were incorrectly mapped and the areas were corrected to be a mixture of Annual Grassland, Coastal Scrub, and Chamise-Redshank Chaparral; (3) Sagebrush was not present and a plot for Mixed Chaparral was substituted; (4) Mixed Chaparral was substituted for Montane Chaparral that was incorrectly mapped and is not present; and (5) Ponderosa Pine was not in the study area and a Montane Hardwood plot was substituted.

Eleven habitat types were determined to occur within the proposed Project boundary. Non-vegetated Water (Lacustrine) habitat (49 percent of the proposed Project boundary, excluding the area over San Bernardino Tunnel) was the most common habitat type within the proposed Project boundary, and Mixed Chaparral (19 percent) was the most common vegetated habitat type within the proposed Project boundary. The acreages of CWHR habitat types within the proposed Project boundary, excluding the area over the San Bernardino Tunnel, are summarized in Table 5.4.1-1 and are shown in Figures 5.4.1-1 and 5.4.1-2.

Table 5.4.1-1. California Wildlife Habitat Relationship and CalVeg Classification Acreages Within the Proposed 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	Number of Sampling Points
Tree-Dominated Habitats				
Sierran Mixed Conifer (SMC)	Bigcone Douglas-Fir, Mixed Conifer – Pine	4	<1	1
Montane Hardwood (MHW)	Bigcone Douglas-Fir, Black Oak, Canyon Live Oak, Coulter Pine, Interior Mixed Hardwood, Mixed Conifer – Pine, Ponderosa Pine	124	6	4
Montane Hardwood-Conifer (MHC)	Bigcone Douglas-Fir, Coulter Pine, Douglas-Fir – Ponderosa Pine, Mixed Conifer – Pine, Ponderosa Pine	21	1	2

Table 5.4.1-1. California Wildlife Habitat Relationship and CalVeg Classification Acreages Within the Proposed 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	Number of Sampling Points
Valley Foothill Riparian (VRI)	Western Sycamore, Riparian Mixed Hardwood, Willow, Willow (Shrub)	52	3	3
Shrub-Dominated Habitats				
Mixed Chaparral (MCH)	Buckwheat, Coulter Pine, Lower Montane Mixed Chaparral, Manzanita Chaparral, Scrub Oak, Semi-Desert Chaparral	391	19	7
Chamise-Redshank Chaparral (CRC)	Chamise	77	4	3
Coastal Scrub (CSC)	California Sagebrush, Coulter Pine, Soft Scrub Mixed Chaparral	146	7	4
Herbaceous-Dominated Habitats				
Annual Grassland (AGS)	Annual Grasses and Forbs	12	1	2
Developed Habitats				
Urban (URB)	Urban/Developed (General)	154	8	2
Non-vegetated Habitats				
Barren (BAR)	Barren, Urban-related Bare Soil	47	2	2
Lacustrine Habitats				
Water (LAC)	Water	987	49	0
Total		**2,015**	**100**	**30**

Notes:
[1]Habitat type abbreviation (in parentheses) is provided for reference to abbreviations in Figure 5.4.1-1 and Figure 5.4.1-2.
[2]Acreages do not include underground features.
Key:
< = less than
CalVeg = USFS Classification and Assessment with Landsat of Visible Ecological Groupings

Tree-Dominated Habitats

Sierran Mixed Conifer (<1% of proposed Project boundary excluding area over San Bernardino Tunnel)

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* var. *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*), bitter cherry (*Prunus emarginata*), mountain whitethorn (*Ceanothus cordulatus*), gooseberries (*Ribes* spp.), and roses (*Rosa* spp.). Understory grasses and forbs include California brome grass (*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, excluding the area above the San Bernardino Tunnel, there are approximately four acres of Sierran Mixed Conifer habitat in several patches located south of Silverwood Lake. A single sampling plot was located within the habitat type. Dominant overstory trees species within the sampled area had over 80 percent canopy cover and included Jeffrey pine (*Pinus jeffreyi*), bigcone Douglas-fir (*Pseudotsuga macrocarpa*), California black oak, and interior live oak (*Quercus wislizeni* var. *wislizeni*). Trees ranged in height from 20 to 80 feet tall, and measured from 0.4 foot to over 4 feet diameter at breast height (dbh). Velvet ash (*Fraxinus velutina*) was also found in this community. Understory shrubs and grasses/forbs observed included Eastwood manzanita (*Arctostaphylos glandulosa*), bush poppy (*Dendromecon rigida*), California lomatium (*Lomatium californicum*), cliff sword fern (*Polystichum imbricans*), fringed pod (*Thysanocarpus curvipes*), bicolored lupine (*Lupinus bicolor*), henbit (*Lamium amplexicaule*), ripgut brome (*Bromus diandrus*), and cheat grass (*Bromus tectorum*). This community had heavy leaf litter.

Montane Hardwood (6%)

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 (*Pinus coulteri*). Lower elevation species include white alder (*Alnus rhombifolia*), coast live oak (*Quercus agrifolia*), bigleaf maple (*Acer macrophyllum*), California laurel (*Umbellularia californica*), bigcone Douglas-fir, and occasionally valley oak (*Quercus riden*), foothill pine (*Pinus sabiniana*), and blue oak (*Quercus douglasii*). Understory shrubs can include manzanita, poison oak (*Toxicodendron diversilobum*), California coffee berry (*Frangula californica*), gooseberries, and California-lilac (*Ceanothus* spp.).

The Montane Hardwood vegetation community is found throughout the vegetated portions of the proposed Project boundary. There were four sampling points within the 124.0 acres of this CWHR habitat. The habitat occurs on the south side of Silverwood Lake, and in the vicinity of Devil Canyon Powerplant, including a portion on the northern extent of the proposed Project boundary within NFS lands. Dominant species within the sampled areas had 60 to over 80 percent canopy cover, and included interior live oak, coast live oak, and California black oak. These trees ranged in height from 10 to 35 feet tall,and measured 0.5 foot to over 5.5 feet dbh. The understory was very sparsely vegetated. Understory shrubs and grasses/forbs observed included honeysuckle (*Lonicera interrupta*), tall stephanomeria (*Stephanomeria rident*), black mustard (*Brassica nigra*), ripgut brome, oats (*Avena* spp.), and cheat grass. This community had heavy leaf litter.

Montane Hardwood-Conifer (1%)

Montane Hardwood-Conifer 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, Pacific madrone (*Arbutus menziesii*), Oregon oak (*Quercus garryana*), canyon live oak (*Quercus chrysolepis*), and coast live oak. The understory is typically relatively sparse.

Canopy species include Jeffrey pine, bigcone Douglas-fir, and incense cedar, with a subcanopy of California black oak, bush interior live oak (*Quercus wislizeni* var. *frutescens*), and California laurel. 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 (*Eriodictyon parryi*).

Within the proposed Project boundary, excluding the area above the San Bernardino Tunnel, the Montane Hardwood-Conifer vegetation community comprises much of the vegetation along the East Fork of the West Fork Mojave River upstream of Silverwood Lake, including a portion on NFS lands. Approximately 21.0 acres of this CWHR habitat type are located within the proposed Project boundary, and two sampling points were included in this area. Dominant species within the sampled areas had 40 to over 60 percent canopy cover, and included ponderosa pine, incense cedar, velvet ash, white alder, arroyo willow (*Salix lasiolepis*), red willow (*Salix laevigata*), western sycamore (*Platanus ridenta*), California black oak, and canyon live oak. These trees ranged in height from 6 to 42 feet tall, and measured 0.5 foot to over 5.5 feet dbh. Understory shrubs and grasses/forbs included bush interior live oak, California blackberry (*Rubus ursinus*), California-lilac, skunk bush (*Rhus aromatica*), mugwort (*Artemisia douglasiana*), horsetail (*Equisetum* sp.), rushes, cliff sword fern, honeysuckle, poison oak, phacelia (*Phacelia* sp.), golden yarrow (*Eriophyllum confertiflorum*), California rose (*Rosa californica*), American vetch (*Vicia ridentat* ssp. *ridentat*), ball gilia (*Gilia ridenta* ssp*. Abrotanifolia*), black mustard, oats, and ripgut brome.

Valley Foothill Riparian (3%)

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 (*Populus fremontii* ssp. *Fremontii*), western sycamore, and valley oak in the canopy. Subcanopy trees include white alder, box elder (*Acer negundo*), and Oregon ash (*Fraxinus latifolia*). Shrub species include rose, California blackberry, blue elderberry (*Sambucus nigra* ssp. *Caerulea*), poison oak, California button willow (*Cephalanthus occidentalis*), and willows (*Salix* spp.). A variety of herbaceous species occur in the understory, including sedges, rushes, grasses, spring beauty (*Claytonia* spp.), mugwort, poison hemlock (*Conium maculatum*), and stinging nettle (*Urtica dioica*). Vines, typically California wild grape (*Vitis californica*), also occur.

Within the proposed Project boundary, excluding the area above the San Bernardino Tunnel, 52.0 acres of Valley Foothill Riparian habitat occurs in a number of areas along the West Fork Mojave River and the East Fork of the West Fork Mojave River upstream of Silverwood Lake, including a portion on NFS lands. 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, western sycamore, and arroyo willow, with understories of other willow species and mule fat (*Baccharis salicifolia* ssp. *Salicifolia*). One location in the northwest portion of the reservoir was mapped as Southern Sycamore Alder Riparian Woodland, based on the Holland (1986) classification. Southern Sycamore Alder Riparian Woodland 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 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: western sycamore, Southern California black walnut (*Juglans californica*), and birch-leaf mountain-mahogany (*Cercocarpus betuloides* var. *betuloides*). Some vegetation, particularly Southern California black walnut, was destroyed by wildfires in 2003 (Herzog 2004). In addition to the Baily Creek revegetation effort, the 1990 FERC order required a revegetation plan (~1991) for construction of the Devil Canyon Second Afterbay that replaced scrub and riparian habitat. This plan and the associated implementation plan was filed with FERC in August 1991 under Articles 409 and 411 of the license. Annual monitoring and reports were filed 1997 through 2004 (see the October 31, 1991 FERC order). DWR extended the revegetation and monitoring efforts through 2002 per a FERC order issued on March 13, 1997. A post-2003 fire vegetation report was filed with FERC in late 2004 that inventoried surviving plants.

There were three sampling points within the Valley Foothill Riparian vegetation community. Dominant species within the sampled areas had over 60 percent canopy cover and included arroyo willow, velvet ash, red willow, western sycamore, and Fremont cottonwood. These trees ranged in height from 12 to 50 feet tall, and measured 0.6 foot to 5 feet dbh. Understory shrubs and grasses/forbs observed included Hinds' willow (*Salix exigua* var. *hindsiana*), blue elderberry, stinging nettle, tarragon (*Artemisia dracunculus*), mugwort, diamond clarkia (*Clarkia rhomboidea*), common cryptantha (*Cryptantha intermedia*), ball gilia, bedstraw (*Galium* sp.), poison oak, chilicothe (*Marah macrocarpa*), prickly lettuce (*Lactuca serriola*), black mustard, cheat grass, soft chess (*Bromus hordeaceus*), fescue (*Festuca* sp.), and ripgut brome.

All areas mapped as Valley Foothill Riparian are considered sensitive natural communities by CDFW using NatureServe's Heritage Methodology. This methodology uses the best scientific information to assess communities based on rarity, threats, and ecological importance (CDFW 2018d).

Shrub-Dominated Habitats

Mixed Chaparral (19%)

Mixed Chaparral generally occurs below 5,000 feet on steep slopes and ridges with relatively thin, well-drained soils. Mature Mixed Chaparral has dense (greater than 80 percent) canopy cover, with shrubs typically between 3 and 13 feet tall. Species generally include inland scrub oak (*Quercus berberidifolia*), California-lilac, and manzanita. Chamise (*Adenostoma fasciculatum*), birch-leaf mountain-mahogany, ashy silktassel (*Garrya flavescens*), toyon (*Heteromeles arbutifolia*), hairy yerba santa (*Eriodictyon trichocalyx* var. *trichocalyx*), California buckeye (*Aesculus californica*), poison oak, sumac (*Rhus* spp. Or *Malosma* spp.), California coffee berry, holly-leafed cherry (*Prunus ilicifolia* ssp. *Ilicifolia*), and chaparral pea (*Pickeringia montana*) can also occur. 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 occurs on approximately 391.0 acres within the proposed Project boundary, excluding the area above the San Bernardino Tunnel. It makes up large patches of vegetation on all sides of Silverwood Lake and the Devil Canyon Powerplant, including portions on NFS lands. Mixed Chaparral species documented in the Silverwood Lake SRA include several species of California-lilac, manzanita, chamise, poison oak, laurel sumac (*Malosma laurina*), holly-leafed cherry, California coffee berry, hairy yerba santa, and toyon. 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 (2014) also observed bigpod ceanothus (*Ceanothus megacarpus* var. *megacarpus*), birch-leaf mountain-mahogany, and chaparral yucca (*Hesperoyucca whipplei*).

There were seven sampling points within the Mixed Chaparral vegetation community. Dominant shrub species within the sampled areas had 40 to over 60 percent cover, and included chamise, white sage (*Salvia apiana*), California buckwheat (*Eriogonum fasciculatum*), black sage (*Salvia mellifera*), chaparral whitethorn (*Ceanothus leucodermis*), birch-leaf mountain-mahogany, big berry manzanita (*Arctostaphylos glauca*), Mexican manzanita (*Arctostaphylos pungens*), hoaryleaf ceanothus (*Ceanothus crassifolius*), cupped leaf ceanothus (*Ceanothus perplexans*), Mojave ceanothus (*Ceanothus pauciflorus*), hairy yerba santa, bush interior live oak, pine bush (*Ericameria pinifolia*), sugar bush (*Rhus ovata*), skunk bush, chaparral yucca, bush poppy, and blue elderberry. These shrubs ranged in height from 0.25 foot to 17 feet tall. Understory shrubs and grasses/forbs observed included deerweed (*Acmispon glaber*), heart leaved penstemon (*Keckiella cordifolia*), saw-toothed goldenbush (*Hazardia squarrosa*), chaparral honeysuckle (*Lonicera subspicata* var. *ridenta*), showy penstemon (*Penstemon spectabilis*), splendid woodland-gilia (*Saltugilia splendens*), poison oak, common sandaster (*Corethrogyne filaginifolia*), leafy fleabane (*Erigeron foliosus*), cotton thorn (*Tetradymia comosa*), mugwort, chaparral dodder (*Cuscuta californica*), little California melica (*Melica imperfecta*), bull thistle, rattail sixweeks grass (*Festuca myuros*), Maltese star-thistle (*Centaurea melitensis*), red brome (*Bromus madritensis* ssp. *Rubens*), black mustard, Arabian schismus (*Schismus arabicus*), ripgut brome, and cheat grass.

Chamise-Redshank Chaparral (4%)

Chamise-Redshank Chaparral 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 (described above). Vegetative structure is similar to Mixed Chaparral, but species differ, with stands often being comprised almost entirely of chamise or redshank (*Adenostoma sparsifolium*). Other species that can occur include toyon, sugar bush, poison oak, California coffee berry, ceanothus, manzanita, scrub oak, and laurel sumac. In southern California, white sage, black sage, and California buckwheat can be found in this habitat type at lower elevations and on recently disturbed sites.

Within the proposed Project boundary, excluding the area above the San Bernardino Tunnel, Chamise-Redshank Chaparral occurs on approximately 77.0 acres in small patches above Silverwood Lake to the south and northeast. There were three sampling points within this habitat type. Dominant shrub species within the sampled areas had 40 to over 60 percent cover, and included chamise, California buckwheat, California coffee berry, Mojave ceanothus, big berry manzanita, chaparral yucca, and bush poppy. These shrubs ranged in height from 0.25 foot to almost 6 feet tall. Understory shrubs and grasses/forbs observed included bajada lupine (*Lupinus concinnus*), chia (*Salvia columbariae*), popcornflower (*Plagiobothrys* sp.), common cryptantha, rattail sixweeks grass, red brome, ripgut brome, Arabian schismus, and cheat grass.

Coastal Scrub (7%)

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 dorrii*), California buckwheat, golden yarrow, goldenbush (*Isocoma* spp. Or *Ericameria* spp.), sticky monkeyflower (*Diplacus aurantiacus*), California brittlebush (*Encelia californica*), and chaparral yucca.

Within the proposed Project boundary, excluding the area above the San Bernardino Tunnel, Coastal Scrub habitat occurs in small patches totaling 146.0 acres above Silverwood Lake to the west and southwest, at the northern extent of the proposed Project boundary, at the Devil Canyon Powerplant south of the afterbays, and near the uppermost section of the penstocks (including a portion on NFS lands). In 2014, during surveys of the perimeter of Silverwood Lake, Environmental Science Associates found these areas to be dominated by California buckwheat and purple sage, with big sagebrush (*Artemisia ridentate*), 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 included many found in Coastal Scrub, such as coast buckwheat (*Eriogonum latifolium*), California buckwheat, California sagebrush (*Artemisia californica*), deerweed, black sage, white sage, mule fat, Palmer’s goldenbush (*Ericameria palmeri*), and telegraph weed (*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). These areas appeared to have regenerated by the time of the 2017 surveys. In addition to the Baily Creek revegetation effort, the 1990 FERC order required a revegetation plan (~1991) for construction of the Devil Canyon Second Afterbay that replaced scrub and riparian habitat.

Dominant shrub species within the four sampled areas had 40 to over 60 percent cover, and included California buckwheat, hairy yerba santa, California sagebrush, black sage, white sage, pine bush, and interior goldenbush (*Ericameria linearifolia*). These shrubs ranged in height from 0.25 foot to 5.25 feet tall. Understory shrubs and grasses/forbs observed included deerweed, California croton (*Croton californicus*), tarragon, fiddleneck (*Amsinckia* sp.), golden yarrow, melicgrass (*Melica* spp.), bajada lupine, red brome, Arabian schismus, Maltese star-thistle, oats, redstem filaree (*Erodium cicutarium*), rattail sixweeks grass, red brome, ripgut brome, soft chess, and cheat grass.

Herbaceous-Dominated Habitats

Annual Grassland (1%)

Annual Grasslands occur in a variety of locations throughout California, replacing much of what were historically native perennial grasslands. These areas are now composed of a variety of predominantly non-native annual grasses, including oats, soft chess, ripgut brome, red brome, barley (*Hordeum* spp.), and rattail sixweeks grass. A variety of native and non-native forbs also occur, including longbeak stork's bill (*Erodium botrys*), redstem filaree, doveweed (*Croton setiger*), clover (*Trifolium* spp.), California burclover (*Medicago polymorpha*), and popcornflower.

Within the proposed Project boundary, excluding the area above the San Bernardino Tunnel, Annual Grassland occurs in various small patches on the margins of Silverwood Lake and near the Devil Canyon Powerplant. Two sampling points were located within the 12.0 acres of this vegetation community. Dominant grass species within the sampled areas ranged from less than 25 percent cover to over 60 percent cover, and included Arabian schismus (*Schismus arabicus*), wild oat (*Avena fatua*), red brome, rattail sixweeks grass, cheat grass, Mediterranean barley (*Hordeum murinum*), and soft chess – all non-native plants. These grasses ranged in height from 2 to 9 inches. Interior goldenbush and mule fat, native plants, had low cover; over time, this area may convert to a mule fat scrub (Desert Riparian) community. Forbs observed included western ragweed (*Ambrosia psilostachya*), American bird's foot trefoil (*Acmispon americanus* var. *americanus*), popcornflower, common cryptantha, telegraph weed, Maltese star-thistle, clover, redstem filaree, common sunflower (*Helianthus annuus*), and doveweed.

Developed Habitats

Urban (8%)

Vegetated Urban habitats include a wide variety of native and non-native species and are classified into five types of vegetative structure by CWHR: 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, excluding the area above the San Bernardino Tunnel, Urban habitat occurs over 154.0 acres in several areas on the margins of Silverwood Lake and around the Devil Canyon Powerplant. Within the two sampled areas, vegetation ranged from 25 to over 60 percent cover, and included ornamental pines (*Pinus* spp.), ornamental junipers (*Juniperus* spp.), rosemary (*Rosmarinus officinalis*), and black mustard.

Non-Vegetated Habitats

Barren (2%)

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

Within the proposed Project boundary, excluding the area above the San Bernardino Tunnel, Barren habitat occurs in various small patches on the margins of Silverwood Lake and near the Devil Canyon Powerplant (approximately 47.0 acres). These include boat ramps, roads, parking lots, the dam and associated structures, and other cleared areas. Within the two sampled areas, substrates were gravelly and vegetation cover was sparse, including low statured rattail sixweeks grass and wild oat.

Water (Lacustrine) (49%)

Water (lacustrine or lake) habitats are inland depressions or dammed river channels with standing water, and vary from small ponds to large lakes. These habitats can be permanently flooded or intermittent. Lakes typically support suspended organisms called phytoplankton, including diatoms, desmids, and filamentous green algae. Duckweed often covers the surface of shallower waters. Submerged plants may include algae and pondweeds; while floating, rooted aquatics, such as smartweeds, are typically found in areas subject to sedimentation.

Water habitats make up 49 percent of the area within the proposed Project boundary, including Silverwood Lake and the Devil Canyon afterbays. This open water community occupies approximately 987.0 acres.

Special-Status Plants

Special-status plants addressed in this section (i.e., Section 5.4.1) of the Application for New License include vascular plants that meet one or more of the following criteria: (1) listed as a Forest Sensitive Species (FSS) by USFS and occurs on NFS lands; (2) listed under the CESA as an endangered, threatened, or rare plant; (3) State-listed rare or endangered under the Native Species Plant Protection Act of 1977 (CDFW 2018a); or (4) listed by the California Native Plant Society (CNPS) on its Inventory of Rare and Endangered Plants (CNPS 2018). Section 5.4.3 of this Application for New License addresses potential effects of the Project on the special-status plant species listed under the ESA.

Between April 4, 2017 and June 16, 2017, DWR conducted a comprehensive botanical inventory of the entire area within the proposed Project boundary, excluding the area over the San Bernardino Tunnel, to identify the locations of special-status plant species. The field methods followed applicable protocol methodology described in the botanical survey section of the CDFW Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities (2009). This protocol uses systematic sampling techniques to ensure thorough coverage of plant communities that could support special-status plant species. The CDFW protocol states that "the level of effort required per given area and habitat is dependent upon the vegetation and its overall diversity and structural complexity, which determines the distance at which plants can be identified" (CDFW 2009). DWR conducted surveys by walking all locations that could be safely accessed to ensure thorough coverage, noting all plant taxa observed. Of the 2,015.0 acres within the survey area, approximately eight acres were not surveyed due to unsafe conditions; in these areas, visual surveys from a distance were conducted (Figure 5.4.1-3). All other areas were surveyed on foot at distances no greater than standard transect widths (15 to 20 meters), which were sufficient to adequately characterize species and vegetation composition. The list of all plant species observed is provided in Appendix D. Because no plants were collected (i.e., as voucher specimens), DWR did not obtain any permits from SBNF to perform the study on NFS lands.

Documentation of surveys on NFS lands included completion of USFS data forms for any FSS, as specified in the USFS Threatened, Endangered, and Sensitive Plants Survey Field Guide (USFS 2005a), and the Threatened, Endangered and Sensitive Plants Element Occurrence Protocol Field Guide (USFS 2005b).

Surveys were performed within the known flowering periods of special-status plant species with the potential to occur (as identified in the May 2017 Draft Final *Botanical Resources Study Approach*), with at least two survey visits performed in all accessible areas of the study area to maximize the likelihood of detection. California Native Species Field Survey Forms were completed for the special-status plant occurrences that were observed, and forms were provided to CDFW to be added to the CNDDB in December 2017. For occurrences that extended beyond the study area boundary, attributes of the entire occurrence, included estimated size, were recorded.

Forty-three occurrences of three special-status plant species were observed during field surveys, as summarized in Table 5.4.1-2 and depicted on Figures 5.4.1-4 through 5.4.1-6. None of the species are listed under CESA. All have been assigned a CNPS rare plant rank of 4.2, which indicates plants of limited distribution that are moderately threatened in California (defined by CNPS as "20 to 80 percent occurrences threatened, with a moderate degree and immediacy of threat") (CNPS 2018). CNPS is an administrative listing and provides plants listed by CNPS with no specific federal or state legal protection. There were no incidental observations of special-status plants during any DWR relicensing studies that were not mapped and recorded on datasheets.

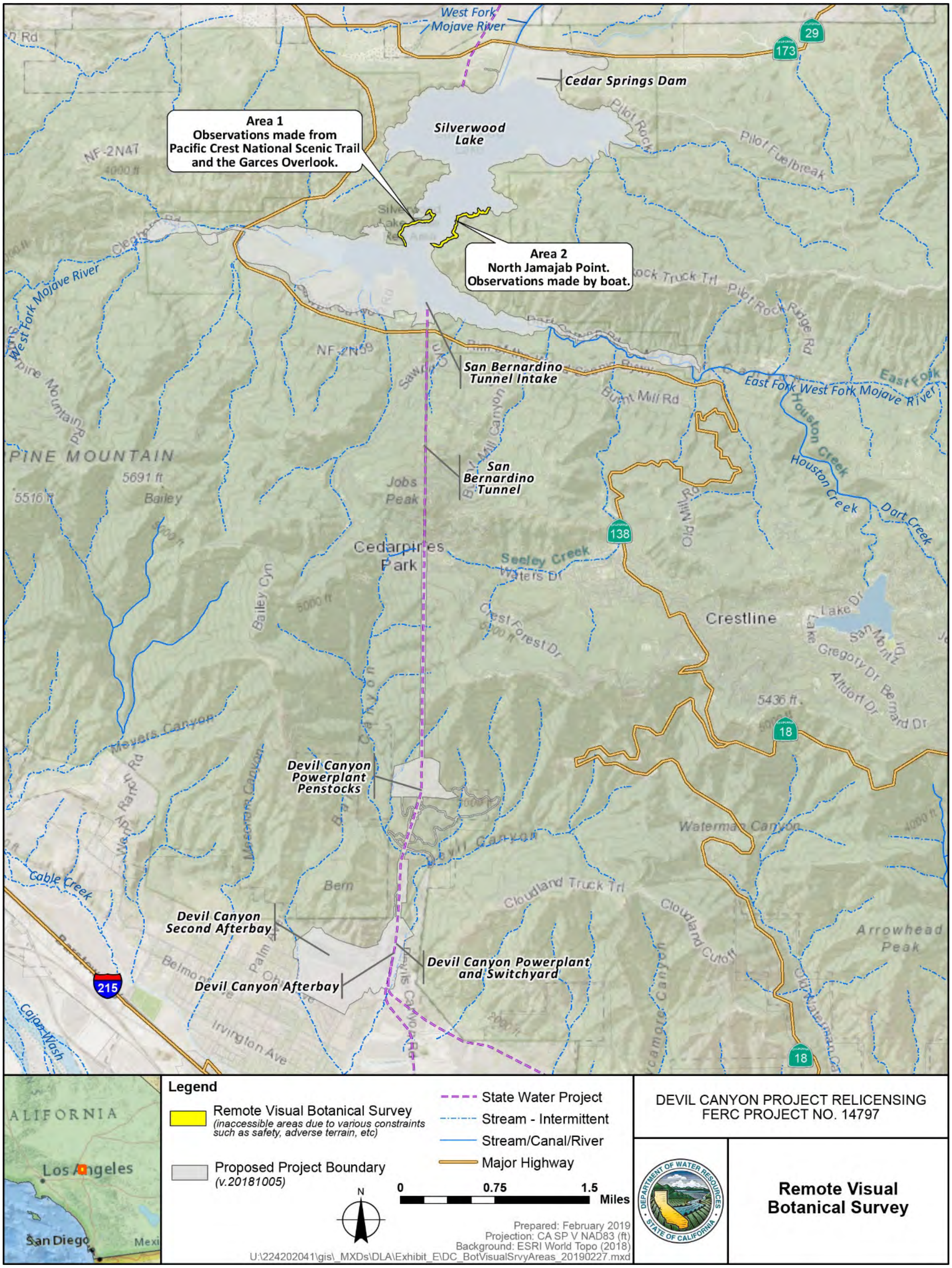

Figure 5.4.1-3. Remote Visual Botanical Survey Areas

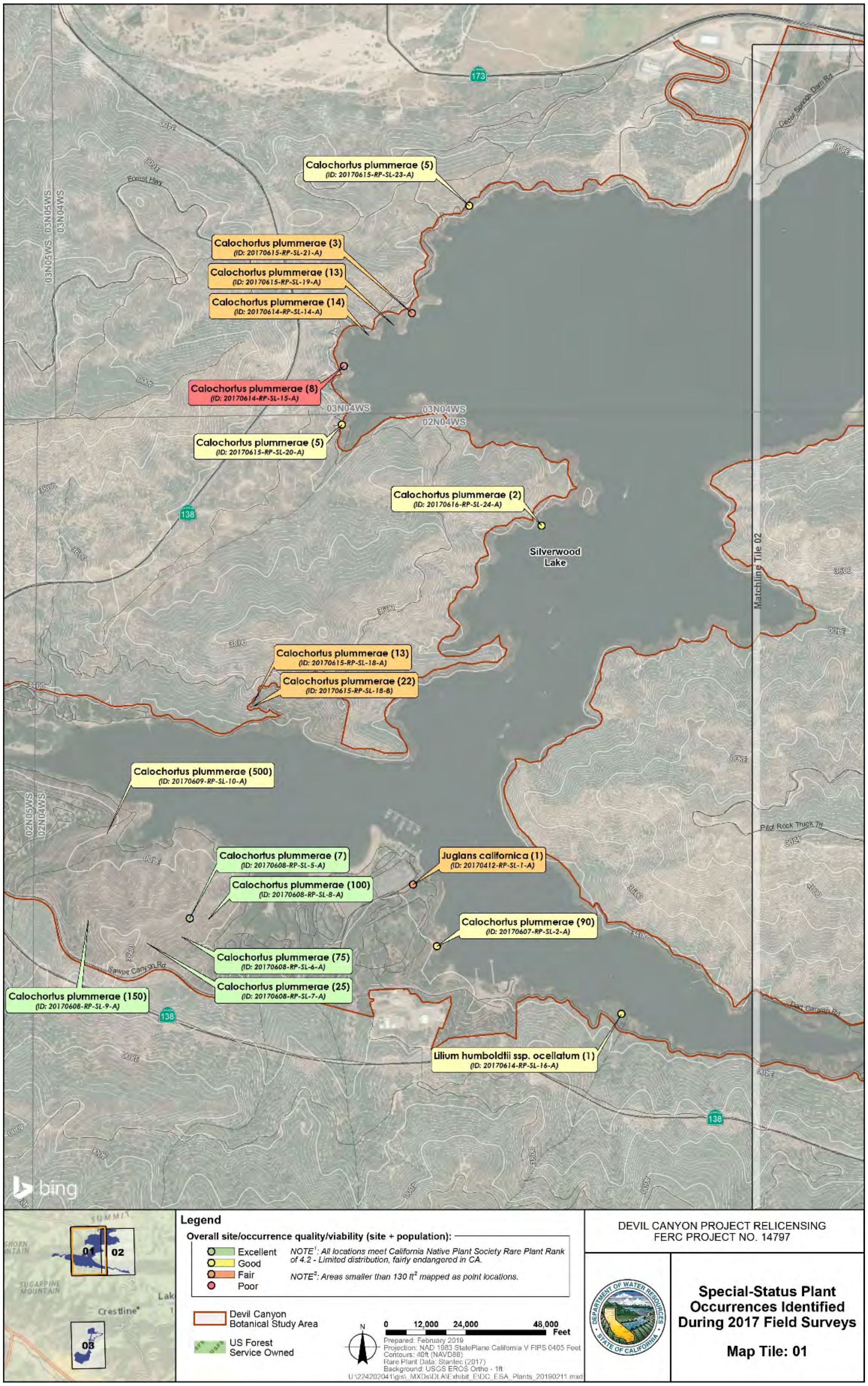

Figure 5.4.1-4. Special-Status Plant Occurrences Identified During 2017 Field Surveys

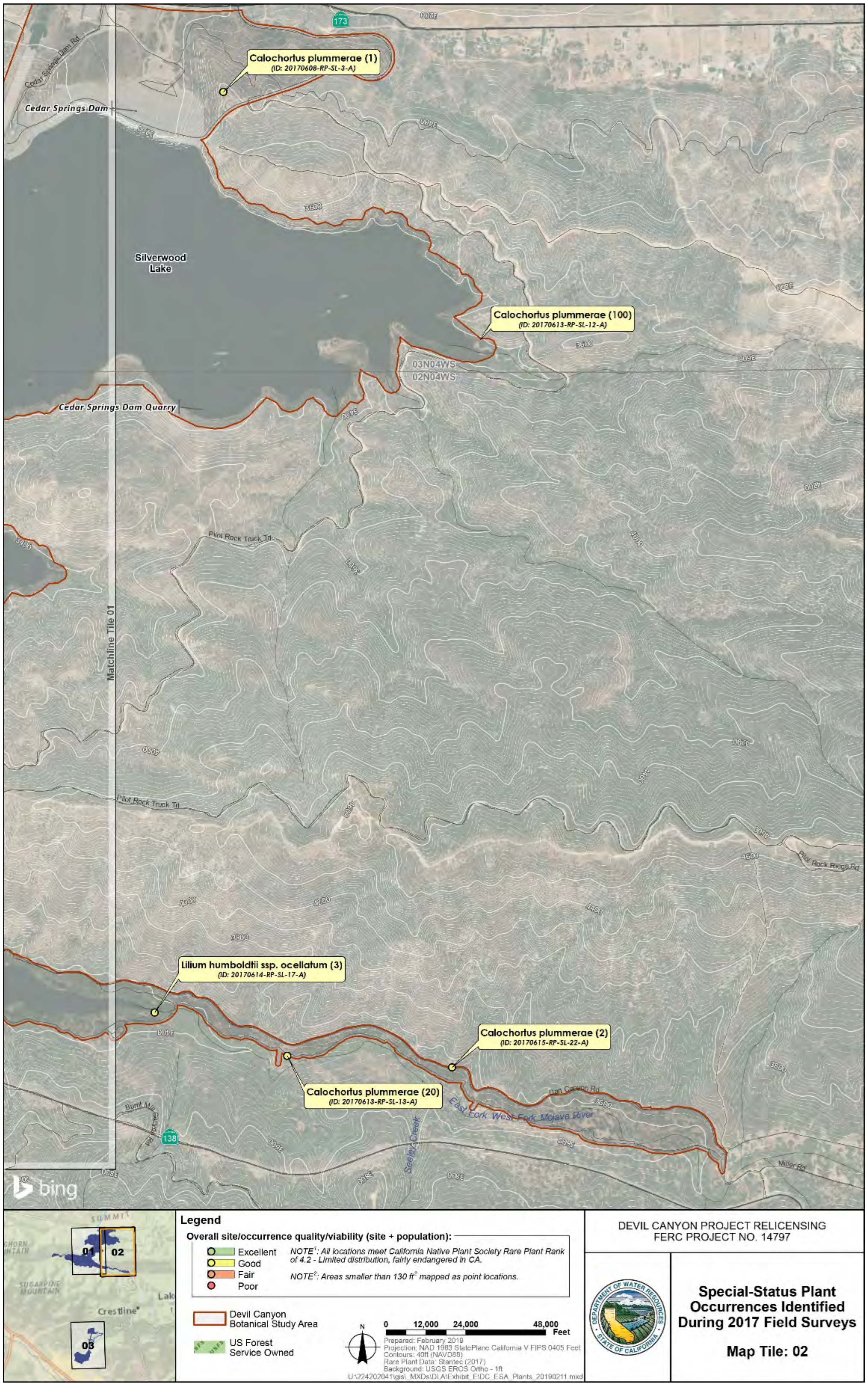

Figure 5.4.1-5. Special-Status Plant Occurrences Identified During 2017 Field Surveys

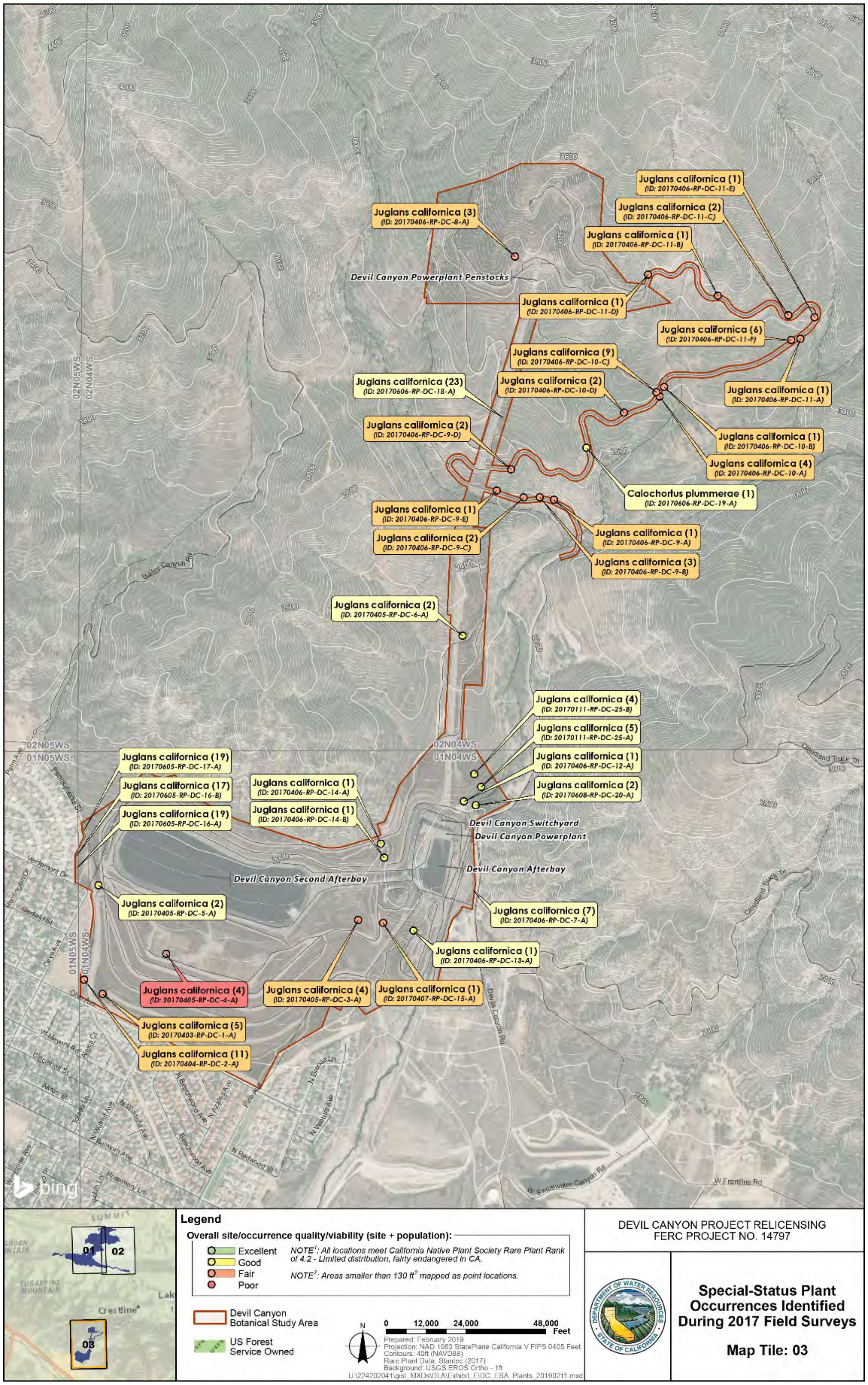

Figure 5.4.1-6. Special-Status Plant Occurrences Identified During 2017 Field Surveys

Table 5.4.1-2. Special-Status Plant Species Occurrences Identified During 2017 Field Surveys

Scientific Name	Common Name	Federal Listing Status	State Listing Status[1]	CNPS Ranking[2]	Number of Occurrences in Study Area	Location of Occurrences[3]	Site Quality[3]	Threats
Calochortus plummerae	Plummer's mariposa lily	None	None	4.2	20	Throughout the Study Area (see Figures 5.4.1-3 through 5.4.1-6). No occurrences were on NFS lands.	5 sites excellent, 10 sites good, 5 sites fair, 1 site poor	Recreation/human use. One occurrence on the west side of Silverwood Lake (feature 20170616-rp-sl-24-A on maps) is threatened by erosion
Juglans californica	Southern California black walnut	None	None	4.2	21	Most occurrences are near Devil Canyon Powerplant. One occurrence is near the Silverwood Lake marina. Three occurrences were on NFS lands.	14 sites good, 21 sites fair, 1 site poor	Encroachment of non-native invasive plants, road and vehicle use, and human use. Occurrences located within the powerplant area may be affected by facilities maintenance
Lilium humboldtii ssp. *Ocellatum*	Ocellated Humboldt lily	None	None	4.2	2	East Fork of the West Fork Mojave River. No occurrences were found on NFS lands.	2 sites good	Recreation/human use
Total	**3 Plant Species**	**None**	**None**	**4.2**	**43**	**--**	**--**	**--**

Source: CDFW 2017a
Notes:
[1]State Ranking: S3 = Vulnerable – Vulnerable in the State due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation from the State.
S4 = Apparently Secure – Uncommon but not rare in the State; some cause for long-term concern due to declines or other factors.
[2]CNPS Ranking: 4.2 = Plants of limited distribution that are moderately threatened in California (defined by CNPS as "20 to 80 percent occurrences threatened, with a moderate degree and immediacy of threat")
[3]An occurrence includes all plants of a given species mapped within ¼ mile. Occurrences may include more than one "site" within a ¼ radius. Therefore, the number of sites may be greater than the number of occurrences.
Key:
CNPS = California Native Plant Society
NFS = National Forest System

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Non-Native Invasive Plants

For the purpose of this Application for New License, NNIP are defined as A-, B-, or C-listed plant species by the CDFA as species identified as invasive by the Cal-IPC, or are included on the SBNF's weed list and occur on NFS lands (USFS 2005c). CDFA ratings provide information on "the statewide importance of the pest, the likelihood that eradication or control efforts would be successful, and the present distribution of the pest within the state. The ratings are not laws, but are policy guidelines that indicate the most appropriate action to take against a pest under general circumstances (CDFA 2018)." Cal-IPC compiles an inventory that categorizes plants that threaten California's natural areas. The list is intended to provide guidance for land managers, landscapers, and the general public, but does not circumscribe legal protections. The SBNF weed list identifies species that may fall under federal legal mandates to control the introduction and spread of invasive species, as described in the Forest Service National Strategic Framework for Invasive Species Management (USFS 2013b) and the 2016 Executive Order, *Safeguarding the Nation from the Impacts of Invasive Species*.

DWR conducted NNIP surveys in 2017 in conjunction with special-status plant species surveys described above. Surveys followed applicable CDFW protocol methodology described earlier in this section. While surveying all accessible areas of the study area and compiling the botanical inventory during surveys, field staff consulted the target species list from the May 2017 draft final *Non-Native Invasive Plants Study Approach* (Table 5.4.1-3), which was prepared based on input from USFS and CDFW. Datasheets were completed whenever target NNIP species were encountered, but all plant species (including non-target NNIP) observed were recorded and are reported in the botanical inventory (Appendix D).

For all NNIP species identified on NFS lands, USFS protocols were followed for data collected in accordance with USFS (2014). Special attention was paid to disturbed areas, including road edges, recreation areas, and maintenance areas. For species that are not listed by CDFA (identified with one asterisk in Table 5.4.1-3), data were collected in accordance with USFS protocols (USFS 2014) only for occurrences on NFS lands. For species identified with two asterisks in Table 5.4.1-3 (species that have a CDFW Rating of A, B, or C), occurrence data were collected wherever they were observed. Although they were not used to determine target species criteria, Cal-IPC ratings are also provided in Table 5.4.1-3 because they provide another indicator of land management priority species.

DWR performed surveys that encompassed the period within which most NNIP were expected to flower (i.e., April through June), with at least two survey visits performed in all accessible portions of the study area to maximize the likelihood of detection of NNIP (see Figure 5.4.1-3 for portions of the study area that were inaccessible).

Table 5.4.1-3. Target NNIP Species Surveyed Within the Proposed Project Boundary, Excluding Area Above the San Bernardino Tunnel

Scientific Name[1]	Common Name	CDFA Rating[2]	Cal-IPC Rating[3]	SBNF Invasive Nonnative Plant Species List[4,5]
**Ageratina adenophora*	eupatory	--	Moderate	Y
***Ailanthus altissima*	tree-of-heaven	C	Moderate	Y*
***Arundo donax*	giant reed	B	High	Y*
**Brassica nigra*	black mustard	--	Moderate	Y
**Brassica tournefortii*	Sahara mustard	--	High	Y
**Bromus diandrus*	ripgut brome	--	Moderate	Y
**Bromus madritensis* ssp. *rubens*	red brome	--	High	Y
**Bromus tectorum*	cheatgrass	--	High	Y*
***Centaurea melitensis*	tocalote	C	Moderate	Y
***Centaurea solstitialis*	yellow star-thistle	C	High	Y*
***Cirsium vulgare*	bull thistle	C	Moderate	Y
**Cortaderia selloana*	Uruguayan pampas grass	--	High	Y*
**Eucalyptus globulus*	blue gum	--	Limited	Y
**Festuca (=Schedonorus) arundinacea*	reed fescue	--	Moderate	Y
**Ficus carica*	edible fig	--	Moderate	Y
**Foeniculum vulgare*	fennel	--	Moderate	Y
**Hedera helix* and *H. canariensis*	English Ivy, Algerian Ivy	--	High	A Y?
**Picris (=Helminthotheca) echioides*	bristly ox-tongue	--	Limited	Y
**Holcus lanatus*	common velvet grass	--	Moderate	Y
**Lolium perenne* ssp. *multiflorum*	Italian ryegrass	--	--	Y
**Medicago polymorpha*	California burclover	--	Limited	A
**Nicotiana glauca*	tree tobacco	--	Moderate	Y
**Pennisetum setaceum*	crimson fountain grass	--	Moderate	A
**Ricinus communis*	castor bean	--	Limited	Y
**Robinia pseudoacacia*	black locust	--	Limited	Y
**Rubus armeniacus (=discolor)*	Himalayan blackberry	--	High	Y

Table 5.4.1-3. Target NNIP Species Surveyed Within the Proposed Project Boundary, Excluding Area Above the San Bernardino Tunnel (continued)

Scientific Name[1]	Common Name	CDFA Rating[2]	Cal-IPC Rating[3]	SBNF Invasive Nonnative Plant Species List[4,5]
***Salsola tragus*	Russian thistle	C	Limited	Y
***Saponaria officinalis*	bouncing-bet	C	Limited	Y
**Schinus molle*	Peruvian pepper tree	--	Limited	Y
**Schismus arabicus, S. barbatus*	Mediterranean grass, Arabian schismus	--	Limited	Y
**Silybum marianum*	milk thistle	--	Limited	A, Y?
***Spartium junceum*	Spanish broom	C	High	Y*
***Tamarix parviflora, T. ramosissima*	saltcedar	B	High	Y*
**Verbascum thapsus*	woolly mullein	--	Limited	Y
**Vinca major*	periwinkle	--	Moderate	Y
Subtotal		**9**	**35**	**36 species are identified by USFS as occurring in or near SBNF**
Total	**36**			

Notes:
[1]For species that are not listed by CDFA (identified with one asterisk), data were collected in accordance with USFS protocols (USFS 2014) only for occurrences on USFS lands. For species identified with two asterisks (species that have a CDFW Rating of A, B, or C), occurrence data were collected wherever they were observed.
[2]CDFA Ratings:
B = Pest of known economic or environmental detriment and, if present in California, it is of limited distribution;
C = Pest of known economic or environmental detriment and, if present in California, it is usually widespread.
[3]Cal-IPC Ratings (Cal-IPC ratings are provided for reference but were not a criterion in determining which species were target species):
Limited = These species are invasive but their ecological impacts are minor on a Statewide level or there was not enough information to justify a higher score. Their reproductive biology and other attributes result in low to moderate rates of invasiveness. Ecological amplitude and distribution are generally limited, but these species may be locally persistent and problematic.
Moderate = These species have substantial and apparent, but generally not severe-ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal, though establishment is generally dependent upon ecological disturbance. Ecological amplitude and distribution may range from limited to widespread.
High = These species have severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal and establishment. Most are widely distributed ecologically.
[4]SBNF Designation: A = USFS-identified species that is known to occur adjacent or near Forest, reasonable to expect invasion on Forest lands within the next five years (as cited in USFS 2005c); Y = present on forest; Y = Forest is currently treating, in process of treating or has treated in past; Y? = plants are adjacent or near and highly likely to be present but not documented*
[5]USFS 2005c
Key:
Cal-IPC = California Invasive Plant Council
CDFA = California Department of Food and Agriculture
NNIP = non-native invasive plant
SBNF = San Bernardino National Forest
USFS = U.S. Department of Agriculture, Forest Service

A total of 177 occurrences of 13 target NNIP species were observed during field surveys. These occurrences are summarized in Table 5.4.1-4 and depicted on Figures 5.4.1-7 through 5.4.1-11. In addition to the target NNIP species, information on other NNIP occurrences (non-target NNIP that are not listed in the table above) were recorded on NNIP datasheets. For occurrences that extended beyond the study area boundary, attributes of the entire occurrence, including estimated size, were recorded.

Table 5.4.1-4. NNIP Target Species Occurrences Within the Proposed Project Boundary, Excluding Area Over the San Bernardino Tunnel, Documented During DWR's 2017 Field Surveys

Scientific Name	Common Name	SBNF Land Occurrences[1]	Number of Occurrences in the Study Area
Ailanthus altissima	tree of heaven	No	3
Brassica nigra	black mustard	Yes	2
Bromus diandrus	ripgut brome	Yes	2
Bromus madritensis ssp. *rubens*	red brome	Yes	1
Bromus tectorum	cheat grass	Yes	1
Centaurea melitensis	tocalote	Yes	29
Cirsium vulgare	bull thistle	No	61
Robinia pseudoacacia	black locust	Yes	1
Salsola australis/tragus	Russian thistle	No	4
Saponaria officinalis	bouncing bet	No	10
Silybum marianum	blessed milk thistle	Yes	1
Spartium junceum	Spanish broom	Yes	38
Tamarix parviflora, T. ramosissima	saltcedar	No	24
		Total:	**177**

Notes:
[1]All occurrences are species on the SBNF invasive nonnative plant species list. Where occurrences did not fall on USFS land (as indicated by a "No" in this column, USFS datasheets were not completed.
Key:
DWR = California Department of Water Resources
NNIP = non-native invasive plant
SBNF = San Bernardino National Forest

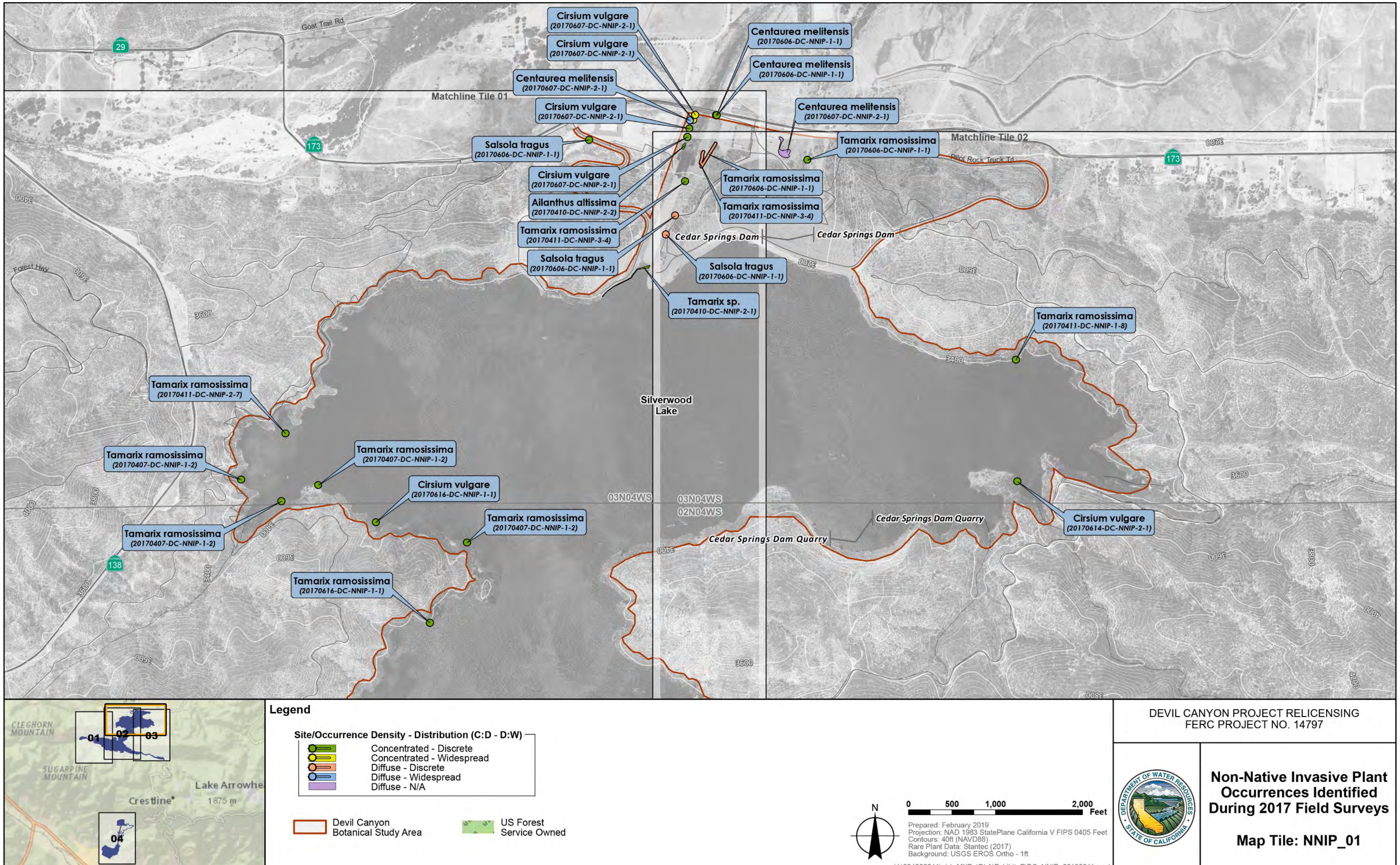
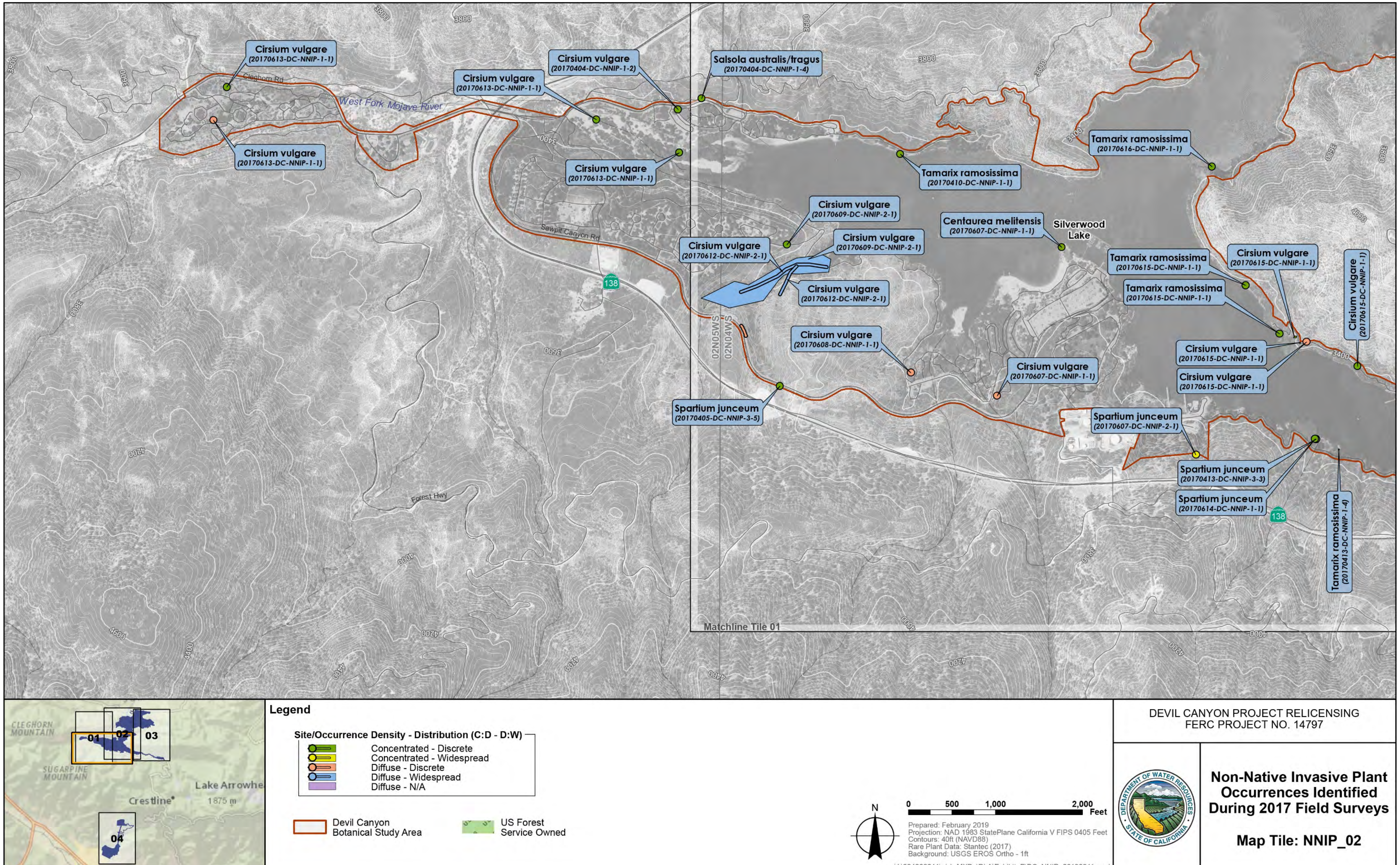


Figure 5.4.1-7. Non-Native Invasive Plant Occurrences Identified During 2017 Field Surveys



Legend

Site/Occurrence Density - Distribution (C:D - D:W)
- Concentrated - Discrete
- Concentrated - Widespread
- Diffuse - Discrete
- Diffuse - Widespread
- Diffuse - N/A

Devil Canyon Botanical Study Area

US Forest Service Owned

N

0 500 1,000 2,000 Feet

Prepared: February 2019
Projection: NAD 1983 StatePlane California V FIPS 0405 Feet
Contours: 40ft (NAVD88)
Rare Plant Data: Stantec (2017)
Background: USGS EROS Ortho - 1ft

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DEVIL CANYON PROJECT RELICENSING
FERC PROJECT NO. 14797

DEPARTMENT OF WATER RESOURCES STATE OF CALIFORNIA

Non-Native Invasive Plant Occurrences Identified During 2017 Field Surveys

Map Tile: NNIP_02

Figure 5.4.1-8. Non-Native Invasive Plant Occurrences Identified During 2017 Field Surveys

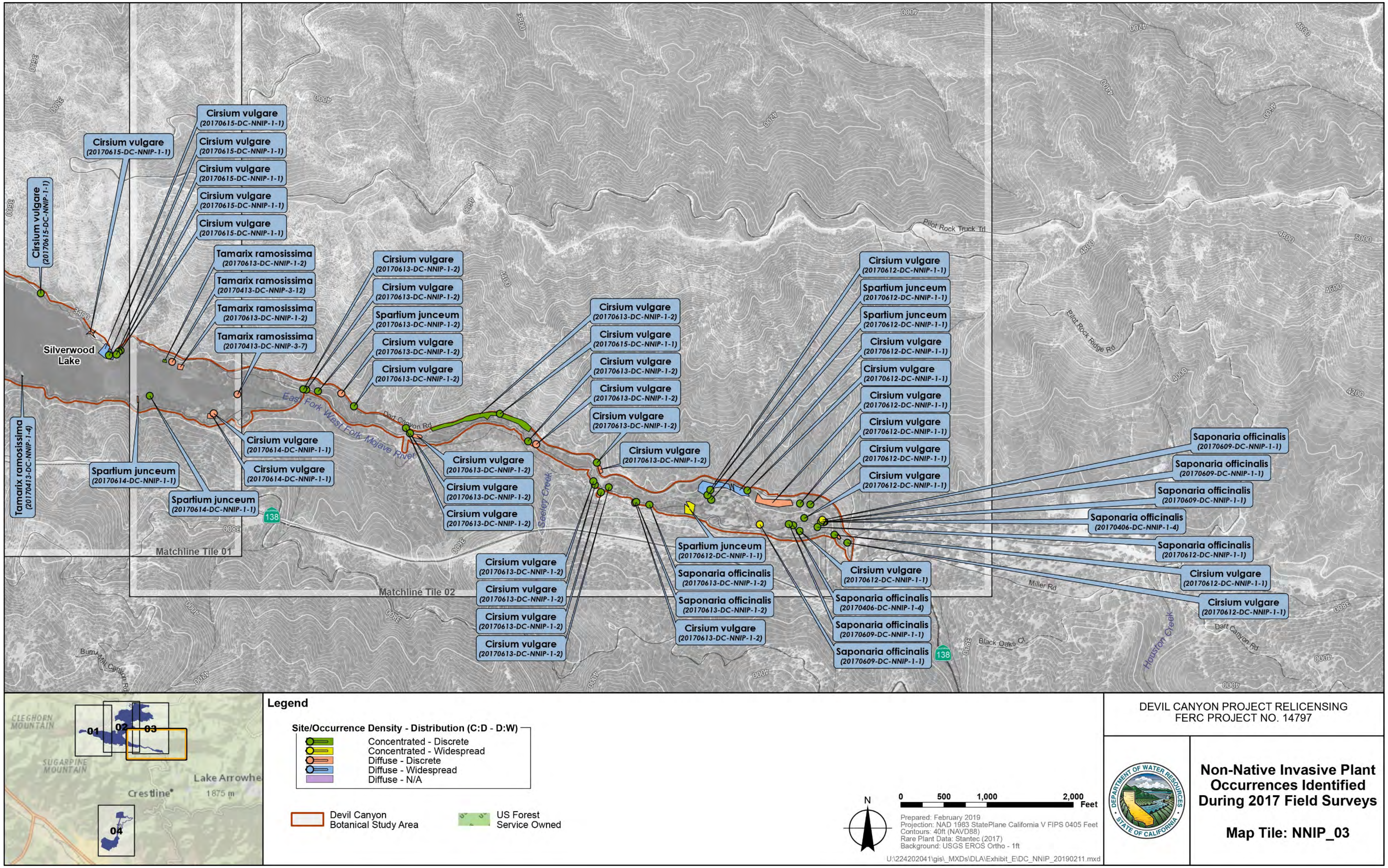

Figure 5.4.1-9. Non-Native Invasive Plant Occurrences Identified During 2017 Field Surveys

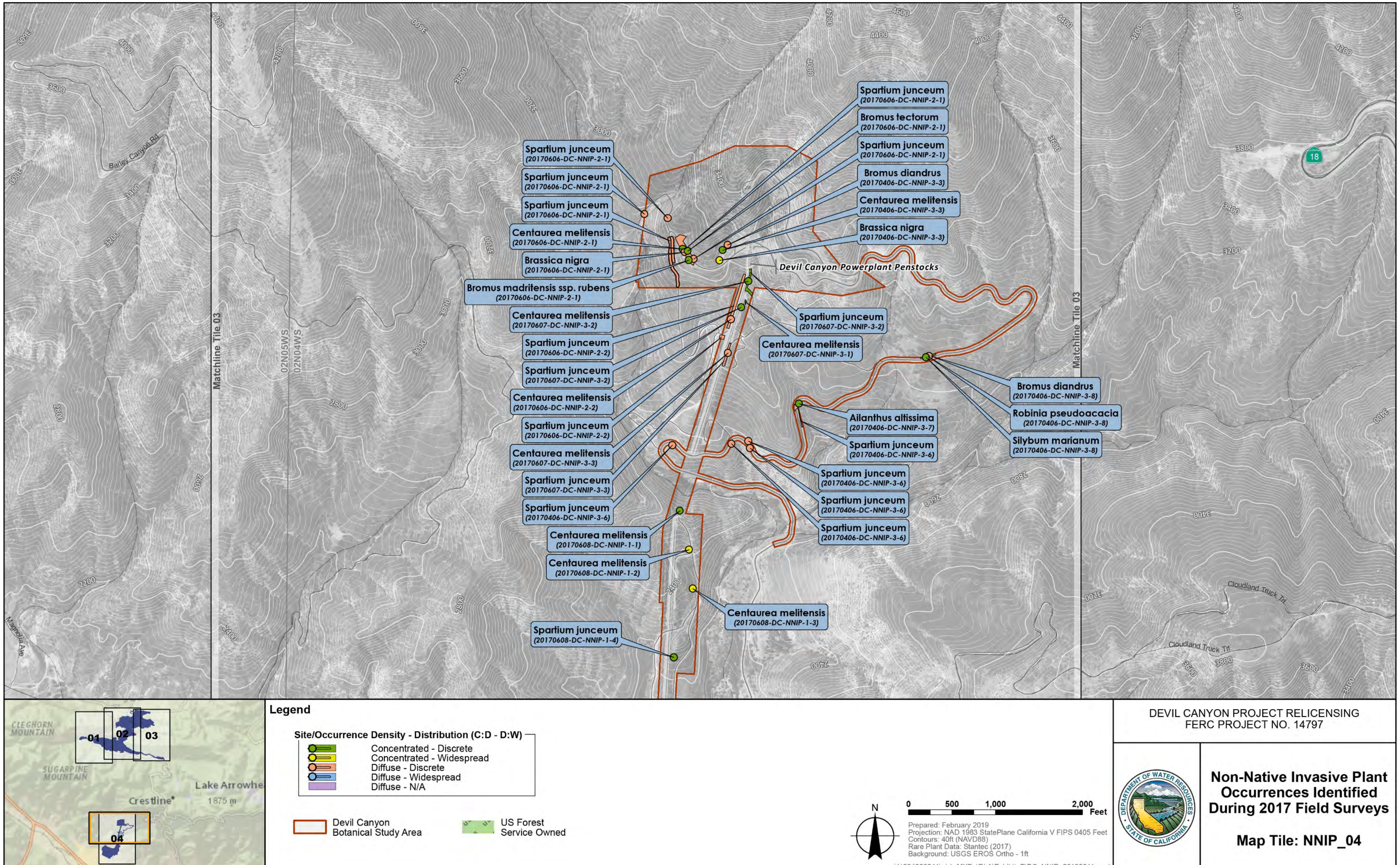

Figure 5.4.1-10. Non-Native Invasive Plant Occurrences Identified During 2017 Field Surveys

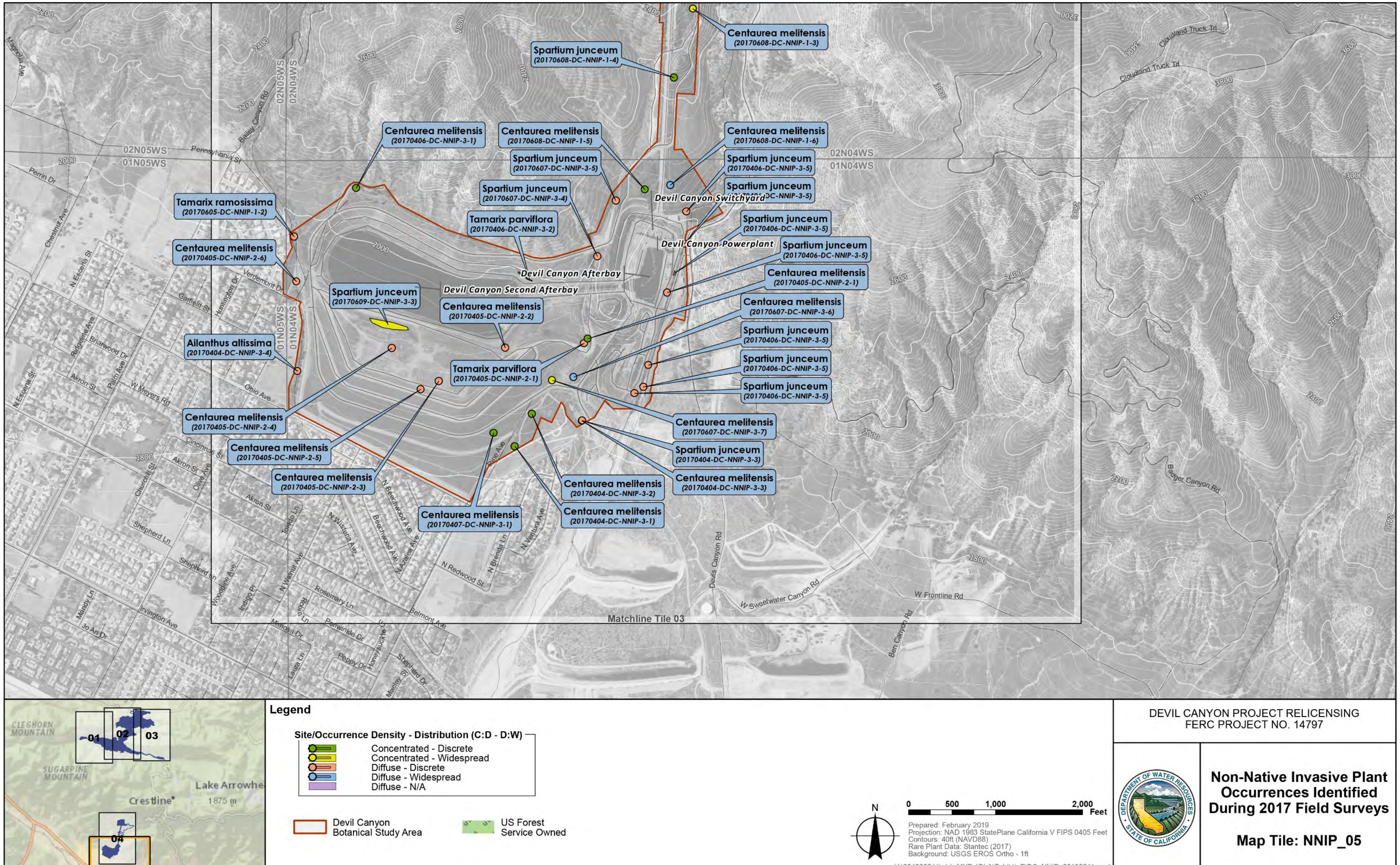

Figure 5.4.1-11. Non-Native Invasive Plant Occurrences Identified During 2017 Field Surveys

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Current Non-Native Invasive Plant Management Activities

As described in Exhibit B, Section 4.4.3, vegetation management (which includes both hand removal and herbicide application) is generally implemented within approximately 75 feet of the powerhouse and switchyard, within approximately 15 feet on either side of roads and trails to Project facilities, and within and adjacent to recreation areas. Herbicide application occurs between December 1 and March 31, with follow-up visits to apply post-emergent herbicides and/or additional treatments (as needed) occurring seasonally, typically between April 1 and June 30, and again between July 1 and October 14.

DWR also periodically removes NNIP manually in the area of the Devil Canyon Powerplant, penstocks, and in the upland areas of the 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®.

Special-Status Wildlife Species

Special-status wildlife discussed in this section (i.e., Section 5.4.1) meet at least one of the following criteria: (1) listed under CESA as threatened, endangered, or candidate, (2) classified as Fully Protected (FP) by the State of California; (3) listed by the CDFW as a Species of Special Concern (SSC) (CDFW 2018a); (4) listed as FSS and occurring on NFS lands (USFS 2013); or (5) protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c). Section 5.4.3 addresses potential effects of DWR's Proposal on the special-status wildlife species listed under the ESA.

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 2018a) 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 quadrangles), 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 five-mile buffer around the proposed Project boundary. This area encompassed by the nine USGS 7.5-minute topographic quadrangles will be referred to throughout this section as the Project vicinity to distinguish it as an area close to, but outside of, the proposed Project boundary.

DWR also queried the CWHR database (CDFW 2018c) for a list of potentially occurring species using the revised vegetation mapping data from the proposed Project boundary. Because CWHR 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 CWHR range maps for each special-status taxa and other sources as needed, including CWHR and other life history accounts and range maps (e.g., Bolster 1998; Zeiner et al. 1988-1990; Shuford and Gardali 2008; IUCN Red List of Threatened Species 2017; California Herps 2018).

Additionally, DWR reviewed various environmental reports for the Project vicinity, including Aspen Environmental Group (2006) and HELIX Environmental Planning (2014).

On the basis of these analyses, DWR identified 53 wildlife special-status species, 10 of which are on more than one agency list, which could potentially be affected by the Project. Table 5.4.1-5 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 based on the presence of suitable habitat. The list of special-status species includes 1 terrestrial amphibian, 8 reptiles (the semi-aquatic two-striped gartersnake [*Thamnophis hammondii*], is addressed in Section 5.3), 26 birds, and 16 mammals. Three species are listed under the CESA: bald eagle (California endangered [CE]), tricolored blackbird (*Agelaius tricolor* [CE]), and Mohave ground squirrel (*Xerospermophilus mohavensis* [CT]). Five of the identified species are listed as FP: golden eagle (*Aquila chrysaetos*), white-tailed kite (*Elanus leucurus*), American peregrine falcon (*Falco peregrinus anatum*), bald eagle, and ringtail (*Bassariscus astutus*). A list of all special-status wildlife species occurring or potentially occurring within or near the proposed Project boundary is provided in Table 5.4.1-5, below.

Table 5.4.1-5. Special-Status Terrestrial Wildlife Species with the Potential to Occur Within the Proposed Project Boundary

Common Name/ Scientific Name	Status[1]	Habitat Association Summary	Temporal and Spatial Distribution[2,3]	Occurrence in or Near the Proposed Project Boundary[4,5]
Amphibians				
Large-blotched ensatina (*Ensatina klauberi*)	FSS	Occurs mostly in oak and pine woodlands, chaparral, and talus in the Peninsular Ranges (San Jacinto Mountains and south), but intergrades with other forms of ensatina that occur in the San Bernardino Mountains. Found under surface objects, in rodent burrows, and in other subterranean retreats.	Yearlong – CSC, MCH, VRI	No records in the CNDDB in Project vicinity.
Reptiles				
Coast horned lizard (*Phrynosoma blainvillii*)	SSC	Occurs in scrubland, grassland, coniferous woods, and broadleaf woodlands where there are openings for basking, areas with loamy or sandy soil suitable for burrowing, scattered shrubs or clumps of grass for hiding cover, and ant colonies (a primary food source). Often found on edges of arroyo bottoms, dry washes, and along dirt roads.	Yearlong – AGS, CRC, CSC, MCH, VRI	25 records in the CNDDB from Project vicinity (AVS, CAJ, DEV, HAM, HES, LAR, SBN, SWL quads) within two miles of Silverwood Lake.
San Diegan tiger whiptail (*Aspidoscelis tigris stejnegeri*)	SSC	Occurs in deserts with sparse vegetation, woodlands, and riparian areas with firm soil or sandy or rocky soil.	Not reported by CWHR	Four records in the CNDDB from Project vicinity (CAJ, HAR, SBN quads).
Southern California legless lizard (*Anniella stebbinsi*)	SSC, FSS	Because this taxon was only recently described as a separate species, information on habitats is limited, but includes coastal sand dunes, sandy washes, alluvial fans, desert scrub, and chaparral. Range is within the coastal plain south of the Transverse Ranges into northern Baja California. Formerly classified as *A. pulchra* (silvery legless lizard).	Yearlong – CRC, CSC, MCH, VRI	Three records in the CNDDB from Project vicinity (DEV, SBN quads).
California glossy snake (*Arizona elegans occidentalis*)	SSC	Most common in desert habitats, but also occurs in a range of scrub and grassland habitats, often with loose or sandy soils, as well as chaparral, sagebrush, valley-foothill hardwood, and pine-juniper.	Not reported by CWHR	Nine records in the CNDDB from Project vicinity (DEV, SBN, HAM quads).
San Bernardino ring-necked snake (*Diadophis punctatus modestus*)	FSS	The species occurs in a wide variety of moist habitats where there is suitable surface cover, including woodland openings, rocky slopes, chaparral, wet meadows, and farmland.	Yearlong – AGS, CRC, CSC, MCH, URB, VRI	Four records in the CNDDB from Project vicinity (SBN, SWL quads).
San Bernardino Mountain kingsnake (*Lampropeltis zonata parvirubra*)	FSS	Found in montane, forested areas of Southern California, including the San Jacinto, San Bernardino, and San Gabriel mountains, often in rocky sites.	Yearlong – AGS, MCH, VRI	During 2017 relicensing surveys, one individual was observed on a hiking/biking trail on Silverwood Lake.
Coast patch-nosed snake (*Salvadora hexalepis virgultea*)	SSC	Occurs in coastal California from San Luis Obispo County to Baja California in coastal plain, canyons, rocky hillsides, and brushy areas. In San Bernardino County, likely limited to low elevation coastal plain.	Yearlong – AGS, BAR, CRC, CSC, MCH, VRI	No records in the CNDDB from Project vicinity.
Red diamond rattlesnake (*Crotalus ruber*)	SSC, FSS	Occurs from sea level to about 3,000 feet msl in chaparral, woodland, and arid desert habitats in rocky areas and dense vegetation.	Yearlong – AGS, BAR, CRC, CSC, MCH, VRI	No records in the CNDDB from Project vicinity.
Birds				
Common loon (*Gavia immer*)	SSC	Winters on lakes, reservoirs, rivers, estuaries, and coastlines. Nests on lakes and other open water areas where there is minimal disturbance. Does not nest in San Bernardino County.	Winter – LAC	During 2017 relicensing surveys, a single juvenile was observed in the cove where Sawpit Creek enters Silverwood Lake. Known to winter within the Proposed Project boundary at Silverwood Lake (DPR 2016).

Table 5.4.1-5. Special-Status Terrestrial Wildlife Species with the Potential to Occur Within the Proposed Project Boundary (continued)

Common Name/ Scientific Name	Status[1]	Habitat Association Summary	Temporal and Spatial Distribution[2,3]	Occurrence in or Near the Proposed Project Boundary[4,5]
American white pelican (*Pelecanus erythrorhynchos*)	SSC	Wintering and post-breeding pelicans occur (sometimes in large numbers) along the coast, and on lakes, reservoirs, rivers, estuaries, bays, and marshes. Rarely breeds in southern California, except along the Colorado River.	Summer – BAR Yearlong – LAC	During 2017 relicensing surveys, a group of six adults was observed in flight over Silverwood Lake near Sycamore Landing.
Least bittern (*Ixobrychus exilis*)	SSC	Occurs in freshwater or brackish marshes with tall, dense, emergent vegetation. A secretive species that can be difficult to document.	Summer – LAC	No records in the CNDDB from Project vicinity.
Redhead (*Aythya americana*)	SSC	Winters and rests during migration in open water on lakes, ponds, and reservoirs. Nests in emergent wetlands, especially where dense cattails or tule are interspersed with open water.	Winter – LAC	No records in the CNDDB from Project vicinity.
Golden eagle (*Aquila chrysaetos*)	FP	Generally occurs in open country, open wooded country, and barren areas, especially in hilly or mountainous regions.	Yearlong – AGS, BAR, CRC, CSC, MCH, URB, VRI	During 2017 relicensing surveys, one adult was observed soaring in the Chamise Cove area. Observed within 1 mile north of Silverwood Lake (Aspen Environmental Group 2006).
Northern harrier (*Circus cyaneus*)	SSC	Found in marshes, meadows, grasslands, open rangelands, emergent wetlands, and cultivated fields.	Winter – CRC, MCH Yearlong – AGS, BAR, CSC, LAC, URB	Observed within 1 mile north of Silverwood Lake (Aspen Environmental Group 2006).
White-tailed kite (*Elanus leucurus*)	FP	Found in savanna, open woodland, marshes, partially cleared lands, and cultivated fields, mostly in lowland situations.	Yearlong – AGS, BAR, CRC, CSC, MCH, URB, VRI	No records in the CNDDB from Project vicinity.
American peregrine falcon (*Falco peregrinus anatum*)	FP	Breeds in open landscapes with cliffs. Winters in any open habitat, mudflats, coastlines, lake edges and mountain chains, especially in areas where potential prey (other birds) are numerous.	Yearlong – AGS, BAR, CRC, CSC, LAC, MCH, URB, VRI	No records in the CNDDB from Project vicinity.
Bald eagle (*Haliaeetus leucocephalus*)	CE, FP, FSS	Breeding habitat usually close to coastal areas, bays, rivers, lakes, or other bodies of water that reflect the general availability of primary food sources. Preferentially roosts in conifers or other sheltered sites in winter in some areas.	Winter – CRC, CSC, MCH Yearlong – AGS, BAR, LAC, VRI	During 2017 relicensing surveys, one immature bird was observed perched in upland habitat near Jamajab Point and one adult was observed flying overhead near Quarry Cove. Five records in the CNDDB from Project vicinity (HAM, LAR, SWL quads), including occurrences at Silverwood Lake (mostly wintering and no successful nesting) (DPR 2016).
Long-eared owl (*Asio otus*)	SSC	Occurs in riparian bottomland forest with overstory of willows and cottonwoods; riparian forest along stream corridors (often dominated by live oak trees). Wooded areas with dense vegetation needed for roosting and nesting, adjacent open areas needed for hunting.	Yearlong – AGS, CRC, MCH, VRI	Two records in the CNDDB from Project vicinity (CAJ, HES quads).
Short-eared owl (*Asio flammeus*)	SSC	Found in open, treeless areas with elevated sites for perches, and dense vegetation for roosting and nesting. Associated with perennial grasslands, prairies, dunes, meadows, irrigated lands, and saline and fresh emergent wetlands.	Winter – MHC Yearlong – AGS, URB, VRI	No records in the CNDDB from Project vicinity.
Burrowing owl (*Athene cunicularia*)	SSC	Found in open grasslands and savanna, sometimes in open areas such as vacant lots near human habitation or airports.	Yearlong – AGS, BAR, CRC, CSC, MCH, URB	Seventeen records in the CNDDB from Project vicinity (AVS, DEV, HES quads).
California spotted owl (*Strix occidentalis occidentalis*)	SSC, FSS	Found in mixed forests dominated by black oak, lodgepole pine, and red fir from 1,200 to 5,500 feet msl.	Yearlong – VRI	The proposed Project boundary includes and abuts a USFS Protected Activity Center for this species.

Table 5.4.1-5. Special-Status Terrestrial Wildlife Species with the Potential to Occur Within the Proposed Project Boundary (continued)

Common Name/ Scientific Name	Status[1]	Habitat Association Summary	Temporal and Spatial Distribution[2,3]	Occurrence in or Near the Proposed Project Boundary[4,5]
Olive-sided flycatcher (*Contopus cooperi*)	SSC	Non-breeding habitat includes a variety of forest, woodland, and open areas with scattered trees, especially where tall dead snags are present. Primary habitat is mature, evergreen montane forest. Breeds in various forest and woodland habitats.	Summer – CRC, MCH	No records in the CNDDB from Project vicinity.
Vermilion flycatcher (*Pyrocephalus rubinus*)	SSC	Occurs in widely scattered locations of desert scrub, cultivated lands, riparian woodlands, usually near water, including ditches, ponds, and irrigation. Trees and tall shrubs used for nesting and roosting.	Not reported by CWHR	Reported by HELIX Environmental Planning (2014) from north of Project vicinity.
Purple martin (*Progne subis*)	SSC	Found in a wide variety of forest and woodland areas, where open and partly open sites occur, frequently near water or around towns, where dragonflies and other large, aerial insects are available prey.	Summer – AGS, LAC, URB, VRI	No records in the CNDDB from Project vicinity or Project area.
Le Conte's thrasher (*Toxostoma lecontei*)	SSC	Closely associated with saltbush and found in relatively open areas, including desert scrub and dry washes.	Not reported by CWHR	Observed by DWR at Silverwood Lake. Four records in the CNDDB from Project vicinity (AVS, DES, HES quads). Observed within 1 mile north of Silverwood Lake (Aspen Environmental Group 2006).
Loggerhead shrike (*Lanius ludovicianus*)	SSC	Found in open country with scattered trees and shrubs, savanna, desert scrub, and, occasionally, open woodland; often perches on poles, wires or fence posts.	Yearlong – AGS, BAR, CRC, CSC, MCH, VRI Winter – URB	Observed by DWR at Silverwood Lake. Observed within 1 mile north of Silverwood Lake (Aspen Environmental Group 2006).
Mountain plover (*Charadrius montanus*)	SSC	Occurs in open plains with low, herbaceous or scattered shrub vegetation.	Winter – AGS, BAR	No records in the CNDDB from Project vicinity or Project area.
Yellow warbler (*Setophaga petechia*)	SSC	Open scrub, second-growth woodland, thickets, farmlands, and gardens, especially near water; riparian woodlands, especially areas with willows.	Migrant – CRC, CSC, MCH Summer – URB, VRI	During 2017 relicensing surveys, one adult was observed in a riparian area near the day use area adjacent to Silverwood Lake.
Lucy's warbler (*Oreothlypis luciae*)	SSC	Occurs in desert wash and desert riparian habitats, especially those dominated by mesquite, but also ranges into saltcedar and other thickets.	Summer – URB	During 2017 relicensing surveys, an individual was observed in riparian areas adjacent to Live Oak Landing.
Yellow-breasted chat (*Icteria virens*)	SSC	Found in second growth, shrubby old pastures, thickets, bushy areas, scrub, woodland undergrowth, and fence rows, including low, wet places near streams, pond edges, or swamps; thickets with few tall trees; early successional stages of forest regeneration; commonly in sites close to human habitation.	Migrant – CSC Yearlong -VRI	No records in the CNDDB from Project vicinity.
Grasshopper sparrow (*Ammodramus savannarum*)	SSC	Prefers grasslands of intermediate height for breeding and often associated with clumped vegetation, interspersed with patches of bare ground. In San Bernardino County, likely limited to South Coast bioregion.	Summer – AGS	No records in the CNDDB from Project vicinity.
Vesper sparrow (*Pooecetes gramineus affinis*)	SSC	Found in various open habitats with grass, including sagebrush steppe, meadows, pastures, and roadsides.	Winter – AGS	No records in the CNDDB from Project vicinity.

Table 5.4.1-5. Special-Status Terrestrial Wildlife Species with the Potential to Occur Within the Proposed Project Boundary (continued)

Common Name/ Scientific Name	Status[1]	Habitat Association Summary	Temporal and Spatial Distribution[2,3]	Occurrence in or Near the Proposed Project Boundary[4,5]
Tricolored blackbird (*Agelaius tricolor*)	CE, SSC	Occurs in freshwater marshes of cattails, tule, and sedges. Nests in vegetation of marshes or thickets, sometimes nests on the ground. Historically strongly tied to emergent marshes; in recent decades, much nesting has shifted to non-native vegetation.	Yearlong – AGS, URB, VRI	No records in the CNDDB from Project vicinity.
Yellow-headed blackbird (*Xanthocephalus xanthocephalus*)	SSC	Found in freshwater marshes of cattail, tule, or bulrushes. Nests in wet grasses, reeds, and cattails. Also in open cultivated lands, pastures, and fields.	Summer – AGS Yearlong – LAC	No records in the CNDDB from Project vicinity.
Mammals				
Pallid bat (*Antrozous pallidus*)	SSC, FSS	Occurs in arid deserts and grasslands, often near rocky outcrops and water. Less abundant in evergreen and mixed conifer woodland. Usually roosts in rock crevices or buildings, less often in caves, tree hollows, mines, etc.	Yearlong – AGS, BAR, CRC, CSC, MCH, VRI Summer -URB	One record in the CNDDB from Project vicinity (HES quad).
Townsend's big-eared bat (*Corynorhinus townsendii*)	SSC, FSS	Maternity and hibernation colonies typically are in caves and mine tunnels. Prefers relatively cold places for hibernation, often near entrances and in well-ventilated areas.	Yearlong – BAR, CRC, CSC, MCH, URB, VRI Summer – AGS	One record in the CNDDB from Project vicinity (AVS quad).
Western mastiff bat (*Eumops perotis californicus*)	SSC	Roosts in crevices and shallow caves on the sides of cliffs and rock walls, and occasionally buildings. Roosts usually high above ground with unobstructed approach. Most roosts are not used throughout the year. May alternate between different day roosts.	Yearlong – AGS, BAR, CRC, CSC, MCH, URB, VRI	Three records in the CNDDB from Project vicinity (HAM quad).
Western red bat (*Lasiurus blossevillii*)	SSC	Roosts in foliage (mostly in trees), forages in open areas (not including deserts) from sea level up through mixed conifer forests. Typically occurs near edges and in habitat mosaics. Migrates between summer and winter ranges.	Yearlong – AGS, CRC, CSC, URB, VRI Summer – LAC, MCH	No records in the CNDDB from Project vicinity.
Western yellow bat (*Lasiurus xanthinus*)	SSC	Roosts in trees in valley foothill riparian, desert riparian, desert wash, and palm oasis habitats. In California, recorded only at sites below 2,000 feet msl. Migrates between summer and winter ranges.	Migrant – VRI	Two records in the CNDDB from Project vicinity (HAR, SBN quads).
San Diego black-tailed jackrabbit (*Lepus californicus bennettii*)	SSC	The species occurs in open country with scattered thickets or patches of shrubs, including open plains, fields, and deserts. The sub-species is restricted to the South Coast bioregion.	Yearlong – AGS, CRC, CSC, MCH, URB	Two records in the CNDDB from Project vicinity (DEV, SBN quads).
Mohave ground squirrel (*Xerospermophilus mohavensis*)	CT	Burrowing species associated with various habitat types in the western Mojave Desert, including areas of saltscrub, Joshua tree woodland, and creosote scrub. Populations may decline sharply during drought conditions.	Yearlong – AGS	Three records in the CNDDB from Project vicinity (AVS, HES quads), although one of these has been extirpated.
San Bernardino northern flying squirrel (*Glaucomys oregonensis californicus*)	SSC, FSS	Occurs mostly in coniferous and mixed forest, and sometimes in deciduous woodlands in relatively high elevation parts of the San Bernardino Mountains and, at least historically, the San Jacinto Mountains. Trees and snags with cavities are likely important as nesting sites.	Yearlong –MHC, VRI	Six records in the CNDDB from Project vicinity (HAM, SBN, SWL quads), including one within forests on south side of Silverwood Lake in the proposed Project boundary
Northwestern San Diego pocket mouse (*Chaetodipus fallax*)	SSC	Associated with a wide variety of arid, shrub-and herbaceous-dominated habitats, where there are sandy soils, rocky slopes, or coarse gravel. Found in burrows during daytime.	Yearlong – AGS, CRC, CSC	Seven records in the CNDDB from Project vicinity (SBN, DEV quads).

Table 5.4.1-5. Special-Status Terrestrial Wildlife Species with the Potential to Occur Within the Proposed Project Boundary (continued)

Common Name/ Scientific Name	Status[1]	Habitat Association Summary	Temporal and Spatial Distribution[2,3]	Occurrence in or Near the Proposed Project Boundary[4,5]
White-eared pocket mouse (*Perognathus alticolus alticolus*)	SSC, FSS	Poorly known taxon restricted to a few sites in the Tehachapi Mountains and near Strawberry Peak in the San Bernardino Mountains, mostly from open, dry pine forests. The population in the San Bernardino Mountains may have been extirpated.	Yearlong – MCH	Three records in the CNDDB from Project vicinity (HAM quad) dated 1920-1934.
Los Angeles pocket mouse (*Perognathus longimembris brevinasus*)	SSC	Occurs in low elevation coastal grassland, alluvial sage scrub, and coastal sage scrub. In San Bernardino County, likely restricted to areas east of the base of the San Bernardino Mountains.	Yearlong – CSC, MCH	Four records in the CNDDB from Project vicinity (SBN quad).
Southern grasshopper mouse (*Onychomys torridus ramona*)	SSC	Most common in arid desert habitats, including desert scrub and alkali desert scrub, but also occurring in coastal scrub, sagebrush, chaparral, and other habitats.	Yearlong – AGS, CSC, MCH, VRI	No records in the CNDDB from Project vicinity.
San Diego desert woodrat (*Neotoma lepida intermedia*)	SSC	The species occurs over a large part of the arid western U.S. and Mexico, whereas the sub-species is evidently limited to coastal areas from San Luis Obispo County south where populations have declined. The species is found in Joshua tree woodlands, pinyon-juniper woodlands, mixed chaparral, sagebrush, and desert habitats.	Yearlong – CRC, CSC, MCH	Woodrat stick houses observed throughout upland areas surrounding Silverwood Lake during 2017 relicensing surveys may belong to this species. Two records in the CNDDB from Project vicinity (SBN quad).
Mohave River vole (*Microtus californicus mohavensis*)	SSC	Occurs in a wide variety of habitats, but is most abundant in early seral stages of montane riparian, dense annual grassland, and wet meadow.	Yearlong – AGS, CSC, URB, VRI	No records in the CNDDB from Project vicinity.
Ringtail (*Bassariscus astutus*)	FP	Associated with areas with a mixture of forest and shrub-dominated habitats, with rock recesses, hollows, and other sites suitable for nesting and cover and within 0.6 mile of water.	Yearlong – AGS, BAR, CRC, CSC, MCH, VRI	Reported to occur in Silverwood Lake SRA by DPR (2016) and California Watchable Wildlife (2015).
American badger (*Taxidea taxus*)	SSC	Occurs in open or brushy habitats, including early successional stages of forests, with dry, friable, often sandy, soils for burrowing.	Yearlong – AGS, BAR, CRC, MCH	Two records in the CNDDB from Project vicinity (SWL, CAJ, HAM, LAR quads).

Notes:
[1] Status: FC= Federal Candidate, FP = State Fully Protected; FSS = Forest Service Sensitive; SC = State Candidate; SE = State Endangered; SSC = Species of Special Concern; ST = State Threatened
[2] Temporal and Spatial Distribution: based on CWHR habitats that are mapped within proposed Project boundary and does not necessarily indicate known occurrence of the species.
[3] CWHR Habitat types: AGS = Annual Grassland; BAR = Barren; CRC = Chamise-redshank chaparral; CSC = Coastal Scrub; LAC = Lacustrine; MCH = Mixed Chaparral;
MHC = Montane Hardwood-Conifer; MHW = Montane Hardwood; SMC = Sierran Mixed Conifer; URB = Urban; VRI = Valley Foothill Riparian
[4] CNDDB (CDFW 2018a)
[5] Quadrangles: AVS = Apple Valley South; CAJ = Cajon; DEV = Devore; HAM = Harrison Mountain; HES = Hesperia; LAR = Lake Arrowhead; SBN = San Bernardino North; SWL = Silverwood Lake
Key:
CNDDB = California Natural Diversity Database
CWHR = California Wildlife Habitat Relationships
msl = mean sea level
SRA = State Recreation Area

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With respect to the 51 special-status species with the potential to occur within the proposed Project boundary, only 1 reptile, 8 birds, and 2 mammals have actually been observed. These include San Bernardino Mountain kingsnake, American pelican, bald eagle, common loon, golden eagle, LeConte's thrasher, loggerhead shrike, Lucy's warbler, yellow warbler, San Bernardino Mountain flying squirrel, and ringtail.

A short life history of all of the 51 special-status species with the potential to occur within the proposed Project boundary is included below.

Special-Status Terrestrial Amphibians

Large-blotched Ensatina (Ensatina klauberi)

Large-blotched ensatina is designated as FSS (CDFW 2018b). It is found in the Peninsular Ranges of southern California and part of the eastern San Bernardino Mountains (where it intergrades with the more common Monterey ensatina), and south to northern Baja California (NatureServe 2017). Habitat types include both evergreen and deciduous forests, as well as oak woodlands. This animal remains underground or under rocks, logs, bark, or other debris during hot, dry periods as well as extreme cold periods, and is typically active above ground at night when it is wet and temperatures are moderate (California Herps 2018).

There are no CNDDB records or other known occurrences of this species within the proposed Project boundary. The CWHR habitat types CSC, MCH, and VRI (all three of which occur within the portion of the proposed Project boundary located on NFS lands) are considered terrestrial habitats suitable for large-blotched ensatina habitat (CDFW 2018c).

Special-Status Reptiles

Coast Horned Lizard (Phrynosoma blainvillii)

The coast horned lizard is designated as SSC and FSS (CDFW 2018b). The coast horned lizard may be found in California at elevations up to 4,000 feet mean sea level (msl) west of the southern California deserts and the Sierra Nevada crest from the Baja California border to the San Francisco Bay area and inland to the northern Sacramento Valley. Its range also extends into Baja California at elevation ranges from msl up to8 (California Herps 2018). Habitat types occupied by the coast horned lizard include valley foothill hardwood, conifer, riparian and annual grasslands. This species will often burrow into loose sandy soil to escape from predators and extreme heat, or will use logs, rocks, mammal burrows or crevices during periods of inactivity and winter hibernation (Zeiner et al. 1988-1990).

Coast horned lizard was widely reported, with 25 CNDDB occurrences in the Project vicinity within 2 miles north of Silverwood Lake, and can be presumed to occur within or near the proposed Project boundary because of the presence of suitable habitat and nearby occurrences (CDFW 2018a). Appropriate CWHR habitat types for coast horned lizard include AGS, MCH, and VRI (CDFW 2018c).

San Diegan Tiger Whiptail (Aspidoscelis tigris stejnegeri)

San Diegan tiger whiptail is designated as SSC (CDFW 2018b). It is found in coastal southern California, west of the Peninsular Ranges and south of the Transverse Ranges, from Ventura County south into Baja California up to 7,000 feet msl. Habitat types occupied by San Diegan tiger whiptail include chaparral, woodland, and riparian areas. This wary animal is active during the day and digs while foraging (California Herps 2018).

The four CNDDB records for the San Diegan tiger whiptail are from streams with riparian and alluvial fan scrub vegetation located within 4 to 7 miles from the Devil Canyon Powerplant (CDFW 2018a). This species does not have suitable habitat within the proposed Project boundary, per the CWHR report (CDFW 2018c).

Southern California Legless Lizard (Anniella stebbinsi)

Southern California legless lizard is designated as SSC and FSS (CDFW 2018b). It is found in southwestern California south of the Transverse Ranges, with separate populations to the north in the Tehachapi and Piute mountains, south into northwestern Baja California. Habitat types include areas with moist, warm, and loose soil that are sparsely vegetated, including grassland, beach dunes, chaparral, pine-oak woodland, conifer woodland, desert scrub, sandy washes, and terraces of riparian areas containing sycamores, cottonwoods, or oaks. This animal spends most of its time underground in burrows, foraging in loose soil, leaf litter, and fallen logs during the morning and evening (NatureServe 2017; California Herps 2018).

The three records for the Southern California legless lizard 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; Stebbins and McGinnis 2012; Papenfuss and Parham 2013). Per CWHR, suitable habitats in the Project area include CRC, CSC, MCH, and VRI (CDFW 2018c). There are no known occurrences of this species within the proposed Project boundary.

California Glossy Snake (Arizona elegans occidentalis)

California glossy snake is designated as SSC (CDFW 2018b). It is found throughout southern California up to 6,000 feet msl. Habitat types include open sandy habitats such as deserts, chaparral, sagebrush, valley-foothill hardwood, pine-juniper, and annual grasslands. This animal is primarily nocturnal, spending inactive periods during the day and winter in mammal burrows and rock outcrops (Zeiner et al. 1988-1990).

There are nine CNDDB records of California glossy snake, associated with alluvial fan sage scrub and grassland habitat, from within a few miles of the Devil Canyon

Powerplant (CDFW 2018a). There were no suitable terrestrial habitats for this species identified by the CWHR program (CDFW 2018c).

San Bernardino Ring-necked Snake (Diadophis punctatus modestus)

San Bernardino ring-necked snake is designated as FSS (CDFW 2018b). This common snake occurs in California (in Kern, Los Angeles, Riverside, and San Bernardino counties) except the Central Valley, high mountains, and desert up to 7,000 feet msl (NatureServe 2017). Habitats include open, rocky areas of valley-foothill, mixed chaparral, and annual grassland. This animal forages on and under the ground surface in areas with leaf litter and herb cover during the day (Zeiner et al. 1988-1990).

There are four records of San Bernardino ring-necked snake associated with the dried, boulder-strewn bed of Grass Valley Creek, located within a few miles northeast of Silverwood Lake (CDFW 2018a). AGS, CRC, CSC, MCH, URB, and VRI are all potential suitable terrestrial habitats for San Bernardino ring-necked snake located within the proposed Project boundary (CDFW 2018c). Of these, CSC, MCH, URB and VRI are all present on NFS lands within the proposed Project boundary.

San Bernardino Mountain Kingsnake (Lampropeltis zonata parvirubra)

San Bernardino Mountain kingsnake is designated as FSS (CDFW 2018b). This snake occurs in southern California in the San Jacinto, Santa Rosa, San Bernardino, Santa Susana, and San Gabriel mountains at elevations up to 9,000 feet msl, and in the Verdugo Hills. Habitat types include coniferous forest, oak-pine woodland, riparian woodland, chaparral, and coastal sage scrub. This secretive animal spends most of its time underground, inside rock crevices, or under surface objects, typically visible above ground when temperatures are more moderate (California Herps 2018).

A single San Bernardino Mountain kingsnake was observed on a hiking/biking trail near the San Bernardino Tunnel Intake on Silverwood Lake. AGS, MCH and VRI (all present on NFS lands within the proposed Project boundary) are considered terrestrial vegetation suitable for the San Bernardino Mountain kingsnake within the proposed Project boundary (CDFW 2018c). There are no CNDDB records of this species within the Project vicinity (CDFW 2018a).

Coast Patch-nosed Snake (Salvadora hexalepis virgultea)

Coast patch-nosed snake is designated as SSC (CDFW 2018b). This snake occurs in southern California from San Luis Obispo County south to coastal northern Baja California up to 7,000 feet msl. Habitat types include semi-arid brush and chaparral, typically in canyons, on rocky hillsides, and in flat areas. This diurnal animal burrows into loose soil, but is also active above ground even during extreme heat (California Herps 2018).

There are no CNDDB records of coast patch-nosed snake within or near the proposed Project boundary (CDFW 2018a). AGS, BAR, CRC, CSC, MCH, and VRI are all potential suitable terrestrial habitats for this species located within the proposed Project boundary (CDFW 2018c).

Red Diamond Rattlesnake (Crotalus ruber)

Red diamond rattlesnake is designated as a SSC and FSS (CDFW 2018b). This snake occurs in southwestern California from San Bernardino County south to San Diego County and Baja California up to 4,000 feet msl. Habitats include chaparral, woodland, and desert habitats with rocky areas and dense vegetation. It seeks shelter in rodent burrows, under surface objects, and in rock crevices, and is most commonly observed in the spring when it is active during the day and at dusk (NatureServe 2017; Zeiner et al. 1988-1990).

There are no CNDDB records of red diamond rattlesnake within or near the proposed Project boundary (CDFW 2018a). AGS, BAR, CRC, CSC, MCH, and VRI are all potential suitable terrestrial habitats for this species located within the proposed Project boundary (CDFW 2018c).

Special-Status Birds

Common Loon (Gavia immer)

The common loon is designated as SSC (CDFW 2018b). The common loon breeds on remote freshwater lakes with both shallow and deep, clear water, in the northern United States and Canada (NatureServe 2017). From May to September, the common loon can be seen in estuarine and subtidal marine habitats along the California coast, but are uncommon on large, deep lakes in valley and foothills throughout the State (Zeiner et al. 1988-1990). Northeastern California is considered to be within the historic breeding range of this species. Courtship begins shortly after territory reoccupation and involves shared displays, including simultaneous swimming, head posturing, and short dives. Many times, a nesting pair will reuse the same site the following year. Nests are nearly always built at the water’s edge in a quiet, protected hidden area and made of aquatic and terrestrial vegetation. Both the male and female build the nest together over the course of a week in May or early June. In winter and during migration, the common loon can be found on lakes, rivers, estuaries and coastlines. Some individuals will overwinter in inland lakes and rivers. Up to 80 percent of their diet is fish, while the remaining 20 percent consists of crustaceans and aquatic plants (Zeiner et al. 1988-1990).

The proposed Project boundary is not within the historic breeding range of this species; however, common loon is known to winter within the proposed Project boundary at Silverwood Lake (DPR 2016). DWR incidentally observed a single juvenile common loon in the cove where Sawpit Creek enters Silverwood Lake. CWHR reported only LAC as a suitable habitat for common loon within the proposed Project boundary (CDFW 2018c). There are no CNDDB records of this species in the Project vicinity (CDFW 2018a).

American White Pelican (Pelecanus erythrorhynchos)

The American white pelican is designated as SSC (CDFW 2018b). Its habitat includes rivers, lakes, reservoirs, estuaries, bays, and open marshes (NatureServe 2017). Nesting sites require flat or gently sloped topography, without shrubs or other obstructions that would impede taking flight, are free of human disturbances and usually have loose earth suitable for constructing nest-mounds (Zeiner et al. 1988-1990). According to Zeiner et al. (1988-1990) and NatureServe (2017), this species currently nests at large lakes in the Klamath Basin of northern California. Outside of nesting season (i.e., April to August), migrant flocks are often seen throughout California.

A group of six adult American white pelicans was incidentally observed in flight over Silverwood Lake near Sycamore Landing during the relicensing studies. Suitable habitat for the pelican within the proposed Project boundary includes LAC and BAR (CDFW 2018c). There are no known CNDDB occurrences of this species in the Project vicinity (CDFW 2018a). The Project is located outside any known breeding areas for American white pelicans; therefore, observed occurrences are likely related to migratory flocks moving between nesting habitat and wintering habitat elsewhere in California.

Least Bittern (Ixobrychus exilis)

Least bittern is designated as SSC (CDFW 2018b). It is a common summer resident in southern California at the Salton Sea and Colorado River, a rare to uncommon breeder in the Owens Valley and Mojave Desert, and a rare to uncommon summer resident in San Diego County, the Sacramento and San Joaquin valleys, and northeastern California. A small part of the population in southern California is nonmigratory; the rest migrate to Mexico in the winter. Habitat types include dense emergent wetlands near freshwater and desert riparian. It typically nests in tules or cattails over water at least 1 foot deep. It eats a variety of insects, fish, amphibians, and small mammals (NatureServe 2017; Zeiner et al. 1988-1990). There are no CNDDB reports of the species within the Project vicinity (CDFW 2018a).

Within the proposed Project boundary, LAC is the only habitat considered suitable for least bittern (CDFW 2018c). There are no CNDDB records of this species in the Project vicinity (CDFW 2018a). Due to its affinity for emergent wetlands near freshwater, least bittern has the potential to occur within or adjacent to the proposed Project boundary. However, no occurrences of the species have been reported within the proposed Project boundary.

Redhead (Aythya americana)

The redhead is designated as SSC (CDFW 2018b). Redhead occurrences range from uncommon to locally common during the winter months from Modoc County to Mono County in eastern California in lacustrine waters, where it is a common breeder during the summer months. It can also be found in the Central Valley, central California foothills and coastal lowlands, and along the coast from Monterey County to Ventura

County during the winter months. Breeding also occurs locally in the Central Valley, coastal southern California, and eastern Kern County (Zeiner et al. 1988-1990). Its habitat includes large marshes, lakes, lagoons, rivers and bays. Nesting sites can be found in dense bulrush or cattail (*Typha* spp.) stands that are interspersed with small areas of open water (NatureServe 2017). This species is known to lay eggs in the nest of other redheads and other duck species, as well as nests of northern harriers (*Circus cyaneus*) (Woodin and Michot 2002). Necessary foraging habitat includes large freshwater marshes with persistent emergent vegetation (NatureServe 2017). Redheads dive for food primarily eating leaves, stems, seeds and tubers of aquatic plants with smaller amounts of aquatic insects (Zeiner et al. 1988-1990).

There are no CNDDB records of redheads within or near the proposed Project boundary (CDFW 2018a). Although the Project is located outside any known breeding areas for these species, potentially suitable habitat for redheads within the proposed Project boundary include LAC (CDFW 2018c).

Golden Eagle (Aquila chrysaetos)

The golden eagle is designated as FP and protected under the Bald and Golden Eagle Protection Act (CDFW 2018b). It ranges up to 11,500 feet msl and can be found throughout California, except the center of the Central Valley (Zeiner et al. 1988-1990). Throughout the Sierra Nevada and foothills adjacent to the Central Valley, golden eagle may be found in sparse woodlands, grasslands, savannas, lower successional forest stages, and shrubland. Cliffs, large trees, and man-made structures (e.g., electric transmission towers) with a commanding view are used for nesting (NatureServe 2017).

A single golden eagle adult was incidentally observed soaring in the Chamise Cove area. Suitable habitat within the proposed Project boundary for golden eagle includes AGS, BAR, CRC, CSC, MCH, URB, and VRI (CDFW 2018c). There are no known occurrences of nesting golden eagles or evidence of nesting activities, which suggests that golden eagles are visitors to the Project area (CDFW 2018a).

Northern Harrier (Circus cyaneus)

The northern harrier is designated as SSC (CDFW 2018b). In California, the northern harrier ranges up to 5,700 feet msl and can be found in the Central Valley and Sierra Nevada. Suitable habitat for this species includes meadows, grasslands, open rangelands, desert sinks, and fresh and saltwater emergent wetlands (Zeiner et al. 1988-1990). According to NatureServe (2017), northern harrier may also be found in wheat fields, ungrazed or lightly grazed pastures, and some croplands (alfalfa, grain, sugar beets [*Beta* spp.], tomatoes [*Solanum* spp.] and melons [*Benincasa* spp., *Citrullus* spp., *Cucumis* spp., *Momordica* spp.]). Nesting habitat includes shrubby vegetation along the edges of marshes, emergent wetlands, or along rivers and lakes. They have been known to nest in grasslands, grain fields or on sagebrush (*Artemisia* spp.) flats several miles from water. Nests are constructed of a large mound of sticks in wet areas, or a smaller cup of grasses in drier areas (Zeiner et al. 1988-1990).

Aspen Environmental Group (2016) reported northern harrier within 1 mile north of Silverwood Lake. Suitable habitats within the proposed Project boundary for this species include AGS, BAR, CRC, CSC, LAC, MCH, and URB (CDFW 2018c). There are no CNDDB records of this species in the Project vicinity (CDFW 2018a).) and there are no known current or historical records of northern harrier nests in the proposed Project boundary. Due to its use of a large variety of habitats, however, northern harrier have the potential to occur within or adjacent to the proposed Project boundary.

White-Tailed Kite (Elanus leucurus)

The white-tailed kite is designated as FP (CDFW 2018b). The white-tailed kite is a common to uncommon, year-long resident in the Sierra Nevada foothills and adjacent valley lowlands within California. The species has increased in numbers and extended its range in recent decades (Zeiner et al. 1988-1990).

White-tailed kite feeds mostly on voles and other small, diurnal mammals, and occasionally on birds, insects, reptiles, and amphibians. They forage in undisturbed, open grasslands, meadows, farmlands, and emergent wetlands. Trees with dense canopies provide cover, and nests are usually placed near the top of dense oaks, willows, or other tree stands near foraging areas. Breeding occurs from February to October, with the peak from May to August. The average clutch is composed of four to five eggs, and the incubation period is about 28 days. Young fledge in 35 to 40 days after hatching. The female incubates eggs and broods young exclusively, while the male supplies her with food (Zeiner et al. 1988-1990).

There are no CNDDB records for white-tailed kite near or within the proposed Project boundary (CDFW 2018a). While there are no known occurrences of nesting individuals or evidence of nesting activities within the proposed Project boundary, white-tailed kite has the potential to occur in a variety of habitats within the proposed Project boundary. Suitable habitat for white-tailed kite within the proposed Project boundary includes AGS, BAR, CRC, CSC, MCH, URB, and VRI (CDFW 2018c).

American Peregrine Falcon (Falco peregrinus anatum)

The American peregrine falcon is designated as FP (CDFW 2018b). The American peregrine falcon is a medium-sized raptor with a wingspan of 3 to 3.5 feet, and can weigh up to 3.3 pounds. They may be found throughout the United States, utilizing cliffs and man-made structures, such as buildings and bridges, for nesting. American peregrine falcon typically breeds at two to three years of age, and pairs are usually bonded for life. Breeding begins in early March, and clutch size ranges from three to seven eggs, with an average of three to four eggs. A second clutch may be laid if eggs are destroyed or removed early in the breeding season. Incubation takes about 29 to 32 days, followed by a nestling period of 35 to 42 days. Primary prey includes birds that range in size from medium-sized passerines up to small waterfowl. American peregrine falcon uses various hunting methods, including stooping, level pursuit, and hunting on the ground (NatureServe 2017).

There are no CNDDB records of American peregrine falcon near the proposed Project boundary (CDFW 2018a). While there are no known occurrences of nesting individuals or evidence of nesting activities within the proposed Project boundary, American peregrine falcon has the potential to occur in a variety of habitats within the proposed Project boundary. Potentially suitable habitat for American peregrine falcon within the proposed Project boundary includes AGS, BAR, CRC, CSC, LAC, MCH, URB, and VRI (CDFW 2018c).

Bald Eagle (Haliaeetus leucocephalus)

The bald eagle has been listed as CE, FP, and FSS, and is also protected under the Bald and Golden Eagle Protection Act (CDFW 2018b; USFS 2013b). The bald eagle is a large raptor with a wingspan between 6 and 8 feet, and can weigh up to 14 pounds. They typically nest within 1 mile of water bodies. The bald eagle breeds and winters throughout California, except for the desert areas, and the statewide population is increasing (CDFG 2005). Most breeding in the State occurs in the northern Sierra Nevada, Cascades, and north Coast Ranges. California's breeding population is resident year-round in most areas where the climate is relatively mild (Jurek 1988). Between mid-October and December, migratory birds from areas north and northeast of California arrive in the State. Wintering populations remain through March or early April. Based on annual wintering and breeding bird surveys, it is estimated that between 100 and 300 eagles winter on the Sierra Nevada National Forests, and at least 151 to 180 pairs remain year-round to breed (USFS 2007). Data from statewide breeding surveys conducted since 1973 indicate that the number of breeding pairs in the State continues to increase on an annual basis (USFWS 2015). The breeding range in California expanded from portions of 8 counties in 1981 to 27 of the State's 58 counties in 2000. Breeding generally occurs from February to July, but can be initiated as early as January via courtship, pair bonding, and territory establishment. The breeding season normally ends around August 31, as the fledglings are no longer attached to their nest area.

Counts of bald eagles wintering at Silverwood Lake are performed annually by DPR and 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 four 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).

Walton (2002) developed a bald eagle territory management plan for Silverwood Lake, although no nesting attempts have been reported to the CNDDB since 1993 (CDFW 2018a). The management plan summarized information collected for DWR by Walton, 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 fish 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 Las 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). As stated above, no nest sites were found.

During DWR's 2017 relicensing surveys, one immature bald eagle was incidentally observed perched in upland habitat near Jamajab Point and one adult was observed flying overhead near Quarry Cove. Suitable habitat for bald eagles within the proposed Project boundary includes AGS, BAR, CRC, CSC, LAC, MCH, and VRI (CDFW 2018c).

Long-eared Owl (Asio otus)

The long-eared owl is designated as SSC (CDFW 2018b). In California, this species can be found from the Sierra Nevada foothills up to dense conifer stands at higher elevations. For roosting and nesting, long-eared owls require dense riparian and live oak thickets that contain densely canopied trees (Zeiner et al. 1988-1990). Resident populations in California have been declining since the 1940s, especially in southern California (Grinnell and Miller 1944; Remsen 1978, as cited by Zeiner et al. 1988-1990). While specific reasons for their decline are unknown, habitat fragmentation of riparian habitat and live oak groves are thought to be major factors. The long-eared owl hunts in open areas for voles and other rodents (Zeiner et al. 1988-1990).

There are two CNDDB records of long-eared owl dating from around 1950 from 3 miles south and 6 miles southwest of Hesperia, approximately 6 miles from the proposed Project boundary (CDFW 2018a). Long-eared owl's suitable habitat within the proposed Project boundary includes AGS, CRC, MCH, and VRI (CDFW 2018c). Due to its use of a wide variety of habitats, long-eared owl has the potential to occur within or adjacent to the proposed Project boundary. However, no occurrences of this species have been reported.

Short-eared Owl (Asio flammeus)

The short-eared owl is designated as SSC (CDFW 2018b). According to Zeiner et al. (1988-1990), the short-eared owl inhabits open areas nearly absent of trees, such as annual grasslands, prairies, dunes, meadows, irrigated lands, and saline and fresh emergent wetlands. Nests are depressions on dry ground that are lined with grasses, forbs, sticks, and feathers, and concealed by surrounding grasses and shrubs. This species is known to breed in the coastal areas of Del Norte and Humboldt counties, the San Francisco Bay Delta, northeastern Modoc plateau, east side of the Sierra Nevada between Lake Tahoe and Inyo counties, as well as the San Joaquin Valley. The short-eared owl migrates from breeding areas in September or October to wintering areas in the Central Valley, western Sierra Nevada foothills, and along the California coast. Numbers have declined over most of the range because of destruction and fragmentation of grassland and wetland habitats, and grazing (Zeiner et al. 1988-1990).

There are no CNDDB records of short-eared owl within or near the proposed Project boundary (CDFW 2018a). Suitable habitat includes MHC, AGS, URB, and VRI for short-eared owl within the proposed Project boundary (CDFW 2018c). While short-eared owl has the potential to occur within the wide variety of suitable habitats within the proposed Project boundary, no occurrences of this species have been reported.

Burrowing Owl (Athene cunicularia)

The burrowing owl is designated as SSC (CDFW 2018b). Typical habitat for this small ground-dwelling owl includes open grassland, open lots near human habitation, and areas along roadsides. Within California, the breeding range of burrowing owl includes the northeastern plateau, Central Valley, San Joaquin Valley, Imperial Valley, Mojave and Colorado deserts, the southwest corner of San Diego County, and a few coastal counties between Los Angeles and San Francisco. Burrowing owls nest in abandoned burrows dug by small mammals, such as ground squirrels (*Spermophilus* spp.), as well as larger mammals, such as foxes (*Vulpes* spp.) and badgers (*Taxidea taxus*). If burrows are unavailable, burrowing owls may dig their own in soft soil, or utilize pipes, culverts and/or nest boxes (Zeiner et. al. 1988-1990).

There were 17 CNDDB records of burrowing owl in the Project vicinity (CDFW 2018a), but outside of the proposed Project boundary. Three of these CNDDB records for burrowing owl were approximately 6 miles southwest of the Devil Canyon Powerplant (CDFW 2018a). Suitable habitat within the proposed Project boundary for this species includes AGS, BAR, CRC, CSC, MCH, and URB (CDFW 2018c). The burrowing owl is not known to breed or nest within the proposed Project boundary, which does not appear to be within its current or historic breeding range. No occurrences of burrowing owl have been reported within or adjacent to the proposed Project boundary.

California Spotted Owl (Strix occidentalis occidentalis)

The California spotted owl is designated as SSC and FSS (CDFW 2018b; USFS 2013b). The species is currently under review for ESA listing with a final decision anticipated by September 30, 2019 (USFWS 2017). Typical habitat for California spotted owl is dense, diverse, multi-layered evergreen forests with open areas under the canopy. Nests are constructed on broken tree tops, cliff ledges, in natural tree cavities, and often can be found using abandoned hawk nests. Foraging habitat includes areas of larger trees with canopy closures of 40 percent and greater, as well as areas characterized by multiple vegetative strata (NatureServe 2017).

Although there were no records of occurrences from the CNDDB nine-quad search (CDFW 2018a), the SBNF has established a USFS Protected Activity Center (PAC) for California spotted owl on NFS lands near approximately 1.5 miles of the southern edge of Silverwood Lake, as described further below. Suitable habitat for the species within the proposed Project boundary includes VRI (CDFW 2018c).

Olive-sided Flycatcher (Contopus cooperi)

The olive-sided flycatcher is designated SSC (CDFW 2018b). This species is a common to uncommon summer resident in a wide variety of forest and woodland habitats below 9,000 feet msl throughout California. It is not found in the deserts, the Central Valley, or other lowland valleys and basins (Zeiner et al. 1988-1990). The olive-sided flycatcher will breed at forest edges and openings such as meadows and ponds (Kaufman 1996). Nests are made of twigs, rootlets and lichens placed out near the tip of horizontal branches of trees. Its winter habitat is also forest edges and clearings where tall trees or snags are present (Altman and Sallabanks 2000). These flycatchers forage primarily by hovering or sallying forward, concentrating on prey via aerial attack. This bird is a passive searcher as well as an active pursuer. Its diet consists of mostly flying insects, with a fondness for wild honey bees and other Hymenoptera (NatureServe 2017).

Suitable habitat within the proposed Project boundary includes CRC and MCH (CDFW 2018c). There are no CNDDB records or other known occurrences of this species in the Project vicinity (CDFW 2018a). Due to its affinity for forested and woodland habitats, however, olive-sided flycatcher has the potential to occur within or adjacent to the proposed Project boundary.

Vermilion Flycatcher (Pyrocephalus rubinus)

Vermilion flycatcher is designated as SSC (CDFW 2018b). It is a rare year-round resident along the Colorado River and nests throughout central southern California, central Arizona, central New Mexico, western Oklahoma, and central Texas. It winters in southern California, northern Arizona, central New Mexico, central Texas, and the Gulf Coast (NatureServe 2017). Habitat types include desert riparian habitats (with cottonwoods, willows, and mesquites), chaparral, and hardwood woodland adjacent to irrigated fields, ditches, or other open wet areas. Vermilion flycatcher nests in willows, cottonwoods, mesquite, or other large trees or shrubs from 8 to 20 feet above ground. It primarily eats insects (NatureServe 2017; Zeiner et al. 1988-1990).

HELIX Environmental Planning (2014) reported vermilion flycatcher from north of the Project, although no suitable habitat types are present within the proposed Project boundary according to CWHR (CDFW 2018c). There are no CNDDB records from the Project vicinity (CDFW 2018a).

Purple Martin (Progne subis)

The purple martin is designated as SSC (CDFW 2018b). This species is a long distance migrant, arriving in California from South America in late March and departing by late September. This species is described by Zeiner et al. (1988-1990) as an uncommon to rare local summer resident of various wooded, low-elevation habitats comprising of montane hardwood, valley foothill and montane hardwood-conifer, and riparian habitats. Purple martin also occurs in coniferous habitats, including closed-cone pine-cypress, ponderosa pine, Douglas-fir, and redwood (*Sequoia sempervirens*). These habitats vary structurally and may be old growth, multi-layered or open, and may also have snags. Purple martin most often nest in old woodpecker cavities found in tall, old, isolated trees or snags in open forests or woodlands. However, they may use man-made structures, such as bridges and culverts, for nesting.

There are no CNDDB records of purple martin within or near the proposed Project boundary (CDFW 2018a). Suitable habitat for purple martin within the proposed Project boundary includes AGS, LAC, URB, and VRI (CDFW 2018c). Due to its use of a wide variety of habitats, purple martin has the potential to occur within or adjacent to the proposed Project boundary. However, no occurrences of this species have been reported within the proposed Project boundary.

Le Conte's Thrasher (Toxostoma lecontei)

Le Conte's thrasher is designated as SSC (CDFW 2018b). It is an uncommon resident in California deserts from southern Mono County south to the border with Mexico, and also occurs in the western and southern San Joaquin Valley. Habitat types include sparsely vegetated desert wash, desert scrub (including areas with alkaline soils), desert succulent scrub, and Joshua tree woodland. Le Conte's thrasher typically nests in dense, spiny shrubs or densely branched cacti in desert washes from 2 to 8 feet above ground. It eats fruits and invertebrates, lizards, and snakes (NatureServe 2017; Zeiner et al. 1988-1990).

Le Conte's thrasher had four CNDDB records in the Project vicinity (CDFW 2018a) and an individual has been observed by DWR on Silverwood Lake, but there is no suitable habitat within the proposed Project boundary according to CWHR (CDFW 2018c). The species is most likely an occasional visitor to the Project.

Loggerhead Shrike (Lanius ludovicianus)

The loggerhead shrike is designated as SSC (CDFW 2018b). It is a common resident and winter visitor in lowland and foothills throughout California. This species prefers habitats that include open-canopied valley foothill hardwood, valley foothill hardwood-conifer, valley foothill riparian, pinyon-juniper and juniper (*Juniperus* spp.), desert riparian, and Joshua tree (*Yucca brevifolia*) habitats (Zeiner et. al. 1988-1990). Loggerhead shrike may often be found perched on poles, wires, or fenceposts.

Loggerhead shrike was observed by DWR personnel at Silverwood Lake. An individual loggerhead shrike was seen about 1 mile north of the proposed Project boundary by Aspen Environmental Group (2006). Suitable habitat for loggerhead shrike within the proposed Project boundary includes AGS, BAR, CRC, CSC, MCH, VRI, and URB (CDFW 2018c). There are no CNDDB records of this species in the Project vicinity

(CDFW 2018a). Due to its use of a wide variety of habitats, loggerhead shrike has the potential to occur within or adjacent to the proposed Project boundary.

Mountain Plover (Charadrius montanus)

Mountain plover is designated as SSC (CDFW 2018b). It is a fairly common winter resident in California from Sutter and Yuba counties south to Los Angeles and western San Bernardino counties to Baja California below 3,200 feet msl. Habitat types include open grasslands, plowed agricultural fields with little vegetation, heavily grazed rangelands, alkali flats, and open sagebrush areas. Mountain plover does not nest in California. It feeds primarily on insects (NatureServe 2017; Zeiner et al. 1988-1990).

There are no CNDDB records of mountain plover within or near the proposed Project boundary (CDFW 2018a). Suitable habitat for mountain plover within the proposed Project boundary includes AGS and BAR (CDFW 2018c). While mountain plover has the potential to occur within the grassland and barren habitats within the proposed Project boundary, no occurrences of this species have been reported. Additionally, the species does not nest in California.

Yellow Warbler (Setophaga petechia)

The yellow warbler is designated as SSC (CDFW 2018b). The yellow warbler is a migrant, found in California between April and October. Yellow warblers construct nests from 2 to 16 feet above ground in riparian deciduous habitat along the western slope of the Sierra Nevada. These riparian deciduous habitats comprise cottonwoods, willows, alders, and other small trees and shrubs found in low, open-canopy woodland. This species breeds in montane shrubbery in open conifer forests. Territory occupied by yellow warbler usually contains tall trees for singing and foraging, and heavy brush in the understory for nesting (Zeiner et. al. 1988-1990). Forage consists mostly of insects and spiders taken from the upper canopy of deciduous trees and shrubs. Yellow warblers have also been known to eat berries (Zeiner et. al. 1988-1990). Brood parasitism by brown-headed cowbirds (*Molothrus ater*) is thought to be a major cause of population decline in lowland localities in recent decades (Remsen 1978).

An adult yellow warbler was incidentally observed in riparian habitat near a day use area adjacent to Silverwood Lake during the 2017 relicensing surveys. Suitable habitats within the proposed Project boundary for the yellow warbler include CRC, CSC, MCH, URB, and VRI (CDFW 2018c). There are no CNDDB records from the Project vicinity (CDFW 2018a).

Lucy's Warbler (Oreothlypis luciae)

Lucy's warbler is designated as SSC (CDFW 2018b). It is an uncommon to common summer resident and breeder along the Colorado River and in desert areas, and is rare near the Salton Sea. It breeds in southeastern California, southern Nevada, Utah, southwestern Colorado, south to northeastern Baja California, southern Arizona, northern Sonora, and east to western Texas. Habitat types include desert wash, desert riparian (especially mesquite dominant, but also including willows and cottonwoods), chaparral, hardwood woodland, and saltcedar thickets. This bird typically nests in natural cavities such as woodpecker holes, behind bark, or along banks from 1 to 15 feet above ground, and feeds on insects and plants (NatureServe 2017).

A single Lucy's warbler was incidentally observed in a riparian area adjacent to Live Oak Landing during DWR's relicensing botanical surveys in 2017. Suitable habitat within the proposed Project boundary for this species includes URB (CDFW 2018c). There are no CNDDB records for this species in the Project vicinity (CDFW 2018a).

Yellow-breasted Chat (Icteria virens)

The yellow-breasted chat is designated as SSC (CDFW 2018b). It is an uncommon summer resident and migrant to coastal California and the foothills of the Sierra Nevada. This species uses thickets of willow and other brushy vegetation in riparian areas near watercourses for cover, and may be found up to 4,800 feet msl in the Sierra Nevada foothills. During migration, yellow-breasted chat may occupy riparian habitat in the lower elevations of mountains (Zeiner et. al. 1988-1990). Foraging occurs in low trees and shrubs and consists of insects, spiders, berries and other fruits. Breeding occurs in early May, and continues into early August, with peak activity in June. Breeding normally takes place in dense shrubs along stream or river courses.

There are no CNDDB records of yellow-breasted chat within or near the proposed Project boundary (CDFW 2018a). Suitable habitat within the proposed Project boundary includes CSC and VRI (CDFW 2018c).

Grasshopper Sparrow (Ammodramus savannarum)

The grasshopper sparrow is designated as a SSC (CDFW 2018b). The grasshopper sparrow prefers grassland habitat, but can also be found in old fields, savannahs and shortgrass prairies. During breeding season, clumped vegetation of intermediate height, interspersed in grasslands is required (NatureServe 2017). They are an uncommon and local summer resident in foothills and lowlands west of the Cascade-Sierra Nevada crest from Mendocino and Trinity counties south to San Diego County (Zeiner et al. 1988-1990). They arrive at nesting areas between March and June in eastern Washington, central Nevada, and southern California. Departure for the wintering grounds in central California, southern Arizona, and south through Mexico and Central America occurs in mid-September. The grasshopper sparrow eats insects, other small invertebrates, grain, and seeds that are picked up from the ground (NatureServe 2017).

There are no CNDDB records of grasshopper sparrow within or near the proposed Project boundary (CDFW 2018a). Suitable habitat for grasshopper sparrow within the proposed Project boundary includes AGS (CDFW 2018c).

Vesper Sparrow (Pooecetes gramineus)

The vesper sparrow is designated as SSC (CDFW 2018b). This species is a common summer resident east of the Cascade crest in Oregon, and breeds from the Inyo Mountains south to the San Bernardino Mountains. They winter in the southern United States and occur north to Owens Valley, Carrizo Plain, and Antelope Valley. It is a ground-dwelling species, preferring dry grass fields, with some shrubs or similar structure, and is found in old fields, grasslands, and cultivated crops. Shallow nests made of woven grasses are placed on the ground. Forage items include seeds of grasses, weeds, grain crops, and during the breeding season, insects (Jones and Cornely 2002).

There are no CNDDB records of vesper sparrow within or near the proposed Project boundary (CDFW 2018a). Suitable habitat for vesper sparrow within the proposed Project boundary includes ASG (CDFW 2018c).

Tricolored Blackbird (Agelaius tricolor)

The tricolored blackbird is currently designated as both SSC and California Endangered (CDFW 2018b). A highly gregarious species, the tricolored blackbird can be found roosting and foraging in flocks. Colonies can sometimes be found within short distances of one another (NatureServe 2017). This species can be found in herbaceous wetland areas, as well as cropland and hedgerow habitats. Tricolored blackbirds are known to breed in fresh-water marshes, consisting of cattails, tule, bulrushes, and sedges (*Carex* spp.) (NatureServe 2017). In addition to insects, tricolored blackbirds feed on seeds and grain in the fall and winter months.

Suitable habitat for tricolored blackbird within the proposed Project boundary includes AGS, URB and VRI (CDFW 2018c). There are no CNDDB records from the Project vicinity (CDFW 2018a).

Yellow-headed Blackbird (Xanthocephalus xanthocephalus)

The yellow-headed blackbird is designated as SSC (CDFW 2018b). This species breeds commonly, but locally, in fresh-water marshes of cattail, tule (*Schoenoplectus* spp.) or bulrush east of the Cascade Range and Sierra Nevada (Zeiner et al. 1988-1990). Nests are basketlike structures of wet grasses, reeds and cattails woven around stems. Nests are placed within a male's territory and always overhanging the water (Twedt and Crawford 1995). During migration and winter, open, cultivated lands, pastures, and fields are used. The yellow-headed blackbird feeds on insects, seeds, and grain in fields, on muddy ground near water or at the water's surface during the breeding season (NatureServe 2017), while foraging outside of the breeding season takes place in upland areas, eating grains and weed seeds (Twedt and Crawford 1995).

There are no CNDDB records of yellow-headed blackbird within or near the proposed Project boundary (CDFW 2018a). Suitable habitat for yellow-headed blackbird within the proposed Project boundary includes AGS and LAC (CDFW 2018c).

Special-Status Bats

There are CNDDB records for four species of bats: pallid bat (*Antrozous pallidus*) (SSC, FSS) and Townsend's big-eared bat (*Corynorhinus townsendii*) (SSC, FSS) occurrences 12 miles north of the proposed Project boundary; western mastiff bat (*Eumops perotis californicus*) (SSC) occurrences 9 miles east of Devil Canyon Powerplant; and western yellow bat (*Lasiurus xanthinus*) (SSC) occurrences approximately 2.5 miles south and 10 miles east of the Devil Canyon Powerplant (CDFW 2018a). Suitable habitat within the proposed Project boundary for pallid bat, Townsend's big-eared bat, and western mastiff bat includes AGS, BAR, CRC, CSC, MCH, URB, and VRI (CDFW 2018c). There was one suitable habitat type for western yellow bat, VRI, reported by CWHR (CDFW 2018c). These four species of bats are discussed in further detail below.

The pallid bat is designated as SSC and FSS (CDFW 2018b; USFS 2013b). The pallid bat is a medium-sized bat, with adults weighing between 13 and 28 grams and having a forearm length between 1.7 and 2.3 inches. Distinguishing characteristics include large ears that measure about 1 inch long, a pale pelage (fur), and a skunk-like odor (WBWG 2017).

The range of pallid bat includes western North America, between the southern interior of British Columbia and the Mexican states of Queretaro and Jalisco, and as far east as Texas. Suitable habitats include low elevation (below 6,000 feet msl) rocky arid deserts and canyonlands, shrub-steppe grasslands, karst formations, and coniferous forests above 7,000 feet msl. Common roosts include crevices in rocky outcrops and cliffs, caves, mines, trees, and various human structures, such as bridges, barns, porches and attics. Roosts may be occupied by one or hundreds of pallid bats. Pallid bats are opportunistic generalists that primarily glean insects from surfaces, but will also capture insects in flight. Mating occurs from October to February; one or two pups are born between late April and July and weaned in August (WBWG 2017).

A single CNDDB occurrence was recorded for pallid bat near the Project vicinity (CDFW 2018a). Pallid bat has the potential to occur throughout a variety of different habitats within the proposed Project boundary. However, no occurrences of this species have been reported within the proposed Project boundary.

The Townsend's big-eared bat is designated as SSC and FSS (CDFW 2018b; USFS 2013). The Townsend's big-eared bat is a medium-sized bat, with adults weighing between 9 and 11 grams and having a forearm length between 1.5 and 1.8 inches. Distinguishing characteristics include a prominent, bilateral nose lump and large ears that measure more than 1 inch long (WBWG 2017).

This species is distributed from southern British Columbia south to central Mexico. Within the United States, Townsend's big-eared bats are found from the Great Plains west through the Rocky Mountains to the Pacific Coast. Suitable habitats include coniferous forests, mixed mesophytic forests, deserts, native prairies, riparian communities, active agricultural areas, and coastal habitat types. Foraging occurs along edge habitats associated with streams and wooded habitats. Townsend's big-eared bats forage almost exclusively on moths, making up more than 90 percent of the diet. This species is known to travel long distances while foraging and has been reported to move more than 93 miles in a single evening. Caves and abandoned mines are primary roosting habitat, but roosts in buildings, bridges, rock crevices, and hollow trees have been reported. Maternity colonies vary in size and can have a few individuals or several hundred. Mating occurs between October and February, and a single pup is born between May and June (WBWG 2017).

The Townsend's big-eared bat has the potential to occur throughout a variety of different habitats within the proposed Project boundary. However, no occurrences of this species have been reported within the proposed Project boundary.

The western mastiff bat is designated as SSC (CDFW 2018b). The western mastiff bat is the largest species of bat in North America, with adults weighing upwards of 65 grams and having a forearm length of 2.8 to 3.2 inches long. Size is this species' most distinguishing characteristic (WBWG 2017). Western mastiff bats are primarily found in the southwestern United States, from California east to western Texas and as far north as southern Utah. They are found in a variety of habitats, including desert scrub, chaparral, oak woodland, ponderosa pine forests, and high elevation meadows in mixed conifer forests. In California, western mastiff bats were thought to only occur below 1,200 feet msl, but recent surveys have found roosts as high as 4,600 feet msl. Roosts are generally high above the ground and allow an unobstructed drop at the roost opening of 10 feet or more. Suitable roosts include exfoliating rock slabs and crevices in large boulders and buildings. Maternity colonies typically have fewer than 100 individuals. Western mastiff bats mate between late winter and early spring, and a single pup is born in early to mid-summer. Foraging occurs 100 to 200 feet above ground and is typically along dry desert washes, floodplains, chaparral, oak woodland, open ponderosa pine forest, grassland, and agricultural areas. Lepidoptera are primary forage food for western mastiff bats; however, beetles (Order Coleoptera), crickets (Gryllidae family) and katydids (Tettigoniidae family) are also consumed (WBWG 2017).

There are three CNDDB records of the western mastiff bat from the Project vicinity (CDFW 2018a). This species can utilize most of the habitat types within the proposed Project boundary.

The western red bat is designated as SSC (CDFW 2018b). The western red bat is small to medium-sized, and weighs between 10 and 15 grams, has a forearm length between 1.5 and 1.6 inches, and an ear length that is less than 0.5 inch. Pelage is red with white patches at the shoulders, elbows, and thumbs.

A widely distributed species, western red bat can be found in southern British Columbia, much of the western United States, Mexico, Central America, Argentina, and Chile. Western red bats are often solitary and roost primarily among foliage of trees or shrubs adjacent to streams, open fields, and occasionally, in urban areas. Cave roosting has been documented at Carlsbad Caverns in southeastern New Mexico. This species migrates in groups and forages in close proximity with one another. Males and females appear to occupy different summer ranges, and differ in the timing of migration. Winter behavior is poorly understood, but it is believed that red bats occasionally wake from hibernation on warm days to feed. Mating occurs in late summer or early fall, and females postpone pregnancy until spring. Gestation is about 80 to 90 days, and up to 5 pups may be born (WBWG 2017).

There are no CNDDB records for western red bat near the proposed Project boundary (CDFW 2018a). The western red bat has the potential to occur throughout a variety of different habitats within the proposed Project boundary. However, no occurrences of this species have been reported.

The western yellow bat is designated as SSC (CDFW 2018b). It occurs in northern Mexico, western Arizona, southern Nevada, and southwestern New Mexico. It also occurs, uncommonly, in southern California, from Imperial County south to Baja California up to 2,000 feet msl. Habitat types include valley foothill riparian, desert riparian, desert wash, palm oases, and urban habitats. This nocturnal bat feeds on flying insects, forages over water and in trees, roosts in trees (fan palms, sycamores, and cottonwoods), forms small maternity groups, and emerges at dusk (WBWG 2017; NatureServe 2017; Zeiner et al. 1988-1990).

Western yellow bat has the potential to occur along the valley foothill riparian habitat within the proposed Project boundary, which occurs on approximately 52.0 acres. Two CNDDB occurrences were recorded for western yellow bat near the Project vicinity (CDFW 2018a). However, no occurrences of this species have been reported within the proposed Project boundary.

Other Special-Status Mammals

San Diego Black-tailed Jackrabbit (Lepus californicus bennettii)

San Diego black-tailed jackrabbit is designated as SSC (CDFW 2018b). It occurs in cismontane and transmontane areas in southern California, including Los Angeles, Riverside, San Bernardino, and San Diego counties, and south to northern Baja California (NatureServe 2017). Habitat types include open plains, fields, deserts with scattered patches of shrubs, open chaparral, scrub, and grasslands (Zeiner et al. 1988-1990).

Per the CWHR, suitable habitat for the San Diego black-tailed jackrabbit includes AGS, CRC, CSC, MCH, and URB (CDFW 2018c). There were two CNDDB records for San Diego black-tailed jackrabbit in the Project vicinity (CDFW 2018a).

Mohave Ground Squirrel (Xerospermophilus mohavensis)

Mohave ground squirrel is designated as CT (CDFW 2018b). It occurs only in the Mojave Desert in San Bernardino, Los Angeles, Kern, and Inyo counties from 1,800 to 5,900 feet msl. Habitat types include open desert scrub, alkali desert scrub, Joshua tree woodland, and annual grassland with relatively flat topography and an abundance of herbaceous vegetation. This squirrel is diurnal, burrows in sandy to gravelly soils, and is typically active above ground in spring and early summer. It eats invertebrates, seeds, and plants (NatureServe 2017; Zeiner et al. 1988-1990).

CNDDB records for Mohave ground squirrel are all from approximately 14 miles north of Silverwood Lake, consistent with expectations that this desert species is not found south of the town of Hesperia (CDFW 2018a; Roach and Naylor 2016; HELIX Environmental Planning 2014). AGS is the only suitable habitat reported within the proposed Project boundary for this species by CWHR (CDFW 2018c).

San Bernardino Northern Flying Squirrel (Glaucomys oregonensis californicus)

San Bernardino northern flying squirrel is designated as SSC and FSS (CDFW 2018b). It historically occurred in the San Gabriel, San Bernardino, and San Jacinto mountains from 3,960 to 8,250 feet msl; however, there is only current information on the San Bernardino population. Habitat types include a variety of coniferous and deciduous forests, including riparian forest and mixed conifer forests with black oak. Although primarily active year-round in trees, this nocturnal, secretive animal also forages on the ground. It nests in tree cavities of Jeffrey pine and white fir, and eats a variety of tree seeds, fruits, insects, fungi, and sap (NatureServe 2017; Bolster 1998).

San Bernardino northern flying squirrel 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. However, after review, the USFWS concluded that listing of San Bernardino northern flying squirrel was not warranted (81 FR 19527). 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 (CDFW 2018a).

San Bernardino northern flying squirrel has six CNDDB records in the Project vicinity, including one within the proposed Project boundary along the south side of Silverwood Lake (CDFW 2018a). Suitable habitat within the proposed Project boundary includes MHC and VRI (CDFW 2018c).

Northwestern San Diego Pocket Mouse (Chaetodipus fallax fallax)

Northwestern San Diego pocket mouse is designated as SSC and FSS (CDFW 2018b). It occurs in southwestern California on the coastal side of the mountains from Los Angeles County to San Diego County, including the San Bernardino Mountains, up to 6,000 feet msl (NatureServe 2017; County of Riverside 2003). Habitats include open, sandy, herbaceous areas in coastal scrub, chaparral, sagebrush, desert scrub and washes, and annual grassland (Zeiner et al. 1988-1990). This nocturnal mouse eats primarily seeds.

Northwestern San Diego pocket mouse has seven CNDDB records in the Project vicinity (CDFW 2018a). Suitable habitat for the northwestern San Diego pocket mouse includes AGS, CRC, and CSC (CDFW 2018c).

White-eared Pocket Mouse (Perognathus alticolus alticolus)

White-eared pocket mouse is designated as SSC and FSS (CDFW 2018b). It occurs in isolated areas of the Tehachapi Mountains and in the San Bernardino Mountains near Strawberry Peak from 3,500 to 5,900 feet msl. This animal was last collected in 1938 in the San Bernardino Mountains; however, the population may no longer exist. Habitat types include ponderosa and Jeffrey pine forest, mixed chaparral, and sagebrush habitats. This nocturnal mouse feeds on plant seeds and insects, and burrows in loose soil, aestivating in very hot weather and hibernating in very cold weather (Zeiner et al. 1988-1990).

There are no known occurrences of this species within the proposed Project boundary. CNDDB records for white-eared pocket mouse 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 (CDFW 2018a; Naylor and Roach 2017). Suitable habitat within the proposed Project boundary, as reported by CWHR, includes MCH (CDFW 2018c).

Los Angeles Pocket Mouse (Perognathus longimembris brevinasus)

Los Angeles pocket mouse is designated as SSC (CDFW 2018b). It occurs in the Los Angeles Basin and is uncommon in the San Bernardino, San Jacinto, and Temecula valleys from 550 to 2,900 feet msl. Habitats include low elevation grasslands, alluvial sage scrub, chaparral, and coastal sage scrub (NatureServe 2017). This nocturnal mouse burrows in sandy soils and is relatively inactive above ground from fall to spring (Zeiner et al. 1988-1990).

There are no known occurrences of this species within the proposed Project boundary.

Southern Grasshopper Mouse (Onychomys torridus ramona)

Southern grasshopper mouse is designated as SSC (CDFW 2018b). This mouse is found in the Mojave Desert and arid habitats in the southern Central Valley of California with low to moderate shrub cover, as well as in Los Angeles and San Diego counties. Habitat types include alkali desert scrub, desert scrub, succulent desert scrub, desert wash, desert riparian, coastal scrub, mixed chaparral, sagebrush scrub, and bitterbrush scrub. The species is less common in valley foothill and montane riparian. This nocturnal animal is active year-round and eats invertebrates (NatureServe 2017; Zeiner et al. 1988-1990).

There are no CNDDB records for southern grasshopper mouse within or near the proposed Project boundary (CDFW 2018a). Suitable habitat for southern grasshopper mouse within the proposed Project boundary includes AGS, CSC, MCH, and VRI (CDFW 2018c).

San Diego Desert Woodrat (Neotoma lepida intermedia)

San Diego desert woodrat is designated as SSC (CDFW 2018b). It occurs in southwestern California from San Luis Obispo County south to northwestern Baja California, as well as in the southern San Joaquin Valley and southern Sierra Nevada. Habitat types include sagebrush scrub and chaparral. This nocturnal animal is active year-round and eats fruits and seeds (NatureServe 2017). It builds houses used for nesting, caching food, and escaping from predators; these houses are built with twigs, sticks, and rocks positioned against a rock crevice, at the base of a shrub, or in the lower branches of trees (Zeiner et al. 1988-1990).

CNDDB records for San Diego desert woodrat are from alluvial fan scrub habitat about 2 miles east of the Devil Canyon Powerplant at the base of the San Bernardino Mountains, and from about 4 miles south of the Devil Canyon Powerplant at the confluence of Cajon and Lytle Creek washes (CDFW 2018a). Although no individual San Diego desert woodrat was observed, stick houses were incidentally observed throughout the upland areas surrounding Silverwood Lake during the 2017 relicensing surveys that may potentially indicate the presence of San Diego desert woodrat. Suitable habitat within the proposed Project boundary for the woodrat includes CRC, CSC, and MCH (CDFW 2018c).

Mojave River Vole (Microtus californicus mohavensis)

Mojave River vole is designated as SSC (CDFW 2018b). This vole occurs in San Bernardino County, and is restricted to wet habitats along the Mojave River between Victorville and Helendale from 2,325 to 2,700 feet msl. Habitat types include meadows, freshwater marshes, ponds, and irrigated pastures. This animal clips vegetation to create runways in grassy areas that lead to shallow burrows and is active both diurnally and nocturnally year-round. It feeds on grasses (Zeiner et al. 1988-1990).

Suitable habitat for Mojave River vole within the proposed Project boundary include AGS, CSC, URB, and VRI (CDFW 2018c). However, there are no CNDDB records for this species in the Project vicinity (CDFW 2018a).

Ringtail (Bassariscus astutus)

The ringtail is designated as FP (CDFW 2018b). Ringtail is a widely-distributed, common to uncommon, permanent resident of California. This species is nocturnal and can be found in low to mid-elevation (up to 5,000 feet msl) riparian, forest and shrub habitats in close proximity to water (less than 0.6 mile). Important elements of ringtail habitat include rocky areas with cliffs or crevices, hollow trees, logs and snags, all of which are used for daytime shelter. Ringtails den in rock crevices, hollow trees, logs and snags, burrows dug by other animals and remote buildings (NatureServe 2017).

Ringtail breeds between February and May, with gestation lasting between 51 and 54 days. Litters contain between one and four young, and at 60 to 100 days, young begin to forage with their mother. By the end of their first summer, young are weaned and leave their mother. Both adult and young ringtails are omnivorous but prefer animal matter (NatureServe 2017).

Ringtail was reported to occur in Silverwood Lake SRA by DPR (2016) and California Watchable Wildlife (2015). Suitable habitat within the proposed Project boundary for ringtail includes AGS, BAR, CRC, CSC, MCH, and VRI (CDFW 2018c). There are no CNDDB records for this species in the Project vicinity (CDFW 2018a).

American Badger (Taxidea taxus)

The American badger is designated as SSC (CDFW 2018b). An uncommon, but permanent resident found throughout most of California, except in the North Coast area (Zeiner et al. 1988-1990), the American badger is found most abundantly in drier open stages of most shrub, forest, and herbaceous habitats, with friable soils. This species' diet consists mostly of rodents: rats (*Rattus* spp.), mice, chipmunks, pocket gophers (Geomyidae family), and ground squirrels. The American badger will also take some reptiles, insects, earthworms, eggs, birds, and carrion as prey items when ground squirrel populations are low (NatureServe 2017). Seasonal dietary shifts in response to prey availability have been observed.

CNDDB records for American badger are from 2 miles northwest of Silverwood Lake and 6 miles to the east of the proposed Project boundary, around Lake Arrowhead (CDFW 2018a). Suitable habitats for the badger within the proposed Project boundary include AGS, BAR, CRC, and MCH (CDFW 2018c).

Commercially Valuable Wildlife Species

A commercially valuable wildlife species is any species listed as a "harvest species" by CDFW. Per CDFW, harvest species are Game Birds (Fish and Game Code [FGC] § 3500); Game Mammals (FGC § 3950); and Fur-bearing Mammals and Non-game animals as designated in the CCR (CDFW 2018c). Based on a search of the CWHR database, DWR identified 43 harvest wildlife species found in San Bernardino County associated with the CWHR vegetation types mapped from the Project area. The list includes 27 species of birds, primarily migratory waterfowl (i.e., 18 species of ducks, geese, and coots) and upland game birds (i.e., 4 gallinaceous species, such as quails and pheasant), and 16 species of mammals, ranging from rabbits and squirrels to mule deer (*Odocoileus hemionus*). All but two of these species (i.e., ring-necked pheasant [*Phasianus colchicus*] and Virginia opossum [*Didelphis virginiana*]) are native. Designated harvest species may be legally hunted under CDFW regulations in California. However, hunting is not permitted within the Silverwood Lake SRA or at the Devil Canyon Powerplant facilities.

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 532,621 individuals in 2017 (CDFW 2017b). 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 2015). In 1976, CDFG, now CDFW, prepared a deer management plan with the goal of restoring deer populations to previous levels (CDFW 2015). 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 2015).

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 Units (DCU). The objectives for each DCU are to characterize the current scientific, environmental, sociological, and economic conditions of the DCUs as they relate to deer management; describe population estimation and monitoring measures; and to identify key habitat areas and strategies for restoration/enhancement.

The Project is within the Transverse and Peninsular Ranges DCU. This DCU includes 9,426,348.0 acres of land, approximately half of which (52 percent) are publicly owned and half (48 percent) are privately owned. 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 2015). In 2015, 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.

<u>Designated Special Ecological Areas</u>

The proposed Project boundary abuts one designated special ecological area, a PAC for California spotted owl (*Strix occidentalis occidentalis*). The PAC is located on NFS lands near 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. 2012). 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 owl PACs, this distance often includes a 0.25-mile area during the breeding season of March 1 through August 15. There are currently no known nests within a 0.25-mile radius of the proposed Project boundary. California spotted owl is currently under review for listing on the ESA with a final listing decision anticipated by September 30, 2019 (USFWS 2017).

No other designated special ecological areas (e.g., Habitat Conservation Plans [HCP], Home Range Core Areas, Critical Biological Land Use Zones) occur within or adjacent to the Project boundary. However, the Devil Canyon Powerplant is included in the proposed Upper Santa Ana River HCP study area, proposed by a group of 11 water and utility districts and 10 federal and State agencies, which does not include DWR (ICF International 2016).

HCPs are planning documents required for actions that will necessitate an incidental take permit for species listed under the ESA, although HCPs often encompass impacts to multiple species. HCPs outline the potential effects of the take, as well as ways to minimize and mitigate for those effects. They are normally written in collaboration between USFWS and other, usually non-federal, parties (USFWS 2018). The Upper Santa Ana River HCP includes the following special-status terrestrial species with the potential to occur in the proposed Project boundary near the Devil Canyon Powerplant in the HCP's draft list of covered species: California glossy snake (*Arizona elegans occidentalis*), yellow-breasted chat (*Icteria virens*), burrowing owl (*Athene cunicularia*), San Diego black-tailed jackrabbit (*Lepus californicus bennettii*), and Los Angeles pocket mouse (*Perognathus longimembris brevinasus*). The draft HCP is currently anticipated to be completed in 2019.

Further, while not a designated special ecological area, some migratory birds along the Pacific Flyway use Silverwood Lake as a stopover for foraging and resting while traveling to breeding grounds or to overwintering habitats located further north and on their return journey (DPR 2016).

5.4.1.2 Effects of DWR's Proposal

This section describes the potential environmental effects of the Project on botanical and terrestrial wildlife resources. DWR has proposed one specific mitigation measure related to these resources (Measure TR1). Measure TR1 would implement the IVMP included in Appendix A. The IVMP provides guidance for the management of terrestrial vegetation within the proposed Project boundary, and it includes the implementation of protection measures for special-status plant populations and special-status natural communities through avoidance, as well as guidance for vegetation management related to Project O&M activities within the proposed Project boundary. Although no federal ESA- or CESA-listed plant species were observed during the 2017 surveys, in the event a species is newly listed by the USFWS, CDFW, CNPS, or USFS, DWR will confer with the appropriate resource agency to determine if the species or un-surveyed suitable habitat for the species is likely to occur within the proposed Project boundary. If a newly protected species is likely to occur within the proposed Project boundary, DWR will assess the potential for the species to be affected by planned maintenance or other ground-disturbing activities, and implement appropriate surveys or resource protection measures, if necessary.

The IVMP also includes methods of NNIP removal, including manual removal and potential herbicide application, appropriate methods of NNIP disposal, and replanting procedures for areas where NNIP are cleared.

Special-Status Plants

Three special-status plant species, all with a CNPS ranking of 4.2, are known to occur within the proposed Project boundary (see Table 5.4.1-2). None of these three species are listed under the federal ESA or CESA or appear on the FSS list. Recreation activities could inadvertently disturb some individual plants through trampling or other means, and some individual plants might need to be removed by DWR or DPR for future O&M activities at some point during the term of the new license. However, implementation of the IVMP is expected to minimize potential adverse effects on special-status plants within the proposed Project boundary.

Non-Native Invasive Plants

NNIP currently exist within the proposed Project boundary. Although the IVMP is not expected to eradicate all NNIP from the proposed Project boundary, the vegetation management activities described in the IVMP are expected to minimize the presence, introduction, and spread of NNIP within the proposed Project boundary and minimize their adverse effects on botanical and terrestrial wildlife resources during the term of the new license.

Special-Status/CESA-Listed and Fully Protected Wildlife

Project O&M activities are performed in and around already existing facilities where disturbance has been ongoing for years. Recreation, although more widespread, is concentrated in and around the recreation areas, which have also been a long-term part of the Project. Therefore, wildlife species present within the existing Project boundary are anticipated to be accustomed to a certain level of human activity. The nature of Project O&M necessary for operations and recreation use has the potential to affect special-status wildlife by continuing this occasional disturbance. Noise and movement generated by these activities could temporarily disturb local wildlife, causing them to flee the activity area for short durations, and wildlife may be flushed or displaced from areas undergoing soil disturbance or vegetation management or removal. However, because these efforts are infrequent and would be a continuation of ongoing activities, the effects are expected to be limited in scope and duration and unlikely to be concentrated on a particular species.

Special-status bats may actively use Project facilities if they are accessible. Bats are sensitive to various disturbances and can be directly or indirectly affected by human activities at roost sites. There are no known roost sites within the proposed Project boundary, but any bats that are established in Project facilities or recreation areas would have been subject to and tolerant of ongoing human activities. As there are no proposed changes to Project activities, any potential roost sites would continue at the same level of disturbance to which they are already accustomed. Therefore, there would be no adverse effects on any established bat roosts, if present.

The Project is not expected to substantially modify any wildlife habitat, including habitat for nesting birds. Vegetation management is generally limited to recreation sites and the areas within approximately 75 feet of the powerhouse and switchyard and 15 feet on either side of roads to Project facilities. Hazard trees are felled where and when necessary within the proposed Project boundary to protect people and Project facilities. The removal or trimming of vegetation can affect nesting birds, if the work is performed during nesting bird season (i.e., January 1 to August 31). FGC Sections 3503, 3503.5, and 3800 prohibit incidental take or needless destruction of birds, their nests, and their eggs. If activities that could disturb nesting birds must be performed between January 1 and August 31, DWR conducts nesting bird surveys and establishes appropriate buffers around active nests and conducts monitoring. DWR would continue this practice under the new license, thereby minimizing effects on nesting birds.

5.4.1.3 Unavoidable Adverse Effects

<u>Special-Status Plants</u>

Implementation of the IVMP is expected to minimize, but might not fully eliminate, adverse effects on special-status plants within the proposed Project boundary. Some individual special-status plants might need to be removed for O&M activities and some could be inadvertently damaged by visitors to the SRA. Therefore, some adverse effects on individual special-status plants caused by ongoing O&M and recreational activity could be unavoidable. None of these plants are listed under the federal ESA or CESA or appear on the FFS list.

<u>Non-Native Invasive Plants</u>

NNIP are known to occur within the proposed Project boundary. Similar to existing conditions, Project maintenance activities have the potential to introduce new NNIP or spread existing infestations during the term of the new license.

Implementation of the IVMP is expected to minimize, but might not fully eliminate, the introduction or spread of NNIP. Therefore, some introduction and dispersal is still likely to occur as an unavoidable effect of the Project.

Special-Status/CESA-Listed and Fully Protected Wildlife

Similar to existing conditions, the nature of the O&M necessary for continued operations has the potential to affect special-status wildlife by way of occasional disturbance. Noise and movement generated by O&M and recreation activities could temporarily and unavoidably disrupt local wildlife for short durations, and animals may be flushed or displaced from areas requiring vegetation management. However, because these efforts are infrequent and dispersed across the Project area and because DWR would continue to minimize disturbance of nesting birds, these unavoidable effects are expected to be limited in scope and duration, are unlikely to be significant, and unlikely to be concentrated on a particular species or habitat.

5.4.2 Wetlands, Riparian & Littoral Habitats

This section discusses existing terrestrial habitats in the Project vicinity. More specifically, Section 5.4.2.1 first defines wetlands, riparian areas, and littoral habitats, and then discusses existing Project conditions related to these terrestrial habitats. Section 5.4.2.2 describes the effects of DWR's Proposal, and DWR's proposed PM&E measures. Section 5.4.2.3 describes any unavoidable adverse effects.

DWR augmented existing, relevant, and reasonably available information regarding wetland and riparian habitats within the proposed Project boundary by conducting the wetland and riparian assessment component of the *Botanical Resources Study Approach*. Refer to the Devil Canyon Project Relicensing Website http://devil-canyon-project-relicensing.com/studies/ for the detailed study approach, study summary, and detailed study data.

5.4.2.1 Existing Environment

Wetlands

Federal policy defines wetlands as "areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and which, under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (EPA 2018). These can include marshes, shallow swamps, lakeshores, bogs, muskegs, wet meadows, estuaries, and riparian areas (Prichard et al. 1993).

With regard to previous wetlands-related field work within the proposed Project boundary, 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 National Wetlands Inventory (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).

NWI Mapped Habitats

The USFWS's NWI data (USFWS 2010) were the only data identified for wetlands mapping within the proposed Project boundary (Figure 5.4.2-1). NWI mapping provides preliminary data on potential location and type of wetlands. These data are based on aerial imagery, which are 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 the type of wetland vegetation, condition of the wetland, whether an area meets the USACE's definition of wetland, or whether the area would be considered jurisdictional. NWI mapped features also include manmade impoundments and water conveyance features.

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.

NWI data include three Cowardin System feature types 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 20.0 acres in area. Riverine Systems include habitats contained in natural or artificial channels that 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 5.4.2-1 summarizes Cowardin classifications for the NWI features mapped within the proposed Project boundary.

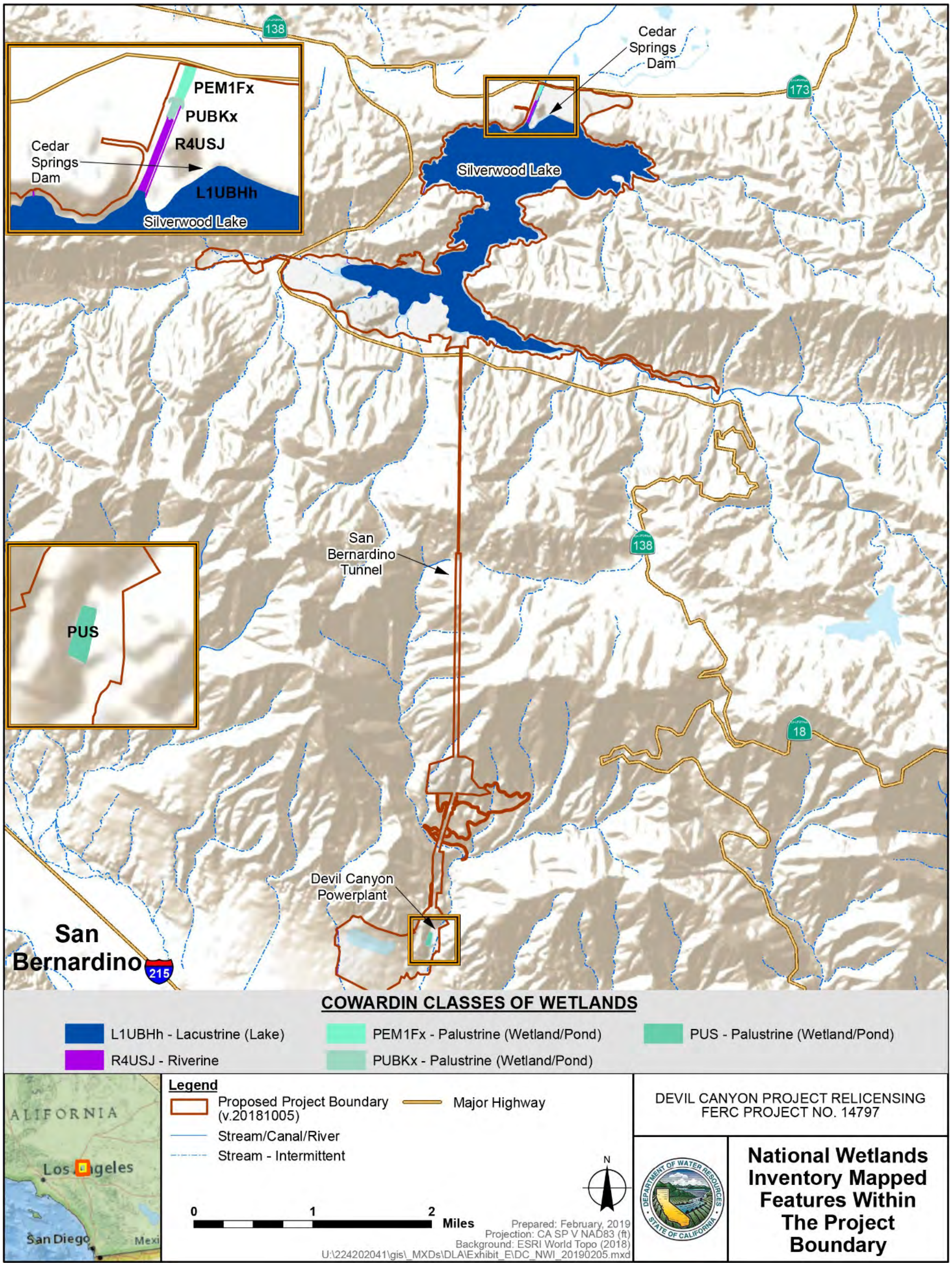


Figure 5.4.2-1. National Wetlands Inventory Mapped Features Within the Proposed Project Boundary

Table 5.4.2-1. Cowardin Classifications for Features Within the Proposed 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
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

Table 5.4.2-1. Cowardin Classifications for Features Within the Proposed Project Boundary (continued)

Cowardin Classifier	Abbreviation	Description
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 et al. 1979
Key:
cm = centimeter

NWI wetland and other water types and specific features mapped within the proposed Project boundary are described below and depicted in Figure 5.4.2-1.

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, Persistent Semi-permanently Flooded Excavated – One excavated wetland occurs in the West Fork Mojave River downstream of Cedar Springs Dam.
- Palustrine, Unconsolidated Shore area – The Devil Canyon Afterbay is mapped as a 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.

Riparian Areas

Riparian areas are those areas where land is directly influenced by permanent water. They have "visible vegetation or physical characteristics reflective of permanent water influence. Lake shores and stream banks are typical riparian areas. Excluded are such sites as ephemeral streams or washes that do not exhibit the presence of vegetation dependent upon free water in the soil" (NRC 2002).

In the proposed Project boundary, 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 rivers are designated on USGS maps as intermittent (do not flow year-round), and flow conditions were evaluated during 2017 field surveys. California Vegetation Classification System 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). 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 (USFWS 2010). Various other small areas of riparian vegetation were 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 (M. Giusti, CDFW, personal communication, October 15, 2015). These areas were assessed during 2017 field surveys, as summarized below.

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 the 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* spp.) 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.

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.

Riparian areas with flowing freshwater are considered “lotic,” and were evaluated using the “Proper Functioning Condition Assessment for Lotic Areas” protocol (Dickard et al. 2015). Riparian-wetland areas that are not lotic (riverine) are considered “lentic,” and were evaluated using *A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lentic Areas* (Prichard et al. 2003). For purposes of this study, lentic features include littoral areas, but a complete littoral habitat assessment was not conducted.

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 the West Fork Mojave River near the Cleghorn Day Use Area by a field team during a site visit in July 2015 (C. Jones, personal communication, 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.

Field Survey Results

DWR performed field surveys between April 4, 2017 and April 20, 2017 to map and assess wetland and riparian habitats using the U.S. Department of the Interior, Bureau of Land Management's (BLM) Properly Functioning Condition (PFC) assessment. During field surveys a qualified team of field staff assessed the condition of wetland and riparian habitat using the PFC qualitative methods for wetlands (i.e., lentic) (Prichard et al. 2003) and riparian (i.e., lotic) areas adjacent to flowing water (Dickard et al. 2015). Surveyors identified areas to be evaluated prior to field surveys during the review of existing information. Field staff traversed all features on foot or by boat, depending on accessibility, including the entire length of riparian vegetation within the proposed Project boundary whenever safely accessible, and collected data at representative areas. Surveyors determined the locations where PFC data were collected (sample points) while in the field based on site observations. Surveyors collected data at a minimum of one sample location per each discrete wetland or riparian area. For wetland or riparian areas that span a sufficiently large area such that physical and biological features vary significantly (as determined in the field based on best professional judgment by DWR's field staff), up to three sample points were evaluated. Field staff completed the Reach Information Form and PFC Assessment Form (either lentic or lotic). The Reach Information Form records key information that must be included with the assessment, and the PFC Assessment Form records the assessment information that will be used for other studies dependent upon this data. Surveyors recorded locations with a GPS unit, took photographs at each sample point, and photographed features at other locations to document conditions within each wetland and riparian area. A summary of these field surveys follows.

Lotic Features

Sixteen lotic areas were assessed. These are depicted in Figures 5.4.2-2 through 5.4.2-5 and are summarized in Table 5.4.2-2. Eleven of the 16 lotic areas were determined to be "Proper Functioning," four were determined to be "Functional – at risk," and one was determined to be "Nonfunctional." Areas were determined to be Functional – at risk or Nonfunctional for a variety of reasons, including limited vegetative structure, riprapped shorelines, recreation/human use (e.g., foot traffic), road/trail interception, and erosion and sedimentation. None of these characteristics is a function of Project operations, with the exception of feature SL-12-Lo-B, which is deeply incised, with continued erosion due to managed lake levels. SL-18-Lo-A also is affected by sedimentation as a result of fluctuating lake levels. Lake levels are maintained for the bass spawning period (per the 2003 MOU with CDFW) and consistent with other operating agreements that require maintaining lake levels during certain periods of the year.

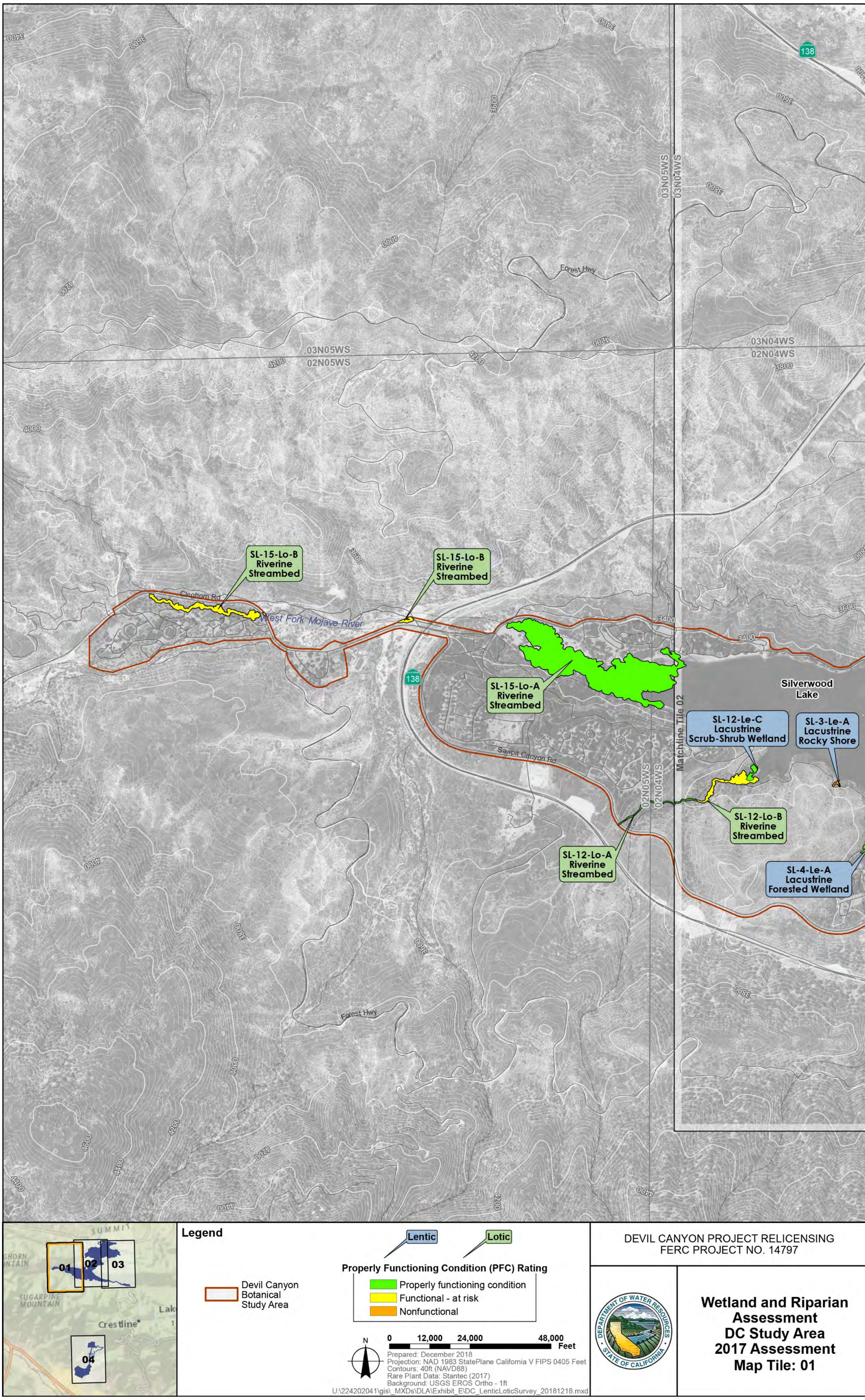


Figure 5.4.2-2. Wetland and Riparian Assessment Field Survey Results

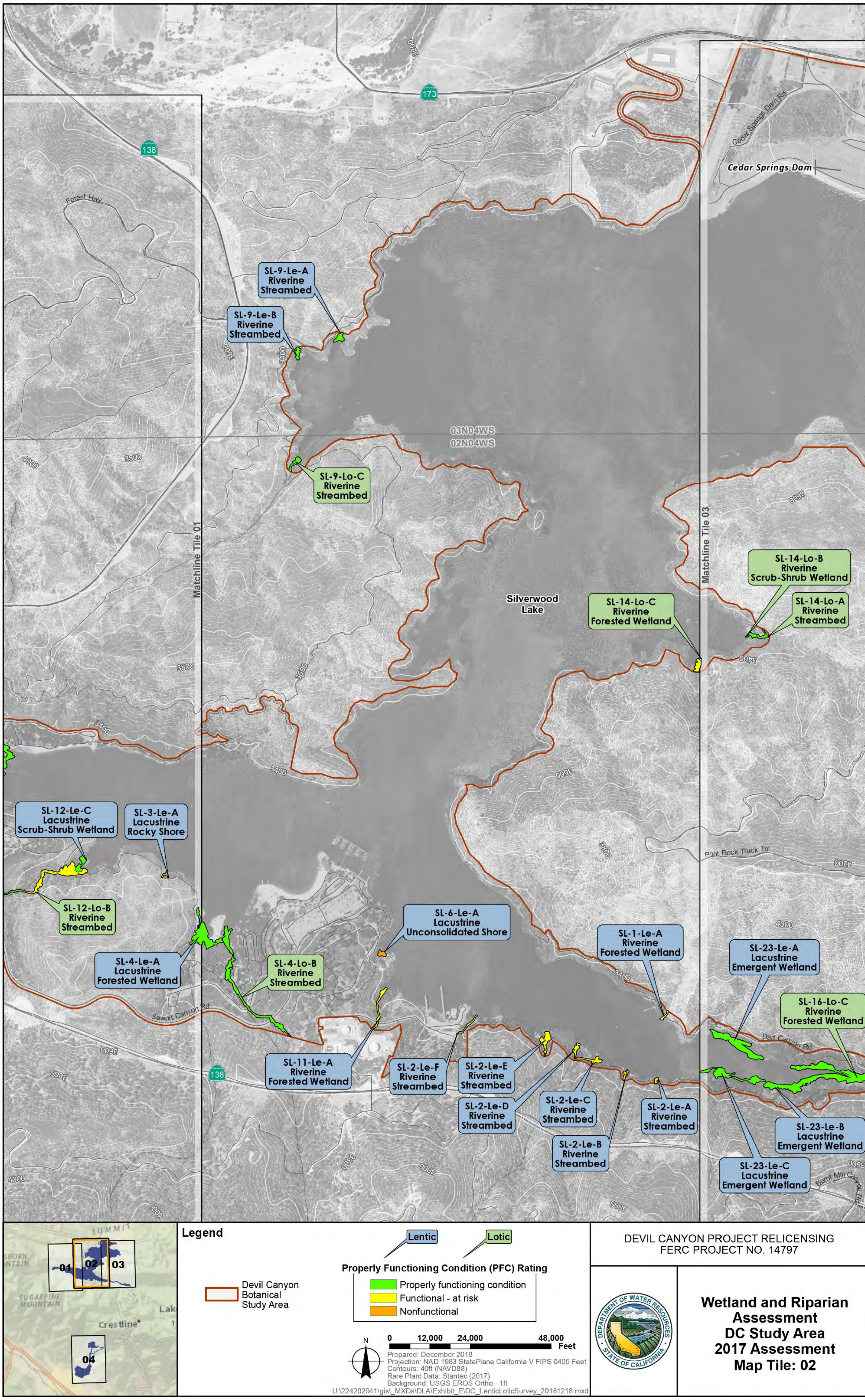


Figure 5.4.2-3. Wetland and Riparian Assessment Field Survey Results

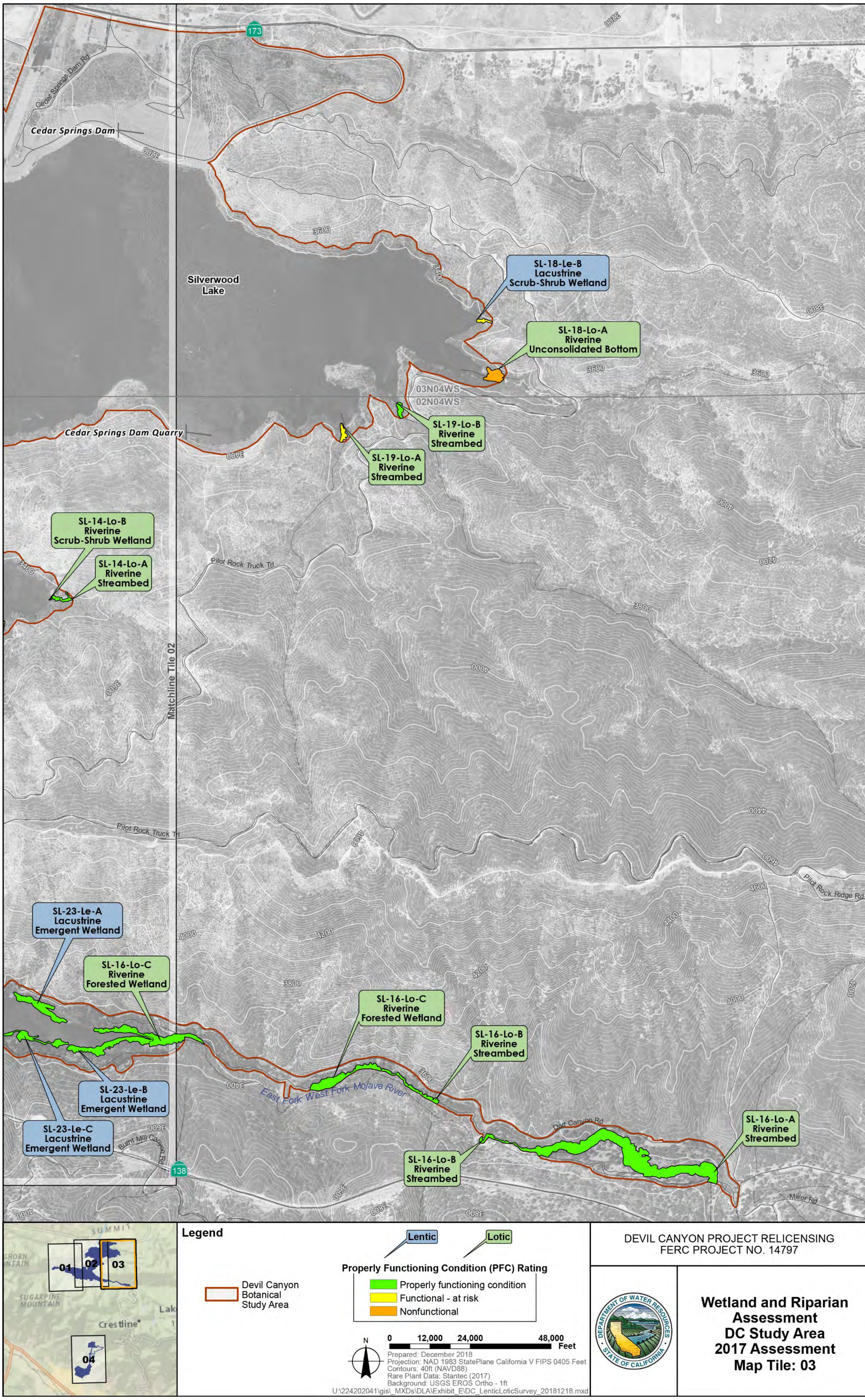


Figure 5.4.2-4. Wetland and Riparian Assessment Field Survey Results

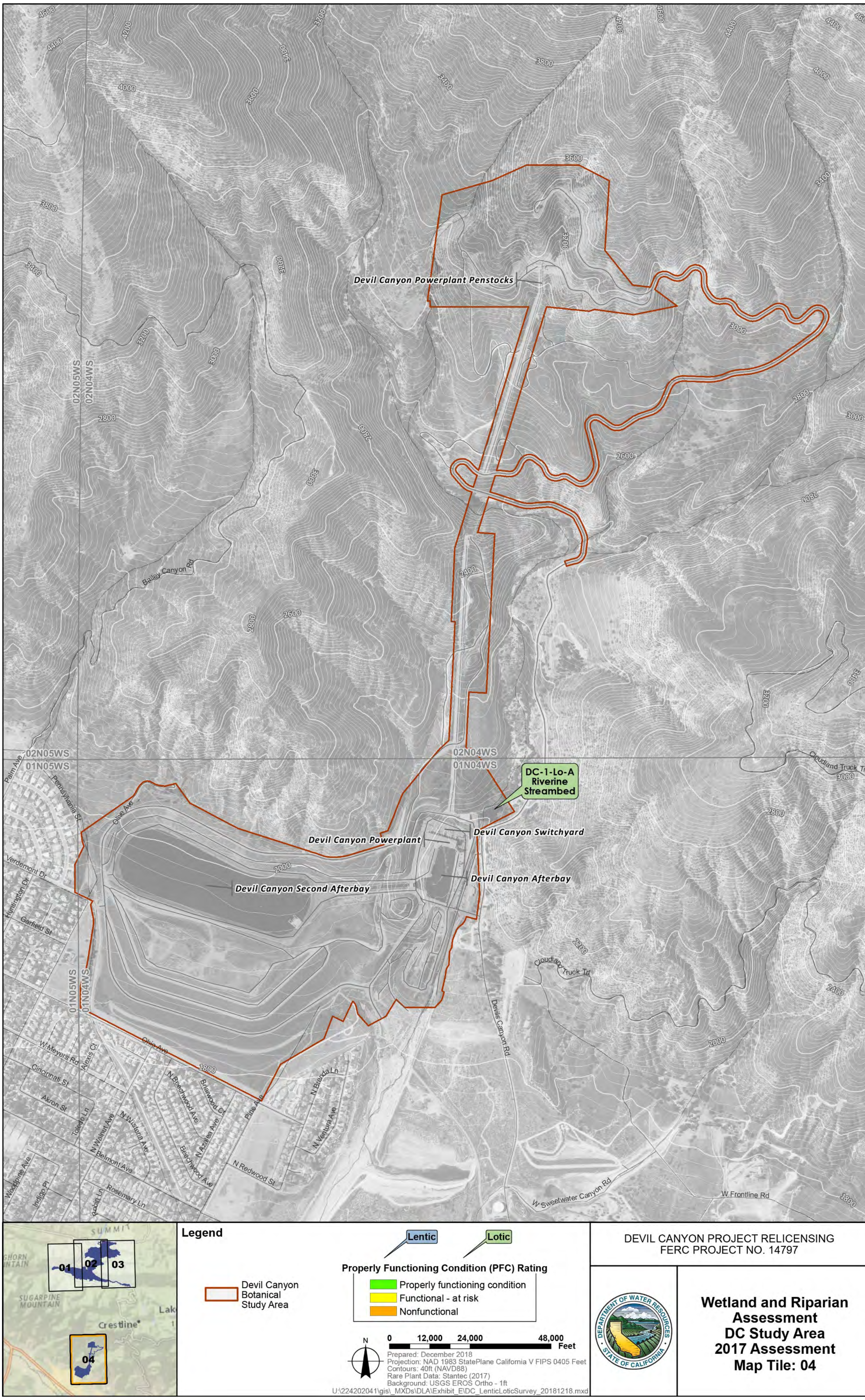


Figure 5.4.2-5. Wetland and Riparian Assessment Field Survey Results

Lentic Features

The 18 lentic areas that were assessed within the proposed Project boundary include many discontiguous areas that were similar and close in proximity but were separated by non-lentic areas or other types of lentic features. These features were combined into a single feature for purposes of analysis and reporting. These are depicted in Figures 5.4.2-2 through 5.4.2-5 and are summarized in Table 5.4.2-3.

Seven features were found to be in “Proper Functioning Condition,” nine were “Functional – at risk,” and two were “Nonfunctional.” Areas were determined to be Functional – at risk or Nonfunctional for a variety of reasons, including limited vegetative structure, riprapped shorelines, recreation/human use (e.g., foot traffic), road/trail interception, and erosion and sedimentation. None of these characteristics are a function of hydropower operations, with the exception of those at features SL-2-Le-F and SL11-Le-A, which appear to be affected by operations at the intake facility. Lake levels are maintained for the bass spawning period (per the 2003 MOU with CDFW) and consistent with other operating agreements that require maintaining lake levels during certain periods of the year.

Table 5.4.2-2. Lotic (Riparian) Features Assessed During 2017 Field Surveys

Feature ID	Location	Functional Assessment	Wetland System*	Wetland Class*	Water Regime*	Basis for Conclusion	Land Ownership
SL-14-Lo-A	East side of Silverwood Lake	Properly functioning	Riverine	Streambed	Intermittently flooded	Hydrological, vegetative, and geomorphic conditions appear stable	DWR
SL-14-Lo-B	East side of Silverwood Lake	Properly functioning	Riverine	Scrub-Shrub Wetland	Semi-permanently flooded	Hydrological, vegetative, and geomorphic conditions appear stable	DWR
SL-12-Lo-B	West of Silverwood Lake marina	Functional - at risk	Riverine	Streambed	Intermittently flooded	Reach is deeply entrenched, significant erosion observed due to management of lake levels	DWR
SL-12-Lo-A	East Fork of West Fork Mojave River	Properly functioning	Riverine	Streambed	Intermittently flooded	Hydrological, vegetative, and geomorphic conditions appear stable	DWR
SL-4-Lo-B	West of Silverwood Lake marina	Properly functioning	Riverine	Streambed	Semi-permanently flooded	Hydrological, vegetative, and geomorphic conditions appear stable	DWR
SL-9-Lo-C	Northwest arm of Silverwood Lake	Properly functioning	Riverine	Streambed	Intermittently flooded	Hydrological, vegetative, and geomorphic conditions appear stable	DPR
SL-15-Lo-A	East Fork of West Fork Mojave River	Properly functioning	Riverine	Streambed	Permanently flooded	Hydrological, vegetative, and geomorphic conditions appear stable	DWR / DPR

Table 5.4.2-2. Lotic (Riparian) Features Assessed During 2017 Field Surveys (continued)

Feature ID	Location	Functional Assessment	Wetland System*	Wetland Class*	Water Regime*	Basis for Conclusion	Land Ownership
SL-15-Lo-B	East Fork of West Fork Mojave River	Functional - at risk	Riverine	Streambed	Permanently flooded	Upland vegetation in floodplain, and limited evidence of overbank flow	DPR
SL-16-Lo-A	East Fork of West Fork Mojave River	Properly functioning	Riverine	Streambed	Permanently flooded	Hydrological, vegetative, and geomorphic conditions appear stable	DPR
SL-16-Lo-B	East Fork of West Fork Mojave River	Properly functioning	Riverine	Streambed	Permanently flooded	Hydrological, vegetative, and geomorphic conditions appear stable	DPR
SL-16-Lo-C	East Fork of West Fork Mojave River	Properly functioning	Riverine	Forested Wetland	Permanently flooded	Hydrological, vegetative, and geomorphic conditions appear stable	DPR
SL-18-Lo-A	Northeast arm of Silverwood Lake	Nonfunctional	Riverine	Unconsolidated Bottom	Intermittently flooded	Sedimentation occurring due to fluctuating lake levels	DPR
SL-19-Lo-A	Northeast arm of Silverwood Lake	Functional - at risk	Riverine	Streambed	Intermittently flooded	Area is disturbed by recreational use, riparian vegetation lacking in structural diversity and density	DPR
SL-19-Lo-B	Northeast arm of Silverwood Lake	Properly functioning	Riverine	Streambed	Intermittently flooded	Hydrological, vegetative, and geomorphic conditions appear stable	DPR

Table 5.4.2-2. Lotic (Riparian) Features Assessed During 2017 Field Surveys (continued)

Feature ID	Location	Functional Assessment	Wetland System*	Wetland Class*	Water Regime*	Basis for Conclusion	Land Ownership
SL-14-Lo-C	East side of Silverwood Lake	Functional - at risk	Riverine	Forested Wetland	Intermittently flooded	Incised banks, confined in very steep, deep canyon, riparian vegetation appears to be transitioning to upland vegetation	DWR
DC-1-Lo-A	Near Devil Canyon Powerplant	Properly functioning	Riverine	Forested Wetland	Semi-permanently flooded	Hydrological, vegetative, and geomorphic conditions appear stable	DWR

Note:
**Classification Source: Cowardin 1979*
Key:
DC = Devil Canyon
DPR = California Department of Parks and Recreation
DWR = California Department of Water Resources
Lo = lotic
SL = Silverwood Lake

Table 5.4.2-3. Lentic (Wetland) Features Assessed During 2017 Field Surveys

Feature ID	Location	Functional Assessment	Wetland System*	Wetland Class*	Water Regime*	Basis for Conclusion	Land Ownership
SL-23-Le-B	East Fork of West Fork Mojave River	Properly functioning	Lacustrine	Emergent Wetland	Permanently flooded	Hydrological, vegetative, and erosion/deposition conditions appear to be functioning properly	DPR
SL-23-Le-A	East Fork of West Fork Mojave River	Properly functioning	Lacustrine	Emergent Wetland	Permanently flooded	Hydrological, vegetative, and erosion/deposition conditions appear to be functioning properly	DPR
SL-23-Le-C	East Fork of West Fork Mojave River	Properly functioning	Lacustrine	Emergent Wetland	Permanently flooded	Hydrological, vegetative, and erosion/deposition conditions appear to be functioning properly	DPR
SL-18-Le-B	Northeast arm of Silverwood Lake	Functional – at risk	Lacustrine	Scrub-Shrub Wetland	Semi-permanently flooded	Fluctuation of water levels, expansion of riparian vegetation is restricted	DPR
SL-2-Le-A	Near East Fork of West Fork Mojave River	Functional – at risk	Riverine	Streambed	NA	Fluctuation of water levels, expansion of riparian vegetation is restricted, lack of structure and diversity of riparian vegetation	DPR
SL-1-Le-A	Near East Fork of West Fork Mojave River	Functional – at risk	Riverine	Forested Wetland	NA	Soils not sufficiently saturated to maintain riparian-wetland vegetation	DPR

Table 5.4.2-3. Lentic (Wetland) Features Assessed During 2017 Field Surveys (continued)

Feature ID	Location	Functional Assessment	Wetland System*	Wetland Class*	Water Regime*	Basis for Conclusion	Land Ownership
SL-2-Le-B	Near East Fork of West Fork Mojave River	Functional - at risk	Riverine	Streambed	NA	Upstream trail and rock wall affect hydrology, expansion of riparian vegetation is restricted, lack of structure and diversity of riparian vegetation	DPR
SL-2-Le-C	Near East Fork of West Fork Mojave River	Functional - at risk	Riverine	Streambed	NA	Fluctuation of water levels, riparian vegetation appears stressed, sandy soils limit soil saturation	DPR
SL-11-Le-A	Near San Bernardino Tunnel Intake	Functional - at risk	Riverine	Forested Wetland	NA	Hydrology appears to be affected by operations at the intake facility	DWR
SL-12-Le-C	West of Silverwood Lake marina	Properly functioning	Lacustrine	Scrub-Shrub Wetland	Semi-permanently flooded	Hydrological, vegetative, and erosion/deposition conditions appear to be functioning properly	DWR
SL-2-Le-E	Near East Fork of West Fork Mojave River	Functional - at risk	Riverine	Streambed	NA	Feature is culverted and confined by adjacent slopes, riparian-wetland vegetation lacking in structure and diversity	DWR

Table 5.4.2-3. Lentic (Wetland) Features Assessed During 2017 Field Surveys (continued)

Feature ID	Location	Functional Assessment	Wetland System*	Wetland Class*	Water Regime*	Basis for Conclusion	Land Ownership
SL-2-Le-F	Near San Bernardino Tunnel Intake	Functional - at risk	Riverine	Streambed	NA	Channelized area appears to be affected by operations at the intake facility, riparian-wetland vegetation lacking in structure and diversity	DWR
SL-2-Le-D	Near East Fork of West Fork Mojave River	Functional - at risk	Riverine	Streambed	NA	Channel confined by slope, road crosses channel upstream	DPR
SL-3-Le-A	West of Silverwood Lake marina	Nonfunctional	Lacustrine	Rocky Shore	NA	Disturbed area with altered hydrology, trail crossings, minimal riparian-wetland vegetation that is lacking in structural diversity	DWR
SL-4-Le-A	West of Silverwood Lake marina	Properly functioning	Lacustrine	Forested Wetland	Semi-permanently flooded	Hydrological, vegetative, and erosion/deposition conditions appear to be functioning properly	DWR
SL-9-Le-A	Northwest arm of Silverwood Lake	Properly functioning	Riverine	Streambed	NA	Hydrological, vegetative, and erosion/deposition conditions appear to be functioning properly	DPR

Table 5.4.2-3. Lentic (Wetland) Features Assessed During 2017 Field Surveys (continued)

Feature ID	Location	Functional Assessment	Wetland System*	Wetland Class*	Water Regime*	Basis for Conclusion	Land Ownership
SL-9-Le-B	Northwest arm of Silverwood Lake	Properly functioning	Riverine	Streambed	NA	Hydrological, vegetative, and erosion/deposition conditions appear to be functioning properly	DPR
SL-6-Le-A	Near Silverwood Lake marina	Nonfunctional	Lacustrine	Unconsolidated Shore	Semi-permanently flooded	Confined by topography and nested within a rocky shore, observable wave erosion, disturbance from foot traffic due to recreational use	DWR

Note:
**Classification Source: Cowardin 1979*
Key:
DC = Devil Canyon
DPR = California Department of Parks and Recreation
DWR = California Department of Water Resources
Le = lentic
NA = not applicable
SL = Silverwood Lake

5.4.2.2 Effects of DWR's Proposal

This section discusses the potential environmental effects of DWR's Proposal, as described in Section 5.4.2.1, on wetland, riparian and littoral habitats. DWR's Proposal includes two measures related to wetland, riparian and littoral habitats: Measure WR1 and Measure TR1. Measure WR1 would continue water surface elevation limitations described in the 1968 USFS MOU, as amended, and 2003 CDFW MOU. Measure TR1 would implement the IVMP included in Appendix A.

The IVMP includes measures for controlling non-native plant species, protecting special-status species, and re-vegetating certain areas disturbed by Project O&M activities.

As described above, two lotic features (SL-12-Lo-B and SL-18-Lo-A) and two lentic features (SL-2-Le-F and SL-11-Le-A) appear to be experiencing incision and erosion due to managed lake levels. Although no changes in lake level management are expected, further incision and erosion of these areas can continue to be expected over the term of the new license. Recreational use associated with Project facilities may continue to affect properly functioning conditions of some features, as described above. These effects are considered to be minor.

5.4.2.3 Unavoidable Adverse Effects

Continued management of lake levels is expected to result in ongoing, unavoidable adverse Project effects to four lotic and lentic features (two lotic, two lentic). Continued recreational activities are expected to contribute to ongoing, unavoidable adverse effects to additional lentic and lotic features that were determined to be nonfunctional or functional – at risk (12 additional features beyond those determined to be caused by lake level fluctuation). Measures TR1 and WR1 would mitigate for certain unavoidable effects of continued Project operations on lentic and lotic features.

5.4.3 Federal Endangered Species Act Listed and Candidate Species

This section provides information regarding species listed as federal endangered (FE), federal threatened (FT), candidates under review, and proposed for listing under the ESA that are known or have the potential to be affected by the Project. In addition to this general introductory information, and background information and definitions of terms provided below, this section is divided into two subsections. Section 5.4.3.1 describes existing Project conditions, including DWR's efforts to identify ESA-listed and candidate species potentially affected by the Project and a species account that includes a brief life history, status, and any known occurrences and abundance within and near the proposed Project boundary. The potential effects of the Project, and DWR's proposed PM&E measures are described in Section 5.4.3.2.

DWR augmented existing, relevant, and reasonably available information regarding potentially affected ESA-listed species by conducting the following three studies: (1) *ESA-Listed Bird Species, Southwestern Willow Flycatcher and Least Bell's Vireo*

Habitat Evaluations Study Approach; (2) *ESA-Listed Plant Species Study Approach*; and (3) *ESA-Listed Terrestrial Wildlife Species – California Wildlife Habitat Relationships Study Approach*. The results of these studies are incorporated into this section. Refer to the Devil Canyon Project Relicensing Website (http://devil-canyon-project-relicensing.com/studies/) for the detailed study approach, study summary, and detailed study data. In addition, if DWR made any incidental observations of ESA-listed species during its other relicensing studies, the incidental observations are noted in this section.

Generally, Section 5.4.3 provides the basis upon which consultation may be conducted between FERC and USFWS. For the purpose of these ESA consultations:

- FERC is the Action Agency.
- The Proposed Action is the issuance of a new license to DWR for the Devil Canyon Project as proposed by DWR in this Application for New License.
- The Action Area is the area within the proposed Project boundary (as proposed by DWR in this Application for New License) and the West Fork Mojave River and adjacent areas downstream of Cedar Springs Dam. Under the ESA, the Action Area is defined as “all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action” (50 CFR § 402.02). The downstream extent of the Action Area is defined as the point where the effects of DWR’s Proposal are no longer measurable.
- The Environmental Baseline includes the past and present effects of all federal, State, or private activities, and other human activities in the Action Area, as well as the anticipated effects of all proposed federal projects in the Action Area that have already undergone formal or early ESA Section 7 consultation, and the effect of State or private actions that are contemporaneous with the consultation in process (50 CFR § 402.02). The Environmental Baseline includes effects attributable to the existence of dams or hydropower facilities and O&M to maintain those structures.
- Direct effects are defined as “the direct or immediate effects of the Proposed Action on the species or its habitat” (USFWS and NMFS 1998).
- Indirect effects are defined as “those that are caused by the Proposed Action and are later in time, but still are reasonably certain to occur” (50 CFR § 402.02).
- Cumulative effects are those effects that occur in conjunction with DWR’s Proposal and with other non-federal projects in the Action Area. The major non-federal project in the Action Area is the SWP.
- No anticipated interrelated or interdependent actions are associated with the Proposed Action, at this time. Interrelated actions are those private actions that

are part of a larger action and depend on the larger action for their justification. Interdependent actions are those private actions having no independent utility apart from the Proposed Action (50 CFR § 402.02). If a particular private activity would not occur "but for" the occurrence of the proposed federal action, the effects of that private action are interdependent and interrelated to the federal action, and the effects of that private action are attributable to the federal action for consultation purposes. To the contrary, activities that would occur anyway, with or without the occurrence of the federal action at issue, are not interdependent or interrelated to the proposed federal action. The ESA Consultation Handbook (USFWS and NMFS 1998) further clarifies that if a project would exist independently of a proposed action, it cannot be considered interrelated or interdependent, even if the proposed action is required to bring the existing facility into compliance with federal law.

5.4.3.1 Existing Environment

Identification of ESA-Listed Species

DWR developed the list of ESA-listed species known, or with the potential, to occur in the Project vicinity by first querying the USFWS' online Information for Planning and Consultation (IPaC) to generate an unofficial list of FE, FT, and proposed endangered, threatened, and candidate species that should be considered as part of any future effects analysis of the Proposed Action (USFWS 2015). The initial query performed for the PAD was repeated on March 8, 2018, with no changes to the list (USFWS 2018i). In addition, DWR accessed existing species records through the California Native Plant Society Online Inventory of Rare and Endangered Vascular Plants of California (California Native Plant Society 2015 and 2018); and the CDFW CNDDB (CDFW 2015 and 2018a). Plant species records were also reviewed on the CalFlora website (CalFlora 2018). 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). The search covered approximately 493 square miles and included an approximate minimum five-mile buffer of the proposed Project boundary. This is an area much larger than that potentially affected by DWR's Proposal, but was intended to ensure a comprehensive initial list. Species for which the National Marine Fisheries Service and USFWS have been petitioned to list and that are under petition review or under 12-month status review after a substantial finding, but that have not been listed or proposed for listing, are not discussed in this section.

DWR's initial IPaC search resulted in a list of 25 species. DWR then researched the known distribution, habitat associations, and requirements of these 25 species to exclude from further consideration species known to be endemic to restricted geographic areas and habitat types not found within the proposed Project boundary or nearby area. DWR found 11 of the 25 species listed by IPaC have no known occurrences within the Action Area or nearby area, and the Action Area is not within these species' known native range. The 11 species excluded from further consideration included:

- Delphi Sands flower-loving fly (*Rhaphiomidas terminatus abdominalis*) (FE)
- Mojave desert tortoise (*Gopherus agassizii*) (FT)
- Stephen's kangaroo rat (*Dipodomys stephensi*) (FE)
- Cashenbury buckwheat (*Eriogonum ovalifolium* var. *vineum*) (FE)
- Southern mountain buckwheat (*Eriogonum kennedyi* var. *austromontanus*) (FT)
- Cushenbury oxytheca (*Oxytheca* [=*Acanthoscyphus*] *parishii* var. *goodmaniana*) (FE)
- Bear Valley sandwort (*Eremogone* [=*Arenaria*] *ursina*) (FT)
- Braunton's milk-vetch (*Astragalus brauntonii*) (FE)
- Ash-gray paintbrush (*Castilleja cinerea*) (FT)
- San Diego ambrosia (*Ambrosia pumila*) (FE)
- Parish's daisy (*Erigeron parishii*) (FT)

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 and there is no potential for effects resulting from DWR's Proposal on this species.

On the basis of this initial analysis, DWR identified 13 species that are listed as FE or FT, and have the potential to be affected by DWR's Proposal. These include one fish, three amphibians, four birds, one mammal, and four plants. Each of these species, including information regarding their status, habitat associations, and known occurrences within or near the Action Area, is listed in Table 5.4.3-1. No candidate or proposed species were identified.

Only three of the 13 species (Mohave tui chub, arroyo toad, and southern mountain yellow-legged frog [SMYLF]) have been documented within the Action Area, primarily before construction of Cedar Springs Dam and the existence of Silverwood Lake. However, the Action Area is within the historical range of each of these 13 species, with the possible exception of Nevin's barberry, a species known to sometimes occur from transplants outside of the species' natural range.

Table 5.4.3-1. ESA-Listed Species Potentially Affected by DWR's Proposal

Common Name (*Scientific Name*)	**Status**	**Habitat Associations**	**Known Historical or Recent Occurrences in Project Vicinity Quadrangles**
Mohave Tui Chub (*Siphateles [Gila] bicolor mohavensis*)	FE SE FP	Fish endemic to Mojave River drainage in deep pools and sloughs, and introduced at a few locations outside of the historical range	SWL, LAR, CAJ, and HES quadrangles, including historical records at the current location of Silverwood Lake, but no recent records; almost certainly extirpated
Arroyo Toad (*Anaxyrus [=Bufo] californicus*)	FE SSC	Breeds in low-gradient perennial and seasonal streams; terrestrial habitat is within associated riparian and adjacent upland areas	SWL, LAR, and CAJ quadrangles, including historical records at the current location of Silverwood Lake; includes recent records in Cajon Wash and Mojave River drainages
California Red-Legged Frog (*Rana draytonii*)	FT SSC	Largely aquatic except during dispersal, summer aestivation, and foraging in riparian areas; breeds in still or slow-moving water, but not in large lakes or reservoirs	SWL, LAR, and HAM quadrangles; no recent records
Southern Mountain Yellow-Legged Frog (*Rana muscosa*)	FE SE	Highly aquatic in moderate to high elevation mountain streams, permanent ponds, and lakes, particularly where fish have not been introduced; believed to be largely extirpated in the San Bernardino Mountains	SWL, LAR, SBN, HAM, and DEV quadrangles, including historical records in the current location of Silverwood Lake; only one site with recent records (City Creek in HAM quadrangle)
California Condor (*Gymnogyps californianus*)	FE SE FP	Soaring bird that seeks carrion in open habitats and nests mostly in cavities on escarpments and in hollows of old growth conifers	None; species is wide-ranging and could fly over the area
Coastal California Gnatcatcher (*Polioptila californica californica*)	FT SSC	Non-migratory songbird associated with coastal sage scrub and chaparral in coastal California to Baja California, Mexico, mostly below 2,000 feet elevation	SBN and DEV quadrangles; recent occurrences within Santa Ana River drainage
Least Bell's Vireo (*Vireo bellii pusillus*)	FE SE	Migratory songbird breeding in dense riparian habitat and adjacent chaparral in river valleys from interior northern California to Baja California, Mexico	SBN, HAM, and DEV quadrangles; recent occurrences within Santa Ana River drainage

Table 5.4.3-1. ESA-Listed Species Potentially Affected by DWR's Proposal (continued)

Common Name (*Scientific Name*)	Status	Habitat Associations	Known Historical or Recent Occurrences in Project Vicinity Quadrangles
Southwestern Willow Flycatcher (*Empidonax traillii extimus*)	FE SE	Migratory songbird breeding in dense riparian thickets along streams and wetlands	CAJ and HAM quadrangles; recent occurrences within Santa Ana River drainage
San Bernardino Merriam's Kangaroo Rat (*Dipodomys merriami parvus*)	FE	Found in alluvial scrub habitat on floodplains and adjacent uplands within San Bernardino, Menifee, and San Jacinto valleys.	DEV, SBN, and HAM quadrangles; recent occurrences within Santa Ana River drainage
Slender-horned Spineflower (*Dodecahema leptoceras*)	FE SE	Annual herb found on floodplain terraces and sandy benches with alluvial fan scrub vegetation at about 660 to 2,300 feet elevation	SBN and DEV quadrangles; recent occurrences within Santa Ana River drainage
Nevin's Barberry (*Berberis nevinii*)	FE SE	Perennial native to chaparral and in washes with scattered occurrences in Riverside, Los Angeles, and San Bernardino counties at 1,400 to 2,000 feet elevation; known occurrences include transplants outside of natural range	HAM quadrangle (extirpated); Project is likely outside of species range, where occurrences would be limited to transplants
Santa Ana River Woolly-star (*Eriastrum densiflorum* ssp. *sanctorum*)	FE SE	Perennial sub-shrub found on infrequently flooded, open, sandy, high alluvial terraces mostly in the Santa Ana River drainage at 500-2,000 feet elevation	DEV quadrangle; recent occurrences within Santa Ana River drainage
Thread-leaved Brodiaea (*Brodiaea filifolia*)	FT SE	Perennial herb in moderately wet to occasionally moist grasslands, on floodplains or associated with vernal pools at 200 to 1,000 feet elevation	SBN quadrangle; recent occurrences within Santa Ana River drainage.

Note:
No federal candidates or proposed species were identified, and none of these species is listed by USFS as sensitive.
Key:
USGS 7.5 minute topographic quadrangles: CAJ = Cajon, DEV = Devore, HAM = Harrison Mountain, HES = Hesperia, LAR = Lake Arrowhead, SBN = San Bernardino North, SWL = Silverwood Lake
Status: FE = Federal endangered, FT = Federal threatened, FP = California fully protected, SE = California State endangered, SSC = California State species of special concern

DWR's *ESA-Listed Terrestrial Wildlife Species – California Wildlife Habitat Relationships Study Approach* was described in Section 5.4.1. This study determined that there were 11 CWHR habitat types within the proposed Project boundary. The information generated from this study helped determine where ESA-listed terrestrial species may be located in the Action Area, based on the general habitat associations of each species. The occurrence of these habitats does not necessarily signify that these areas are suitable or that the species is present or occupying the habitat.

An account of each of the 13 potentially-affected ESA-listed species is provided below.

Species Accounts

Mohave Tui Chub[29]

The Mohave tui chub was listed as endangered on October 13, 1970 (35 FR 16047). Critical Habitat has not been designated for this species. The Recovery Plan was issued on September 12, 1984 (USFWS 1984), and the results of a five-year review was issued on February 4, 2009 (USFWS 2009d). No recovery actions specific to the proposed Project boundary or nearby 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. The Mohave tui chub was extirpated (including loss of genetically pure Mohave tui chub) from nearly all of its range by 1970 as a result of the introduction of the related arroyo chub, a species which interbred and competed with Mohave tui chub; introduction of other predaceous fish species; and development of water projects which reduced flow in the Mojave River. 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 2009d) represent introductions outside of the historical range. Few areas of the Mojave River remain suitable for the species, which would at minimum require elimination of arroyo chub.

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 2009d).

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

There are five records of Mohave tui chub from the Project vicinity (CDFW 2018a). 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."

There are no known recent records of Mohave tui chub within the Action Area, where the species had likely already been extirpated by 1970 due to the spread of introduced arroyo chub.

Arroyo Toad[30]

The arroyo toad 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). The Recovery Plan was issued on July 24, 1999 (USFWS 1999), and the results of a five-year review was issued on August 17, 2009 (USFWS 2009a). 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 existed and new threats were identified (80 FR 79805). No recovery actions specific to the proposed Project boundary or the nearby 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 2009a). Known extant populations of arroyo toad occur within about 75 percent of the original range (USFWS 2009a), 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 2018b). 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

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

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 occur at the lower end of the upstream sections of third to sixth order streams (Sweet 1992, as cited by Sweet and Sullivan 2005). These 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, which are not suitable habitat and represent a barrier to dispersal, may be limited by marginal habitat conditions (e.g., inadequate hydrology) (Sweet and Sullivan 2005; USFWS 2009a).

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 studies 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 1999).

There are 15 CNDDB records of arroyo toad in the Project vicinity on Silverwood Lake, Lake Arrowhead, and Cajon quadrangles (CDFW 2018a). 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 USACE's Mojave River Forks Dam was constructed (Jennings and Hayes 1994). The CWHR identifies a general habitat association of arroyo toad to two habitat types, Mixed Chaparral and Valley Foothill Riparian, as occurring within the Action Area (CDFW 2018b).

Hitchcock and Fisher (2004) reported finding only one adult arroyo toad observed twice in the Silverwood Lake SRA 500 to 1,000 feet upstream of Silverwood Lake on the West Fork Mojave River in 2003 and 2004, but described a "large, healthy population" at Little Horsethief Canyon, a tributary of the West Fork Mojave River downstream of Cedar Springs Dam. USFWS (2009a) listed the Mojave River Basin as one of many basins where arroyo toad is affected 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 (a non-Project facility); 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 SWP aqueduct repairs to between September 1 to November 1, except during emergencies, and minimizing nighttime use of roads where arroyo toads may occur.

In a related matter, on May 1, 2017, the Center for Biological Diversity, San Bernardino Valley Audubon Society, Sierra Club, Hesperia Venture I, LLC, and Terra Verde Group, LLC entered into a Settlement and General Release Agreement regarding the proposed Tapestry Community Development, which is anticipated to break ground in early 2019 and is described in Section 5.4.3.2. The Final Environmental Impact Report for the Tapestry Community Development was issued in August 2015. The agreement binds in perpetuity Hesperia Venture I, LLC, and Terra Verde Group, LLC through a newly established homeowner's association to complete the following measures for arroyo toad and other ecological resources in the area of the former Las Flores Ranch, Horsethief Creek, and the West Fork Mojave River:

- Preserve about 1,070.6 acres of arroyo toad habitat as open space north of the proposed Project boundary within the area of the former Las Flores Ranch;
- Prepare, fund and implement an arroyo toad Habitat Management Plan;
- Provide an option for the Center for Biological Diversity to purchase 2,749.8 acres of an open space area within the former Las Flores Ranch property in lieu of residential development;
- Develop, fund, and implement a Non-Native Predators Plan for both the development area and the 2,749.8 acres (if it is not purchased);
- Develop, fund, and implement a Bullfrog Plan within the 2,749.8 acres and adjacent areas, and any open space areas that are not part of the project;
- Create wildlife corridors;
- Prohibit cattle grazing within the development area and the 2,749.8 acres of open space; and
- Prepare, fund and implement a plan to restrict off road vehicles in the 2,749.8 acres, West Fork Mojave River corridor, and the Horsethief Creek corridor.

Two observations of an individual arroyo toad (confirmed as the same individual by identical shapes and positions of warts as described by Hitchcock and Fisher 2004) within the Action Area on the West Fork Mojave River upstream of Silverwood Lake in 2003 and 2004 after three years of surveys with no other observations was not regarded by USFWS (2009a) as evidence of a population in this reach. Although the West Fork Mojave River upstream of Silverwood Lake includes areas that may appear geomorphically suitable for arroyo toad breeding (Hunt and Associates and Aspen Environmental Group 2004), this 1-mile-long reach lacks essential habitat elements (76 FR 7245).

California Red-legged Frog[31]

The California red-legged frog (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). The Recovery Plan was issued on May 28, 2002 (USFWS 2002a). A five-year review was initiated on May 25, 2011 (76 FR 30377). No recovery actions specific to the proposed Project boundary or nearby area are identified in the Recovery Plan.

The historical range of the CRLF extends through the 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 (Shaffer et al. 2004) and the other in Ventura County, both with few documented adults. Jennings and Hayes (1994) regarded populations of CRLF documented by museum records in San Bernardino County to be extinct. “Core areas” identified in the Recovery Plan (USFWS 2002a) as watersheds where recovery efforts for CRLF should be focused included Core Area 30, Forks of the Mojave, encompassing the upper Mojave River drainage, which is described as unoccupied (i.e., CRLF extirpated), but with potential for reestablishment of the species.

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.

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

[31] Photo credit: U.S. Army, California National Guard [public domain], via Wikimedia Commons

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 enough for breeding to occur and larvae to complete development) (Jennings and Hayes 1994; 71 FR 19244). Dense, shrubby riparian vegetation (e.g., willow and bulrushes [*Schoenoplectus* spp.]), 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 50.0 acres, such as Silverwood Lake, do not represent breeding or dispersal habitats (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 three 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 one 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).

The CNDDB has two records of CRLF in the Project vicinity (CDFW 2018a). An old historical location (date unknown) is reported from the Mojave River Public Camp, about three miles northeast of the present day location 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. Both occurrences are described in the CNDDB report as "presumed extant," but there are no recent sightings in either area (USFWS 2002a). A population also occurred near Victorville further downstream on the Mojave River (USFWS 2002a). The CWHR identifies a general habitat association of CRLF to the following habitat types occurring within the Action Area: Annual Grassland, Coastal Scrub, Mixed Chaparral, Montane Hardwood-conifer, Montane Hardwood, and Valley Foothill Riparian (CDFW 2018b).

There are no known records of CRLF within the Action Area.

Southern Mountain Yellow-legged Frog, Southern California Distinct Population Segment[32]

The Southern California Distinct Population Segment (DPS) of mountain yellow-legged frog 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 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) and the draft recovery plan was issued July 19, 2018 (USFWS 2018a). 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 Angeles National Forest (ANF). Adult populations at most sites are precariously small (i.e., usually 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

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

Creek, Little Rock Creek, and Devil's Canyon). Although additional undiscovered populations are possible, 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, including some subunits that are currently unoccupied.

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 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, *Batrachochytrium dendrobatidis*, 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 two 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 tags generally remained within relatively small home ranges during a four-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 2018a). 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); based on this description, the location was at of the present day location of Silverwood Lake. 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. The CWHR identifies a general habitat association of SMYLF to three habitat types occurring within the Action Area: Montane Hardwood-conifer, Montane Hardwood, and Sierran Mixed Conifer (CDFW 2018b).

There are no known recent records of SMYLF within the Action Area.

California Condor[33]

The California condor 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). The third and most recent revision of the Recovery Plan was issued on April 25, 1996 (USFWS 1996), and the results of the most recent five-year review on June 4, 2013 (USFWS 2013). No recovery actions specific to the proposed Project boundary or nearby 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 10 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 populations located in southern California, Arizona, and Baja California, Mexico, had increased to 290 by the end of 2017 (USFWS 2017a). 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

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

nest, causing impaction and often eventual death. Mortality from collisions with powerlines and electrocution of California condors perched on power-poles sometimes occurs (USFWS 2013).

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 2013). 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 2013).

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 proposed Project boundary is Sespe-Piru in the Los Padres National Forest in Ventura County, located more than 80 miles west (USFWS 2018c). CWHR did not identify potential habitat for the California condor within the proposed Project boundary (CDFW 2018b).

There are no known records of California condor within the Action Area.

Coastal California Gnatcatcher[34]

The coastal California gnatcatcher 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. The results of a five-year review were issued on September 29, 2010 (USFWS 2010a). No recovery actions specific to the proposed Project boundary or the nearby area are identified in the five-year review. On August 31, 2016, USFWS issued a finding that the coastal California gnatcatcher was a valid subspecies with continuing threats, and that therefore delisting was not warranted (81 FR 598952).

The coastal California gnatcatcher is a small, non-migratory songbird, which occurs almost exclusively in certain sub-associations of coastal sage scrub plant communities

[34] Photo credit: USFWS [public domain]

and occasionally in chaparral (58 FR 16742). Almost all known occurrences (i.e., 99 percent of records) are below 2,000 feet elevation (USFWS 2010a). 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 2010a). 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 2.0 and 14.0 acres. (USFWS 2010a).

There are six CNDDB records of this species in the Project vicinity on the San Bernardino North and Devore quadrangles (CDFW 2018a). The nearest critical habitat to the Project is located approximately 16 miles from Silverwood Lake and 13 miles from Devil Canyon Powerplant, along the Santa Ana River in San Bernardino County (USFWS 2018d). Available information, including query of the IPaC, indicates that this species does not occur near Silverwood Lake, but could occur at the lower elevations in the vicinity of the Devil Canyon Powerplant and afterbays, where patches of vegetation south and west of the Devil Canyon Second Afterbay are mapped as Coastal Scrub. These include locations where DWR planted native vegetation in 2000 as part of a mitigation project at Bailey Creek. The CWHR identifies a general habitat association of coastal California gnatcatcher primarily to Coastal Scrub, and only at low frequency to the following other habitat types occurring within the proposed Project boundary: Annual Grassland, Chamise-redshank Chaparral, Mixed Chaparral, and Valley Foothill Riparian (CDFW 2018b).

There are no known records of coastal California gnatcatcher within the Action Area.

Least Bell's Vireo[35]

The least Bell's vireo 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). The draft Recovery Plan was issued on May 6, 1998 (USFWS 1998), and the results of a five-year review were issued on September 26, 2006 (USFWS 2006). No recovery actions specific to the proposed Project boundary or the nearby 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 were the primary factors 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).

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 (CDFW 2018a). Least Bell's vireo was not detected during surveys performed to evaluate potential effects of the Horsethief Creek Check 66 Access Road Bridge Project

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

(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 2018e). The CWHR identifies a general habitat association of least Bell's vireo to one habitat type, Valley Foothill Riparian, occurring within the proposed Project boundary (CDFW 2018b).

Surveys for least Bell's vireo were performed by DWR under its relicensing *ESA-Listed Bird Species, Southwestern Willow Flycatcher and Least Bell's Vireo Habitat Evaluations Study Approach.* The surveys, which adhered to accepted protocols for surveys of this species (USFWS 2001), covered all potential habitat in the Silverwood Lake area, including areas that may be marginal in quality because of small patch size or sparse willows, distributed in nine separate locations, and a site adjacent to the Devil Canyon Powerplant (Figures 5.4.3-1a and 5.4.3-1b). An additional area of potential habitat within the proposed Project boundary north of the Devil Canyon Powerplant was not surveyed because it is at a location associated with the buried San Bernardino Tunnel. The surveyed areas included:

- Five small (i.e., 0.2 - 0.9 acre) patches of riparian vegetation in coves on Silverwood Lake accessible only by boat from the lake (Outhouse Cove, Quiet Cove, Eastern Cove, Chamise Cove and Mesa Cove);
- Rio Campground (1.4 acres) along the West Fork Mojave River;
- Cleghorn Day Use Area (11.9 acres) along the West Fork Mojave River;
- Serrano Beach (0.3 acres);
- Miller Canyon from the upper end of the lake to the Miller Canyon Group Campground (2.2 acres); and
- Devil Canyon east-northeast of the fenced Devil Canyon Powerplant along a small, intermittent drainage (1.0 acres).

Consistent with the protocols, each site was surveyed eight times during the least Bell's vireo's breeding season, with at least 10 days between survey visits for each site. There were two detections of brown-headed cowbird during the surveys, one at the Cleghorn Day Use Area and the other at Miller Canyon. No least Bell's vireos were detected by the surveys.

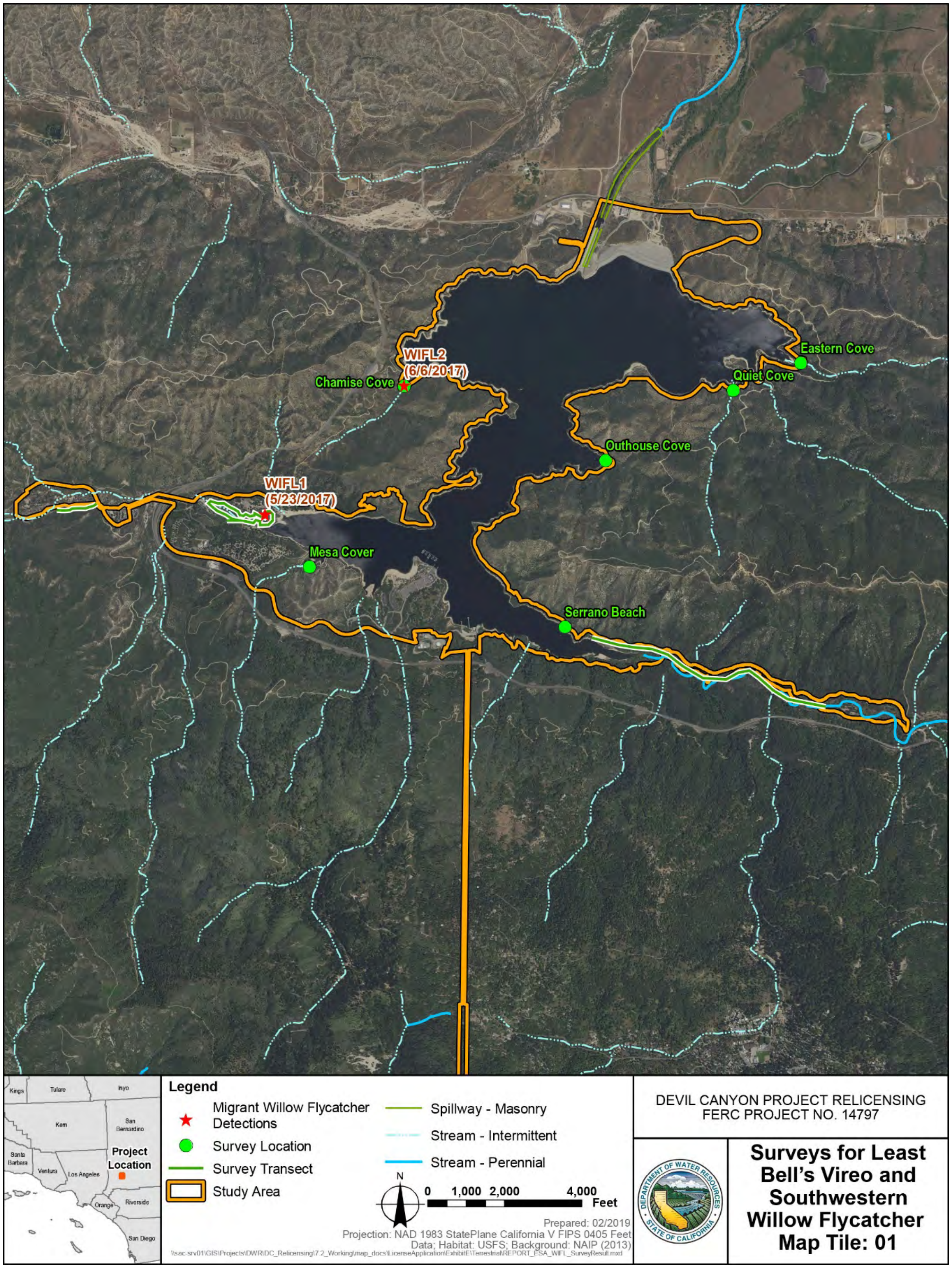


Figure 5.4.3-1a. Survey Locations and Results of DWR's Relicensing Surveys for Least Bell's Vireo and Southwestern Willow Flycatcher

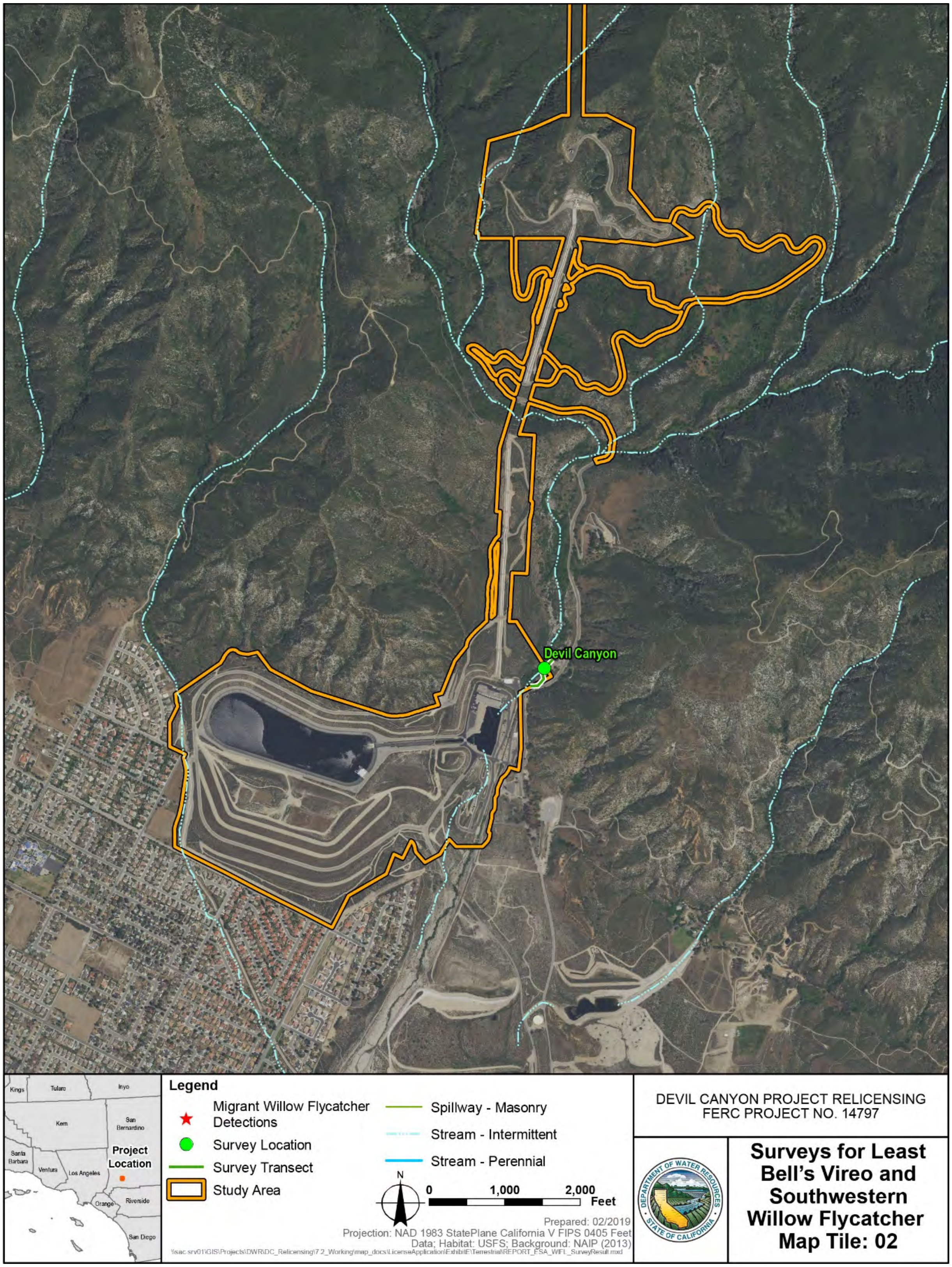


Figure 5.4.3-1b. Survey Locations and Results of DWR's Relicensing Surveys for Least Bell's Vireo and Southwestern Willow Flycatcher

Southwestern Willow Flycatcher[36]

The southwestern willow flycatcher 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). The Recovery Plan was issued on August 30, 2002 (USFWS 2002b) and the results of a five-year review were issued on December 29, 2017 (USFWS 2017b). No recovery actions specific to the proposed Project boundary or the nearby 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. Nest parasitism by brown-headed cowbirds (*Molothrus ater*) is also considered a moderate threat to southwestern flycatcher (USFWS 2017b). 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 0.3 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 2017b).

There are five CNDDB records of the southwestern willow flycatcher in the Project vicinity on the Cajon and Harrison Mountain quadrangles (CDFW 2018a). 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)

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

(USFWS 2018g). 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. CWHR does not identify potential habitat for the southwestern willow flycatcher within the proposed Project boundary (CDFW 2018b).

Surveys for southwestern willow flycatcher were performed by DWR under its relicensing *ESA-Listed Bird Species, Southwestern Willow Flycatcher and Least Bell’s Vireo Habitat Evaluations Study Approach* at the same 10 sites surveyed for least Bell’s vireo described above (Figures 5.4.3-1a and 5.4.3-1b), which included all potential flycatcher habitat in the Silverwood Lake area and potential habitat that could be affected by the Project adjacent to the Devil Canyon Powerplant. Consistent with southwestern willow flycatcher survey protocols (Sogge et al. 2010), each site was surveyed five times: one visit during Period 1 (May 15 to May 31); two visits during Period 2 (June 1 to June 24); and two visits during Period 3 (June 25 to July 17). Each visit was at least five days apart. Surveys of the sites were conducted during morning hours (prior to 10:30 a.m.) and when the temperature exceeded 13°C. Less than 3 kilometers of habitat was surveyed per day. In total, two migrant, male willow flycatchers were detected during the surveys, each of which was only detected once, and there was no evidence of breeding activity. The detections occurred at the Cleghorn Day Use Area during the first southwestern willow flycatcher survey and at Chamise Cove during the second survey, respectively (Figures 5.4.3-1a and 5.4.3-1b). Because neither detection was within the “non-migrant period” (i.e., June 15 to July 20) (Sogge et al. 2010), and since no evidence of breeding was observed, these detections likely represent migrant willow flycatchers, and the subspecies of the migrant individuals cannot be determined. There were two detections of brown-headed cowbird during the surveys, one at the Cleghorn Day Use Area and the other at Miller Canyon.

San Bernardino Merriam’s Kangaroo Rat[37]

The San Bernardino Merriam’s kangaroo rat was listed as endangered under emergency rule on January 27, 1998 (63 FR 3835) that was 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). The results of a five-year review were issued on August 14, 2009 (USFWS 2009e). No recovery actions specific to the proposed Project boundary or the nearby area are identified in the five-year review.

[37] Photo credit: USFWS [public domain]

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

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 2018a). 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 2018f). The final rule (73 FR 61936) describes Unit 4 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, indicates that San Bernardino Merriam's kangaroo rat does not occur near Silverwood Lake. The CWHR identifies a general habitat association of San Bernardino Merriam's kangaroo rat to three habitat types occurring within the proposed Project boundary, Annual Grassland, Coastal Scrub, and Mixed Chaparral (CDFW 2018b).

There are no known records of San Bernardino Merriam's kangaroo rat within the Action Area. Required alluvial fan habitat is not present within the proposed Project boundary, but occurs south of the Project associated with Bailey Creek, Devil Canyon Creek, and tributaries of Cable Creek.

Slender-horned Spineflower[38]

The slender-horned spineflower was listed as endangered on September 28, 1987 (52 FR 36265). Critical habitat has not been designated for this species. The results of a five-year review were issued on October 1, 2010 (USFWS 2010c). No recovery actions specific to the proposed Project boundary or the nearby 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 2010c). 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 2010c).

There are five CNDDB records of slender-horned spineflower in the Project vicinity, all from the Cajon and Harrison Mountain quadrangles (CDFW 2018a). 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 and afterbays, if there is suitable habitat.

Surveys for ESA-listed plants were performed by DWR under its relicensing *ESA-Listed Plant Species Study Approach*. Systematic floristic surveys of the proposed Project boundary area, excluding some areas of steep terrain that could not be surveyed safely on foot, were performed between April 4 and June 16, 2017 in conjunction with DWR's relicensing *Botanical Resources Study Approach* field surveys. Slender-horned spineflower was not found, nor were any other ESA-listed plants. Suitable habitat for slender-horned spineflower was not observed.

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

Nevin's Barberry[39]

Nevin's barberry 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). The results of a five-year review were issued on August 14, 2009 (USFWS 2009b). No recovery actions specific to the proposed Project boundary or the nearby 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 2018a), 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).

As described above, surveys for ESA-listed plants were performed by DWR under its relicensing *ESA-Listed Plant Species Study Approach*. Nevin's barberry was not found, although potential habitat occurs.

[39] 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

Santa Ana River Woolly-star[40]

The Santa Ana River woolly-star was listed as endangered on September 28, 1987 (52 FR 36265). Critical habitat has not been designated for this species. The results of a five-year review were issued on October 29, 2010 (USFWS 2010b). No recovery actions specific to the proposed Project boundary or the nearby 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 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 2010b).

There are four CNDDB records of this species in the Project vicinity, all from the Devore quadrangle (CDFW 2018a). There are no records of this species from the Mojave River drainage. Available information, including query of the IPaC, indicated that this species does not occur near Silverwood Lake, but could occur in the vicinity of the Devil Canyon Powerplant and afterbays, if there is suitable habitat.

As described above, surveys for ESA-listed plants were performed by DWR under its relicensing *ESA-Listed Plant Species Study Approach*. Santa Ana River woolly-star was not found by the surveys, and suitable habitat for Santa Ana River woolly-star was not observed.

[40] Photo credit: Ken Corey, USFWS [public domain], via Wikimedia Commons

Thread-leaved Brodiaea[41]

The thread-leaved brodiaea 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). The results of a five-year review were issued on August 13, 2009 (USFWS 2009c). No recovery actions specific to the proposed Project boundary or the nearby 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 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, from Arrowhead Hot Springs and a second location near the Hot Springs (CDFW 2018a). 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 2018h). 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 and afterbays, if there is suitable habitat.

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

As described above, surveys for ESA-listed plants were performed by DWR under its relicensing *ESA-Listed Plant Species Study Approach*. Thread-leaved brodiaea was not found by the surveys, and suitable habitat for thread-leaved brodiaea was not observed.

5.4.3.2 Effects of DWR's Proposal

This section describes potential effects of the Proposed Action on ESA-listed species. DWR's Proposal is described in Section 2.0. For the reasons stated below, DWR has proposed one specific measure related to ESA-listed species: (1) Measure TR1 would implement the IVMP included in Appendix A. The plan specifies that herbicides shall not be applied in sensitive habitat areas and that pre-construction assessments will be completed.

Three possible conclusions exist regarding the Proposed Action's effects on listed species under the ESA (USFWS and NMFS 1998). These conclusions are as follows:

- No effect. This conclusion is appropriate when it is determined that a proposed action will not affect a listed species or designated critical habitat.
- May affect, but is not likely to adversely affect. This conclusion is appropriate when effects of a proposed action on ESA protected species are expected to be discountable, insignificant, or completely beneficial. "Insignificant effects relate to the size of the impact, and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur" (USFWS and NMFS 1998).
- May affect, is likely to adversely affect. This conclusion is appropriate if any adverse effect to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not discountable, insignificant or beneficial.

An important distinction when assessing the Proposed Actions' effects is the Action Agency's (i.e., FERC's) discretionary versus non-discretionary activities. Non-discretionary activities usually include those that are required by law, required for facility or public safety, or water rights, and are binding agreements that cannot be altered by FERC. Discretionary activities include most other Project activities. Where DWR has concluded that the effect on the ESA-listed species is a cumulative effect, DWR has attempted to describe the portion of the effect that occurs as a result of the Proposed Action.

Constituent Components of the Proposed Action

This section clearly identifies and geographically distinguishes the individual constituent components of the Proposed Action as either: (1) constituent components that will have no effect to ESA-listed species or their critical habitats; or (2) constituent components that may affect ESA-listed species or their critical habitats.

The Proposed Action constituent components that will have no effect on ESA-Listed species or their critical habitats are generally legal (e.g., comply with a law) or administrative (e.g., filing of a plan), and those that require monitoring but do not include adaptive management (i.e., the plan does not include a change in Project operations that would be triggered by the monitoring results). In particular, DWR's Proposal would have no effect on flow in the West Fork Mojave River downstream of Cedar Springs Dam—all natural inflow into Silverwood Lake is released into the West Fork Mojave River consistent with water supply agreements and water rights consistent with a court decree (see Exhibit B). FERC is not required to consult with USFWS under Section 7 of the ESA on Proposed Action constituent components that FERC determines will have no effect.

Proposed Action constituent components that may affect ESA-listed species or their critical habitats are primarily related to ground-disturbing activities, vegetation management, access, and recreation. FERC is required to consult with USFWS under Section 7 of the ESA on Proposed Action constituent components that FERC determines may affect ESA-listed species. These constituent components are discussed below.

<u>Fish Stocking in Silverwood Lake</u>

The Project will continue stocking fish for a recreational fishery at Silverwood Lake and some of these fish will have the potential to move downstream into the West Fork Mojave River from spills and water transfers. Generally, continued reservoir fish stocking has the potential to affect ESA-listed fish or other aquatic or semi-aquatic species, especially aquatic-breeding amphibians, from predation or competition. However, Silverwood Lake is unlikely to support any ESA-listed species. Downstream passage of stocked fish from spills or water transfers contributes to introduced fish populations in the West Fork Mojave River; although introduced fish of greatest concern in the West Fork Mojave River (e.g., arroyo chub, green sunfish, and mosquitofish) are not stocked, and have presumably established from escapes of bait fish, water transfers of the SWP, and deliberate releases for mosquito control.

<u>Normal O&M of Dams and Powerhouses, including DWR Access for O&M</u>

Normal O&M of Cedar Springs Dam and the Devil Canyon Powerplant will continue to occur, including required O&M access to these facilities by Project personnel. Generally, the potential for normal O&M of such constructed facilities that are devoid of vegetation to affect ESA-listed species is limited. O&M-related access on Project roads could be a source of disturbance if ESA-listed species occur near these roads.

<u>Vegetation Management</u>

Vegetation management, including control of non-native invasive species and trimming or removing unwanted vegetation around Project facilities, will continue to occur and has the potential to affect ESA-listed plants and terrestrial wildlife, if these species occur in vegetation management locations. Vegetation management will include provisions to avoid sensitive resources, and implementation of these provisions will make effects to ESA-listed species unlikely. Refer to DWR's proposed IVMP for a detailed discussion of vegetation control, including use of herbicides.

Ongoing Recreational Use of Silverwood Lake

Recreational use of Silverwood Lake and adjacent parts of the Silverwood Lake SRA within the proposed Project boundary will continue to occur, including fishing, boating, camping, picnic day use, hiking, horseback riding, and nature/wildlife viewing. Such activities have the potential to affect ESA-listed species by increased human presence (e.g., disturbance of nesting birds or trampling vegetation) or inadvertent or illegal introduction (e.g., escape of bait fish, which are illegal at Silverwood Lake) of invasive species. General measures to limit effects of recreational use on sensitive resources (e.g., signage, trail designations, and boat inspections for invasive species) would also be protective of ESA-listed species, if present within the proposed Project boundary and areas downstream of Cedar Spring Dam that could be affected by water releases or spills.

Silverwood Lake Water Surface Fluctuations

Minor fluctuations in water surface elevation will continue to occur at Silverwood Lake. Because Silverwood Lake is unlikely to support any ESA-listed species, no effects to ESA-listed species from water level fluctuations are foreseeable.

Capture of Sediment and Large Woody Material in Silverwood Lake

Silverwood Lake will continue to store water and capture sediment and large woody material that would otherwise move downstream. The general effects of reduced sediment and large woody debris in streams below other impoundments include changes in instream habitat structure, such as fewer pools and loss of spawning gravel, and indirect effects on riparian vegetation. However, there is no evidence that these general and indirect effects documented elsewhere are applicable to the Mojave River or are pertinent to ESA-listed species downstream of the Project, where the only ESA-listed fish species, Mohave tui chub, no longer occurs in the Mojave River. The breeding pool habitat requirements of arroyo toad are maintained by periodic flooding that redistributes sediments and scours encroaching vegetation. Reduction in instream large woody debris is unlikely to affect arroyo toad, a species not associated with deep, stable pools.

Passage of Water through Silverwood Lake

Water will continue to pass through Silverwood Lake to the West Fork Mojave River, which could affect aquatic organisms downstream of Cedar Springs Dam if water temperatures or water quality are impaired. Although largely independent of Project operations, water temperature could be affected by release schedules. However, there is no evidence that water temperature or water quality are significantly affected, and no effects to ESA-listed species downstream of the Project (i.e., arroyo toad) related to water temperature or water quality are known to occur.

Conclusions Regarding Project Action Effects by Species

Mohave Tui Chub

Mohave tui chub is the only ESA-listed fish species with potential to occur in the Mojave River drainage. Mohave tui chub occurred historically within the Action Area. However, the species has since been extirpated and is not known to still occur in Silverwood Lake, the Mojave River, or its tributaries. This species has been cumulatively affected by water development projects in the Mojave River basin, which have altered the hydrology of the river and indirectly introduced competing and predatory fish downstream. Reestablishing Mohave tui chub in perennial sections of the Mojave River is not feasible without first eliminating arroyo chub. The remaining known populations of Mohave tui chub are in isolated locations with no surface connection to the Mojave River, and are, therefore, not affected in any way by the Project, including the downstream movement of stocked fish from Silverwood Lake; nor does the Project affect critical habitat, which has not been designated for Mohave tui chub. Therefore, the Proposed Action would have no effect on Mohave tui chub.

Arroyo Toad

The Proposed Action has a limited potential to affect arroyo toad. The only known report of arroyo toad within the Action Area since just after Silverwood Lake was formed in 1972 was an adult arroyo toad observed repeatedly in the Silverwood Lake SRA upstream of Silverwood Lake in 2003 and 2004 (Hitchcock and Fisher 2004). The reservoir is not suitable habitat and the West Fork Mojave River upstream of the reservoir lacks essential habitat elements to support an arroyo toad population. USFWS (2009a) described Cedar Springs Dam and Silverwood Lake as an “insurmountable barrier to further movement upstream.”

Although arroyo toad occurs downstream of the Project, the species is evidently absent between Cedar Springs Dam and the confluence of Horsethief Creek (HELIX Environmental Planning, Inc. 2014), most likely because of unsuitable habitat, including extensive deep pools with emergent vegetation associated with beaver dams (Ramirez 2003, as cited by Aspen Environmental Group 2006).

DWR was engaged in USFWS ESA consultation associated with the Horsethief Creek Check 66 Access Road Bridge Project and implemented a series of protective mitigation measures for arroyo toad, including: intensive surveys for arroyo toads in advance of the project along Horsethief Creek and the Check 66 Access Road; radio-telemetry of arroyo toads to better determine areas being used; using exclusion fences in 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 introduced beavers and American bullfrog. Suggested recommendations to minimize potential effects on arroyo toad in the future included scheduling aqueduct repairs from September 1 to November 1, except during emergencies, and minimizing nighttime use of roads where arroyo toads may occur. USFWS (2007) concluded that with these mitigative measures, the bridge project would not appreciably affect arroyo toad.

The Settlement and General Release Agreement for the proposed Tapestry Community Development will protect in perpetuity arroyo toad habitat around Horsethief Creek, and the West Fork Mojave River, including approximately 1,070.0 acres northwest of the Mojave Siphon. In addition, the Agreement provides for an arroyo toad Habitat Management Plan, a Non-Native Predators Plan, and a Bullfrog Plan; prohibition of cattle grazing; and restriction of off road vehicles. A habitat evaluation of affected areas of the West Fork Mojave River by HELIX Environmental Planning, Inc. (2014) determined that 25 of 26 pools were unlikely to be used by arroyo toad because of very low flow and high levels of algae, and the remaining one pool had a low potential to support arroyo toad breeding.

The preceding mitigative measures in the area along Horsethief Creek and West Fork Mojave River downstream of Cedar Springs Dam represent cumulative effects on arroyo toad. Other cumulative effects include water development projects in the upper Mojave River basin, which have eliminated arroyo toad habitat and altered the hydrology of the river, and the historical introduction of non-native fish.

DWR concludes the Proposed Action has no effect on arroyo toad and its designated critical habitat.

<u>California Red-Legged Frog and Southern Mountain Yellow-Legged Frog</u>

There are known historical records of SMYLF from the Project area, and CRLF occurred historically in the Mojave River downstream of the Project, but neither species has been documented in the drainage recently. The historical introduction of non-native fish and water development projects in the upper Mojave River basin are cumulative effects, which may have extirpated these species. Silverwood Lake is not suitable habitat for SMYLF or CRLF. Records of SMYLF from near the current Project location in 1941-1968 likely represent populations that have all since been extirpated, a conclusion supported by lack of detections from recent USGS surveys. However, known extant populations of CRLF and SMYLF in southern California are all small and, therefore, undetected populations may occur, particularly in areas where intensive surveys have not been performed (e.g., on private lands outside of the proposed Project boundary). HELIX Environmental Planning, Inc. (2014) reported that neither species was observed in the area assessed for the Tapestry project despite extensive field surveys including surveys for arroyo toad. Project O&M activities that have a potential to affect these amphibians, if present, include fish stocking and escapes of stocked fish downstream of Cedar Springs Dam, and vegetation management, particularly in regard to CRLF, a species which may use terrestrial habitat seasonally and during dispersal. Therefore, the Proposed Action may affect, but is not likely to adversely affect, CRLF or SMYLF.

DWR proposes no PM&E measures specifically pertaining to CRLF or SMYLF. As indicated for arroyo toad, the following measures to protect special-status species will minimize potential effects on CRLF and SMYLF:

- Implement DWR's proposed Integrated Vegetation Management Plan

California Condor

California condor has not been documented to occur within the Action Area, and there are no known Project effects on this species. Although the wild population of the species is slowly increasing, the Project is far removed from release sites, known nests, and roosting sites. However, California condors are wide-ranging when foraging and could foreseeably occur at some time near the Project. The primary threats to California condors feeding on carrion include ingestion of lead ammunition and microtrash, factors unrelated to continued Project operations and maintenance. Therefore, the Proposed Action will have no effect on California condor.

Coastal California Gnatcatcher

Coastal California gnatcatcher has not been documented to occur within the Action Area and there are no known Project effects on this species. Because coastal California gnatcatcher is associated with lower elevation coastal scrub and less often in chaparral habitats, potential habitat within the proposed Project boundary is likely limited to patches of vegetation mapped as Coastal Scrub west and south of the Devil Canyon Second Afterbay, including areas where DWR planted native vegetation in 2000 as part of a mitigation project at Bailey Creek. However, these areas are likely too fragmented and proximate to urban development to support nesting coastal California gnatcatcher. Therefore, the Proposed Action would have no effect on coastal California gnatcatcher.

Least Bell's Vireo and Southwestern Willow Flycatcher

There are no known records of least Bell's vireo or southwestern willow flycatcher in the Project area, and there are no known Project effects on either species. Neither species was detected during surveys performed to evaluate potential effects of the Horsethief Creek Check 66 Access Road Bridge Project, which also included surveys of construction staging areas (Aspen Environmental Group 2006). The latter project entailed replacement of culverts with a bridge and was located on private lands north of Silverwood Lake. Absence of least Bell's vireo and southwestern willow flycatcher was attributed to limited habitat and distance from known populations. Although there is critical habitat for southwestern willow flycatcher north of Silverwood Lake on the West Fork Mojave River and Deep Creek, neither of those areas is currently known to support breeding populations (78 FR 343).

Surveys for southwestern willow flycatcher that were performed by DWR in 2017 under its relicensing *ESA-Listed Bird Species, Southwestern Willow Flycatcher and Least Bell's Vireo Habitat Evaluations Study Approach* detected no least Bell's vireos and only migrating willow flycatchers (two detections, subspecies unknown). Potential habitat for these species is restricted to small, scattered patches, where individuals of either species may briefly occur during migration. Therefore, the proposed Action would have no effect on least Bell's vireo or southwestern willow flycatcher.

<u>San Bernardino Merriam's Kangaroo Rat</u>

San Bernardino Merriam's kangaroo rat has not been documented to occur within the proposed Project boundary, where required alluvial fan habitat is not present. Therefore, the Proposed Action would have no effect on San Bernardino Merriam's kangaroo rat or designated critical habitat.

<u>ESA-Listed Plants</u>

There are no historical records of ESA-listed plants within the Action Area, suitable habitat for ESA-listed species is largely absent, and no ESA-listed plants were observed during surveys performed by DWR under its relicensing *ESA-Listed Plant Species Study Approach*. Therefore, the Proposed Action would have no effect on ESA-listed plants, including slender-horned spineflower, Nevin's barberry, Santa Ana River woolly-star, and thread-leaved brodiaea.

5.5 RECREATION RESOURCES

This section addresses recreation resources and includes four subsections. Section 5.5.1 describes existing recreation conditions, with a focus on recreational opportunities in the Project region and at the Project, recreation demand and use at the Project, visitation use patterns, recreation use patterns and carrying capacity analysis. Section 5.5.2 presents an analysis of potential Project effects on recreation resources. Section 5.5.3 outlines cumulative Project effects on recreation resources, and Section 5.5.4 describes any unavoidable adverse effects on recreation resources.

DWR augmented existing, relevant, and reasonably available information regarding recreation resources by conducting a Recreation Facilities Condition and Demand Assessment. Refer to the Devil Canyon Project Relicensing Website http://devil-canyon-project-relicensing.com/project/ for the detailed study approach, study summary, and detailed study data.

5.5.1 <u>Existing Environment</u>

Recreation at the Project is centered almost exclusively on Silverwood Lake and its State-owned shore lands. As a 980.0 acre lake with 13 miles of shoreline and many developed recreation overnight and day use facilities, it serves as a well-established recreational destination for residents of the surrounding region. A small portion of the proposed Project boundary (i.e., 6 percent or 126.0 acres) is located on NFS lands managed by the SBNF. While NFS lands make up only a small portion 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. Project facilities are also within San Bernardino County.

5.5.1.1 Recreation Opportunities in the Project Region

There are several nationally-significant recreation-designated areas in the region. Within 100 miles of Silverwood Lake is the newly designated Mojave Trails National Monument. Within 30 miles is the 346,177.0acre San Gabriel Mountains National Monument designated in 2014. The nearest federally designated Wilderness Area is the Cucamonga Wilderness, located approximately 15 miles west of Silverwood Lake. Other nationally recognized recreation resources in the region include the PCT, which traverses the Project area adjacent to Silverwood Lake. On the west side of Silverwood Lake, State Highway 138 extents south leading up into the SBNF and is part of the Rim of the World scenic drive that is popular for sightseeing.

San Bernardino County

As described in the San Bernardino County General Plan Environmental Impact Report (San Bernardino County 2007), 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 NPS; BLM; USFS; DPR; the County Regional Parks Department; and local city parks departments.

There are nine regional parks in San Bernardino County. Regional parks generally encompass 100.0 or more acres and are designed to serve a population of 100,000 residents (see Figure 5.5-1). 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 15.0 to 20.0 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.

Mojave River Forks Regional Park is located on Highway 173 in Summit Valley. It offers camping, equestrian camping, and hiking and equestrian trails with direct access to the PCT. The Mojave River Forks Regional Park consists of approximately 1,100.0 acres and offers 50 campsites, of which 25 are full hook-up sites. Mojave River Forks Regional Park also provides three group camping sites, hot showers, and RV dump stations. The Park is 9 miles from Silverwood State SRA, and when Silverwood Lake SRA is full, this park serves as an alternate camping area.

The county, as a whole, currently exceeds its stated standard of 2.5 acres of park area for each 1,000 persons. The county population total (incorporated and unincorporated) is approximately 2,155,590. Using the stated standard of 2.5 acres per 1,000 persons, San Bernardino County would need approximately 4,290.0 acres of parkland. The total parkland (including approximately 2,400.0 acres at Silverwood Lake SRA) is 9,647.0 acres. (San Bernardino County 2007).

The San Bernardino County General Plan's (2007) vision for the future, which is useful to help evaluate potential Project recreation needs, includes:

- Extension, enhancement, and increased connectivity of trail systems throughout the County (Goals CI-6 and OS-2)
- Local parks and recreational amenities throughout the County (Goal OS-1)
- Expansion of cultural and entertainment opportunities countywide (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 (Goal OS-4)

Additional regional recreation resources are provided by private entities, including the Andy Jackson Airpark, located about 1 mile southeast of the Devil Canyon Powerplant (see Figure 5.5-2).

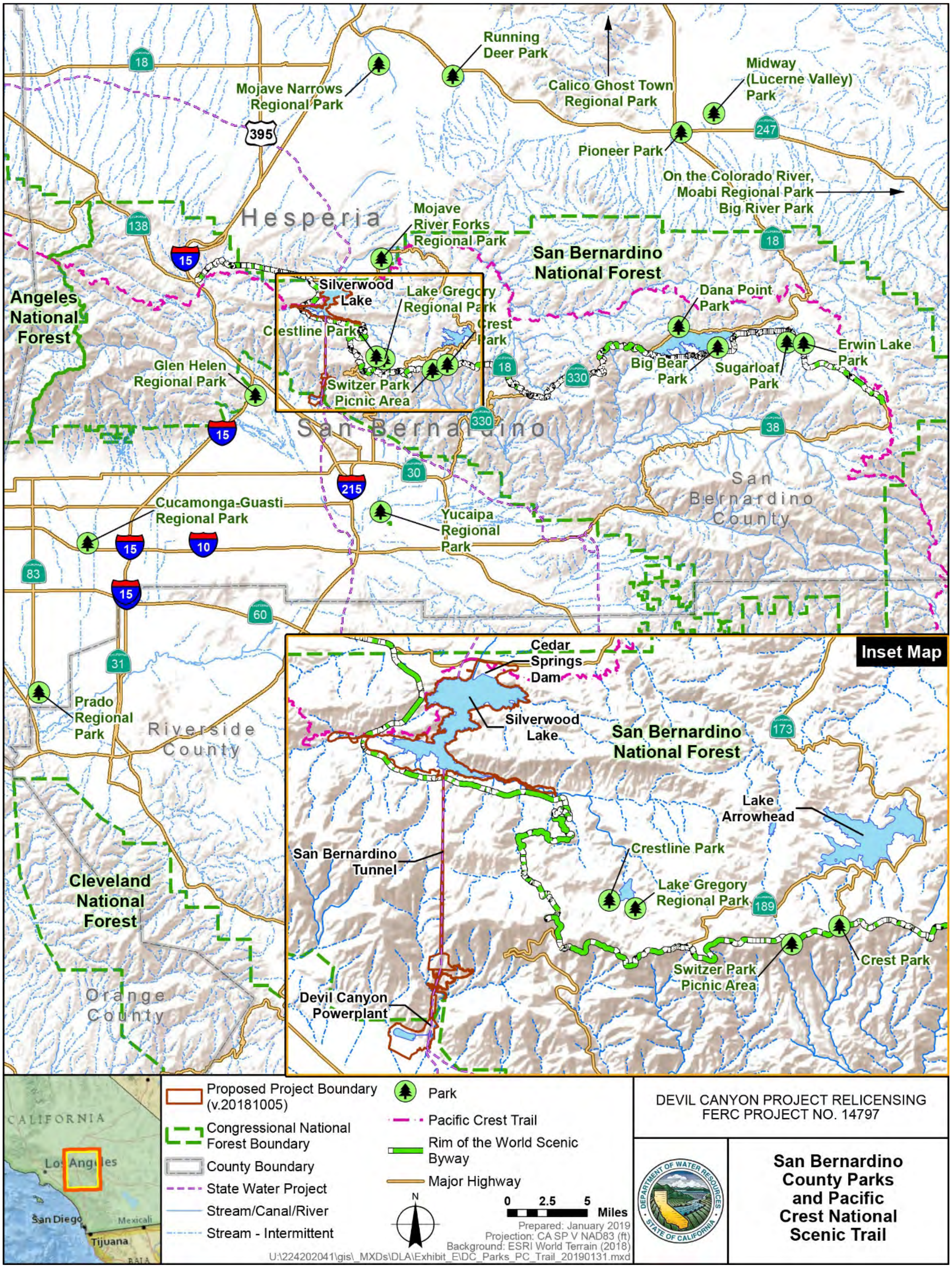


Figure 5.5-1. San Bernardino County Parks and Pacific Crest National Scenic Trail

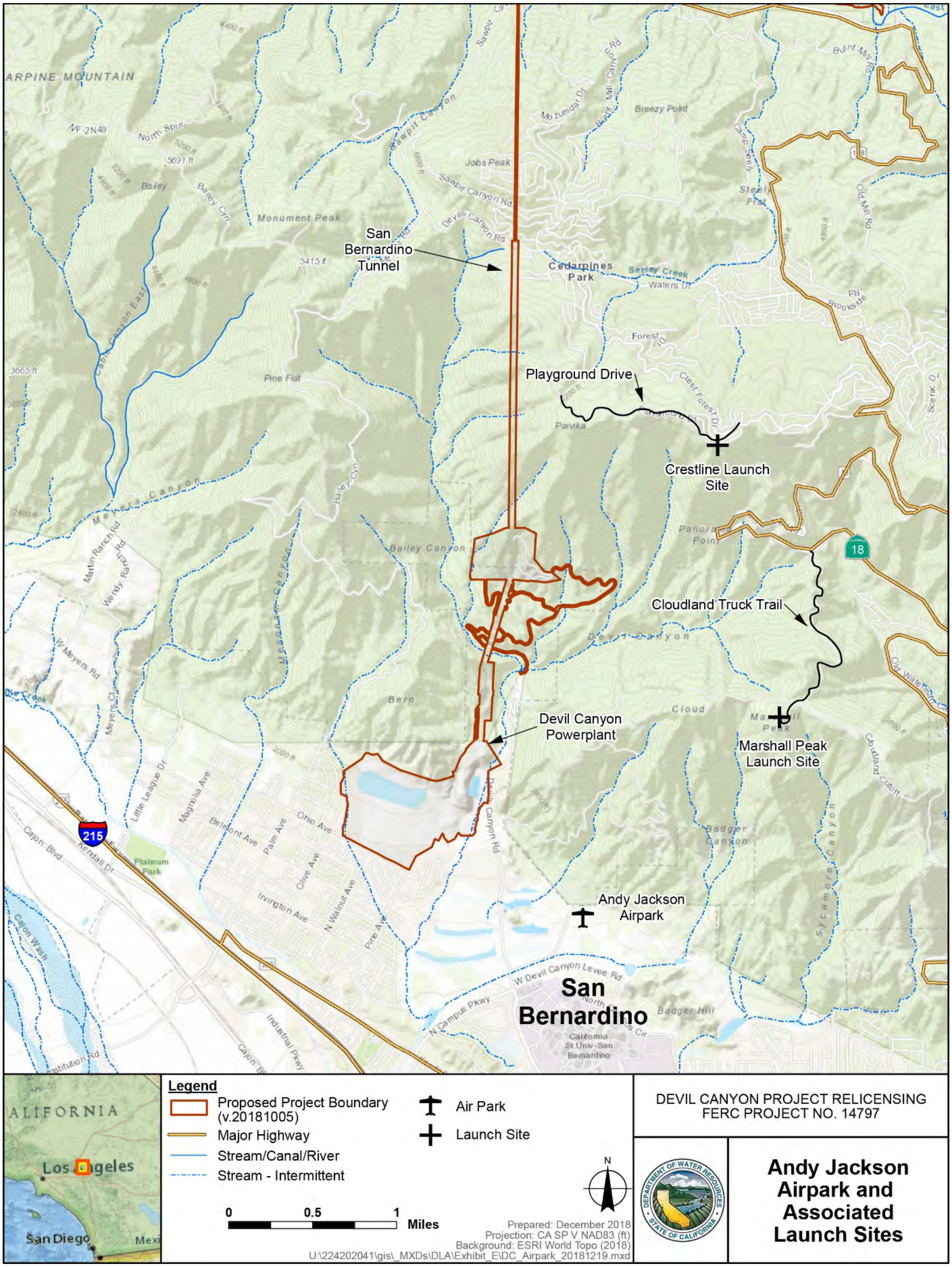


Figure 5.5-2. Andy Jackson Airpark and Associated Launch Sites

Pacific Crest National Scenic Trail

USFS manages the PCT, the only nationally designated trail in the Project area, in partnership with NPS, BLM, DPR, and the PCTA. The PCT is a designated National Scenic Trail, which is approximately 2,650 miles long.

The PCT was designated with passage of the National Trails System Act (Public Law 90-543) on October 2, 1968. The trail is one of the premier long distance trails in the nation, traversing three states (California, Oregon, and Washington) from Mexico to Canada. National scenic trails are established "to provide for maximum outdoor recreation potential and for the conservation and enjoyment of the nationally significant scenic, historic, natural, or cultural qualities of the areas through which such trails may pass" (16 U.S.C. § 1242).

The PCT is used by hikers and equestrians. The National Trails System Act states that "[t]he use of motorized vehicles by the general public along any national scenic trail shall be prohibited;" however, the Act also goes on to state… "That private lands included in the national recreation, national scenic, or national historic trails by cooperative agreement of a landowner shall not preclude such owner from using motorized vehicles on or across such trails or adjacent lands from time to time in accordance with regulations to be established by the appropriate Secretary" (16 U.S.C. § 1246). On federal lands, 36 CFR § 261.20 prohibits use of motorized vehicles on the PCT without a special-use authorization. Further, there is a trail-wide special order in place which prohibits the use of mechanical transport on the PCT, including bicycles on federal lands occupied by the PCT (about 90 percent of the trail) (USFS Order 88-4, August 31, 1988 Pacific Southwest Region, Paul F. Barker, Regional Forester, San Francisco, CA).

One hundred fifteen miles of the PCT cross through San Bernardino County. A portion of the PCT passes through the Silverwood Lake SRA. On the north side of Silverwood Lake, the trail (a non-Project facility) crosses into the Silverwood Lake SRA just northeast of Cedar Springs Dam. It also runs along the south side of State Route 178 in the vicinity of the dam's spillway and SWP water intake. The PCT follows the west shore of the lake's northern part, then passes just north of the Cleghorn Day Use Area (see Section 5.5.1.2 for information on recreation facilities). In this section, the PCT follows along a portion of the Silverwood Hike and Bike Path and Cleghorn Road, and then to the west passes outside the Silverwood Lake SRA near the West Fork Group Camps (Rio, Barranca and Valle Group Camp Facilities). USFS has a trail easement agreement with DPR for USFS to operate and maintain an 8-foot-wide trail corridor through Silverwood Lake SRA and a similar agreement with DWR for a 20-foot-wide trail corridor along and near the base of Cedar Springs Dam (DWR 1980).

Desired conditions for the PCT, as stated by the PCTA in its 2018-2021 Strategic Plan, are to:

> ensure the conservation of the PCT's nationally significant wild, scenic, natural, and heritage resources, and to maximize its intended recreation opportunities, the trail's entire length, together with sufficient land area on both sides to safeguard and preserve its character, should be publicly owned, permanently protected, and managed as a single entity across jurisdictions. The investment of citizen stewards offers another critical thread of continuity from Mexico to Canada.
>
> The PCT experience should favor panoramic views of undisturbed landscapes in an uncrowded, non-mechanized, tranquil, and predominantly natural environment. It should feature diverse, untrammeled ecosystems and historic high country landmarks while avoiding, as much as possible, road crossings, private operations and other signs of modern development. Trail facilities such as campsites, water sources and other amenities for hiker and pack-and-saddle use should be simple. Such conditions will provide for the nature and purposes for which the PCT was established. (PCTA 2018).

Further, the PCTA's website outlines 15 principals related to desired conditions and trail experience):

1. The Trail as an invitation into nature. An established route showcasing significant features of natural landscapes for the user's edification.

2. Wild scenery of the highest caliber and integrity. Extolled as spiritual by many classic advocates of wildlands (Bob Marshall said wildlands afforded "pure aesthetic rapture"), these landscapes inspire awe for their immensity, timelessness, and self-organized complexity.

3. Refuge from industrialized civilization and its sights, sounds, and smells.

4. Non-mechanized travel on foot or horseback. Simpler locomotion from simpler times, a more natural pace that allows all our senses to work.

5. The freedom of an unconfined type of recreation.

6. Therapeutic effects of elevated "crest" views and naturally open landscapes, dwarfing human concerns within the perspective of a larger framework. Self-forgetting and humility, along with a sense of belonging to the natural whole.

7. Solitude and detachment from routine social pressures and distractions, providing the setting for inward reflection and self-discovery.

8. An extended retreat. National Scenic Trails were conceived as long-distance trails providing rare opportunities for extended backcountry trail travel, stretching for days, weeks or even months.

9. Physical challenge and personal accomplishment. Self-reliance, honing one's primitive travel and survival skills.

10. Taking part in an iconic journey. Reminiscent of pilgrimages, vision quests, or the struggles of early American explorers and pioneers to find new beginnings in the landscapes of our nation.

11. Forming meaningful bonds with fellow travelers and the rest of the trail community. Discovering beauty in how the trail affects people.

12. Cultural resources reaching into the history of the American West, including sites sacred to Natives, landmarks for prospectors, sheepherders, and pioneers, historic lodges and lookouts, and, in many areas, the engineering wonders of the treadway itself.

13. Citizen ownership of, and investment in, resources of national significance. The pride and passion of citizen stewardship of the Trail and its landscapes.

14. The satisfaction of bequeathing to future generations wild lands and their riches. Clean water and air, thriving wildlife, and healthy ecosystems—the value of their economic services.

15. Vicarious journeys and option value. Countless people who never set foot on the PCT nonetheless derive satisfaction from experiencing it through photos and accounts by others. For them, there is value simply in knowing it is possible to walk from Mexico to Canada on a continuous primitive trail.

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 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. As described by USFS (2005), 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.

- 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 ROS can also be used to plan how areas should be managed for recreation on SBNF in the future (USFS 1986, in USFS 2005a). Changes in a national forest's mix of ROS classes affect the recreation opportunities offered.

As shown in Figure 5.5-3, the ROS settings for NFS lands within and around the proposed Project boundary, including Silverwood Lake and the Devil Canyon Powerplant, are ”semi-primitive non-motorized,” “semi-primitive motorized,” and “roaded natural.”

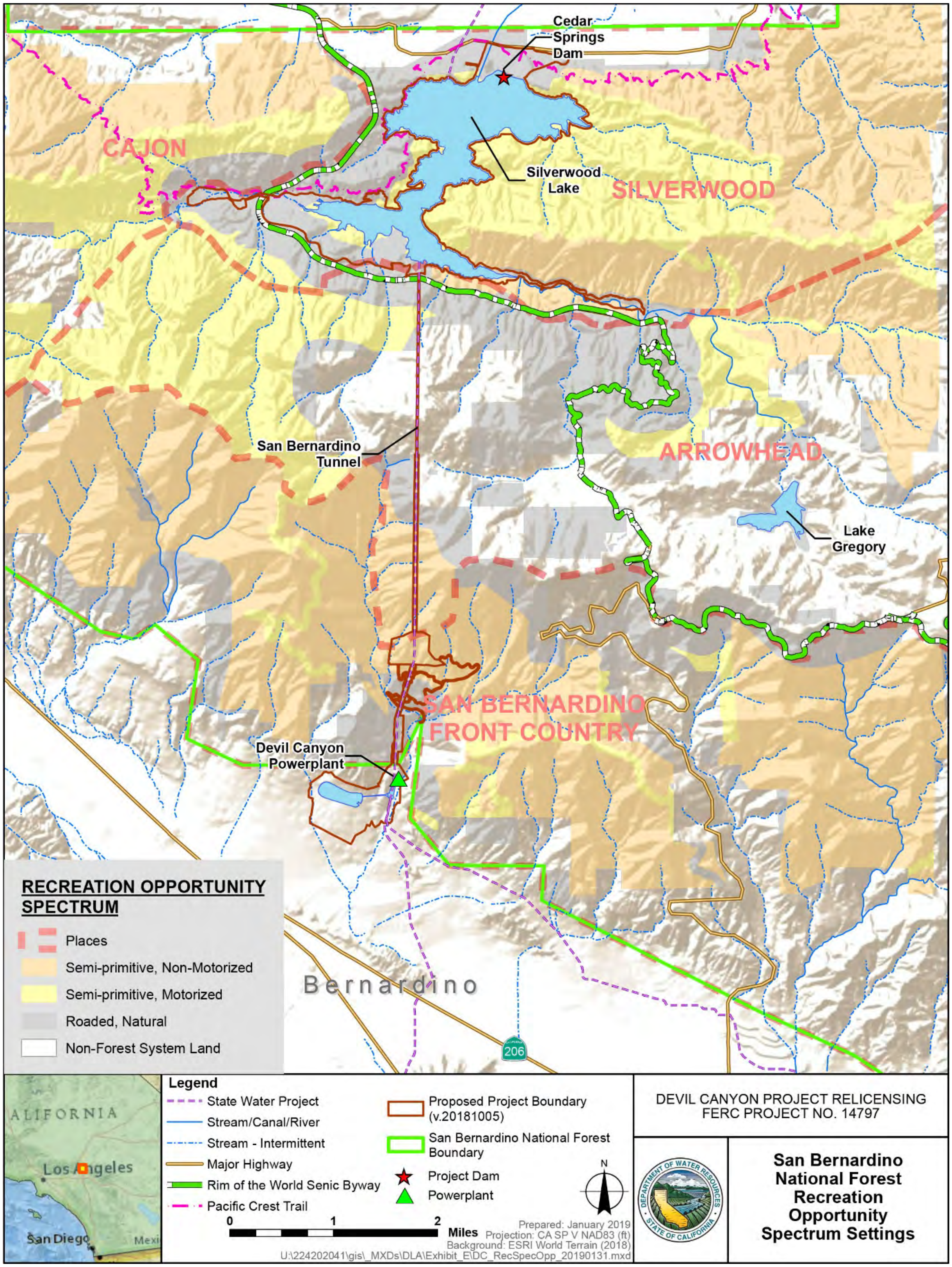


Figure 5.5-3. San Bernardino National Forest Recreation Opportunity Spectrum Settings in the Project Vicinity

Within the Project vicinity, the SBNF provides facilities for OHV use. East of Silverwood Lake, the Miller Canyon/Pilot Rock area is a popular OHV riding area. Miller Canyon (approximately 0.5 miles outside the proposed Project boundary), serves a strategic portal for OHV use onto the SBNF from private and BLM lands to the north. In 2016, the SBNF developed a new day use site, Miller Canyon Trailhead, for OHV users. A new level surface parking area has been constructed with a combination of tail-in parking and pull through parking for vehicles with trailers, separated by islands of vegetation and barriers. Two access points provide ingress and egress to the staging area, and gates have been installed to close the site as needed. A vault toilet, trash receptacles, and picnic tables have been installed as well. The OHV site can receive up to 50 vehicles with trailers in a day during the summer. The site connects into approximately 21 miles of OHV trails.

SBNF Road 2N33, also known as Pilot Rock Road, is used extensively and connects to the Cedar Springs Dam Road on the north (a-state build road), where a parking and turn-around area near Cedar Springs Dam on State land is often used for OHV parking on the north side of the trail system. This informal staging area at the end of Cedar Springs Dam Road can accommodate about 25 vehicles. Based on observation surveys, a few OHV users sometimes walk down from Pilot Rock Road to the shores of Silverwood Lake near Live Oak Landing for day use activities, including swimming and picnicking. Other OHV trails in the Project region include SBNF Road 2N47, also known as Cleghorn Ridge Road, which receives more jeep-type usage and is generally accessed from the Summit Trailhead near Interstate 15.

5.5.1.2 Project Recreation Facilities

Project recreation resources are focused on Silverwood Lake, as there is no recreation use or public access at the Devil Canyon Powerplant and Afterbays. The Project recreation facilities are all within the Silverwood Lake SRA and include all developed recreation sites of the SRA. The 2,400.0-acre Silverwood Lake SRA was classified as an SRA on June 9, 1972, and is operated and maintained by DPR. The recreation facilities were constructed in the early and middle 1970s. As described in detail below, Silverwood Lake SRA recreation facilities include: campgrounds, a nature center, picnic areas, boat launches, a marina, swim beaches and bike and hike trails (Figure 5.5-4). In addition to the Project recreation facilities, Parks maintains administrative and storage facilities and a public road system (between recreation sites) as well as a water supply system serving Silverwood Lake SRA that are not part of the licensed Project facilities.

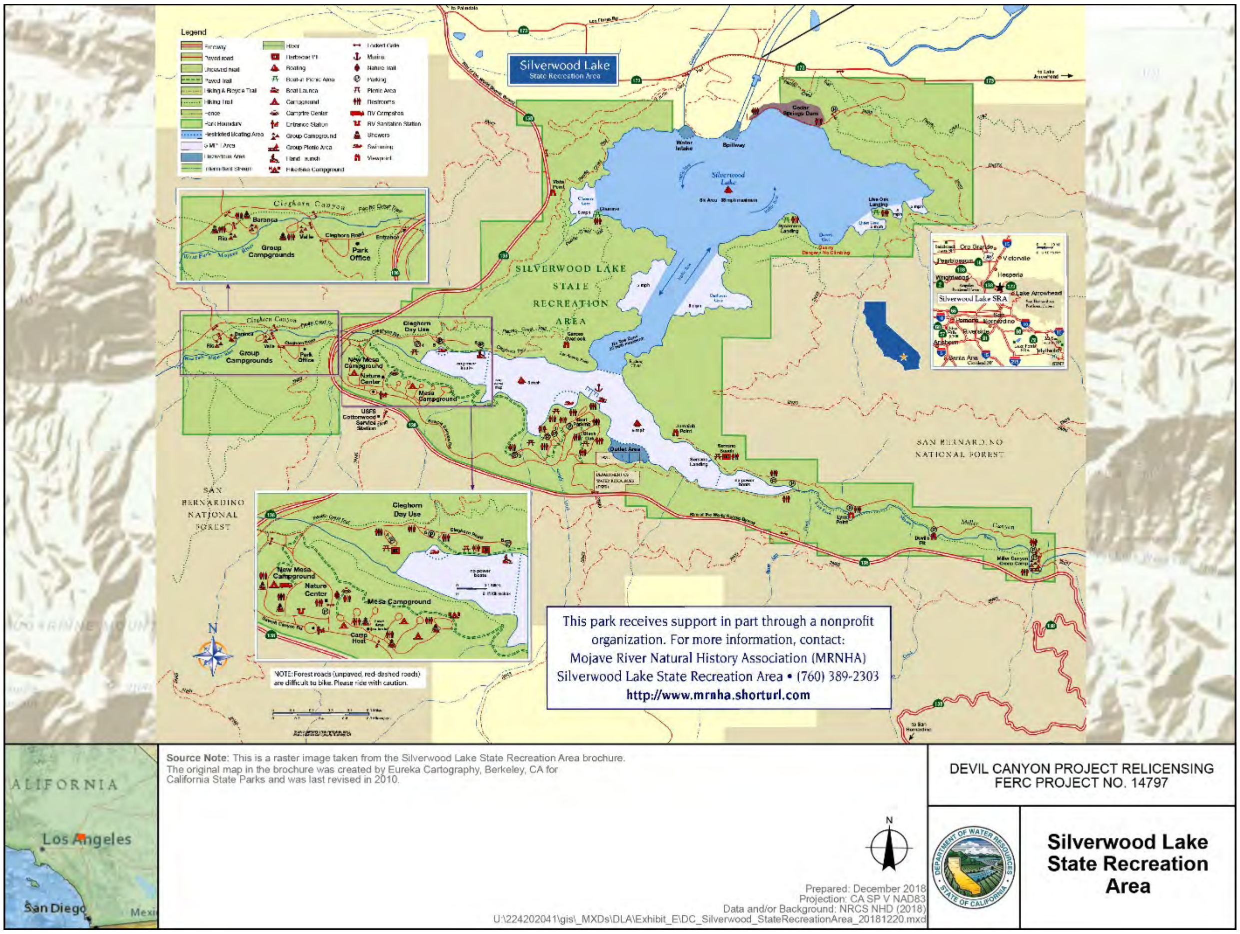


Figure 5.5-4. Silverwood Lake SRA with Project Recreation Facilities

Silverwood Lake is a popular destination for residents from San Bernardino, Los Angeles, and Riverside Counties, where many users are less than 60 miles from Silverwood Lake SRA facilities. The 980.0-acre lake is popular with boaters and anglers, particularly due to the fairly constant lake level throughout the year and even during drought periods. The lake and recreation facilities are easily accessible for visitors coming from the high desert communities or the greater Los Angeles area. The SRA is just 11 miles east of Interstate 15. 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.

Silverwood Lake at an elevation of over 3,000 feet msl 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 (Section 5.3). Fishing is permitted in most areas of the lake; however, fishing and boating are restricted at the inlet for SWP water, Cedar Springs Dam spillway, and San Bernardino Tunnel Inlet. These areas are restricted from boat access by barriers installed to protect the public from potential hazards.

Silverwood Lake SRA offers boating and dispersed shoreline uses and developed recreation facilities. The developed sites that are part of the existing FERC-licensed Project are listed in Table 5.5-1 and are discussed further in the following sections.

As part of the recreation study, areas of dispersed recreation uses were also identified that include shorelines of Silverwood Lake where anglers were observed. Other dispersed use areas included areas in the north end of Silverwood Lake along shorelines near Live Oak Landing and Chamise Day Use Areas. Based on the recreation survey work, it appears users are parking vehicles along State Highway 138 and USFS Road 2N33 and walking down to the boat-in day use sites on user made trails.

As part of the relicensing studies, DWR conducted a Recreation Facilities Condition and Demand Assessment Study in 2017. The study included an inventory and condition assessment, a carrying capacity assessment, an evaluation of Americans with Disabilities Act of 1990 (ADA) improvements, and a recreation use and demand assessment. The study was undertaken to help determine the level and types of uses at Project recreation facilities; to evaluate the adequacy of the existing facilities and management; and to determine new measures to help meet the needs of the recreating public over the new license term. The condition assessment includes a facility inventory documenting the number of parking spaces, picnic and camping units, and facility components. A qualitative assessment was conducted with respect to visible condition issues and facilities were identified as to condition categories of “poor,” “fair,” or “good.” Poor condition was assigned if the majority of the paved or improved areas had crumbling paving, missing parts of paving, overgrown vegetation encroaching on facilities, broken barbeques, warping picnic tables, and very weathered ramadas. The fair designation was assigned if less than half of the facility had some poor condition components easily observable. Good condition was assigned when the facility was generally absent of the observable condition issues noted above and the facilities were deemed to be in working order.

The Recreation Facilities Condition and Demand Assessment Study, including assessment of ADA improvements and needs, was undertaken in June, July, August, and November of 2017. The study identified the number and variety of recreation facilities and amenities, the relative condition of those facilities and amenities, and areas where ADA improvements are in place. Following a description of the ADA findings, the resulting analysis is presented and summarized below for each of the 31 Project recreation facilities.

<u>Americans with Disabilities Act</u>

ADA established new precedence for accessibility guidelines enforced on construction projects that will serve public purposes. ADA ensures compliance with all applicable standards that are set forth at the federal level. Guidelines for compliance and accessibility designs continue to change as the Federal Access Board amends existing standards and incorporates new ones.

The California State Parks Accessibility Guidelines (Guidelines) introduce regulations for implementing accessibility under ADA in State park locations, including Project facilities at Silverwood Lake SRA. The Guidelines encompass “accessibility standards, recommendations, and regulations for compliance with accessibility laws” (California State Parks Accessibility Guidelines 2015). The Guidelines are meant for use as a reference source to help improve facilities to meet ADA standards. The manual is periodically updated with changes to laws and/or other amendments that affect California State Parks. This guide is the primary tool that is provided by the California State Parks Accessibility Section and is meant to help successfully incorporate universal access in California State Parks (California State Parks Accessibility Guidelines 2015). FERC also requires licensees to consider compliance with accessibility needs under ADA when recreation improvements are proposed on non-federal lands.

Accessibility is defined as “the combination of various elements in a building or outdoor area, which allows access, circulation, and full use of the building, facilities, and programs by person with disabilities” (California State Parks Accessibility Guidelines 2015). Accessibility determines the specifications needed for “ground and floor surfaces, changes in level, wheelchair turning space, clear floor space, knee and toe clearances, protruding objects, reach ranges, and operable parts” (California State Parks Accessibility Guidelines 2015).

At Silverwood Lake SRA, several projects over the last 10 years have been completed specifically to improve conditions related to accessibility at Project recreation facilities. Two principal projects, the Silverwood Lake Phase I and Phase II ADA Improvements, are complete and include improvements to several facilities. The Cleghorn Day Use Area, Mesa Campground, Campfire Center, and Entrance Station are all Project recreation facilities recently upgraded and remodeled to substantially improve ADA accessibility. ADA improvements and conditions are noted in the following sections.

A summary of the recreation inventory related to capacity is presented in Table 5.5-1 and on Figure 5.5-4.

Table 5.5-1. Devil Canyon Project Recreation Facilities and Capacities

Recreational Facility	Total # Parking Spaces	Total # Campsites	Total # Picnic Sites
Rio Group Camp	33	Designed to serve 100 persons	14
Barranca Group Camp	39	Designed to serve 100 persons	13
Valle Group Camp	37	Designed to serve 100 persons	13
Cleghorn Day Use Area	239 (SRA Parking Lots 4 & 5)	0	91

Table 5.5-1. Devil Canyon Project Recreation Facilities and Capacities (continued)

Recreational Facility	Total # Parking Spaces	Total # Campsites	Total # Picnic Sites
Cleghorn Boat Launch	39 (SRA Parking Lot 6) (8 of the parking spots accommodate vehicles and boat trailers)	0	0
Garces Overlook	0	0	0
New Mesa Campground	84 in campsites (2 vehicles per site), plus 6 others	42	0
Entrance Station	2	0	0
Nature Center	30	0	8
Mesa Campground	190 in 95 designated car campsites (2 vehicles per site), plus 16 other spaces	107	0
Campfire Center	1	0	0
Sawpit Canyon Picnic Area 3	75 (SRA Parking Lot 3)	0	57
Sawpit Canyon Picnic Area 2	71 (SRA Parking Lot 2)	0	45
Sawpit Canyon Picnic Area 1	206 (SRA Parking Lot 1)	0	10
Sawpit Canyon Day Use Area	0	0	33
Black Oak Picnic Area	122	0	84
Sawpit Canyon Marina	68	0	0
Sawpit Canyon Boat Launch	172 (151 of the sites accommodate vehicles and boat trailers)	0	0
Jamajab Point Overlook	0	0	0
Serrano Landing Day Use Area	0	0	6
Miller Canyon Picnic Area	0	0	12
Lynx Point Overlook	0	0	0
Devil's Pit Overlook	0	0	0

Table 5.5-1. Devil Canyon Project Recreation Facilities and Capacities (continued)

Recreational Facility	Total # Parking Spaces	Total # Campsites	Total # Picnic Sites
Miller Canyon Group Camp	56	3 camps designed to serve 40 persons each	42
Miller Canyon Trailhead	50	0	0
Sycamore Landing Day Use Area	0	0	13
Live Oak Landing Day Use Area	0	0	8
Chamise Day Use Area	0	0	7
East Fork Trail	0	0	0
Miller Canyon Trail	0	0	0
Silverwood Hike and Bike Path	0	0	0

Key:
SRA = State Recreation Area

Based on the recreation surveys, the following section provides details regarding the recreation facilities and amenities maintained as part of the Project within Silverwood Lake SRA.

Rio Group Camp

Rio Group Camp is a group camping site on the west side of State Highway 138 (also known as the West Fork Group Camp area). This facility holds up to 100 persons at one time (PAOT) and includes amenities such as a large tree-shaded camping area and a restroom facility with four separate unisex rooms with flushing toilets and pay showers. The camp has a three-part shade ramada that covers a sizeable concrete pad that includes a large central fire pit, food preparation counters with two grills, two sinks, and two large trash receptacles nearby. Additionally, the group site includes three water spigots and three parking lot light poles. There are 14 picnic tables, most of which are ADA accessible. The facility has a roundabout loop for trailer and vehicle parking, which has approximately 33 regular parking spaces, but no defined ADA spaces. Overall, the facility is in good condition. There are several user-made trails leading to the West Fork Mojave River. Rio Group Camp is open in the main visitor use season from May through September by reservation through reservecalifornia.com.

Barranca Group Camp

Barranca Group Camp is another group camping site in the West Fork Group Camp area. The site can accommodate up to 100 PAOT and includes such amenities as a large central fire pit, large tree-shaded camping area, and a restroom facility with four separate unisex rooms with flushing toilets and pay showers. The camp has a large three-part shade ramada that covers a large concrete pad that includes food preparation counters with two grills, three sinks, and two large trash receptacles nearby. Additionally, the group site includes three water spigots and three parking lot light poles.

There are 14 picnic tables, most of which are ADA accessible. The facility also includes a roundabout loop for trailer and vehicle parking for approximately 39 regular parking spaces, but no defined ADA spaces. Overall, the facility, including the group area and restrooms, is in good condition. There are a number of trails within the site; some of them show evidence of erosion and evidence of trail subsidence. There are some trails that have areas of uneven pavement, and potential risk for washout and flooding in locations close to West Fork Mojave River. Barranca Group Camp is open during the main visitor use season from May through September by reservation.

Valle Group Camp

Valle Group Camp is the main group camping site in the West Fork Group Camp. The site accommodates up to 100 PAOT and includes such amenities as a large tree-shaded camping area and a restroom facility with three separate unisex rooms with flushing toilets and pay showers and a laundry sink. The camp has a three-part shade ramada that covers a sizeable concrete pad that includes a large central fire pit, concrete food preparation counters with two grills, two sinks, electrical power outlet, and two large trash receptacles nearby. Additionally, the group site includes one water spigot and four parking lot light poles. There are 13 picnic tables, all of which are ADA accessible. Parking is available on both sides of a large oval loop, and includes approximately 37 regular parking spaces, but no defined ADA spaces. Overall, the facility is in good condition. Valle Group Camp is open year-round by reservation.

Cleghorn Day Use Area

Cleghorn Day Use Area is a multi-use area with swimming, shoreline fishing, and picnicking opportunities available. This day use facility includes 91 picnic tables, approximately 52 of which are ADA accessible. Two large shade ramadas are present with 13 common cooking grills, 12 food preparation tables, 2 sinks, 6 water spigots, 8 water fountains, 3 parking lot light poles, and 5 receptacles for hot coal disposal. The site is in good condition and includes a sandy swim beach with lifeguard facilities and three flush toilet restrooms, along with a portable restroom (near the beach area), seven changing rooms, and one large trash receptacle (dumpster). There are 230 regular parking spaces available at the site which also serves as Silverwood Lake SRA Parking Areas 4 and 5. The parking lot includes nine ADA-designated spaces (four are van accessible).

In 2017, ADA improvements were made including reconstructed and repaved sidewalks and pathways, additional ADA-compliant parking, a rehabilitated restroom, ADA-compliant picnic tables, and changing facilities. Overall, the day use facility was greatly improved with numerous ADA improvements and is in good condition.

Cleghorn Boat Launch

Cleghorn Boat Launch provides two launch lanes for non-motorized watercraft and offers such amenities as a dock, two portable restrooms, and one large trash receptacle. The facility has 23 regular parking spaces and eight trailer spaces that serve as Silverwood Lake SRA Parking Area 6. Overall, this facility is in good condition with ADA accessibility in the parking areas and restroom facilities.

Garces Overlook

The Garces Overlook site includes a 0.5-mile-long natural surface trail used by bicycles and hikers linking Cleghorn Day Use Area to Garces Overlook, a developed viewpoint situated on a point overlooking Silverwood Lake. There are no ADA-accessible features. The trail and overlook facility are both in fair condition. The site has an octagonal hilltop gazebo with picnic tables. While not part of the Project-maintained facility, there are also some user-created trails to the shoreline below (dispersed recreation use areas).

New Mesa Campground

New Mesa Campground includes 42 full hookup campsites that each have a grill, picnic table, and fire pit. The facility includes two restroom facilities with flush toilets and two shower stalls in each. The campground includes six water spigots and two additional water fountains. In addition to parking spaces at each site that can accommodate RVs up to 30 feet in length, there are four additional regular parking spaces and two other ADA-accessible spaces near the restrooms. The facility also has an RV dump station that was improved in 2016 to make it ADA-compliant. This facility has ADA-accessible campsites and overall is in good condition. The developed and previously improved trails that run throughout the facility have steep sections, and in some areas have missing asphalt paving and are overgrown with vegetation.

Entrance Station

The Entrance Station facility provides the entrance kiosk for visitors entering the Silverwood Lake SRA. This entrance serves all boaters and vehicles accessing Silverwood Lake recreational amenities other than those in Miller Canyon and West Fork Group Camps. The facility has only temporary parking spaces adjacent to the facility and provides two portable restrooms. In 2017, ADA-compliant improvements were made to windows, cabinets, counter tops, pathways, and parking at the entrance station. The facility is in good condition, with new asphalt laid recently around the perimeter of the facility. It also has a new ADA van accessible parking stall that was constructed for visitor use.

Nature Center

Nature Center is a 2,700-square-foot building built for interpretive exhibits and displays. The site amenities include eight picnic tables, two benches, one flush toilet restroom that is ADA-compliant, and one bike rack. The site has 28 regular parking spaces and two ADA-designated parking spaces (one is van accessible). This building has good access to ADA-accessible parking and is overall in good condition.

Mesa Campground

Mesa Campground includes 107 individual campsites, each with grills, picnic tables, and fire pits, eight of which are ADA-accessible. Additionally, the campground facility has 19 water spigots, three water fountains, and one sink for camp users. The facility provides three flush toilet restrooms that also have pay shower stalls in each. A total of 11 trash receptacles are provided throughout the campground. In addition to individual site parking, there are 13 regular parking spaces, two van accessible ADA spaces, and one regular ADA-accessible space located at the Mesa Campground restroom. ADA accessibility improvements were made in 2017 that updated one restroom and shower facility. In most areas, Mesa Campground pathways were repaved and adjusted to an accessible grade. Several of the ADA-accessible campsites were improved, and the facility is overall in good condition.

Campfire Center

Campfire Center is an outdoor amphitheater that is used for interpretive talks and also serves as a gathering spot for campers at Silverwood Lake SRA. The facility includes one flush restroom; a stage with podium; two fire pits surrounded by bench seating; drinking water fountains; and one water spigot. There is one van ADA accessible parking space located at the campfire center, and the surrounding amphitheater benches include some ADA-accessible seating.

In 2016, the Campfire Center was refurbished and the old seating was removed. A new seating area was created that has ADA-compliant seating. The restroom facility was fully rehabilitated with ramps and ADA-compliant features. Landscaping adjacent to pathways and around the facility was updated, and a new podium was installed. A nature trail encircles the area. The facility was found to be in good condition overall.

Sawpit Canyon Picnic Area 3

Sawpit Canyon Picnic Area 3 is a picnic area that includes 57 picnic tables, each located on an asphalt slab. This facility has 2 flush-capable restrooms, 12 water spigots, and 2 water fountains available. There are 75 regular parking spaces in total that also serve as Silverwood Lake SRA Parking Area 3. This facility includes five common grill stations with 18 grills, two food preparation tables, three receptacles for hot coal disposal, two benches, and one trash receptacle. Many of the paths in this area have degrading pavement, and there are no ADA spaces available in the parking lot. Four additional asphalt slab picnic sites are present, but in 2017 a picnic table was missing. The sidewalks in the parking area are in poor condition but the facility is in fair condition overall.

Sawpit Canyon Picnic Area 2

Sawpit Canyon Picnic Area 2 is a picnic area that includes 45 total tables, 37 of which are located on asphalt pads. The site has 70 regular parking spaces and one ADA-designated space, with this area serving as Silverwood Lake SRA Parking Area 2. This facility includes four common grilling stations that incorporate 16 grills in total and nine food preparation tables. The picnic site has four receptacles for hot coals and six trash receptacles. One large shade structure (with six large tables that are accounted for in the total number of picnic tables) is present close to the water's edge. The picnic area has one flush restroom and an adjacent portable restroom nearby. Other amenities include seven water spigots and three water fountains. The picnic tables vary in age and condition, and the facility is in fair condition overall.

Sawpit Canyon Picnic Area 1

Sawpit Canyon Picnic Area 1 is a picnic area with 10 tables. There are 201 regular parking spaces that serve as Silverwood Lake SRA Parking Area 1. The parking lot includes three authorized vehicle-only spaces (for Park Rangers), and two ADA-designated spaces, one of which is van accessible. One common shared grill station is available that has three grills, one hot coal receptacle, and one trash receptacle. In 2017, the tables were found to be in poor condition (warped), and paths were overgrown; yet overall the facility is in fair condition.

Sawpit Canyon Day Use Area

Sawpit Canyon Day Use Area is the SRA's most popular destination. It is a large day use area which has an approximately 1,000-foot-long sandy swim beach that has lifeguard towers, sand, and a designated swimming area (rope buoy–enclosed). There are 28 shade ramadas available. The facility has 33 picnic tables, 18 benches, 30 trash receptacles, and two receptacles for hot coals. A concession building serves as a snack shop/convenience store. The facility has a jet ski/paddleboat/kayak rental booth. In addition, there are three flush restrooms, indoor and outdoor showers, five changing rooms, three portable restrooms, four water spigots, and five water fountains. Additional amenities include two large picnic sites with six grills and four food preparation tables. Overall, this facility is in good condition; however, the shade structures are aging. The facilities have amenities that have been brought up to ADA standards and many ADA-compliant picnic sites are available.

Black Oak Picnic Area

Black Oak Picnic Area has 84 picnic tables with approximately 60 of the tables located on asphalt pads. The remainder sit on dirt adjacent to the access road or scattered throughout the grassy areas. There are 121 parking spaces distributed along the looped access road traversing the facility and one ADA-designated space. Eight common grill areas contain a total of 26 shared cooking grills with 16 food preparation tables. Two flush restrooms are available with three water fountains and 14 water spigots. The facility has one receptacle for hot coal disposal and six trash receptacles. There is also a large irrigated lawn area for recreation uses. Overall the facility is in fair condition.

There are 13 to 15 asphalt pads missing a picnic table, and the parking and road areas have striping that is badly fading. The paths and walkways have overgrown vegetation that restricts use and access, and are cracked in many places. A paved sidewalk trail that runs parallel to the parking area is crumbling in some areas and shows signs of subsidence in places.

While there is one ADA-designated parking space, facilities (including restrooms) at Black Oak Picnic Area are not ADA-compliant. However, the access areas to walkways and sites have curb barriers.

Sawpit Canyon Marina

Sawpit Canyon Marina provides a floating dock structure with 61 boat slips and a concessionaire for boat rentals and supplies. There are three floating restrooms associated with this facility (moored on the lake), a large ADA-compliant flush restroom, an ADA-compliant fish cleaning station, three drinking fountains, and five sitting benches. The facility has 61 regular parking spaces that include 3 spaces for concessionaire and park management use and 4 ADA-accessible spaces, 1 of which is van accessible. Overall, this facility is in good condition. In 2015, several new ADA-compliant parking spaces were constructed, and new concrete walkways and sidewalks were installed with ADA-compliant curb ramps from the parking to restrooms and connecting pathways.

Sawpit Canyon Boat Launch

Sawpit Canyon Boat Launch offers a six-lane boat ramp with two adjoining courtesy docks. There are 15 regular parking spaces, 151 trailer spaces, and 6 ADA-accessible spaces, 1 of which is trailer size. The site has a fish cleaning station and one trash receptacle. The ramps are serviceable at all normal operating lake surface levels. Overall, this facility is in good condition and meets ADA requirements.

Jamajab Point Overlook

Jamajab Point Overlook is a developed overlook viewpoint in the Miller Canyon area at the terminus of the East Fork Trail. The site is paved but has degraded surfaces. No specific amenities are available. The adjoining slopes show signs of erosion near the overlook, and the facility is in poor condition overall.

Serrano Landing Day Use Area

Serrano Landing Day Use Area is a Miller Canyon day use facility serving as a boat-in and hike-in site that includes one courtesy boat dock. There are also three picnic tables each with shade structures and grills. Three additional tables are present. The area is served by one flush restroom, one vault restroom and one drinking fountain. The area is a hike-in/bike-in/boat-in site, but there are 14 regular parking spaces remaining from when the site was once open to vehicular access; although those are not counted in the inventory for evaluating user types and capacity. The site has one bike rack.

Miller Canyon Picnic Area

Miller Canyon Picnic Area is a hike and bike day use facility with 12 picnic tables, 1 large fire pit, and 1 vault restroom. In 2017, the site was unused, dilapidated, vandalized, overgrown with vegetation, and no drinking water was available. The site has no ADA-accessible features and is in poor condition overall.

Lynx Point Overlook

Lynx Point Overlook is a developed overlook viewpoint situated along Miller Canyon trail. The site has one vault restroom but no observable ADA features. The amenities at this facility are in generally fair to poor condition overall.

Devil's Pit Overlook

Devil's Pit Overlook is situated along the Miller Canyon trail and consists of an ADA-accessible elevated wooden deck-type structure extending out into the canyon that serves as an overlook viewpoint. The facility is freshly painted and in good condition.

Miller Canyon Group Camp

Miller Canyon Group Camp consists of three group camps that can hold 40 persons each. Each group site includes large food preparation tables, one large grill, one fire pit, and one water spigot with a drinking fountain attachment. There is a total of 42 picnic tables across the three group sites, most of which are ADA-accessible. There are 55 regular parking spaces, 1 ADA-designated space, and 1 flush-capable restroom. The restroom shows signs of disrepair, and the facility has vegetation that is overgrown. The asphalt trails amongst group gathering sites are in fair condition, but the asphalt sidewalk along the parking lot is in poor condition and needs resurfacing. Facilities at Miller Canyon Group Camp are not ADA-compliant.

Miller Canyon Trailhead

The Miller Canyon Trailhead facility consists of a paved parking area and is the main entrance (by vehicle) to the Miller Canyon day use sites that can be accessed by walking or biking around the gate on Dart Canyon Road. The site has one flush restroom and has an "iron ranger" self-pay station for park users. There are 49 regular parking spaces and one ADA-designated parking space available at the facility. In 2017, the parking lot was newly surfaced and in good condition.

Sycamore Landing Day Use Area

Sycamore Landing Day Use Area is a boat-in site in the northern section of Silverwood Lake. It includes picnic facilities with 13 shade structures. Each structure has its own trash receptacle and picnic table. One vault restroom is present. Overall, this facility is in good condition with good ADA accessibility.

Live Oak Landing Day Use Area

Live Oak Landing Day Use Area is also a boat-in site in the north section of Silverwood Lake. The site has eight picnic sites available, and each site includes a shade structure, picnic table, and trash receptacle. The facility has one vault restroom. This site receives some use from OHV and other walk-in users that access the facility by walking down to the shore from USFS Road 2N33. The site is also adjacent to the dispersed use areas known as Twin Coves that also receives boat-in and walk-in day use. The Live Oak Landing Day Use area is not ADA-accessible. Overall, the Live Oak site is in good condition.

Chamise Day Use Area

Chamise Day Use Area is a boat-in site located in the northern section of Silverwood Lake. The facility has seven picnic sites, each having a picnic table and shade structure. The picnic sites have seven trash receptacles that are distributed throughout the facility. One vault restroom is present. The sites are in good condition, but the restrooms have graffiti. Overall, this facility is in good condition. There are user-made trails in poor condition connecting the site to pullouts on State Highway 138 and connecting the facility to the PCT. This site has good ADA accessibility.

East Fork Trail

East Fork Trail is a 0.3-mile paved asphalt trail used by bicycles and hikers that connects Serrano Landing Day Use Area with Jamajab Point. The trail is somewhat degraded and in poor condition. There are several sections where the asphalt has degraded severely, and there is overgrown vegetation along its length.

Miller Canyon Trail

Miller Canyon Trail is a 1.6-mile-long natural surface hiking trail that connects Miller Canyon Group Camp to the Silverwood Bike Path. The trail is in overall good condition; however, one area has been partially washed out. There are no directional or informational signs at either end of the trail guiding users. The trail is not ADA-accessible.

Silverwood Bike Path

The Silverwood Bike path is a 5.6-mile-long asphalt trail that connects to most of the main facilities in the SRA, and extends from Serrano Landing Day Use Area in the Miller Canyon area to the Cleghorn Day Use Area. The trail is laid out in four segments, which include:

1. A 1.6-mile section of paved trail from Serrano Landing Day Use Area to Black Oak Picnic Area. This trail provides access to the Miller Canyon Picnic Area and has several areas with side bank erosion and past washouts, and is in fair condition overall. Few directional signs are present.

2. A 1.2-mile section of paved trail from Black Oak Picnic Area to Sawpit Canyon areas. The trail is in good condition.
3. A 1-mile section of paved trail from the Sawpit Canyon areas to Mesa Campground. Overall, the trail is in fair condition.
4. A 1.8-mile section linking the Mesa and New Mesa Campgrounds to the Cleghorn Day Use Area. This section of the trail has crumbling pavement and is in fair condition. Few directional signs are present.

Recreation Area Management and Public Safety

DPR provides patrols on the water and in recreation areas. DPR staff at the facility include three supervisors and five rank-and-file badged officers. On busy weekends, Visitor Services performs visitor-intercept patrols along State Highway 138. Facilities maintenance includes another four DPR employees. A DPR concessionaire, Rocky Mountain Recreation Company (RMRC), operates the marina and beach store under a lease agreement. Ingress to Silverwood Lake SRA is via a 0.4-mile-long double lane access road leading to the entrance station. There are trash receptacles and a portable restroom along the roadside shoulder.

There is a $10 entrance fee for vehicles using day use facilities; boats and trailers require an extra charge. The $10 fee is charged per vehicle coming through the entrance kiosk whether to park or launch a boat inside the park. For boaters, there are 60 total boat launch reservations that can be made per day through https://www.reservecalifornia.com. There is no limit to how many people come into the park in a vehicle.

All camping reservations, including the 6 group camps (i.e., 3 in West Fork/Cleghorn Canyon with a 100 maximum capacity at each site and 3 at Miller Canyon with a 40 maximum capacity at each site), can also be made at reservecalifornia.com. Camping is $45/night for a standard site and $50/night for a site with electric and water hookups (i.e., New Mesa Campground only). Two cars per campsite are allowed. There is no charge for walk-ins.

The park is only open to vehicles and day use from 7:00 AM – 7:00 PM in winter and 6:00 AM to 9:00 PM in summer (April – September). All recreational vessels are required to be trailered by sunset, and all vehicles must be out of day use areas by 9:00 PM or they will be issued a citation by DPR. The reservoir is open at all times to anglers.

At full park capacity, DPR issues a “closure” and engages California Highway Patrol for assistance. DPR has a management system that has been in use for many years for dealing with the crowds on busy weekends. The SRA historically fills to capacity soon after opening on some summer weekends and holidays. Vehicles line up very early in the morning outside of the entrance kiosk and along the entrance road in order to enter the SRA when the park opens in hopes of getting in before the park fills to capacity.

DPR staff allow them to que on the 0.4-mile-long entrance road (near the kiosk) back toward State Highway 138 on- and off-ramps. No parking is allowed on the highway off-ramp. Cars are allowed by DPR staff to que on the shoulder of State Highway 138, outside the white fog line, and when this happens, do so from just beyond the off-ramp extending along State Highway 138. At most two hundred vehicles may que in a closure situation or usually less if awaiting opening in the morning.

When the park fills to parking capacity, some users walk-in. DPR staff try to help people by directing them where to go.

Trash is picked up daily at the developed sites, and restrooms are cleaned on hourly rotations during busy days. A barge is used to pick up trash from boat-in sites once a week, generally on Fridays.

In recent years, there have been harmful algal blooms in Silverwood Lake, as indicated by the presence of cyanotoxins, which are compounds produced by blue-green algae, or cyanobacteria. In response to these blooms and following the issuance of the SWRCB’s draft voluntary Statewide guidance for blue-green algae blooms, DWR monitors cyanotoxin levels in the lake, including the swim areas. In accordance with cyanotoxin threshold levels established by SWRCB, DWR water quality staff advise DPR on the recommended recreational health advisory and associated protective measures. In 2016, elevated cyanotoxin concentrations at Cleghorn swim beach prompted the issuance of a recreational health advisory. DPR closed the swim beaches for 10 days and closed the lake to all water recreation activities for six days. In 2017, elevated cyanotoxins levels from a harmful algal bloom prompted the closure of the swim beaches and adjacent day use areas for two weeks. There are three recreational advisory levels based on cyanotoxin concentration. These are: (1) caution; (2) warning; and (3) danger. Under warning and danger recreational health advisories, swimming is not advised and the swim beaches are closed to protect public health. Other water contact activities, such as boating, water skiing, and jet skiing, may be prohibited during a danger-level advisory.

DPR manages Silverwood Lake boating through a set of safety rules that are widely noticed/signed at the boat ramp and in brochures and signs. These rules 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 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.
- Riding on the bow, gunwale, or transom of any vessel is prohibited.
- 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.
- 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, and outlet areas at Cedar Springs Dam is not allowed. (DPR 2010).

5.5.1.3 Recreation Demand and Use

<u>Recreation Provider Interviews</u>

DWR conducted interviews with Silverwood Lake SRA park managers and staff, Project operations staff, USFS staff, Silverwood Lake SRA's concessionaire manager, staff from the City of Hesperia and Hesperia Recreation and Parks District, California Department of Transportation (Caltrans) District 8 planning staff, a representative of the Mojave River Natural History Association (MRNHA), a regional representative for the PCT Association and a volunteer for the USFS Adopt-A-Trail program active in the Miller Canyon area. The interviews were conducted to gather information about recreation user needs, use levels, user patterns, and issues related to law enforcement and vehicular traffic considerations including parking, traffic management and periodic road backups outside entry points.

The interviews yielded relevant information on current use, user preferences and needs, perceived regional uniqueness and significance of recreation opportunities within the Project area. Additionally, the recreation providers in the area offered information based on their firsthand insight into user needs based on their observations and contact with recreationists as well as potential recreationists who inquire about opportunities regardless of whether they actually visit and experience the SRA. The recreation provider interviews provided important insight into use patterns within the Project vicinity and also yielded considerable information regarding existing and potential future recreation needs based on their assessments.

<u>California Department of Parks and Recreation</u>

DPR managers and park staff were interviewed about recreation use management and user trends. As managers at the site on a regular basis, they have extensive knowledge of recent, past, and present recreation use patterns and influencing factors. The following visitor use observations were made in discussions held on July 10 and November 16, 2017.

In terms of park usage and capacity, the SRA consistently fills to capacity on most holiday weekends by mid-morning. Day use limits are governed by the parking capacity, and DPR limits cars coming in to about 1,500. DPR park staff also allows only 150 boats to enter on a given day, and the marina concessionaire's rental fleet includes another 20-30 boats. The limit is the maximum which, based on the staff determination, should be allowed for safe and enjoyable use on the lake based on experience of having many crowded weekends, user patterns, and problems that evolve during high use periods.

Both individual campgrounds and day use areas can also fill to capacity on many summer weekends. The high-use season is generally from April to October. The group camps are also consistently being utilized on most summer weekends.

Other information and key observations noted by DPR are as follows:

- Although DPR limits the number of vehicles within the SRA, there is no limit to how many people may enter the park in a vehicle, and staff mentioned that some families/groups will exit the park to shuttle additional people into the park under the same vehicle day use pass.

- Some boaters and day users line up as early as 3:00 AM to gain admittance into the park when it opens at 6:00 A.M. When the SRA reaches capacity, it typically remains full and does not reopen until the afternoon. At that time, additional vehicles are permitted into the SRA. While at maximum capacity, park staff operate under a “one-out, one-in” type of arrangement for boaters waiting to launch. Wake boarding boats often leave after the morning when the water gets rough, as they prefer calm water conditions. For other user groups, the SRA staff waits until there are approximately 40 open parking spaces before accepting additional visitors.

- At full closure, DPR engages California Highway Patrol for assistance. DPR has a system that has been in use for many years for managing the crowds on busy weekends. People line up very early in the morning outside of the entrance kiosk and along the Park access roads to enter the Recreation Area during peak times. DPR allows them to line up on the entrance road (near the kiosk) down to the State Highway 138 on- and off-ramps. No parking is allowed on the highway off-ramp. If necessary, vehicles are allowed to line up on the shoulder of State Highway 138, outside the white fog line, and do so from just beyond the off-ramp to the north on State Highway 138 (southbound traffic).

- In the past, DPR had a sign at State Highway 138 and Interstate Highway 15 informing people if the park was full. As noted in the interviews, there is potential for temporary signage posted at I-15 and State Highway 138 to inform en route visitors of a closure shortly after it occurs. The Caltrans electronic Interstate signs are not an option since they are only used for emergency notifications (e.g., Amber alerts).

- The Sawpit Day Use area is very popular with park users. Cleghorn Day Use area is usually the last day use area to fill up. It was further noted that visitors fill the parking lots at Sawpit Canyon before going to Black Oak or Cleghorn day use areas (aside from a slight minority of users who prefer Cleghorn Day Use area over the other areas).

- The Miller Canyon day use area re-opened in 2016 after being closed for approximately 10 years due to fire damage from the Old Fire (2003). There is a newly surfaced access road that leads from the parking lot to the lake for pedestrians, hikers and cyclists.

- On weekends and holidays, Silverwood Lake is a destination recreation facility and visitors plan to stay for the entire day or for the term of their planned visit.

When the park fills to capacity, those destination users often park outside of the SRA and walk in, unlike local users who might return home or go elsewhere.

- The Live Oak Landing boat-in site receives occasional pedestrian access from SBNF Road 2N33. No camping is allowed in this area, and DPR issues tickets to violators (there is signage on the entry road with rules). Typically, enforcement in this area is conducted by patrol boat, which results in a slower response than might otherwise be experienced along roaded areas of the SRA. Many people that go to this area are locals.

- At Mesa Campground, sites 1 through 65 are typically removed from the advanced reservation online system after October 1st, whereas sites 66 through 95 remain on the reservation system year-round. DPR staff prefers to not turn away visitors, and will re-open campground loops to meet demand.

- Biking is a growing recreation use at Silverwood SRA. Hiking, kayaking, canoeing, and paddle boarding are also increasing. Staff has noticed a trend of visitors bringing their own equipment to the park for personal use, including kayaks, hiking accessories, and bikes for riding the SRA trails.

- Staff noted repeat visitorship at Silverwood Lake. High visitation occurs on weekends, and many visitors have visited the park before. Day use is the most popular type of visit at the lake. There was also an observation that the majority of boaters probably come from the nearby high desert communities.

- Recreational fishing occurs year-round, with higher usership from fall to early spring. Bass fishing tournaments (including some with night fishing) must be arranged in advance and are permitted outside of the busy summer season (not allowed between Memorial Day to Labor Day).

<u>San Bernardino National Forest</u>

USFS staff from the SBNF were interviewed about recreation use management and user trends on Federal lands that surround Silverwood Lake. As managers of important public lands in the Project vicinity, they have extensive knowledge of recent, past, and present recreation use patterns and influencing factors. The key points noted in a meeting on July 11, 2017 are summarized as follows:

- The adjoining lands both east and west of Silverwood Lake SRA are used extensively for a variety of OHV uses, including jeeps, motorcycles, and other all-terrain vehicles. Some SBNF roads have signage precluding vehicles with Green Stickers (i.e., vehicles that do not have a highway registration), meaning that only street legal vehicles are allowed.

- SBNF has one staff member assigned to maintain the OHV trails surrounding the Silverwood Lake area. OHV users are supposed to stay on designated trails, but user-made OHV trails are still created. The USFS tries to close them off where possible. The single staff member conducts all of the maintenance on these OHV trails, and can haul out as much as three truckloads of trash daily. This trash must be taken to a transfer station, and fees are assessed to USFS for this expense. It was mentioned that the trash that accumulates on FS Road 2N33 can take up to one week to remove (at three trips per day) by the OHV Technician.

- OHV use patterns are somewhat consistent, and the trails remain busy year-round. There is no high season. During winter, this area is popular as it does not get snowed out like other Forest OHV areas. Therefore, USFS feels that this area is a unique resource, as its elevation is lower than many other OHV back-country roads and trails in the SBNF.

- The USFS is concerned about the potential for fire starts on recreational use areas surrounding Silverwood Lake (both in the SRA and on NFS lands). There is a particular concern in places like the Twin Coves area, which is near the Live Oak Landing Day Use Area. In that location, OHV users and people who want to access the lake for free often walk down to the shoreline and set up barbeques. While fires and barbeques are not authorized in this area, there is concern that there are no hot coal and ash receptacles located in these areas where unauthorized use does occasionally take place.

- It was noted that for the shoreline lands around the north lobe of the lake, DPR officials patrol and maintain the shoreline area by boat, and yet trash regularly accumulates on trails leading upslope and crossing onto USFS lands.

- The OHV area east of Silverwood is accessible from the Cedar Springs Dam Road and parking area, as well as from Miller Canyon (four wheel drive vehicles only). This area includes Pilot Rock Road (road 2N33) and is a popular route used by a variety of OHV users.

- The USFS staff indicated that they were considering the possibility of relocating the PCT immediately west of where it crosses State Highway 138. In its current alignment, the PCT is within the flood plain of the West Fork Mojave River and therefore the trail can get washed out in storm events. At this location, upslope and above the trail, DPR maintains a small shooting range. When in use, this shooting range can startle various PCT users who are not expecting an abrupt disturbance.

- There is not much equestrian use of the PCT, but equestrian users sometimes park on the side of State Highway 138 and head south into the national forest.

- The USFS recently completed building and relocating an OHV staging area in Miller Canyon and plans to decommission and restore the older area that is along the shoreline of the East Fork of the West Fork Mojave River.

- Miller Canyon is an area that has a unique array of biota as it is an ecological transition zone between the higher mountains and desert areas below. This area is probably the most used area in the Project vicinity for wildlife viewing (particularly birding).

- Dispersed camping is allowed on SBNF lands, and USFS lands can receive “spill-over” campers who have been turned away from Silverwood Lake SRA when it is full. Dispersed camping is allowed along USFS roads as long as campsites are located at least 10 to 15 feet off the road. If Silverwood Lake SRA fills to capacity, campers generally turn to Mojave River Forks Park and, after that fills up, some users will try to find USFS lands to camp on along the road system.

- Boaters have limited choices if Silverwood Lake SRA is full, as Lake Perris is two hours away and has had low lake levels in recent years. Lake Arrowhead is not open to the public. Big Bear Lake is often available, but many vessels require the adjustment of boat props, as they need to be at a different pitch due to the higher elevation conditions present at Big Bear Lake.

Pacific Crest Trail Association

A regional representative from the PCTA was interviewed on September 20, 2017 to gather more information about recreational use and user trends associated with the PCT in the Project area. The PCTA is focused on protecting, preserving and promoting the PCT as a world-class experience for hikers and equestrians, and for all the values provided by wild and scenic lands. A summary of the key findings is as follows.

- The PCT is a National Scenic Trail that was designated by an Act of Congress in 1968. The trail runs from the Mexican to Canadian border. Over the past 10 years use has increased significantly. Through-hiking (going from the southern terminus to the northern terminus) is popular on the trail. This type of use has grown from a few hundred people per year (approximately a decade ago) to over a few thousand people each year (in recent years). Most through-hikers begin in April or May.

- PCTA has an MOU with DPR, USFS, and other public land managers, in order to address improvements, maintenance, and operations of the PCT on these public lands.

- There are two types of PCT hikes that require a permit: long distance hikes greater than 500 miles and through-hikes for those intending to hike from the Mexican border to the Canadian border. There is a limited number of long distance and through-hiker permits available. The maximum is 50 permits per day during peak hiking season, which is March through June, for different trailhead locations. In 2013, there were 988 northbound through-hiker permits issued. In 2016, there were 3,164 northbound through-hiker permits issued.

- For through-hikers, beginning at the Mexican border means that hikers will take approximately 3 to 4 weeks to reach Silverwood Lake.

- It was noted that long distance hikers and through-hikers are a small percentage of people that actually use the trail. The permit application process allows PCTA and USFS to track the number of long distance trail users. However, actual use on the trail is not easily tracked because most use of the PCT is from local people who use the trail for recreational hiking.

- The PCTA, California Conservation Corps, American Conservation Experience, and various other volunteer groups conduct trail maintenance in and around Silverwood Lake. DPR does not conduct trail maintenance on the PCT but will support maintenance efforts in other ways (e.g., by providing campsites and entry to the SRA).

- One PCTA representative noted potential effects of the Project on the PCT, including increased litter (garbage) and likely sanitary issues. It was also noted that these issues may be due to the fact that Silverwood Lake is near an area with a large population that has easy access to the PCT.

<u>Caltrans</u>

The Project area is located within Caltrans District 9 with regard to planning, operation and maintenance on area public state highways. A group interview meeting was held in District 9 offices on November 17, 2017, to discuss vehicle traffic patterns and management/design standards for State Highways 173 and 138 around the Silverwood Lake area. The key findings of the discussion are as follows:

- Caltrans staff discussed proposed development and changes in land use that require further highway traffic analysis, known as a warrant process, to identify when signalization might be required. There were no current warrants or other inquiries into State Highways 173 or 138, in the Silverwood Lake area that Caltrans staff were aware of.

- When traffic is constrained and studies are warranted, Caltrans assesses turning volumes, crash experience, peak hours, and pedestrian volume to determine if signalization is warranted. From what the Caltrans staff knew of the periodic back-ups on State Highway 138, it did not appear that the situation would justify signalization, and the preferred approach included having law enforcement officers present to direct traffic, which is a common remedy to such peak occurrences that are fairly predictable.

- It was noted there are at least 14 paved pullouts along State Highway 138’s east side affording views of Silverwood Lake. These pullouts were not designed to serve as parking areas. Rather, they are pullouts intended for use as pull-out viewing areas and also to provide a turnout for slow vehicles with 5 or more following vehicles.

- Caltrans is sensitive to any activity that would increase maintenance, so even the placement of new signage or changes in trash receptacles at the pullouts can be problematic for them.

- Caltrans sponsors the Adopt-a-Highway program that can help address maintenance concerns, and Caltrans also sometimes uses a Federal Land Access Program that has funding to help recreationist access Federal lands for recreation uses.

- If new proposed facilities or signage are placed on the Caltrans right-of-way, an encroachment permit should be pursued.

Mojave River Natural History Association

The MRNHA was formed in 1983 and became a non-profit organization in 1984. The group is active in hosting activities at Silverwood Lake and assists with operating the Nature Center. Activities include hosting the annual Applefest event in October and helping run the winter Bald Eagle surveys. The following presents a summary of the key findings from a telephone interview held on December 1, 2017, with a representative of the MRHNA. The representative noted that he had been volunteering at Silverwood Lake SRA for many years and offered some first-hand reflections about visitor use and demands, as well as some ideas for park improvements.

- It was noted the MRNHA is a volunteer organization with 80-90 percent of funding stemming from firewood sales they do near the Park entrance kiosk from May through September each year.

- The MRNHA has been running the annual fall Applefest celebration for about five years and have had as many as 300 attendees. In 2017, between 70 and 80 people attended this event. The festival includes harvesting apples from 100-year-old trees that were part of a larger apple orchard around the old town of Cedar Springs prior to construction of Cedar Springs Dam. MRNHA has an old apple press they use to make cider during these events.

- In the summer, the MRNHA staffs the Silverwood Nature Center for DPR. In was noted the Nature Center building was built with bond money from 1998 but construction did not start until 2004; however, it was not occupied until 2012.

- MRNHA keeps the center open on Fridays, Saturdays, and Sundays through the summer season for four hours a day. However, to do this they have to fund a part time DPR staff person to help ($4,100 in 2017 was given to DPR for this position). There are very few displays at the nature center. It was noted that the center could use additional display items to attract more patrons from the SRA to visit the center.

- At the nature center, MRNHA hosts some activities for recreationists on Fridays and Saturdays to increase visitation. Last year, for example, the activities included making butterfly feeders. The MRNHA representative estimated they received between 150-200 visitors on a typical Friday (where sometimes campers are also registering there), between 50-60 people on Saturday, and less than 10 visitors on Sunday.

- MRNHA would like to procure a display case for the Nature Center, but they need more display items and suggested more could be done to celebrate the history of the old Cedar Springs community. It was mentioned that possibly the Las Flores Ranch held onto many artifacts and they could be used to celebrate the Native American history of the area with displays.

- The MRNHA representative thought more local school outings could be undertaken if the Nature Center had more exhibits and displays.

- On visitor use and needs, the MRNHA volunteer noted that Silverwood receives two major types of visitors. During summer, people come from the greater Los Angeles area, and that period also experiences use by inner-city residents that brings great diversity to the SRA. In the off season, outside of the summer periods, the user base is mostly local, from the high-desert communities. Many if not most days in the off season, less than 50 visitors a day come to Silverwood Lake SRA.

- There is no recycling at Silverwood Lake SRA, and MRNHA experiences increasing problems with more litter and graffiti in the summer season.

- It has been observed by MRNHA that there is a growing demand for hook-ups at campsites, and that New Mesa is favored by overnight campers because it has hook-ups. There is more demand by the growing baby boomer age cohort who are retiring and buying RVs.

- There is also new demand for additional parking at individual camping sites, and there is a need for some sites to be designed for more than 8-persons (current limit per site). The Mesa Campground area has a large meadow that, according to the MRNHA representative, could be converted to a larger site for small groups.

- MRNHA staff did not feel that Silverwood Lake SRA reaching capacity on holiday weekends was a problem and noted the Park Rangers often hand out flyers to tell people where else they could go, for example, to Mojave Narrows Park.

Rocky Mountain Recreation Company

RMRC is the primary concessionaire for DPR at Silverwood Lake SRA. RMRC operates a snack bar, small store, the marina, and boat and other watercraft rentals. RMRC's site manager provided the following observations and information about their operation in an interview on July 10, 2017:

- RMRC main operations involve operating the marina, renting out daily or annual boat slips, renting out watercraft, operating the store and snack bar, and providing a mobile goods delivery service to the day use and campground areas. This mobile goods delivery service offers ice, firewood, ice cream, and other food products.

- The store and marina operate year-round, and the operation is only closed on Thanksgiving and Christmas days.

- RMRC rents 14-foot aluminum boats by the hour and has three pontoon boats for rent to larger groups. They also have a lease with another vendor who rents personal watercraft, kayaks, paddleboards, and pedal boats (two- or four-person boats available). They also rent slips in the marina, both for overnight and monthly use. DPR retains six to seven marina slips for its use. There is a wait list for reserving a boat slip on the monthly contract. The marina slips are open year-round. Typically, the daily overnight slips are available and used by campers at the park who do not wish to pull their boat out at night. RMRC would like to expand the marina to accommodate more monthly moorage.

- For park entrants bringing their own equipment to the lake, DPR tries to maintain a lake limit of no more than 150 vessels at once. However, the concession rentals do not count in that limit, and, therefore, represent use above the 150-vessel limit.

- The RMRC staffer shared that, based on his many years at Silverwood, he felt that most boaters got along well. Many of RMRC boat rental users tend to stay in Cleghorn Cove and southern parts of the lake, while private watercraft often venture to the north part. Regardless, there is mixed use of boat types throughout the lake on most days.

The City of Hesperia and Hesperia Recreation and Park District

Hesperia Recreation and Park District works with city, county, and State officials to administer and manage public parks within the district. The Recreation and Park District also works in conjunction with city, county, or State agencies to adopt annual budgets and set overall goals. The Recreation and Park District operates, maintains, and plans for parks and recreation needs in the community. An interview with representatives of the Recreation and Park District and the City of Hesperia was held on November 16, 2017, to learn more about future recreation needs, including information regarding how recreation needs of the new residents anticipated with the recently approved Tapestry development will be met. The following are some observations about recreation trends and needs in the region:

- The proposed Tapestry Development is a phased project to be constructed over the next 30 years as the regional population increases. The development will be built from north to south, with the areas closest to Hesperia being constructed first. It was mentioned that the project would be staged over a 35-year timeframe. There are currently 15,663 dwelling units, or homes, proposed in the Tapestry Specific Plan. This proposed total reflects the most recent settlement agreement. At full build out, Tapestry is projected to increase the population of Hesperia by one-third.

- Hesperia is a high desert bedroom community that includes over 50,000 daily commuters to the Greater Los Angeles and San Bernardino area. The Tapestry development will house commuters 15 to 20 minutes closer to the metro areas than current high-desert housing tracts.

- The proposed Tapestry development will provide a 60 percent increase in funding for local schools in the future.

- As planned, the development will double the size of Hesperia Recreation and Park District lands, which currently totals 360.0 acres. Tapestry will provide a total of 387.4 additional acres of parks and 94.2 acres of open spaces with trails. Recreation facilities proposed at Tapestry include a community sports park, traditional parks, and trails. Proposed trails will be mostly located within open space. A sports park and trails with open space are a part of the first phase. The proposed parks will be managed by both the homeowner’s associations and Hesperia Recreation and Park District.

- After 200 homes are built, a traffic impact analysis will be required. A new Ranchero exit off Interstate 15 is proposed, and infrastructure improvements to Ranchero Road are included in the Tapestry Specific Plan. Highway 173 will be widened to four lanes in later phases.

- Development agreements for the Tapestry Development are not finalized.

- In regard to Silverwood Lake SRA, it was noted that more communication between DPR and the community could help with coordinating the planning of events. Local citizens potentially could serve as volunteers who could hold community days to help remove weeds, provide litter clean-up patrol, assist with vegetation management, and perform trail maintenance and other light maintenance duties.

Miller Canyon Adopt-A-Trail Program Volunteer

A long-time Adopt-A-Trail volunteer and OHV and Utility Task Vehicle user in the Pilot Rock/Miller Canyon area was interviewed based on SBNF recommendations. The volunteer noted the new SBNF Miller Canyon OHV staging area trailhead has less capacity than the previous staging area. Since the new area is smaller, there could be traffic backups which could bring more crowds to the area just outside the proposed Project boundary. It was also noted that other areas of the SBNF had closed recently (Azusa Canyon), and the Miller Canyon/Pilot Rock and Pinnacles areas may receive more use and higher demand due to displaced users from the Azusa Canyon area.

The volunteer noted that the OHV user groups want access to nearby camping, and the Miller Canyon Group camps have in the past been open for OHV users to camp. However, because the Miller Canyon Group Camps are currently available by reservation from only May through October, the area does not accommodate the mostly individual and small group OHV users who need nearby camping sites for staging. The volunteer noted that staying at New Mesa or Mesa Campgrounds does not work for most of the OHV users since it is illegal to drive most OHV equipment on State Highway 138 to access Miller Canyon OHV trails. His suggestion was to open up Miller Canyon Group Camp to individual campers and keep it open year-round.

Recreation Uses and Visitation

DWR and DPR researched visitation records from 2001 to 2017. These visitor records provide user counts in the form of recreation visitor days. A recreation visitor day is a count or estimation of each visit by a person to a development for recreational purposes during any portion of a 24-hour period. The visitor records from the early 2000s provide a useful comparison to visitation trends in the last 10 years. Form 80 recreation reports contain estimates of visitation and provide some insight into past visitation levels. This form was filed with FERC for years 1996, 2001, 2010, and 2014. Based on these records, annual visitation was consistently above 250,000 recreation visitor days. Visitation was higher from 2002 to 2009 compared to 2016 to 2017 (Table 5.5-2).

In addition, it was reported that visitation was more than 700,000 recreation visitor days during the late 1980s (DWR 1991). Based on the last 10 years of records, about 83 percent of all use is day use and 17 percent is overnight use.

Visitation trends indicate that park use is declining slightly over the last 20 years, and this trend is noticeable in the annual visits (Table 5.5-2) and by examining monthly use figures (Figure 5.5-4). Similarly, overnight camping use is also declining at a slightly greater rate than total use (combined day and overnight use)(Figure 5.5-5). Records for boating indicated by number of boat launches show a fairly steady pattern of use for the period of 2011-2017 (Figure 5.5-6).

While the records do not indicate how often the park had to be closed due to reaching capacity, SRA managers indicate that closures are fairly predictable and generally occur in the same pattern every year, including the three summer holiday weekends –

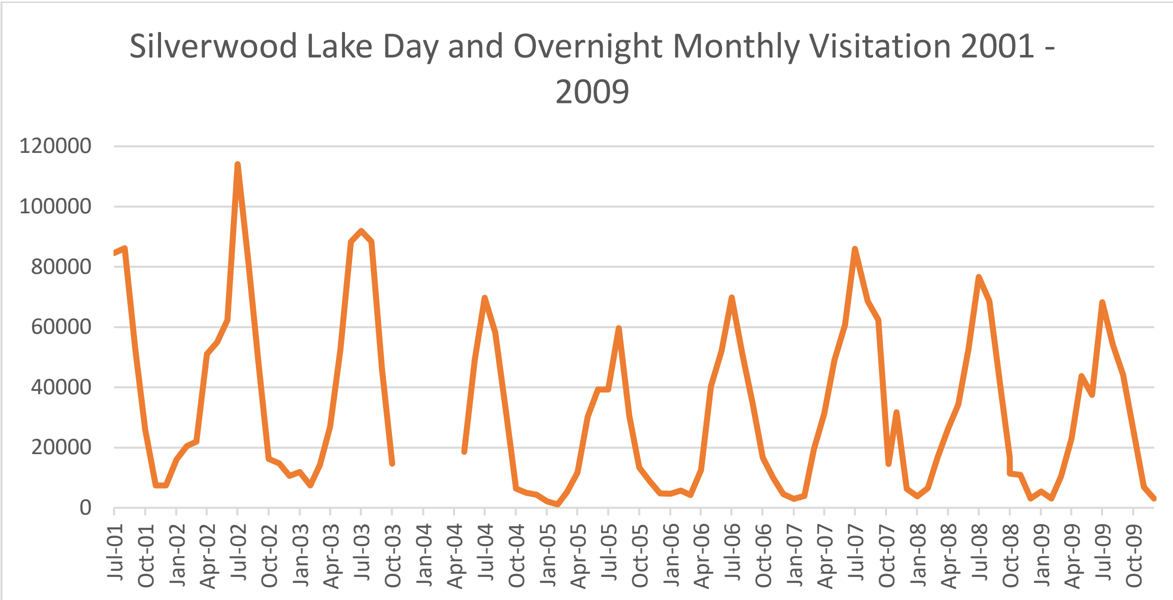
Memorial Day, Fourth of July, and Labor Day. These weekends involve the SRA closing for vehicle entrance during the early morning hours, except for the holiday day itself (typically, the Monday of the weekend). The SRA closes to vehicular entry on many weekend days in the summer recreation season. Park staff closely manages visitation levels on busy weekends, and after the main parking areas are full (estimated to be about 1,500 parking spaces) they close the park to additional vehicles. Boaters are stopped from entering the park after 150 boats have entered, and additional boats can be accommodated in a one-out, one-in arrangement as users depart. However, for day use, about 40 parking spaces need to become available in order for DPR to re-open the park on a limited entry basis.

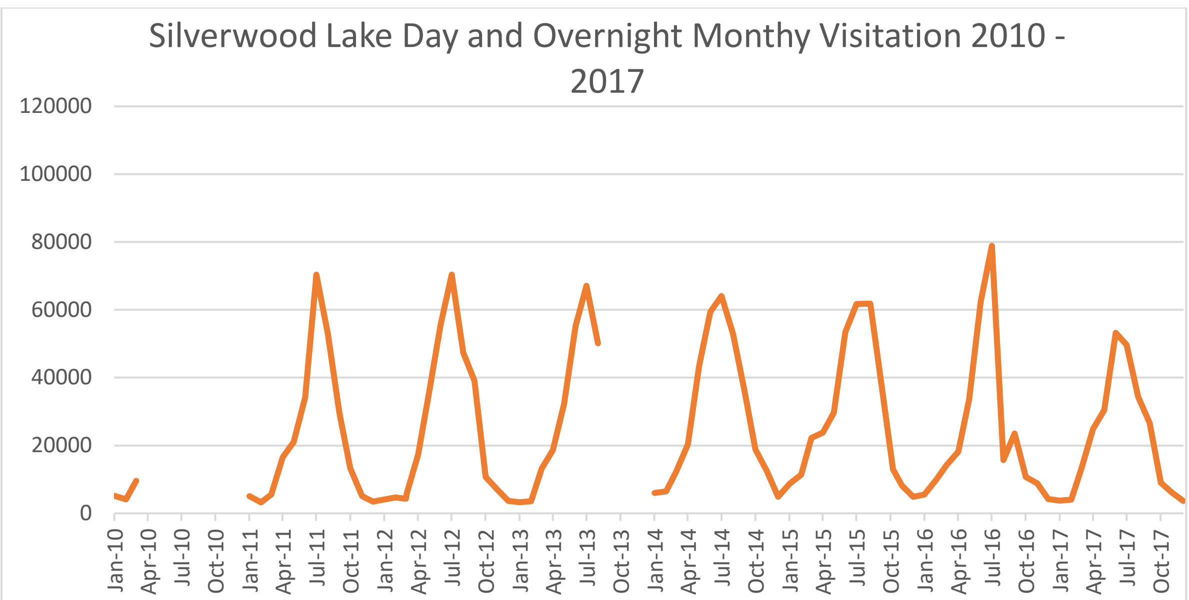
The group camps at the SRA also reach capacity on many weekends (Fridays and Saturdays) in June, July, and August (Figure 5.5-7).

Table 5.5-2. Annual Recreation Visitor Days at Silverwood Lake

Year	Visitor Days	Notes
2002	512,693	--
2003	441,987	Old Fire led to park closure in late October through December.
2004	--	No complete record for year available.
2005	245,690	--
2006	306,354	--
2007	436, 733	--
2008	357,986	--
2009	310,933	--
2010	--	No complete record for year available.
2011	260,122	--
2012	301,314	--
2013	--	No complete record for year available.
2014	337,116	--
2015	335,281	--
2016	285,759	Miller Canyon areas re-open after being closed for 13 years due to Old Fire damage in the area. Harmful algal bloom prompted the closure of Sawpit and Cleghorn swim beaches for 10 days (8/4/16-8/14/16) and lake-wide closure to all water recreation for 6 days (8/8/16-8/14/16). Miller Canyon closed on 8/7/16 due to nearby Pilot Fire.
2017	258,822	Silver Fire on 7/4/17 closed park after opening but did not lead to other day closures. Harmful algal bloom prompted the closure of swim beaches and adjacent Sawpit and Cleghorn day use areas for 2 weeks (7/14/17 to 7/-28/17).

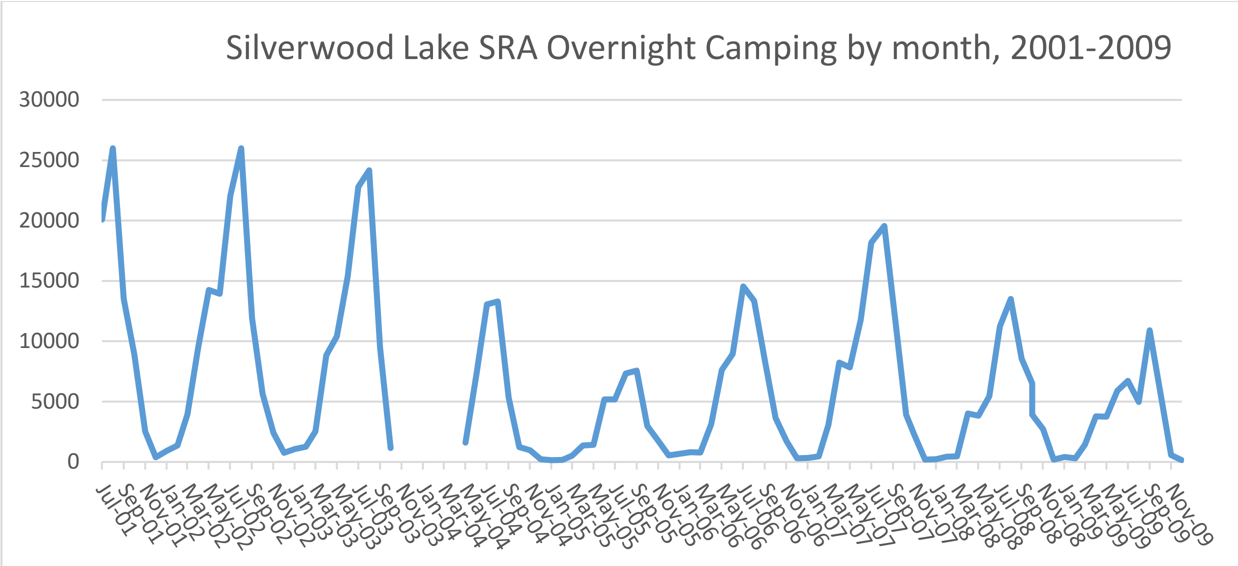
Source: DPR annual compilations of visitor days by month, 2002-2017

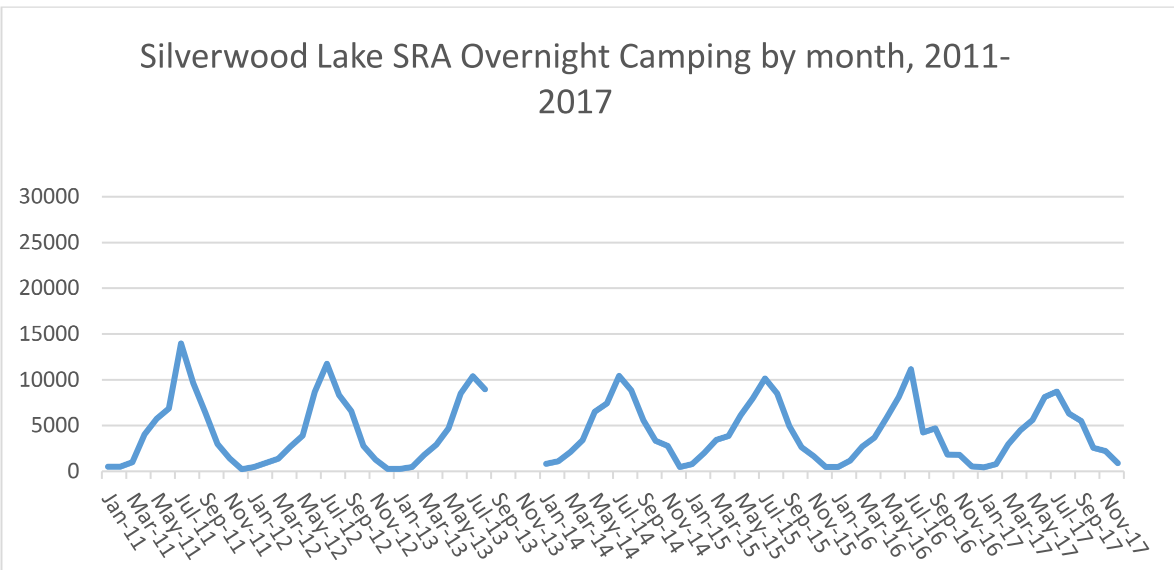




Note:
Number of persons is displayed on X-axis of graph

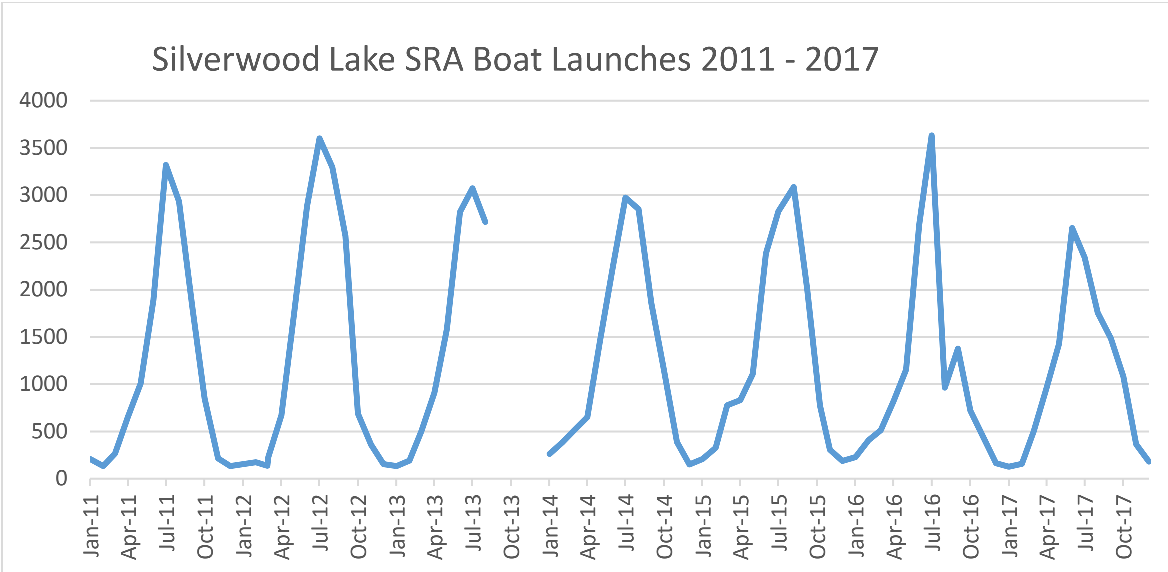
Figure 5.5-5. Daily/Monthly Visitation to Silverwood Lake SRA from 2001 through 2009 and 2010 through 2017





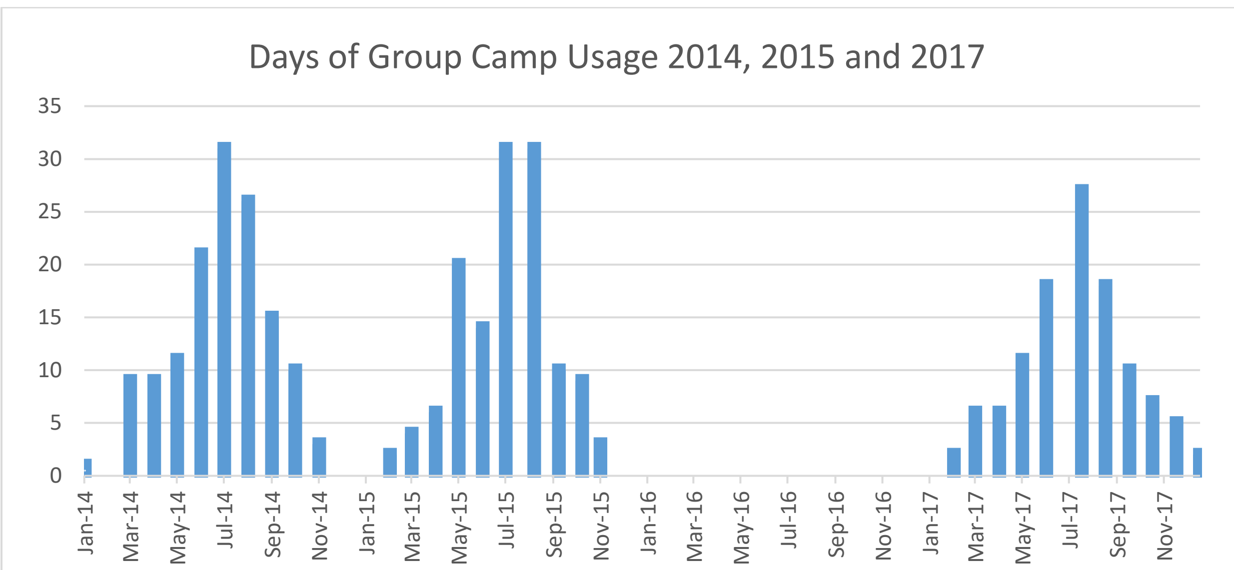
Note:
Number of persons is displayed on X-axis of graph

Figure 5.5-6. Overnight Visits to Silverwood Lake SRA from 2001 through 2009 and 2011 through 2017



Note:
Number of boat launches is displayed on Y-axis on graph

Figure 5.5-7. Number of Boat Launches by Month for 2011 through 2017



Note:
Number of days is displayed on X-axis of graph

Figure 5.5-8. Days of Group Camp Use for 2014, 2015, 2017

USFS maintains visitor use records through the National Visitor Use Monitoring Program. Records available for the SBNF from the 2009 and 2014 surveys (periods when surveys were conducted) indicate the most popular recreational uses of the SBNF are hiking, downhill skiing, bicycling, and relaxing. Records indicate OHV use represents almost 8 percent of SBNF visits. Total annual visits to the SBNF (excluding downhill skiing visits) were an estimated 1,803,000 visitors in Federal fiscal year 2009, and an estimated 1,447,000 visitors in fiscal year 2014 (USFS 2018).

Observation Survey

As part of DWR's Recreation Facilities Condition and Demand Assessment Study, on-site observational surveys were conducted in summer of 2017. During the survey period, researchers counted recreationists at eight sites in the Project area between June and October 2017. The work included morning and afternoon surveys at each site on four weekdays, two weekend days, and two holiday weekend days. Table 5.5-3 summarizes the results of the survey work.

Table 5.5-3. Summary of 2017 Observation Surveys Conducted at Silverwood Lake SRA

Recreation Area	Summer Day of Week	# People/ # Groups	# Vehicles/ # Nearshore Watercraft	Activities Observed
Cleghorn Day Use Area (include swim beach)	Weekdays	12-23/4-7	6-7 / 0	Fishing, kayaking, picnicking, pet play, swimming
	Weekends	80-170/14-24	26-52 / 6-10	Fishing, kayaking, picnicking, pet play, swimming, playing music, paddle boat, frisbee
	Holiday Weekends	550-1570/67-157	67-252 / 2	Fishing, picnicking, swimming, field sports, boating/kayaking
Nature Center	Weekdays	0/0	0 / N/A	No visitors at Nature Center itself
	Weekends	0-3/0-1	10-12 / N/A	Cars at Nature Center parking lot but no visitors
	Holiday Weekends	0/0	25-27 / N/A	Park filled to capacity so Nature Center parking lot used as overflow parking for day use
Sawpit Canyon Day Use Area (includes snack bar concession)	Weekdays	40-95/12-30	29-170 / 0 but many boat trailers	Groups dock fishing, picnicking, boat launch congregating
	Weekends	1,000-1,200/112-140	165-305 / 0 but many boat trailers	Fishing, swimming, picnicking, dog walking, paddle boat, jet ski
	Holiday Weekends	2,060-2,270/258-284	432-457 / 0 but 68-101 boat trailers	Fishing, boat launching, swimming, picnicking, dog walking, paddle boat, jet ski, field sports
Black Oak Picnic Area	Weekdays	0/0	5 cars / N/A	None
	Weekends	8-12/1-4	9-15 / N/A	Hiking, picnicking, barbeque
	Holiday Weekends	18-85/2-12	10-98 / N/A	Picnicking, frisbee, barbeque (Some cars were overflow from Sawpit area)

Table 5.5-3. Summary of 2017 Observation Surveys Conducted at Silverwood Lake SRA (continued)

Recreation Area	Summer Day of Week	# People/ # Groups	# Vehicles/ # Nearshore Watercraft	Activities Observed
Serrano Landing Day Use Area	Weekdays	0/0	0 / N/A	No visitors
	Weekends	9-20/2-4	0 / 3-8	Fishing, picnicking, canoeing
	Holiday Weekends	2-20/1-4	0 / 1-2	Kayaking, fishing, sunbathing, picnicking
Sycamore Landing Day Use Area	Weekdays	5-16/2-6	0 / 0-8	Sunbathing, boating, picnicking, swimming, jet and water skiing
	Weekends	12-20/3-6	0 / 3-4	Picnicking, sunbathing, swimming, fishing, kayaking
	Holiday Weekends	35-55/5-7	0 / 3-6	Boating, swimming, picnicking, fishing, jet skiing, sunbathing
Live Oak Landing Day Use Area	Weekdays	6-12/2-4	0 / 0-3	Swimming, boating, picnicking, sunbathing (vehicles parked on USFS road, walk-in)
	Weekends	40-65/10-10	3-4 / 4-17	Boating, swimming, picnicking, fishing, kayaking, jet skiing (vehicles parked on USFS road, walk-in)
	Holiday Weekends	36-45/6-8	0 / 4-5	Boating, swimming, picnicking, sunbathing
Chamise Day Use Area	Weekdays	3-7/1-3	0 / 1-2	Fishing, picnicking, boating
	Weekends	35-96/8-12	0 / 4-8	Boating, fishing, swimming, sunbathing, picnicking
	Holiday Weekends	30-40/10-12	0 / 4-6	Picnicking, swimming, fishing, jet skiing, boating

The results of the observational surveys indicate that weekends and holiday weekends are much busier than weekdays, and the activities observed on both weekends and weekdays are typically water or shoreline-based activities, with picnicking, boating, fishing and swimming being the most common. Overall, the results show that Silverwood Lake and associated water-based or shoreline activities are the major attraction.

Angling Use

DWR is required to stock rainbow trout in Silverwood Lake annually and to periodically conduct creel surveys to determine angler success and satisfaction rates for rainbow trout fishing. These surveys have 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. The sampling effort required to conduct the creel surveys was approximately two to three hours per survey day. 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 Sawpit Canyon launch ramp, immediately following their fishing efforts. Anglers were asked a fixed set of questions. Demographic data were also recorded to understand the characteristics of anglers (CDFW 2013).

The most recent study showed that most anglers (50 percent) 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 1 to 4) in the October 2014 through May 2015 creel survey. Summer creel surveys, conducted from June to September of the same year, were performed 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 through 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 5.2.1.2.

Carrying Capacity

A component of DWR’s Recreation Facilities Condition and Demand Assessment Study is a carrying capacity assessment. This study developed an overall assessment of the types and levels of recreational use to determine if use levels are compatible with the capacity of existing Project recreation facilities. Maintaining use levels within a recreation site’s capacity is important for the purposes of protecting natural, cultural, and recreation resources, as well as helping to assure public safety, providing predictability, and helping to assess management alternatives.

The concept of recreation carrying capacity was originally developed out of biological models that attempted to determine the capability of a given environment (e.g., range, pasture) to sustain a specific number of animals over time. While density-related information is an important factor in capacity, many management issues regarding recreation carrying capacity decision-making are not necessarily density dependent. Rather, recreation carrying capacity issues are also related to the ecological, social, and managerial aspects of recreational opportunities.

Recreation carrying capacity can be evaluated by considering several factors together to estimate a level of use beyond which impacts exceed common recreation industry and USFS standards. Three types of capacity were evaluated: (1) biophysical/ecological; (2) social; and (3) physical/spatial aspects, including management components. These primarily qualitative analyses focused on the capacity of existing developed recreation facilities and involved evaluating each developed site with respect to:

- Biophysical/Ecological Capacity – Relative impacts on the ecosystem, such as impacts to wetlands or riparian communities, observed soil erosion, vegetation damage, and observed trash accumulation and sanitary problems, among others. By design, developed/hardened recreation sites typically have fewer ecological concerns compared to dispersed use areas. The relative level of this factor can be noted and elaborated on in the condition assessment component.

- Social Capacity – Reported social impacts of recent and past visitor's recreation experience, such as perceived crowding, actual and/or perceived conflict, and overall satisfaction.

- Physical/Spatial Capacity – Identification of the number of units from the inventory component combined with recreation management considerations (including law enforcement) that will inform physical capacity (the number of people who can typically use a site at one time), and includes a spatial capacity component that accounts for periodic problems, parking, traffic flow or backups at entrances.

Recreation carrying capacity types were assessed at each developed recreation site at the Project. For each developed site, qualitative and quantitative data was used to identify a comparative and general status with respect to likely ecological, social, and/or management capacity impacts, and to establish an existing capacity parameter (expressed in qualitative terms, including "below," "approaching," "at," or "exceeding" capacity).

Based upon the findings of DWR's Recreation Facilities Condition and Demand Assessment Study, a qualitative and quantitative analysis of carrying capacity of each developed facility was undertaken and the results are summarized by recreation site in Table 5.5-4.

Table 5.5-4. Estimated Carrying Capacity by Recreation Facility

Recreational Facility*	Bio/Eco Capacity	Social Capacity	Physical Capacity	Overall Capacity Assessment
Rio Group Camp	Some user-created trails leading to West Fork Mojave, some veg trampling, exposed soils compacted. This camp is generally closed October through April, reducing potential ongoing effects.	No known problems; big spaces allow room even at full use	100 persons at a time capacity; 3 large shade ramadas; 4 restroom units, each with showers; 33 parking spaces (at capacity this roughly provides parking for 2 persons per vehicle average)	Approaching capacity and at or near capacity on most summer weekends
Barranca Group Camp	Has very little vegetation trampling and fewer disturbed soil areas than the other two adjoining group camps. This camp is generally closed October through April, reducing potential ongoing effects.	No known problems; big spaces allow room even at full use	100 persons at a time capacity; 3 large shade ramadas; 4 restroom units each with showers; 39 parking spaces (at capacity this roughly provides parking for 2 persons per vehicle average)	Approaching capacity and at or near capacity on most summer weekends
Valle Group Camp	Few user-created trails but some vegetation trampling on margins, exposed soils compacted	No known problems; big spaces allow room even at full use	100 persons at a time capacity; 3 large shade ramadas; 3 restroom units each with showers; 37 parking spaces (at capacity this provides 2 person per vehicle average)	Approaching capacity and at or near capacity on most summer weekends
Cleghorn Day Use Area	Erosion of disturbed soils has led to some vegetation loss at riparian edges of the West Fork Mojave River	Because the facility reaches capacity on holiday weekends, crowding or perceived over-crowding is likely an issue for some users; the possibility of user conflicts rises. Graffiti present indicates some level of misuse that could be a concern for some users' desired comfort level.	91 picnic sites with 239 vehicle spaces (provides capacity average of 2.6 vehicles per site or approximately 9 persons per site – or just over 800 persons capacity) (only considering picnic units)	Approaching capacity and at capacity on some summer and at least one day of each summer holiday weekend
Cleghorn Boat Launch	No known issues; site is fairly small and well hardened. Oil and grease runoff from vehicles in parking areas can add pollutants to the lake during rain events.	N/A	39 parking spaces, of them 8 suitable for vehicles with trailers; 2 launch lanes, one dock	Approaching capacity and at or near capacity on most summer weekends
Garces Overlook	Few user-created trails, but some vegetation trampling on margins; exposed soils compacted	No known problems; low use site leaves few likely encounters	Estimated to be less than 20 comfortably at one time	Below capacity
New Mesa Campground	Few user-created trails, but some vegetation trampling on margins; exposed soils compacted	Because the facility reaches capacity on holiday weekends, crowding or perceived over-crowding is likely an issue for some users; the possibility of user conflicts rises.	42 individual camping units at maximum allowed capacity of 3 vehicles and 8 persons per site; maximum capacity estimated at 336 persons	Approaching capacity and at or near capacity on most summer weekends
Entrance Station	No known issues; site is fairly small, highly developed and well hardened	Line queuing, especially during closures, could lead to some conflicts but no known issues.	2 vehicles at a time, less than 2 minutes likely per vehicle in normal flow	At capacity on many summer and holiday weekends
Nature Center	No known issues; site is fairly small, highly developed and well hardened	No known problems; infrequent use is group driven and likely acceptable to most users	Building can accommodate 40 people maximum; 111 persons total capacity, based on 30 parking spaces using factor of 3.7 persons per vehicle	Below capacity
Mesa Campground	Few user-created trails, but some vegetation trampling on margins; exposed soils compacted	Because the facility reaches capacity on Holiday weekends crowding or perceived over-crowding is likely an issue for some users, the possibility of user conflicts rises.	107 individual camping units at maximum allowed capacity of 3 vehicles and 8 persons per site; maximum capacity estimated at 856	Approaching capacity and at or near capacity on most summer weekends
Campfire Center	Few user-created trails, but some vegetation trampling on margins; exposed soils compacted	No known problems, infrequent use is group driven and likely acceptable to most users	Estimated to be less than 120 persons at one time	Approaching capacity at scheduled events

Table 5.5-4. Estimated Carrying Capacity by Recreation Facility (continued)

Recreational Facility*	Bio/Eco Capacity	Social Capacity	Physical Capacity	Overall Capacity Assessment
Sawpit Canyon Picnic Area 3	Few user-created trails, but some vegetation trampling on margins; exposed soils compacted	Because the facility reaches capacity on holiday weekends, crowding or perceived over-crowding is likely an issue for some users; the possibility of user conflicts rises.	278 persons total capacity, based on 75 parking spaces using factor of 3.7 persons per vehicle	Approaching capacity and at or near capacity on most summer weekends
Sawpit Canyon Picnic Area 2	Few user-created trails, but some vegetation trampling on margins; exposed soils compacted	Because the facility reaches capacity on holiday weekends, crowding or perceived over-crowding is likely an issue for some users; the possibility of user conflicts rises.	262.7 persons total capacity, based on 71 parking spaces using factor of 3.7 persons per vehicle	Approaching capacity and at or near capacity on most summer weekends
Sawpit Canyon Picnic Area 1	Few user-created trails, but some vegetation trampling on margins; exposed soils compacted	Because the facility reaches capacity on holiday weekends, crowding or perceived over-crowding is likely an issue for some users; the possibility of user conflicts rises.	762 persons total capacity, based on 206 parking spaces using factor of 3.7 persons per vehicle	Approaching capacity and at or near capacity on most summer weekends
Sawpit Canyon Day Use Area	Few user-created trails, but some vegetation trampling on margins; exposed soils compacted	Because the facility reaches capacity on holiday weekends, crowding or perceived over-crowding is likely an issue for some users; the possibility of user conflicts rises. Micro litter scattered about can be a problem for some users' enjoyment and expectations.	Estimated at approximately 1,600	Approaching capacity and at or near capacity on most summer weekends
Black Oak Picnic Area	Non-paved exposed areas include user-created trails leading to some vegetation trampling on margins; exposed soils compacted	No known problems, site has large spaces that are fairly well screened by vegetative cover.	451 persons total capacity, based on 122 parking spaces using factor of 3.7 persons per vehicle	Approaching capacity on most summer weekends
Sawpit Canyon Marina	No known issues; site is well hardened. Oil and grease from motorboats can add pollutants to reservoir.	Because the facility reaches capacity on Holiday weekends crowding or perceived over-crowding is likely an issue for some users, the possibility of user conflicts rises.	252 persons total capacity, based on 68 parking spaces using factor of 3.7 persons per vehicle	Approaching capacity and at or near capacity on most summer weekends
Sawpit Canyon Boat Launch	No known issues, site is well hardened. Oil and grease from motorboats and runoff from left vehicles during rain events can add pollutants to reservoir.	Because the facility reaches capacity on Holiday weekends crowding or perceived over-crowding is likely an issue for some users, the possibility of user conflicts rises.	636 persons total capacity, based on 172 parking spaces using factor of 3.7 persons per vehicle	Approaching capacity and at or near capacity on most summer weekends
Jamajab Point Overlook	Non-paved exposed areas include side cut bank that is eroding. Some user-created trails with some vegetation trampling on margins; exposed soils compacted	No known problems; low use site leaves few likely encounters	Estimated to be less than 20 comfortably at one time	Below capacity
Serrano Landing Day Use Area	Non-paved exposed areas include user-created trails leading to some vegetation trampling on margins; exposed soils compacted	No known problems; low use site leaves few likely encounters	Estimated to be less than 30 comfortably at one time	Approaching capacity on most summer weekends
Miller Canyon Picnic Area	Erosion of site; crumbling infrastructure and invasive weeds taking hold	No known problems; low use site leaves few likely encounters	Estimated to be less than 20 comfortably at one time	Below capacity
Lynx Point Overlook	Non-paved exposed areas include user-created trails, with some vegetation trampling on margins; exposed soils compacted	No known problems; low use site leaves few likely encounters	Estimated to be less than 20 comfortably at one time	Below capacity
Devil's Pit Overlook	Elevated wood platform avoids effects on vegetation and local habitats.	No known problems; low use site leaves few likely encounters	Estimated to be less than 20 comfortably at one time	Below capacity

Table 5.5-4. Estimated Carrying Capacity by Recreation Facility (continued)

Recreational Facility*	Bio/Eco Capacity	Social Capacity	Physical Capacity	Overall Capacity Assessment
Miller Canyon Group Camp	Non-paved exposed areas include user-created trails with some vegetation trampling on margins; exposed soils compacted	No known problems; ample spaces appear to allow room even at full use	40 persons at a time capacity	At capacity on most summer weekends
Miller Canyon Trailhead	No known issues; site is fairly small and well hardened	No known problems	185 persons total capacity, based on 50 parking spaces using factor of 3.7 persons per vehicle	At capacity on some summer and holiday weekends
Sycamore Landing Day Use Area	Non-paved exposed areas include user-created trails with some vegetation trampling on margins; exposed soils compacted. Litter accumulation and scattering by wind, rodents, and birds	Because the facility reaches capacity on holiday weekends, crowding or perceived over-crowding is likely an issue for some users; the possibility of user conflicts rises	13 picnic sites and adjoining areas estimated to hold approximately 50 persons total capacity	Approaching capacity and at or near capacity on most summer weekends
Live Oak Landing Day Use Area	Non-paved exposed areas include user-created trails with some vegetation trampling on margins; exposed soils compacted. Litter accumulation and scattering by wind, rodents, and birds	Because the facility reaches capacity on holiday weekends, crowding or perceived over-crowding is likely an issue for some users; the possibility of user conflicts rises	8 picnic sites and adjoining areas estimated to hold approximately 30 persons total capacity	Approaching capacity and at or near capacity on most summer weekends
Chamise Day Use Area	Non-paved exposed areas include user-created trails with some vegetation trampling on margins; exposed soils compacted. Litter accumulation and scattering by wind, rodents, and birds	Because the facility reaches capacity on holiday weekends, crowding or perceived over-crowding is likely an issue for some users; the possibility of user conflicts rises	7 picnic sites and adjoining areas estimated to hold approximately 30 persons total capacity	Approaching capacity and at or near capacity on most summer weekends

Note:
An average of 3.7 persons per vehicle are an estimated averaged based on experience from DPR at Silverwood Lake SRA.
Key:
N/A = not applicable

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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 5.5-5).

Table 5.5-5. 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 2014

5.5.1.4 Recreation Demand and Needs in the Project Region

The Project is located in an area where the primary recreation opportunities are associated with the SBNF, Silverwood Lake SRA, San Bernardino County, and adjoining municipalities. This section describes regional recreation demand trends and demographics based on existing literature.

USFS

Almost all visitation to southern California national forests is 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 2005a).

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 2005a).

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 2005a).

The SBNF received an estimated 1.9 million visitors in 2014, down from an estimated 2.5 million visits in 2009 (National Visitor Use Monitoring Program 2018). However, USFS' forest plans note that visitor use is changing and there will be inevitable growth in many activities including OHV trail use (USDA Forest Service 2005b).

Recreation in southern California is a complex social activity, and constantly changing preferences and interest levels create increased challenges for agency land 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 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 RV 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 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 2005b).

Regional Demographic Trends

For analysis of recreation demand, it is important to understand anticipated population and demographic changes, as well as regional recreation participation trends. Population and demographics tend to be the major determinants of recreation participation trends. In terms of recreation participation trends, in general, as a population increases, the number of people participating in outdoor recreation activities also increases.

Los Angeles County is one of the most populous and diverse counties in the nation. With just over 10.1 million residents, the county’s population is expected to reach nearly 11 million by 2030 (California Department of Finance 2018). Despite the projected growth rate, segments of the population will grow at different rates. The greater Los Angeles metropolitan region is home to more than 18 million residents (National Park Service 2015).

San Bernardino County was reported to have a total population of 2,155,590 persons as of January 1, 2017; and the population of Hesperia - 93,590 persons (California Department of Finance 2018). The Los Angeles and San Bernardino County areas surrounding Silverwood Lake are continuing to experience population growth. With that growth, there is an increased demand for recreation facilities.

As an example, the proposed Tapestry development that will be located just north of Silverwood Lake is expected to add more than 15,000 housing units by 2050. While it is a phased development dependent upon the success of its sales, at build-out the development could increase the population of Hesperia by one-third. The Tapestry development will include community parks. As the community is built out, there will be increased demand for destinations like Silverwood Lake for water-based recreation activities and camping.

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. The SCORP also offers policy guidance to all outdoor recreation providers, including federal, State, local, and special district agencies throughout California.

The current SCORP (2015) is summarized below, along with the following key supporting documents: DPR's Survey on Public Opinions and Attitudes on Outdoor Recreation in California (SOPA) 2012 and DPR's 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. The SCORP establishes the following statewide actions to address California's park and recreation needs:

- Inform decision-makers and communities of the importance of parks.
- Improve the use, safety, and condition of existing parks.
- Use GIS mapping technology to identify park deficient communities and neighborhoods.
- Increase park access for Californians, including residents in underserved communities.
- 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, and access for, 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 of several variables by region, and differences and similarities between

Hispanics and non-Hispanics, have been continued as a focus of investigation. Some relevant components of the 2012 study are outlined below by study category.

State 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 five 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 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 five years ago, and 26 percent answered that they were not as good as five 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.

5.5.2 Effects of DWR's Proposal

This section discusses the effects on recreation resources of DWR's Proposal, as described in Section 2.0. DWR's Proposal includes one measure related to recreation. Measure WR1 is a continuation of Article 58 in the existing license that states: "Maintain Silverwood Lake at the highest level possible, commensurate with Project purposes, during summer for recreation." However, DWR anticipates it would continue to operate Silverwood Lake consistent with the minimum pool conditions in DWR's 1968 Agreement with USFS and in DWR's 2003 Agreement with CDFW. DWR has begun collaboration with Relicensing Participants on the development of a RMP for DWR's Proposal but were unable to complete discussions prior to issuance of the DLA. Therefore, DWR is not including a RMP with the DLA. DWR will include a RMP in the FLA.

Effects on recreation include effects related to Project operations and those derived from the use and provision of recreation facilities and amenities. Project operations, particularly water level fluctuations, can affect the quality and type of recreation on reservoirs. Other recreation effects described in this section are those that are related to supply and demand for recreation uses at the Project.

Project power generation is driven by how Silverwood Lake is operated and used to convey SWP water supply. Silverwood Lake is generally operated within only three feet of water level fluctuations, as shown in Exhibit B (Section 4.1.3.5 and 4.2.2). Silverwood Lake also provides emergency water storage and is rarely drawn down below three feet. DWR typically operates Silverwood Reservoir within 3,350-3,353 feet elevation. The normal maximum water surface elevation is 3,353 feet.

DWR has proposed to operate Silverwood Lake consistent with past agreements with USFS and CDFW regarding the maintenance and operation of lake levels at Silverwood

Lake. As described in Exhibit B, the DWR proposed to operate to maintain a water surface elevation in Silverwood Lake from March 1 to September 15 of each year, within a range of not more than 30 inches during each 7-day period, beginning at midnight Sunday, and within a range of not more than 11 inches each day (see Exhibit B, Section 4.1.5.5).

A 2003 agreement with CDFW stipulates additional operations constraints to help protect bass spawning. Each year, on April 1, DWR reports the Silverwood Lake water level to CDFW; during the period of April 1 to June 30, DWR will manage the lake such that the lake is not lowered more than three feet during that time from the April 1 reported level. A consultation process was established in the agreement that would be implemented if DWR needs to lower the lake level by more than three feet during this period. Through these agreements and based on DWR's operational needs using Silverwood Lake storage to meet the need of the state water contractors, the reservoir remains high and continued operations of the hydroelectric facilities will continue to provide a positive effect on recreation.

At full pool, the reservoir provides 962.0 surface acres that can be used by all types of water craft for recreation, and is often used to its capacity of an estimated 150 boats and several dozen self-propelled watercraft. Since the reservoir does not fluctuate significantly, both daily and seasonally, it provides a consistent and dependable recreation resource for boaters that is typically not available in other southern California reservoirs. Within this few feet of typical fluctuation, the boat ramps and marina are fully serviceable and the shoreline areas are generally useful and attractive to recreationists; however, the rocky nature of most areas means there are few beach areas whether at full pool or three to five feet below full pool.

The developable areas at Silverwood Lake SRA for recreation facilities are mostly built out based on discussions with Park managers. The facilities that have been developed are generally meeting the needs of the recreating public. However, the facility parking, camping, and picnic site spacing and amenities offered can influence use patterns and can affect utilization and be more or less favored by some users. When the facilities are at or near capacity on certain holiday weekends, the overflow areas for camping are used, and all picnic areas are opened and used.

Based on the visitation number, interviews with recreation providers, and observation surveys, the Project recreation facilities appear to be accommodating most Project visitor use, providing boating and shoreline access to the main Project reservoir (Silverwood Lake), and providing for public safety, and protection of natural and cultural resources. As noted previously, at times demand exceeds capacity and the recreation facilities are closed to prevent overcrowding and other potential safety issues and likely a diminished quality of recreation experiences for those recreating at the lake. Additionally, some users are walking in on unauthorized trails to access the shoreline areas. DWR assessed the adequacy of the existing Project recreation facilities related to visitor needs and current and future uses. Recreation use records indicate that, in the last nine years, both overnight and day use visitation is slightly lower than it was in the prior decade. For weekday periods and weekends outside the primary recreation season (May through September), the facilities appear to adequately meet demand and recreation needs. The analysis also confirmed that there are fairly predictable times on summer weekends, and on Saturdays and Sundays of holiday weekends, when demand exceeds the capacity of facilities and the park reaches capacity and limits the number of vehicles and watercraft. This condition is carefully managed by DPR staff with enforcement officers helping recreationists with information on other nearby recreation facilities and information on park vehicle re-opening procedures.

While demand for recreation access at the SRA sometimes exceeds the capacity of recreation facilities and opportunities present at the Project, there appears to be no further room to expand recreational access. This is because the size of Silverwood Lake presents a limiting factor, and the lake appears to be at or near its managed carrying capacity. Additionally, with growth in regional population and particularly developments like the Tapestry Development in Hesperia, CA, there could be increased demand for destinations like Silverwood Lake SRA for water-based recreation activities and camping.

The comfortable capacity of use on Silverwood Lake has been identified by DPR and any exceedance of those levels could have adverse effects on the ecology, habitats, and – importantly – the quality of the environment that recreationists value. Adding more people to Project shorelines and waters would degrade the experience for all users, whereas the current capacity limits for Silverwood Lake SRA (when 1,500 parking spaces are filled) and for the on-water boating limits (150 boat launches) allow enough space and distribution of users to not appear to degrade the quality of the recreation experience that users desire.

The carrying capacity of Silverwood Lake is dependent on many factors, but generally can be broken down into four major categories. These are:

1. Environmental effect (effects on water quality, shoreline and quantity and extent of lake and shoreline litter, sensitive vegetation and wildlife habitats).

2. Public safety (boat crowding, and shoreline crowding).

3. Public perception (urban, rural, or primitive experiences).

4. Management capability and institutional or administrative limitations.

Each of these factors can help establish a limit on the maximum use, and any one factor can be a restricting factor. At Silverwood Lake SRA DPR has, based on several years of operations, set the capacity to a limit of 1,500 vehicles and 150 boats. That represents a managed capacity limit that helps maintain and not worsen environmental conditions, degrade facilities, and lead to public safety problems based on experience and the capacity of facilities. Because Silverwood Lake is a major attraction and its size is limited, adding more people to the shoreline areas would likely lead to more environmental effects and could reduce the quality of experience for all users.

Instead of considering expansion of the supply of facilities, it would be more beneficial to the recreating public to continue to rehabilitate the existing infrastructure in the park to harden surfaces, provide more ADA-compliant amenities, and improve circulation and offerings at the facilities to meet the changing demands and needs of recreationists. As noted in demand studies, Californians want more amenities, including outdoor settings for large groups, a wider range of overnight camping facility choices, and an increase of shorter trails. The studies show visitors prefer clean restrooms, picnic areas, and tables free of garbage and graffiti, and adequate lighting in campgrounds to feel safe. Signs need to be bilingual with Spanish and English. Also, the studies show the growing Hispanic populations tend to prefer forested sites with water features and amenities to support a day-long, extended-family social outings with extensive onsite meal preparation. The current facilities at Silverwood Lake SRA, with some improvements, can provide for these changing demands and uses without expansion of overall capacities. Additionally, more land-based recreation opportunities such as natural surface and bike trails can be added, and existing paved and natural surface trails can be improved without adding to overall capacity at Silverwood Lake SRA.

As part of the recreation studies, DWR identified areas of concern with regard to facilities that are helping to meet public use recreation needs. Continued recreation use at these Project facilities without their rehabilitation has the potential to further degrade the condition of the infrastructure, cause further erosion or ecological damage, increase public health and safety concerns, and not meet visitor needs. The concept of “hardening” recreation facilities to reduce damage to natural resources and providing for more intensive use, while maintaining quality recreation facilities, can improve the recreation experience for users and reduce maintenance costs and environmental effects. Table 5.5-6 presents a summary of condition issues for recreation facilities at the Project, based on the 2017 condition assessment conducted by DWR. The condition issues, if not addressed, could worsen over time or continue to degrade the quality of the recreation experience at Silverwood Lake SRA.

As part of the recreation study, an analysis was undertaken of management measures of recreation user traffic that sometimes backs up onto State Highway 138 during busy weekends and at times of park closures. As noted in Section 5.5.1.2, at full closure, DPR engages California Highway Patrol for assistance. Vehicles line up very early in the morning outside of the entrance kiosk and along the park access roads to enter the SRA during peak times. DPR staff allows them to line up on the entrance road (near the kiosk) down to the State Highway 138 on- and off-ramps. No parking is allowed on the highway off-ramp. If necessary, vehicles are allowed to line up on the shoulder of State Highway 138, outside the white fog line, and do so from just beyond the off-ramp to the north on State Highway 138 (southbound traffic).

Table 5.5-6. Project Recreation Facility Condition Issues

Recreational Facility	Identified or Inventoried Concern
Rio Group Camp	Poor trail and path conditions; lack of ADA-designated spaces; no information signs; barbeque pits and grills degraded
Barranca Group Camp	Poor access conditions, and uneven pavement; erosion and subsidence near creek beds; lack of ADA-designated parking spaces; barbeque pits and grills degraded
Valle Group Camp	Uneven surfaces on internal trails; no ADA-designated parking spaces; barbeque pits and grills degraded
Cleghorn Day Use Area	Uneven pavement; overgrown vegetation; faded signs and parking stripes; risk of flooding in eroded areas; graffiti on lifeguard tower; a drinking fountain not functional
Cleghorn Boat Launch	No inventoried concerns
Garces Overlook	Missing picnic table
New Mesa Campground	Some areas of uneven paved surfaces; outdated signage; overgrown vegetation; some water spigots not functioning properly
Entrance Station	No inventoried concerns
Nature Center	No inventoried concerns
Mesa Campground	Poor ramp condition and access at campsite 31; fallen tree on adjacent trail; uneven route surfaces
Campfire Center	Uneven surfaces on path around center and overgrown vegetation
Sawpit Canyon Picnic Area 3	Uneven surfaces; degraded picnic sites; overgrown vegetation; no ADA-accessible facilities
Sawpit Canyon Picnic Area 2	Outdated picnic tables; some drinking fountains and water spigots not working
Sawpit Canyon Picnic Area 1	Outdated picnic tables; overgrown vegetation; uneven surfaces; poor access conditions
Sawpit Canyon Day Use Area	Uneven surfaces; some areas with rough access conditions; excessive amounts of litter
Black Oak Picnic Area	Uneven and cracked pavement in areas; outdated picnic tables; overgrown vegetation encroaching on picnic sites
Sawpit Canyon Marina	Some areas of uneven surfaces in parking lot
Sawpit Canyon Boat Launch	No inventoried concerns
Jamajab Point Overlook	Eroded trail surface as washout location
Serrano Day Use Area	Restroom facilities have graffiti

Table 5.5-6. Project Recreation Facility Condition Issues (continued)

Recreational Facility	Identified or Inventoried Concern
Miller Canyon Picnic Area	Overgrown vegetation; uneven surfaces and access routes; water access is off
Lynx Point Overlook	Facilities are in fair condition
Devil's Pit Overlook	No inventoried concerns
Miller Canyon Group Camp	Some areas of uneven and cracked pavement; outdated picnic tables; barbeque grills and counter tops showing signs of wear
Miller Canyon Trailhead	No inventoried concerns
Sycamore Landing Day Use Area	Excessive amount of litter
Live Oak Landing Day Use Area	Lack of formalized access routes; outdated signage; excessive quantity of litter
Chamise Day Use Area	Graffiti present

Key:
ADA = Americans with Disabilities Act

As noted in consultation with Caltrans, the periodic back-ups on Highway 138 are not something that would justify signalization; rather, having law enforcement officers present to direct traffic is a common remedy to such peak occurrences that are fairly predictable. Caltrans records of traffic volume on State Highway 138 indicate peak traffic months in summer are not increasing, but rather slightly decreasing, as the average daily traffic on the peak months of 2005 and 2015 was found to be 1,950 and 1,700 vehicles, respectively, on State Highway 138 at Cleghorn Road (Caltrans 2016; 2006).

In the course of the recreation studies, there were several areas of evidence of dispersed recreation use along shorelines in the northern areas of Silverwood Lake. Dispersed recreation uses are those that take place outside of developed camping or day-use recreation facilities and have no facility infrastructure. A series of user-made paths and shoulder parking areas were noted along State Highway 138 and USFS Road 2N33 where users are parking on the roadway shoulders and walking down to Silverwood Lake. There is evidence of increased litter and some trampling of vegetation in these areas; however, developed sites nearby provide sanitary facilities these recreationists can use. Further monitoring and additional cleanup of shorelines in this area could help reduce the adverse effect of these users, and additional options can be evaluated to consider closing or implementing user restrictions in these areas to help reduce unauthorized use. Other options include developing designated trails and closing unauthorized trails to confine use to more hardened surfaces, thereby reducing adverse effects on vegetation communities and reducing potential soil erosion in these areas.

DWR will include a Recreation Management Plan in its FLA.

Once a RMP has been completed for the Project it is anticipated that effects from continued recreation use at Project facilities would be less than significant under DWR's Proposal.

5.5.3 Cumulative Effects on Recreation

DWR's Proposal, in combination with residential development activities associated with the Tapestry Development in Hesperia, California, has the potential to cumulatively affect recreation resources in the Project region. Build-out or partial build-out of the Tapestry housing areas will require new park and recreation facilities based on the approved general development plan. The influx of new residents would increase the demand for recreation facilities and opportunities both near the housing areas and in the region, that would include Silverwood Lake water-based opportunities and the variety of recreation opportunities on the SBNF. The Tapestry Development conditions include the provision for providing parkland amenities at a ratio of a total of five acres per 1,000 residents. The proposed Tapestry development project would provide a total of 367.0 acres of parks and an extensive trail system for hiking, biking, and equestrian use in the area north of Silverwood Lake. The development of an extensive park and trail system in the Tapestry development will on one hand help disperse recreation uses within the region to help meet demand while potentially not leading to a decrease in quality of experience or lead to further environmental degradation at and around recreation facilities in the region. However, the new residents will not be provided water or mountain-based recreation opportunities, which may result in increased demands on facilities at Silverwood Lake SRA and the SBNF. Silverwood Lake SRA already is at capacity on several weekends including holiday weekends in the peak summer use season. Adding further local demand for lake-related recreation uses can result in adverse effects to park users and environmental conditions in and around Silverwood Lake. It is anticipated by Hesperia Recreation and Park District staff that new residents will follow similar patterns of the existing high desert communities' residents in learning to avoid holidays and peak-use weekends and rather choosing to go to Silverwood Lake SRA during off-peak season periods or weekdays. This use pattern, if it continues, will help to offset the increased possible number of users trying to recreate at Silverwood Lake SRA during the holiday and peak weekend periods. Employing additional capacity controls, such as advance reservations and dissemination of real-time park capacity information, will greatly offset the potential for affecting recreationists quality of experience at Silverwood Lake SRA.

The continued use and potential growth in use of OHV recreation on the neighboring SBNF has the potential to also increase demand for more water-based and overnight recreation uses at the Project. Additionally, when Silverwood Lake is at capacity and admission is restricted, the NFS lands could receive some additional "spillover" use. However, users planning for water or shoreline based experiences at Silverwood Lake SRA are not necessarily going to partake in very dissimilar non-water based recreation with few developed amenities if their planned experience was related to water or shoreline-based recreation at Silverwood Lake. Similarly, if Silverwood Lake SRA campgrounds fill to capacity, there could be some spillover to neighboring NFS lands but most users seeking camping opportunities at Silverwood Lake SRA are probably in desire of developed campground experiences rather than primitive camping opportunities. In general, the continued day and overnight recreation use at Silverwood Lake SRA, over the course of a year, could also help offset some general recreation use that would otherwise take place on National Forest lands, particularly those with water-based recreation opportunities. Because there are few recreation opportunities similar to Silverwood Lake water and shoreline-based uses on adjoining SBNF lands, it is likely that adverse cumulative effects from additional "spill-over" recreation use on the NFS lands would be less than significant.

Providing enhanced recreation use information under DWR's Proposal and rehabilitating and upgrading existing recreation facilities should help reduce potential cumulative adverse effects resulting from increased use on the National Forest lands as a result of continued operation of the Project combined with residential development projects discussed above.

5.5.4 Unavoidable Adverse Effects

Operating and maintaining the Project with DWR's proposed license terms and conditions, including its proposed PM&E measures, could potentially create some unavoidable Project effects for recreation users. Recreation maintenance activities could temporarily limit use in some developed areas or delay seasonal opening of developed facilities.

5.6 LAND USE AND MANAGEMENT

This discussion of land use and management is divided into three sections. Section 5.6.1 discusses existing Project conditions, including land use and management in the region and within the proposed Project boundary. The nearest designated Wild and Scenic River, Wilderness Area, and other special land use designations are identified. In addition, FEMA floodplains are identified. Section 5.6.2 discusses potential effects of DWR's Proposal with respect to land use and management, and Section 5.6.3 describes any unavoidable adverse effects.

DWR found existing, relevant, and reasonably available information was adequate to address potential Project effects on land use and management and did not perform any specific studies for land use and management.

5.6.1 Existing Environment

The Project is located in San Bernardino County on the East Branch of the SWP. The existing Project boundary comprises 3,744.0 acres of land (Figure 5.6-1). Within the total acreage, 221.0 acres are federal lands managed by USFS as part of the SBNF (see Section 4.0 of Exhibit A). Most of these federal lands are located along the west side of Silverwood Lake, San Bernardino Tunnel and Surge Chamber, and Devil Canyon Powerplant Penstock areas.

The policies and programs of the San Bernardino County General Plan (San Bernardino County 2007) are intended to underlie most land use decisions in the county. 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 the Project vicinity are generally located outside the proposed Project boundary to the north of Silverwood Lake and to the south of the Devil Canyon Powerplant, although a small area (about 40.0 acres, including some private lands and City of San Bernardino lands) is situated within the proposed Project boundary. 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 5.6-1). Each of these is discussed below (San Bernardino County 2007).

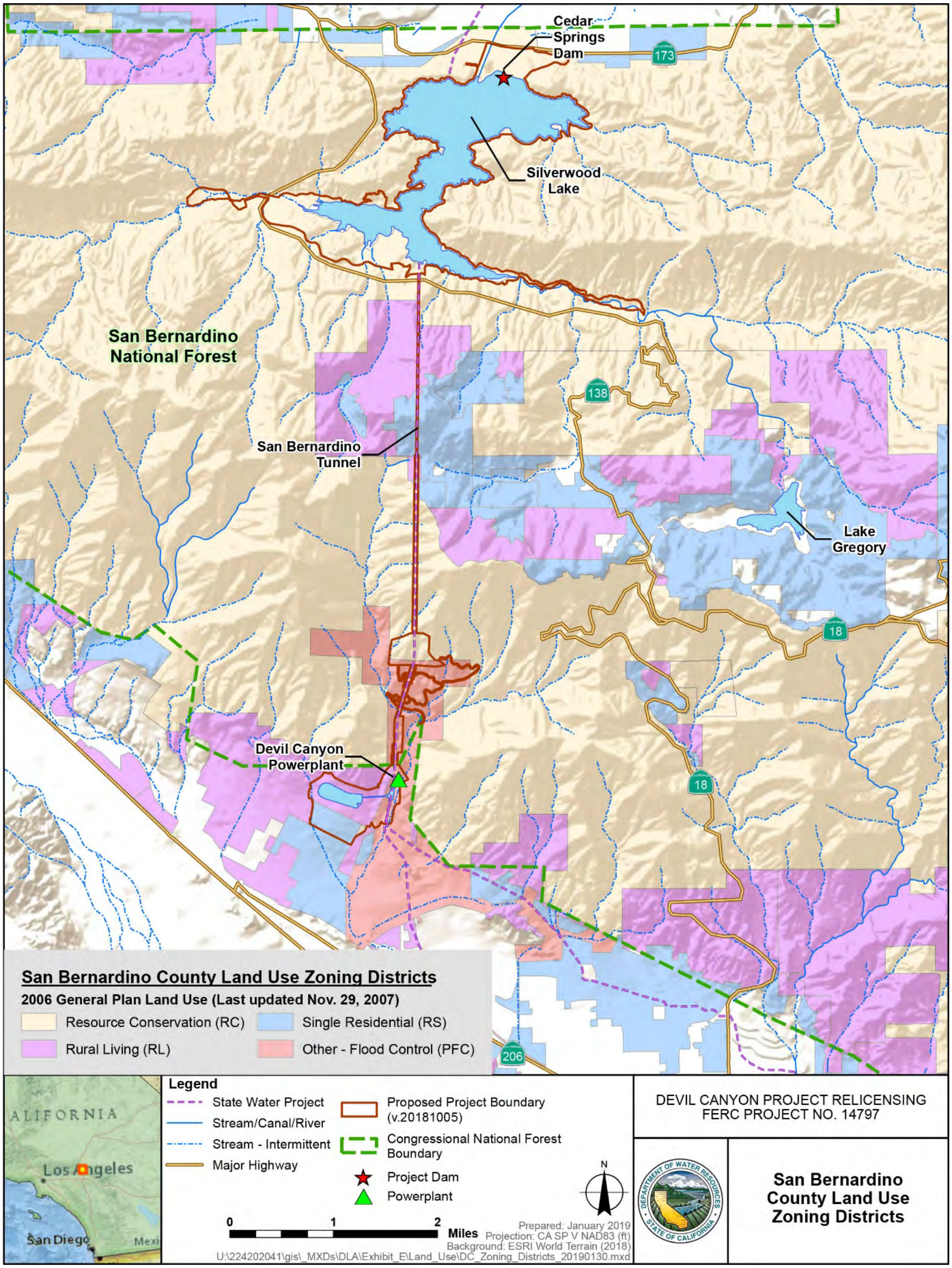


Figure 5.6-1. San Bernardino County Land Use Zoning Districts in the Project Vicinity

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

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

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

In addition to San Bernardino County land use planning, the community of Hesperia is going through growth and new residential development. A major new development called Tapestry is a phased project that has construction planned for the next 30 years.

The Tapestry Specific Plan addresses development on approximately 9,365.0 acres in the southeastern portion of the City of Hesperia, at the southern edge of the San Bernardino County High Desert area. The project site is approximately eight miles east of Interstate 15, with connections provided via State Highway 138 to the southern portion of the site and Ranchero Road to the northern portion of the site. Highway 173 generally serves as the Project site's southern and eastern boundary. The northerly boundary is Ranchero Road.

There are currently 15,663 dwelling units, or homes, proposed in the Tapestry Specific Plan. The proposed Tapestry development project would provide a total of 367.0 acres of parks and an extensive trail system for hiking, biking, and equestrian use in the area north of Silverwood Lake. Development agreements and site-specific plans are required to be approved prior to development taking place. The Specific Plan notes that, after 200 homes are built, a traffic impact analysis will be required. A new Ranchero exit off of Interstate 15 is proposed and infrastructure improvements to Ranchero Road are included in the Specific Plan. Highway 173 will be widened, but only in later phases, when it will be upgraded to four lanes.

5.6.1.1 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) describe the strategic direction at the broad program level for managing NFS 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 2005a). The accompanying Final Environmental Impact Statement describes the analysis used in formulating the revised forest plans (USFS 2005b).

As noted in Section 2.1.3, 126.0 acres (6 percent) of the area within the proposed Project boundary are on NFS lands. Most of the lands within the proposed Project boundary are State-owned, and policies and programs associated with the SBNF apply only to NFS lands.

Seven land use zones have been identified for the SBNF. These zones are applicable only to 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 within or adjacent to the Project boundary. These are: Developed Area Interface, Back Country, and Back Country Non-Motorized (see Figure 5.6-2). Each is discussed below.

The Developed Area Interface land use zone is generally found in areas adjacent to communities or concentrated use areas, and in 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 boundary, 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 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.

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, penstocks, and access road to its east
- Small area in the Miller Canyon area

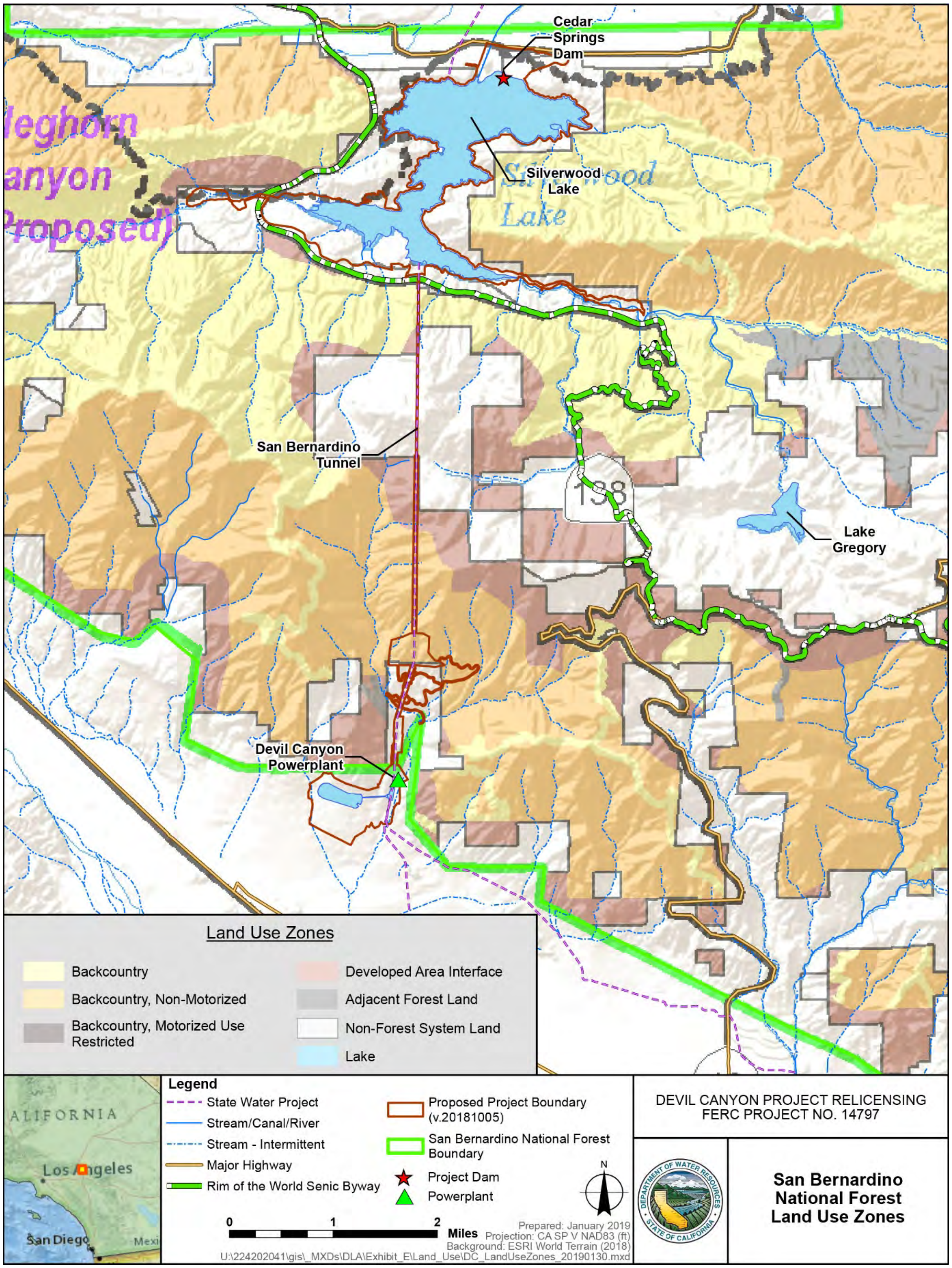


Figure 5.6-2. San Bernardino National Forest Land Use Zones in the Project Vicinity

5.6.1.2 Wild and Scenic River, and Other Land Use Designations

No Wild and Scenic River, Wilderness, or other special land use designations occur in the vicinity of the proposed Project boundary and no portion of the Project drains to a Wild and Scenic River. Deep Creek, located over 5 miles east of the Project, is Wild and Scenic River eligible; and the Cucamonga Wilderness Area is located over 15 miles west of the Project.

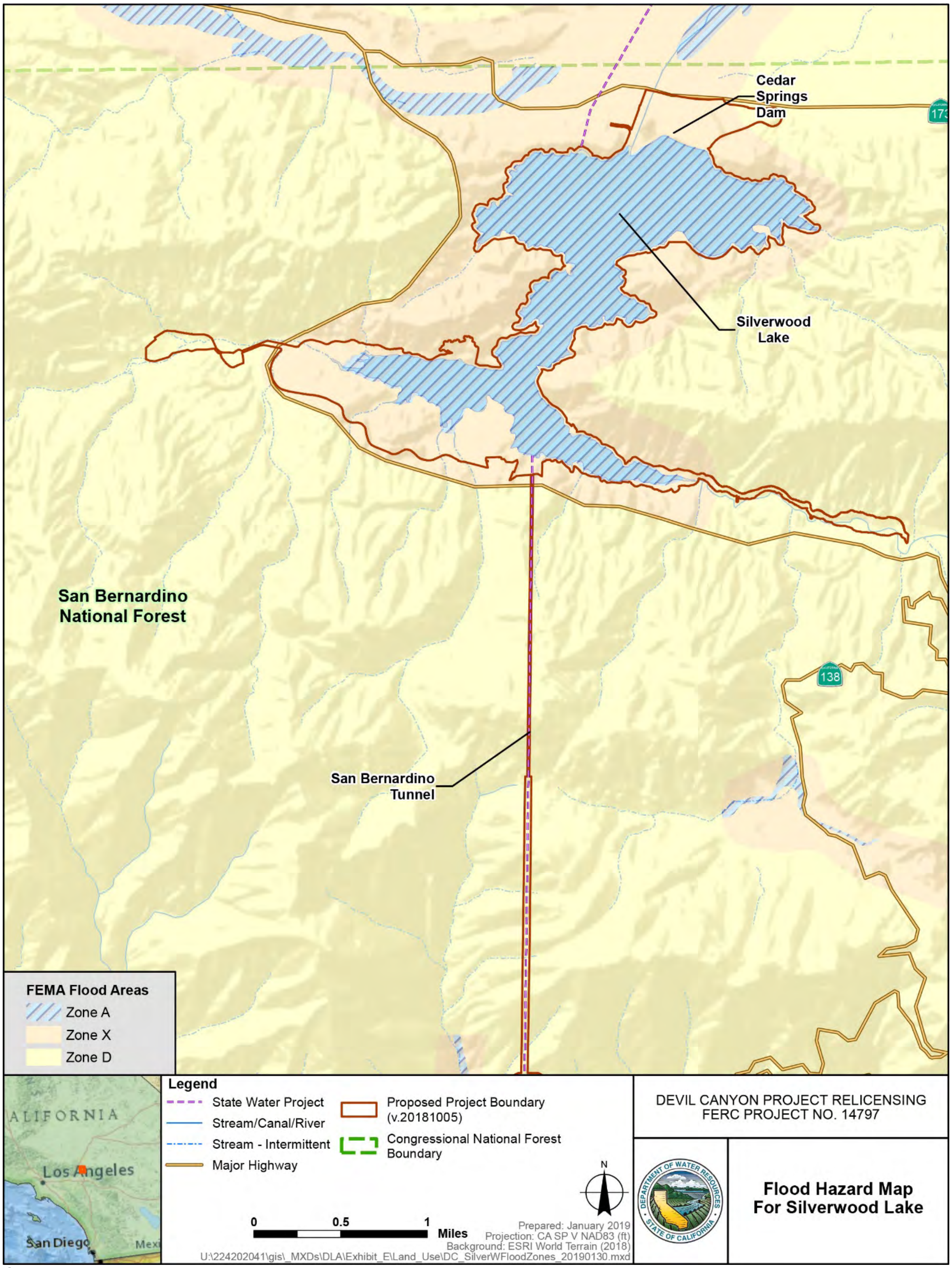
The SBNF candidate Cleghorn Canyon Research Natural Area is located approximately 4 miles west of the proposed Project boundary. This USFS-recommended natural area represents a mixture of natural communities, and the most significant element is western sycamore-alder riparian forest.

As described in Section 5.5, Recreation, the PCT is located along the north and west shores of Silverwood Lake. USFS manages the PCT, the only nationally designated trail in the Project area, in partnership with the NPS, BLM, DPR, and the PCTA. The PCT is a designated National Scenic Trail that is approximately 2,650 miles long running from Canada to Mexico (additional discussion regarding the non-Project PCT is found in Section 5.5, Recreation).

5.6.1.3 Floodplains

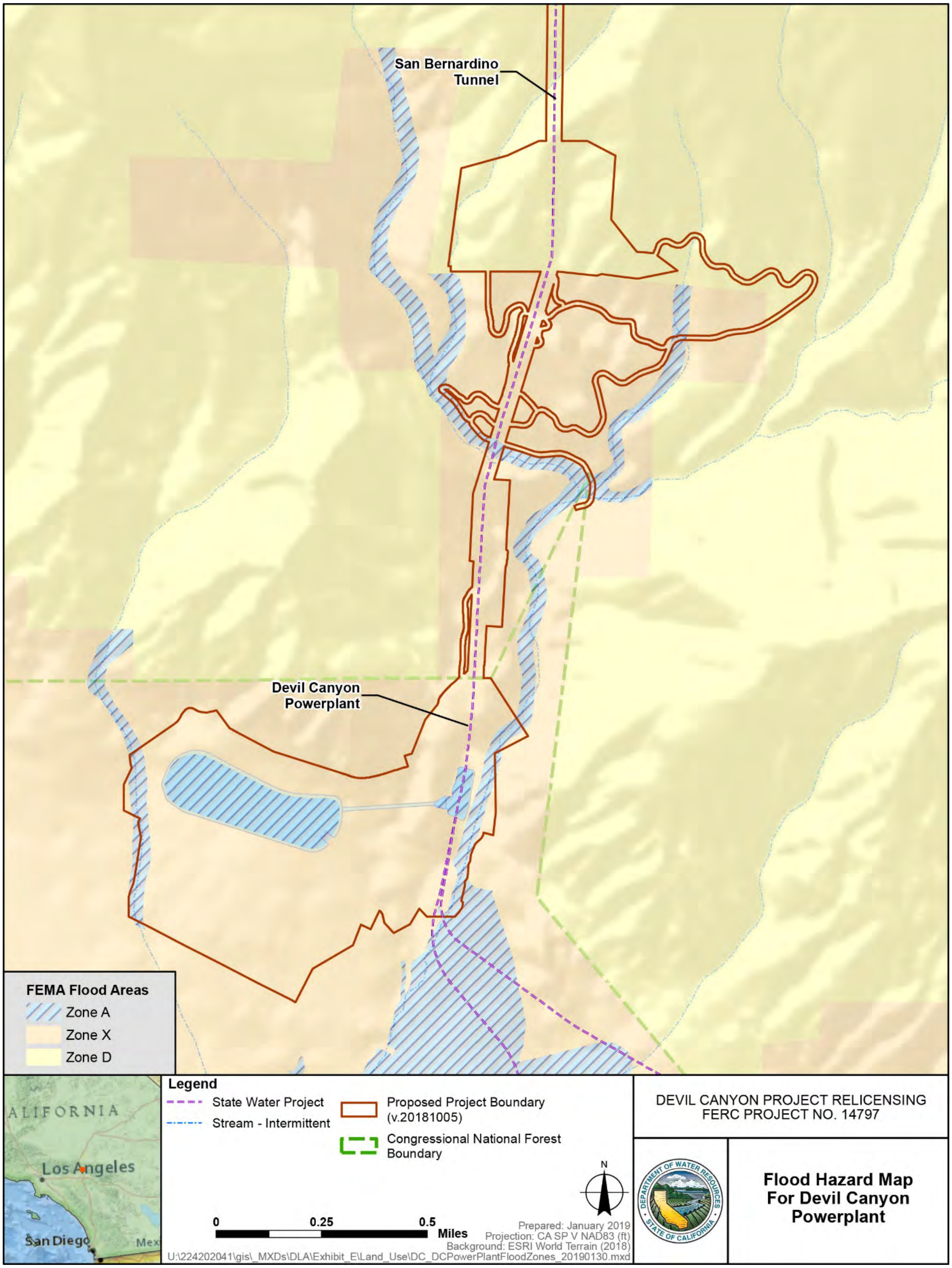
A search of the FEMA flood hazard mapping website indicates that lands immediately adjacent to the Silverwood Lake area are “special flood hazard areas subject to inundation by the 1 percent (100-year) annual chance flood” (Zone “X” on Figure 5.6-3). Zone X indicates areas determined to be outside the 0.2 percent annual chance floodplain.

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” (Zone “A” on Figure 5.6-4). Zone A indicates areas subject to the 100-year annual flood chance, where no base flood elevations have been determined (FEMA Website). The remaining Zone “D” areas are for mapped areas in which flood hazards are undetermined, but possible (FEMA Website).



Source: FEMA Website

Figure 5.6-3. Flood Hazard Map for Silverwood Lake and Vicinity



Source: FEMA Website

Figure 5.6-4. Flood Hazard Map for Devil Canyon Powerplant and Vicinity

5.6.1.4 Land Use and Management Within the Proposed Project Boundary

As shown on Figure 5.6-5 and in Table 5.6-1, the majority of land within the proposed Project boundary is owned by the State of California, with DWR managing and operating the Project, and DPR managing and operating the Project recreational facilities at Silverwood Lake SRA.

Table 5.6-1. Land Ownership Within the Proposed Project Boundary

Ownership	Acres	Percent of Total
State of California, DWR and DPR	1913.3	92
San Bernardino National Forest	126.0	6
City of San Bernardino and private	40.2	2
Total	**2,079.4**	**100**

Source: DWR 2015
Key:
DPR = California Department of Parks and Recreation
DWR = California Department of Water Resources

The San Bernardino Tunnel right-of-way is located on lands managed by USFS as part of the SBNF and on lands owned by private parties. 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 the SBNF. The Devil Canyon Powerplant and afterbays are located on State of California lands. Within the proposed Project boundary, these access roads are not open to public vehicular access.

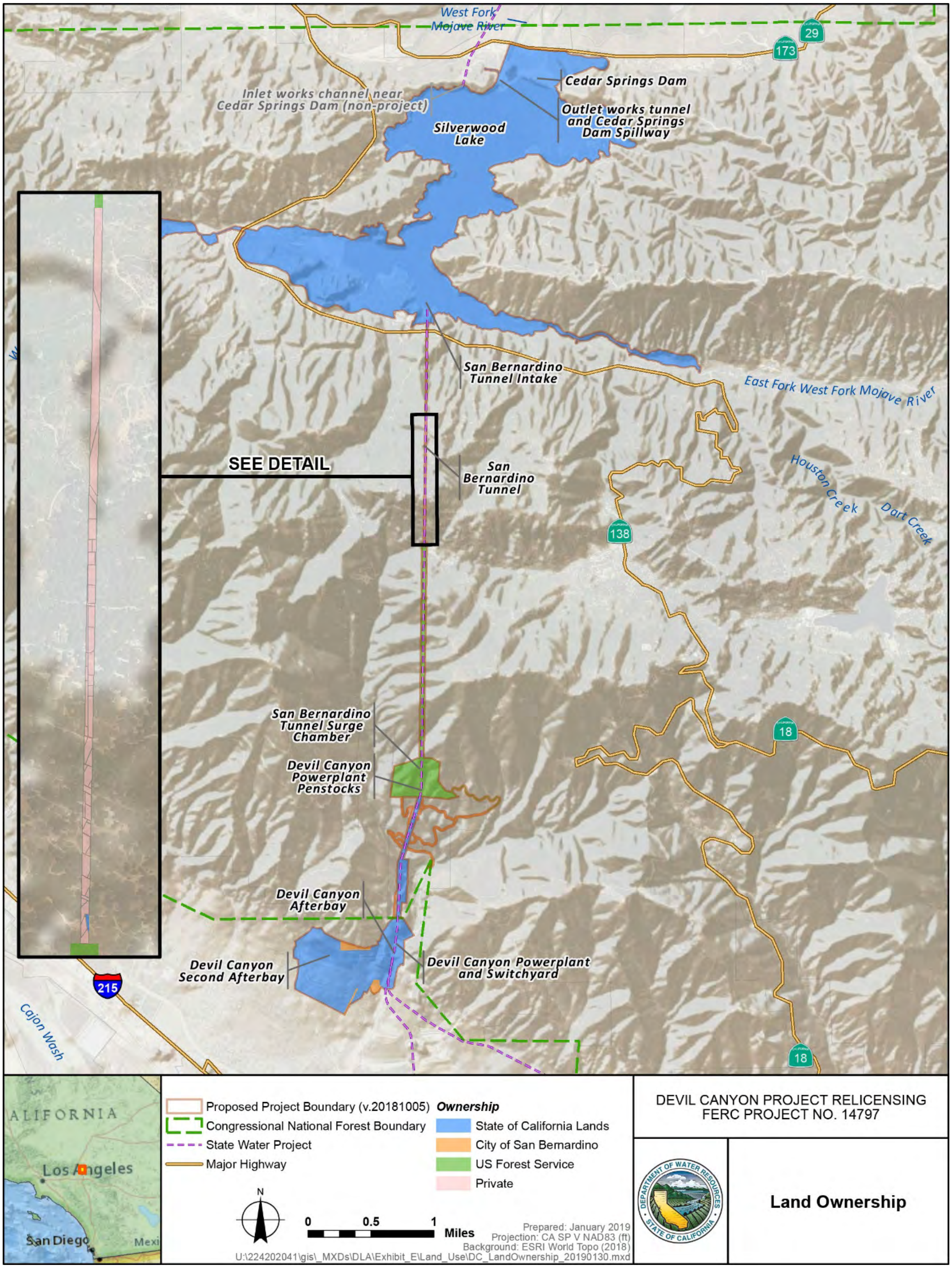


Figure 5.6-5. Land Ownership Within the Proposed Project Boundary

In 1970, DWR executed an agreement with DPR to develop, operate, and maintain the Silverwood Lake SRA. In 1971 (amended 1996), DWR issued a permit to CLAWA for use of lands near the San Bernardino Tunnel Intake. 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 the SBNF, the City of San Bernardino, and private entities.

In 2004, CDFG (now CDFW) and DWR entered into a Stream Alteration Maintenance Agreement (per Stream Alteration Notification No. R4-2004-0154 and pursuant to California Fish and Game Code Section 1602) delineating and defining routine maintenance activities within streams and lakes associated with the SWP including the aqueduct located in DWR's Southern Field Division. The agreement 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. Permitted activities, as described in the agreement, 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 and stated in 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.
    - 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.

- 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.
- Routine maintenance work within the streams may commence after all pertinent permits and authorizations from other agencies are secured.
- This agreement is subject to renewal every 5 years.
- Any oaks removed that are greater than 3 inches diameter at breast height shall be replaced in kind at specified replacement ratios.
- Whenever possible, invasive species shall be removed and controlled in a legal manner that prevents seed dispersal.
- 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 contact with water, DWR shall employ only those herbicides, such as Rodeo®, which are approved for aquatic use.
- 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.
- 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.
- Cleared debris shall be removed from the stream zone and placed in an approved spoil site.
- Clean natural boulders or “shot-rock” (not broken concrete) shall be used to replenish and maintain bank stability in previously rip-rapped areas.
- Any temporary stream diversion shall be coordinated and approved by CDFW.
- DWR’s ability to minimize turbidity, siltation, and erosion in a stream shall be subject to conditions of the Lahontan RWQCB Basin Plan.
- 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.
- This Agreement does not allow for the take, or incidental take, of any federal or State-listed special-status species.

- 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.
- 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.
- 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.
- 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.
- Annual reports, summarizing the activities completed during the past year, shall be submitted by January 31 of each year.
- DWR shall have primary responsibility for monitoring compliance with all protective measures included in the Agreement.

5.6.1.5 DWR Access Routes to Project Facilities

Public vehicular access to Project facilities at Silverwood Lake is provided by State Highway 138 (Rim of the World Scenic Byway), State Route 173, Cleghorn Road, Sawpit Canyon Road, and other roadways within the Silverwood Lake SRA. 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 to the outlet area is provided via State Highway 138 to the north shore of the south side's East Fork of the West Fork Mojave River Arm (Miller Canyon Road).

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. Devil Canyon Road is gated and public access to the north is prohibited approximately one-half mile north of the powerplant entrance. Public vehicular access is discussed further in Exhibit A, Project Description, Section 3.7 (Access Roads).

5.6.1.6 Wildfires and Fire Suppression and Prevention Policies

Fire suppression 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). Fire suppression on NFS lands is the responsibility of USFS. 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, at higher elevations. There is a risk of catastrophic fire due to forest densification, 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 2005c).

Vegetation in the Devil Canyon Powerplant vicinity includes coastal sage scrub, mixed chaparral, and stands of bigcone Douglas-fir, 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. Non-native invasive weeds are present.

Fire prevention, fuels reduction, and fire suppression are the major components of 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 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 2005c).

All wildland fires on NFS lands within the SBNF are considered to be a potential threat to communities. 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 2005c).

As described in a DWR letter to FERC dated January 8, 2004, the Grand Prix/Old/Padua fires burned more than 170,000.0 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 DWR 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, 12 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 (Bonnie Duecker, DWR, pers. comm., 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 2015) are as follows:

- 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.

5.6.1.7 Public Safety in Project Area

As described in the South SWP Hydropower Project Public Safety Plan (DWR 2014), DWR has implemented many practices to ensure the safety of its employees and the public.

DWR's 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 all 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 powerplant 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 a 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 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.

Cedar Springs Dam

Cedar Springs Dam is closed to the public. Dam safety concerns related to 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 on public roads that identify where public access is available. 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 are locked at all times and every exterior door will alarm the ACC if it is opened.

Silverwood Lake and San Bernardino Tunnel Intake Tower

The San Bernardino Tunnel Intake Tower is not a publicly accessible facility. The intake tower and Silverwood Lake are included in the informational videos available at Vista Del Lago 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 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 not a publicly-accessible facility. The 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 identification badges. Signs advise the public that the area is closed to public access.

5.6.1.8 Law Enforcement

As described above, Project facilities at Silverwood Lake are managed by DPR as part of the Silverwood Lake SRA. State Park Peace Officer Rangers and lifeguards provide not only public safety law enforcement and aquatic rescue services, but also public education. 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.

5.6.1.9 Restrictions to Project Waters and Lands

Silverwood Lake SRA boating and fishing rules are described in Section 5.5, Recreation. Additional restrictions relative 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.

5.6.1.10 DWR Shoreline Management and Buffer Zone Policies

The Silverwood Lake shoreline is managed by DPR in accordance with the lake's designation as an 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.

5.6.2 Effects of DWR's Proposal

This section discusses the potential environmental effects of DWR's Proposal, as described in Section 2.0. As part of the Project relicensing, DWR proposes to modify the existing Project boundary, thereby reducing the area within the boundary from 3,744.0 acres to 2,079.0 acres. This change would reduce the 221.0 acres of federal land (6 percent of the total area within the existing Project boundary) to 126.0 acres of federal land (also approximately 6 percent of the total area within the proposed Project boundary). In addition, DWR proposes to include in the new license three land-use related measures. Measure LU1 would implement a Transportation System Management Plan that provides guidance for the maintenance of Primary Project Roads and Trails. Measure LU2 would implement the Fire Prevention and Response Plan that provides measures for preventing, reporting, and investigating Project-related wildfires. The two plans are included in Appendix A, and were developed in collaboration with interested parties. The last measure, LU3, would require DWR to develop and file with FERC for approval within a year of license issuance a Project Safety Plan that provides measures for installing and maintaining signs, lights, sirens, and other devices below Cedar Springs Dam needed to protect the public. This measure is similar to Articles 60 and 402 in the existing license.

DWR's proposed change to the existing Project boundary will have no effect on the public's use of Project lands. Project lands around Silverwood Lake and overlaying the San Bernardino Tunnel will continue to be available for public use for recreational purposes. Non-Project uses will continue to be allowed on Project lands on a permission-only basis through DWR's administration of the standard license land use articles ensuring existing and proposed uses are consistent with the purposes of protecting and enhancing the environmental values of the Project. Per FERC standard article 5, a licensee of a hydropower project may receive requests from neighboring landowners, government agencies, or private organizations to use project land for a variety of purposes unrelated to operating the project (i.e., non-project uses). A non-project use of project lands is a third-party use and occupancy of project property authorized by the licensee through the conveyance of a specific interest in project lands and waters. These uses may include, but are not limited to, land for boat docks, marinas, bridges, pipelines, water withdrawals, and utility lines.

Upland habitats and weed-infested areas along Project roads and maintenance locations will receive enhanced management measures under DWR's proposed IVMP, which should improve environmental performance including land management practices associated with the occupancy of lands for Project power generation purposes.

A new RMP for the Project should improve conditions for the recreating public and their use of the shore lands surrounding Silverwood Lake.

DWR will continue to implement its land use agreements policies for non-Project uses and agreements with DPR for administration of Silverwood Lake SRA facilities and lands. Additionally, DWR will continue to work with the SBNF and CAL FIRE on road access agreements and management to ensure public safety and lands are available and easily accessible to emergency and administrative service needs, as well as providing controlled public access.

5.6.3 Unavoidable Adverse Effects

Continued O&M activities associated with DWR's Proposal have no known unavoidable Project effects relative to ongoing land use and management.

5.7 AESTHETIC RESOURCES

This discussion of aesthetic and scenic resources is presented in three sections. Section 5.7.1 discusses existing Project conditions, and characterizes aesthetic and scenic resources in the Project vicinity; describes management plans that are pertinent to scenic resources potentially affected by the Project; and discusses the aesthetic and scenic character of each aboveground Project facility. Section 5.7.2 describes the effects of the Project on aesthetic and scenic resources, and Section 5.7.3 describes any unavoidable adverse effects to aesthetic and scenic resources.

DWR conducted a Scenic Integrity Study to supplement existing, relevant, and reasonably available information regarding aesthetic resources. Refer to the Devil Canyon Project Relicensing Website http://devil-canyon-project-relicensing.com/project/ for the detailed study approach, study summary, and detailed study data.

5.7.1 Existing Environment

5.7.1.1 Scenic 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 2005). 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 State Highway 138 (Rim of the World Scenic Byway) and California State Route 173. Both of these roads are designated San Bernardino County scenic highways, as discussed below, and are considered eligible State scenic highways by Caltrans (Caltrans 2013). State Highway 138 is part of the 110-mile Rim of the World Scenic Byway which encompasses portions of State Highways 138, 18, and 38[42] (USFS 2018). In the Project area, State Highway 138 includes one formal vista point with parking along the west side of Silverwood Lake that provides expansive views of the Project reservoir and the facilities near the dam. In addition, there are several roadside pull off areas along the south side of the Project area that provide limited views of the Project reservoir and facilities. Much of the roadside pull offs along the southern side of the reservoir lack views of the Project due to thick vegetation.

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 the proposed Project boundary 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 significant scenic resources.

Located at the northern edge of the City of San Bernardino (Exhibit A, Section 2.0, Figure 2.0-1), 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.

[42] The Rim of the World Scenic Byway does not have a corridor management plan that typically would provide scenic resource guidance.

No designated wild and scenic rivers or designated wilderness areas are located in the Project vicinity.

5.7.1.2 Pertinent Management Plans

San Bernardino County General Plan

The Project is located entirely within San Bernardino County (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 scenic 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 seeks 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

San Bernardino National Forest Land Management Plan

The Project is within the overall boundaries of the SBNF, although NFS lands occupy little (6 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 lands is maintained, USFS has established five scenic integrity objectives (SIO), 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 SIOs. Each SIO depicts a level of scenic integrity used to direct landscape management on NFS lands. The complete range of SIOs and their respective definitions are as follows (USFS 1995):

- Very High - landscape unaltered
- High - landscape appears unaltered
- Moderate - landscape slightly altered
- Low - landscape moderately altered
- Very Low - landscape heavily altered
- Unacceptably Low - landscape extremely altered

Based on the SIO maps set in the SBNF Land Management Plan (USFS 2005), the SIO for NFS lands within and around the proposed Project boundary is "High" (i.e., landscape appears unaltered). 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.

State Water Project Architectural Motif

As described in its Water Resources Engineering Memorandum No. 30a, dated March 15, 1984, DWR has established an architectural motif which, consistent with economy and operational efficiency, is applied to all SWP facilities, which include Project facilities. The objective of the architectural motif is to create 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 DWR'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,
    - reducing noise and glare,
    - screening of unsightly areas,
    - providing shade for buildings and equipment, and
    - establishing vehicular and pedestrian traffic patterns.
9. Irrigation systems and plantings shall be consistent with water conservation.

Responsibilities

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 (DWR 1984).

5.7.1.3 Scenic Resources at Project Facilities

Scenic resources within the Project area include those associated with the following Project facilities:

- Cedar Springs Dam, Silverwood Lake, recreation facilities, and appurtenant Project facilities (e.g., roads and inlet/outlet works)
- Devil Canyon Powerplant and its penstocks, switchyard, afterbays and associated roads

These scenic resources are described and photographically documented below. All photographs were taken at the equivalent of a 50-millimeter lens that best represents what the human eye can view at one point in time.

Recreation facilities and roadways constitute key viewpoints from which the public may observe Project facilities and features. In May 2018, DWR conducted a Scenic Integrity Study of the existing scenic character of the Project facilities, including identifying 23 key observation points (KOP) where DWR evaluated the consistency of the existing visual condition (EVC) with applicable visual or scenic quality guidance, dependent on the land ownership from the following viewpoints: foreground (i.e., within one-half mile of the Project facility), middle ground (i.e., one-half mile to 4 miles) and background (i.e., 4 miles to horizon) (USFS 1995). Refer to Figures 5.7-1 and 5.7-2 for a map of the KOPs analyzed by DWR.

The KOP location numbers (KOP #01 through KOP #23) shown in Figures 5.7-1 and 5.7-2 are numbered based on the order the sites were evaluated in the field from May 21, 2018, through May 23, 2018. The following section utilizes a selection of the 24 KOPs that show critical viewpoints or highly representative viewpoints of the Project facilities. Where applicable, DWR identified the KOP in the discussion below. Notably, all of the Project facilities are located on State lands, except for a short segment of the Devil Canyon Penstocks and the Surge Chamber on the Devil Canyon Powerplant side of the Project. All the Project facilities at Silverwood Lake are on State lands. Non-Project facilities (e.g., the PCT and vista points along State Highway 138 – Rim of the World Scenic Byway) traverse or are located in or adjacent to the Silverwood Lake SRA but are not Project facilities. The PCT is aligned on State land along the north and west shores of Silverwood Lake, but the PCT is administered by USFS.[43]

[43] On March 26, 1980, the State of California, acting through DWR, granted the United States, acting through USFS, non-exclusive agreements for use of certain State of California–owned parcels in San Bernardino County to locate, construct, use, maintain, relocate, and repair the Pacific Crest Trail. DWR reserved its right to use the area for its purposes.

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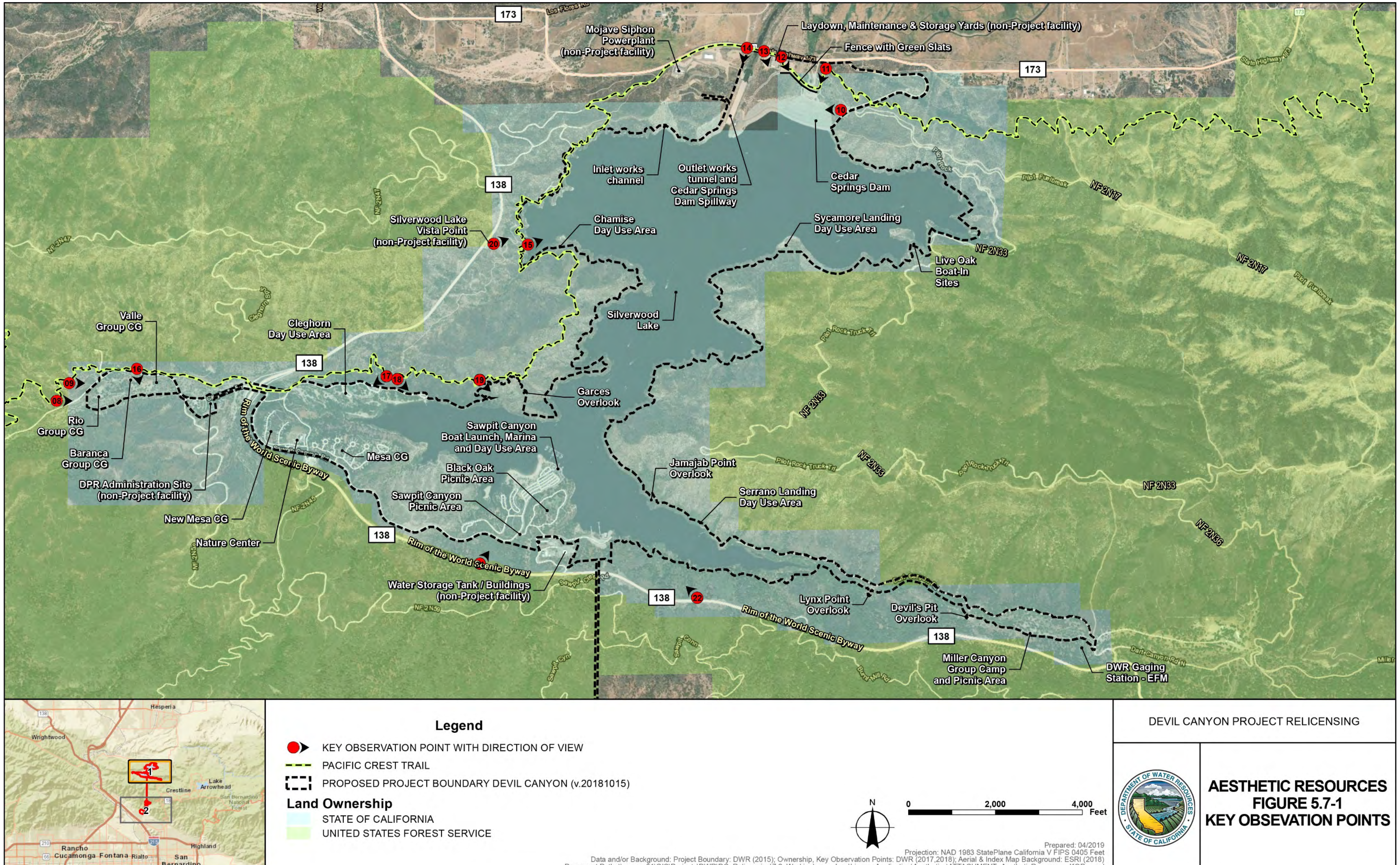


Figure 5.7-1. DWR's Proposed Devil Canyon Project Facilities at Silverwood Lake, including the Non-Project Pacific Crest Trail and Key Observation Points

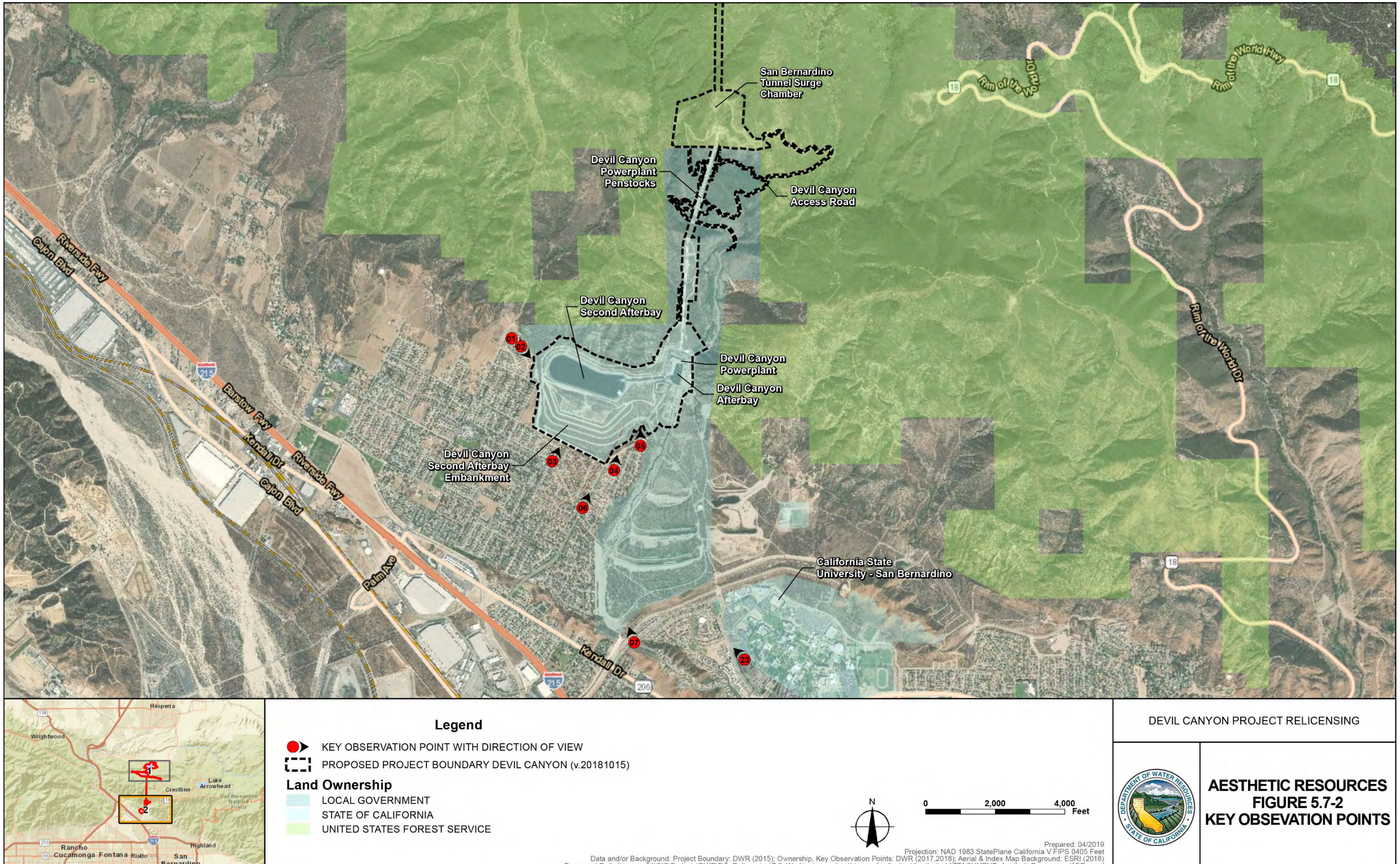


Figure 5.7-2. DWR's Proposed Devil Canyon Project Facilities in the Devil Canyon Powerplant Area and Key Observation Points

Silverwood Lake

All of the Project facilities associated with Silverwood Lake, both recreational and operational, are located on lands owned and managed by the State of California. NFS lands surround the State of California lands, except to the north, where the ownership is private. Some non-Project facilities (e.g., the PCT) traverse or are located in the Silverwood Lake SRA, but they are not Project facilities.

The PCT crosses through Silverwood Lake SRA on State of California lands along the north and west shores of Silverwood Lake (Figure 5.7-1) and is administered by USFS through an easement agreement with DPR. On State lands near Cedar Springs Dam, USFS has an easement agreement with DPR for the PCT in this area. On March 26, 1980, the State of California, acting through DWR, granted the United States, acting through USFS, a non-exclusive agreement for use of certain State of California-owned land parcels in San Bernardino County to “locate, construct, use, maintain, relocate and repair” the PCT on lands below Cedar Springs Dam (DWR 1980), which had already been built and was already in operation. The agreement reserved DWR’s rights to continue to use the area for its purposes and specified that USFS was responsible for constructing and maintaining the PCT on those land parcels.

State Highway 138 passes along the west and south sides of the Project in the Silverwood Lake area (Figure 5.7-1). State Highway 138 is part of the 110-mile Rim of the World Scenic Byway which encompasses portions of State Highways 138, 18, and 38 (USFS 2018). A Corridor Management Plan for the portion of State Highway 138 near the Project has not been prepared. The Rim of the World Scenic Byway traverses the rim of the San Bernardino Mountains from Cajon Pass to their eastern and then southern edges offering numerous vistas and panoramas along the route. Within the proposed Project boundary, State Highway 138 includes one formal vista point with parking (a non-Project facility) along the west side of Silverwood Lake that provides expansive views of Silverwood Lake and the facilities near the dam. In addition, there are several roadside pull off areas along the south side of Silverwood Lake that provide limited views of the lake and associated Project and non-Project facilities. Much of the roadside pull offs along the southern side of the reservoir lack views of the lake due to thick vegetation.

Silverwood Lake is located in the transition zone from high desert to the north and mountains to the south. In this zone, Silverwood Lake represents a major scenic attraction for the area and is one of the reasons it is managed as a State Park. The lake attracts a wide range of recreation activities, from boating and camping to biking and hiking. While the reservoir is a scenic asset for the area, it also has hydropower and recreation facilities that do not always blend in with the natural landscape; these facilities are described below.

Cedar Springs Dam, Spillway, and Associated Facilities

The Cedar Springs Dam and spillway, all on State lands, are visible from the PCT along a nearly 1-mile PCT segment, and Highway 173, which the PCT parallels for nearly one-half mile. These Project facilities all present visual contrast to the natural setting that results in EVCs that are rated from low to very low (refer to Figures 5.7-3 and 5.7-4) (DWR 2018). This is due to the strong white color of the rock-covered dam and very smooth texture of the light-colored concrete spillway in contrast to the tans and grey greens of the soil and vegetation of the high desert. In addition, both of these features have defined geometric shapes that contrast with the natural irregular shapes of the landscape. While not part of the Project, the Mojave Siphon Powerplant west of the spillway and the laydown, maintenance and storage yards east of the spillway are in the same viewshed and add similar visual contrast issues. There are Project roads associated with the dam and spillway that present visual contrast, depending on the viewpoint, but overall the contrast is light to moderate.

Note: Photo taken May 22, 2018

Figure 5.7-3. Cedar Springs Dam and Laydown Yard (non-Project facility) Viewed from KOP 12 on the PCT at the North East Corner of the Maintenance Yard (non-Project facility)

Note: Photo taken May 22, 2018

Figure 5.7-4. Cedar Springs Dam Spillway Viewed from KOP 14 on the PCT at the East End Abutment of the State Highway 173 Bridge Over Spillway Outlet

The Cedar Springs Dam and Spillway, as seen from the reservoir side, present less visual contrast due to the water covering most of the dam and spillway. Views of these same facilities from boats on the reservoir present moderate contrast in foreground that diminishes as the views change to middleground perspectives. Land-based views of the dam and spillway include views from three boat-in day use sites, the PCT, and vehicle traffic on State Highway 138, including two scenic overlooks. From the boat-in sites viewpoints, the visual contrast is slightly less than views from boats because the facilities are located on the edge of where foreground becomes middleground. The views from the PCT and State Highway 138, including the numerous vista points, present slight to no contrast due to the middleground distances, the limited amount of Project facilities' surfaces exposed, and in the case of the dam from the vista point and PCT the background ridge behind the dam matches up with the color and texture of the dam (refer to Figures 5.7-5 and 5.7-6). The outlet works and inlet works are located on the north and south sides of the reservoir, and have varied visual contrast results depending on whether views are from the water surface or land-based at recreation facilities, trails, and roads. The outlet works and inlet works in foreground as seen from the reservoir present moderate to strong visual contrast due to the light color and smooth textures of the concrete in contrast to the tans, greens, and rougher textures of the landscape. Primary Project Roads associated with the dam and spillway can also present various levels of visual contrast, depending on the view point, but overall the contrast is light to moderate if seen.

Recreation Facilities

At Silverwood Lake SRA, there are four boat-in day use sites, two family campgrounds, a group campground, a group day use and picnic area, three day use picnic sites, a seven-lane boat ramp and associated parking areas, a marina, an extensive beach, a car-top boat launch, a nature/visitor center, several overlooks, and 6.5 miles of the PCT within State lands. Most of the recreational facilities are located on flat or gentle slopes in tree covered areas, which results in many of the facilities being screened by vegetation and having little visual contrast with the natural landscape. This is the case for the two main campgrounds, group campgrounds, picnic grounds, day use sites, and visitor center. However, the marina, boat ramp, and associated large parking areas are quite visible from the PCT, boaters on the reservoir and State Highway 138 (refer to Figures 5.7-7 through 5.7-9). While not part of the Project, other non-Project facilities are in the same viewshed that present moderate visual contrast issues, particularly the white-colored water storage tank and buildings immediately south of the Sawpit Boat Ramp and Marina facilities (refer to Figure 5.7-7).

Note: Photo taken May 22, 2018

Figure 5.7-5 Chamise Boat-in Site and Cedar Springs Dam Viewed from KOP 15 on the PCT Looking Northeast

Note: Photo taken May 23, 2018

Figure 5.7-6. Cedar Springs Dam, Inlet Works, Outlet Works, and Transmission Line Viewed from KOP 20 at the State Highway 138 Vista Point Looking Northeast

The Sawpit Boat Launch and Sawpit Canyon Marina are the most visible facilities from the PCT and State Highway 138 due to the light color of the docks, buildings, and boats, as well as the many lines and geometric shapes that strongly contrast with the blue water and the green vegetation nearby. While the marina presents strong visual contrast, recreation users know what the facility is and expect to see these shapes and colors. The parking area and boat ramp present some contrast due to the smooth texture and dark color of the pavement, and the large size of the facility along the shoreline. Shade trees interspersed in the large parking areas help to soften the visual contrast. Note that the white water tank and buildings in the far right of Figure 5.7-7 are non-Project. Refer to Figures 5.7-7 through 5.7-9.

The boat-in day use sites are visible from the water surface and PCT, and present slight contrast due to light soil color contrast to the green vegetation and geometric shapes of shade structures. Chamise Boat-in Site is also visible in foreground from the State Highway 138 vista point and the PCT (refer to Figures 5.7-5 and 5.7-6). The shade structures are clearly visible due to their geometric (pyramid-like roof) shapes, but the green paint applied to these structures allow them to blend well with the surrounding vegetation.

Note: Photo taken May 22, 2018

Figure 5.7-7. Sawpit Canyon Boat Ramp, Marina, Swim Beach, Parking, and Water Intake Facility Viewed from KOP 19 on the PCT Looking Southeast

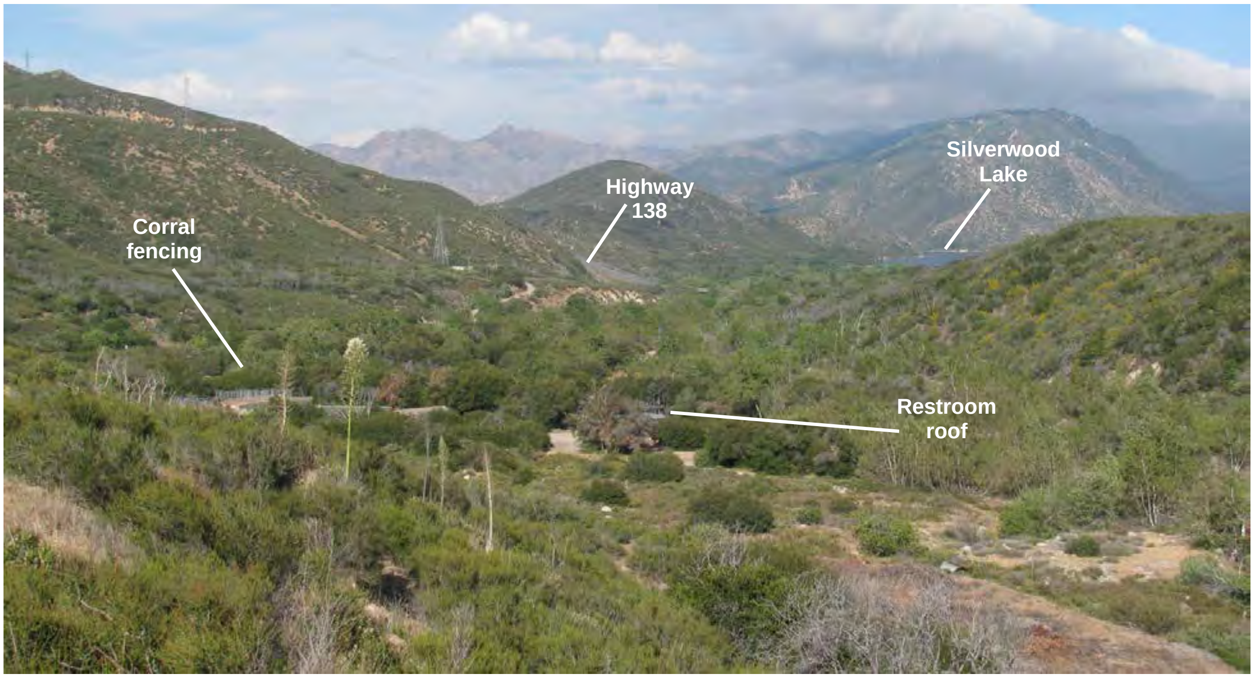
Notes:
[1]Photo taken May 23, 2018
[2]Cedar Springs Dam (far middleground) virtually invisible as it matches with the background ridgeline

Figure 5.7-8. Sawpit Canyon Boat Launch, Marina, and Parking Area Viewed from KOP 21 at the State Highway 138 Pullout Looking Northeast

Note: Photo taken May 22, 2018

Figure 5.7-9. Sawpit Canyon Boat Ramp and Marina Viewed from KOP 22 at the State Highway 138 Pullout Looking Northwest

The group campground facilities (Valley, Barranca, and Rio sites) are generally well screened by vegetation as viewed in foreground from the PCT and Cleghorn Road. Occasional views of toilet building roofs and shade structures occur periodically from the PCT. Overall, the toilet building colors match the local native soil well and only present some contrast due to their geometric shape. East of the group campgrounds, the PCT crosses over to NFS lands with views of the Rio Group Campground (refer to Figure 5.7-10). From NFS lands on the PCT, metal corral fencing is visible in foreground and presents moderate visual contrast due to the light gray color, lines, and geometric shapes that contrast with the surrounding vegetation. The views from the PCT here have an EVC of “Moderate” (landscape slightly altered). Other views of Project facilities beyond Rio Group Campground are limited and a small portion of Silverwood Lake is seen in middleground; but the reservoir is mostly screened by the topography.



Note: Photo taken May 21, 2018

Figure 5.7-10. Silverwood Lake State Recreation Area Rio Group Campground in the Foreground Viewed from KOP 8 on National Forest System Land on the PCT Looking East-Northeast

Devil Canyon Penstocks, Powerplant, Afterbays, and Associated Facilities

The Devil Canyon penstock, powerplant, and afterbay facilities are located on the south side of the San Bernardino Mountains at the transition from mountains to inland coastal plain. Suburban housing tracts are located immediately adjacent to the mountains and afford many foreground and middleground views of these Project facilities. The mountainous areas are generally within the SBNF, but in this case the majority of the Project facilities are on State lands with only a very small portion of the Project on NFS lands (i.e., upper surge chamber and very top of the penstocks).

Viewing conditions vary throughout the year from clear conditions to a thick marine layer that dramatically reduces visibility. The lower mountain areas are covered with a community of chamise and chaparral that tends to be dark green with gray and brown tints. The lower mountain areas tend to remain steep right to the transition zone, which means that manmade structures (i.e., roads or penstocks) are easily visible. The primary view area for these facilities is from the residential communities located east of Interstate 215 and generally south of the Project, including the California State University, San Bernardino (CSUSB) campus. Views are from individual homes, apartments, businesses, and public roads in foreground and middleground. On clear days, the Project can be seen in background (i.e., beyond 4 to 5 miles) from several communities, but is a much smaller aspect of the overall viewing environment and therefore not further addressed. The more critical views of the Project facilities are addressed below.

Devil Canyon Penstocks and Powerplant

The two parallel penstocks, roads, surge chamber, and the powerplant are visible in the middleground from the south near the CSUSB campus and from the residential communities of Verdemont and University Heights (Figures 5.7-11, 5.7-12, 5.7-14, 5.7-15, and 5.7-16). The penstocks and associated concrete are in strong visual contrast with the surrounding greens and browns of the landscape as they descend through Devil Canyon. The light colors, lines, and geometric shapes of the Devil Canyon Powerplant, surge chamber, Devil Canyon Second Afterbay, and Primary Project Roads are visible from the south and create a strong visual contrast against the visual character of the mountains.

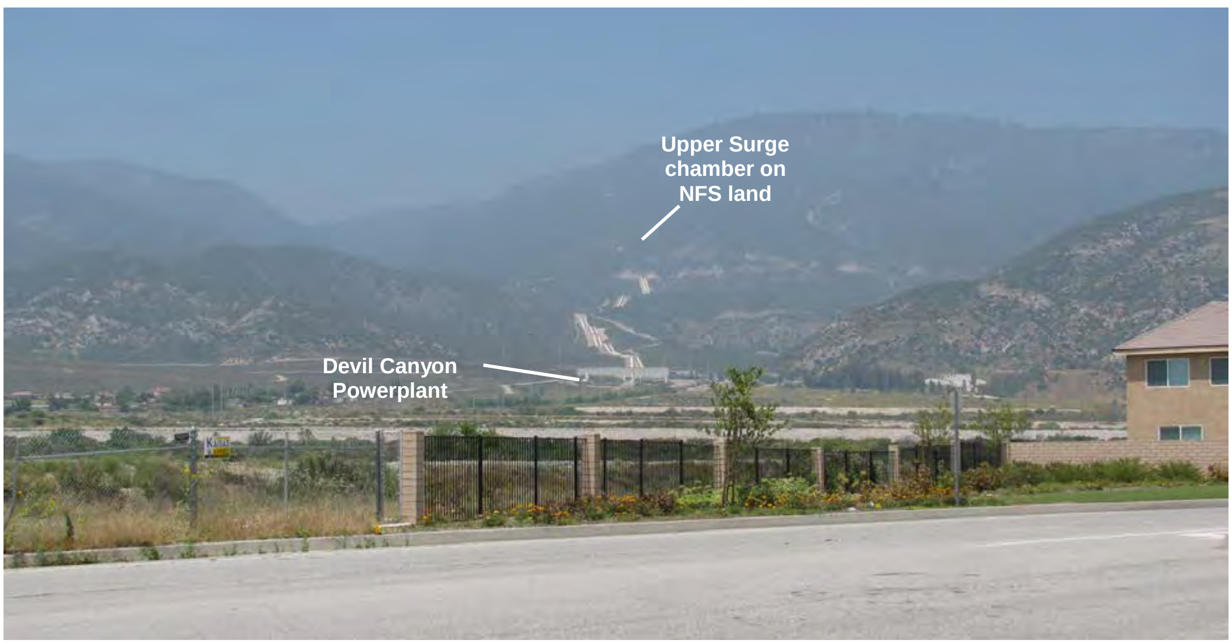
Public roads, from which the penstocks are apparent in these areas, include: Campus Parkway, Northpark Boulevard West, and University Parkway (refer to Figures 5.7-12 and 5.7-13). The penstocks are white in color, 1.3 miles long (in two separate sections, divided by a natural appearing hillside), 10 to 12 feet in diameter, and surrounded by concrete that is light gray in color. The penstocks and associated concrete are in strong visual 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 light gray in color, as well as surge tanks, afterbays, switchyard, transmission lines, and Project roads are visible from the south and contribute to the strong visual contrast from light colors, lines, and geometric shapes. The views from the CSUSB area have less contrast due to the viewing distance of middleground (refer to Figure 5.7-14). The views in foreground from Pine Avenue North, the Ashley Court area, North Ventura Avenue, and public use portions of Devils Canyon Road represent the views with the strongest visual contrast because viewers are closer to the facilities (refer to Figures 5.7-14 through 5.7-16).

The part of the Project on NFS lands is a short distance of penstock located at the top of the visible penstock and a surge chamber just above the penstock. These facilities are seen in middleground and still exhibit strong visual contrast due to the very light color contrast and geometric shapes in contrast to the greens and browns of the surrounding natural landscape (refer to Figures 5.7-11, 5.7-12, 5.7-14, 5.7-15, and 5.7-16). This is an indication that the EVC is moderately altered to heavily altered (DWR 2018). As such, the facility is not meeting the High SIO set in the SBNF Land Management Plan.

Overall, these types of Project facilities (i.e., penstocks, roads, surge chambers, powerplant, pumping plants, and transmission structures) often have high visual contrast and do not blend with the surrounding landscape. However, these types of structures are common and the public is accustomed to viewing these types of facilities. Further, the visual effect of the Project facilities on the Devil Canyon Powerplant side is mitigated, such that most of the views are bracketed by residential areas that have geometric shapes and light color contrast similar to the Project facilities. Overall, the geometric shapes of the Project facilities are not as obtrusive when views are framed by residential housing and developments.

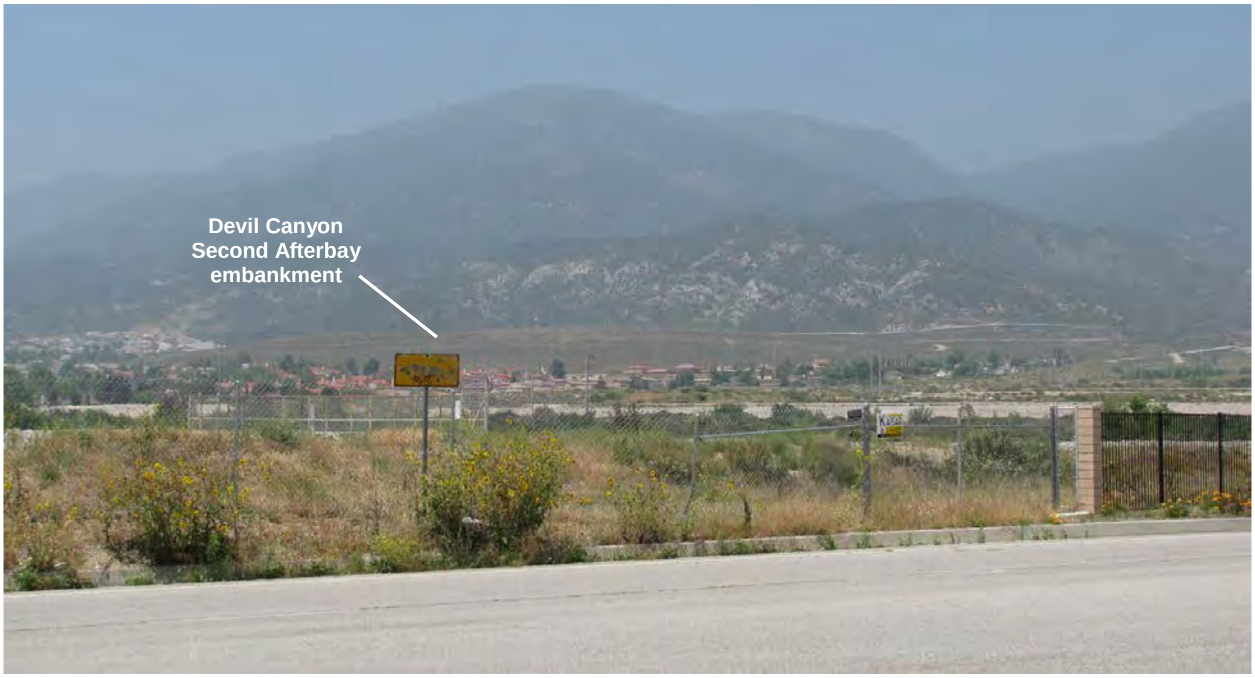
Note: Photo taken May 23, 2018

Figure 5.7-11. Devil Canyon Penstocks in Middleground Viewed from KOP 23 in the California State University, San Bernardino Parking Area Looking Northwest



Note: Photo taken May 23, 2018

Figure 5.7-12. Devil Canyon Penstocks Viewed from KOP 7 on Campus Parkway Looking Northwest



Note: Photo taken May 23, 2018

Figure 5.7-13. Second Afterbay Embankment in Middleground Viewed from KOP 7 on Campus Parkway Looking Northwest

Note: Photo taken May 23, 2018

Figure 5.7-14. Devil Canyon Penstocks in Middleground Viewed from KOP 6 on Pine Avenue Looking Northeast

Note: Photo taken May 23, 2018

Figure 5.7-15. Devil Canyon Power Plant, Transmission Lines, and Penstocks in Foreground Viewed from KOP 5 in the Cul de Sac at the End of North Ventura Avenue Looking to Northeast

Note: Photo taken May 23, 2018

Figure 5.7-16. Devil Canyon Penstocks in Foreground Viewed from KOP 4 at the Intersection of Ohio Street and Ashley Court Looking to Northeast

Second Afterbay

Devil Canyon Second Afterbay, located entirely on State lands, is viewable in the foreground from the nearby residential communities (Figure 5.7-2). A portion of the University Heights residential community lies immediately west and south of the Devil Canyon Second Afterbay. Homes along upper North Melvin Avenue have views of the Second Afterbay in foreground resulting in moderate contrast due to the light concrete edging, straight lines, and geometric shape, compared to the natural landscape to the north, as well as the dark greens and browns established on the constructed embankment to the south (refer to Figure 5.7-17). Homes lower down on North Melvin Avenue have foreground views of terracing and roads associated with the embankment south of the Second Afterbay, which results in high visual contrast due to the three sets of curving terraces that have a very light tan color and geometric shapes in contrast to the green and browns of the native chaparral established on the embankment (refer to Figure 5.7-18). 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 foreground in an inferior position. Since the viewer is looking up, the terraces are completely or mostly screened from view and therefore the visual contrast is low to slight. The Second Afterbay embankment is vegetated with native chaparral/sage scrub plant species, and appears natural when viewed from the south in foreground and middleground (refer to Figure 5.7-19).

Note: Photo taken May 23, 2018

Figure 5.7-17. Devil Canyon Second Afterbay and Embankment in Foreground Viewed from KOP 1 at the Top of North Melvin Street Looking to Southeast

Note: Photo taken May 23, 2018

Figure 5.7-18 Devil Canyon Second Afterbay Embankment Terraces in Foreground Viewed from KOP 2 on North Melvin Street Looking to Southeast

Note: Photo taken May 23, 2018

Figure 5.7-19. Devil Canyon Second Afterbay Embankment in Foreground Viewed from KOP 3 at the Intersection of North Walnut Avenue and Meyers Road Looking to Northeast

5.7.2 Effects of DWR's Proposal

This section discusses the potential effects of DWR's Proposal, as described in Section 2.0, on scenic resources. DWR has proposed one measure specifically related to scenic resources: Measure VR1, would implement the Visual Resources Management Plan included in Appendix A. The plan includes measures to reduce the visual contrast of some Project facilities. DWR developed this plan in collaboration with interested parties.

The effects of DWR's Proposal are the continuation of the existing Project effects, as described in Section 5.7.1. On the Silverwood Lake side of the Project, the Cedar Springs Dam and Spillway (entirely situated on State lands) would continue to present an industrial environment with very light-colored materials, geometric shapes, straight lines, and smooth textures in contrast to the surrounding natural high desert landscape as seen from the PCT and State Highway 138 vista points in foreground. However, the Visual Resource Management Plan would implement measures to enhance the interpretation of these Project facilities (entirely situated on State lands) as viewed from the PCT by installing an interpretive sign along the PCT near the location (also situated on State lands) where the Cedar Springs Dam complex is first viewed by PCT users. The interpretive sign would explain the size and purpose of the Project, including where the water is coming from and going to. DWR would consult with USFS and the PCTA on the location and details related to the interpretive sign. This measure does not lessen the existing visual contrast of these Project facilities; however, it is impractical to significantly mitigate the visual contrast due to the combination of the shape, design and coloration of these critical hydroelectric facilities.

On the Devil Canyon Powerplant side of the Project, the parallel penstocks, powerplant, surge chambers, and two afterbays do not blend with the natural landscape and are equivalent to a heavily altered landscape in foreground and moderately altered landscape in middleground. Most of these facilities are on State lands, except for the upper surge chamber, a short section of penstock, and an access road on NFS land. As part of DWR's proposed Visual Resource Management Plan, DWR, at the time of major rehabilitation of these facilities requiring full re-coating of the penstocks or repainting of the exterior of the powerplant building, will consider using colors and materials that will help these industrial facilities blend into the surrounding landscapes, except for those facilities and/or site components that by Occupational and Safety Health Administration standards are required to stand out. Further, in general, DWR will not use colors that are too dark for Project facilities or components where heating and expansion are of concern.

Overall, the Project would result in continuing the same visual effects as described in Section 5.7.1 for the life of the new license and partially mitigate some of these effects through the implementation of Measure VR1. As such, no substantial change in these effects is expected to occur and DWR's Proposal would have minor adverse effects on scenic resources.

From April 2018 through February 2019, DWR met with agencies to collaboratively discuss PM&E measures. As a result of these collaborative discussions, DWR identified two PM&E aesthetic measures proposed by the SBNF for Project facilities located on State lands. These include: (1) staining the Cedar Springs Dam and Spillway to reduce the color contrast; and (2) re-coating the Devil Canyon Penstocks and Surge Chamber with a color that blends better visually with the surrounding landscape.

Regarding the SBNF's proposed PM&E measure to stain the Cedar Springs Dam and Spillway, these Project facilities are located on State lands and not NFS land. The downstream faces of the dam and spillway are not visible from NFS land. As seen from the reservoir side, these structures present less visual contrast because the water covers most of the dam and spillway (refer to Figures 5.7-5 and 5.7-6). Staining the rock on the downstream faces of the dam and the concrete spillway would potentially improve the color contrast, primarily as seen from State and private land to the north of these structures, but this measure would not mitigate the remaining visual contrast of the shape and design of the dam and the spillway, and there is no practical PM&E measure to address these visual contrast issues. Also, any visual benefit from staining the upstream faces of the dam and spillway would be minimal considering the limited visible surface of these structures seen from the south. Overall, the SBNF's proposed PM&E measures to minimize the dam's color contrast would not be practical given that the visual contrast of the dam's shape and design would remain.

5.7.3 Unavoidable Adverse Effects

DWR's Proposal, including Measure VR1 (Visual Resources Management Plan), would partially mitigate the existing Project's minor adverse effects. The unavoidable Project effects of continuing views of existing Project structures are considered minor due to the localized nature of the effects and the nature of the visual inconsistencies. In addition, the inconsistencies are considered minor because the public using the areas are generally accustomed to these features and understand the function and purpose of such facilities. Also, the facilities pre-date the Land Management Plan and, in many cases, the steep terrain and industrial design and function of Project facilities precludes other functional options where facilities might fit in the landscape with less visual effect.

5.8 CULTURAL AND TRIBAL RESOURCES

This section includes three main sub-sections. Section 5.8.1 describes existing Project conditions, and presents a cultural history overview. Section 5.8.1 also describes DWR's cultural resources investigations; provides a general overview of the cultural resources documented within the Area of Potential Effects (APE); and lists potentially affected Native American tribes and describes the results of the tribal resources study. Section 5.8.2 describes the effects of DWR's Proposal on cultural resources and tribal resources, and DWR's proposed PM&E measures. Section 5.8.3 describes any unavoidable Project effects on cultural and tribal resources.

DWR augmented existing, relevant, and reasonably available information regarding cultural and tribal resources in the Project area by conducting two studies: (1) a *Cultural Resources Study Approach*, and (2) a *Tribal Resources Study Approach*. Refer to the Devil Canyon Project Relicensing Website at http://devil-canyon-project-relicensing.com/studies/ or detailed approaches and study summaries. Given the sensitive nature of the information developed as part of each study (e.g., locations and maps of cultural and tribal resources), a confidential Privileged Study Report will be filed with FERC for each resource study and made available to the USFS, State Historic Preservation Officer (SHPO), and tribes, with the tribes' concurrence on the tribal resources report consistent with existing non-disclosure agreements. The confidential Privileged cultural and tribal resources information is only summarized in this section.

5.8.1 Existing Environment

5.8.1.1 Background Information

This section provides information regarding cultural and tribal resources located within the Project APE. The APE includes at a minimum all lands and facilities within the existing Project boundary, which includes all Project facilities and features.

The existing Project boundary comprises 3,744.0 acres of land. Within the total acreage, 221.0 acres are federal lands managed by the U.S. Department of Agriculture, Forest Service as part of the San Bernardino National Forest. Most of these federal lands are located along the west side of Silverwood Lake, San Bernardino Tunnel and Surge Chamber, and Devil Canyon Powerplant Penstocks areas.

DWR proposes several changes to the existing Project boundary to more accurately define lands necessary for the safe O&M of the Project and other purposes, such as recreation, shoreline control, and protection of environmental resources. The proposed changes include: 1) the addition of lands to the existing Project boundary that are currently utilized with a preponderance of use related to the Project O&M (e.g., the drainage area west of the Devil Canyon Second Afterbay), and, 2) the proposed removal of lands from the existing Project boundary that do not have Project facilities and are not used or necessary for Project O&M (e.g., certain areas between Silverwood Lake and State Highway 138). These proposed changes are essentially corrections to the existing Project boundary. Other modifications include proposed changes to the existing Project boundary around the Project reservoir and impoundments from surveyed coordinates to a contour located above the NMWSE. These changes reflect the preferred method of defining a project's boundary, as outlined in the FERC Drawing Guide (FERC 2014), and more accurately represents lands required for Project O&M around the Project reservoir. The most significant change in the delineation is the use of a 100-foot buffer from Silverwood Lake's NMWSE to define the proposed Project boundary around portions of the lake, which reduces the land area considerably on the eastern, western, and southern side of Silverwood Lake.

The net effect of modifying the existing Project boundary is the reduction of area within the boundary from 3,744.0 acres to 2,079.4 acres. This change would reduce the 221.0 acres of federal land (approximately 6 percent of the total area within the existing Project boundary) to 125.9 acres of federal land (approximately 6 percent of the total area within the proposed Project boundary).

For purposes of defining the APE, DWR used the proposed Project boundary, inclusive of 2,079.4 acres of land, with the exclusion of non-Project facilities not affected by Project O&M, and excluding lands overlying the San Bernardino Tunnel on which DWR does not perform any Project-related activities. The SHPO concurred with the APE in a letter dated September 21, 2017 (Appendix E). The APE is shown on Figures 5.8-1 and 5.8-2.

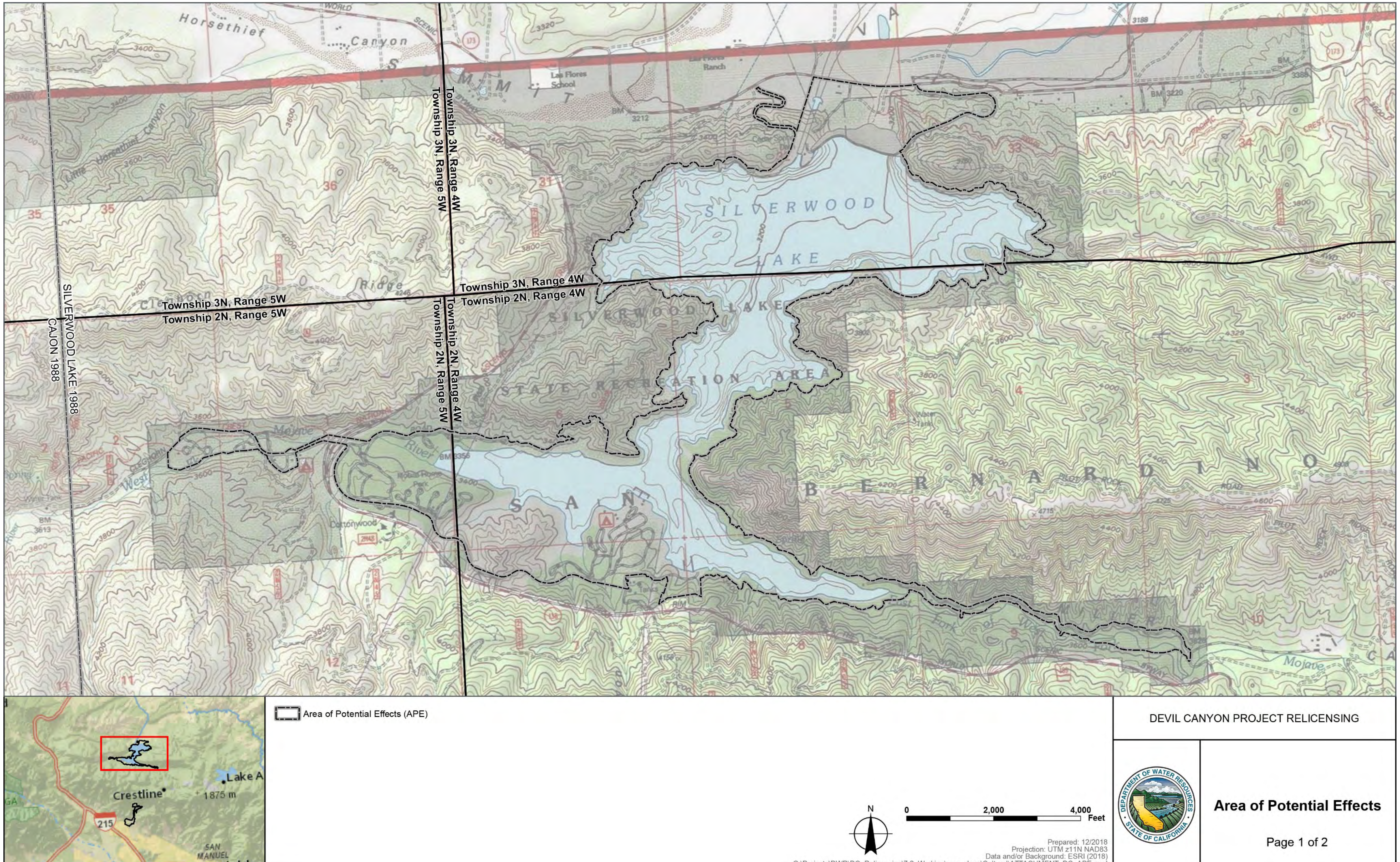


Figure 5.8-1. APE Around Silverwood Lake

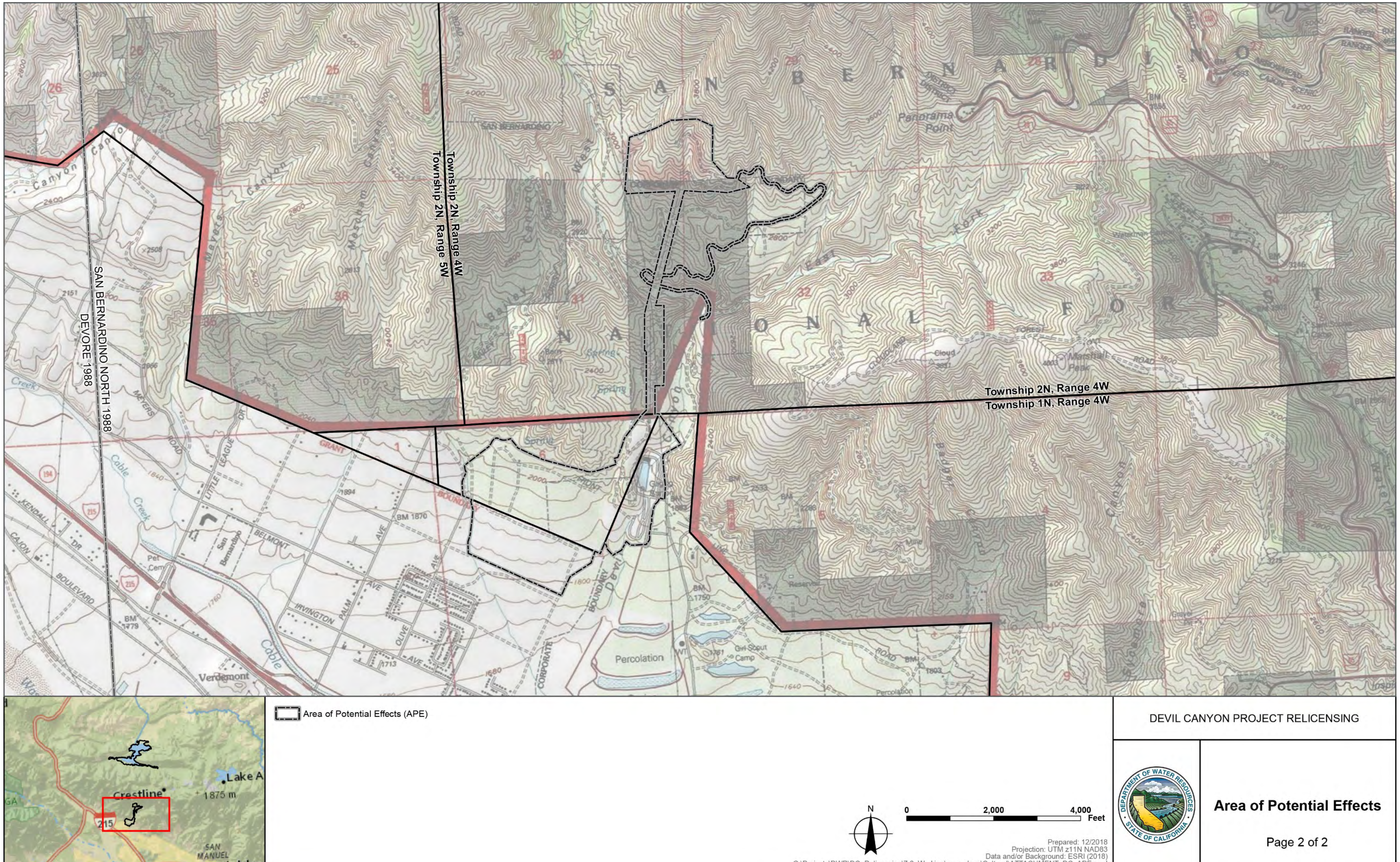


Figure 5.8-2. APE Around the Devil Canyon Powerplant, Devil Canyon Afterbay, Devil Canyon Second Afterbay, Surge Chamber, Penstocks and Access Road

For the purpose of this section, a cultural resource is any prehistoric or historic district, site, building, structure or object, regardless of its National Register of Historic Places (NRHP) eligibility.

Tribal resources are primarily Indian Trust Assets (ITA), Traditional Cultural Properties (TCP), or other resources or locations of interest. Agreements that may exist between tribes and other entities, such as land-managing agencies, may be useful in further identifying potentially undocumented tribal resources. 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. An ITA 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: (1) are rooted in that community's history, and (2) are important in maintaining the continuing cultural identity of the community.

Agreements are contracts between a tribe and a private land owner or land-managing agency that provide tribes with access to a landowner's or agency's property for fishing, gathering of traditional plants, or other tribal practices.

5.8.1.2 Cultural History Overview

The cultural history overview provides a context by which the significance of cultural resources can be measured and evaluated. The Project region has a long history of human occupation, which is discussed below, and which is focused on the presence or absence of archaeological evidence collected over many decades from the APE and surrounding area. Additionally, in-depth reviews of ethnographic sources were conducted as part of the Tribal Resources Study Approach to develop the site-specific context as may be applicable to the physical locations identified during past and current archaeological investigations and discussions with local tribes and tribal members.

Prehistory

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). Based on some of the more recent studies, the APE is located 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 through 7,000 B.P.), the Pinto Complex (ca. 7,000 through 4,000 B.P.), the Gypsum Complex (ca. 4,000 through1,500 B.P.), and the Saratoga Springs Complex (ca. 1,500 through800 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 7,950 B.P.), the Archaic Period (ca. 7,950 through 1,450 B.P.), and the Emergent Period (ca. 1,450 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).

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).

Archaic Period

The Paleoindian Period concludes and the Archaic Period emerges around 4,050 B.P. 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. 7,950 through 4,950 B.P.)

The first 3,000 years of the Archaic Period are referred to as the Lower Archaic and are 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 (4,950 through 2,950 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 3,700 through 3,500 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. 2,950 through 1,450 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).

Emergent Period

The Emergent Period (ca. 1,450 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 in the archaeological record at this time. (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. 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).

Ethnohistory

The APE is located within the southwestern portion of lands occupied by the Serrano, as depicted on a 2015 Serrano Ancestral Territory map provided to DWR by the San Manuel Band of Mission Indians (SMBMI) (2016). 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 Serrano of the mountains were generally a sedentary people and did not migrate seasonally. However, desert groups like the Vanyume travelled to the foothills annually to obtain commodities not found in the desert through trade and foraging. The Serrano were part of an interdependent and extensive trade network that linked the coast with the Colorado River via the most widely traveled trade corridor in this region along the Mojave River (Earle 2005; Walker 1986). Commodities like seashells, wood, bone, stone, plant fibers, the Serrano’s lavishly decorated baskets, tortoise-shell rattles, pipes, and a variety of tools and implements were traded to neighboring tribes like the Cahuilla to the south, the Paiute to the east, and the Kawaiisu to the north. Generally, relations within the Serrano tribe were peaceful with reciprocal economic relationships. However, various bands of Serrano fought with neighboring tribes over hunting rights or grievances from time to time, thereby occasionally disrupting trade. Although the various bands of Serrano were of the same tribe, there was no form of pan-tribal political union among the clans (Bean and Smith 1978; Earle 2005).

The Serrano were patrilineal and lived in exogamous clans associated with one of two moieties (Bean and Smith 1978:572). The principle of totemic moieties is unique, as this practice is primarily found among indigenous peoples of South America (Goldstein 2005). However, other Native American tribes in California, such as the Yokuts and Me-wuk, share this practice but with some variations. Generally, moieties divide a group into two balanced and complementing halves, with each half being prescribed different political and ceremonial duties. Moieties are based on totemic spirits, with one moiety holding precedence over the other. For instance, the Serrano Coyote moiety, *wahiˀami*, is led by the village *ki•kaˀ* with control over the conduct of ceremonies, while the Wildcat moiety, *tukʷutam*, is presided over by the *paxa•ˀ* with control over the ceremonial bundle. Moieties are typically stratified and regulate most aspects of village life but with the Serrano bonds between moieties were strictly ceremonial in nature (Bean and Smith 1978; Kroeber 1976 [1925]).

The clans included hereditary chiefs called *ki•kaˀ*, a term that Kroeber (1976 [1925]:618) indicates comes from the Shoshone word for “house” or “live.” The *ki•kaˀ* was believed to possess psychic abilities and served as each clan’s religious and ceremonial leader. Each *ki•kaˀ* was assisted with ceremonies by a hereditary *paxa•ˀ*, (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. The *ki•kaˀ* was the religious leader of the principal moiety while the *paxa•ˀ* was the religious leader of the lesser lineage (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 and stirrers); and pottery and basketry (Bean and Smith 1978:571).

Some plant foods such as the acorn and piñon nuts had to be prepared before they could be eaten. These items were collected in great quantities during harvest and stored for future use; only what was to be eaten was removed from the stores. Acorns were cracked open on metates or shallow mortars with pestles, and the meats were put into deeper conical mortars to grind into meal. The meal was sifted with a basket and placed on a shallow bed of sand or sandstone to leach out the tannin and remove the bitterness. Four acorn dishes were made from the meal: soup, mush, biscuits, and bread. Soup and mush were made by boiling the meal in baskets; fired stones were added to the water to bring it to a boil. Biscuits were made by extending the process by immersing the basket in a stream for extended cooling. Bread was made by taking the meal and broiling it directly on a hot stone. Many other foodstuffs were cooked and prepared in a similar fashion. The Serrano used a variety of finely crafted watertight baskets and pots for cooking (Barrett and Gifford 1933; Bean and Smith 1978; Bunnell 2016 [1892]; Desert Gazette 2017).

Serrano settlements were focused on water sources, resulting in smaller villages (Bean and Smith 1978:571). Village structures consisted of residential houses, ramadas, sweathouses, and a ceremonial house. Family houses were usually circular and built from willow with domed thatched roofs that included outside ramadas that served as work areas. Cords, usually made of yucca fibers, were used to secure the frames and thatching. The size of these structures varied, as they were built to provide sleeping quarters and storage for small to large familial groups, and in some cases just a single individual. 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. The village ceremonial house was a large structure similar in design to a residential house. It served as the religious center of the village and the home of the lineage leader or *ki•kaˀ* (Bean and Smith 1978; Kroeber 1976 [1925]).

Serrano religion included many rituals, dances, and ceremonies, the most prominent being the mourning ritual and ceremonies associated with attaining adolescence. The aforementioned seven-day mourning ceremony also included other activities besides the eagle dance. The first two days were spent preparing foods and gifts to be used throughout the conduct of the ceremony. On the third night, the *paxa•ˀ* would present the sacred bundle to the assembled tribal members. It is unclear exactly what the sacred bundle contained but Bean and Smith (1978) refer to it as “the raison d’être for the Serrano.” Adolescence ceremonies differed for males and females. The *paxa•ˀ* presided over the boys’ ceremony, referred to as the *tamonin*, which consisted of ingesting a concoction prepared from the root of the jimsonweed (*Datura* spp.) that would inebriate a participant and cause hallucinations or visions. The visions and dreams would then be interpreted by shamans who foretold the boys’ future lives. The girls’ ceremony, referred to as the *waxan*, occurred at the same time as the boys’ ceremony and included dietary restrictions, pit roasting, ingestion of bitter herbs, and instructions on how to be good wives (Bean and Smith 1978; Kroeber 1976 [1925]).

Serrano tribal shamans, or *h*^{w}*ö•mč*, had the power to cause or cure ailments through their guardian spirits. Similar to shamans in other cultures, they obtained their powers by seeking out guardian spirits through vision quests, dreams, and trances assisted by the ingestion of *Datura*. A Serrano shaman's main duties were to cure and heal tribal members. The most important shaman was the spirit doctor or sucking shaman who had the ability to locate the cause of a disease and remove it by sucking it from the victim (Levy 1978). Herb shamans were the next most important as they administered medicinal plants that could cure various ailments. All shamans had special roles during ceremonies, such as assisting the *paxa•ˀ* during the *tamonin* (Bean and Smith 1978; Kroeber 1976 [1925]).

In Serrano culture, almost immediately following death the deceased would be cremated with all their possessions except certain articles of clothing that would be used during ceremonies. The first ceremony, called a *mamakwot*, would take place within a month of death and included a night of singing, dancing, and the burning of some remaining personal possessions. The deceased was honored further during an annual seven-day mourning ceremony where an effigy of the deceased was created. The annual ceremony included the naming of children born during the previous year, an eagle-killing ceremony, and an eagle dance. Singing and dancing would continue through the sixth night followed by the giving of gifts and the distribution of shell money. On the morning of the seventh day, the effigies of the deceased were burned along with their remaining possessions. The Serrano almost exclusively practiced cremation; however, after the imposition of Spanish control, the practice of burial became more widespread (Bean and Smith 1978; Kroeber 1976 [1925]).

History

At the time of Spanish contact in the eighteenth century, two distinct ethnolinguistic groups occupied the Western Mojave region: Takic-speaking Tataviam, Kitanemuk, and Desert Serrano (or Vanyume) in the south, and Numic-speaking Kawaiisu, Chemehuevi, and Southern Paiute to the north (Blackburn and Bean 1978; Earle 1990, 2004, 2005; King 2004; King and Blackburn 1978; Kroeber 1976 [1925]; Sutton 1980). The linguistic and cultural frontier between these groups ran east to west across the Antelope and Mojave River Valleys (Earle et al. 1997). Both groups practiced an annual subsistence round that took advantage of seasonal resources on the desert floor and in the adjacent upland areas within and surrounding the Project APE. Earle (2005) notes that Takic-speaking groups to the south lived in larger semi-permanent settlements housing 80 people or more, whereas Numic-speaking groups to the north had lower population densities (villages housed approximately 30 people) and practiced higher-mobility subsistence strategies. This difference may have been due in part to the exploitation by Kitanemuk and Desert Serrano groups of acorns that were easily available in oak groves at the foot of the San Gabriel and San Bernardino Mountains.

The forced removal of the Serrano populations to Franciscan missions closer to the coast began in the early 1800s, leaving untold numbers of Serrano villages in the Project region abandoned. In the nineteenth century, the Western Mojave experienced an influx of Numic-speaking Chemehuevi groups from further east, as well as possibly a later movement of Kawaiisu groups from the Tehachapi Mountains region (Earle 2004; Earle et al. 1997). By the mid-nineteenth century, most of the Native American groups labeled as "Serrano" fell under the power of the missions. The Vanyume and Chemehuevi, who managed to avoid being taken by the Spanish, soon found that they were unable to continue their previous lifeways. By the end of the nineteenth century, they had ceased to exist as a distinct people. Most of the Vanyume and Chemehuevi were absorbed into the Serrano tribe (Bean and Smith 1978; NLA 2015).

Researchers have estimated that prior to European contact, the population of the Serrano was between 1,500 and 2,500 individuals (Bean and Smith 1978; Kroeber 1976 [1925]). From 1819 to 1834, large numbers of Serrano-speaking Native Americans were taken into the San Gabriel Mission system and were forced to work on the San Bernardino cattle rancho and participate in mission activities (CMRC 2017). Those who escaped the missions to return to their homeland were hunted down and either brought back to the missions or killed. In the nineteenth century, four methods of dealing with the Natives were utilized on a case-by-case basis: destruction, assimilation, protection on ancestral lands, and relocation to reservations (Calloway 2008). During the late nineteenth century, militias from San Bernardino hunted down the Serrano during a 32-day campaign and forced the survivors out of the mountains. In 1891, the Act for Relief for the Mission Indians was passed establishing Serrano reservations (SMBMI 2017). Today, only several hundred people claim Serrano descent and are part of sovereign tribal governments like the SMBMI and the Morongo Band of Mission Indians.

<u>History of the Region</u>

At more than 20,000 square miles, San Bernardino County is the largest county in the United States and is larger than the nine smallest states in the Union combined (Ellicot 1965:17). The county is bisected by the San Bernardino Mountains, which extend across the southwestern portion of the county. The land southwest of these mountains comprises the San Bernardino Valley and is home to the majority of the county's population. The primary waterway of the San Bernardino Valley is the Santa Ana River, which rises from the mountains and flows west to the Pacific Ocean across southwestern San Bernardino County and Orange County. The Mojave River is the principal waterway northeast of the mountains, traveling from their northern slope down and across 150 miles of desert (Ellicot 1965:18).

The history of southern California can be broken down into three major periods: Spanish (1769-1822), Mexican (1823-1848), and American (1848-present). Native Americans settled in the San Bernardino Valley many centuries before the first European is known to have visited (Robinson 1989:3). The Serrano people referred to the valley as Gauchama, the land of plenty, a place rich in plant and animal life with sufficient water to support regular human habitation (Weeks 2010:14).

Spanish Period (1769-1822)

Prior to the eighteenth century, Spain did not show much interest in the lands to the north of Baja California. Missions were already being established in Baja California, and the Jesuits were slowly making their way north. However, perceived international interference from the British and Russians forced Spain to change its tactics and gain a presence in Alta California (Bolton 2018; Brown and Boyd 1922; Hayes 2007). 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. A total of 21 missions was established along the California coastline from San Diego in the south to Sonoma in the north (HARD Townsites Team 2007).

In 1767, Carlos III, the King of Spain, ordered the expulsion of Jesuits from New Spain. They were to be replaced by the Franciscan order led by Father Junípero Serra. Veteran army commander Gaspar de Portolá was selected to carry out this mission in preparation for the northward expansion of New Spain. In 1769, Portolá led "The Sacred Expedition" into Alta California with orders to occupy Monterey Bay. The expedition made it as far as San Diego before encountering a number of difficulties, including the loss of most of its supplies. Nevertheless, Portolá was resourceful and pressed on, leaving Father Serra behind to found the Mission of San Diego de Alcalá. On July 30, 1769, the expedition entered what was to become Los Angeles County and made camp near La Puente (Hayes 2007; Hoover et. al. 2002; Starr 2007).

By 1770, Portolá and Serra succeeded in establishing a presidio and mission (Mission San Carlos Borromeo de Carmelo) at Monterey, which facilitated the expansion of New Spain throughout the coastal California region. A third mission, San Antonio de Padua, was quickly established just to the southeast of Monterey; however, the founding of the fourth Spanish mission in the San Gabriel Valley was to come from San Diego. In August of 1771, friars Pedro Cambón and Angel Somera took a contingent of 10 soldiers north to establish a new mission, and by September, Mission San Gabriel Arcángel, Pride of the Missions, was founded. The original mission was established on a small bluff adjacent to the San Gabriel River at the Native American village of Shevaanga (CMRC 2017; Hayes 2007; Hoover et. al. 2002; Starr 2007). In 1775, the mission was relocated approximately three miles to the northwest at the Native American village of Lisanchanga (CMRC 2017).

From an economic standpoint, Mission San Gabriel Arcángel was the most successful of the 21 California missions. Fathers Antonio Cruzado, Miguel Sanchez, and José Zalvidea oversaw the construction of asistencias, canals, vineyards, orchards, gardens, and mills. By the early nineteenth century, the mission maintained more than 25,000 heads of cattle, 15,000 sheep, and produced more than 350,000 bushels of wheat, barley, corn, beans, peas, and lentils. The padres proved themselves to be masters of organization and industry. However, this success was mainly due to the subjugation of the more than 1,700 Native Americans who worked the mission lands (CMRC 2017; Starr 2007). The Tongva and Chumash were the first to fall under the power of Mission

San Gabriel, and regular expeditions were sent throughout the region to collect more Native Americans, such as the Serrano and Mojave to the north and east (Bean and Smith 1978; SMBMI 2017). Native peoples were captured and forced to work the mission lands. Those who resisted were killed and those who did not resist were subjected to forced assimilation and harsh treatment by the padres. Many of the padres maintained a distain for the Native Americans, viewing them as little more than children incapable of comprehension, thought, and feeling (Starr 2007).

The Native Americans, under the tutelage of the padres, constructed some of the finest early structures in the region, such as the second mission church of San Gabriel (1791-1803) (Figure 5.8-3) and California's first water-powered gristmill (1810-1812). The San Gabriel church was constructed of stone and cement up to the windows and then brick throughout the remainder of the structure. The interior of the church was painted with depictions of the 14 Stations of the Cross – the earliest post-contact Native American art in California. The old mill is approximately two miles to the north of the mission and is constructed of solid masonry. Both structures are still in use today and are a testament to the architectural and engineering prowess of the Spanish Mission Period. Several of the numerous adobe structures that served the mission have also survived (Hoover et. al. 2002).

Source: USC Digital Library 2017

Figure 5.8-3. Exterior View of the Mission San Gabriel taken by Edward Vischer before 1875

Aside from Mission San Gabriel's economic importance, it was a primary stop and staging point for many Spanish expeditions in southern California. Throughout the 1770s, Juan Bautista Anza ("the last conquistador"), Pedro Fages, and Father Francisco Garcés utilized San Gabriel as a resupply point. Anza and Fages primarily led expeditions for settlement while Garcés was in search of new Native American converts. In 1772, Fages traveled along the western end of what would become San Bernardino County while pursuing deserters from the Presidio at San Diego (Hoover et. al. 2002). Two years later, Anza would become the first European to view the San Bernardino Valley while in search of a direct land route between Sonora, Mexico, and Monterey (Bolton 2018; Brown and Boyd 1922; Hayes 2007; Hoover et. al. 2002; Starr 2007).

One of the most notable expeditions was that of Father Garcés in 1776. Initially, Garcés was attached to Anza's Colorado River expedition; however, Garcés broke off from Anza and traveled west in search of the Mojave Trail, a long-established trade route that linked Colorado River Native American villages with coastal villages (Earle 2005; Hayes 2007; Starr 2007; Walker 1986). Garcés' mission was a success, and he managed to locate a number of Native American villages, including a village of Gauchamas Native Americans in the San Bernardino Valley, and learn about their socio-economic complexity before reaching Mission San Gabriel (Brown and Boyd 1922; Walker 1986). Garcés attempted to pass on the knowledge he gained to educate others on the intelligence of the Native Americans, but to no avail (Earle 2005; Hayes 2007; Starr 2007; Swisher 1999). In 1781, the overland route through San Bernardino to Alta California was closed after the Yuma Native Americans destroyed the missions along the Colorado River and massacred a military detachment that included Garcés (Hayes 2007).

It has been well established that Garcés followed the Mojave River during his 1776 expedition; however, the western portion of this route through the San Bernardino Mountains has been debated. Originally, it was thought that Garcés reached the San Bernardino Valley using the Cajon Pass, but careful study of his diary entries from the expedition suggests that he followed the West Fork of the Mojave River. From the river, it is believed that Garcés followed Sawpit Canyon to the summit of the mountains and then traveled along the ridgeline between Devil Canyon and Cable Canyon into the San Bernardino Valley and then west to Mission San Gabriel (possibly along the path of what became Swarthout Road depicted on the 1877 Plat Survey map of Township 2 North, Range 4 West). Although the precise route can never be known, it has been generally accepted that Garcés followed the West Fork of the Mojave River rather than Cajon Pass (BLM 2017; Brown and Boyd 1922; CSBa 2018; Garret 1998; Hatheway 2007; Hoffman 2014; Hoover et al. 2002; Leadabrand 1964; Robinson 1989; Walker 1986).

During the late eighteenth and early nineteenth century, the San Bernardino Valley remained unsettled by the Spanish while coastal areas near the missions saw a moderate amount of growth. According to local tradition, on May 20, 1810, Father Francisco Dumetz, a Franciscan missionary based at San Gabriel, led a contingent of padres, soldiers, and missionized Native Americans eastward from Mission San Gabriel to establish an *asistencia* (Weeks 2010:14). He named the valley after St. Bernardine, the saint whose feast day it was, and the settlement was named Politana after Hipolito, the trusted missionized Native American left in charge. Politana flourished until 1812 when the local Native Americans revolted, destroyed the mission buildings, and killed all those who served the mission (Brown and Boyd 1922; SBC 2018).

Although there is some doubt about the veracity of the tradition of Dumetz's visit, it is known that, by 1819, missionaries from San Gabriel had moved into the valley. Mission records state that just before the end of the Mexican War of Independence, the Native Americans of the San Bernardino Valley requested assistance from the padres in establishing farming and stock raising (Brown and Boyd 1922). Based on the interactions of the padres with Native Americans throughout Alta California, it seems unlikely that the padres would have been invited into the San Bernardino Valley (Hayes 2007; Starr 2007). A more plausible explanation would be that the padres chose to reestablish a presence in the San Bernardino Valley with the hope of support from the new government. Regardless of the reasoning, the padres began to rebuild the asistencia between 1821 and 1822, starting with the construction of an adobe chapel.

Mission workers soon constructed a series of *estancias*, small outposts, along the Santa Ana River (Weeks 2010:17). The San Bernardino outpost was flourishing once again but support for the missions from Mexico would not be forthcoming. San Bernardino would be attacked and raided by Native American peoples from the Mojave Desert several times in the years to follow (Brown and Boyd 1922). In addition to the lands controlled by the missions, large land grants and *ranchos* were gifted to individuals by the Spanish government; this includes a generous provision of land known as Rancho San Bernardino, which was established in 1819 to provide supplies to the San Gabriel Mission and totaled over 35,000.0 acres (Robinson 1989:9; San Bernardino County 2018).

In 1819-20, Father Pedro Alvarez of the San Gabriel Mission directed both Spanish and native workers to build the Mill Creek Zanja, an irrigation ditch that carried water from Mill Creek Canyon to the heart of Rancho San Bernardino (Crider 2014:1). This was the first human-made irrigation work in the valley and would support the establishment of several outposts and ranches along its 12-mile corridor, as well as serve as the foundation of irrigation efforts that would become integral to the development of San Bernardino County.

Mexican Period (1823-1848)

Mexico won its independence from Spain in 1822, signaling the waning of the mission system and shifting the control of many ranchos to the newly formed Mexican government. Many mission ranchos were then sold and granted to private citizens. At first, the secularization of the missions was intended to give lands back to Hispanicized Native Americans, but José Figueroa, governor and creator of this plan, died before it could be realized, and only a small number of Native Americans were granted mission lands (Hayes 2007; Starr 2007). Generally, the treatment of the Native Americans did not change, and many were exploited as forced labor by Mexican rancheros (Shipek 1977).

By 1835, nearly all missions in southern California had been secularized with ranchos established on their lands. The first rancho in the San Bernardino Valley was the 15,400.0 acre Jurupa Grant, given to Juan Bandini in 1838; followed by the Santa Ana Del Chino Grant, given to Don Antonio María Lugo in 1841; the 37,700.0 acre San Bernardino Grant, given to Don Lugo, his sons, and his nephew, Diego Sepulveda, in 1842; the 30,144.0 acre El Cajon de Muscupiabe Grant, given to Miguel Blanco (Michael White) in 1843; and the 6,600.0 acre Rancho San Gorgonio, given to Powell Weaver in 1846 (Robinson 1989:10). Prior to these grants, the San Bernardino Valley was used by the Native Americans to pasture stolen livestock before going north over the mountains. The establishment of the first three ranchos was meant to deter the constant Native American raids into the San Gabriel Valley and promote economic growth. To promote settlement, the Lugos began donating large tracts of land in the San Bernardino Valley to Mexican families and foreigners, such as the Workman-Rowland Party. Some of these families were lured by Bandini to the Jurupa Rancho with more lucrative prospects (Brown and Boyd 1922).

Despite efforts to discourage Native American raids in the San Bernardino Valley, these continued unabated. The Lugos did not have the manpower to protect such vast holdings, which led Manuel Micheltorena, Governor of Alta California, to create the Muscupiabe Grant. The grant was given to Michael White, an Englishman who came to California in 1817 as a trader and eventually became a naturalized Mexican citizen. With financial help from Bandini and the Lugos, White built a “fortress-home” at Cajon Pass and hired men to protect the valley residents from raids. However, in less than a year, White lost all of his livestock to raids. Not being a wealthy man himself and realizing the futility of trying to defend San Bernardino from the Native Americans, White abandoned the rancho. Although he was unable to remain safely on Rancho Muscupiabe, White held title to the land even after the conclusion of the Mexican-American War. In 1856, he sold half his interest to Isabel Granger and Charles Crittenden; a year later he sold the other half to Henry Hancock (Brown and Boyd 1922; Garrett 1998; Robinson 1989; Robinson 1993:374).

The creation of these ranchos, as well as many others, helped facilitate the growth of a secular society; however, this society only benefited those families fortunate enough to receive land grants. The owners of the Mexican ranchos became the wealthy elite of Californian society and were known as Californios (Starr 2007). Along with the wealth achieved through such prosperous land grants, the Californios enjoyed a degree of political autonomy and favored self-rule and a separation from Mexico. The wealth and power of the Californios attracted many foreign businessmen like Michael White who desired to marry into these families. These marriages were encouraged by the American government, which increasingly sought to annex California towards the mid-nineteenth century (Olson-Raymer 2015; Robinson 1989; Starr 2007).

During the Mexican Period, the Mexican government did not have any real authority over the Californios – or California, for that matter. Between 1831 and 1836, 11 Mexican governors were appointed but were unable to control the political situation and create a stable system of government. Mexico also had little control over those appointed to the governorship of California, who fostered a military despotism more akin to California under Spanish rule. Mexican California had a legislative branch of government; however, when convened it only acted as an advisory council to the governor (Olson-Raymer 2015).

In 1836, the Californios, led by Juan Bautista Alvarado and assisted by Tennessee mountain men, declared California a sovereign State. With neither the Californios nor Mexico having the men or resources to win by force, the Mexican government decided to resolve the situation by upgrading California's territorial status with Alvarado as governor. Mexico also began enlisting the assistance of foreign emigrants like German-born John Augustus Sutter, who would later founded the City of Sacramento, but their financial interests would eventually work against the aims of the Mexican government. Rather than repel foreign incursions, they invited them as potential business prospects. By the late 1830s, American companies in partnership with the Californios were exploiting most of California with little resistance (Starr 2007).

The Mexican government did make efforts to militarize the frontiers of California to protect against hostile Native Americans, incursions by Russians from Fort Ross, trappers from the Hudson Bay Company, and incursions by American mountain men like Jedediah Smith. However, Mexico lacked the resources to effectively defend its frontiers, and men like Smith were generally able to traverse the territory unmolested (Hayes 2007; Starr 2007). In 1826, Smith and his party of trappers entered California using the Mojave Trail. Smith, like Garcés, did not use Cajon Pass but followed the West Fork of the Mojave River into the San Bernardino Mountains. Based on Smith's diary entries, most researchers believe that his route took him through Sawpit Canyon and Devil Canyon to the San Bernardino Valley, but the entries lack enough detail to sufficiently pinpoint the route. Smith was the first American to set eyes on the San Bernardino Valley and visit the San Bernardino outpost (Brooks 1977; Brown and Boyd 1922; Hoover et. al. 2002; Walker 1986).

Leading up to the Mexican-American War (1846-1848), the United States government sent an increasing number of expeditions to California, and more pioneers began making their way to the region. The early expeditions of Jedediah Smith, Charles Wilkes, and George Emmons were highly publicized in the eastern United States, and in 1841, the first wagon train entered California, guided by Northern Paiute Indians. One of the primary routes used was the Truckee Pass, now known as Donner Pass, which traversed the Sierra Nevada Mountains leading into the Central Valley. The pass, discovered by John Frémont (Faigin 2012), was later used by the Central Pacific Railroad and roughly followed the route of modern-day Interstate 80 (Hayes 2007). Many settlers also took the southern route. For example, the Workman-Rowland party took the Old Spanish Trail (Mojave Trail) to Los Angeles towards the end of 1841 (Starr 2007; Walker 1986).

Generally, the Californios were not opposed to an affiliation with the United States and some historians agree that California would have become part of the American Union even if the Mexican-American War had not occurred (Dana and Smith 1911; Starr 2007). What was important to the Californios was that their language, customs, religion, and land titles be respected by the United States following annexation. However, to allow this would have been contrary to the principles of Manifest Destiny favored by many in the American government like Senator Thomas Benton, father-in-law of John Frémont. By 1845, unbeknownst to the Mexican government and many Californios, the wheels of conquest were already in motion (Starr 2007). That same year, Pío de Jesús Pico IV was appointed governor of California; he would be the last of the Mexican governors (Ciancimino 2005; Hoover et. al. 2002).

In January 1846, John Frémont, at the head of a 60-man army expedition financed by the U.S. War Department, entered California on his way to Monterey. The expedition was exploratory in nature, but the true intentions behind it were to test the defenses of Mexican California and possibly instigate a war. José Castro, *comandante* of the North at Monterey, was outraged by the presence of armed American troops and ordered Frémont to leave. Frémont did not leave, but instead camped his men on top of Galiván Peak and raised the American flag. Castro, fearing the possibility of a Californio uprising, remained fortified in Monterey and waited. Frémont, having no orders to seize Monterey, went north to Oregon (Hayes 2007; Starr 2007).

On May 13, 1846, the United States declared war on Mexico; the news would not reach California for several months. While in Oregon, Frémont met with Archibald Gillespie, who was carrying confidential dispatches to a United States agent in California. Although it has never been substantiated, Frémont claims that Gillespie gave him a message from President Polk to seize California. Frémont, with a reinforced expeditionary force, entered California gathering American settlers along the way. When Frémont reached Sonoma he incited “The Bear Flag Revolt” in which American settlers (the Bear Flaggers) took over the town and captured Mexican general Mariano Vallejo. Hearing of the revolt, Commodore John Sloat of the U.S. Navy made the decision to seize Monterey. Frémont and the Bear Flaggers helped capture San Francisco and Monterey before being taken by ship to San Diego to occupy southern California. By August of 1846, Los Angles had fallen and Governor Pico fled to Mexico to escape capture (Hayes 2007; Starr 2007).

The conquest of California seemed complete; however, harsh treatment of the Californios led to an insurrection in southern California. American forces were forced to flee Los Angeles and General Kearney was defeated at San Pasqual by Andrés Pico, the brother of Pío Pico (Hoover et. al. 2002; Starr 2007). Near San Bernardino, the uprising occurred at the Rancho Santa Ana Del Chino. After Gillespie was ousted from Los Angeles, he called upon American settlers from Rancho Jarupa to come to his aide. Twenty men left Jarupa for the Chino Rancho to get resupplied with powder and ammunition before moving on to Los Angeles. However, upon arriving at Chino, they found that Colonel Williams, headquartered at the ranch house, was also in need of supplies. Before they could leave for Los Angeles, Williams and the rest of the

Americans fell under attack and decided to withstand the siege. More than 70 Californios under the leadership of Cervol Varela, Diego Sepulveda, Ramon Carillo, and Jose Lugo attacked the ranch house and set fire to the roof. The Americans were forced to surrender and were taken to Los Angeles as prisoners until the conclusion of the war (Brown and Boyd 1922).

In 1847, the United States concentrated its forces to retake Los Angeles and free the captive Americans. Andrés Pico, entrenched on the bluffs of the San Gabriel River, held the United States forces at bay for a short time at the Battle of San Gabriel; however, he was eventually forced to fall back to Los Angeles (Hoover et. al. 2002; Starr 2007). On January 10, 1847, the Californio and Mexican Forces defending Los Angeles were defeated at the Battle of La Mesa. The Californios surrendered to Frémont three days later outside of the city during a formal ceremony known as the Capitulation of Cahuenga. On February 2, 1848, the treaty of Guadalupe Hidalgo was signed. The United States acquired all territory north of the Río Grande in exchange for a $15 million payment to the Mexican government and $3.25 million in reparations to Mexican citizens (Olson-Raymer 2015; Starr 2007).

American Period (1848-present)

The United States had won the Mexican-American War, but the subsequent establishment of California as an occupied enemy territory in 1848 threatened to destabilize the Missouri Compromise of 1820. The entrance of California into the Union as either a territory or a State would disrupt the balance of free versus slave states. The United States government understood that when the time came, California would be made a free State. Southern politicians could not accept that California would be a free State, and therefore, Congress did not act. California's official entrance into the Union would have to wait, but as time went on the situation would get more and more tenuous, especially after the onset of the Gold Rush (Starr 2007).

The Gold Rush

Some sources (LAC 2017; Hoover et. al. 2002) argue that the Gold Rush of 1848-49 was California's second gold rush, with the first occurring in 1842 within the San Gabriel Mountains. Francisco López of Rancho San Francisquito was gathering wild onions in Placerita Canyon when he noticed sparkling dust and pebbles clinging to the roots. López took his find to Los Angeles and was told it was, in fact, gold. News of the discovery spread primarily in southern California and northern Mexico. Nearly 1,300 pounds of gold were retrieved from Placerita Canyon between 1842 and 1847. One American, Abel Stearns, did send gold from the Placerita mines to the United States mint in Philadelphia, but after 1842 the amount of gold dwindled. The Placerita Canyon mines represent the first discovery of gold in California; however, the discovery pales in comparison to what would occur six years later near San Francisco (SCVHS 2017).

The Gold Rush began in 1848 after James Wilson Marshall, a Bear Flagger who served with Frémont, discovered gold nuggets in the American River during the inspection of a hydraulically powered sawmill. As the story goes, Marshall brought his discovery back to his companions and proclaimed “I have found it”—a proclamation that would later influence the inclusion of “Eureka” on the State flag. News of the find spread rapidly, and by mid-1848, the Gold Rush began regionally. By December 1848, prospectors started coming from all over the country, and by 1849, it was an international frenzy. During 1850, more than 45,000 settlers streamed across the Sierra Nevada Mountains in search of their fortunes. This was a true rush that changed the trajectory of California’s future. In 1848, the non-native population of California was approximately 10,000; by 1849, it was approaching 100,000; and by 1851, it had reached approximately 255,000 (SCVHS 2017; Starr 2007).

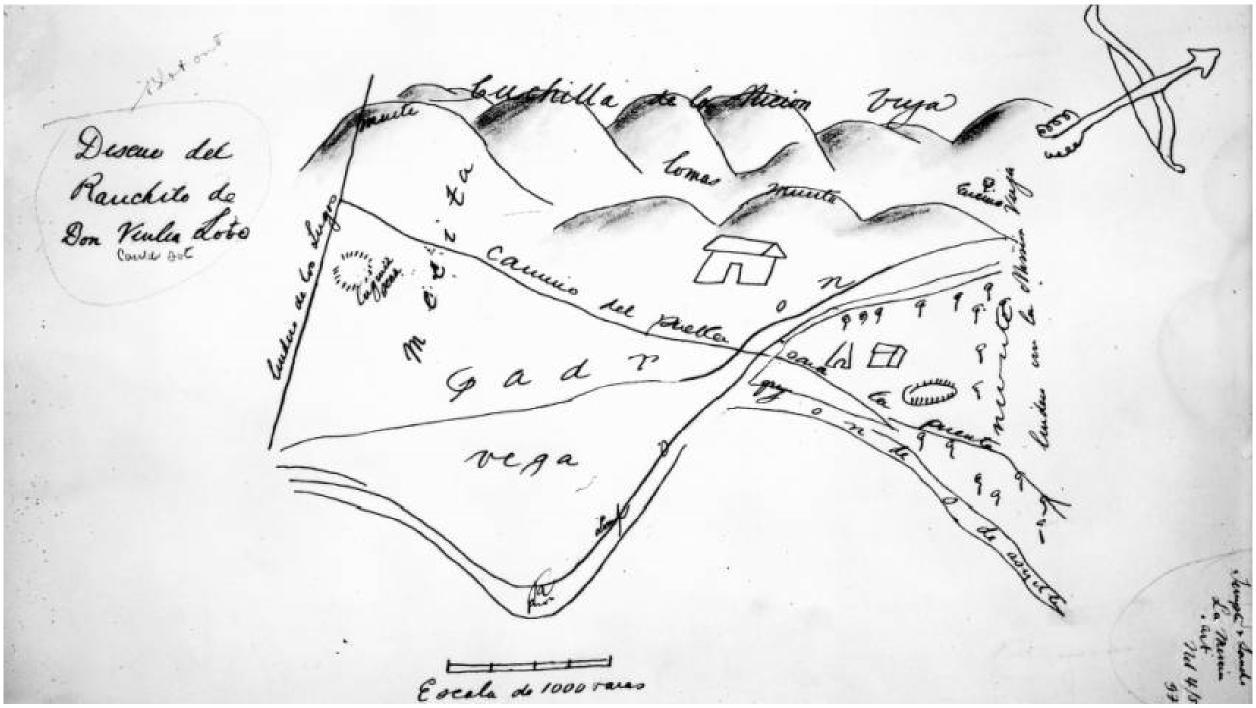
The growth resulting from the Gold Rush placed ever-increasing pressure on the issue of statehood and the implementation of a stable government. The influx of people from 1848 to 1850 led to a drastic increase in crime (Cataldo 2002; DeSoucy 2006; Hayes 2007; Hoover et. al. 2002; Starr 2007). According to Starr (2007), Los Angeles County, which included San Bernardino at this time, recorded 44 murders in 1850, equating to a rate of 414 murders per 100,000 people. By 1851, this had increased to 1,240 per 100,000 people—the highest homicide rate in American history.

Statehood

In 1849, the military governor, Brigadier General Bennett Riley, decided to take matters into his own hands and direct California to form a State government. Forty-eight delegates were selected to convene in Monterey and form a state constitution using constitutions of other states as guidelines. The new California constitution had many flaws, such as limited franchise and legal privileges for non-whites, but it was a starting point. The size of California following the Mexican-American War was enormous and included the areas destined to become the States of Arizona, New Mexico, Nevada, Utah, and Colorado. Californians knew that Congress would never approve the admission of such a large state, so the eastern portion of California was trimmed away. The exclusion of the east from the proposed State of California would make the proposition more palatable because these territories could potentially be entered into the Union as slave states to avoid upsetting the Missouri Compromise (Hayes 2007; Starr 2007).

By the end of 1849, California was poised for inclusion into the Union; the new State constitution was ratified and a general election was held. Peter Burnett was elected as governor, John McDougal as lieutenant governor, and George Wright and Edward Gilbert to the U.S. House of Representatives. John Frémont and William Gwin were selected as U.S. Senators charged with negotiating acceptance of California as a State. The debate on accepting California into the Union lasted for almost nine months, with many lawmakers viewing the formation of the State without Congressional approval as an act of gross illegality. Nevertheless, the Compromise of 1850 was reached and California was admitted into the Union as a free State, with the formation of New Mexico and Utah as territories not barring slavery. On September 9, 1850, President Fillmore signed the bill creating California (Starr 2007).

After California became a State, another problem arose: sorting out the legitimacy of the hundreds of Mexican land grants. Most grantees were not as fortunate as Michael White in obtaining legitimacy for the Rancho Muscupiabe Claim. The majority of ranchos were never surveyed and those that were documented utilized an ad-hoc system that relied on general descriptions of terrain (Figure 5.8-4).



Source: USC Digital Libraries 2017

Figure 5.8-4. Undated Map of the Lugo Claim from Southern California

Therefore, many Mexican Rancho grantees were in danger of losing their holdings and a series of moves designed to displace and dispossess Mexican landowners and California Native Americans from their land soon followed. A Board of Land Commissioners was created to assess the legitimacy of all Spanish and Mexican Land grants, with each grantee having to argue their claim before the Board or in federal court. In many cases, this process took up to two decades and very few were able to afford the cost of litigation. Most grantees sold their belongings or gifted land to their lawyers in exchange for representation. By the time the claim was settled, owners were lucky if even a fraction of their original claim was left (Hayes 2007; Starr 2007).

Local History

The local history provides a more focused discussion of context and themes for understanding and evaluating, to the extent possible, the historic significance of the resources located in and immediately surrounding the APE.

Industry

Forest and Timber Management

The years leading up to the twentieth century were a time of enlightenment for San Bernardino residents and the nation as a whole with a growing concern over treatment of the environment. Extensive logging during the previous decades, combined with ranching, resulted in wide spread deforestation and the pollution of the San Bernardino watershed (Brown and Boyd 1922; Robinson 1989; Tetley 2005). In 1886, California appointed Abbott Kinney as the first chairman for California's Board of Forestry, and after an investigation he reported, "The necessity of the hour is an intelligent supervision of the forest and brush lands of California, with a view to their preservation." In 1890, the San Bernardino Board of Trade appointed a committee to seek government protection of the mountain country and a petition was sent to the California State legislature and Congress requesting support. Congress responded, and passed the Forest Reserve Act of 1891, which gave the President of the United States executive authority to set aside lands for protection. B.F. Allen was appointed to investigate the California watersheds and President Harrison acted on his findings by creating four forest reserves in California (Robinson 1989; USDA 2017).

On February 25, 1893, the 737,280.0-acre San Bernardino Forest Reserve was created. However, like the previous creation of Native American Reservations, Congress did not consider the administration of the reserves or appropriate any funding for their management. From 1893 to 1897, the San Bernardino Forest Reserve was only a reality on paper with no administration, officers, or rangers to enforce the law. During these years, timber cutting and livestock grazing continued unchecked to the dismay of many San Bernardino citizens. The outcry was heard, and in 1896, a Forest Reserve Commission consisting of Charles Sargent, John Muir, and Gifford Pinchot visited the San Bernardino Forest Reserve. The Commission declared that the protection of reserves in southern California were of the utmost importance due to their symbiotic relationship with the water supply. A rudimentary administrative structure was created and B.F. Allen was put in charge of the reserves in the southwestern United States. Allen selected Charles Newhall as an assistant forestry agent and placed him in charge of the San Bernardino Forest Reserve (Robinson 1989).

Newhall set to tracking down illegal timber operations and grazing but was unable to provide sufficient protection for such a vast area. Allen and Newhall pleaded with Congress for funding to hire additional help, and in July of 1898, they received permission to hire 20 forest rangers. Local residents, C. Mathew Lewis, and William Williams were the first selected, and five more rangers were hired by the end of the year. The rangers only worked during the fire season, were paid $50 a month, and had to pay for all of their expenses, including horse and equipment. Volunteer fire departments were created in nearby communities, like Cedar Springs, to assist the rangers in combating forest fires. Local ranchers, like the Talmadge Family, were also pressed into aiding the rangers and those that refused would have their grazing permits revoked. Fire prevention and protection was one of the hallmark duties of the rangers and remains so to the present day (Robinson 1989; Stone 1989 and 1990).

Even with rangers in the San Bernardino Forest Reserve, there were many difficulties to overcome. The administration of these lands was still in its infancy and there was much to learn regarding the replanting of fire denuded slopes, as well as the prevention and containment of devastating forest fires. In addition to these issues, there was also a drastic lack of funding and an increasing number of visitors entering the forest every year. In 1902, the San Gabriel and San Bernardino Forest Reserves were combined in hopes that consolidation would provide a better organized structure. Initially, there was little effect because the appropriate leadership was lacking, but in 1905, Gifford Pinchot was appointed head of the newly created USFS. Pinchot devised a civil service exam for prospective rangers and created a set standard of qualifications for supervisors and rangers to create a professional staff of well-qualified foresters. The term “reserve” was eliminated because Pinchot believed it implied the forests were off limits, so the San Bernardino Forest Reserve became the SBNF in 1907. The following year, President Theodore Roosevelt combined the San Gabriel National Forest and the SBNF into the Angeles National Forest (ANF). The San Bernardino Mountains would remain part of the ANF under the supervision of Ruston Charlton until 1925, when President Coolidge reestablished the SBNF as a separate entity (Robinson 1989).

Under Charlton, and with the help of the Tri-Counties (Riverside, San Bernardino, and Orange) Reforestation Committee, much was done to improve the situation within the San Bernardino Mountains. Experimental stations to grow saplings and study reforestation techniques were established at Lytle Creek and Converse Flat, the first fire lookout tower was built in the upper Cajon Canyon, and aerial fire patrols from March Field were started. In 1911, the Waterman Fire, which consumed almost 13,000.0 acres, resulted in the forest being divided into three separate fire districts to organize firefighting efforts. The improved organization and new methods definitely helped to save a great deal of the forest, but the fires could not be stopped completely, as evidenced by the 1922 Helva Fire that devastated another 18,230.0 acres (Robinson 1989; San Bernardino Daily Sun 1908).

As San Bernardino progressed into the 1920s, the automobile became more available to the masses, roads were improved, and more people started making their way into the San Bernardino Mountains. Automobiles initially were not allowed on mountain roads, but were now commonplace, and traffic in the mountains increased dramatically (Hatheway 2007; Robinson 1989; San Bernardino Daily Sun 1915). The San Bernardino Mountains had been a popular destination for many southern California residents since the 1890s, but during the 1920s there was a population boom. The boom was the result of several factors: efforts of USFS to create more recreation areas, development of the “Rim of the World Highway” as a high-gear road, and the development of several mountain communities, such as Cedar Springs and Crestline (Hatheway 2007; Robinson 1989; Tetley 2005).

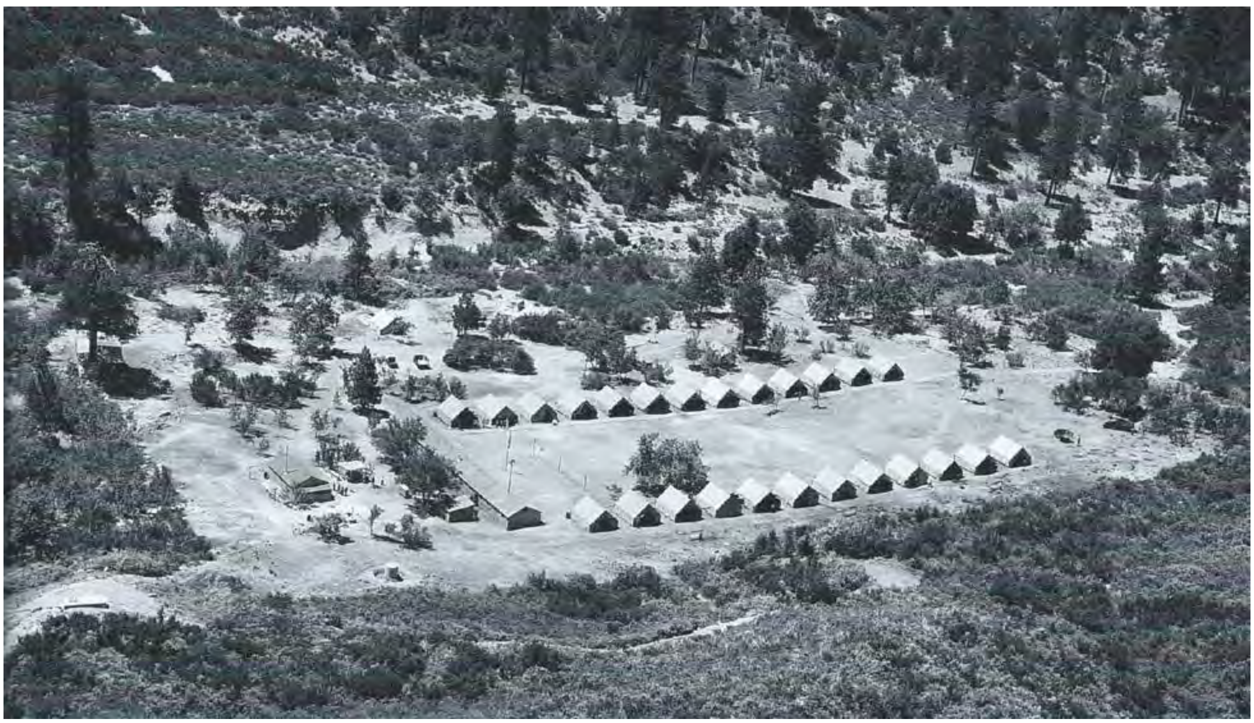
On September 30, 1925, President Coolidge signed a proclamation recreating SBNF as a separate entity from ANF under new leadership. The forest was reorganized with the addition of the eastern portion of the San Gabriel Mountains and the San Jacinto Mountains taken from the Cleveland National Forest. More fire towers were constructed and horse patrols were replaced with automobiles (Robinson 1989). In 1926, a new forest experiment station and tree nursery was set up in Devil Canyon to study the best methods of fire control, erosion control, and planting on fire-denuded slopes. The nursery was the only one of its kind in southern California, and was a joint program supported by USFS, the U.S. Department of Agriculture, and the City and County of San Bernardino. Experiments and studies conducted at the nursery determined the best varieties of shrubs and trees to be planted on barren dry slopes not only within the SBNF but in the Cleveland, Angeles, and Santa Barbara National Forests as well (Robinson 1989; San Bernardino Daily Sun 1926a, 1926b, 1926c). USFS also used the Devil Canyon site to test new graders and experiment with more efficient methods for road building and clearing (AEDC 2017). Devil Canyon was completely closed off to the public and typically only USFS personnel were allowed admittance; however, special studies by groups such as the Botanical Society of Southern California were permitted (San Bernardino Daily Sun 1931). The Devil Canyon nursery remained an important site into the mid-twentieth century until lack of funding and support eventually led to its closure in 1940 (San Bernardino Daily Sun 1940).

In response to the hard times created by the Great Depression of the 1930s, the California Division of Forestry, in partnership with USFS, created a number of work camps for economic relief and the betterment of the national forests. Between 1931 and 1932, three camps were established in the SBNF filled with unemployed men from the streets of San Bernardino. The men worked six days a week building roads, trails, and firebreaks in exchange for three meals a day and lodging. These camps were the beginning of the largest construction and fire control program in USFS history (Robinson 1989).

The Civilian Conservation Corps

In 1933, President Franklin Roosevelt launched his New Deal Program, which included the Emergency Conservation Act. The Act created the Civilian Conservation Corps (C.C.C.), which operated along the same lines as the California Relief Program but on a larger scale. Within a few months of its establishment, the C.C.C. would enroll approximately 275,000 men in 1,300 camps across the United States, and by the end of the 1930s the number of enrollees was over one million. The SBNF was allocated 16 camps that contained 100 to 200 workers. Enrollment was organized by the U.S. Army at March Field, and the camps were administered by USFS. Enrollees had to commit to a six-month term and be between the ages of 17 and 29. They worked eight hours a day, five days a week on USFS projects in exchange for room, board, and a monthly salary of $35. The Works Progress Administration, the National Industrial Relief Administration, and the State Emergency Relief Administration also worked in the SBNF during the 1930s. These groups not only improved the infrastructure of the SBNF, but were instrumental in reforestation projects and battling forest fires (Robinson 1989; San

Bernardino Daily Sun 1933, 1934a, 1934b, 1936). One of these C.C.C. camps was set up in Miller Canyon, where the Pilot Rock Conservation Center currently resides (Figure 5.8-5). Workers from this camp were responsible for upgrading the Rock Camp Road (later the Pilot Rock Truck Trail) as well as building the road through Miller Canyon and the road connecting Cedar Springs with Crestline. The Miller Canyon and Crestline roads would eventually be designated as California Highway 2, which was the most important thoroughfare on the west side of the SBNF. Towards the middle to late twentieth century, the road was redesigned as Legislative State Route 188, and then California State Highway 138. The alignment of the route was changed many times and was eventually added to the Rim of the World Highway route (DRMC 2017; Faigin 2012; Garrett 1998; Hatheway 2007; Leadabrand 1964; NETR 2017; Robinson 1989).



Source: Robinson 1989

Figure 5.8-5. Miller Canyon C.C.C. Camp in 1933

The United States entered World War II at the close of 1941, and this effectively ended the Great Depression along with most of the federal relief programs. The C.C.C. was disbanded in 1942 and the former workers traded in their shovels for rifles. The USFS also lost 40 percent of its rangers who signed up for military service. In less than a year, the SBNF went from having an endless supply of labor to having to recruit high school students. During the war, most San Bernardino high school boys spent their summer vacations in camps working for the USFS (Robinson 1989). However, after the conclusion of the war in 1945, the ranger service was rebuilt with returning veterans, and southern California experienced another population boom. Many returning veterans chose to stay in California, which increased the need for available housing and expanded the economy with the opening of more commercial enterprises (Starr 2007). The increase in population also led to an increased number of people going to the San

Bernardino Mountains. By 1950, more than 7,000 people were living year-round in small mountain communities like Cedar Springs and Crestline, with approximately 52,000 staying during the summer. Within the next 20 years, the populations of these towns more than doubled and visitation to the SBNF reached more than 12 million people a year (Robinson 1989).

The population increase within the San Bernardino Mountains led to greater challenges for USFS and residents. Devastating forest fires, such as the 1954 Panorama Fire that scorched more than 17,000.0 acres between Devil Canyon and City Creek, continued to threaten the San Bernardino watershed. With the devastation of these fires increasing, San Bernardino and USFS began to develop new methods of fire prevention, like the introduction of fire-resistant plants into the watershed and the use of helicopters for fighting fires. In 1960, Congress passed the Multiple Use Act, which became a cornerstone of the USFS. The Act mandated that the national forests be administered for recreation, grazing, timber, watershed protection, and wildlife, with management practices that ensure the ability to support all areas of use. In 1965, USFS began charging fees for the use of recreational sites to help pay for maintenance (Robinson 1989). In 1968, a portion of the PCT was constructed in the SBNF. The PCT was originally proposed by Clinton Clarke of Pasadena in 1932; however, construction of the trail was not authorized by Congress until 36 years later (Garrett 1998). Into the latter decades of the twentieth century, San Bernardino and USFS continued to grow, develop, and protect the precious watershed of the San Bernardino Mountains.

Agriculture

The native tribes who first settled in the area of San Bernardino referred to the valley as Gauchama, the land of plenty. The valley was abundant in plant and animal life, with plentiful hot and cold springs as well as streams running towards the ocean (Weeks 2010:14). Soon after the first Europeans came to the valley in the early nineteenth century, initial and small-scale irrigation began, and the land became regularly cultivated. Don Antonio Lugo and his family ran large numbers of cattle over the area during the 1840s. After the Mormons purchased Rancho San Bernardino, agrarian efforts diversified and livestock farming was supplemented with fruit, nut, and olive trees (Weeks 2010:21). This influx of settlers, as well as the changes in agriculture, including the types of crops being planted, led to the region’s first intensive irrigation efforts (Scott 1968:11). The new settlers built a dam on the Santa Ana River and two diversion ditches to irrigate fields and carry water to settlements (Scott 1968:12). By 1869, agriculture would employ more people in California than mining, and by 1879, it would surpass mining and become the chief element of the economy (Starr 2007).

Among the most substantial agricultural imports were fruit trees. In 1857, the first orange trees were planted in what is now Loma Linda. Within a decade, citrus groves were located in various parts of San Bernardino County (Weeks 2010:38). In 1873, Eliza Tibbets of Riverside planted two navel orange trees imported from Brazil and soon cuttings from her trees were being sold throughout southern California as the orange-growing industry rapidly expanded (Weeks 2010:40-41).

From the early 1870s to approximately World War II, the primary agricultural export of the region was the orange (Weeks 2010:44). Statistics from the California Board of Agriculture show that in 1873, there were approximately 7,000 orange trees in San Bernardino. In less than 10 years, the number more than doubled to approximately 15,400; and by 1885, more than 200,000. Millions of oranges were shipped across the United States, and by 1920, the orange crop was worth more than $30 million per year (approximately $380 million in today's value). For years, San Bernardino hosted the National Orange Show in late winter. Tourists from the United States and abroad visited the area to see the "orange groves as far as the eye can see" (Weeks 2010:47-48). To support the burgeoning citrus industry, more lumber was needed to build packing houses and crates for shipment (Brown and Boyd 1922).

Although oranges dominated agricultural activity in the region, a variety of crops were being grown in San Bernardino County in the nineteenth century. Additional citrus plants, including lemons and grapefruit, were introduced (Robinson 1989:47). Grapes were introduced in the 1870s, and by 1880, the raisin industry was established (Ellicot 1965:110). Other fruits were also successfully produced by the early 1880s, including cherries, figs, apricots, peaches, pears, currants, olives, strawberries, raspberries, blackberries, and plums. Nuts were also plentifully produced, including almonds and walnuts. Apples were an important crop, grown throughout the valley, but especially at higher elevations where that fruit was better suited to the temperatures and conditions than were citrus fruits (Ellicot 1965:118). Apples were also grown in substantial numbers northeast of the San Bernardino Mountains, in Victor Valley. There were enough apple orchards in that area by the 1890s to give the town of Apple Valley, northeast of Hesperia, its name (Security Pacific Bank 1979:15). Though apple orchards were most commonly found in the Apple Valley region, some smaller orchards did develop within the vicinity of the Project. In the early twentieth century, dairy farms were being pushed out of Los Angeles and Orange counties by increasing land values as a result of metropolitan growth, and western San Bernardino became an important dairying center (Schuiling 1984:102).

During the second half of the twentieth century, the prominence of agriculture in the economy of the San Bernardino Valley and the San Bernardino Mountains began to wane. Citrus groves and fruit orchards were supplanted by development as the Los Angeles metropolitan area expanded eastward. Manufacturing and industry moved into the valley, and as the population grew, so did the retail and service sectors of the economy. By 1979, less than 5 percent of the workforce in San Bernardino and Riverside counties was employed in agriculture. San Bernardino, by that time, was the nation's top milk-producing county. Other important agricultural products in the later part of the twentieth century included poultry, citrus, grapes, and alfalfa (Security Pacific Bank 1979:6). The trend continued into the twenty-first century, and by 2016, approximately 0.6 percent of the San Bernardino County workforce was employed in agriculture (U.S. Census Bureau 2016).

Native American Reservations

Along with the environmental movement, California was also becoming more committed to atoning for the past treatment of the Native Americans. The current system of reservations was of little or no help, so Congress was pressed to pass "An Act for the Relief of Mission Indians" on January 12, 1891, that confirmed many of the original southern California grants between the Mexican government and the natives (Shipek 1988). The Act authorized a commission to investigate and improve the reservations for the survival of California Native Americans. The commission noted the past injustices committed on the Serrano Reservations and reorganized them with a legal basis for ownership. Federal patents were created for the Morongo and San Manuel Reservations and would be held in trust. The San Manuel Reservation remained the same size but the Morongo Reservation was reduced to 14,500.0 acres. Although the size of the Morongo Reservation was reduced, the change ensured that the majority of the land was arable with water rights so residents could cultivate the land. At the end of the 25-year trust period, the reservation lands would be subdivided and sold to the Native Americans. Although the 1891 reorganization of the reservations was not perfect, it established a solid basis for the Serrano to be recognized as a sovereign nation. Later, Congress passed the Indian Reorganization Act allowing for the formation of tribal governments (Robinson 1989; SMBMI 2017). Local efforts to help Native Americans, like purchasing Bircham's Ranch for the Serrano, were proposed but never materialized because the opposition always prevailed (Los Angeles Herald 1902; Robinson 1989).

The San Manuel Casino

Within the Project region is the San Manuel Casino. The San Manuel Band of Mission Indians' reservation was established on 657.0 acres in the steep foothills of the San Bernardino Mountains and named in honor of their leader, Santos Manuel (Shipek 1978; SMBMI 2018a). Today, the reservation is just over 900.0 acres, located just north of the cities of Highland and San Bernardino.

Under the direction of former Chairperson Henry Duro, the San Manuel tribe hired a management team and opened a bingo hall on the reservation on July 21, 1986, with an initial staff of 50-60 employees (Indian Gaming 2011:40). With the success of the enterprise, the gaming operation was expanded in 1994 to a 100,000-square-foot facility, and included a card room and slot machines. However, during this period, Indian gaming in California faced many political and legal uncertainties as California was one of the last states to negotiate gaming compacts with federally recognized tribes as required by the Indian Gaming Regulatory Act of 1988 (Valley 2003). The uncertainty was not resolved until 2000, when California voters passed Proposition 1-A (Indian Gaming 2011:41).

The State-level approval of the Indian gaming compacts led to a period of expansion and growth for the reservation-based casinos. The San Manuel Casino facility underwent an amenity enhancement project in 2003 and completed a two-year, $50 million renovation project in 2016. In 2018, the tribe began construction on a new expansion to include a 500-room hotel and new entertainment venue. The San Manuel Casino now employs more than 3,000 people and generates revenue to "…provide a better quality of life for its citizens by building infrastructure, maintaining civil services and promoting social, economic and cultural development" (SMBMI 2018b).

Community Development

The development of affordable automobiles in the 1920s, combined with the construction of improved, useable roads, resulted in a population boom in the San Bernardino Mountains as new locations were becoming accessible and settlements such as Dr. John Baylis's Pinecrest, Henry Gurnsey's Crestline, and Carl and Ella Hewitt's Cedar Springs Health Resort were established.

San Bernardino

Throughout the 1850s and 1860s, the number of settlers in southern California continued to increase. However, San Bernardino was slower to develop compared with more populated coastal areas, such as Los Angeles. In 1851, the first major settlement of the San Bernardino Valley occurred when a large contingent of Mormons from Salt Lake City, Utah (Zion), arrived. The group of settlers, led by Charles Rich, Amasa Lyman, Captain Seeley, Captain Hunt, and Captain Lytle, numbered more than 500. Originally, the party was expected to be less than 100 persons, but members of the Mormon Battalion, who served the United States during the Mexican-American War, returned to Salt Lake City with gold sparking the interests of many. By June 1851, the party reached Cajon Pass and camped there until a suitable location for settlement was found.

On February 27, 1852, the settlers purchased 35,000.0 acres of the San Bernardino Rancho from the Lugos for a price of $77,500 (Tetley 2005:7). The Mormons feared being attacked, and quickly settled on the site of today's San Bernardino County Courthouse in the City of San Bernardino and fortified the location. A stockade was built around the settlement for protection, and as a result, the rancho became known as Fort San Bernardino. The fortifications were the most elaborate in southern California and did much to discourage raids within the valley, as there are no accounts of the fort ever being attacked (Brown and Boyd 1922; Cataldo 2002). The Mormons fenced pastures and planted fruit, nut, and olive trees (Weeks 2010:21).

Although the fortifications of San Bernardino were a significant deterrent, there were other reasons for the decline in hostilities between the settlers and Native Americans. The same year the Mormons settled the valley, hostilities with the Native Americans were coming to a head all over the frontier regions of California. In the southern Sierra Nevada Mountains, Native Americans were being hunted down in what has been termed "The Indian War of 1851." While this war was being conducted, a group of federally appointed Indian Commissioners came to California at the request of the governor to help work with the Native Americans. Native American leaders met with these commissioners either willingly or by force to sign treaties giving up their land in exchange for government assistance (Bunnell 2016 [1892]; Salcedo 2016; Starr 2007). Within the San Bernardino region, one of the Commissioners drafted the Treaty of Temecula, which reserved for the Native Americans a large portion of land extending from San Gorgonio Pass to northern San Diego. The treaty also offered $1.25 per acre of land that had already been settled by the whites. The agreement may have placated the Native Americans of San Bernardino for the time being; however, Congress never ratified the Treaty of Temecula or any of the other treaties the Commissioners drafted. Therefore, the United States government never upheld its part of the bargain and this was perceived by the Native Americans as a malicious betrayal (Brown and Boyd 1922; Ellicott 1965).

Along with the construction of defenses, the Mormons expanded the Mill Creek Zanja, built an elaborate system of irrigation ditches, and built a 16-mile road into the San Bernardino Mountains to access lumber (later called the Mormon Road). The road was constructed through Hot Springs Canyon (later Waterman Canyon) and was the first road into the mountains from San Bernardino. Construction of the road led to the establishment of three sawmills in the mountains, which supplied lumber for the development of San Bernardino and Los Angeles (Robinson 1989:20-22). In 1852, they built the first public building which was used as a school, a church, and the first post office (Schuiling 1984:47). In 1854, one year after the county of the same name was organized, the City of San Bernardino was incorporated. Soon, regular stagecoach service connected the new city to Los Angeles and the port there, and in 1857, the first hotel was built (Weeks 2010:22). The foundations for the future City of San Bernardino were also established with a street grid using a 1-square-mile plat, the creation of a large grist mill, and civic institutions, such as schools and a city government. Essentially, the Mormons built a miniature copy of Salt Lake City in the San Bernardino Valley (Brown and Boyd 1922; Cataldo 2002; Garrett 1998; Hatheway 2007).

When the Mormons first settled the San Bernardino Valley, it was part of Los Angeles County, with the county seat in the City of Los Angeles. As San Bernardino started to grow, the distance from the county seat was becoming unworkable because all official business had to be conducted there. In 1853, Captain Jefferson Hunt was elected to the California State Legislature and one of his first actions was to relay a petition for the creation of San Bernardino County (Brown and Boyd 1922; DeSoucy 2006; Swisher 1999). On April 26, 1853, the measure was proposed and passed to create San Bernardino County from lands that were originally part of Los Angeles, San Diego, and Mariposa counties (CSB 2018a). The following year, the City of San Bernardino was incorporated as the county seat and Amasa Lyman was appointed as the first mayor (Brown and Boyd 1922; CSB 2018a; Robinson 1993:386-388). It seemed as though the rapid development of San Bernardino would be fostered by these actions; however, this would not occur. Events were about to take place that would arrest the development of the city for more than a decade (Brown and Boyd 1922).

In 1857, Brigham Young, the leader of the Mormon Church in Salt Lake City, called all of his followers back to Utah to assist him in a dispute with the United States government. The majority of the Mormon colonists answered the call and, within a year, everything in the newly incorporated city came to a halt (Brown and Boyd 1922; Tetley 2005). The Mormons sold San Bernardino to a syndicate that in turn sold the lands to W.A. Conn, who subdivided the land and began selling plots to settlers. The plots sold and new residents took the place of the Mormons, but the new inhabitants lacked the cohesion and drive of their predecessors. The discovery of gold by Jack Martin and W.F. Holcomb during 1859 in Holcomb, Bear Valley, and Lytle Creek kept the region from falling into decline, but also introduced a lawless social element that was not necessarily conducive to the healthy growth of a municipality. Therefore, after 1857, San Bernardino did not go into a period of decline but did not continue to grow, either.

The settlers answering the call of the 1859 gold discovery began inhabiting the San Bernardino Mountains. Mining mainly took place in the vicinity of the initial discovery but other areas of the mountains such as the Burrough's Mining District near Burcham's Ranch also had some activity (Los Angeles Herald 1883). The new settlers were not only miners, but lumberjacks and ranchers hoping to make a living. Nathan Swarthout, wanting to harvest the pine forests in Sawpit Canyon, built a road from the valley into the mountains in 1867. Although most of the Mormons left to assist Young, some important figures did not answer the call back to Zion. Men like James Franklin Houghton (Surveyor General of California from 1862-1866) and Frank (Francis) Talmadge started large ranches at the head of the Mojave River and in Big Bear Valley, respectively (Brown and Boyd 1922; CSLC 2017; Robinson 1989). Houghton obtained most of the property in the vicinity of the West Fork of the Mojave River, as well as many other tracts of land throughout California. Houghton operated the lucrative ranch for several years selling beef to nearby mining camps before transferring ownership to John Bircham. Bircham expanded the ranch and acquired property to the south that would one day be the town of Cedar Springs. Here, he dug irrigation ditches and cultivated wheat and barley to support the ranch (BLM 2017; Brown and Boyd 1922; Robinson 1989). Bircham's Ranch later became the Las Flores Ranch. Frank Talmadge settled the San Bernardino Mountains using the Homestead Act of 1862 and started work in the mountains as a lumberman. Towards the late nineteenth century, the Talmadge Family started raising cattle, which developed into a ranching legacy lasting into the late twentieth century (Brown and Boyd 1922; Robinson 1989; Stone 1989 and 1990).

The San Bernardino Mountains now replaced the San Bernardino Valley as the new frontier. The Native Americans were slowly pushed further out into the Mojave Desert while their seasonal camps and foraging grounds were taken over. Unbeknownst to the settlers, these new transgressions were a violation of the Treaty of Temecula and led to regular attacks on homesteads, logging camps, and ranches like the Talmadge's and Bircham's. The attacks led to a quasi-war in the San Bernardino Mountains between the settlers and Native Americans that lasted throughout the 1860s, with atrocities committed on both sides (Brown and Boyd 1922; Ellicott 1965; Garrett 1998; Robinson 1989; Stone 1989 and 1990).

The second blow to the development of San Bernardino came in 1861 when the Civil War broke out. The influx of settlers ceased and some residents left the valley to fight in the war on either side. On March 6, 1863, the incorporation of San Bernardino as a city was revoked and it was reincorporated as a town in 1869 (Brown and Boyd 1922; Robinson 1989; Starr 2007). Mormons such as Captain Andrew Lytle did not answer Young's call to Utah. He remained and began to form organized groups set on hunting down the Native Americans in the San Bernardino Mountains to punish them as outlaws. Frank Talmadge also led one of these groups which included other prominent men of the region like John Brown, who opened the first toll road in the county through Cajon Pass in 1862, and the young Wyatt Earp, who would later gain fame as a lawman. From 1866 to 1868, the violence reached its peak and numerous battles took place (Brown and Boyd 1922, DeSoucy 2006; Drylie 2010; Hall 2009; Robinson 1989; SMBMI 2017; Stone 1989 and 1990). During one of these battles at Indian Point (Hamiltaire), Frank Talmadge killed a Paiute chief and displayed his skull at the entrance to the ranch. The Talmadge Family recalled, for years after hostilities ended, the Native Americans would travel to the mountains via Dark (Miller) Canyon every fall to collect pinion nuts and perform a ceremony in front of the ranch for their chief. William Talmadge, Frank's oldest son, recalled one instance in 1867 (possibly the Battle of Blue Jay) when he was put into a cabin with all of the other children and the women during a raid of 40 to 50 Paiutes. Several cabins were burned at the head of Miller Canyon and the fight lasted for several hours (Stone 1989 and 1990). In 1867, the settlers made several excursions into the Mojave Desert to hunt down the Native American raiders. Fighting in the San Bernardino Mountains ceased after 1868 when the U.S. Army built an outpost at Camp Cady along the Mojave Trail (Brown and Boyd 1922; DeSoucy 2006; Robinson 1989).

The Native Americans who once inhabited the San Bernardino Valley and Mountains were forced into the most arid and unlivable parts of the Mojave Desert. The Serrano and Cahuilla peoples, devastated by war and disease, were in danger of extinction. Most settlers in California did not care and prescribed to the belief that "a good Indian is a dead Indian;" however, there were Americans such as Helen Hunt Jackson and Charles Fletcher Lummis who wrote about the plight of the Native Americans and educated easterners. Eventually, President Ulysses Grant responded by creating reservation lands by executive order. In 1876, two reservations were created for the Serrano – the 88,000.0-acre *Potrero Ajenio* (Morongo) Reservation in San Gorgonio Pass and the 653.0 acre San Manuel Reservation in the foothills of the southern San Bernardino Mountains. Sadly, the establishment of these reservations would not be enough to prevent further depredations from occurring (Brown and Boyd 1922; Robinson 1989).

While settlers were fighting the Native Americans for control of the San Bernardino Mountains, the town of San Bernardino made small improvements. In 1866, weekly stage coaches traveled back and forth between surrounding cities like San Diego and Los Angeles. In 1867, the first brick buildings were constructed at Third and D Streets and by 1869, the social life began to improve with theater and dances. Trade was also increased with the establishment of John Brown's toll road, which provided access to the markets of Arizona, New Mexico, and Utah over the Santa Fe (Mojave) Trail (Brown and Boyd 1922; Robinson 1989; Walker 1986). With the conclusion of the Civil War and the pacification of Native Americans, settlers once again began to make their way to California (Starr 2007). Although San Bernardino did not experience the population booms that other Californian cities experienced, the stage was being set for a prosperous future.

The Southern Pacific Railroad bypassed the City of San Bernardino in 1875, building its depot in Colton after being unable to come to acceptable terms with the city (Ellicot 1965:76). In 1883, however, another railroad – the California Southern – laid lines into San Bernardino from San Diego. Two years later, the Santa Fe Railroad acquired the California Southern, and in 1886, the Santa Fe Railroad built a depot in San Bernardino as it laid track on a line northward towards San Francisco (Weeks 2010:50-51). As the Santa Fe and Southern Pacific lines crossed in San Bernardino, the city became a key transportation crossroad (Weeks 2010:51). The Santa Fe Railroad made San Bernardino its division headquarters, and quickly became the dominant single employer: by the early 1920s, nearly half the city’s total workforce was employed by the Santa Fe Railroad (Weeks 2010:59). The city flourished as a hub for the citrus and shipping industries and began to grow rapidly.

In 1878 and 1879, the City of San Bernardino suffered from two large fires that destroyed most of the structures. However, the disasters were actually a blessing in disguise because the city was rebuilt with brick, which gave it a more modern aesthetic appearance attracting newcomers. In 1881, the National Gas Company of New York opened a plant in the city and for the first time San Bernardino had street lights and residential lighting. A previous attempt at establishing a gas plant occurred in 1873 but the plant was shut down the same year due to poor quality. In 1882, the first telephone line was installed connecting San Bernardino with Colton, Redlands, and Riverside (Brown and Boyd 1922).

In the early 1890s, San Bernardino fell into an economic depression which is typical following a population boom. However, the depression was not severe and San Bernardino continued to progress with the construction of a State hospital (i.e. the Patton State Hospital, formerly the Southern California Asylum for the Insane and Inebriate) in 1890, a library in 1892, a new courthouse in 1893, and the establishment of an electric trolley system in 1899 (Brown and Boyd 1922; PERHS 2017). For the first time ever, the development of roads allowed people to live in rural areas and commute to work in San Bernardino, thereby increasing rural growth (Garabedian and Ruud 2016). The same year that the library was built, Henry Sinclair incorporated the Redlands Electric Light and Power Company and introduced electricity to San Bernardino. Throughout the 1890s, Sinclair purchased smaller power companies and formed the Southern California Power Company in 1897. A year later, the Los Angeles based Edison Electric Company merged with Sinclair to form Southern California Edison, which held a monopoly over electricity in San Bernardino during the period (Robinson 1989).

By the early twentieth century, San Bernardino had become one of California's most modernized cities: electricity was available throughout the city, including powering an electric trolley service; police and fire departments were formalized; new civic structures including a courthouse, schools, and hospitals were constructed; and the downtown business district was rapidly expanding (Weeks 2010:68-71). Residents also enjoyed increasing access to the recreational escape of the nearby mountains as inns, camps, and Lake Arrowhead were developed and road access was improved. By the 1920s, modern amenities included state-of-the-art theaters, cinemas, and hotels, as well as an array of shopping that brought many visitors to San Bernardino (Weeks 2010:87-88). The Arrowhead Hot Springs Hotel, nestled in the foothills of Waterman Canyon, was known for regularly hosting celebrities and the elite.

Pinecrest

Pinecrest was born out of the period of environmental enlightenment when Dr. John Baylis purchased the 160.0-acre Smithson family property to save it from the Gurnsey Lumber Company. Construction of the resort began in 1906 with a clubhouse, several cabins, a boarding house, stables, a lodge house, a dance pavilion, and a dining room. The mountain resort was instantly popular with the residents of San Bernardino, and by 1909, it began to transition to a mountain village. Electricity was installed and several commercial buildings were constructed, including a general store, a blacksmith, and a garage. In 1917, a three-story hotel called "The Rookery" was built, complete with a swimming pool, tennis courts, and croquet courts. By the 1920s, the village of Pinecrest could accommodate more than 500 people and many would make it their permanent residence (Hall 2009; Hatheway 2007; Robinson 1989; Tetley 2005).

Crestline

Although the Mormons left the mountain area in 1857, logging continued and logging companies began acquiring large tracts of land. Some of those lands passed into private hands after they were logged over, and cabins began to dot the crest of the mountains (Carthew 1964:71). In 1893, the federal government created the San Bernardino Forest Reserve, later the SBNF, and the private lands formed the pockets of development that give the community of Crestline its distinctive hill-top character (Carthew 1964:72).

Henry Gurnsey, owner of the Gurnsey Lumber Company, also devised a plan in 1906 for the Crestline community. Gurnsey's plan was different from many of the other communities in that it was going to be established as a subdivided residential community on a 630.0-acre deforested section of the San Bernardino Mountains. Lots were parceled out, a street grid was set up, wells were dug, and water mains installed. Gurnsey built his own home in a section he called Skyland Heights; lots sold quickly, and within a year the once tree-barren wasteland was a fully functioning community. Initially, the community was called Summer City in the Pines, but was changed to Crestline after residents participated in a naming contest. In 1919, an old warehouse from the San Bernardino Lumber and Box Company was turned into a community tavern. By the 1920s, the community was expanding so rapidly that new subdivisions like Cedarpines Park and Valley of Enchantment were built (Robinson 1989; Tetley 2005) (Figure 5.8-6).

Source: Robinson 1989

Figure 5.8-6. Main Street Crestline in 1936

By the early twentieth century, the toll road up into the mountains had been relocated, though it continued to be used by logging and transportation companies as well as private citizens, an increasing number of whom were camping in the mountains for recreation (Tetley 2005:8). By that time, Arrowhead Hot Springs Hotel Company had purchased the ranch owned by Robert W. Waterman after his death in 1891 and developed a resort. The company also constructed the Lake Arrowhead Dam and a camp at the crest of the road (Tetley 2005:17-18). The community of Crestline grew up there, taking its name from its place on the crest of the road. The name was formalized in 1919 when a post office was moved from Skyland into Crestline (Tetley 2005:7). Skyland later became the southwestern most neighborhood within the greater Crestline area.

Several inns and camps soon dotted the area, and automobiles and improved roads made the scenic mountains an increasingly popular place for visitors from San Bernardino Valley. In the 1920s, Frank Tetley, Sr. developed part of Seely Flats as “Rim of the World Park,” putting in waterlines, electricity, and roads to encourage the construction of vacation homes. This area became known later as the Valley of Enchantment (Tetley 2005: 55). In 1924, the City of Los Angeles purchased the site of the former Seely Mill and created Camp Seeley as a place for citizens and employees of Los Angeles to vacation away from the growing city (Tetley 2005:54). In 1936, the Works Progress Administration began work on the Lake Gregory Dam, and in 1937, after federal funding ran out, the community of Crestline took over the funding and completed the project in 1938 (Tetley 2005: 67-8). A local champion of the project, Arthur Gregory, owned much of the land in Huston Flats. After providing for a 150-foot reserve around the entirety of the lake, Gregory sold the surrounding land to the San Mortiz Land and Water Company, which sold it for private vacation housing. Club San Moritz closed in the 1970s, and San Bernardino County utilized the preserve and some of the surrounding acreage for a regional park (Tetley 2005:69-70). Today, Crestline continues to be a popular destination for tourists in the San Bernardino Mountains, including a large number of vacation homes owned by Valley dwellers.

Cedar Springs

The community of Cedar Springs at the West Fork of the Mojave River was initially born out of the Las Flores Ranch (formerly Houghton's and Burcham's) in the 1890s (Figure 5.8-7). Residents slowly purchased plots sold by the Ranch and began to settle in Sawpit and Miller canyons, overtaking lands once occupied by the Serrano. By 1912, there were approximately 100 families living and farming in the relatively isolated area. The community included a church and a school. Crops cultivated by the residents included potatoes, onions, corn, and strawberries, with the latter being the most popular and bringing tourists to the tiny community. Early Cedar Springs was more or less a remnant of the previous century on the verge of becoming a town. Then, in 1914, Carl Hewitt, a medical student, and his wife Ella, a nurse, homesteaded 160.0 acres in Sawpit Canyon. The Hewitts provided medical assistance to all of the surrounding communities and envisioned the establishment of a facility where they could treat and care for tuberculosis patients. In 1919, with the help of some investors, the Hewitts purchased more land and made their vision a reality by opening the Cedar Springs Health Resort.

The opening of the resort represented the first commercial enterprise, and the Hewitts were instrumental in facilitating the growth by making Cedar Springs known to outside communities. During the 1920s, a Seventh Day Adventist colony was established as well as a Pisgah. The real catalyst for turning Cedar Springs into a town occurred during the 1930s, when San Bernardino County built a road through the town from Crestline via Miller Canyon. After building the road, Cedar Springs was no longer isolated and quickly became a retreat destination for southern California residents. Ironically, the residents of Cedar Springs opposed the construction of the Lake Gregory Dam in 1938, which saved their town from being washed away during a record rainfall the same year. It is also interesting that a dam similar to Lake Gregory would result in the town being inundated with water 30 years later (Garrett 1998; Hall 2009; Robinson 1989).

As the 1930s approached, the United States fell into the Great Depression, which was the most devastating economic catastrophe the country ever experienced. The depression slowed the growth of San Bernardino and forced the closure of several mountain resorts, including the Hewitt's Cedar Springs Health Resort.

Source: Robinson 1989

Figure 5.8-7. Undated Photograph Depicting Part of Cedar Springs

In 1963, the town of Cedar Springs was condemned, and between 1968 and 1972, the residents were relocated and all buildings and other features associated with the community, as well as villages previously occupied by the Serrano, were subject to inundation through the construction of the Cedar Springs Dam (Brewster 2012:4; Garrett 1998:20). A historic apple orchard, known as the Historic Cedar Springs Apple Orchard, is the only resource that remains within the APE associated with the community. The orchard today covers approximately one-quarter of the area that it once did in 1938 (Historic Aerials 2017).

Transportation Development

Roads

After the Mormons purchased Rancho San Bernardino in 1852, they needed access to the mountain timbers in order to build their community. To accomplish this, they quickly constructed a road up the steep slopes of Waterman Canyon and began logging in the area of what is now Crestline (Carthew 1964:68-9). The 16-mile Mormon Road, the first road constructed from San Bernardino into the San Bernardino Mountains, led to the establishment of three sawmills in the mountains, which supplied lumber for the development of San Bernardino and Los Angeles (Robinson 1989:20-22). For decades, this road was used as a primary access to the mountains – and thereby the timber –

and to scenic views from the crest. Two of the sawmills established in the area included one built by brothers David and Wellington Seely near the location of modern-day Camp Seeley, and the second, a steam-powered mill, was built in the area of Huston Flats, now under Lake Gregory (Carthew 1964:70).

With the growing need for lumber, more and more sawmills were built in the San Bernardino Mountains along with a number of roads to access the timber. Construction of these mountain roads could cost several thousand dollars and neither the City nor the County of San Bernardino subsidized any of the costs. Therefore, almost all of the mountain roads were constructed as joint ventures and tolls were charged for use of the roads. The only concession that toll road operators received was to maintain the roads in lieu of paying property taxes (CSB 2018b). In 1870, the Twin and City Creek Turnpike (Daley Canyon Toll Road) was constructed followed by the Devil Canyon Toll Road several years later (Brown and Boyd 1922; Hatheway 2007; Robinson 1989; Tetley 2005).

The Devil Canyon Toll Road was constructed by William Van Slyke, Earnest Sommers, and Sheldon Stoddard between 1873 and 1879 to access lumber without having to use the Twin and City Creek Turnpike. The lower portion of the road, controlled by Van Slyke and Sommers, was opened in 1876; the upper portion, near the summit, was completed and opened by Stoddard in 1879. Initially, two sawmills utilized the toll road, the Jobs Peak Mill and the Cedar Flats Mill, but it would later serve a number of sawmills in the vicinity of Seeley Flat such as the Tyler brothers and William La Praix’s Cedar Flats Mill (Garret 1998; Leadabrand 1964; Robinson 1989) (Figure 5.8-8). Numerous lime kilns, under the ownership of W. R. Wiggens, also operated within Devil Canyon in the late nineteenth century (Cataldo 1986:35-37). Eventually the Devil Canyon Road was extended north connecting to desert roads at Burcham’s Ranch.

In 1881, James Doyle and John Flannigan purchased the Devil Canyon Road from Van Slyke. They operated and maintained the road until 1890, when the cost of maintenance became too great (San Bernardino Daily Sun 1939, 1948, 1978). In 1891, W. R. Wiggins bought a controlling share in the Devil Canyon Road and partnered with Doyle. San Bernardino residents continued to use the road to travel to the mountains for leisure (Tetley 2005).

Although San Bernardino fell into an economic depression in the early 1890s, the development of reliable road systems allowed the city to continue developing public judicial, medical, transportation, and other infrastructure into 1899 (Brown and Boyd 1922; PERHS 2017) as this opened up options for people to live in rural areas and to commute to work in San Bernardino, thereby allowing the increase in rural growth (Garabedian and Ruud 2016). With the establishment of the Arrowhead Reservoir Company came a new mountain toll road up Waterman Canyon in 1892 (Robinson 1989) that paved the way for San Bernardino residents to enjoy mountain recreational opportunities. The establishment of a $2.00 per wagon toll charge by the Arrowhead Reservoir Company resulted in an outcry for a free public road. In 1903, the State Legislature passed an act that allowed county roads to be built or purchased out of general funds. San Bernardino began planning immediately and considered a number of different options such as using the Devil Canyon Road or building a new road. By 1905, the decision was made to purchase the Waterman Canyon Road from the Arrowhead Reservoir Company. San Bernardino County was set to buying branch roads, cutting down hillsides, and building switchbacks.

Source: Robinson 1989

Figure 5.8-8. Cedar Flats Mill Owned by the Tyler brothers and William La Praix, 1879

In 1906, San Bernardino County bought all the private logging and toll roads, opening them to the public and bringing increased visitation to the mountains (Tetley 2005: 21). In 1913, the county purchased the last roadway and completed the toll free, 101-mile “Rim of the World Highway” as it would be named. There were already a number of resorts in the mountains, such as the Squirrel Inn (est. 1893), but the new road would eventually give rise to towns and communities like Crestline (Mormon Springs), Big Bear, and Cedar Springs (Brown and Boyd 1922; Hatheway 2007; Robinson 1989, San Bernardino Daily Sun 1895; Tetley 2005). Rim of the World Road, which boasted beautiful scenery on its winding route up the mountain and across the crest, opened in 1915, and was later replaced in the 1920s by a paved State road that would become State Highway 18. This route eliminated the 13 switchbacks and steep grades that required drivers to remain in low gear, but also bypassed Crestline. Residents soon pressed the county to build a road to connect them to the new highway, leading to the development of Highway 138 (Tetley 2005:24).

The Devil Canyon Road was not selected to be the free county road; however, the canyon was the focus of the Southern Sierra Power Company and the Union Pacific

Railroad during the early twentieth century. In 1911, the Southern Sierra Power Company began constructing a 238-mile, 89,000-volt power line from hydroelectric plants in Bishop, across the Mojave, and over the San Bernardino Mountains through Sawpit Canyon and Devil Canyon (Robinson 1989, San Bernardino Daily Sun 1911). The new line provided a significant amount of power to San Bernardino and challenged Southern California Edison's monopoly on electricity, thereby making electricity rates more affordable. After construction of the power line, James Doyle threatened the Southern Sierra Power Company with violence if they continued to use his road. San Bernardino County filed a lawsuit against Doyle in 1912 for title, but the court ruled in favor of Doyle as the rightful owner of the road (San Bernardino Daily Sun 1912). While the power line was being constructed, the Union Pacific Railroad conducted a number of surveys to assess the possibility of constructing a rail line from San Bernardino to Hesperia through Devil Canyon and Sawpit Canyon. In 1921, the Union Pacific Railroad presented its plan to San Bernardino railway officials; however, the plan never materialized because the City of San Bernardino already had plans to utilize the canyon for a municipal water project (Brown and Boyd 1922; Robinson 1989; San Bernardino Daily Sun 1910, 1921a, 1921b).

In the early 1950s, high-speed, limited-access highways began expanding across the nation, and by 1954, the westernmost stretch of Interstate 10 had reached San Bernardino (Weeks 2010:118). Upon its completion, Interstate 10 connected Los Angeles with Jacksonville Florida, and San Bernardino remained a major city along the transcontinental route. However, the damage caused by the dramatic losses of the railroad economy at that time was not erased, and by the 1960s, the railroad industry began substantial downsizing. In 1972, the Santa Fe Railroad along with most other railroads in the United States turned over passenger travel to Amtrak. By the early 1990s, the Santa Fe Railroad had few employees remaining in San Bernardino (Weeks 2010:64). The San Bernardino economy was forced to diversify, and many residents began working for Kaiser Steel in Fontana, General Electric's iron factory in Ontario, warehouses, transportation companies, or other new industries (Schuiling 1984:145-7).

Railroad Development

In 1861, a railroad engineer named Theodore Judah devised a plan to build a Pacific Railroad line and proposed the idea to Congress for financial backing. Congress, although it liked the idea, denied the request due to the impending Civil War. Judah then proposed his idea to a group of four San Francisco merchants who provided the financial backing for the creation of the Central Pacific Railroad. The four merchants were Amasa Leland Stanford, Collis Huntington, Mark Hopkins, and Charles Crocker; known as "The Big Four." In 1862, President Lincoln pressed Congress to pass the Pacific Railroad Bill authorizing the Central Pacific Railroad and Union Pacific Railroad to construct a transcontinental line and the first rails were spiked in 1863. However, construction of a rail line from San Francisco through the Sierra Nevada Mountains was an astronomically difficult task and numerous problems were encountered. First, the government was slow to provide the promised financial support; and second, railroad employees would frequently desert the project for more lucrative prospects. These problems were solved by the close of 1865 when the Central Pacific Railroad found that thousands of Chinese laborers, who were unemployed due to the decline of the Gold Rush, were willing to work the railroad without complaint. Within four years, these Chinese rail workers accomplished an extraordinary feat of engineering when they met the Union Pacific Railroad in Utah on May 10, 1869, and connected the transcontinental line. California was now connected by rail to the rest of the United States (Hayes 2007; Starr 2007).

While the transcontinental line was being constructed, companies like the Southern Pacific Railroad were laying sections of track connecting cities in southern California. In 1868, "The Big Four" purchased the Southern Pacific Railroad and intended to lay tracks north out of Los Angeles to join with the Central Pacific Railroad and its connection to the Transcontinental Railroad. Los Angeles was nearly bypassed by the Southern Pacific Railroad until a group of Los Angeles business leaders convinced "The Big Four" to run the mainline through Los Angeles in exchange for the county's purchase of railroad bonds and stock. The line was completed when the Southern Pacific Railroad met the Central Pacific Railroad at Lang's Station in Santa Clarita where the two companies joined track in a "golden spike" ceremony on September 5, 1876. The Southern Pacific Railroad turned an overly used trail and stagecoach route into a transcontinental gateway and southern California was now connected to San Francisco as well as the eastern United States (Hayes 2007; SCVHS 2017; Starr 2007).

The building of the Southern Pacific Railroad was a boon to the development of southern California but at the expense of the Native Americans. In the same year President Grant established the Morongo Reservation, the Southern Pacific Railroad brought their line through the middle of it and made legal claim to every odd numbered parcel along their right of way. American settlers followed suit and began patenting land and usurping all of the water rights on the reservation leaving the Serrano with nothing and no means of recourse. Once again the Serrano had to endure more hardship and were forced to the worst parts of what was supposed to be their reservation (Brown and Boyd 1922; Robinson 1989).

Throughout the late 1860s, San Bernardino made numerous proposals to the Southern Pacific Railroad to bring a line through the town, but there was not enough support for any of the ventures. The problem was that the residents of San Bernardino thought their town was important enough to lure the railroad companies without granting any concessions. Although disappointed in the lack of a railroad connection, San Bernardino was progressing steadily and finally had a chance for a direct railroad connection. The Atchison, Topeka, and Santa Fe (AT&SF) Railroad was making an effort to build a second transcontinental route west into southern California and even considered bringing the route through Devil Canyon. Both San Bernardino and Riverside were lobbying for the AT&SF depot. San Bernardino secured the railroad connection by offering land for the depot and right-of-way amounting to approximately $20,000 (Brown and Boyd 1922; Robinson 1989). The depot was secured, but "The Big Four" held a railroad monopoly in California and did everything they could to block the AT&SF. While the Atlantic and Pacific Railroad (a subsidiary of the AT&SF) was building their line west, they were stopped at Needles, California by the Southern Pacific Railroad, who built a line north through the Mojave. The block was a success, forcing the Atlantic Railroad and Pacific Railroad to lease the Southern Pacific Railroad line for access to the California coast. The Santa Fe Depot was built in San Bernardino and the first trains entered the City in 1883. However, the lease rates charged by Southern Pacific Railroad were extortionate and the AT&SF began developing plans for an alternate, shorter route to the California coast that would render the Southern Pacific Railroad's Mojave line worthless. Abandonment of the route would have been disastrous for the Southern Pacific Railroad and for San Bernardino. Then, in 1884, the Southern Pacific Railroad decided to sell the Mojave line to the AT&SF at cost—a move that would ensure the prosperity of the City of San Bernardino as well as the survival of many small towns throughout the county (Berkman 1988; Brown and Boyd 1922).

The Late Nineteenth Century: Boom and Bust

The entrance of the AT&SF into California was exactly what San Bernardino needed. Now that "The Big Four" had serious competition, a railroad rate war ensued which continuously lowered prices for travel and freight shipment. From 1885 to 1890, while the rest of California was entering a depression, San Bernardino experienced its first population boom as easterners made their way to California in droves. The influx was furthered by the discovery of silver in the Calico Mountains to the north along the newly established railroad. Instead of temporary mining camps like those at Searles Lake (1860s) and Ivanpah (1870s), more permanent mining towns like Daggett would be established along the railroad leading to the markets of San Bernardino. Establishment of the railroad also furthered the lumber and citrus industries. More sawmills were built in the San Bernardino Mountains to provide lumber for growing towns, and scores of residents were employed for picking fruits and vegetables, transporting them to the packing houses, and preparing them for shipment throughout California and beyond via the railroad (Brown and Boyd 1922; Swisher 1999). By 1890, refrigerated railcars could take produce from the fields of the San Bernardino Valley to the eastern seaboard, and the population of San Bernardino was more than three times what it was 10 years earlier (Brown and Boyd 1922; Garabedian and Ruud 2016).

As discussed above, by the early twentieth century, San Bernardino had become one of California's most modernized cities, and residents increasingly accessed the nearby mountains for recreation. By the 1920s, modern amenities included theaters, cinemas, and hotels, and shopping that brought many visitors to San Bernardino (Weeks 2010:87-88).

The economy evolved during and after World War II. In 1942, the U.S. Army Air Corps opened a supply depot that grew to become the logistical wing for the Desert Training Center established in the Mojave Desert. After the war, and the establishment of the U.S. Air Force, this became Norton Air Force Base. Norton Air Force Base remained an important employer in San Bernardino until the 1990s when it closed. After World War II, changes in transportation technology led to a decline in rail passenger traffic nationwide and an increase in trucking. In addition, San Bernardino's citrus industry had begun to decline. Combined, both activities greatly affected the economy of the city.

In 1963, California announced that it would establish a new state college in San Bernardino, which is located directly adjacent to the Project area's southern end. Although a campus of the University of California had opened in 1954 in Riverside, approximately 15 miles south, the demands of rapid population growth and the post-GI Bill era explosion of college attendance led to the decision to locate another college in the Inland Empire area. California State College at San Bernardino opened in 1965, near the base of Devil Canyon in northern San Bernardino, with an initial enrollment of 293 students. In 1967, the college celebrated its first graduating class (California State University, San Bernardino 2018). In 1984, the institution achieved university status and became officially known as California State University, San Bernardino. At that time, it was educating more than 5,000 students and its initial six degree programs had expanded to 36 undergraduate and 9 graduate programs (Schuiling 1984:73). Currently, it is home to more than 20,000 students, the majority of whom are first-generation college students from within the Inland Empire area (California State University, San Bernardino 2018).

The city continued to grow, fueled by a massive migration to California, especially southern California, of both industry and the general American population. The formerly advantageous position in a valley led to San Bernardino being dubbed the "smog capital" as air pollution increased in the mid-century (Weeks 2010:131). The growing population also put increased pressure on available water sources, a situation alleviated by the SWP bringing water to San Bernardino in the early 1970s. In the later twentieth century, the closure and downsizing of American manufacturing interests forced a shift in San Bernardino's economy. By 2016, the population of San Bernardino exceeded 209,000, and of the more than 76,000 people in the workforce, most were employed in the retail, transportation, and healthcare sectors (U.S. Census Bureau 2016).

Recreation

The earliest outdoor recreation to occur in the vicinity of the Project was focused around the Crestline area and was discussed earlier in this context. The Sawpit Canyon Marina, day use, and picnic areas, located within the Silverwood Lake SRA, were not completed until 1973. The Black Oak Day Use Area received its name circa 1986-1995; however, this appears to be a misnomer as the 1986 Sawpit Canyon Recreation Plan refers to this day use area as part of the Sawpit Canyon recreation complex and is referred to herein as part of the Sawpit Canyon recreation complex accordingly. The Sawpit Canyon recreation complex is not thematically or temporally related to the recreation that occurred in Crestline. This recreation site is best evaluated within the context of mid-twentieth-century recreation development in San Bernardino County, specifically as it relates to a man-made reservoir development.

California, generally blessed with a dry and moderate climate, offers many opportunities for outdoor recreation. Many of the nation's finest national parks and reserves are located in California, and the State has a large number of State and regional parks. However, as most of California's population is clustered in densely populated metropolitan areas, access to recreational opportunities moving into the mid-twentieth century was found to be insufficient, particularly among minority and poorer populations (DPR 1974:165). In 1957 the California Legislature recognized the growing demand for outdoor recreation and the lack of adequate facilities through the passage of the California Public Outdoor Recreation Plan Act. The Act established a committee that developed a report in 1960 considered the first comprehensive statewide outdoor recreation plan in the nation. The plan provided a statewide inventory of recreation facilities and outlined goals moving forward for future recreation planning (DPR 1974:1).

The Sawpit Canyon Marina and Day Use Area was the first recreation resource completed at Silverwood Lake. Completed between 1972 and 1973, the facility includes picnic areas, a marina, a boat launch, 11 restrooms, a designated swimming area, four lifeguard towers, as well as the original entry kiosk known as the "Sawpit Kiosk." The years following the completion of the Sawpit Canyon Marina and Day Use Area saw the addition of numerous facilities located on and near Silverwood Lake; however, all of the facilities were completed after 1973, and are thus not yet 45 years old. There are no overnight camping facilities associated with the Sawpit Canyon Marina and Day Use Area.

The recreation facilities at Silverwood Lake were constructed over time, though the overall recreation plan developed in 1970 guided construction over the next two decades. Facilities were paid for through Recreation and Fish and Wildlife Enhancement Bond Funds allocated in 1970. The first recreation activity to occur began in 1972, with informal boating and fishing being allowed near the Cedar Springs Dam in May 1972. There are no built environment resources related to recreation that were built near the dam at that time. The first use of the permanent recreation facilities began in June 1973, when the Sawpit Canyon Marina and Day Use Area was completed. Upon completion, the day use area included a six-lane boat launch, a 185-trailer parking area, a boarding dock, a concessionaire-operated snack bar, a boat rental facility, a store for fishing supplies, picnicking areas, a swimming beach, 400 single-car parking spaces, and restroom facilities. Approximately 20 years after its opening, overcrowding of recreational facilities at Silverwood Lake and other SWP sites, as well as State and regional parks, had become an issue on most weekends and over the summer season (DWR 1991:1). By that time, additional facilities had been opened, including family and group campsites, expanded picnicking sites, and new paved walking and bicycling trails.

By 1986, a visitor's center had been constructed with interpretive material about the plants and wildlife in the area, and a general store and two snack bars were being operated by a private concessionaire (DWR 1991:4). Nonetheless, increasing population in the southern California metropolis, as well as increases in leisure time, disposable income, and transportation options put perpetually more strain on recreational facilities. The majority of visitors traveled less than 61 miles to Silverwood Lake SRA from Los Angeles, Riverside, and San Bernardino counties (DWR 1991:5). In all, by the late 1980s, more than 700,000 recreation days per year were spent at

Silverwood Lake (DWR 1991:9-10). Expanded facilities were needed to accommodate the increasing demand. Boat-in recreation was made available at the Chamise Area, Sycamore Landing, and the Live Oak areas in June of 1973 as well; however, all built environment resources associated with those areas were completed in the 1990s and 2000s. There are no known resources dating to 1973 or earlier located within those recreation areas surrounding Silverwood Lake.

Pacific Crest National Scenic Trail

The PCT was originally envisioned as early as 1926 during a conversation between Catherine Montgomery, a teacher at the Washington State Normal College, and Joseph Hazard, a textbook salesman and mountaineer (Mann 2011). Hazard went on to promote the proposed trail to The Mountaineers, a Seattle-based hiking club established in 1906. The effort received an additional boost in 1932, when Clinton C. Clarke, chairman of the Mountain League of Los Angeles, organized the inaugural Pacific Crest Trail System Conference to promote the idea of a multi-state border-to-border trail. The original proposal was to link the John Muir Trail and the Tahoe-Yosemite Trail (both in California), the Skyline Trail (in Oregon) and the Cascade Crest Trail (in Washington). Attendees included the Boy Scouts, the YMCA, the Sierra Club, as well as many local and regional hiking clubs, including The Mountaineers of Seattle (PCTA 2018). Over the next 25 years, Clarke served as president of the conference, organized volunteer groups to scout routes and locations, and kept the idea of the border-to-border trail alive until the popularization of hiking began to receive more national attention in the 1960s (Livermore 2013).

In a response to the growing interest in the outdoors and the environmentalism movement, in 1965, President Lyndon B. Johnson called for the development of a system of trails to enhance American's access to the outdoor environment. A committee comprising of members representing four federal agencies conducted a study culminating in the volume "Trails for America," published in 1966. The volume formed the basis for the original language of what was to become the National Trails System Act, passed by Congress on October 2, 1968. The Appalachian Trail and the PCT were designated as the nation's first national scenic trails (Livermore 2013; PCTA 2018).

In 1970, the Pacific Crest National Scenic Trail Advisory Council was appointed and held its first meeting with a membership that included hiking clubs, equestrian groups, Native Americans, cattle ranchers, timber and mineral interests, youth organizations, and each of the trail states (PCTA 2018). On January 30, 1973, USFS published the selected route of the Pacific Crest National Scenic Trail (38 FR 2832). In 1993, the PCTA joined the USFS and other land management agencies in celebrating the completion of the trail with a "Golden Spike" ceremony near Soledad Canyon in the Angeles National Forest (PCTA 2018). Today, the PCT (along with the Appalachian Trail and the Continental Divide Trail) is considered one of the three long-distance trails that comprise the "Triple Crown of Hiking" (Berger 2001). In 2015, a Memorandum of Understanding was executed (updating previous agreements from 1993 and 2009) between the USDA Forest Service (Regions 4, 5, and 6), the National Park Service

(Pacific West Region), the U.S. Department of the Interior Bureau of Land Management (State offices of California, Oregon, and Washington), the California Department of Parks and Recreation, and the Pacific Crest Trail Association to document the roles and responsibilities of each party and recognizing the PCTA as the government's major partner for the PCT.

The Development of Water Infrastructure

Regional Water Storage, Conveyance, and Hydropower

One of the earliest issues Californians faced was periodic and often devastating floods resulting from storms and run-off from the mountains. Floods eroded canyons, causing mudslides that wreaked havoc in the foothills as well as inundating the flatland areas (DWR 1980:26). One of the methods for addressing this was the construction of foothill reservoirs that could control the downstream flow. As the provision of water for crops and residents was a primary concern from the start of settlement in San Bernardino it is unsurprising that the first three-phase hydroelectric plant in California was completed in San Bernardino County in 1893 near Redlands. Other such plants followed throughout the State, and for several decades, most of the electricity used in California was generated by hydroelectric power. In the San Bernardino area, Southern California Edison Company was the sole owner of the hydroelectric facilities by 1911 (Scott 1968:35).

Water scarcity in the rapidly-growing region of southern California directly prompted the development of a large-scale water control and carrying project that became known as the SWP. Early water planning in 1957 resulted in the development of a California Water Plan that presented preliminary plans for developing the State's water resources for meeting California's water needs. The Burns-Porter Act, coupled with a bond, authorized funds for construction of the SWP and was formally known as the California Water Resources Development Bond Act. Intended primarily to transfer water from northern California to the San Joaquin Valley and thence to southern California, the SWP incorporated reservoirs that served a multitude of benefits: flood control, water storage, recreation, fish and wildlife enhancement, and in several cases, the production of electricity. The SWP as a water supply project naturally turned to hydroelectric power to offset the power needs necessary for water supply operations, but it also reflected an increasing interest in clean and renewable energy production in California. The SWP is one of the largest conveyance systems in the world. Using a series of natural rivers and a system of canals and pipelines, the SWP stores and transports surplus northern California water over 700 miles for use in the central and southern regions of the State (Hydro Review 1992:62).

By 1974, approximately 30 percent of the electrical energy used in California was produced from hydroelectric plants (DWR 1974:1). Ever-increasing population combined with an increase in per capita electricity use created exponential growth in the demand for electrical power. By the early 1970s, oil had become the primary fuel used in thermal generating plants in California, but with rising oil prices California began examining alternatives. The construction of nuclear plants had fallen behind schedule across the country by the 1970s amidst both protests and cost overruns that averaged more than 200 percent. Natural gas was not expected to be available in sufficient quantities for thermal generating plants. Thus, California turned its attention to alternatives such as increased hydroelectric generation (DWR 1974:2). One of the key issues facing efforts to build new hydroelectric generating plants, however, was that more than half the potential energy yield occurs at locations subject to State and federal natural preservation laws governing scenic rivers and national parks (DWR 1974:1). Nonetheless, DWR recommended that available sites be developed for the production of hydroelectric power.

In days past, hydroelectric power was in general, considered renewable and environmentally friendly; however, plant construction still came with logistical challenges. Even for single-use hydroelectric plants, storage reservoirs needed to be built in order to assure a steady flow of water into the plant, since California's climate tended to create greater streamflow in the winter and spring followed by periods of substantially less streamflow during summer and autumn (DWR 1974:6). The natural irregularity of flow as well as competing water demands limited the production of hydroelectric power in California. By the late 1960s, development of further sites for hydroelectric generation was also complicated by the logistics of planning, funding, permitting, licensing, and constructing multi-phase systems, as well as acquiring the necessary water rights (DWR 1974:7).

By the early 1970s, there were 19 hydroelectric generating plants in the South Coastal Basin region, which included a small, but the most densely populated, portion of San Bernardino County. The SWP had four hydroelectric plants at the time, including the Devil Canyon Powerplant in San Bernardino County, and DWR recommended four potential additions to increase generating capacity along the SWP, including one at Lake Perris in Riverside County (DWR 1974:63). Beginning in 1990, the Mojave Siphon Powerplant was constructed just north of Cedar Springs Dam. Despite these additions, the SWP continues to use the majority of the power it produces.

The SWP is currently California's fourth-largest energy producer, but also its largest single user of electricity. Its dams and hydroelectric powerplants along with DWR entering into long-term and short-term contracts and agreements with other electric utilities and the CAISO for transmission access and for power purchases and sales, primarily power the work of the SWP itself. When production exceeds what is required to pump water from northern California deep into southern California, then DWR sells the surplus (DWR 1999:18).

<u>The Governor Edmund G. Brown California Aqueduct</u>

The Governor Edmund G. Brown California Aqueduct (constructed between 1960 and 1974) was incorporated into the Burns-Porter Act as part of the SWP and originally called the San Joaquin Valley-Southern California Aqueduct before being renamed simply the Governor Edmund G. Brown California Aqueduct. Governor Edmund G.

Brown, Sr., stated in his first inaugural address as governor (January 5, 1959) that "Development of our water resources is crucial to every segment of our state — the ranchers in our mountain areas, the farmers who make California the nation's leading agricultural producer and the homeowners in our population, which will grow to 20 million by 1970. No problem has occupied more of my time in the weeks since election than water. Striking progress has been made. I can tell you now that I will soon present a water program, which is rational, realistic and responsive to the needs of all the people of the state" (Aquapedia 2018). Brown's efforts led to the passing of the California Water Resources Development Bond Act (Burns-Porter Act) in 1959, which authorized construction of the SWP. The voters approved Proposition 1 in November 1960 that authorized the act's funding. The SWP provided resources necessary for the growth of southern California, flood control in northern California, and the California agricultural industry (Los Angeles Times 2018).

As a component of the SWP, the California Aqueduct along with the North Bay Aqueduct, South Bay Aqueduct, Coastal Branch, West Branch, East Branch, East Branch Extension and the joint use facilities in the California Central Valley are managed by five separate field divisions. Although the Devil Canyon Project is being licensed as a separate facility, the East Branch of the SWP includes Cedar Springs Dam and Silverwood Lake. In total, the mainline of the California Aqueduct measures 444 miles, making it the longest water conveyance feature of the SWP system. Silverwood Lake is considered a forebay of the greater California Aqueduct system (Brewster 2012:3-5).

The East Branch of the SWP consists of approximately 137 miles of canals, siphons, tunnels, penstocks, powerplants, pumping stations, and reservoirs. Construction of the East Branch of the SWP began in 1967 and continued through 1973 at a total cost of approximately $375 million (Brewster 2012:4).

<u>The Devil Canyon Project</u>

By the mid-twentieth century, ongoing concerns about sufficient water for residents of San Bernardino County dominated local politics and economic concerns. San Bernardino was far from the only area in the State with such concerns, as the rapidly increasing population of California had begun overtaxing the available freshwater sources of the predominantly dry climate by the 1920s. A State Water Plan was first published in 1931, leading to the development of the Central Valley Project (CVP). The CVP was completed in 1937 with federal funding, is operated by the U.S. Bureau of Reclamation, and primarily delivers water to agricultural users in the Central Valley, as well as to urban users in the San Francisco Bay Area (DWR 1999:10).

During and after World War II, industries rapidly moved to California and several new industries developed or expanded as well. This fed a continued population boom, especially into southern California. To address concerns about access to sufficient fresh water for both agriculture and the populace, DWR undertook several studies and developed plans for the development of California's water resources, including a massive project to transfer water from areas of plenty to areas with a shortage (DWR 1999:13).

The project was initially investigated as the Feather River and Sacramento-San Joaquin Delta Diversion Projects that was authorized by the State Legislature in 1951 under the Central Valley Project, but in 1955 it was known as the Feather River Project, as the initial work was to be the construction of a multi-purpose dam and reservoir on the Feather River near Oroville. The goal of the project was to provide flood control, produce electricity, and create a large reservoir to feed a system of aqueducts that would transport water from Oroville to the Bay Area, the San Joaquin Valley, and continue south from there into southern California. Flooding in 1955, which caused over $200 million of damages and cost 64 lives, led to speedy support of the plan, and the State legislature approved emergency funding, voters passed a bonds issue, and the federal government also contributed to funding for flood control (DWR 1999:14). With the completion of the Feather River Project, the SWP was born. The first water deliveries were made in 1962 (DWR 1999:24).

This did not immediately aid residents in San Bernardino as Feather River water was not expected to reach San Bernardino until 1972, awaiting the completion of the necessary infrastructure along the approximately 450-mile route. The pressures of population growth in San Bernardino County and the surrounding counties – especially in Orange County which lay west and therefore downstream of San Bernardino along the Santa Ana River – meant there were persistent concerns about water scarcity and the likelihood of water rationing if San Bernardino waited for completion of the SWP to San Bernardino. It was clear that the county had to import water from somewhere: whether to join the Metropolitan Water District (headquarted in Los Angeles) and bring it in from the Colorado River along already-built lines or wait for the SWP. The voters of San Bernardino decided to wait for the SWP whose contract granted substantially larger amounts of AF of water to San Bernardino (Crider 2014:9-20).

The SWP constructed a system to bring water into San Bernardino over the San Bernardino Mountains, which required a complex series of pumps along the aqueduct. To offset the ongoing costs of powering the pumps bringing water 450 miles up, over, and occasionally through mountains, the plan also called for a hydroelectric plant to be constructed on the north side of the City of San Bernardino at Devil Canyon, about 5 miles north of downtown. This was one of six powerplants south of the Tehachapi Mountains that appeared on SWP plans in the early 1960s (Hebert 1961). To supplement the water supply from the north and assure a steady flow into the powerplant at Devil Canyon, a reservoir on the West Fork Mojave River on the northeast side of the mountains was needed. The Cedar Springs Dam was built across the West Fork Mojave River to create the reservoir, approximately 13 miles north of downtown San Bernardino. The dam was named after the small mountain community that was to be inundated by the creation of Silverwood Lake (Buie 1961:11). Also lost was the Miller Canyon campground in the SBNF. California Highway 138 had to be rerouted as well, with a 9-mile segment of road having to be built around the lake to replace what subsequently lies beneath Silverwood Lake (San Bernardino Daily Sun

1968:B-3). The construction of the dam, reservoir, and the rest of the SWP's infrastructure in the area was expected to cost approximately $95 million (Buie 1961:11).

By July of 1964, final designs for the Cedar Springs Dam and a 216,000 AF reservoir (Silverwood Lake) were prepared based on the projected needs of contracted water users in San Bernardino County and points further south. However, DWR's Consulting Board for Earthquake Analysis determined in April 1965 that a fault offset was possible (although unlikely) at the dam site, and the reservoir was resized to only 75,000 AF. A complete redesign, completed by DWR's Division of Design and Construction, became necessary since no appropriate alternate location for the reservoir could be located (Brewster 2012:4).

Construction of Cedar Springs Dam began in 1968 under the direction of the Morrison-Knudsen Company (Foley 1970:B-3). Morrison-Knudsen was a Boise, Idaho-based construction and engineering firm, founded in 1912, that had previously been involved in substantial infrastructure projects, such as the Hoover Dam and airfield facilities in the Pacific Theatre during World War II, and went on to establish itself as one of the major contractors for the American space program (Baker Library 2018). Along with the construction of the earth-filled dam, the project included the construction of the aqueduct in the area, building overshoots and culverts to carry washes and creeks over or under the aqueduct, and a nearly 200-foot-tall concrete intake tower connecting to the tunnel that would carry water to the Devil Canyon Powerplant (Foley 1970:B-3).

Silverwood Lake and Cedar Springs Dam were completed in the summer of 1972, followed in December of that same year with the completion of the Devil Canyon Powerplant (Crider 2014:47). Construction of the hydroelectric plant began in 1969. The powerplant is capable of producing 291 MW per hour in its four units (DWR 1999:139). Water approaches the plant via the 20,064-foot-long San Bernardino Tunnel under the mountains from Silverwood Lake (DWR 1999:135). On this route, the water drops approximately 1,600 feet, permitting the turbines to harness the energy of the falling water. After passing through the powerplant, the water enters the two afterbays, where some of it is delivered to State Water Contractor contracting agencies. (Danskin et al. 2006:29).

Originally the plant had just one afterbay, but a second afterbay was constructed between 1992 and 1995 that increased the plant's capacity (DWR 1999:139).

Between 1990 and 1996, the SWP constructed a second powerplant along the aqueduct, just north of the Cedar Springs Dam. The Mojave Siphon Powerplant, included under a separate FERC authorization, generates electricity from the energy of water flowing downhill from Check 66 through the Mojave Siphon to the Mojave Siphon Powerplant. After passing through the powerplant, the water is discharged into Silverwood Lake. It has a generating capacity of 32.4 MW in its three units (DWR 1999:136). Combined with the installed generating capacity of the Devil Canyon Powerplant (272,796 kW) and the Alamo Powerplant (17 MW), this brings the total capacity of hydroelectric plants in this section of the East Branch of the SWP to about 322 MW. Most of the time, the power produced helps to offset the cost of using and maintaining the SWP for water supply operations. Without the powerplants, especially the large energy recovery plant at Devil Canyon, the costs of bringing in water would substantially increase.

The Devil Canyon Powerplant was originally designed for later expansion, which began in the early 1990s when a second penstock was added to the facility. Drawings dating to 1972 indicate the location of a future second penstock, further demonstrating that the addition was part of the original intended design. Expansion began after a 1986 agreement between DWR and several of its water contractors called for the enlarging of the East Branch of the SWP. The project included the second penstock, two additional 76.5 MW operating units, a substantial building expansion, as well as a second, and much larger, afterbay (Hydro Review 1992:62).

5.8.1.3 Overview of the Cultural Resources Study and Results

As part of its Cultural Resources Study Approach, DWR conducted data gathering at the South Central Coast Information Center (SCCIC), the SBNF, and DWR's archives and library. DWR found 52 reports documenting prior 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 within the APE and a surrounding quarter-mile buffer used to gather the data prior to conducting the study field investigation. Approximately 90 percent of the previous investigations occurred 10 or more years ago and were conducted for various DWR projects, private land developments, and transportation projects. Some documents were related to hazard tree removal and fire suppression activities.

DWR's review of the previous field studies revealed that they did not meet current professional standards, and were, therefore, inadequate for identification of cultural resources that may be affected by the Project. As a result, DWR conducted archaeological and historical built resources field surveys of the entire APE, where safety considerations allowed access and examination with the objective of addressing information gaps in the existing, relevant and available information. The field surveys were conducted from October 2017 through December 2017, and were used to verify data collected from the earlier investigations; identify previously unidentified and undocumented cultural resources; evaluate at the field survey level, if possible, any resources that are potentially eligible for listing on the NRHP (historic properties); and determine whether the Project is currently affecting any historic properties or unevaluated cultural resources. Additional information provided to DWR by the SMBMI in a letter dated December 29, 2016 and discussions on survey methods with SMBMI and the Morongo Band of Mission Indians were incorporated into the study approach.

Methods employed during the Cultural Resources Study included conducting additional archival research at relevant repositories and DWR facilities to develop the historic context by which the local, regional, State, or national significance of archaeological and historical built environment resources could be evaluated and a determination on their potential for listing on the NRHP. Prior to conducting the fieldwork, DWR prepared a Privileged cultural resources sensitivity map to aid the field survey in verifying locations of previously recorded cultural resources and to identify previously unknown cultural resources in the study area.

Field methods included field crews walking pedestrian transects spaced 15-20 meters apart on all accessible lands (i.e., gentle to moderate slopes, locations with no or moderate densities of vegetation, other areas deemed by field personnel to be safe) within the APE. Field crews found the APE to include either accessible or not accessible lands, with wider transects being deemed unnecessary. Locations that could not be accessed in a safe manner (e.g., locations containing dense vegetation or unsafe slopes) and areas inundated when the surveys were performed were not surveyed. The areas examined and those locations not accessible during the field survey were plotted onto the appropriate United States Geological Survey (USGS) 1:24,000 scale topographic map. Identified resources were documented using a GPS receiver with sub-meter accuracy. The GPS data utilized the North American Datum of 1983 (NAD 83) and the Universal Transverse Mercator (UTM) system. Previously recorded and newly discovered cultural resources, including isolated finds, were fully documented following the procedures outlined in *Instructions for Recording Historical Resources* (OHP 1995), which utilizes DPR 523 Forms A-L. Previous documentation for resources deemed to be adequate was updated using the DPR 523 Continuation Sheet. Sketch maps were drawn to scale, and the identified resources photographed using digital color photography. The locations of archaeological sites, historic built resources, and isolates documented during the field survey were plotted onto the appropriate USGS 1:24,000 scale topographic map by hand at the time of discovery, and the locations recorded using a GPS receiver based on the NAD 83 and UTM system. Of the 2,015.0 acres encompassed within the APE, 964.0 acres (48 percent) are inundated by Silverwood Lake and the Devil Canyon afterbays, and thus were not examined during the field surveys. Of the remaining 1,051.0 acres within the APE, 641.0 acres (32 percent) were accessible and surveyed, and 389.0 acres (19 percent) could not be examined due to impenetrable vegetation or steep slopes. An additional 21.0 acres at the Cedar Springs Dam Spillway were examined under a separate effort as part of DWR's regular routine Project maintenance activities (Ottenhoff et al. 2017). In accordance with DWR's California Data Exchange Center, the elevation of the water in Silverwood Lake at the time of the field surveys ranged from a high of 3,350 feet to a low of 3,345 feet. Thus, the lowest elevation surveyed at Silverwood Lake during the relicensing field effort was 3,345 feet. The APE and the field survey coverage are shown on Figure 5.8-9 and Figure 5.8-10.

The field surveys also included limited subsurface exploration in locations considered sensitive for potential buried cultural deposits, based on the Privileged sensitivity map prepared by DWR. The subsurface exploration used Surface Scrape Units (SSU) measuring 1 meter by 1 meter in size. The SSUs were excavated to a depth of 10 centimeters from the top of the ground surface, below vegetation and ground cover. SSUs were placed in areas generally characterized by: (1) thick vegetation or open areas but with close to zero ground visibility; (2) low slope (less than 10 percent); and (3) topography commonly considered to be sensitive for cultural resources. Of the 144 SSUs excavated, all were sterile with no artifacts or other indications of archaeological materials or deposits.

The archaeological field survey resulted in the confirmation of three previously recorded resources. The locations of three additional previously recorded sites correspond to inaccessible areas of the APE and were therefore not visited as part of the survey. Additionally, evidence of the previously recorded Mojave Trail was not encountered within the APE and may have been misplotted on the SCCIC resource location maps, may have been removed by Project construction, or succumbed to other means of its disappearance. Eighteen newly discovered archaeological sites were documented during the study, resulting in a total of 25 sites identified within the APE that include previously recorded sites located in areas deemed to be inaccessible, not relocated, or that otherwise could not be revisited during the survey. Of the 25 sites identified within the APE, 3 are prehistoric sites, 20 are historical sites, and 2 are multicomponent sites. The surveys also recorded seven historic and one prehistoric newly discovered isolated artifacts.

The historical built environment resources survey identified 12 resources within the APE for the Project associated with four categories: Devil Canyon Project Resources (nine resources), Devil Canyon Recreation Resources (one resource), Cedar Springs Community Resources (one resource), and Infrastructure Resources (one resource). These are primarily related to the Project facilities. The locations of all cultural resources are Privileged and not included in this summary. An overview of the resources identified within the APE is provided below

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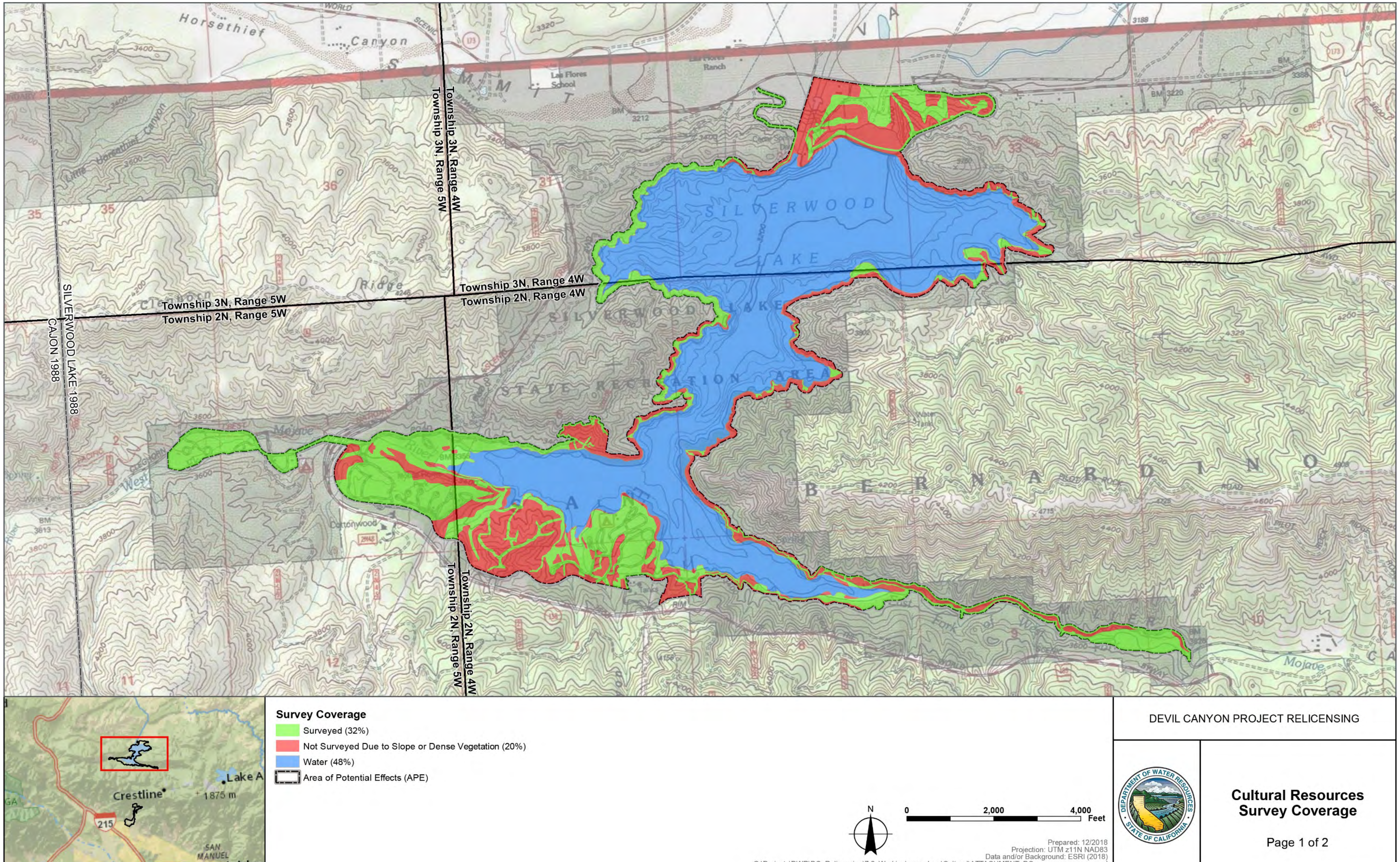

Figure 5.8-9. Survey Coverage Within the APE around Silverwood Lake

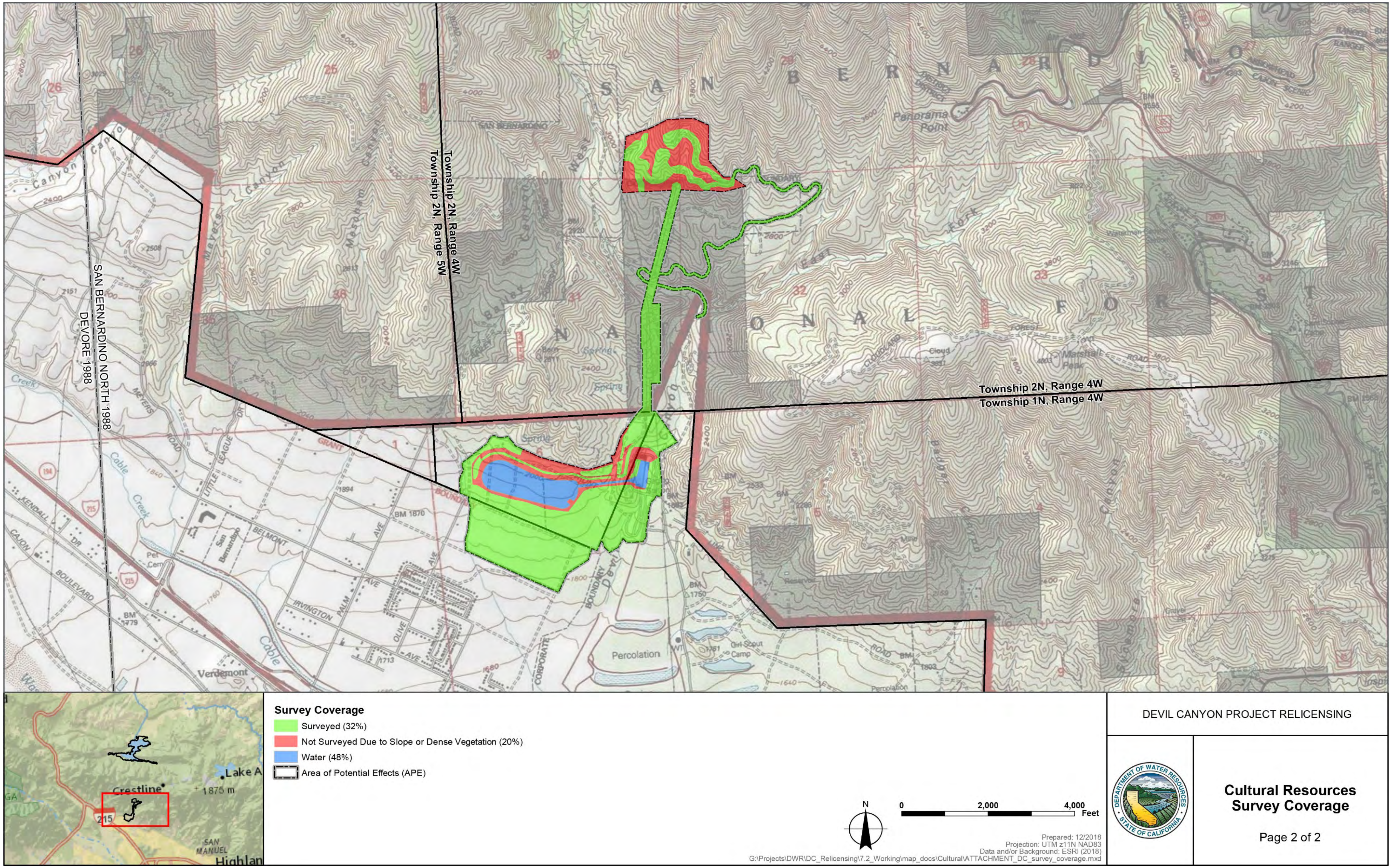

Figure 5.8-10. Survey Coverage Within the APE around Devil Canyon Powerplant, Surge Chamber, Penstocks, Devil Canyon Afterbay, and Devil Canyon Second Afterbay

Archaeological Sites

The three prehistoric archaeological sites located within the APE represent task-specific locations, such as plant or other material processing (Table 5.8-1). As shown in Table 5.8-1, the construction of the current Project had effects only on P-36-08913, a site that was documented and evaluated by DWR as not eligible for listing on the NRHP in 1994 as part of an archaeological study conducted for the reconstruction of the San Bernardino Tunnel intake (Hines 1997). The SHPO concurred with this finding in a letter dated August 20, 1994 and the site is recorded in the OHP directory as not eligible by consensus. SHPO's concurrence letter is provided in Appendix E.

Table 5.8-1. Prehistoric Archaeological Sites Within the APE

Primary No.	Trinomial	USFS No./ Temporary No.	Description	Project-Related Effects	NRHP and CRHR Eligibility
P-36-00174	CA-SBR-0174	05-12-51-20	Previously recorded milling location with flaked stone scattery	No	Previously tested for the NRHP in 1973 by Robert Orlins; results not found during study research and requires investigation beyond this study; considered unevaluated
P-36-08913	CA-SBR-8913		Previously recorded flaked stone scatter with milling and other tools located in area deemed not accessible and not visited during relicensing survey.	No	1997 DWR Evaluation Not Eligible; Listed "Not Eligible" in OHP Directory by Consensus; SHPO concurred in 1997
None	None	DC-HDR-006	Small milling location with no associated artifacts	No	Unevaluated

Source: 2015 SCCIC Records Search; 2016 USFS Records Search; 2017 Field Survey
Key:
APE = Area of Potential Affects
CRHR = California Register of Historic Resources
DWR = California Department of Water Resources
NRHP = National Register of Historic Places
OHP = Office of Historic Preservation under the California Department of Parks and Recreation
SCCIC= South Central Coastal Information Center
USFS = U.S. Department of Agriculture, Forest Service

As reported in Sutton et al. (1992), test excavations were conducted at prehistoric site P-36-00174 in 1973 by Robert Orlins. The results of Orlins' work was never formally reported, although Orlins presented a paper on the site at a conference in 1990

(Schneider and Orlins 1990). A note written on a 1989 update sheet attached to the site record on file at the SCCIC, states that Mark Sutton of California State University (CSU), Bakersfield provided a photocopy of Orlins' excavation notes and his artifact catalog on May 9, 1994, presumably to the SCCIC. Additional research is needed to determine whether P-36-00174 was formally evaluated following the excavation, and whether the SHPO was provided the opportunity to concur with the findings, as this information has not been found in the archival research or records search at the SCCIC. Monica Nolte of DWR's Division of Environmental Services, surveyed P-36-00174 in 2016 and determined that the majority of the site had been covered by fill during construction of the Project (Nolte 2016a:2). Nolte examined a small portion of the site adjacent to the primary site deposit and provided an updated site record to the SCCIC (Nolte 2016b). Site P-36-00174 was also visited in 2017 as part of the relicensing field survey and found to be in a similar condition as previous observations (Lloyd et al. 2019). Based on the research and background information collected for the current study, P-36-00174 is considered to be unevaluated for listing on the NRHP and will be managed as if eligible. The site appears to have contained a fairly substantial archaeological subsurface deposit at one time that was quite possibly eligible for listing on the NRHP. However, the level of disturbance and possible destruction of the site, or portions of the site, from Project construction is not fully known, but could potentially be determined through a more substantial study beyond a site inventory.

Site DC-HDR-006 is a small isolated milling station. It has not been evaluated for listing on the NRHP. Although no surface evidence of artifacts was observed at the site, the possibility of buried, subsurface artifacts or deposits can not be ruled out without further exploration and study. The site is therefore considered potentially eligible for listing on the NRHP. The current study did not identify any Project effects at the site. Confidential details regarding each site are provided in the Privileged cultural resources study report.

Most of the 20 identified historical sites are paved and unpaved roads; trails, water control features, a trash scatter, irrigation features, and residential remains were also documented. The historical archaeological sites are consistent with the potential types of archaeological resources that might be encountered within the APE, as identified on historic period topographic maps and General Land Office plats during pre-field research. Site DC-HDR-003 includes three segments of the PCT that differ in alignment than the original intended trail alignment identified in the 1973 selected route, which put the alignment west of Highway 138 away from the APE (38 FR 2934).These segments were newly constructed under two easements issued in 1980, granting the USFS permission to relocate the three segments onto State lands within the APE. These sections of the trail are less than 45 years of age and do not meet the NRHP eligibility thresholds at this time. Observations made at four of the historical archaeological sites during the *Cultural Resources Study Approach* revealed they are currently affected by the Project. Three others were initially affected by the construction of the Project but do not show signs of being affected currently. Historical sites located within the APE are listed below in Table 5.8-2.

Table 5.8-2. Historical Archaeological Sites Within the APE

Primary No.	Trinomial	USFS No./ Temporary No.	Description	Project-Related Effects	NRHP Eligibility[1]
P-36-13421	None	None	Previously recorded (2007), Devil Canyon Toll Road, between ca. 1873 and 1879	No	Not Eligible
P-36-24109	CA-SBR-15294H/ 15294H	None	Four segments of road built for construction of the Cedar Springs Dam and facilities, between ca. 1968 and 1973	Yes, ongoing maintenance and improvements	Not Eligible
P-36-24794	CA-SBR-15835H	None	Previously recorded road segment with modern improvements; known as both “Dark Canyon Road” and “Miller Canyon Road,” ca. 1902; may have been in use earlier as a trail route	Yes	Unevaluated
None	None	DC-HDR-001	Paved access road to the Devil Canyon Powerplant facilities, ca. 1960s	No	Not Eligible
None	None	DC-HDR-002	Irrigation system dating to before Cedar Springs Dam construction; consists of vertical standing cement pipes, a pump mechanism part, and pipe fragments	No	Not Eligible
None	None	DC-HDR-003	Three modern (1980) segments of the PCT, a maintained dirt national recreational trail	No	Not Eligible

Table 5.8-2. Historical Archaeological Sites Within the APE (continued)

Primary No.	Trinomial	USFS No./ Temporary No.	Description	Project-Related Effects	NRHP Eligibility[1]
None	None	DC-HDR-005	Segment of the Pilot Rock Truck Trail; remnant dirt road cut into the hill slopes; dates prior to 1938	No	Not Eligible
None	None	DC-HDR-007	Unnamed road cut with degraded asphalt surface; dates prior to 1942	No	Not Eligible
None	None	DC-HDR-008	Building foundations and structural remains associated with the former park headquarters; formerly the Nella Property, constructed ca. 1935	No	Unevaluated
None	None	DC-HDR-009	Two unnamed historic road segments, estimated to date to between 1942 and 1968	Yes	Not Eligible
None	None	DC-HDR-010	Two concrete low-head dam features	No	Not Eligible
None	None	DC-HDR-011	1960s era scatter of bottles, cans, and other refuse	No	Not Eligible
None	None	DC-HDR-012	Small, crudely constructed water retention feature of granite cobbles/ mortar; built into a narrow drainage path on a steep side slope	No	Not Eligible

Table 5.8-2. Historical Archaeological Sites Within the APE (continued)

Primary No.	Trinomial	USFS No./ Temporary No.	Description	Project-Related Effects	NRHP Eligibility[1]
None	None	DC-HDR-014	Paved road (Sawpit Canyon Road); original road bed constructed ca. 1960s	No	Not Eligible
None	None	DC-HDR-015	Paved and unpaved segments of historic Cleghorn Road with modern improvements and culverts	No	Not Eligible
None	None	DC-HDR-017	Channelized concrete water control system	No	Not Eligible
None	None	DC-HDR-018	Residential property remains, cellar/ basement, brick wall, cistern, water pipes, and landscaping trees	Unknown if disturbed by Project	Unevaluated
None	None	DC-HDR-019	Concrete pad and associated vertical water pipes	Unknown if disturbed by Project	Not Eligible
None	None	DC-HDR-021	Remnant road segment associated with former State Route 173/138 route; initial construction prior to 1926	Yes	Unevaluated
None	None	DC-HDR-022	Cedar Springs Townsite	Yes	Unevaluated

Source: 2015 SCCIC Records Search; 2016 USFS Records Search; Historic Topographic and General Land Office Maps; 2017 Field Survey
Note:
[1] NRHP Recommended Eligibility Determinations Evaluated as Part of Study Pending Consultation and SHPO Concurrence
Key:
APE = Area of Potential Effects
ca. = circa
NRHP = National Register of Historic Places
PCT = Pacific Crest National Scenic Trail
USFS = U.S. Department of Agriculture, Forest Service

Two previously recorded multicomponent sites are located in the APE. One is a prehistoric milling station with both prehistoric and historical artifact scatters (P-36-00501). The site was originally recorded in 1967 and was evaluated by DWR for the NRHP during a study for the reconstruction of the San Bernardino Tunnel intake in 1994. FERC determined that the site was not eligible for listing in the NRHP and SHPO concurred with this finding in a letter dated December 6, 1994. SHPO's concurrence letter is provided in Appendix E. The Mojave Trail (P-36-03033) has been documented as a pre-contact (i.e., prior to Euro-American settlement) Native American trail and historic period trail extending north to south through the APE (Table 5.8-3). The documented locations for prehistoric and historical trails are often estimates based on old maps or other documents, and are often misplotted. The Mojave Trail was not relocated within the APE during the 2017 field survey and may have been misplotted on the SCCIC maps, removed through construction of the Devil Canyon Project, or otherwise lacks evidence within the APE for other reasons.

Table 5.8-3. Multicomponent Archaeological Sites Within the APE

Primary No.	Trinomial	USFS No./ Temporary No.	Description	Project-Related Effects	NRHP and CRHR Eligibility
P-36-00501	CA-SBR-501/H	None	Previously recorded occupation site with milling features and both prehistoric and historical artifact scatters; included in both the cultural resources and tribal resources studies; site not accessible and not visited during survey	Yes	Not Eligible; SHPO concurred in 1994
P-36-03033	CA-SBR-3033/H	None	Multicomponent: Mojave Trail included in cultural and tribal resources studies; SCCIC data plots the trail through the APE; evidence of the trail was not found during the 2017 survey	Unknown if disturbed by Project	Unevaluated

Source: 2015 SCCIC Records Search, 2016 USFS Records Search, and 2017 Field Survey
Key:
APE = Area of Potential Effects
CRHR = California Register of Historic Resources
NRHP = National Register of Historic Places
SCCIC = South Central Coastal Information Center
SHPO = State Historic Preservation Officer
USFS = U.S. Department of Agriculture, Forest Service

Isolated Artifacts

As shown in Table 5.8-4, eight isolated artifacts were documented during the field surveys. These include three survey markers installed by DWR, dated 1959, 1967, and

1968; and one survey marker installed by the National Geodetic Survey as part of its U.S. Coast and Geodetic Survey, dated 1952. Two isolates represent historic period ranching or residential activities (i.e., barbed wire fencing and a possible water pump foundation), one isolated find is a historic period coffee can, and one isolate is a prehistoric period tested cobble.

Table 5.8-4. Isolated Artifacts Within the APE

Isolate Number	Description
DC-HDR-ISO-001	1967 survey marker placed by DWR
DC-HDR-ISO-002	1952 U.S. Coast and Geodetic Survey marker installed into a granite boulder
DC-HDR-ISO-003	1968 survey marker placed by DWR
DC-HDR-ISO-004	Pink quartzite tested cobble
DC-HDR-ISO-005	Section of barbed-wire fencing, consisting of two burnt wooden posts and downed segment of barbed wire
DC-HDR-ISO-006	Concrete footings used to support a possible windmill or water pump feature
DC-HDR-ISO-007	1959 survey benchmark placed by DWR
DC-HDR-ISO-008	Crushed coffee can

Source: 2017 Field Survey
Key:
DWR = California Department of Water Resources

Historical Built Environment Resources

In accordance with the *Cultural Resources Study Approach*, the built environment survey included a field inspection and documentation of buildings and structures 45 years in age or older located within the APE. This resulted in the identification and recording of 12 locations within the APE, consisting of groupings of individual buildings, structures, or objects designed and constructed to operate as a unit. These resources have been grouped into four categories: Devil Canyon Project Resources (nine), Devil Canyon Recreation Resources (one), Cedar Springs Community Resources (one), and Infrastructure Resources (one), as listed in Table 5.8-5.

Archival research aided in determining the associations between the individual features and the 12 built resources, and those grouped together were recorded collectively on the same DPR cultural resources site records. The additional acquisition of construction drawings further aided in these determinations, especially for the outlet structure for which the drawings revealed additional features below ground, and the multiple individual features of the Sawpit Canyon recreation complex. Cedar Springs Dam (P-36-25233) is the only previously recorded individual feature and is a component of DWR's proposed resources.

NRHP evaluation of the historical built environment resources resulted in recommendations of three of the resources as eligible and nine resources as not eligible for listing on the NRHP (Table 5.8-5).

Table 5.8-5 Summary of Historical Built Environment Resources in APE

Category and Building/Structure Designation	Recommended NRHP Eligible[1]
Devil Canyon Project Resources	
Cedar Springs Dam	Yes
Silverwood Lake Reservoir	Yes
Cedar Springs Dam Spillway	Yes
Cedar Springs Dam Low-Level Outlet Works	No
San Bernardino Tunnel Intake	No
San Bernardino Tunnel Surge Chamber	No
Devil Canyon Powerplant Penstocks	No
Devil Canyon Powerplant Facility	No
Devil Canyon Water Treatment Plant & Monitoring Station	No
Devil Canyon Recreation Resources	
Sawpit Canyon Marina, Sawpit Canyon Boat Launch, and Sawpit Canyon Day Use Area	No
Cedar Springs Community Resources	
Cedar Springs Historical Apple Orchard	No
Infrastructure Resources	
Old Highway 173 Bridge	No

Note:
[1]Pending consultation and SHPO concurrence
Key:
APE = Area of Potential Effects
NRHP = National Register of Historic Places
SHPO = State Historic Preservation Officer

This study also identified 10 additional built environment facilities within the Project APE that are excluded from the study. All 10 facilities were located within the Project APE, but are not considered to be Project related as they are not used in any way in support of the Project or its hydropower generation, and are avoided by Project O&M (Table 5.8-6).

Table 5.8-6. Historical Built Environment Resources Not Considered in the Study

Facility Name	Description
Mojave Siphon Inlet Works at Silverwood Lake	Transition structure, chute, energy dissipation structure, and associated riprap; part of the conveyance from the Mojave Siphon, a separate SWP facility
Crestline-Lake Arrowhead Water Agency (CLAWA) Facilities	Water intake, treatment facilities, and distribution facilities of the CLAWA located at the south end of Silverwood Lake
Cleghorn Wastewater Treatment Plant	Collection system and outflow pipeline of the Crestline Sanitation District on the west side of State Highway 138, near the DPR Park Administration Building
DPR Park Administration	DPR Park Administration Building located on the west side of State Highway 138
Silverwood SRA Trails	The entire recreation trail network of the SRA, this also includes a portion of the PCT. The SRA trails are non-Project features maintained and cared for by a separate State agency that will not be affected by DWR Project-related activities. Those portions of the PCT within the APE, but outside the SRA, were documented during the survey and are discussed above in Section 5.8.1.2.1, Archaeological Sites.
State Highway 138	Includes a small section of State Highway 138 that crosses through the APE near its intersection with Cleghorn Road
SCE Transmission Line System	Includes the entire SCE transmission system and previously recorded resources *P-36-10316* and *P-36-24800*, which are both a part of that system
Non-Project Pipelines	Multiple pipelines that connect to the Devil Canyon Afterbay and Devil Canyon Second Afterbay to further distribute water beyond the APE; includes the San Bernardino Pipeline, Santa Ana Pipeline, Azusa Pipeline, Rialto Pipeline, and Inland Feeder, and all related valves turnouts, meters, and connections
Laydown and storage yard	Includes the fenced-in laydown and storage yard at the base of Cedar Springs Dam.
Non-Project distribution line	Includes a 2,600-foot section of powerline that includes 18 poles and provides electricity from a connection point adjacent to Highway 173 to the laydown and storage yard (immediately above). The line continues from the storage yard to the Mojave Siphon Powerplant, a separate SWP facility operating under a separate FERC authorization.

Key:
APE = Area of Potential Effects
CLAWA = Crestline-Lake Arrowhead Water Agency
DPR = California Department of Parks and Recreation
DWR = California Department of Water Resources
FERC = Federal Energy Regulatory Commission
PCT = Pacific Crest National Scenic Trail
SCE = Southern California Edison
SRA = State Recreation Area
SWP = State Water Project

5.8.1.4 Overview of the Tribal Resources Study and Results

DWR augmented existing, relevant, and reasonably available information for tribal resources by conducting a *Tribal Resources Study Approach*. Given the sensitive nature of the information developed as part of the study, a Privileged Study Report will be made available to the tribes, and to FERC, USFS and SHPO, with the agreement of the tribes consistent with non-disclosure agreements. The Privileged information is only summarized in this section.

Potentially Affected Native American Tribes

DWR contacted the Native American Heritage Commission (NAHC) on June 1, 2015 to obtain a list of tribes and individual tribal members who may have an interest in the Project. The NAHC provided the tribal contacts listed in Table 5.8-7 in a letter dated July 17, 2015 (see Lloyd et al. 2019).

In July 2015, all individuals and organizations included on the NAHC list were mailed letters of introduction to the Project and the relicensing process, and questionnaires (Lloyd et al. 2019) to solicit information and concerns about the Project APE. DWR did not encounter other tribes or tribal members outside of the contacts provided by the NAHC who were interested in the Project relicensing. In a letter dated September 30, 2016 (Lloyd et al. 2019), FERC designated DWR as its non-federal representative for day-to-day NHPA Section 106 consultation. FERC cannot delegate its government-to-government responsibility to consult with federally recognized tribes. Through DWR's tribal consultation efforts, the NAHC list was updated to reflect staff changes and current contacts, as provided in Table 5.8-7.

DWR held a Section 106 Kick-off Meeting with tribes, agencies, HDR, SHPO, and FERC on May 15, 2017. The purpose of the meeting was to provide potential consulting parties with details regarding the Project, the scope and schedule of the relicensing, the regulatory drivers for the relicensing, and to discuss the cultural and tribal resources studies. On August 24-25, 2017, DWR hosted a Meet-and-Greet and a site visit with representatives of the San Manuel Band of Mission Indians, the Morongo Band of Mission Indians, HDR, and the relicensing ethnographers (Albion Environmental, Inc.; Statistical Research, Inc.; and Reddy Anthropology Consulting). The purpose of the meeting was to introduce the ethnographers to the tribes and to discuss the tribal and cultural resources studies and coordination. The day after the meeting, DWR showed the ethnographers and tribal representatives around the Project. A log of the NHPA Section 106 consultation conducted to date is included in Appendix F.

Table 5.8-7. Tribal Contacts Provided by the Native American Heritage Commission

Gabrieleno Band of Mission Indians - Kizh Nation Andrew Salas, Chairperson	Gabrielino/Tongva Nation Sam Dunlap, Cultural Resources Director
Gabrielino/Tongva Nation Sandonne Goad, Chairperson	Gabrielino/Tongva San Gabriel Band of Mission Indian Anthony Morales, Chairperson
Morongo Band of Mission Indians Robert Martin, Chairperson	Morongo Band of Mission Indians Ernest H. Siva, Tribal Elder
Morongo Band of Mission Indians Denisa Torres, Cultural Resources Manager	Morongo Band of Mission Indians Travis Armstrong, Tribal Historic Preservation Officer
San Manuel Band of Mission Indians Lee Clauss, Director-CRM Dept.	Morongo Band of Mission Indians Shane Helms, Director
San Fernando Band of Mission Indians John Valenzuela, Chairperson	San Manuel Band of Mission Indians Lynn Valbuena, Chairwoman
Serrano Nation of Mission Indians Goldie Walker, Chairwoman	

Source: NAHC 2015 correspondence and ongoing tribal consultation (Appendix G)

<u>Known Tribal Resources</u>

DWR's June 1, 2015 request to the NAHC for information included a search of their files for a list of any known sacred lands that may be within the APE and a quarter-mile buffer surrounding the APE. Additionally, background research on tribal resources was conducted by DWR between June 23, 2015 and July 29, 2015. This included the SCCIC records search detailed above in Section 5.8.1.2 and archival research conducted at the San Bernardino County Library and the U.S. Department of the Interior, Bureau of Indian Affairs' GIS database to review any references or data relevant to the history, tribal occupation, tribal lands, or other ITAs within the APE and the quarter-mile buffer surrounding the existing larger Project boundary.

As requested by the SMBMI in a letter dated December 29, 2016 (Lerch and Swope 2019) the study included efforts to identify botanical resources of importance and use to the tribe if located within the APE. SMBMI provided DWR with the confidential "*Non-Exhaustive List of Plants of Cultural Importance to Serrano Peoples*." All plant species on the list were also included in the species lists for the *Botanical Resources Study Approach* and were documented to the level specified in that plan. Moreover, many of the plants included on the cultural plant list were also included in the

Special-Status Terrestrial Wildlife - California Wildlife Habitat Relationships Study Approach field verification, and the data gathered on their locations within the APE were collected in accordance with the methods of that plan. The results of the plant identification efforts from these studies were coordinated with the ethnographers for the *Tribal Resources Study Approach*.

The *Tribal Resources Study Approach* was initiated in late 2017 and early 2018. DWR's ethnographers conducted additional background research to review tribal and USFS library sources, the ethnographers' private libraries, and other potential online and repository reference materials. Information relating to Native American residence and activity within the Project APE was sought both in published volumes and available archival documents. The information from these sources were developed to provide a background context within which to interpret site-specific data. In addition to the literature search, the study investigation included consultation and cooperative efforts with the tribe(s) to identify culturally sensitive and valuable locations. These locations and the information pertaining to them, and the approaches to identification, documentation and evaluation of them, are outlined in Bulletin 38 (Parker and King 1998), which guided the study.

Following finalization of Non-Disclosure and Confidentiality Agreements between DWR and the tribes, the ethnographers contacted the Tribal Historic Preservation Officer and tribal cultural resources management directors, as appropriate, to find individuals interested in and wishing to be interviewed for the study.

The NAHC's search of its files indicated there are no known sacred lands listed within the existing Project APE. Moreover, 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, agreements between tribes and land-managing agencies, or other potential tribal resources, as defined above.

Two previously recorded archaeological sites, CA-SBR-501 and CA-SBR-3033/H, were identified in the archival research and are important locations for inclusion in any interview discussions. However, CA-SBR-501 is under Silverwood Lake and was not accessible at the time of the cultural and tribal resources studies, and no evidence of CA-SBR-3033/H, the Mojave Trail, was found during either study.

Plant species of importance to the Serrano were identified during DWR's relicensing botanical studies. This information is considered confidential and Privileged and is not presented herein. The discussion of plants identified within the APE that are of importance to the tribe(s) is included in the Privileged technical study report that will be provided to FERC, SHPO, and the USFS, SBNF with tribal agreement consistent with existing non-disclosure agreements.

One tribal interview was conducted on March 12, 2018, with a Serrano/Cahuilla elder and Tribal Historian for the Morongo Band of Mission Indians (MBMI). No tribal resources or TCPs were identified during the interview, and no additional interviews are expected from Morongo Band of Mission Indians tribal members. An invitation was extended to the SMBMI's Cultural Advisor Working Group to conduct interviews with interested tribal members. No tribal members have requested interviews and no further interviews are expected from the MBMI or SMBMI.

5.8.2 Effects of DWR's Proposal

This section discusses the potential effects of DWR's Proposal on cultural and tribal resources, as described in Section 2.0. DWR includes in DWR's Proposal one measure, CR1, specifically related to cultural resources. Measure CR1 would implement the Historic Properties Management Plan (HPMP), which is included in the privileged Appendix A and will be provided to interested agencies and tribes for review and comment. The privileged HPMP contains sensitive confidential information and will be filed separately with FERC as privileged and provided only to those on a need to know basis.

As shown in Tables 5.8-1, 5.8-2, and 5.8-3, Project effects were observed at 10 archaeological sites in the APE. Two were previously evaluated as not eligible, with SHPO concurrence, and five are recommended as not eligible, pending SHPO concurrence. Three sites with Project effects are unevaluated and will be avoided by Project O&M. If it is determined that avoidance of these resources is not possible, DWR will follow the measures included in the HPMP to address unevaluated or NRHP-eligible cultural resources experiencing effects, including consultation with tribes, agencies, and SHPO, as appropriate.

The proposed changes to the FERC boundary would result in the exclusion of four archaeological sites currently located within the existing FERC boundary (Table 5.8-8). Three of these sites are located on lands managed by SBNF. Archaeological site P-36-3128 is an unevaluated prehistoric lithic processing station, P-36-14904 is an unevaluated prehistoric litchic scatter and midden site, and multicomponent site P-36-4366 is an unevaluated prehistoric lithic scatter and historical debris. Because the three sites will continue to be managed by SBNF, their exclusion from the Project boundary will not result in an adverse effect on historic properties.

Table 5.8-8. Archaeological Sites Omitted from the Proposed Project Boundary and APE

Primary No.	Trinomial	SBNF No.	Description	Landowner	NRHP and CRHR Eligibility
P-36-3128	CA-SBR-3128	05-12-51-70	Prehistoric lithic processing station	SBNF	Unevaluated
P-36-4366	CA-SBR-4366/H	05-12-51-93	Multicomponent lithic scatter and historical debris	SBNF	Unevaluated
P-36-14904	CA-SBR-13142	05-12-51-246	Prehistoric lithic scatter and midden	SBNF	Unevaluated
P-36-24108	CA-SBR-15293H	None	Historical road	State	Unevaluated

Source: SCCIC, 2018 Field Survey
Key:
Lithic = Stone (Modified)
BRM = Bedrock Mortars
CRHR = California Register of Historic Resources
NRHP = National Register of Historic Places
SCCIC = Southern Central California Information Center
SBNF = San Bernardino National Forest

The other site is P-36-24108, an unevaluated historical road located on lands managed by the State. The site will continue to be managed by the State and, therefore, its exclusion from the proposed Project boundary will not result in an adverse effect on a historic property.

The historical built environment resources recommended as eligible for listing on the NRHP are currently in use as intended at the time of their construction, and there are no Project activities that are anticipated to have any specific effects on the historical built environment resources within the APE.

No ITAs or TCPs have been identified within the APE. Plant species of importance and use to the tribe(s) have been identified.

FERC typically completes NHPA Section 106 by entering into a Programmatic Agreement or Memorandum of Agreement with the Advisory Council on Historic Preservation (ACHP) and the SHPO that typically require the license applicant to develop and implement an HPMP that considers and manages effects on historic properties throughout the term of the license.

As stated in 36 CFR § 800.5(a)(1), the regulations guiding compliance with NHPA Section 106, an adverse effect to an historic property:

> …is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the

> property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative.

The Project's HPMP prescribes specific actions and processes to manage historic properties within the Project APE. If, during the course of a new license issued by FERC for the proposed Project, historic properties are found to be adversely affected by Project O&M or new construction, the HPMP would be followed to resolve adverse effects pursuant to 36 CFR § 800.6, which requires consultation with potentially affected tribes, the USFS, and SHPO.

5.8.3 Unavoidable Adverse Effects

With implementation of DWR's HPMP no adverse effects to cultural resources are anticipated to occur.

5.9 SOCIOECONOMICS

This section provides information about the socioeconomic resources and population characteristics in the Project vicinity. This section is divided into three main subsections. Section 5.9.1 describes existing conditions in the Project vicinity, and addresses population; race and ethnicity; education; housing and household characteristics; labor force and income; and industries in the Project region. This section also discusses Project-specific socioeconomic information, including staffing and annual fees paid by DWR to local entities for the Silverwood Lake SRA. Section 5.9.2 discusses the effects of the Project on socioeconomic resources, and Section 5.9.1.3 addresses any unavoidable socioeconomic adverse effects.

DWR did not conduct any studies related to socioeconomics; existing, relevant, and reasonably available information is sufficient to determine the potential effects of the Project on socioeconomics and to inform requirements in the new license.

5.9.1 Existing Environment

5.9.1.1 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 at Silverwood Lake is accessible from the north by State Highway 138 via Interstate 5 at Cajon Junction or from the south by State Highway 138 via State Highway 18 through Crestline and Muscoy. The afterbay and second afterbay at the south end of the Project area are located in Muscoy near Interstate 215. Cajon Junction, Crestline, and Muscoy are census designated places (CDP). Of the 2,070.0 acres within the proposed Project boundary, 132.0 acres are NFS lands managed by USFS as part of the SBNF. Only the surge chamber and the uppermost section of the Devil Canyon Powerplant Penstocks are located on NFS lands. San Bernardino County, located in southeastern California, comprises more than 20,057 square miles and is the largest county geographically in the United States.

Population

Size and Density

The population of San Bernardino County increased 19.1 percent between 2000 and 2010, from approximately 1.7 million people to more than 2.0 million people. California Department of Finance projections indicate that population growth in San Bernardino County is expected to continue increasing to more than 2.5 million people by 2030 (Table 5.9-1). The county's overall population density is largely influenced by its large land area and is projected to reach 125 persons per square mile of land by 2030. The county contains vast rural areas with sparse populations, and urban areas where population densities are much higher. Populations for populated places (cities and CDPs) within or near the proposed Project boundary are presented below.

Table 5.9-1. 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: U.S. Census Bureau 2000; U.S. Census Bureau 2010; California Department of Finance 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. A small portion of the proposed Project boundary, in the vicinity of the Devil Canyon Powerplant, is located within the northern portion 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, and has a population of 90,173. The CDP of Lake Arrowhead is located along the State Highway 18 corridor east of the proposed Project boundary and is a popular visitor destination. The City of Fontana, located southwest of the proposed Project boundary, has the densest population of the urban communities in the Project vicinity. Table 5.9-2 provides populations and population densities for cities and CDPs with populations greater than 5,000 people within 15 miles of the proposed Project boundary.

Age

Consistent with State trends, a shift in the age distribution of residents can be observed in San Bernardino County. As shown in Table 5.9-3, the greatest number of individuals in San Bernardino County, 62.5 percent, fall 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 5.9-2. Selected Cities and Census Designated Places with a Population of 10,000 or More Within 10 Miles of the Proposed Project Boundary, 2010

Cities and Census Designated Places	Population	Proportion of San Bernardino County (percent)	Population Density (people per square mile)
Incorporated Areas			
San Bernardino	209,924	10.3	3,546
Hesperia	90,173	4.4	1,234
Rialto	99,171	4.9	4,437
Fontana	196,069	9.6	4,621
Highland	53,104	2.6	2,832
Colton	52,154	2.6	3,403
Rancho Cucamonga	165,269	8.1	4,147
Victorville	115,903	5.7	1,584
Redlands	68,747	3.4	1,903
Loma Linda	23,261	1.1	3,095
Grand Terrace	12,040	0.6	3,438
Apple Valley	69,135	3.4	975
Unincorporated Areas			
Crestline	10,770	0.5	778
Muscoy	10,644	0.5	3,387
Lake Arrowhead	12,424	0.6	701
Phelan	14,304	0.7	238
Bloomington	23,851	1.2	3,984

Source: U.S. Census Bureau 2010
Key:
CDP = census designated place

Table 5.9-3. San Bernardino County Age Groups, 2014

Population: Age	San Bernardino County		California	
	2014 (percent of population)	2010 through 2014 (percent change)	2014 (percent of population)	2010 through 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: U.S. Census Bureau 2015

Race and Ethnicity

The racial and ethnic makeup of San Bernardino County compared to the Statewide makeup is presented in Table 5.9-4. 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 5.9-4. Regional Race and Ethnicity, 2014

Race and Ethnicity	San Bernardino County		California	
	Population (percent)	Percent Change (2010 through 2014)	Population (percent)	Percent Change (2010 through 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: U.S. Census Bureau 2015

Education

Education levels in San Bernardino County and the State are presented in Table 5.9-5. 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 (U.S. Census Bureau 2015).

Table 5.9-5. 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: U.S. Census Bureau 2015

Housing and Household Characteristics

Table 5.9-6 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 5.9-6. 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: U.S. Census Bureau 2015

Labor Force and Income

Labor force and income characteristics for San Bernardino County and the State are provided in Table 5.9-7. 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 percentage of persons below poverty in San Bernardino County, as estimated by the U.S. Census Bureau in 2014, exceeded the percentage of persons below the statewide poverty level.

Industry

San Bernardino County includes goods-producing, service-providing, and government industry sectors. Table 5.9-8 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 5.9-7. 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: U.S. 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.

Table 5.9-8. 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

Approximately 126.0 acres within the proposed Project boundary are located on NFS lands managed by the SBNF. The entire SBNF encompasses 679,380.0 acres of land and includes a range of facilities, including nine picnic areas, 25 trailheads, 46 campgrounds, and the capacity to accommodate 4,350 campers (USFS 2005). The SBNF is divided into three ranger districts. The SBNF has a total annual budget of approximately $27 million (USFS 2005, 2018). In 2014, the SBNF supported 1,910 jobs with an approximate annual labor income for wage earners and business sole proprietors of $76,700,000 (USFS 2016).

The PCT passes through the SBNF from the Santa Rosa Mountains in the south to the San Gabriel Mountains in the west. Approximately 115 miles of the PCT traverses the San Bernardino County area.

Due to the forested and natural setting of most of the SBNF, Silverwood Lake SRA, and San Bernardino County, firefighters and law enforcement resources comprise a large portion of the staff and volunteer resources in the region due to potential wildfire risks. In the SBNF alone there are more than 90,000 residential and commercial structures worth approximately $10 billion, and historically the SBNF is one of the most wildfire prone forests in the country (USFS 2005). Management of wildfires in the region are under the joint jurisdiction of USFS and CalFire, with additional support from local agencies, such as the San Bernardino County Fire Protection District.

There are also numerous public and private roads located within and adjacent to the Project area. The public roads are largely maintained by Caltrans District 8, San Bernardino. The Caltrans 2018/2019 budget for transportation includes $13.6 billion (Caltrans 2018).

Proposed Development

The proposed Tapestry development that will be located just north of Silverwood Lake in Hesperia is expected to add 15,663 dwelling units by 2050. While it is a phased development dependent upon the success of its sales, at build-out the development could increase the population of Hesperia by one-third. Hesperia is a high desert bedroom community that includes over 50,000 daily commuters to the Greater Los Angeles and San Bernardino metropolitan areas. Tapestry Development will put commuters 15 to 20 minutes closer to these metropolitan areas than current high desert housing tracts. The development will be built from north to south, with the areas closest to Hesperia being constructed first. The Tapestry development will provide a 60 percent increase in funding for local schools in the future, and a total of 387.4 additional acres of parks and 94.2 acres of open spaces with trails, traditional parks, and a sports park. After 200 homes are built, a traffic impact analysis will be required. A new Ranchero exit off of Interstate 15 is proposed and infrastructure improvements to Ranchero Road are included in the Specific Plan. Highway 173 will be widened, but only in later phases, when it will be upgraded to four lanes. At the time this document was prepared, development agreements for Tapestry had not been finalized.

5.9.1.2 Project-Specific Socioeconomic Information

As part of the Project, Silverwood Lake SRA contributes to the national and local economies. Revenues and expenditures for Silverwood Lake SRA are summarized below. There are some portions of the Silverwood Lake SRA that are outside of the proposed Project boundary; however, these areas mostly consist of access roads, trails, and open space. There is no recreation use or public access at the Devil Canyon Powerplant and Afterbays.

Silverwood Lake State Recreation Area

Silverwood Lake SRA attendance totaled 365,224 (281,834 day use and 83,390 night/camping use) in fiscal year 2015/2016 (DWR 2016). The Silverwood Lake SRA is currently managed by DPR Inland Empire District, in accordance with the California Davis-Dolwig Act of 1961. This statute designates DPR as the agency with the responsibility to design, construct, operate, and maintain recreation facilities associated with the SWP, which includes the Silverwood Lake SRA. Fee collection, daily operations, and routine maintenance activities are performed by DPR. Recreation revenue sources at Silverwood Lake SRA consist of entrance fees, boat launching fees, camping fees, annual pass sales, special event fees, and concessions. Recreation revenues totaled $1,562,880 in fiscal year 2015/2016, as shown in Table 5.9-9. DWR receives no revenues from recreation fees. The direct operating expenses budget for

DPR in 2015 was $3,663,361, as shown in Table 5.9-9. In total, revenue was 42.7 percent of the direct expenditures budget in fiscal year.

Table 5.9-9. Recreation Revenue and Operating Expenditures Budget for Silverwood Lake SRA, Fiscal Year 2015/2016

Revenue/Expenditures	Dollars ($)
Revenue	
User fees (day use, boat launch, camping, annual passes, etc.)	1,513,363
Concessions	49,417
Total Revenue	**1,562,880**
Direct Expenditures Budget	
Staffing	**2,314,372**
Operating expenses	609,738
Parks projects	203,965
Encumbrances	535,286
Total Direct Expenditures Budget	**3,663,361**

Source: DPR 2016
Note: Total revenue includes $100 miscellaneous revenue not included in user fees or concessions.

Fee revenues from all California State parks are deposited into the State Park and Recreation fund. Each year, the Inland Empire District (formerly the Tehachapi District in fiscal year 2015/2016), receives an allocation to operate Silverwood Lake SRA from the State Park and Recreation Fund. The funding allocation covers permanent and seasonal staff, operations and equipment expenses, and maintenance projects. Capital improvements are funded by DPR through its Capital Outlay Projects Fund (DWR 2015/2016).

FERC License Fees

FERC collects annual administrative fees from license holders based on the magnitude of power generation at the facility. FERC has identified an annual charge of $1,619,328 for P-2426 in 2018, the maximum annual fee amount (FERC 2018). It's anticipated fee amounts will be calculated for P-14797 and re-evaluated for P-2426 upon splitting of the license after relicensing is complete.

5.9.2 Effects of DWR's Proposal

This section discusses the potential socioeconomic effects of DWR's Proposal, as described in Section 5.9. DWR has not proposed any measures related to socioeconomics because DWR's Proposal would have less than significant adverse effects on socioeconomics.

The change to the proposed Project boundary would not change existing Project facilities, operations, or maintenance, nor would there be changes to recreation at Silverwood Lake SRA, Project power generation, or local water deliveries. Ongoing fee revenues from the Silverwood Lake SRA would be deposited into the State Park and Recreation fund. Patrons of the Silverwood Lake SRA would also spend money at other establishments locally and regionally (e.g., for food, travel, and lodging). The Project would continue to provide employment (i.e., operation of the facilities, Silverwood Lake SRA, and management of the Project by DWR).

With growth in regional population and particularly developments like Tapestry in Hesperia, there could be increased demand for destinations like Silverwood Lake for water-based recreation activities and camping. While this would result in collection of additional fees by DPR, it would also result in increased use of facilities and operating expenses and could increase operations. Additionally, the influx of new residents over time would increase spending at other businesses in the region, as well as increase the demand for local resources such as fire protection and law enforcement. This increase in demand for resources could affect the ability of resources to serve the public. However, these new effects are attributed to increased demand for resources from the Tapestry project, and not DWR’s Project. It is expected that potential effects of the Tapestry project would be evaluated and coordinated with local resource agencies, and DWR/DPR would be engaged as appropriate to coordinate resources. Therefore, the Project would have a less than significant effect with regard to socioeconomic conditions.

Continued O&M of the Project and Project-related recreation would require continued commitment of local law enforcement and fire protection resources. There have been few, if any, Project-related wildfires; however, should a fire occur, local fire response services would be needed. Project facilities would be used to provide water for fighting fires. The frequency or level of need for local fire response services would not change under DWR’s Proposal as compared to the existing Project, because no changes are proposed that would alleviate the risk of project-related fires.

5.9.3 Unavoidable Adverse Effects

The Project is not expected to result in unavoidable effects with regard to socioeconomic conditions.

5.10 AIR QUALITY

This section discusses air quality in the Project region. Existing conditions are discussed in Section 5.10.1, the effects of DWR's Proposal on air quality, including effects associated with GHG emissions, are described in Section 5.10.2, and unavoidable adverse effects (if any) are described in Section 5.10.3. DWR did not conduct any studies related to air quality for the Project; existing, relevant, and reasonably available information is sufficient to determine the potential effects of the Project on air quality and to inform any relevant requirements in the new license.

5.10.1 Existing Environment

This section begins with a discussion of regulatory context, and then describes existing air quality conditions.

5.10.1.1 Regulatory Context

The California Air Resources Board (CARB), as part of the 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 (O3), particulate matter, and nitrogen dioxide (NO2), 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. Typical sources of air emissions include commercial and industrial operations, fugitive dust, vehicles and trucks, aircraft, boats, trains, and natural sources such as biogenic and geogenic hydrocarbons and wildfires.

The USFS is responsible for assessing and preventing injury to forest trees and other air quality–related values in wilderness areas, per the Clean Air Act of 1970, and Clean Air Act Amendments (1977 and 1990). Natural resource areas, such as national wilderness areas, were prioritized for protection. Class 1 wilderness areas, characterized by specific areal and formal designation criteria, were afforded the greatest degree of air quality protection. In particular, the harmful effects of ozone on western yellow pines (i.e., Ponderosa [*Pinus ponderosa*] and Jeffrey [*Pinus jeffreyi*] pines) are still considered by federal land managers to be a regional-scale ecological stress to air quality-related values in wilderness areas in California (Peterson et al. 1993). Information on the effects of ozone on ponderosa and Jeffrey pines is also considered by CARB staff when reevaluating the welfare effects component of existing State ambient air quality standards (Stromberg et al. 1987).

Federal land managers review applications for new and modified sources of air pollutants that may affect their administrative domain, including proposed sources within 62 miles of a wilderness area (Takemoto and Procter 1996). Seven Class 1 wilderness areas occur within the Project region; these areas are listed below with their respective distances from the Project:

- Cucamonga (14 miles)

- Sheep Mountain (19 miles)
- San Gorgonio (23 miles)
- Pleasant View Ridge (28 miles)
- San Gabriel (32 miles)
- Bighorn Mountain (33 miles)
- Magic Mountain (36 miles)

To reduce harmful exposure to air pollutants, the federal Clean Air Act requires the EPA to set outdoor air quality standards for the United States 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 O3, particulate matter, CO, NO2, sulfur dioxide and lead. California and federal AAQS for criteria pollutants are presented in Table 5.10-1.

Table 5.10-1. 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 µg/m^3)	Ultraviolet Photometry	--	Same as Primary Standard	Ultraviolet Photometry
	8 Hour	0.070 ppm (137 µg/m^3)		0.070 ppm (137 µg/m^3)		
Respirable Particulate Matter (PM10)[9]	24 Hour	50 µg/m^3	Gravimetric or Beta Attenuation	150 µg/m^3	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	20 µg/m^3		--		
Fine Particulate Matter (PM2.5)[9]	24 Hour	--	--	35 µg/m^3	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	12 µg/m^3	Gravimetric or Beta Attenuation	12.0 µg/m^3	15 µg/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 µg/m^3)	Gas Phase Chemiluminescence	100 ppb (188 µg/m^3)	--	Gas Phase Chemiluminescence
	Annual Arithmetic Mean	0.030 ppm (57 µg/m^3)		0.053 ppm (100 µg/m^3)	Same as Primary Standard	
Sulfur Dioxide (SO_2)[11]	1 Hour	0.25 ppm (655 µg/m^3)	Ultraviolet Fluorescence	75 ppb (196 µg/m^3)	--	Ultraviolet Fluorescence; Spectrophotometry (Pararosaniline Method)
	3 Hour	--		--	0.5 ppm (1,300 µg/m^3)	
	24 Hour	0.04 ppm (105 µg/m^3)		0.14 ppm (for certain areas)[11]	--	
	Annual Arithmetic Mean	--		0.030 ppm (for certain areas)[11]	--	
Lead[12,13]	30 Day Average	1.5 µg/m^3	Atomic Absorption	---	--	High Volume Sampler and Atomic Absorption
	Calendar Quarter	--		1.5 µg/m^3 (for certain areas)[12]	Same as Primary Standard	
	Rolling 3-Month Average	--		0.15 µg/m^3		
Visibility Reducing Particles[14]	8 Hour	See footnote 14	Beta Attenuation and Transmittance through Filter Tape	No National Standards		
Sulfates	24 Hour	25 µg/m^3	Ion Chromatography			
Hydrogen Sulfide	1 Hour	0.03 ppm (42 µg/m^3)	Ultraviolet Fluorescence			
Vinyl Chloride[12]	24 Hour	0.01 ppm (26 µg/m^3)	Gas Chromatography			

Source: CARB 2016
Notes (CARB 2016):
[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 µg/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 µg/m^3 to 12.0 µg/m^3. The existing national 24 hour PM2.5 standards (primary and secondary) were retained at 35 µg/m^3, as was the annual secondary standard of 15 µg/m^3. The existing 24-hour PM10 standards (primary and secondary) of 150 µg/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 98th 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. In this case, the national standard of 100 ppb is identical to 0.100 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 99th 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 µg/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.
Key:
µg = microgram; m^3 = cubic meter; mg = milligram; ppb = part per billion; ppm = part per million; O_3 = ozone

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Both the State 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 and help determine whether Project emissions would be considered significant under NEPA and CEQA. 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.

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

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

5.10.1.2 Existing Air Quality

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 2014). Table 5.10-2 shows the current federal and State attainment status for each pollutant in San Bernardino County.

The topography and meteorology of San Bernardino County and the San Bernardino Mountains are important factors in the environmental effects of air quality in the Project vicinity. Dispersion of high pollutant concentrations is influenced by the mountainous topography with wind flows directed around mountains in some areas and can result in air stagnation in downwind basins.

The Project is situated within geographic areas that are currently designated as nonattainment for 8-hour ozone, NO2 (federal only), Fine Particulate Matter (PM2.5), and Respirable Particulate Matter (PM10). Project O&M and the use of recreation facilities generate some minor amount of air pollutant emissions, mainly in the form of automobile emissions, motorized water craft emissions, and campfires during recreation facility use. These emissions are locally minor and mostly seasonal.

Table 5.10-2. Attainment Status for Air Quality Pollutants in San Bernardino County

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 2014; 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.

5.10.2 Effects of DWR's Proposal

This section discusses the potential air quality effects of DWR's Proposal. DWR has not proposed any measures related to air quality because DWR's Proposal would have a less than significant adverse effect on air quality.

No substantial change in emissions are expected to occur for the term of the new license. O&M under DWR's Proposal would result in continuing the same air pollutant emissions as the existing Project currently generates. DWR's Proposal does not include any new permanent sources of air pollutants. It is conceivable that some short-term Project-related activities could require DWR to obtain activity-specific permits and approvals, which might include air quality permits. Adherence to the requirements of such permits would minimize air quality effects. Operations of DWR's Proposal would not result in a net increase of any criteria pollutant, including ozone. Therefore, DWR's Proposal would have a less than significant adverse effect on air quality.

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 five 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. With regard to DWR's Proposal, the Project reservoirs have been in existence for over 50 years (Silverwood Lake began operation in 1967); therefore, environmental effects associated with GHG emissions are expected to be less than significant.

A common approach in analyzing the GHG-generating effects of a non-fossil fuel energy project is to compare the GHG emissions of the proposed facility with those of a fossil fuel energy facility that would supply a similar amount of energy as the proposed facility. Should the State be deprived of the use of the Project, the economically rational and technically logical replacement would be gas turbine generation. However, use of additional gas-fired generation would be inconsistent with the Department's Climate Action Plan and the State's greenhouse gas reduction targets and renewable portfolio standard requirements (Senate Bill 350 [2015], Senate Bill 100 [2018]). To be true to these plans and mandates, the State likely would need to rely on wind and/or solar generation. Hydropower is considered a more stable and reliable source of energy than intermittent renewable sources, like solar and wind. Thus, if the State cannot continue to rely on the Project, it will have to replace the Project's output with more expensive, less reliable forms of zero emission and renewable resource generation.

5.10.3 Unavoidable Adverse Effects

The use of Project facilities will continue to generate emissions, mostly through vehicular use; however, the effects would be local and minor. Project O&M and the use of recreation facilities will continue to generate some minor amount of air pollutant emissions, mainly in the form of automobile emissions, motorized water craft emissions, and campfires during recreation facility use. Some short-term Project-related activities could require DWR to obtain activity-specific permits and approvals, which might include air quality permits. Adherence to the requirements of such permits would minimize air quality effects. Operations of DWR's Proposal would not result in a net increase of any criteria pollutant, including ozone. DWR's Proposal would not create any significant short- or long-term unavoidable adverse effects related to air quality.

5.11 NOISE

This section discusses noise in the Project region. Existing conditions are discussed in Section 5.11.1, the effects of DWR's Proposal are described in Section 5.11.2, and any unavoidable adverse effects are described in Section 5.11.3.

DWR did not conduct any studies related to noise for the Project; existing, relevant, and reasonably available information is sufficient to determine the potential effects of the Project on noise and to inform requirements in the new license.

5.11.1 Existing Environment

This section includes a background discussion of how noise is generally defined, the existing regulatory context related to noise, and the existing sources of noise associated with O&M of DWR's Proposal.

5.11.1.1 Background Information

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

In considering the first of these factors, it is important to note that individuals have different sensitivities 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 L90 is the sound level exceeded for 90 percent of the measurement period and is commonly used to represent background sound levels. The L10 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.

5.11.1.2 Regulatory Context

For the State of California, noise intensity is 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 5.11-1 summarizes San Bernardino County's noise standards.

Table 5.11-1. 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

5.11.1.3 Existing Noise

The vast majority of the Project is located in remote areas. Two Project areas generate somewhat continuous sources of noise: Devil Canyon Powerplant and Silverwood Lake.

Noise generated at the Devil Canyon Powerplant is primarily caused by operation of the power generating units and general maintenance activities. The powerhouse encloses and baffles noise generated by the power units and interior maintenance activities, substantially lessening noise levels detectable from outside the powerhouse. O&M activities outside the powerhouse are typically short-term and don't generate substantial levels of noise. Noise generated by DWR vehicles used for O&M near the powerplant blends with the existing traffic noise of the local area. The nearest residences and other sensitive noise receptors are located approximately 0.5 mile from the powerplant. For these reasons, noise generated by the Devil Canyon Powerplant is not a substantial component of the local noise environment.

Project noise at Silverwood Lake is typically generated by recreation activities, such as picnicking and swimming, with higher noise levels generated by motorized watercraft. Noise caused by land vehicles used by visitors to access the lake is also audible. Silverwood Lake SRA is located in a remote area, with few nearby residences or other sensitive receptors. Therefore, recreation noise is most noticeable to SRA visitors who expect to hear such noise. Periodic maintenance activities at Cedar Springs Dam, the San Bernardino Tunnel Intake, and the SRA can also result in some noise; but these maintenance activities are usually very short in duration and occur in a relatively remote location.

5.11.2 Effects of DWR's Proposal

This section discusses the potential noise effects of DWR's Proposal. DWR has not proposed any measures related to noise because DWR's Proposal would have a less than significant adverse effect on noise.

DWR's Proposal would result in continuation of the current noise generated by O&M and recreation activities for the term of the new license. O&M activities occur in remote areas and often within enclosed structures (e.g., the powerplant). Noise from outdoor maintenance activities would be intermittent and minor, like existing conditions. Noise generated by recreation activities at Silverwood Lake also occurs in a remote location, and is expected by the recreating public. Therefore, DWR's Proposal would have a less than significant adverse effect on noise.

5.11.3 Unavoidable Adverse Effects

The effect of DWR's Proposal on the noise environment, given the remote location of the facilities and type of activities anticipated, will be very minor and localized. Therefore, DWR's Proposal is not expected to have any significant unavoidable adverse effects.

DWR considered the following two alternatives:

- No Action Alternative. This is the current operation of the Project under its existing license conditions and operations. Under the No Action Alternative, the inflow to the Project and downstream water demands are the same as they have been historically. Under the No Action Alternative, there are no changes to existing Project facilities or operations. Costs under the No Action Alternative are DWR's best estimate of the costs to operate the Project in the future.

- DWR's Proposal. This is DWR's proposed Project, including DWR's proposed mitigation and enhancement (PM&E) measures, which is described in DWR's license application. Costs under DWR's Proposal are similar to the costs under the No Action Alternative, with the exception of DWR's proposed changes to the PM&E measures.

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