
SOUTH SWP HYDROPOWER FERC PROJECT NO. 2426-227



Updated Study Report

From May 1, 2018 through April 30, 2019

May 2019



**State of California
California Natural Resources Agency
DEPARTMENT OF WATER
RESOURCES
Hydropower License Planning and
Compliance Office**



**Los Angeles
DEPARTMENT OF
WATER AND POWER**

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COMMONLY USED TERMS, ACRONYMS & ABBREVIATIONS

§	Section
%	percent
<	less than
>	greater than
°C	degrees Celsius
A	absence
ABAAS	Architectural Barriers Act Accessibility Standards
ABL	Aquatic Bioassessment Laboratory
ADA	Americans with Disabilities Act
AGS	Annual Grassland
AF	acre-feet
AIS	aquatic invasive species
ANF	Angeles National Forest
APE	Area of Potential Effects
AW	American Whitewater
BAR	Barren
BLM	U.S. Department of the Interior, Bureau of Land Management
BMI	benthic macroinvertebrate
BOP	Blue Oak – Foothill Pine
BOW	Blue Oak Woodland
CalVeg	Classification and Assessment with Landsat of Visible Ecological Groupings
CDEC	California Data Exchange Center
CDFA	California Department of Food and Agriculture
CDFW	California Department of Fish and Wildlife
CFR	Code of Federal Regulations
cfs	cubic feet per second
CI	confidence interval
cm	centimeter
CNDDB	California Natural Diversity Database
COW	Coastal Oak Woodland

CPUE	catch per unit effort, fish per minute
CR	California Rare
CRC	Chamise – Redshank Chaparral
CRLF	California red-legged frog
CSC	Coastal Scrub
CSCI	California Stream Condition Index
CWHR	California Wildlife Habitat Relationships
DLA	Draft Application for New License
DO	dissolved oxygen
DPR	California Department of Parks and Recreation
DRI	Desert Riparian
DS	downstream
DSW	Desert Wash
DWR	California Department of Water Resources
E. coli	Escheriachia coli
eDNA	environmental deoxyribonucleic acid
Elev.	elevation
EPT	Ephemeroptera, Plecoptera, Trichoptera
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
FEW	Fresh Emergent Wetland
fps	feet per second
FL	fork length
FSORAG	Forest Service Outdoor Recreation Accessibility Guidelines
FSTAG	Forest Service Trail Accessibility Guidelines
FYLF	foothill yellow-legged frog
g	gram
GIS	Geographic Information System
GPS	Global Positioning System
H'	Shannon's Diversity Index
HEC DSS	U.S. Army Corps of Engineers' Hydrologic Engineering Center Data Storage System
IHA	Indicators of Hydrologic Alteration

in	inch
ISR	Initial Study Report
JST	Joshua Tree
JUN	Juniper
KOP	Key Observation Point
LADWP	Los Angeles Department of Water and Power
LBVI	least Bell's vireo
Licensees	California Department of Water Resources and Los Angeles Department of Water and Power
LMB	largemouth bass
LPNF	Los Padres National Forest
m	meter
Max	maximum
MCH	Mixed Chaparral
MCP	Montane Chaparral
mg/L	milligrams per liter
MHC	Montane Hardwood – Conifer
MHW	Montane Hardwood
Min	minimum
mL	milliliter
mm	millimeter
MMI	multi-metric index
MPN	most probable number
MQO	Measurement Quality Objectives
MRI	Montane Riparian
NAVD	North American Vertical Datum
ND	non detection
NFS	National Forest System
NMFS	National Marine Fisheries Service
NMWSE	normal maximum water surface elevation
NNIP	non-native invasive plants
No.	Number
NTU	Nephelometric Turbidity Units

NVUM	National Visitor Use Monitoring
NWI	National Wetlands Inventory
O/E	observed-to-expected
OB	observed but not counted or sampled
P	presence
PAD	Pre-Application Document
PAS	Pasture
PFC	Proper Functioning Condition
PGS	Perennial Grassland
PJN	Pinyon – Juniper
Project	South SWP Hydropower, FERC Project Number 2426
Project vicinity	The area within the FERC Project boundary and the area surrounding the Project on the order of a USGS 1:24,000 quadrangle
PSC	prickly sculpin
PSD	proportional size distribution
PSD-P	relative size distribution
PWC	personal water craft
PYM	CDEC Pyramid Lake station
Pyramid reach	18.5-mile-long section of Piru Creek that extends from Pyramid Dam to the NMWSE of Lake Piru
qPCR	quantitative Polymerase Chain Reaction
RBT	rainbow trout
Relicensing Participants	FERC, federal and California State agencies, Native American tribes, local governments, non-governmental organizations, businesses, members of the public, and others interested in the Project relicensing
Relicensing Studies	The studies FERC ordered the Licensees to perform in FERC’s Study Plan Determinations
RM	river mile
RSD	relative stock density
RTK	Real-Time Kinematic
RV	recreational vehicle
RWQCB	Regional Water Quality Control Board
SCORP	California Statewide Outdoor Recreation Plan

SGB	Sagebrush
SIO	Scenic Integrity Objective
SMC	Sierran Mixed Conifer
SOPA	Survey on Public Opinions and Attitudes
SSC	State Species of Concern
ST	survey team
Study Plan Determinations	FERC's June 14, 2017 and September 7, 2018 Study Plan Determinations; when referred to in singular form, it refers to one of the two Study Plan Determinations issued by FERC where specified
Sucker spp.	unknown sucker species
SWAMP	Surface Water Ambient Monitoring Program
SWP	State Water Project
SWFL	southwestern willow flycatcher
TES	Threatened, Endangered, and Sensitive
URB	Urban
US	upstream
U.S.	United States
µS/cm	microsiemens per centimeter
USDA	U.S. Department of Agriculture
USFS	U.S. Department of Agriculture, Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USR	Updated Study Report
UWCD	United Water Conservation District
VCWPD	Ventura County Watershed Protection District
VES	visual encounter survey
VOW	Valley Oak Woodland
VRI	Valley Foothill Riparian
Warne Powerplant	William E. Warne Powerplant
WIFL	willow flycatcher
WSE	water surface elevation
WTM	Wet Meadow

WY water year
YBCU yellow-billed cuckoo

EXECUTIVE SUMMARY

The California Department of Water Resources and the Los Angeles Department of Water and Power (Licensees) are on schedule to complete 22 studies that the Federal Energy Regulatory Commission's (FERC) June 14, 2017, and September 7, 2018, Study Plan Determinations directed the Licensees to perform in support of relicensing the South SWP Hydropower, FERC Project Number 2426.

As of April 30, 2019, the Licensees have completed 16 studies, and have made the results of each completed study available to interested parties by posting on the Licensees' relicensing website (www.south-swp-hydropower-relicensing.com) the FERC-approved study plans, study results, and study data. Five of the remaining studies are nearly complete, with only the gathering data along short (i.e., total of less than 17 miles of the approximately 60 miles) sections of roads left to complete. The sixth study is awaiting completion of tribal interviews. The studies in-progress are:

1. Study 4.1.5, Botanical Resources
2. Study 4.1.6, Non-Native Invasive Plants
3. Study 4.1.8, ESA [Endangered Species Act]-Listed Plants
4. Study 4.1.9, ESA-Listed Riparian Bird Species: Southwestern Willow Flycatcher, Least Bell's Vireo, and Yellow-Billed Cuckoo Riparian Habitat Evaluations
5. Study 4.1.12, Cultural Resources
6. Study 4.1.13, Tribal Resources

For each of these in-progress studies, the Licensees have posted the FERC-approved study plan and currently available study results and data to their relicensing website. Prior to filing with FERC their Draft Application for New License (DLA) in September 2019, the Licensees will complete each of the remaining in-progress studies and will revise the study results and data on the Licensees' relicensing website.

All study results will be included in the Licensees' DLA. While some minor variances to the FERC-approved study plans have occurred, none of the variances has affected the intent of the individual studies.

The Licensees conclude the information developed by the 22 studies, together with other existing, relevant, and reasonably available information that will be included in the Licensees' DLA, is adequate for the Licensees, FERC, and interested parties to assess potential effects of the Licensees' Proposal and to inform requirements for inclusion in the new license. The Licensees do not propose any modifications to the FERC-approved studies or any new studies.

The Licensees have scheduled a meeting on May 29, 2019, in Arcadia, California, with FERC and interested parties to discuss the results and status of the 22 studies, and any proposals to modify the FERC-approved studies or to perform new studies.

The Licensees intend to file with FERC a DLA, rather than a Preliminary Licensing Proposal.

1.0 INTRODUCTION

Pursuant to the Federal Energy Regulatory Commission's (FERC) regulations in Title 18 of the Code of Federal Regulations (CFR), Section (§) 5.15(f), this Updated Study Report (USR) provides the status of the studies being performed by the California Department of Water Resources (DWR) and the Los Angeles Department of Water and Power (LADWP) (Licensees), as directed by FERC's June 14, 2017, and September 7, 2018, Study Plan Determinations (Study Plan Determination[s]) in support of the South SWP Hydropower (FERC Project Number [No.] 2426) (Project) Integrated Licensing Process. The studies are referred to as the "Relicensing Studies." The current license expires on January 31, 2022, and the Licensees intend to file a draft application for a new license (DLA) on or before September 3, 2019, and a final application for new license by January 31, 2020.

This USR is a progress report that covers the period from May 1, 2018, through April 30, 2019. The Licensees' Initial Study Report (ISR), filed with FERC on May 15, 2018, reported on study progress from initiation of the Relicensing Studies through April 30, 2018. In addition, this USR describes any modifications to the Relicensing Studies and any new studies proposed by the Licensees. The Licensees, in collaboration with FERC and interested stakeholders, have scheduled a USR meeting on May 29, 2019, in Arcadia, California to discuss the results and status of the 22 studies, and any proposals to modify the FERC-approved studies or to perform new studies.

1.1 BACKGROUND

The Licensees are in the relicensing process for the Project. In support of these efforts, the Licensees have filed with FERC the following documents:

- Notice of Intent to File an Application for a New License filed August 1, 2016
- Pre-Application Document (PAD) filed August 1, 2016
- Proposed Study Plan filed January 13, 2017
- Revised Study Plan filed May 15, 2017
- ISR filed May 15, 2018
- ISR Meeting Summary filed June 7, 2018
- Response to Comments on ISR and ISR Meeting Summary filed August 8, 2018

FERC issued a National Environmental Policy Act Scoping Document No. 1 for the Project on September 30, 2016; conducted a site visit to the Project vicinity on October 25, 2016; held afternoon and evening Project scoping meetings on October 26, 2016; and issued Scoping Document No. 2 on January 13, 2017.

The Study Plan Determination issued by FERC on June 14, 2017, specified that the ISR for Relicensing Studies must be filed by May 15, 2018. This USR is being filed one year after the ISR was filed.

1.2 DESCRIPTION OF THE EXISTING PROJECT AND LICENSEES' PROPOSAL

The existing Project is a power recovery project and part of a larger water storage and delivery system, the State Water Project (SWP), which is the largest state-owned and operated water supply project of its kind in the United States (U.S.). The SWP provides southern California with many benefits, including affordable water supply, reliable regional clean energy, opportunities to integrate green energy, accessible public recreation, and environmental enhancements.

The existing Project is located at the southern end of the West Branch of the SWP in Los Angeles County, California, between the towns of Castaic and Gorman, and has an installed capacity, excluding one pump-starting unit at the Castaic Powerplant, of 1,349,290 kilowatts. The existing Project, which ranges in elevation from 3,325 feet to 1,130 feet, includes two developments: Warne Power Development and Castaic Power Development. The major features of the Warne Power Development include: (1) Quail Lake and Embankment; (2) Lower Quail Canal; (3) Peace Valley Pipeline and Peace Valley Pipeline Intake Embankment; (4) Gorman Bypass Channel; (5) William E. Warne Powerplant (Warne Powerplant) and Switchyard; and (6) Quail Lake recreational facilities. The major features of the Castaic Power Development include: (1) Pyramid Dam and Lake; (2) Angeles Tunnel and Surge Chamber; (3) Castaic Penstocks; (4) Castaic Powerplant and Switchyard; (5) Elderberry Dam and Forebay; (6) Storm Bypass Channel and Check Dams; (7) Castaic transmission lines; and (8) Pyramid Lake recreation facilities. DWR operates and manages all existing Project facilities upstream of the Angeles Tunnel Surge Chamber. LADWP operates and manages all existing Project facilities downstream and including the Angeles Tunnel Surge Chamber.

The Project's existing FERC boundary includes 6,928.0 acres, of which 2,249.5 acres are National Forest System (NFS) lands managed by the U.S. Department of Agriculture, Forest Service (USFS), as part of the Angeles National Forest; 1,016.2 acres are NFS lands managed by USFS as part of the Los Padres National Forest; and 21.7 acres are lands administered by the U.S. Department of the Interior, Bureau of Land Management.

1.3 RELICENSING STUDIES

Beginning in September 2015, the Licensees began to meet with FERC, federal and California State agencies, Native American tribes, local governments, non-governmental organizations, businesses, members of the public, and others interested in the Project relicensing (Relicensing Participants). These meetings served to familiarize interested parties with the existing Project and its operations, identify potential issues, discuss the relicensing process, and collaboratively develop the study proposals. On May 15, 2017, the Licensees filed with FERC their Revised Study Plan that included 22 studies. The purpose of the Relicensing Studies is to gather pertinent

information for environmental analysis of the Licensees' Proposal and alternatives, for which information would not be otherwise reasonably available. On June 14, 2017, FERC issued its Study Plan Determination that approved without modification 10 of the 22 studies in the Licensees' Revised Study Plan and approved with modification 12 of the studies.

On May 15, 2018, the Licensees filed with FERC their ISR. At that time, 1 Relicensing Study had been completed, 18 studies were in progress, and 3 studies had not yet been initiated. The ISR did not propose any study modifications or new studies. On May 23, 2018, the Licensees held the ISR meeting in Valencia, California.

Subsequent to the ISR meeting, based on discussions during the meeting, the Licensees did the following:

1. On May 30, 2018, the Licensees posted to the Project relicensing website (www.south-swp-hydropower-relicensing.com) environmental deoxyribonucleic acid (eDNA) laboratory results from Study 4.1.3, Pyramid Reach Fish Populations.
2. On June 18, 2018, the Licensees posted to the Project relicensing website an acronym list at the request of John Mudre of FERC.

As additional information was made available on the Project relicensing website, the Licensees sent emails to the Relicensing Participants stating that the additional information relative to the Relicensing Studies had been posted. See Section 2.0 of this USR for details regarding when additional information was made available.

In addition, on June 7, 2018, the Licensees filed with FERC an ISR Meeting Summary. The following parties filed comments in response to the Licensees' ISR and ISR Meeting Summary:

- USFS in a letter dated June 21, 2018;¹
- U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS) in a letter dated June 21, 2018;²
- California Department of Fish and Wildlife (CDFW) in a letter dated July 3, 2018;³ and
- State Water Resources Control Board in a letter dated July 6, 2018.⁴

¹ FERC's ELibrary; Accession Number 20180710-0022.

² FERC's ELibrary; Accession Number 20180622-5007.

³ FERC's ELibrary; Accession Number 20180705-5078 and 20180711-0016 (same letter appears in the docket twice under different Accession Numbers).

⁴ FERC's ELibrary; Accession Number 20180622-5007.

A number of the comments received from Relicensing Participants on the ISR and Meeting Summary did not specifically request modifications to the approved studies and, therefore, were not addressed in FERC's September 7, 2018 Study Plan Determination. The Licensees filed their Response to Comments on the ISR and ISR Meeting Summary on August 8, 2018.

On September 7, 2018, FERC issued its Determination on Requests for Study Modifications and New Studies⁵ that made modifications to the following studies: Quail Lake Fisheries Assessment (Study 4.1.2), Pyramid Reach Fish Populations (Study 4.1.3), Special-Status Aquatic Amphibians and Semi-Aquatic Snakes (Study 4.1.4), Cultural Resources (Study 4.1.12), Tribal Resources (Study 4.1.13), Scenic Integrity (Study 4.1.15), and Water Quality and Temperature (Study 4.1.16). No new studies, as requested by the Relicensing Participants, were approved.

Table 1.3-1 lists the 22 studies included in the Licensees' Revised Study Plan, and the requirements of FERC's Study Plan Determinations for each study. Each FERC-approved study plan is available on the Project relicensing website.

⁵ FERC's ELibrary; Accession Number 20180907-3005.

Table 1.3-1. Studies Proposed by Licensees in the Revised Study Plan and Subsequently Approved or Approved with Modification by FERC

Study Number	Studies Proposed in Licensees' May 15, 2017 Revised Study Plan	FERC's June 14, 2017 Study Plan Determination		FERC's September 7, 2018 Study Plan Determination ¹	
		Study Approved ²	Study Approved with Modification ³	Study Approved with Modifications	Not Applicable to Study ⁴
4.1.1	Aquatic Invasive Species		X		X
4.1.2	Quail Lake Fisheries Assessment		X	X	
4.1.3	Pyramid Reach Fish Populations Study	X		X	
4.1.4	Special-Status Aquatic Amphibians and Semi-Aquatic Snakes	X		X	
4.1.5	Botanical Resources		X		X
4.1.6	Non-Native Invasive Plants		X		X
4.1.7	Special-Status Terrestrial Wildlife Species – California Wildlife Habitat Relationships		X		X
4.1.8	ESA-Listed Plants		X		X
4.1.9	ESA-Listed Amphibians – California Red-legged Frog	X			X
4.1.10	ESA-Listed Riparian Bird Species, Southwestern Willow Flycatcher, Least Bell's Vireo, and Yellow-billed Cuckoo Riparian Habitat Evaluations		X		X
4.1.11	Recreation Facilities Demand Analysis and Condition Assessment		X		X
4.1.12	Cultural Resources	X		X	
4.1.13	Tribal Resources	X		X	
4.1.14	Indicators of Hydrologic Alteration		X		X
4.1.15	Scenic Integrity	X		X	
4.1.16	Water Quality and Temperature	X		X	

Table 1.3-1. Studies Proposed by Licensees in the Revised Study Plan and Subsequently Approved or Approved with Modification by FERC (continued)

Study Number	Study Proposed in Licensees' May 15, 2017 Revised Study Plan	FERC's June 14, 2017 Study Plan Determination		FERC's September 7, 2018 Study Plan Determination ¹	
		Study Approved ²	Study Approved with Modification ³	Study Approved with Modifications	Not Applicable to Study ⁴
4.1.17	Fish Entrainment Risk Assessment	X			X
4.1.18	ESA-Listed Terrestrial Wildlife Species – California Wildlife Habitat Relationships		X		X
4.1.19	Whitewater Boating		X		X
4.1.20	Special-Status Raptors		X		X
4.1.21	Pyramid Reach Benthic Macroinvertebrates	X			X
4.1.22	Pyramid Lake Tributaries Fish Passage Barriers	X			X
Subtotal		10	12	7	15
Total		22			

Notes:

¹The September 7, 2018 Study Plan Determination was issued by FERC in response to requests for: (1) modifications to 10 of the 22 previously approved studies; and (2) a request for a new study. In its Study Plan Determination, FERC approved the requested modifications for 7 of the 10 studies, and did not approve the request for the new study.

²These studies were approved by FERC as filed by the Licensees in their Revised Study Plan.

³These studies as included in the Licensees' Revised Study Plan were approved by FERC with recommended modifications.

⁴The September 7, 2018 Study Plan Determination does not apply to this study; therefore, the study remains the same as approved in FERC's June 14, 2017 Study Plan Determination.

1.4 USE OF FIELD RESULTS AND DATA SUMMARY REPORTS

Preparation of what the Licensees refer to as “field results and data summary reports” are required under the Study Plan Determinations for each study. Each of the reports presents, or will present, the results of the study. Final and interim field results and data summary reports for each study have been included in Section 2.0 of this USR. The summaries include any incidental observations made to date while performing the Relicensing Studies.

Each field results and data summary report includes: (1) completed work to date; (2) key accomplishments and a summary of findings to date; (3) a list of associated data files for field results; (4) variances from the FERC-approved study, including study methods, schedule, or approach, and unexpected field conditions; and (5) remaining work. The attachments to these field results and data summary reports may include maps, background information, and data. The Licensees have posted on the Project relicensing website the final or interim field results and data summary reports, and associated data files for studies with data that have undergone appropriate quality assurance and quality control review. These postings are included in this USR by reference.

1.5 STATUS OF STUDIES

Of the 22 Relicensing Studies included in the Study Plan Determinations, 16 studies have been completed and six studies are in progress and close to completion. Studies are only considered complete after the Licensees have completed all the steps required by the FERC Study Plan Determinations. For studies considered “in progress” by the Licensees, most data have been reported, but additional steps are required for these studies to be considered complete.

1.6 UPDATED STUDY REPORT CONTENT AND CONSIDERATIONS

This USR includes the following sections:

Section 1.0 – Introduction. This section describes the Project background; presents a Project description and information regarding the Relicensing Studies and associated field results and data summary reports; addresses the status of the relicensing studies; and lists the content of this USR.

Section 2.0 – Status of Each Study. This section describes the Licensees’ progress with implementing each of the Relicensing Studies.

Section 3.0 – Licensees’ Proposed Study Modifications and New Studies. This section describes any modifications to FERC-approved studies proposed by the Licensees, and any new studies proposed by the Licensees.

Section 4.0 – Election to File Draft License Application. This section advises FERC that the Licensees elect to file a Draft License Application.

Section 5.0 – Updated Study Report Meeting. This section describes the Licensees' plans to hold a public meeting to discuss this USR.

Section 6.0 – References Cited. This section includes a list of references cited in this USR.

2.0 STATUS OF EACH STUDY

In their draft application for a new license, the Licensees plan to include final field results and data summary reports for each of the 22 Relicensing Studies included in the Study Plan Determinations. Final and interim field results and data summary reports are provided below for each of the FERC-approved studies. For Relicensing Studies that are in progress, the Licensees consider the interim field results and data summary reports to be progress reports only. The status of the 22 Relicensing Studies is provided in Table 2.0-1.

Table 2.0-1. Status of Relicensing Studies

Study Number	Study Description	Fieldwork Completion		Study Completion		Date(s) Study Results Made Available ⁴
		FERC's Study Plan Determinations	Licensees' Current Anticipated Schedule	FERC's Study Plan Determinations	Licensees' Current Anticipated Schedule	
4.1.1	Aquatic Invasive Species	August 2018	Fieldwork Complete	December 2018	Study Complete	4/29/2019
4.1.2	Quail Lake Fisheries Assessment	November 2018	Fieldwork Complete	November 2018	Study Complete	4/30/2018, 3/26/2019
4.1.3	Pyramid Reach Fish Populations	September 2018	Fieldwork Complete	December 2018	Study Complete	5/30/2018, 3/26/2019
4.1.4	Special-Status Aquatic Amphibians and Semi-Aquatic Snakes	September 2018	Fieldwork Complete	June 2019	Study Complete	4/30/2018, 2/8/2019
4.1.5	Botanical Resources ¹	April 2018	May 2019	December 2018	July 2019	4/30/2018, 3/26/2019, 4/23/2019
4.1.6	Non-Native Invasive Plants ¹	April 2018	May 2019	December 2018	July 2019	3/26/2019
4.1.7	Special-Status Terrestrial Wildlife Species–California Wildlife Habitat Relationships	September 2018	Fieldwork Complete	December 2018	Study Complete	4/3/2019
4.1.8	ESA-Listed Plants ¹	May 2018	May 2019	December 2018	July 2019	3/26/2019
4.1.9	ESA-Listed Amphibians – California Red-legged Frog	July 2018	Fieldwork Complete	June 2019	Study Complete	2/8/2019
4.1.10	ESA-Listed Riparian Bird Species, Southwestern Willow Flycatcher, Least Bell's Vireo, and Yellow-billed Cuckoo Riparian Habitat Evaluations ¹	August 2018	August 2019	June 2019	August 2019	11/13/2018, 4/10/2019, 5/2/2019

Table 2.0-1. Status of Relicensing Studies (continued)

Study Number	Study Description	Fieldwork Completion		Study Completion		Date(s) Study Results Made Available ⁴
		FERC's Study Plan Determinations	Licensees' Current Anticipated Schedule	FERC's Study Plan Determinations	Licensees' Current Anticipated Schedule	
4.1.11	Recreation Facilities Demand Analysis and Condition Assessment	October 2018	Fieldwork Complete	June 2019	Study Complete	4/30/2018, 5/6/2019
4.1.12	Cultural Resources ²	October 2017	Fieldwork Complete	December 2018	July 2019	4/30/2018
4.1.13	Tribal Resources ³	June 2018	March 2019	October 2018	September 2019	4/30/2018, 4/25/2019, 5/8/2019
4.1.14	Indicators of Hydrologic Alteration	No Fieldwork	No Fieldwork	December 2018	Study Complete	4/30/2018, 12/18/2018, 5/1/2019
4.1.15	Scenic Integrity	June 2018	Fieldwork Complete	June 2018	Study Complete	4/30/2018, 4/3/2019
4.1.16	Water Quality and Temperature	September 2018	Fieldwork Complete	December 2018	Study Complete	4/30/2018, 3/26/2019
4.1.17	Fish Entrainment Risk Assessment	No Fieldwork	No Fieldwork	May 2018	Study Complete	4/30/2018
4.1.18	ESA-Listed Terrestrial Wildlife Species – California Wildlife Habitat Relationships	September 2018	Fieldwork Complete	December 2018	Study Complete	3/27/2019
4.1.19	Whitewater Boating	December 2018	Fieldwork Complete	June 2019	Study Complete	5/7/2019
4.1.20	Special-Status Raptors	November 2018	Fieldwork Complete	February 2019	Study Complete	4/30/2018, 10/30/2018, 4/3/2019
4.1.21	Pyramid Reach Benthic Macroinvertebrates	July 2018	Fieldwork Complete	December 2018	Study Complete	3/26/2019

Table 2.0-1. Status of Relicensing Studies (continued)

Study Number	Study Description	Fieldwork Completion		Study Completion		Date(s) Study Results Made Available ⁴
		FERC's Study Plan Determinations	Licensees' Current Anticipated Schedule	FERC's Study Plan Determinations	Licensees' Current Anticipated Schedule	
4.1.22	Pyramid Lake Tributaries Fish Passage Barriers	September 2017	Fieldwork Complete	November 2017	Study Complete	4/30/2018, 12/18/2018
Completed Studies		16				--
No Change to Schedule in Determinations		17 of 22		16 of 22		
Change to Schedule in Determination		5 of 22		6 of 22		
Total		22				

Note:

¹The study is substantially complete; the only remaining work is gathering data along a few sections of Primary Project Roads. The Licensees anticipate the study will be complete and the data results included in the Licensees' DLA in September 2019. Refer to the study summary for a discussion of completed and in-progress work.

²The study is substantially complete; the only remaining work is the final analysis and reporting of the data. The Licensees anticipate the study will be complete and the data results will be included in the Licensees' DLA in September 2019. Refer to the study summary for a discussion of completed and in-progress work.

³The study is substantially complete; the only remaining work is the completion of the Privileged Tribal Resources Report.

⁴As additional information was made available on the Project relicensing website, the Licensees sent emails to the Relicensing Participants stating that the additional information relative to the Relicensing Studies had been posted.

Key:

For ease of reference, completed fieldwork or studies are shaded in green.

2.1 AQUATIC INVASIVE SPECIES STUDY

2.1.1 Completed Work to Date

The Study is complete. The Licensees completed all portions of the FERC-approved Study Plan, which include Step 1 (Gather Data and Prepare for Field Effort) and Step 2 (Conduct Surveys). Pyramid Lake, Quail Lake and the Elderberry Forebay were surveyed for aquatic invasive species (AIS) targeting curly-leaf pondweed (*Potamogeton crispus*), Eurasian watermilfoil (*Myriophyllum spicatum*), hydrilla (*Hydrilla verticillata*), water hyacinth (*Eichhornia crassipes*), parrot's feather milfoil (*Myriophyllum aquaticum*), coontail (*Ceratophyllum demersum*), sago pondweed (*Stuckenia pectinata*), water primrose (*Ludwigia* spp.), European ear snail (*Radix auricularia*), Asian clam (*Corbicula fluminea*), New Zealand mudsnail (*Potamopyrgus antipodarum*), and red-eared slider (*Trachemys scripta elegans*), and incidental sightings of American bullfrog (*Lithobates catesbeianus*) and red swamp crayfish (*Procambarus clarkii*). Other AIS that were not specifically targeted were documented if present. Surveys for aquatic invasive snails and clams were performed at 10 locations in Pyramid Lake, two locations in Quail Lake, and one location in Elderberry Forebay.

2.1.2 Key Accomplishments and Summary of Findings to Date

- AIS invertebrate surveys were conducted from July 30, 2018 to August 2, 2018; from August 6, 2018 to August 10, 2018; and from August 13, 2018 to August 17, 2018, at Quail Lake, at and below Pyramid Lake, and at Elderberry Forebay. A total of 69 AIS invertebrate occurrences were recorded and 2 types of AIS invertebrate species were found: Asian clam and channeled apple snail (*Pomacea canaliculata*). Asian clam was found in all three water bodies, and channeled apple snail was found in Pyramid Lake and Quail Lake. Asian clam was recorded at 6 focused survey sites in Pyramid Lake, both focused survey sites at Quail Lake, and the one focused survey site at Elderberry Forebay. Two occurrences were recorded on the small arm of Pyramid Lake just north of the Piru Creek arm and at the survey site on Quail Lake just across from the inlet structure. No Quagga mussels were incidentally found during AIS invertebrate surveys.
- AIS plant surveys were conducted on August 6, 2018, August 10, 2018, from August 13, 2018 to August 17, 2018, and on October 9, 2018 at Quail Lake, at and below Pyramid Lake, and at Elderberry Forebay. A total of 65 AIS plant occurrences were recorded and three AIS plant species were found: sago pondweed, coontail, and small pondweed (*Potamogeton pusillus*). Sago pondweed was found in coves at Pyramid Lake and the coves of Elderberry Forebay. Coontail was found only at Pyramid Lake in areas near Chumash Island and other small coves. Small pondweed was found at all three reservoirs: in the western cove of Quail Lake; in areas near Chumash Island and other small coves at Pyramid Lake; and in areas near the dam at Elderberry Forebay.

Red-eared slider visual encounter/basking surveys were performed at Quail Lake on July 30, 2018; at Pyramid Lake from July 31, 2018 to August 2, 2018, from August 7, 2018 to August 10, 2018, and on August 14, 2018; and at Elderberry Forebay on August 16, 2018. No red-eared sliders occurrences were recorded during visual encounter/basking surveys; however, two incidental sightings of red-eared slider were recorded at Pyramid Lake during the study.

- Audible American bullfrog (*Lithobates catesbianus*) vocalizations were recorded in the reeds along the north banks of Pyramid Lake on July 31, 2018. On August 2, 2018, audible American bullfrog vocalizations, observations of American bullfrog tadpoles, and observations of red swamp crayfish (*Procambarus clarkii*) were recorded at Piru Creek, below Pyramid Dam.

2.1.3 Incidental Observations:

During other Licensees' relicensing studies, Licensees recorded no additional incidental observations of AIS.

During the AIS Study, the Licensees recorded the following incidental observations: a flock of tri-colored blackbird (a California Endangered Species Act-listed species) was briefly observed and recorded on July 30, 2018 at Quail Lake.

2.1.4 Associated Data Files

File Name	Data Description	File Type	File Location
AIS Plant_Data Sheets	Scans of field data sheets	PDF	Project Website
AIS_SSWP 2018_Plant Data Summary	Summary of field data	PDF	Project Website
AIS Invert_Data Sheets	Scans of field data sheets	PDF	Project Website
AIS SSWP 2018_Invert Data Summary_P1	Summary of field data	PDF	Project Website
AIS SSWP 2018_Invert Data Summary_P2	Summary of field data	PDF	Project Website
2018 AIS SSWP Photos.zip	Photos	Zipped JPEG	Project Website
AIS_SSWP 2018_Photo Log	Photo log	PDF	Project Website
AIS_Elderberry_DataSummary	Map Summary	PDFs	Project Website
AIS_PyramidLake_DataSummary	Map Summary	PDFs	Project Website
AIS_QuailLake_DataSummary	Map Summary	PDFs	Project Website
2018_SSWP_AIS_Plant_Invert	Geodatabase Files	Zipped GDB	Project Website

2.1.5 Variances from Study Methods, Schedule or Approach, and Unexpected Field Conditions

The completed work referenced above resulted in the following variances:

- The original invertebrate sampling site located at Pyramid Dam was inaccessible and too deep for dredge samples off the side of the boat. Another nearby sampling site, located approximately 2,000 feet east of the original sampling site, was selected as an alternative sampling location.
- The original sampling site at Liebre Gulch (east of Interstate 5) was changed due to safety issues for accessing the site. Another nearby sampling site located near Serrano Day Use Area, approximately 3,000 feet southwest of the original sampling site, was selected as an alternative sampling site. The alternative sampling site near the Serrano Day Use Area is a more integral part of Pyramid Lake and could be safely accessed.
- The sampling site at Elderberry Forebay was modified for the AIS invertebrate survey. Upon arrival at the site, the field crew determined that the site had suitable basking surfaces for red-eared sliders, but no habitat for AIS invertebrate species due to the rocky substrate. An alternative AIS invertebrate sampling site with sandy substrate was chosen northwest of the turtle survey/original sampling site.

2.1.6 Remaining Work

None; the Study is complete.

2.2 QUAIL LAKE FISHERIES ASSESSMENT STUDY

2.2.1 Completed Work to Date

The Study is complete. As required by the FERC-approved Study Plan, the Licensees completed Step 1 (Data Gathering and Planning) and Step 2 (Fieldwork). Step 2 is comprised of two fieldwork components: boat electrofishing and creel surveys. Boat electrofishing was conducted at Quail Lake on October 9, 2018, using a Smith Root Generator Powered Pulsator 5.0 system. Quail Lake has a total of 3.28 miles of shoreline. For the purpose of this Study, the shoreline was split into six discrete habitat units, each approximately 0.5 miles long (see attached file). The six units were characterized as follows:

1. South Shore: primarily composed of partially submerged, concrete walkway with no visible vegetation
2. East Shore: limited tules present, dam rip-rap, and submerged trees
3. North Shore: tule habitat and inlet rip-rap
4. North Shore: predominately tule and shoal habitat

5. Northwest Shore: predominately shallow tule and shoal habitat
6. Southwest Shore: includes outlet and partially submerged concrete walkway

Each unit was sampled in a “leap frog” manner to minimize herding of fish. Some sections of Units 3 and 6 (approximately 5 percent of the total shoreline) could not be sampled due to minimal depth and angler presence. Sampling was conducted in accordance with the California Department of Fish and Wildlife (CDFW)-issued Scientific Collecting Permit. Length in millimeters (mm), weight in grams (g), and general condition were collected for up to 50 individuals of each fish species collected; additional fish were examined and enumerated, but not measured or weighed.

Recreational anglers at Quail Lake were surveyed through stratified random sampling that incorporated an active creel design to gather information on fishing pressure and impact on game fish species. A total of 50 surveys were conducted from October 1, 2017 to July 31, 2018, representing 16 high-use days (weekends and major holidays) and 34 low-use days (weekdays) that were randomly selected. Each survey was also randomly selected as an AM (morning) or PM (evening) survey, with 30 surveys completed in the morning and 20 in the evening. Each survey lasted three hours and occurred from 7:00 a.m. to 10:00 a.m. for the AM period and 3:00 p.m. to 6:00 p.m. for the PM period. Surveys were conducted at the parking lot of Quail Lake, as this was the only public access to the lake. Information collected included the following:

- Start and end time of angling outing and the time of the interview
- Number of fish caught by species (including fish harvested and released)
- Targeted fish species
- Angler age by category (younger than 16, 16 to 55, older than 55 years old)
- Angler gender (male, female)
- Angler distance traveled by category (less than 20 miles, 20 to 50 miles, greater than 50 miles)
- Whether angling was the primary reason for their visit to Quail Lake
- Zip code of residences
- Additional information collected for each survey date included the date, day of the week, approximate air temperature, a brief general description of the weather, and harvested fish measured in millimeters using fork length or standard length depending on the type of species

2.2.2 Key Accomplishments and Summary of Findings to Date

2.2.2.1 Boat Electrofishing

Species composition was represented by warmwater fishes, including common game fish for California. A total of 13 species were sampled; the most abundant fishes captured were largemouth bass (*Micropterus salmoides*), white catfish (*Ameiurus catus*), and striped bass (*Morone saxatilis*) (n=116, n=50, and n=27, respectively). Other species captured included bluegill (*Lepomis macrochirus*), bigscale logperch (*Percina macrolepida*), prickly sculpin (*Cottus asper*), common carp (*Cyprinus carpio*), goldfish (*Carassius auratus*), Sacramento blackfish (*Orthodon microlepidotus*), channel catfish (*Ictalurus punctatus*), shimofuri goby (*Tridentiger bifasciatus*), threadfin shad (*Dorosoma petenense*), and inland silverside (*Menidia beryllina*). Due to the large numbers of individuals present, threadfin shad and inland silversides were documented for presence/absence in each unit and their numbers were not collected.

Sampling results are presented in Table 2.2-1, and overall catch per unit effort (CPUE, fish per minute of electrofisher operation) and species composition are provided in Figure 2.2-1. Table 2.2-1 lists the 13 fish species collected and observed; Figure 2.2-1 lists only the 11 fish species collected (excludes threadfin shad and inland silverside).

Game fishes were assessed for their proportional size distribution (PSD) and relative size distribution (PSD-P) (Guy et al. 2007). Quail Lake can be characterized as a “big bass fishery” (Willis et al. 1993) with largemouth bass having a high PSD and PSD-P (80 and 32, respectively) and bluegill having low PSD and PSD-P values (20 and 0, respectively). The striped bass fishery was also healthy (relative condition = 0.84-1.22; Fulton’s condition = 1.04-1.48, average = 1.28), and had a similar PSD to largemouth bass (PSD = 80).

Table 2.2-1. Population Summary of Boat Electrofishing at Quail Lake

Common Name (<i>Scientific Name</i>)	Number Collected	Length (mm)	Weight (g)	Relative Condition ¹	Fulton Condition ¹	Percent of Total Catch by Number	CPUE	PSD ²	PSD-P ²
		Min-Max (Mean)	Min-Max (Mean)	Range	Range (Average)				
Largemouth Bass (<i>Micropterus salmoides</i>)	116	83-458 (199) ³	7.5- 2,040.0 (294.9) ³	0.49-1.35 ³	0.77-2.31 (1.54) ³	48.7%	0.58	80 ³	32 ³
White Catfish (<i>Ameiurus catus</i>)	50	115-503 (270)	13.8- 3,150.0 (439.4)	0.64-1.32	0.91-2.48 (1.57)	21.0%	0.25	--	--
Striped Bass (<i>Morone saxatilis</i>)	27	191-718 (283)	80.0- 4,000.0 (613.1)	0.84-1.22	1.04-1.48 (1.28)	11.3%	0.13	80	0
Bluegill (<i>Lepomis macrochirus</i>)	13	34-174 (81)	4.4-152.0 (34.7)	0.45-1.95	--	5.5%	0.06	20	0
Bigscale Logperch (<i>Percina macrolepida</i>)	9	80-91 (87)	2.7-5.4 (4.2)	--	--	3.8%	0.04	--	--
Prickly Sculpin (<i>Cottus asper</i>)	8	39-95 (73)	1.3-14.9 (7.6)	--	--	3.4%	0.04	--	--
Common Carp (<i>Cyprinus carpio</i>)	7	629-676 (656)	5,110.0- 5,650.0 (5436.7)	--	--	2.9%	0.03	100	100
Goldfish (<i>Carassius auratus</i>)	3	354-385 (366)	1,530.0- 2,080.0 (1,810.0)	--	--	1.3%	0.01	--	--
Sacramento Blackfish (<i>Orthodon microlepidotus</i>)	2	475-485 (480)	1,620.0- 1,700.0 (1,660.0)	--	--	0.8%	0.01	--	--

Table 2.2-1. Population Summary of Boat Electrofishing at Quail Lake (continued)

Common Name (<i>Scientific Name</i>)	Number Collected	Length (mm)	Weight (g)	Relative Condition ¹	Fulton Condition ¹	Percent of Total Catch by Number	CPUE	PSD ²	PSD-P ²
		Min-Max (Mean)	Min-Max (Mean)	Range	Range (Average)				
Channel Catfish (<i>Ictalurus punctatus</i>)	2	350-475 (413)	1,230.0- 1,960.0 (1,595.0)	--	--	0.8%	0.01	50	0
Shimofuri Goby (<i>Tridentiger bifasciatus</i>)	1	48	2.8	--	--	0.4%	<0.01	--	--
Threadfin Shad ⁴ (<i>Dorosoma petenense</i>)	Observed	--	--	--	--	--	--	--	--
Inland Silverside ⁴ (<i>Menidia beryllina</i>)	Observed	--	--	--	--	--	--	--	--
Total	238	--	--	--	--	100.0%	1.19 ⁵	--	--

Notes:

¹Relative and Fulton's condition factors could not be calculated for all fish. Non-game fish, species with insufficient sampled individuals, and species without a fusiform body shape (Fulton) were not calculated.

²Proportional and relative stock densities were only calculated for species recognized as game fish by the California Department of Fish and Wildlife.

³The first 50 individuals captured were used in metric calculations. All individuals captured thereafter were examined and enumerated but not measured or weighed and therefore not used in some calculations.

⁴Threadfin shad and inland silversides were noted for presence/absence in each unit due to the large quantities present throughout the sampling event.

⁵Presented CPUE for individual species are rounded to two decimal places, and therefore may not sum to the presented total CPUE.

Key:

% = percent

CPUE = catch per unit effort, fish per minute

g = grams

Max = maximum

Min = minimum

mm = millimeters

PSD = proportional size distribution

PSD-P = relative size distribution – preferred

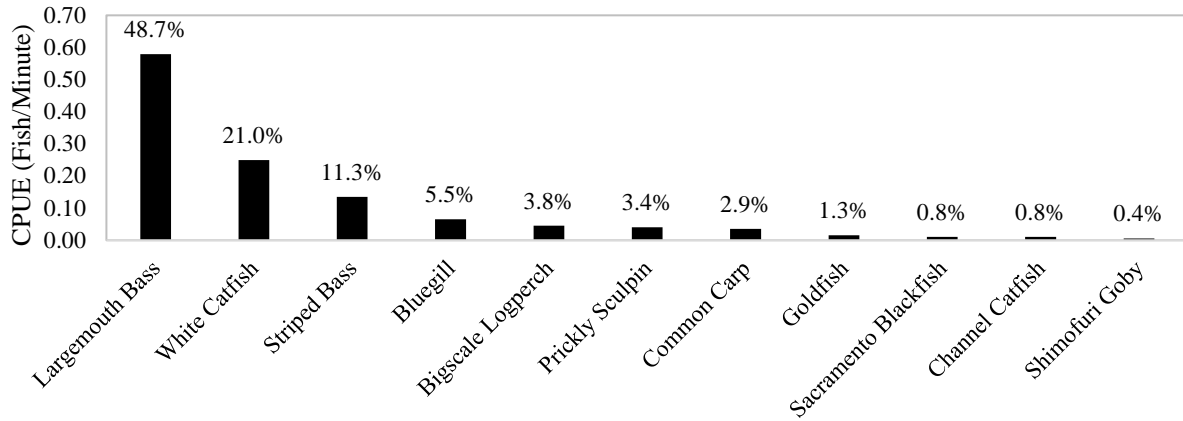


Figure 2.2-1. Overall CPUE (Fish Per Minute) with Composition of Species Collected During Boat Electrofishing on Quail Lake

The fish captured showed a wide range of weight relative to length. Bluegill displayed both the lowest and highest relative condition, a measure of relative expected weight based on length of sampled fish. Fulton’s condition, an independent measure of fish condition for fish displaying fusiform body shape, averaged well above 1.0 (considered good). Threadfin shad and inland silversides were documented in large quantities throughout all units, indicating the presence of a large prey base for predatory game fish. The diverse assemblage and broad range of fish conditions may indicate a relatively competitive population within the lake.

CPUE varied by unit for the six units sampled. Unit 2 exhibited the highest density of fish with a CPUE of 1.89 fish per minute (fish/minute), and Unit 1 the least with a CPUE of 0.61 fish/minute. CPUE for all units combined was 1.19 fish/minute. Sampling effort (i.e., minutes with electrofisher on) was variable between units dependent on accessible habitat and angler presence. Unit 3 had the least amount of shoreline, but it also had multiple anglers in the area (near the inlet). Table 2.2-2 provides CPUE for all species and for all units.

Table 2.2-2. Overall CPUE (Fish/Minute) by Habitat Unit During Boat Electrofishing on Quail Lake

Species (Scientific Name)	Total Catch	Overall CPUE	Unit 1		Unit 2		Unit 3		Unit 4		Unit 5		Unit 6	
			#	CPUE	#	CPUE	#	CPUE	#	CPUE	#	CPUE	#	CPUE
Largemouth Bass (<i>Micropterus salmoides</i>)	116	0.58	9	0.22	68	1.22	11	0.66	12	0.47	8	0.32	8	0.22
White Catfish (<i>Ameiurus catus</i>)	50	0.25	6	0.15	5	0.09	3	0.18	25	0.97	10	0.41	1	0.03
Striped Bass (<i>Morone saxatilis</i>)	27	0.13	8	0.20	6	0.11	1	0.06	2	0.08	1	0.04	9	0.25
Bluegill (<i>Lepomis macrochirus</i>)	13	0.06	0	0.00	8	0.14	0	0.00	2	0.08	1	0.04	2	0.05
Bigscale Logperch (<i>Percina macrolepida</i>)	9	0.04	0	0.00	9	0.16	0	0.00	0	0.00	0	0.00	0	0.00
Prickly Sculpin (<i>Cottus asper</i>)	8	0.04	1	0.02	5	0.09	0	0.00	1	0.04	0	0.00	1	0.03
Common Carp (<i>Cyprinus carpio</i>)	7	0.03	0	0.00	4	0.07	0	0.00	0	0.00	0	0.00	3	0.08
Goldfish (<i>Carassius auratus</i>)	3	0.01	0	0.00	0	0.00	0	0.00	1	0.04	2	0.08	0	0.00
Sacramento Blackfish (<i>Orthodon microlepidotus</i>)	2	0.01	0	0.00	0	0.00	0	0.00	1	0.04	1	0.04	0	0.00
Channel Catfish (<i>Ictalurus punctatus</i>)	2	0.01	0	0.00	1	0.02	0	0.00	0	0.00	1	0.04	0	0.00
Shimofuri Goby (<i>Tridentiger bifasciatus</i>)	1	0.00	1	0.02	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Threadfin Shad (<i>Dorosoma petenense</i>)	OB	--	OB	--	OB	--	OB	--	OB	--	OB	--	OB	--
Inland Silverside (<i>Menidia beryllina</i>)	OB	--	OB	--	OB	--	OB	--	OB	--	OB	--	OB	--
Total Catch	238		25		106		15		44		24		24	
CPUE	1.19		0.61		1.89		0.90		1.71		0.97		0.66	
Effort (minutes)	200.35		40.80		55.97		16.68		25.73		24.65		36.52	

Key:
CPUE = catch per unit effort, fish per minute
OB = Observed but not counted or sampled

Species composition varied among the six sampled units. Unit 2 produced the most species and Unit 3 the least (8 and 3, respectively). The three most abundant fish species (largemouth bass, striped bass, and white catfish) were found in all six units. Figure 2.2-2 shows the percent composition of fish species by unit.

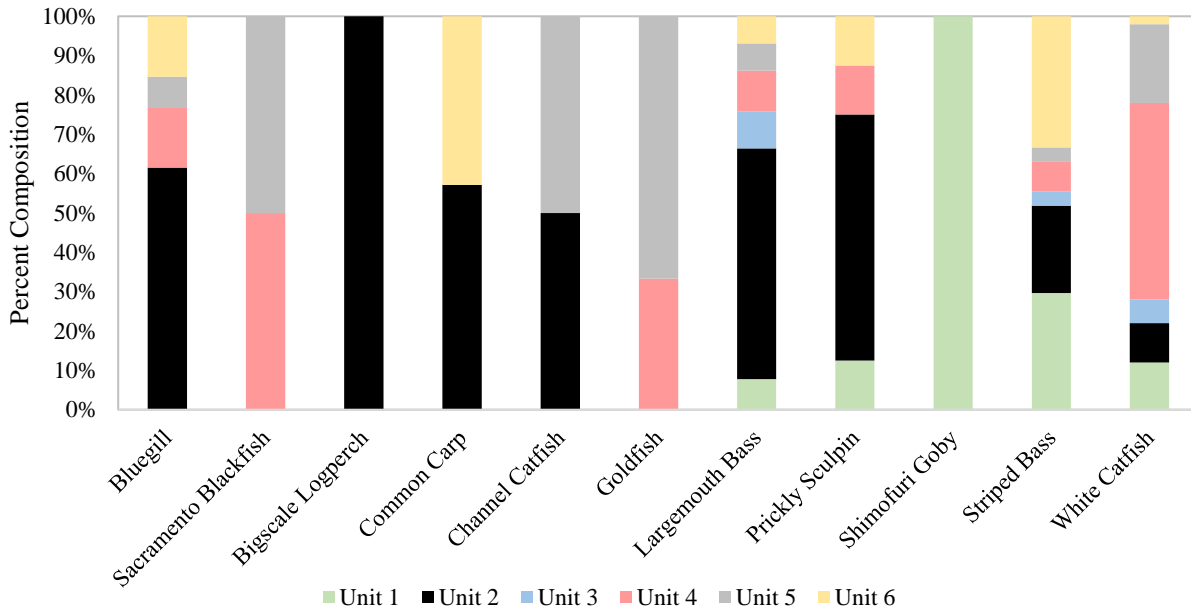


Figure 2.2-2. Percent Composition by Habitat Unit During Boat Electrofishing on Quail Lake

2.2.2.2 Creel Surveys

A total of 85 angler parties were interviewed, representing 175 individual anglers. These anglers had a combined 854.6 angling hours, catching a total of 58 fish. Fish caught were represented by 4 categories: striped bass, black bass, catfish, and perch. Based on electrofishing data, black bass were likely largemouth bass, and catfish either were white catfish or channel catfish. Some fish recorded were based on angler responses and may not have been accurately identified. Overall CPUE was low, at less than 0.1 fish per hour. Table 2.2-3 presents the overall creel results.

Table 2.2-3. Summary of AM and PM Creel Survey Results for High-Use and Low-Use Periods

Event	Number of Surveys	Number of Angler Parties	Number of Anglers	Total Angler Hours	Total Fish Caught	Number Released	CPUE
Weekends, High-Use (n=16 surveys)							
Saturday	8	30	65	427.1	26	10	0.06
Sunday	8	17	40	155.5	7	1	0.05
Weekend Subtotal	16	47	105	582.6	33	11	0.06
Weekdays, Low-Use (n=34 surveys)							
Monday	5	6	9	11.8	7	2	0.59
Tuesday	7	7	17	67.7	2	0	0.03
Wednesday	9	9	17	110.9	7	6	0.06
Thursday	5	8	13	42.4	1	0	0.02
Friday	8	8	14	39.2	8	4	0.20
Weekday Subtotal	34	38	70	272.0	25	12	0.09
Overall Total	50	85	175	854.6	58	23	0.07

Key:
CPUE = catch per unit effort, fish per hour of angling effort

Thirty-nine of the 58 fish caught by anglers were measured for length and identified to species (Table 2.2-4). The most common fish caught (and kept) was striped bass, representing almost 70 percent of the fish recorded. All striped bass recorded were over 300 mm. Catfish and black bass were caught less frequently and were also targeted less often by anglers. One angler reported catching three perch but did not indicate the species.

Table 2.2-4. Length Frequency of Measured Fish During Creel Surveys

Species	Length (mm)				Total	Percent of Total
	0-150	150-304	304-533	533-787		
Striped Bass	0	0	11	16	27	69.2%
Catfish sp. ¹	0	1	2	2	5	12.8%
Black Bass ¹	0	3	1	0	4	10.3%
Perch ²	0	0	3	0	3	7.7%
Total	0	4	17	18	39	100.0%

Notes:

¹Based on electrofishing data, black bass were likely largemouth bass, and catfish either white catfish or channel catfish.

²Three perch were reported during angler interviews, but the exact species was not identified.

Key:

mm = millimeters

Eighty four of the 85 parties interviewed provided information on distance traveled. Most angler parties interviewed traveled from nearby counties, primarily Los Angeles (72 percent). Only a few anglers traveled to Quail Lake from counties outside of the greater Los Angeles area (Figure 2.2-3). Anglers were asked to rate their level of satisfaction for overall fishing experience on a scale of 1 to 5. Eighty-three of the 85 parties interviewed answered this question and the average satisfaction was 3.1, meaning more anglers were satisfied with their angling experience than were dissatisfied.

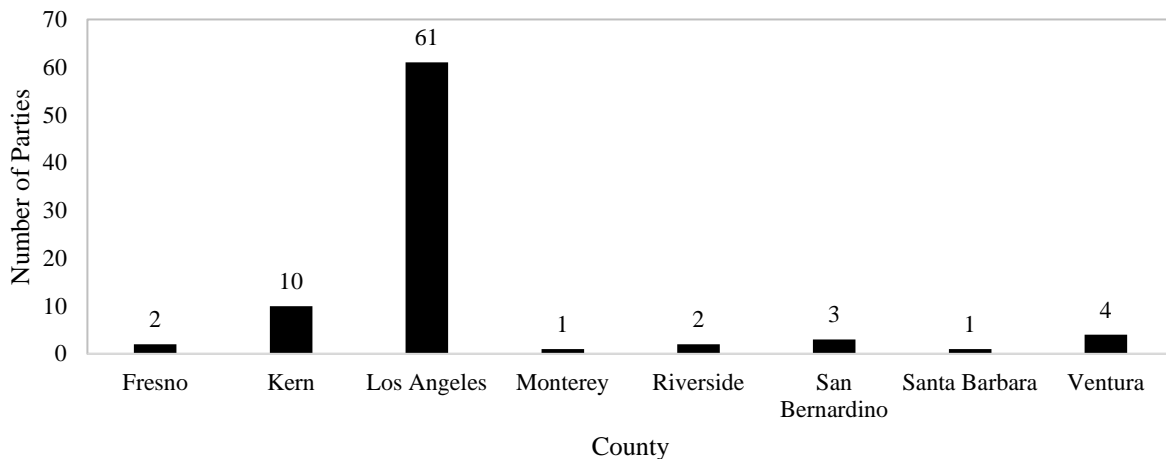


Figure 2.2-3. Angler Parties' Home Location

During all sampling efforts, there were no incidental observations of aquatic invasive or special-status species.

2.2.3 Associated Data Files

File Name	Data Description	File Type	File Location
Quail Lake Electrofishing Database	Database containing all raw data collected during boat electrofishing	XLSX	Project Website
Quail Lake Electrofishing Data Sheet	Blank boat electrofishing data sheet	PDF	Project Website
Creel Survey Database	Database containing all raw data collected during creel surveys	XLSX	Project Website
Creel Survey Data Sheet	Blank creel survey data sheet	PDF	Project Website
Map of Quail Lake Electrofishing Habitat Units	Map of habitat units sampled by boat electrofishing	JPEG	Project Website

2.2.4 Variances from Study Methods, Schedule or Approach, and Abnormalities in Expected Field Conditions

Two variances from the FERC-approved Study Plan occurred. The Study Plan states that boat electrofishing would occur in October 2017, and the study would be completed by August 2018. However, the Licensees did not receive the necessary scientific collecting permit from CDFW for this work until March 2018. The Licensees completed the boat electrofishing on October 9, 2018, and the overall study was completed in early November 2018 consistent with FERC's Study Plan Determination issued on September 7, 2018. While this variance is a modification to the June 14, 2017 FERC-approved Study Plan, it did not affect the overall study because the data were collected in the same months specified in the Study Plan and will be included in the Licensees' Updated Study Report and Draft License Application.

The second variance from the FERC-approved Study Plan, was that creel surveyors only asked one out of the three questions regarding angler satisfaction. The two questions not asked during surveys were regarding: 1) angler satisfaction of number of fish caught, and 2) size of fish caught. The two questions not asked during the surveys are generally used for management decisions related to fish stocking. Quail Lake is not stocked with any fish so these questions would not aid in any management decisions regarding angling opportunities. While this is a variance to the Study Plan, it did not affect the outcome or objectives of the Study.

2.2.5 Remaining Work

None; the Study is complete.

2.3 PYRAMID REACH FISH POPULATIONS STUDY

2.3.1 Completed Work to Date

The Study is complete. As required by the FERC-approved Study Plan, Licensees have completed Step 1 (Classify Mesohabitat and Channels), Step 2 (Conduct eDNA sampling), Step 3 (Select Sampling Sites for Fish Population Sampling), and Step 4 (Sample Fish Population).

2.3.1.1 **Step 1: Classify Mesohabitat and Channels**

Mesohabitats of Piru Creek were classified from the normal maximum water surface elevation (NMWSE) of Lake Piru upstream to Pyramid Dam (Pyramid reach). A three-tiered habitat mapping classification system developed by Hawkins et al. (1993) was used to assist in the identification of individual habitat units in the field. The Licensees conducted extensive habitat mapping (i.e., mapped each individual unit) of 6.4 miles of Pyramid reach, from River Mile (RM) 0.86 to RM 3.77, and RM 14.97 to RM 18.42. Habitat units were also characterized in the canyon section (RM 4 to 15) as part of the environmental deoxyribonucleic acid (eDNA) sampling.

2.3.1.2 **Step 2: Conduct eDNA Sampling**

The Licensees conducted eDNA sampling in Pyramid reach at 500 meter (m) intervals, for a total of 60 sample sites, in spring 2018 (see attached map). All samples collected were analyzed for the presence of rainbow trout (*Oncorhynchus mykiss*), Santa Ana sucker (*Catostomus santaanae*), and arroyo chub (*Gila orcutti*).

At each site, two sterivex filters were collected, and approximately one liter of stream water was passed through each filter. Analysis of all collected eDNA was completed by Genidaqs, a qualified genetics laboratory. eDNA was isolated from each filter following man et al. (2016) and analyzed using quantitative Polymerase Chain Reaction (qPCR) assays. A standard assay for rainbow trout existed and was used for this analysis. Assays for Santa Ana sucker and arroyo chub did not exist but were developed by Genidaqs for this Study using mitochondrial DNA sequences from the National Center for Biotechnology Information Nucleotide database. Because the assays were developed from mitochondrial DNA sequences, the eDNA analysis did not distinguish between genetically pure eDNA of the species of interest and hybrids if the mother of the hybrid was of the target species. Therefore, a positive detection for Santa Ana sucker could also indicate a hybrid between a Santa Ana sucker and an Owens sucker (*Catostomus fumeiventris*). Based on the possibility of hybridization, and the inability of the analysis to differentiate pure from hybridized Santa Ana sucker, all suckers are referred to as sucker species (sucker spp.) in this report.

2.3.1.3 **Step 3: Select Sampling Sites for Fish Population Sampling**

Using aerial imagery and habitat mapping data, the Licensees selected three sampling sites based on three criteria: (1) the site is reasonably accessible to field crews; (2) the site represents the overall mesohabitat ratios found in the stream segment of the reach

in which the site is located; and (3) the site can be effectively sampled using backpack electrofishing equipment. On May 17, 2018, the Licensees conducted a field site visit with agencies to discuss Preliminary Fish Sampling Sites 1, 2 and 3. After receiving feedback from the agencies, the Licensees agreed to relocate two of the sampling sites (Fish Sampling Site 1 and Fish Sampling Site 3) from their original locations. The Licensees filed a letter with FERC on August 1, 2018, describing the Preliminary Fish Sampling Sites 1, 2 and 3 and the rationale for selecting the new locations (Fish Sampling Sites 1, 2 and 3). FERC agreed with the selection of Fish Sampling Sites 1, 2 and 3 in the Study Plan Determination dated September 7, 2018.

2.3.1.4 Step 4: Sample Fish Population

Multiple-pass depletion electrofishing (Reynolds 1996; Temple and Pearsons 2007) using two Smith Root LR 24 units was conducted at Fish Sampling Sites 1, 2, and 3 selected under Step 3 on Pyramid reach in October 2018. The upstream and downstream ends of each site were blocked with fine mesh nets to prevent fish passage. Electrofishing was conducted by qualified biologists in accordance with a California Department of Fish and Wildlife (CDFW)-issued Scientific Collecting Permit.

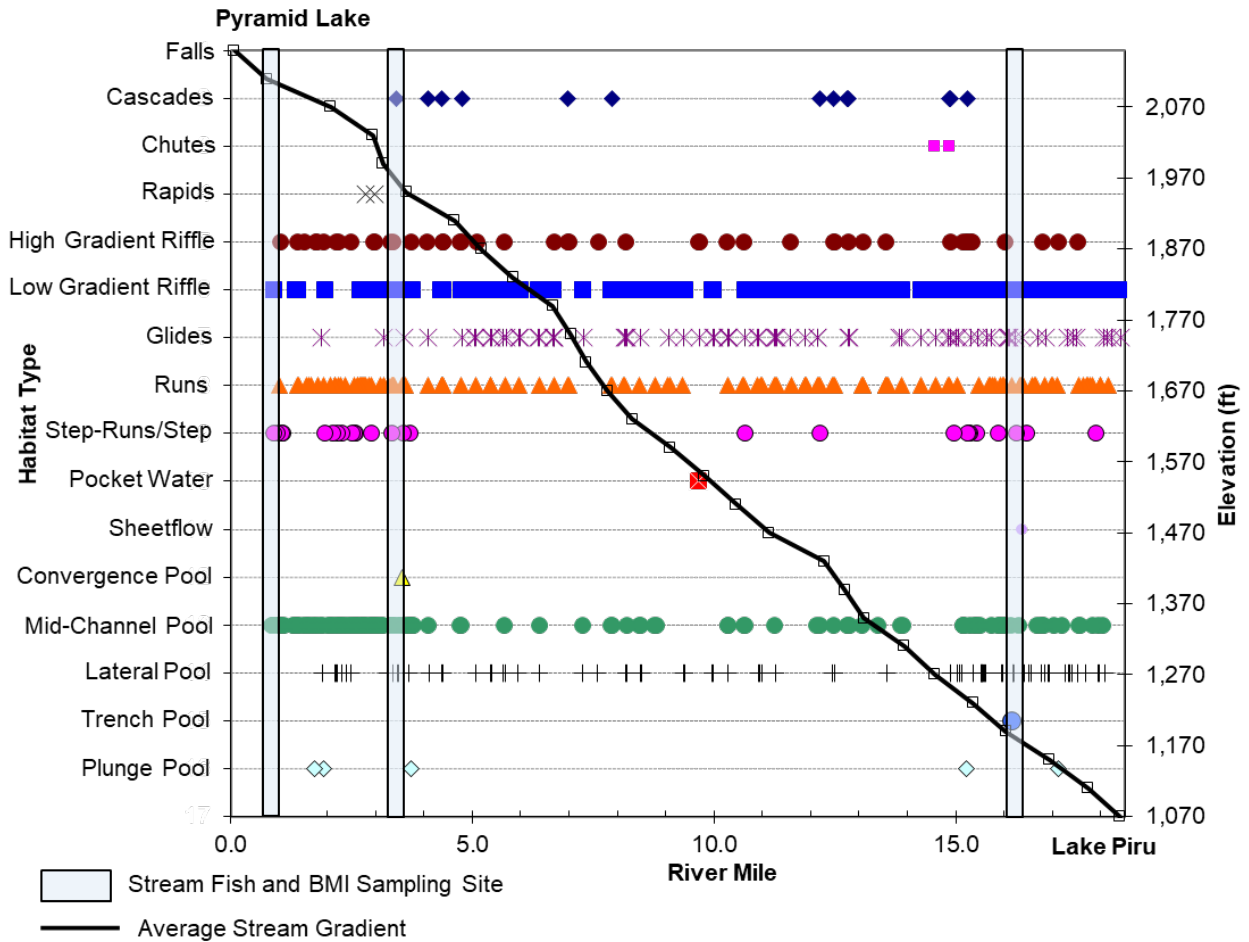
Captured fish were retained in aerated buckets until each pass was completed. All fish were identified to species (when possible) and counted. Individuals were measured to the nearest millimeter (mm) (fork length when applicable) and weighed by digital scale to the nearest gram. Scale samples were collected on a subsample of largemouth bass (*Micropterus salmoides*) for validating length-age indices. In a collaborative effort, the Licensees coordinated with United Water Conservation District (UWCD) biologists who collected scale samples from rainbow trout captured during electrofishing efforts. UWCD staff collected rainbow trout scale samples under a separate CDFW Scientific Collecting Permit.

Scale samples were collected from rainbow trout equal to or greater than 120 mm in fork length and from largemouth bass equal to or greater than 150 mm in length. Scales from each sampled individual were mounted on glass microscope slides and examined under a dissecting microscope by an experienced biologist to determine age. For rainbow trout, lengths and ages of individuals for which age was able to be determined were used to construct a model which was utilized to estimate ages for individuals from which scales were not collected or age determination was not possible through scale analysis. Length-age regression was not possible for largemouth bass because scale analysis yielded a single age class. Instead, ages for unknown-age largemouth bass were estimated by analyzing the largemouth bass length-frequency distribution (Devries and Frie 1996), which showed two distinct age classes (Age 0 and Age 1). These were the only two age classes of largemouth bass encountered during the sampling effort.

2.3.2 Key Accomplishments and Summary of Findings to Date

2.3.2.1 Mesohabitats

Figure 2.3-1 provides the distribution of mesohabitat types identified in Pyramid reach during the habitat mapping effort. In general, habitats typical of lower gradient streams (pools, runs, glides, and low gradient riffles) were the most common.



Key:
 ft = feet

Figure 2.3-1. Mesohabitat Types Identified In Pyramid Reach

Extensive habitat mapping of 6.35 miles of Pyramid reach was divided into three stream segments: two segments located within the first 4 miles immediately downstream of Pyramid Dam and one directly upstream of the NMWSE of Lake Piru. These segments were identified to assist in selecting sampling sites for backpack electrofishing. Table 2.3-1 shows that mid-channel pools (31 percent) accounted for the largest percent of habitat types, followed by runs (17 percent), and low-gradient riffles (15 percent). A total of 33,515 feet was mapped in detail.

Table 2.3-1. Habitat Units Found Within the Extensively Mapped 6.35 Miles of Pyramid Reach

Habitat Unit	Total		Stream Segment 1 (RM 0.86-2.99)		Stream Segment 2 (RM 3.0-3.77)		Stream Segment 3 (RM 14.97-18.42)	
	Total length (feet)	Proportion (%)	Total length (feet)	Proportion (%)	Total length (feet)	Proportion (%)	Total length (feet)	Proportion (%)
Mid-Channel Pool	10,351.7	31	6,130.3	54	1,512.1	33	2,709.3	15
Run	5,536.6	17	2,105.8	19	498.6	11	2,932.3	17
Low-Gradient Riffle	5,159.4	15	590.4	5	665.8	15	3,903.2	22
Lateral Pool	3,398.1	10	242.7	2	288.6	6	2,866.7	16
Glide	3,145.5	9	203.4	2	229.6	5	2,712.6	15
Split Channel	2,843.8	8	757.7	7	823.3	18	1,262.8	7
Step Pool	1,567.8	5	669.1	6	246.0	5	652.7	4
High-Gradient Riffle	911.8	3	393.6	3	91.8	2	426.4	2
Cascade	183.7	<1	0	0	131.2	3	52.5	<1
Plunge Pool	154.2	<1	91.8	1	19.7	<1	42.6	<1
Rapids	72.2	<1	72.2	1	0	0	0	0
Not Classified	49.2	<1	49.2	<1	0	0	0	0
Trench Pool	49.2	<1	0	0	0	0	49.2	<1
Convergence Pool	45.9	<1	0	0	45.9	1	0	0
Sheet Flow	39.4	<1	0	0	0	0	39.4	<1
Falls	6.6	<1	6.6	<1	0	0	0	0
Total	33,515.0	100	11,312.7	100	4,552.6	100	17,649.7	100

Key:
RM = river mile
% = percent

2.3.2.2 eDNA

Rainbow trout were detected at 59 of the 60 sampling locations (98 percent) throughout the entire reach. Sucker spp. were detected at 54 of the 60 sampling locations (90 percent) between approximately RM 1.9 and RM 18.3 and were absent in an approximately 1.5-mile-long stretch directly below Pyramid Dam. Arroyo chub were detected in 13 of the 60 sampling locations (21.7 percent), which were distributed throughout Pyramid reach between RM 2.5 and RM 18.3 (Table 2.3-2). The full Genidaqs report is available on the relicensing website.

Table 2.3-2. eDNA Sampling Results for Pyramid Reach

Pyramid Reach Segment	Total Number of Samples Collected	Target Species DNA Detections in Samples Collected		
		Rainbow Trout	Sucker spp.	Arroyo Chub
Pyramid Dam to Fish Creek (RM 0.0 - 6.5)	22	22	16	3
Fish Creek to Agua Blanca Creek (RM 6.6 - 16.65)	32	31	32	7
Agua Blanca to Piru Lake NMWSE (RM 16.66 - 18.5)	6	6	6	3
Total	60	59	54	13

Key:
RM = river mile
NMWSE = normal maximum water surface elevation

2.3.2.3 Fish Population

A total of four species were observed during backpack electrofishing. Sampling at Fish Sampling Site 1 yielded rainbow trout (n=78), largemouth bass (n=49), and prickly sculpin (n=10, *Cottus asper*). Sampling at Fish Sampling Site 2 yielded rainbow trout (n=47) and sucker spp. (n=81) that could not be identified to species. Sampling at Fish Sampling Site 3 yielded no fish and field crew members did not visually observe any fish within the site during the entirety of the sampling effort. Additionally, backpack electrofishing was conducted for approximately 200m immediately upstream and downstream of Fish Sampling Site 3, and no fish were captured or observed. Sampling results are presented in Table 2.3-3.

Table 2.3-3. Population Summary of Backpack Electrofishing on Pyramid Reach

Species		Fish Sampling Site 1			Fish Sampling Site 2	
		Rainbow Trout	Largemouth Bass	Prickly Sculpin	Rainbow Trout	Sucker spp.
Abundance	Number captured by pass (total)	52-16-10 (78)	31-12-6 (49)	5-4-1 (10)	29-7-11-0 (47)	46-25-8-2 (81)
	Estimated abundance	82	52	10	54	86
	95% CI	75-89	46-58	7-13	42-66	76-96
	Fish/100 m	14.88	9.44	1.81	7.69	12.24
	Fish/mile	785.77	498.29	95.83	405.86	646.38
Length (mm)	Range (Average)	68-360 (131.14)	57-206 (130.27)	70-135 (107.9)	57-173 (97.74)	70-205 (128.28)
Weight (grams)	Total	2330.20	2214.40	243.10	610.50	2404.30
	Range (Average)	3.85-281.29 (31.07)	2.80-163.20 (46.13)	4.80-71.50 (24.31)	2.10-50.40 (12.99)	4.50-108.70 (30.74)
	Total estimated weight (grams)	2449.70	2350.0	243.10	701.40	2617.30
	Weight (grams)/100 m	422.90	401.89	44.12	86.90	342.25
	Pounds/acre	23.46	22.50	2.33	9.59	35.78
	Kilogram/hectare	26.29	25.22	2.61	10.75	40.10
Condition Factor	Relative – range	0.80-1.31	0.81-1.13	0.80-1.64	0.61-1.19	0.73-1.18
	Fulton's – range (average)	0.90-1.62 (1.21)	1.32-1.91 (1.59)	1.26-2.97 (1.59)	0.70-1.47 (1.21)	0.99-1.60 (1.36)
RSD (% of population > 150 mm FL)		18	24		6	6
Community Diversity	Proportion of Catch per Site	0.57	0.36	0.07	0.37	0.63
	Shannon Index (H')	0.88			0.66	
	Richness ¹ (Standard Error)	3.00 (< 0.01)			2.00 (< 0.01)	

Notes:

¹Richness values were calculated using rarefaction and apply to a sampling size of 100 individuals. Values are estimated number of species present.

Key:

% = percent

< = less than

> = greater than

CI = confidence interval

FL = fork length

H' = Shannon's Diversity Index

m = meters

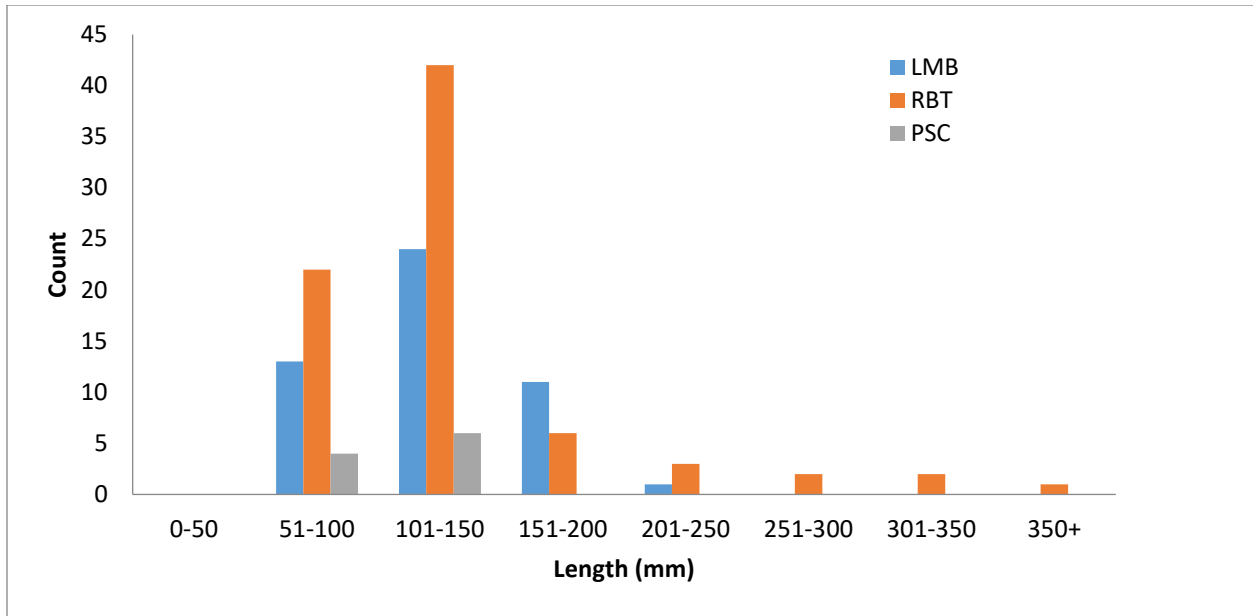
mm = millimeters

RSD = relative stock density

Game fish (rainbow trout and largemouth bass) were assessed based on relative stock density (RSD) calculations. Consistent with the FERC-approved study plan, RSD was calculated as the percent of fish sampled that were greater than 150 mm (6 inches) in length (Nevada Irrigation District and Pacific Gas and Electric Company 2010). Fulton's condition factor, an independent measure of fish condition for fish displaying fusiform body shape, was calculated cumulatively and by site (Table 2.3-3). All sampled fish visually appeared to be free of parasites and disease.

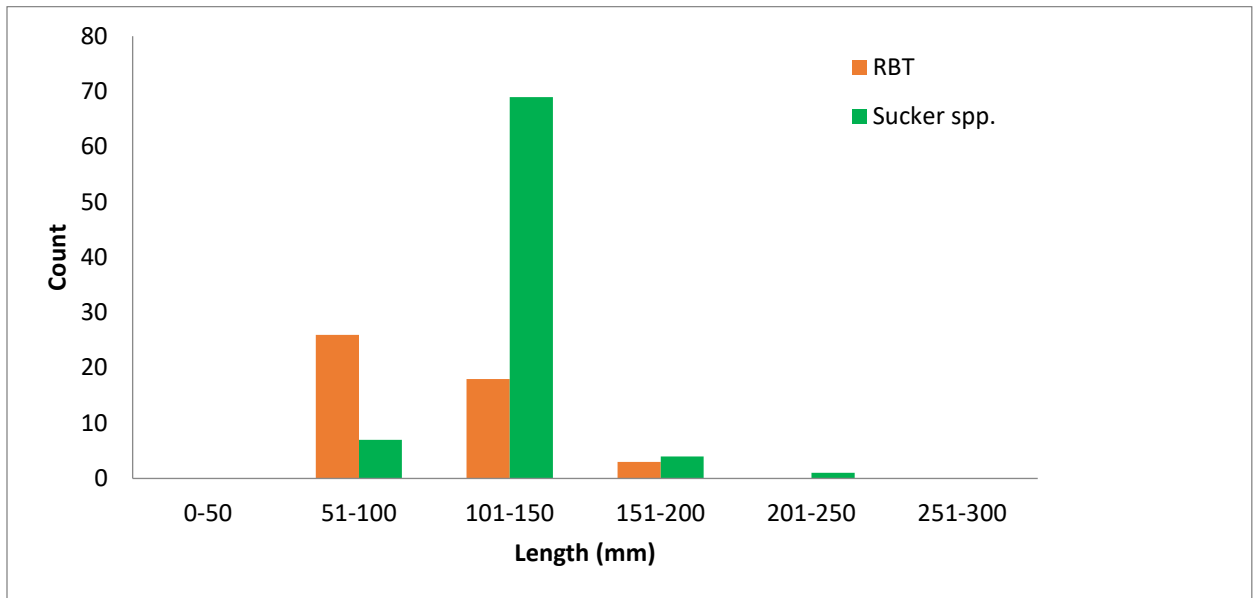
Fish community analysis for Fish Sampling Site 1 and Fish Sampling Site 2 includes species composition and relative abundance of each species (Table 2.3-3). In addition, species diversity and species richness were calculated using the Shannon Diversity Index and richness rarefaction, respectively (Table 2.3-3). Species richness, as estimated by rarefaction at a standard sample size of 100 individuals, shows that three species are present within Fish Sampling Site 1 and two species are present within Fish Sampling Site 2, with a standard error of less than 0.01 for each site estimate. The Shannon Diversity Index calculations illustrate relatively low diversity across both sites, with Fish Sampling Site 1 having slightly greater calculated diversity than Fish Sampling Site 2. Rarefaction calculations were completed using the 'vegan' package (Oksanen et al. 2018) in R Statistical Software (R Core Team 2018).

Fish sampled in Fish Sampling Site 1 were generally larger than those in Fish Sampling Site 2. The majority of rainbow trout and largemouth bass in Fish Sampling Site 1 were in the 101 to 150 mm range, with one individual rainbow trout up to 360 mm (Figure 2.3-2). Fish Sampling Site 1 showed a broader range of size classes than did Fish Sampling Site 2. Most of the sucker spp. in Fish Sampling Site 2 were in the 101 to 105 mm range with few individuals outside this size class. Rainbow trout in Fish Sampling Site 2 were most abundant in the 51 to 100 mm size class, supplemented by fish in the 101 to 150 mm range. No rainbow trout were observed over 200 mm in Fish Sampling Site 2, and only one sucker spp. was found over 200 mm (Figure 2.3-3).



Key:
 Count = number of individuals captured
 LMB = largemouth bass
 mm = millimeters
 PSC = prickly sculpin
 RBT = rainbow trout

Figure 2.3-2. Length Frequencies of Fish Sampled at Fish Sampling Site 1 on Pyramid Reach



Key:
 Count = number of individuals captured
 mm = millimeters
 RBT = rainbow trout
 Sucker spp. = unknown sucker species

Figure 2.3-3. Length Frequencies of Fish Sampled at Fish Sampling Site 2 on Pyramid Reach

Overall catch per unit effort (CPUE, fish per minute) was calculated cumulatively, as well as by species, for each site. Sampling effort was calculated by summing the total time the backpack electrofishing units were in use, or “on,” over all passes within the site. Overall effort and CPUE between Fish Sampling Sites 1 and 2 were similar (Table 2.3-4)

Table 2.3-4. CPUE with Species Composition for Fish Sampling Sites 1 and 2 on Pyramid Reach

Species	Total Catch	Overall CPUE	Fish Sampling Site 1		Fish Sampling Site 2	
			Raw	CPUE	Raw	CPUE
Rainbow Trout	125	0.22	78	0.29	47	0.18
Largemouth Bass	49	0.08	49	0.18	0	0.00
Sucker spp.	81	0.14	0	0.00	81	0.32
Prickly Sculpin	10	0.02	10	0.03	0	0.00
Total Catch	265		137		128	
Overall CPUE	0.46		0.50		0.50	
Effort (seconds)	34,781		16,285		15,436	
Effort (minutes)	579.68		271.42		257.27	

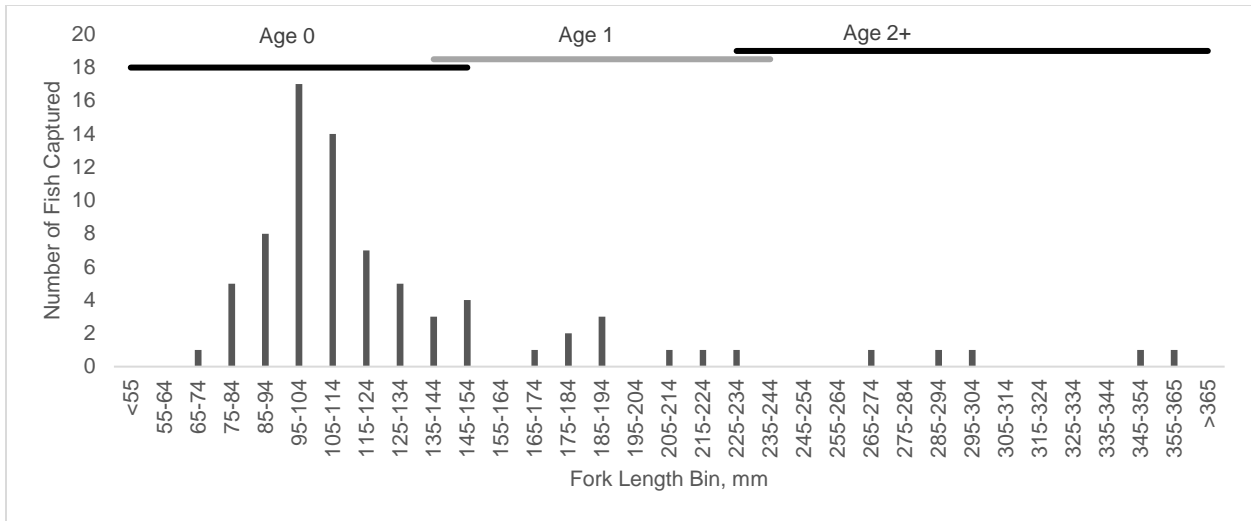
Key:
CPUE = catch per unit effort, number per minute

Age analysis results for rainbow trout and largemouth bass are presented in Table 2.3-5 and show multiple age classes for both species. Figure 2.3-4 and Figure 2.3-5 display the length frequencies associated with the different age classes for rainbow trout sampled at Fish Sampling Site 1 and Fish Sampling Site 2. During scale analysis, spawn checks were identified on two rainbow trout scale samples for which age determination was possible (285 and 350 mm fork lengths). Additionally, two other rainbow trout scale samples appeared to display spawn checks, but due to scale regeneration, these were not confirmed (265 and 301 mm fork lengths). The presence of multiple age classes and spawning checks indicates that the rainbow trout population is healthy and naturally reproductive.

Table 2.3-5. Age Distribution of Game Fish at Fish Sampling Sites 1 and 2 on Pyramid Reach

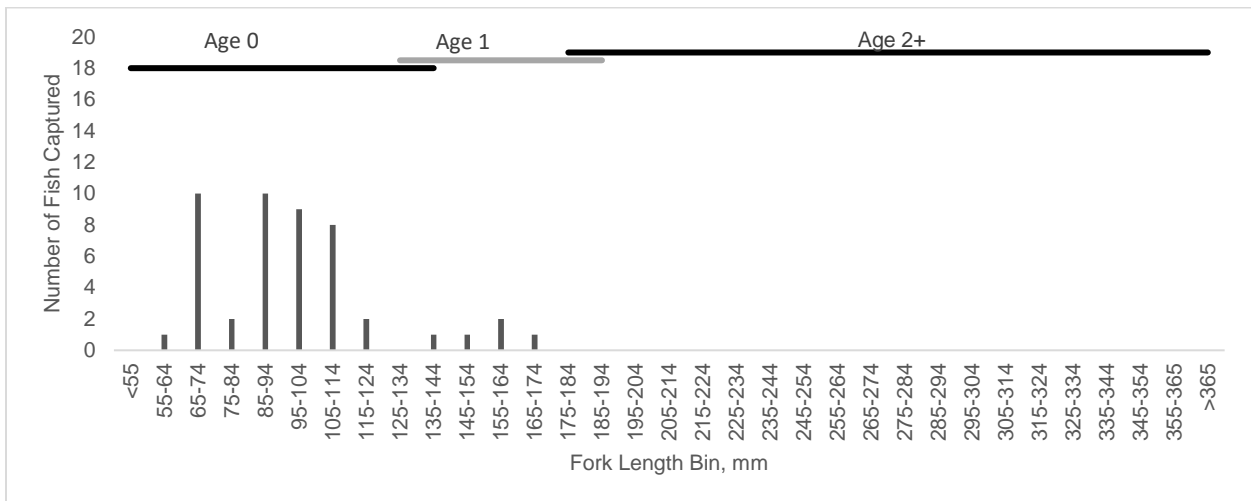
Species	Total		Fish Sampling Site 1		Fish Sampling Site 2	
	Age	Count (%)	Age	Count (%)	Age	Count (%)
Rainbow Trout	0	104 (83%)	0	62 (79%)	0	42 (89%)
	1	15 (12%)	1	10 (13%)	1	5 (11%)
	2	6 (5%)	2	6 (8%)	2	0
Largemouth Bass	0	15 (31%)	0	15 (31%)	0	0
	1	34 (69%)	1	34 (69%)	1	0
	2	0	2	0	2	0

Key:
% = percent



Key:
 mm = millimeters

Figure 2.3-4. Age-Length Frequency Relationship for Rainbow Trout Sampled at Fish Sampling Site 1



Key:
 mm = millimeters

Figure 2.3-5. Age-Length Frequency Relationship for Rainbow Trout Sampled at Fish Sampling Site 2

While conducting the Pyramid Reach Fish Population Study, there was one incidental observation to report. During electrofishing efforts at Fish Sampling Site 1, American bullfrogs (*Lithobates catesbeianus*) were observed and eradicated when possible. Adult bullfrogs were not observed at Fish Sampling Site 2 or Fish Sampling Site 3; however, bullfrog tadpoles were observed at Fish Sampling Site 1.

2.3.3 Associated Data Files

File Name	Data Description	File Type	File location
Pyramid Reach Fish Pop Database	Database containing all raw data collected during backpack electrofishing	XLSX	Project Website
Pyramid Reach Electrofishing Data Sheet	Blank backpack electrofishing data sheet	PDF	Project Website
eDNA Sampling Data Sheet	Blank eDNA sampling data sheet	PDF	Project Website
Piru Creek eDNA Report Final	Report from Genidaqs containing eDNA results	PDF	Project Website
20180511_dwr_sswp_P2426_Pyramid_Reach_Habitat_Units	Habitat data from Pyramid reach	XLSX	Project Website
Pyramid Reach Sampling Sites for eDNA, Stream Fish, and BMI between RM's 0.0 and 18.3	Two-page map of Pyramid reach including habitat mapping locations and sampling sites for eDNA, stream fish, and BMI	PDF	Project Website

2.3.4 Variances from Study Methods, Schedule or Approach, and Unexpected Field Conditions

There was one variance from the FERC-approved Study Plan. The Study Plan stated that the habitat mapping would occur from July 2017 to September 2017, and that fieldwork would occur from June 2018 to September 2018. Habitat mapping was not completed until May 2018, and fieldwork was completed between March 2018 and October 2018. Habitat mapping was conducted in 2018 to more accurately represent conditions to be encountered during the 2018 fieldwork. The eDNA sampling effort began three months early in order to take advantage of favorable stream conditions. The fish sampling took place one month later than anticipated, at the request of CDFW and to comply with water temperature requirements listed in the Scientific Collecting Permit. While this variance is a modification to the FERC-approved Study Plan, it did not affect the overall Study or the quality of data collected.

2.3.5 Remaining Work

None; the Study is complete.

2.4 SPECIAL-STATUS AQUATIC AMPHIBIANS AND SEMI-AQUATIC SNAKES STUDY

2.4.1 Completed Work to Date

The Study is complete. As required by the FERC-approved Study Plan, the Licensees completed Step 1 (Identify Potential Habitat), Step 2 (Conduct Field Reconnaissance and Surveys), and Step 3 (Prepare Results).

2.4.2 Key Accomplishments and Summary of Findings to Date

Surveys were conducted for the following special-status amphibian and semi-aquatic reptile species throughout the Study area as follows.

2.4.2.1 *Foothill Yellow-legged Frog*

Stream reaches with potential habitat for foothill yellow-legged frog (FYLF) were identified by a desktop review of aerial imagery and other information, followed by a pre-survey field reconnaissance on February 27, 2018 and February 28, 2018. This assessment determined that potential habitat for FYLF in the Study area is limited to Piru Creek, upstream and downstream of Pyramid Lake. Seasonal streams that are not tributaries of larger streams with persistent aquatic habitat were not regarded as potential FYLF habitat. These seasonal streams included ephemeral channels that appear to hold water only after heavy precipitation. Los Alamos Creek (Cañada de Los Alamos) and Gorman Creek include sections with apparent perennial flows, but neither is characteristic of FYLF habitat because of fine-grained (i.e., sand and silt) substrates, and dense emergent and overhanging riparian vegetation inconsistent with FYLF habitat.

Survey sites were designated in a segment of Piru Creek upstream of Pyramid Lake within the Study area and in representative sections of potentially suitable habitat within Pyramid reach. No survey sites were designated downstream of Ruby Canyon, which is the section that has been surveyed annually by DWR for arroyo toad and other sensitive species since 2010. Each designated survey site was surveyed for FYLF following visual encounter survey (VES) methods on three dates as detailed below, with the exception of one site located approximately 1.5 miles upstream of Ruby Canyon. The latter site, which was not safely accessible because of the distance from the nearest access point (6.5 miles) and dangerous conditions (e.g., rugged terrain requiring heavy backpacks, heat, and lack of satellite phone coverage), was surveyed once on April 17, 2018, after which no further surveys were attempted.

Because the only access points for Piru Creek between Frenchman's Flat and Ruby Canyon (i.e., Frenchman's Flat and Blue Point Campground) are separated by about 5 miles of stream, the surveys within this reach focused on scattered habitats suitable for egg deposition and potential larval habitat, which collectively comprised up to 20% of the sites. The intervening habitats were not intensively searched but were traversed while alert for sightings of FYLF or other special-status species, a procedure also followed while traversing to and from the following survey sites.

- Piru Creek (upstream of Pyramid Lake within Study area) – One site approximately 2,600 feet long on April 4, May 16, and July 25, 2018
- Piru Creek (Pyramid reach)
 - Pyramid Dam to upstream of Frenchman’s Flat: Two contiguous sites representing a total distance of 2,300 feet on April 3, May 15, and May 29, 2018
 - Frenchman’s Flat to Fish Creek confluence: Four sites, including two contiguous sites, representing a total distance of approximately 8,500 feet on April 18, May 30, July 23, September 25, and September 26, 2018
 - Fish Creek to Ruby Canyon: Three sites, including two contiguous sites, representing a total distance of approximately 3,800 feet on April 16, April 17, September 25, and September 26, 2018

In addition to the VES, water samples were collected at 500-meter intervals along the entire Pyramid reach as part of the *Pyramid Reach Fish Population Study* to be analyzed for eDNA to assess the presence of target fish species. These samples were also analyzed for the presence of FYLF DNA.

The results of the VES included no observations of FYLF at any site nor did the eDNA analysis indicate the presence of FYLF DNA. In addition, there were no incidental observations of this species during other field work.

2.4.2.2 Western Spadefoot

Potential western spadefoot breeding habitat was identified at only two locations in the Study area. Seasonal pools on each end of a culvert under Orwin Road appeared to be suitable habitat and were surveyed on May 18, 2018, when only western toad larvae were found. These pools were dry when revisited on July 26, 2018. The other location that may represent suitable habitat was a depression within a former channel of Piru Creek upstream of Frenchman’s Flat along the Pyramid reach on the west side of Golden State Highway. Although this pool was dry when first discovered on May 15, 2018, it may hold water seasonally for a sufficient period to be habitat for western spadefoot. No western spadefoot were detected during the Study or observed incidentally during other field work.

2.4.2.3 Two-Striped Gartersnake and South Coast Gartersnake

Potentially suitable habitat for special-status gartersnakes were identified along perennial and intermittent streams, and in riparian habitat patches associated with Project reservoirs, including the mouths of seasonal tributary streams. These areas indicated below were each surveyed on multiple dates for gartersnakes. Seasonal swales at Los Alamos Campground that were observed to be dry during the Study were surveyed.

- Quail Lake – Riparian habitat patches surveyed entirely on April 2 and May 31, 2018
- Gorman Bypass Channel, immediately below Quail Lake Spillway on April 5, May 31, and July 26, 2018
- Gorman Creek on April 5, May 17, and July 26, 2018
- Los Alamos Creek on April 5, May 14, and July 26, 2018
- Los Alamos Campground on April 5, May 14, and July 26, 2018
- Select Pyramid Lake recreation sites and reservoir tributaries, including Spanish Point Day Use Area, Bear Trap Boat-In Site, Yellow Bar Boat-In Site, Piru Creek (upstream of Pyramid Lake within Study area), and at four other coves, on April 4, May 16, and July 25, 2018
- Piru Creek (Pyramid reach) on April 3, 16, 17, and 18; May 15, 29, and 30; July 23; and September 25, and 26, 2018
- Select Elderberry Forebay tributaries and habitat patches on May 18, June 1, and July 27, 2018

A total of four two-striped gartersnakes were observed during the Study. All of these were observed in the Pyramid reach of Piru Creek as follows:

- April 16, 2018 near Turtle Canyon, this individual was deceased and had been recently killed by a predator. It was found on the banks in cobble substrate
- April 17, 2018 near Turtle Canyon
- April 17, 2018 downstream of Fish Creek
- May 30, 2018 upstream of Fish Creek

No South Coast gartersnakes were found during the Study or observed incidentally during other field work. Notable findings during the Study included observations of southern western pond turtles within the Pyramid reach of Piru Creek and within Pyramid Lake north at the confluence with Piru Creek.

Based on the number and location of two-striped gartersnakes found during this Study, as well as during annual arroyo toad surveys conducted by DWR in the lower section of Pyramid reach (i.e., Blue Point to Ruby Canyon), it appears that suitable habitat for this species is concentrated in the more open sections of the lower Pyramid reach, with less suitable areas upstream.

2.4.3 Associated Data Files

File Name	Data Description	File Type	File Location
20181031_SSWP_SS_Amphibian_site_habitat_assessment_Data_Sheets	Site habitat assessment datasheets	PDF	Project website
20181031_SSWP_SS_Amphibian_Survey_Data_Sheets	Survey datasheets	PDF	Project website
20181126_SSWP_SS_Amphibian_photo_log	Photo log of amphibian surveys	PDF	Project website

2.4.4 Variances from Study Methods, Schedule or Approach, and Unexpected Field Conditions

There were no variiances in Study Methods, Schedule, or Approach from the FERC-approved Study Plan.

2.4.5 Remaining Work

None; the Study is complete.

2.5 BOTANICAL RESOURCES STUDY

2.5.1 Completed Work to Date

The Licensees have completed Step 1 (Existing Data Assembly) of the Study. The Licensees assembled existing data relevant to the special-status plant species and wetland and riparian assessment, and prepared field maps. The majority of Step 2 (Special-Status Plant Surveys) and Step 3 (Wetland and Riparian Assessment) have been completed.

2.5.2 Key Accomplishments and Summary of Findings to Date

2.5.2.1 Step 2: Special-Status Plant Surveys

- Prior to conducting field surveys, reference sites for Nevin's barberry (*Berberis nevinii*), short-jointed beavertail cactus (*Opuntia basilaris* var. *brachyclada*), Peirson's morning glory (*Calystegia peirsonii*), Plummer's mariposa lily (*Calochortus plummerae*), slender mariposa lily (*Calochortus clavatus* var. *gracilis*), Palmer's mariposa lily (*Calochortus palmeri* var. *palmeri*), Davidson's bush mallow (*Malacothamnus davidsonii*), Ross' pitcher sage (*Lepechinia rossii*), Santa Susana tarplant (*Deinandra minthornii*), Baja navarretia (*Navarretia peninsularis*), Tehachapi monardella (*Monardella linoides* ssp. *oblonga*), and Peirson's lupine (*Lupinus peirsonii*) were checked and verified to determine local phenology, habitat, and other site factors that could contribute to special-status plant species identification within the proposed Project boundary. Although

Nevin's barberry, Davidson's bush mallow, Santa Susana tarplant and Peirson's lupine were not listed in the Botanical Resources Study Plan, reference sites for these plants were visited because it was later determined that there was potential for these plant species to occur within the proposed Project boundary.

- The Botanical Resources Study Area is provided in the Associated Data Files section, below. The Study Area was evaluated between March 26, 2018 and September 13, 2018, for the presence of special-status plants. A complete early season survey, apart from Primary Project Roads, was conducted between March 26, 2018 and April 19, 2018. A complete late season survey was conducted between May 29, 2018 and September 13, 2018. Some areas of steep terrain could not be surveyed on foot, but were visually evaluated with binoculars (see Associated Data Files section, below). On April 2, 2019, while conducting early season botanical comprehensive surveys on the Castaic Transmission Line, five California condors (*Gymnogyps californianus*) were observed. The California condor is a State and federally listed special-status wildlife species. No other federally listed, State listed, or California Species of Special Concern special-status wildlife incidental observations were observed during the botanical comprehensive surveys. A comprehensive list of incidental wildlife observations is provided in the Associated Data Files section, below.
- Special-status plant surveys were conducted in conjunction with the Botanical Resources Study field surveys, and special-status plant occurrences were assessed using protocols specified in the Botanical Resources Study Plan.
- Appropriate data forms were completed for areas in which these species were found. Specifically, California Department of Fish and Wildlife California Native Species Field Survey Forms were completed for all findings in the Study Area. In addition, U.S. Department of Agriculture, Forest Service (USFS) Region 6 Threatened, Endangered, and Sensitive Plant Element Occurrence Field Forms were completed for occurrences on National Forest System (NFS) lands.
- A total of 136 occurrences of five special-status species were observed during field surveys, as summarized in Table 2.5-1 and depicted on maps (see Associated Data Files). None of the species are listed under the federal Endangered Species Act or the California Endangered Species Act. However, three of the five special-status species that were observed during field surveys are Forest Service Sensitive Species.

Table 2.5-1. Special-Status Plant Species Occurrences Identified During 2018 Field Surveys

Scientific Name	Common Name	State Ranking ¹	USFS Ranking ¹	Number of Occurrences in Study Area	Location of Occurrences	Site Quality	Threats
<i>Calochortus clavatus var. gracilis</i>	slender mariposa-lily	S3	S	11	Throughout the Study Area (see maps); occurrences were found on NFS lands	6 excellent 1 good 4 fair	Encroachment of non-native invasive plants, road and vehicle use, and human use via recreation
<i>Calystegia peirsonii</i>	Peirson's morning glory	S4	None	79	Throughout the Study Area (see maps); occurrences were found on NFS lands	44 good 30 fair 5 poor	Encroachment of non-native invasive plants, road and vehicle use, and human use via recreation
<i>Delphinium parryi ssp. purpureum</i>	Mt. Pinos larkspur	S4	S	1	Occurrence found in the Castaic Transmission Line area; on NFS lands	1 good	Road and vehicle use
<i>Juglans californica</i>	Southern California black walnut	S4	None	1	Occurrence found in the Castaic Creek; not on NFS lands	1 good	Encroachment of non-native invasive plants.
<i>Opuntia basilaris var. brachyclada</i>	short-joint beavertail	S3	S	44	Throughout the Study Area (see maps); occurrences were found on NFS lands	1 excellent 10 good 27 fair 6 poor	Encroachment of non-native invasive plants, road and vehicle use, and human use via recreation
Total	5 plant species	2 (S3) & 3 (S4)	3 (S) & 2 (None)	136	--	--	--

Source:

¹CDFW 2018

Notes:

CDFW State Listing Ranks:

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.

USFS Plant Ranks:

S = Sensitive

Key:

NFS = National Forest System

2.5.2.2 Step 3: Wetland and Riparian Assessment

The Licensees identified and assessed nine lotic areas in the 2017 and 2018 surveys. The information collected for these features is summarized in Table 2.5-2 and is displayed on field summary maps (see Associated Data Files). Seven of the nine lotic areas were determined to exhibit “Proper functioning condition,” and two areas were determined to be “Functional – at risk”.

Table 2.5-2. Lotic Features Observed During 2017 and 2018 Field Surveys

Feature ID	Location	Functional Assessment	Wetland System (Cowardin)	Wetland Class (Cowardin)	Water Regime (Cowardin)
CC-4-Lo-A	Castaic Creek	Proper functioning condition	Riverine	Streambed	Permanently flooded
CC-4-Lo-B	Castaic Creek	Functional at risk	Riverine	Streambed	Intermittently flooded
GC-1-Lo-A	Gorman Creek	Proper functioning condition	Riverine	Streambed	Semi-permanently flooded
GC-1-Lo-B	Gorman Creek	Proper functioning condition	Riverine	Riverine	Semi-permanently flooded
GC-2-Lo-A	Gorman Creek	Proper functioning condition	Riverine	Streambed	Permanently flooded
PD-2-Lo-A	Piru Creek	Proper functioning condition	Riverine	Streambed	Permanently flooded
PL-1-Lo-C	Pyramid Lake	Proper functioning condition	Riverine	Streambed	Permanently flooded
PL-10-Lo-A	Pyramid Lake	Functional at risk	Riverine	Rock Bottom	Permanently flooded
Py-UpperPiru-1	Pyramid Lake	Proper functioning condition	Riverine	Forested	Flowing

The Licensees identified and assessed twenty-two lentic areas in the 2017 and 2018 surveys. This includes many disjunct areas that were similar and close in proximity, but not connected (e.g., areas of cattail marsh that were similar in structure and composition but separated by a different type of vegetation or shoreline structure). These features were combined into a single feature for purposes of analysis and reporting. These are summarized in Table 2.5-3 and displayed on field summary maps (see Associated Data Files).

Table 2.5-3. Lentic Features Observed During 2017 and 2018 Field Surveys

Feature ID	Location	Functional Assessment	Wetland System (Cowardin)	Wetland Class (Cowardin)	Water Regime (Cowardin)
CC-3-Le-A	Castaic Creek	Nonfunctional	Palustrine	Unconsolidated Shore	Ponded
EF-1-Le-A	Elderberry Forebay	Functional - at risk	Lacustrine	Rocky Shore	Ponded
EF-1-Le-B	Elderberry Forebay	Functional - at risk	Lacustrine	Rocky Shore	Ponded
EF-1-Le-C	Elderberry Forebay	Functional - at risk	Lacustrine	Emergent Wetland	Ponded
EF-4-Le-A	Elderberry Forebay	Proper functioning condition	Lacustrine	Emergent Wetland	Ponded
EF-5-Le-A	Elderberry Forebay	Proper functioning condition	Lacustrine	Emergent Wetland	Ponded
LG-2-Le-A	Liebre Gulch	Functional - at risk	Lacustrine	Emergent Wetland	Ponded
LG-3-Le-A	Liebre Gulch	Proper functioning condition	Lacustrine	Emergent Wetland	Ponded
PD-1-Le-A	Pyramid Reach	Proper functioning condition	Palustrine	Rocky Shore	Ponded
PD-1-Le-B	Pyramid Reach	Proper functioning condition	Palustrine	Rocky Shore	Ponded
PD-1-Le-C	Pyramid Reach	Proper functioning condition	Palustrine	Rocky Shore	Ponded
PL-1-Le-A	Pyramid Lake	Functional - at risk	Lacustrine	Scrub-Shrub Wetland	Ponded
PL-1-Le-B	Pyramid Lake	Proper functioning condition	Lacustrine	Emergent Wetland	Ponded
PL-1-Le-D	Pyramid Lake	Proper functioning condition	Lacustrine	Emergent Wetland	Ponded
PL-1-Le-E	Pyramid Lake	Functional - at risk	Lacustrine	Scrub-Shrub Wetland	Other
PL-4-Le-A	Pyramid Lake	Nonfunctional	Lacustrine	Unconsolidated Shore	Other

Table 2.5-3. Lentic Features Observed During 2017 and 2018 Field Surveys (continued)

Feature ID	Location	Functional Assessment	Wetland System (Cowardin)	Wetland Class (Cowardin)	Water Regime (Cowardin)
PL-9-Le-A	Pyramid Lake	Nonfunctional	Lacustrine	Emergent Wetland	Ponded
Py-Lake-1	Pyramid Lake	Proper functioning condition	Lacustrine	Forested	Flowing
Py-3	Pyramid Lake	Proper functioning condition	Lacustrine	Scrub-shrub	Ephemeral
QL-1-Le-A	Quail Lake	Nonfunctional	Lacustrine	Emergent Wetland	Ephemeral
QL-3-Le-A	Quail Lake	Functional - at risk	Palustrine	Emergent Wetland	Ponded
QL-5-Le-A	Quail Lake	Functional - at risk	Lacustrine	Emergent Wetland	Ponded

Ten features were found to have “Proper functioning condition,” eight - “Functional – at risk,” and four - “Nonfunctional.” Areas were determined to be Functional – at risk or Nonfunctional for a variety of reasons, including limited vegetative structure and ripped shorelines. None of these characteristics were identified as a function of Project operations with the exception of those at features EF-1-Le-A, EF-1-Le-B, and EF-1-Le-C where water levels fluctuate. More detail is provided in the datasheets (see Associated Data Files).

Lentic and lotic feature polygons were digitized in Geographic Information System (GIS) based on collected field data and aerial imagery.

2.5.3 Associated Data Files

File Name	Data Description	File Type	File Location
Various. Naming convention is date_dwr_sswp_p2426_location_location type_photo number	Photos of lotic and lentic features, shoreline areas, reconnaissance	JPG	Project website
Various. Naming convention is date_dwr_sswp_p2426_PFC_FeatureID_datasheetname	PFC lentic and lotic datasheets, botanical species observed by day	PDF	Project website
20170728_dwr_sswp_p2426_pfc_incidental_observations_compiled	Incidental wildlife observations during PFC surveys	Excel	Project website
20170731_dwr_sswp_p2426_pfc_botanical_observed_species_compiled	List of all plant species observed during PFC surveys	Excel	Project website

File Name	Data Description	File Type	File Location
20170505_dwr_sswp_p2426_weekly_summary_pfc_study_crew1_wk1	Field notes for 1st week of PFC surveys	Word	Project website
20170518_dwr_sswp_p2426_weekly_summary_pfc_study_crew1_wk2	Field notes for 2nd week of PFC surveys	Word	Project website
20170523_dwr_sswp_p2426_weekly_summary_pfc_study_crew1_wk3	Field notes for 3rd week of PFC surveys	Word	Project website
20170823_dwr_sswp_p2426_PFC_lentic_polygons	.ZIP file with GIS Shapefile containing lentic feature polygons with descriptive data	GIS Shapefile	Project website
20170823_dwr_sswp_p2426_PFC_lotic_polygons	.ZIP file with GIS Shapefile containing lotic feature polygons with descriptive data	GIS Shapefile	Project website
20170823_dwr_sswp_p2426_LenticLotic_PFC_Study.pdf	Maps depicting lentic and lotic features, with PFC assessment	PDF	Project website
20181210_p2426_sswp_botanical_inventory_fnl	List of all plant species observed during 2018 botanical surveys	PDF	Project website
Various. Naming convention is date (year, month, day), location and photo number	Photos of special-status botanical occurrences, points and polygons	JPG	Project website
20181211_p2426_sswp_incidental_observations	Incidental wildlife observations during 2018 botanical surveys	Excel	Project website
Various. Naming convention is date (year, month, day) SSWP_Daily_Survey Team Number (ST#)	2018 botanical daily data forms	PDF	Project website
Various. Naming convention is date (year, month, day) SSWP_TES_USFS_Survey Team Number (ST#)	2018 botanical TES Element USFS forms	PDF	Project website
Special-status_GIS_Data_20181210	2018 special-status point and polygon GIS Shapefiles	GIS Shapefile	Project website
Access_GIS_Data_20181210	2018 Study Area inaccessible access areas point, polygon, and line GIS Shapefiles	GIS Shapefile	Project website
Various. Naming convention is SSWP_Rare_Plants_11x17_Landsc_20190129_Figure #	Maps depicting special-status plant occurrences	PDF and JPG	Project website
SSWP_Inaccessible_Visual_Surveys_8x11_20190129	Map depicting inaccessible access in the Study Area	PDF and JPG	Project website
SSWP_Botanical_Resources_Study_Area_8x11_20190129	Map depicting the Botanical Resources Study Area	PDF and JPG	Project website

File Name	Data Description	File Type	File Location
Various. Naming convention is date (year, month, day) SSWP_CA_Native_Spp_Survey _Form_Survey Team Number (ST#)	2018 botanical CNDDDB forms	PDF	Project website

Key:
 CNDDDB = California Natural Diversity Database
 GIS = Geographic Information System
 PFC = Proper Functioning Condition
 SSWP = South SWP Hydropower Relicensing
 ST = survey team
 TES = Threatened, Endangered, and Sensitive
 USFS = U.S. Department of Agriculture, Forest Service

2.5.4 Variances from Study Methods, Schedule or Approach, and Unexpected Field Conditions

There were two variances from the FERC-approved Study:

1. Step 2 (Special-Status Plant Surveys): The Study was scheduled to be completed by December 2018. However, due to ongoing fieldwork, the Study is expected to be completed in July 2019.
2. Step 3 (Wetland and Riparian Assessment): The fieldwork was scheduled to be completed by April 2018, but was not completed until June 2018.

These two variances from the FERC-approved Study will affect the Study schedule, but they are not expected to affect the overall Study because the same Study approach and methodology will be utilized as outlined in the Botanical Resources Study Plan. Therefore, all outstanding information to be collected by July 2019 will not be provided in the Updated Study Report, but an updated data summary will be posted on the relicensing website once the field results have undergone QA/QC. Final field results, with accompanying GIS figures, will be provided in the Draft License Application.

2.5.5 Remaining Work

Remaining work includes the following:

- Step 1 (Existing Data Assembly): Completed.
- Step 2 (Special-Status Plant Surveys): (1) Complete remaining early season botanical field surveys of the Primary Project Roads in the Castaic Transmission Line area; and (2) process data.
- Step 3 (Wetland and Riparian Assessment): (1) Process data.

After the steps above are completed, the final field results and data summary report will be posted on the relicensing website. The Licensees expect to complete the Study in July 2019.

2.6 NON-NATIVE INVASIVE PLANTS STUDY

2.6.1 Completed Work to Date

The Licensees have completed Step 1 (Gather Data and Prepare for Field Effort) and completed the majority of Step 2 (Conduct Field Surveys).

2.6.2 Key Accomplishments and Summary of Findings to Date

The completed work referenced above resulted in the following:

- The Study Area for this effort is the same as for the Botanical Resources Study (see Associated Data Files section, below).
- The Study Area was evaluated between March 26, 2018 and September 13, 2018, for the presence of non-native invasive plants (NNIP). A complete early season survey, apart from Primary Project Roads, was conducted between March 26, 2018 and April 19, 2018. A complete late season survey was conducted between May 29, 2018 and September 13, 2018. Some areas of steep terrain could not be surveyed on foot, but were visually evaluated with binoculars (see Associated Data Files section, below). Furthermore, no incidental observations of federally listed, state listed, or California species of concern special-status wildlife species were observed during this study. A comprehensive list of incidental wildlife observations is provided in the Associated Data Files section, below.
- NNIP surveys were conducted in conjunction with the Botanical Resources Study field surveys. NNIP general data forms were completed for any California Department of Food and Agriculture (CDFA)-rated species occurrences observed. In addition, U.S. Department of Agriculture, Forest Service (USFS) Invasive Species Infestation Record Forms were completed for any occurrences of the CDFA-rated target species on National Forest System (NFS) lands. The USFS form was also completed for non-CDFA-rated plants identified by USFS as species of interest (see Table 2.6-1 for the complete Target NNIP Species list).
- Field forms were completed for all target NNIP in the Study Area (see Completed Work above). A total of 877 occurrences of 32 different NNIP species were observed during field surveys. These occurrences are summarized in Table 2.6-2 and depicted on maps (see Associated Data Files).
- During the 2018 botanical field efforts, Geographic Information System (GIS) data could not be collected for eight NNIP species due to a variety of factors, including Global Positioning System unit malfunctions, post-field identification, and other technical issues. The general locations of these occurrences are known, and more accurate data reflecting their locations and sizes will be recorded during the 2019 botanical surveys.

Table 2.6-1. Target NNIP Species to Survey in the Study Area

Scientific Name ¹	Common Name	CDFA Rating ²	Cal-IPC Rating ³	ANF Invasive Species Non-Native Plant Species List ⁴	LPNF Invasive Species Non-Native Plant Species List ⁴
** <i>Acacia</i> sp.	Acacia	B		--	--
** <i>Acroptilon repens</i>	Russian knapweed	B	Moderate	--	--
* <i>Ageratina adenophora</i>	Eupatory	--	Moderate	--	--
** <i>Ailanthus altissima</i>	Tree of heaven	C	Moderate	Y	Y
** <i>Arundo donax</i>	Giant reed grass	B	High	Y*	A
** <i>Asphodelus fistulosus</i>	Asphodel	B	--	--	--
* <i>Atriplex semibaccata</i>	Saltbush	--	Moderate	--	Y
* <i>Brassica tournefortii</i>	African mustard	--	High	--	--
** <i>Cardaria (Lepidium) draba/pubescens</i>	Hoary cress/Whitetop	B	Moderate	--	Y
** <i>Carduus pycnocephalus</i>	Italian thistle	C	Moderate	--	Y
** <i>Centaurea solstitialis</i>	Yellow star thistle	C	High	Y	Y
** <i>Centaurea maculosa</i>	Spotted knapweed	A	High	--	--
** <i>Centaurea melitensis</i>	Tocalote	C	Moderate	--	Y
** <i>Cirsium arvense</i>	Canada thistle	B	Moderate	--	--
** <i>Cirsium vulgare</i>	Bull thistle	C	Moderate	--	Y
* <i>Cistus creticus</i>	rockrose	--	--	--	--
* <i>Cnicus benedictus</i>	blessed thistle	--	--	--	--
* <i>Colutea arborescens</i>	Bladderpod senna	--	--	--	--
* <i>Conium maculatum</i>	Poison hemlock	--	Moderate	--	Y
** <i>Cortaderia jubata/selloana</i>	Pampas grass	B	High	--	Y
** <i>Cynara cardunculus</i>	Artichoke thistle	B	Moderate	--	Y
* <i>Cynosurus echinatus</i>	Hedgehog dogtail grass	--	Moderate	--	--

Table 2.6-1. Target NNIP Species to Survey in the Study Area (continued)

Scientific Name ¹	Common Name	CDFA Rating ²	Cal-IPC Rating ³	ANF Invasive Species Non-Native Plant Species List ⁴	LPNF Invasive Species Non-Native Plant Species List ⁴
** <i>Cystisus scoparius</i>	Scotch thistle	C	--	--	--
** <i>Delairea odorata</i>	German ivy	B	--	--	--
* <i>Dipsacus sativus</i>	Teasel	--	Moderate	--	--
* <i>Dimorphotheca sinuata</i>	African daisy	--	--	--	--
* <i>Eichornia crassipes</i>	Water hyacinth	--	--	--	--
* <i>Elaeagnus angustifolius</i>	Russian olive	--	Moderate	--	--
* <i>Erharta</i> sp.	Veldt grass	--	--	--	--
* <i>Eucalyptus globulus</i>	Blue gum	--	Limited	--	--
* <i>Euphorbia dendroides</i>	Tree spurge	--	--	Y*	--
** <i>Euphorbia terracina</i>	Geraltion carnation	B	Limited	--	--
* <i>Ficus carica</i>	Fig	--	Moderate	--	--
* <i>Foeniculum vulgare</i>	Fennel	--	Moderate	--	Y
* <i>Fumaria officinalis</i>	Fumitory	--	--	--	--
** <i>Genista monospeulana</i>	French broom	C	High	--	Y
** <i>Halogeton glomeratus</i>	Halogeton	A	Moderate	--	--
* <i>Hedera helix</i>	English ivy	--	High	Y	--
* <i>Lathyrus latifolius</i>	Perennial sweetpea	--	--	--	--
** <i>Lepidium latifolium</i>	Perennial pepperweed	B	High	--	Y
** <i>Linaria genistifolia</i> ssp. <i>dalmatica</i>	Dalmatian toadflax	A	Moderate	--	Y*
* <i>Lobularia maritima</i>	sweet alyssum	--	Limited	--	--
* <i>Marrubium vulgare</i>	horehound	--	Limited	--	--
* <i>Nicotiana glauca</i>	Tree tobacco	--	Moderate	Y	Y

Table 2.6-1. Target NNIP Species to Survey in the Study Area (continued)

Scientific Name ¹	Common Name	CDFA Rating ²	Cal-IPC Rating ³	ANF Invasive Species Non-Native Plant Species List ⁴	LPNF Invasive Species Non-Native Plant Species List ⁴
<i>*Olea europaea</i>	Olive	--	Limited	--	--
<i>**Pennisetum clandestinum</i>	Kikuyu grass	C	Limited	--	Y
<i>*Pennisetum setaceum</i>	Fountain grass	--	Moderate	--	Y
<i>*Picris echioides</i>	Bristly ox-tongue	--	Limited	--	--
<i>*Prunus cerasifera</i>	Cherry plum	--	Limited	--	--
<i>*Pyracantha sp. pyracantha</i>	Pyracantha	--	--	--	--
<i>*Raphanus sativus</i>	Wild radish	--	Limited	--	--
<i>**Retama monosperma</i>	Bridal broom	B	Moderate	--	--
<i>*Ricinus communis</i>	Castorbean	--	Limited	Y	--
<i>*Robinia pseudoacacia</i>	Black locust	--	Limited	Y	Y
<i>*Rosmarinus officianalis</i>	Rosemary	--	--	--	--
<i>*Rubus discolor (armeniacus)</i>	Himalayan blackberry	--	High	--	Y
<i>**Salsola tragus</i>	Russian thistle	C	Limited	Y	Y
<i>**Salsola paulsenii</i>	Barbwire Russian thistle	C	Limited	--	--
<i>*Saponaria officinalis</i>	Bouncing bet	--	Limited	--	Y
<i>*Schinus molle</i>	Peruvian pepper tree	--	Limited	--	--
<i>*Silybum marianum</i>	Milk thistle	--	Limited	--	Y
<i>**Spartium junceum</i>	Spanish broom	C	High	Y	Y
<i>*Stipa miliacea</i>	Smilo grass	--	Limited	--	--
<i>**Tamarix ramosissima</i>	Saltcedar	B	High	--	--
<i>*Tradescantia fluminensis</i>	Small-leaved spiderwort	--	--	--	--
<i>**Tribulus terrestris</i>	Puncture vine	C	Limited	--	--

Table 2.6-1. Target NNIP Species to Survey in the Study Area (continued)

Scientific Name ¹	Common Name	CDFA Rating ²	Cal-IPC Rating ³	ANF Invasive Species Non-Native Plant Species List ⁴	LPNF Invasive Species Non-Native Plant Species List ⁴
* <i>Ulnus parvifolia</i>	Chinese elm	--	--	--	--
* <i>Vinca major</i>	Periwinkle	--	Moderate	Y	Y
* <i>Washingtonia robusta</i>	Mexican fan palm	--	Moderate	--	--

Notes:

¹For species that are not listed by the California Department of Food and Agriculture (CDFA) (identified with one asterisk), data were collected in accordance with USFS protocols (USFS 2014) only for occurrences on NFS lands. For species identified with two asterisks (species that have a CDFA Rating of A, B, or C), occurrence data were collected wherever they were observed.

²CDFA Ratings (CDFA 2018):

A = An organism of known economic importance subject to State (or commissioner when acting as a State agent) enforced action involving: eradication, quarantine regulation, containment, rejection, or other holding action.

B = An organism of known economic importance subject to: eradication, containment, control or other holding action at the discretion of the individual county agricultural commissioner. Or an organism of known economic importance subject to State endorsed holding action and eradication only when found in a nursery.

C = An organism subject to no State enforced action outside of nurseries except to retard spread. At the discretion of the county agricultural commissioner. OR An organism subject to no State enforced action except to provide for pest cleanliness in nurseries.

³Cal-IPC Ratings (Cal-IPC ratings are provided for reference but were not a criteria in determining which species were target species) (Cal-IPC 2018):

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.

⁴ANF and LPNF Designation (USFS 2005):

Y = Present on forest

* = Forest is currently treating, in process of treating or has treated in past

A = adjacent or near forest, reasonable to expect invasion on forest lands within next five years

? = plants are adjacent or near and highly likely to be present but not documented

= plant added to CDFA noxious weed list 8/2003; pest rating not finalized but “C” rating expected

Key:

ANF = Angeles National Forest

Cal-IPC = California Invasive Plant Council

CDFA = California Department of Food and Agriculture

LPNF = Los Padres National Forest

USDA = U.S. Department of Agriculture

USFS = U.S. Department of Agriculture, Forest Service

Table 2.6-2. NNIP Target Species Occurrences in the Study Area Documented During 2018 Field Surveys

Scientific Name	Common Name	CDFA Rating ¹	National Forest Land Occurrences	Number of Occurrences in the Study Area
** <i>Acacia</i> sp.	Acacia	B	No	2
** <i>Ailanthus altissima</i>	Tree of heaven	C	Yes	2
** <i>Arundo donax</i>	Giant reed grass	B	Yes	11
* <i>Atriplex semibaccata</i>	Saltbush	--	Yes	12
* <i>Brassica tournefortii</i> ²	African mustard	--	No	1
** <i>Cardaria (Lepidium) draba/pubescens</i>	Hoary cress/Whitetop	B	Yes	2
** <i>Carduus pycnocephalus</i>	Italian thistle	C	Yes	14
** <i>Centaurea solstitialis</i>	Yellow star thistle	C	Yes	73
** <i>Centaurea melitensis</i>	Tocalote	C	Yes	172
** <i>Cirsium arvense</i>	Canada thistle	B	Yes	6
** <i>Cirsium vulgare</i>	Bull thistle	C	Yes	53
** <i>Cortaderia jubata/selloana</i>	Pampas grass	B	Yes	9
* <i>Dipsacus sativus</i> ²	Teasel	--	No	1
* <i>Ficus carica</i> ²	Fig	--	No	2
* <i>Foeniculum vulgare</i>	Fennel	--	Yes	1
** <i>Halogeton glomeratus</i>	Halogeton	A	Yes	1
** <i>Lepidium latifolium</i>	Perennial pepperweed	B	Yes	7
* <i>Marrubium vulgare</i>	horehound	--	Yes	20
* <i>Nicotiana glauca</i>	Tree tobacco	--	Yes	7
* <i>Pennisetum setaceum</i> ²	Fountain grass	--	No	2
* <i>Prunus cerasifera</i> ²	Cherry plum	--	No	1
* <i>Ricinus communis</i>	Castorbean	--	Yes	1
* <i>Robinia pseudoacacia</i>	Black locust	--	Yes	9
* <i>Rosmarinus officianalis</i> ²	Rosemary	--	No	2
* <i>Rubus discolor (armeniacus)</i> ²	Himalayan blackberry	--	No	1
** <i>Salsola tragus</i>	Russian thistle	C	Yes	202

Table 2.6-2. NNIP Target Species Occurrences in the Study Area Documented During 2018 Field Surveys (continued)

Scientific Name	Common Name	CDFA Rating ¹	National Forest Land Occurrences	Number of Occurrences in the Study Area
* <i>Schinus molle</i>	Peruvian pepper tree	--	Yes	7
* <i>Silybum marianum</i> ²	Milk thistle	--	No	2
** <i>Spartium junceum</i>	Spanish broom	--	Yes	96
* <i>Stipa miliacea</i>	Smilo grass	--	Yes	12
** <i>Tamarix ramosissima</i>	Saltcedar	--	Yes	141
** <i>Tribulus terrestris</i>	Puncture vine	--	Yes	5
Total:				877

Source:

¹CDFA 2018.

CDFA Ratings:

A - An organism of known economic importance subject to State (or commissioner when acting as a State agent) enforced action involving: eradication, quarantine regulation, containment, rejection, or other holding action.

B - An organism of known economic importance subject to: eradication, containment, control or other holding action at the discretion of the individual county agricultural commissioner. Or an organism of known economic importance subject to State endorsed holding action and eradication only when found in a nursery.

C - An organism subject to no State enforced action outside of nurseries except to retard spread. At the discretion of the county agricultural commissioner. Or an organism subject to no State enforced action except to provide for pest cleanliness in nurseries.

All occurrences are species on the Angeles National Forest and Los Padres National Forest invasive non-native plant species list. Where occurrences did not fall on NFS land (as indicated by a "No" in this column), USFS datasheets were not completed.

Notes:

²Geographic Information System (GIS) data will be collected during 2019 surveys

*Full-datasets collected only on NFS land

**Occurrence mapped wherever found

Key:

CDFA = California Department of Food and Agriculture

USFS = U.S. Department of Agriculture, Forest Service

2.6.3 Associated Data Files

File Name	Data Description	File Type	File Location
Various. Naming convention is date (year, month, day)_SSWP_NNIP_dataforms	NNIP compiled daily datasheets	PDF	Project website
Various. Naming convention is date (year, month, day)_SSWP_Invasive_Species_dataforms_USFS	NNIP Invasive Species Infestation Record USFS Field Forms	PDF	Project website
Various. Naming convention is SSWP_NNIP_11x17_Landsc_20190129_Figure #	Maps depicting NNIP occurrences in the study area	PDF and JPG	Project website
NNIP_Shapefile_Data_20181210	2018 NNIP point and polygon GIS Shapefiles	GIS Shapefile	Project website
20181210_p2426_sswp_botanical_inventory_fnl	List of all plant species observed during 2018 botanical field surveys	PDF	Project website
20181211_p2426_sswp_incidental_observations	Incidental wildlife observations during 2018 botanical surveys	Excel	Project website
SSWP_Botanical_Resources_Study_Area_8x11_20190129	Map depicting the Botanical Resources Study Area	PDF and JPG	Project website
SSWP_Inaccessible_Visual_Surveys_8x11_20190129	Map depicting inaccessible access in the Study Area	PDF and JPG	Project website

Key:
 GIS = Geographic Information System
 NNIP = non-native invasive plants
 SSWP = South SWP Hydropower Relicensing
 USFS = U.S. Department of Agriculture, Forest Service

2.6.4 Variations from Study Methods, Schedule or Approach, and Unexpected Field Conditions

There was one variance from the FERC-approved Study. The Study was scheduled to be completed by December 2018. However, due to ongoing fieldwork, the Study is expected to be completed by July 2019. This variance will affect the Study schedule, but it is not expected to affect the overall Study because the same Study approach and methodology will be utilized as outlined in the Non-Native Invasive Species Study Plan. Therefore, all outstanding information to be collected by July 2019 will not be provided in the Updated Study Report, but an updated data summary will be posted once the field results have undergone QA/QC. Final field results, with accompanying Geographic Information System figures, will be provided in the Draft License Application.

2.6.5 Remaining Work

Remaining work includes the following:

- Step 1 (Existing Data Assembly): Completed.
- Step 2 (Conduct Field Surveys): (1) complete remaining early season botanical field surveys of the Primary Project Roads in the Castaic Transmission Line area; and (2) collect GIS data on the eight NNIP species identified in Table 2.6-2.
- Step 3 (Prepare Data): (1) process data and (2) issue final field results and data summary.

The Licensees expect to complete the Study in July 2019.

2.7 SPECIAL-STATUS TERRESTRIAL WILDLIFE SPECIES – CALIFORNIA WILDLIFE HABITAT RELATIONSHIPS STUDY

2.7.1 Completed Work to Date

The Study is complete. Specifically, the Licensees have completed Step 1 (Select Sampling Locations and Create Field Study Maps, and Step 2 (Conduct Field Habitat Assessments to Evaluate Habitat, Document Potential Movement Barriers at the Lower Quail Canal and Castaic Penstocks, and Incidentally Document Special-Status Terrestrial Wildlife) of the Study Plan. The Licensees developed field study maps for California Wildlife Habitat Relationship (CWHR) vegetation types under Step 1. A summary of completed work is as follows:

- Prior to field surveys, a total of 66 randomized locations representing 26 habitat types were identified (2 Blue Oak – Foothill Pine [BOP], 1 Blue Oak Woodland [BOW], 2 Coastal Oak Woodland [COW], 1 Desert Riparian [DRI], 2 Desert Wash [DSW], 1 Joshua Tree [JST], 2 Juniper [JUN], 1 Montane Hardwood – Conifer [MHC], 2 Montane Hardwood [MHW], 2 Montane Riparian [MRI], 3 Pinyon – Juniper [PJN], 1 Sierran Mixed Conifer [SMC], 2 Valley Oak Woodland [VOW], 2 Valley Foothill Riparian [VRI], 5 Chamise – Redshank Chaparral [CRC], 6 Coastal Scrub [CSC], 6 Mixed Chaparral [MCH], 1 Montane Chaparral [MCP], 4 Sagebrush [SGB], 3 Annual Grassland [AGS], 2 Fresh Emergent Wetland [FEW], 1 Pasture [PAS], 2 Perennial Grassland [PGS], 3 Wet Meadow [WTM], 2 Urban [URB], 2 Barren [BAR], and 5 locations in areas previously unmapped by the Classification and Assessment with Landsat of Visible Ecological Groupings [CalVeg]) and had no designated habitat type.
- A single CWHR Habitat Element Checklist datasheet was completed for each of the survey point locations.
- Three non-overlapping, 0.1-acre circular plots were sampled at each wooded habitat location, and three non-overlapping, 25-foot by 25-foot square plots were surveyed at each non-wooded (i.e., shrub or herbaceous-dominated) habitat

location using the California Department of Fish and Wildlife (CDFW) CWHR System data forms.

- Photos were taken in the four cardinal directions from the center of each plot looking outwards. In the dataset, photo 1 = north, photo 2 = east, photo 3 = south, and photo 4 = west.
- Changes in vegetation boundaries from the CWHR habitat map were mapped in the field using an iPad, or in the office using ArcGIS.
- The entire length of both the 2-mile-long Quail Lake Canal and the 2,400-foot-long Castaic Penstocks were walked and assessed as potential barriers to wildlife movement. Any areas with at least a 2.5-foot clearance were marked by a Global Positioning System device and photographed.
- Any incidental observations of special-status species were noted and a California Native Species Field Survey Form was prepared for submittal to CDFW for addition to the California Natural Diversity Database (CNDDDB).
- Due to safety concerns, some areas were deemed inaccessible based on the presence of private property, steep slopes, unstable footing, dense vegetation, or inundation. As a result, data collection was restricted in these areas. These data collection restrictions are summarized below.
 - Inaccessibility due to safety concerns eliminated the possibility of collecting plot data at some locations. In these instances, an “over-the-fence” approach was implemented, which included the completion of a CWHR Habitat Element Checklist, as well as an estimation of percent cover by species. This modified assessment was conducted at nine of the 65 sample locations, including: AGS7, BOW12, DRI26, DSW28, FEW29, FEW30, PAS46, PGS48, and PJN49.
 - Photos were generally taken in the four cardinal directions from the center of each plot looking outwards, except where site conditions prevented standing at those precise locations (e.g., steep slopes, unstable terrain, etc.). When locations were inaccessible, photos were taken from afar.

2.7.2 Key Accomplishments and Summary of Findings to Date

A summary of key results includes:

2.7.2.1 CWHR

Based on updated mapping, a total of 26 habitat types occur in the Study area. Within the proposed Project boundary, a total of 18 CWHR habitat types, including Lacustrine, occur. The acreages of CWHR habitat types in the proposed Project boundary and Study area are summarized in Table 2.7-1. Refer to CWHR_Habitat_Maps.pdf (in

Associated Data Files, listed below) for maps showing the sample locations, as well as the acreages and distribution of habitats within the Study area.

Habitat was determined to be incorrectly mapped by CalVeg at 33 locations out of the 65 total locations sampled. As a result of this ground-truthing, it was determined that initial habitat mapping based on available CalVeg data was incorrect in just under 50 percent of the sampled cases. This indicates that portions of the Study area that were not ground truthed as part of this Study may be inaccurately mapped. However, most of these areas are largely inaccessible or located on the outer edges of the Study area, far from the proposed Project boundary. For the purposes of this Study, a conservative approach was taken and areas that were not directly observable were assumed to be correctly mapped.

One of the CWHR habitat types, Pasture (PAS), previously mapped in the Study area, was eliminated. All areas previously mapped as PAS were surveyed in their entirety and changed to Annual Grassland (AGS).

All five unknown (UNK) points in the previously unmapped (by CalVeg) area north of Quail Lake were surveyed and determined to be a mix of Annual Grassland (AGS) and Sagebrush (SGB) habitats. These data, along with surrounding mapped vegetation types, were used to extrapolate and fill in the entirety of the unmapped area.

The ground-truthed CWHR habitat mapping paired with special-status species queries of the CNDDDB, USFS Sensitive Animals Species Lists, and the CWHR database, resulted in the determination that 55 special-status terrestrial species have the potential to occur in the proposed Project boundary. This includes 1 terrestrial invertebrate, 1 terrestrial amphibian, 10 reptiles, 27 birds, and 16 mammals.

Refer to [CWHR_Species_Table.pdf](#) for more information on the 55 special-status terrestrial wildlife species determined to have the potential to occur in or adjacent to the Study area based on the presence of potential habitat. The table includes listing status, habitat requirements, expected CWHR habitat associations, and whether the species has been documented or potentially occurs within the proposed Project boundary or Study area.

Table 2.7-1. CWHR Habitat Acreages and Percentages Within the Study Area and Proposed Project Boundary

CWHR Habitat Type	Number of Sampling Points Planned ¹	Number of Sampling Points Actual ²	Acreage in Proposed Project Boundary ³	Percentage of Proposed Project Boundary	Acreage in Study Area ³	Percentage of Study Area
Tree-Dominated Habitats						
Blue Oak - Foothill Pine (BOP)	2	2	0.5	0.01	610.7	0.7
Blue Oak Woodland (BOW)	1	1	-	-	381.1	0.4
Coastal Oak Woodland (COW)	2	2	2.8	0.1	264.0	0.3
Desert Riparian (DRI)	1	2	51.5	1.2	65.4	0.08
Joshua Tree (JST)	1	1	0.2	0.004	5.4	0.01
Juniper (JUN)	2	0	-	-	144.5	0.2
Montane Hardwood - Conifer (MHC)	1	2	-	-	90.4	0.1
Montane Hardwood (MHW)	2	0	0.5	0.01	329.3	0.4
Montane Riparian (MRI)	2	0	-	-	12.1	0.0
Pinyon - Juniper (PJN)	3	0	5.1	0.1	572.3	0.7
Sierran Mixed Conifer (SMC)	1	0	-	-	80.1	0.1
Valley Oak Woodland (VOW)	2	2	-	-	307.0	0.4
Valley Foothill Riparian (VRI)	2	5	96.4	2.2	516.4	0.6
Shrub-Dominated Habitats						
Chamise - Redshank Chaparral (CRC)	5	6	135.2	3.0	9,391.8	11.0
Coastal Scrub (CSC)	6	9	545.1	12.2	13,784.0	16.2
Desert Wash (DSW)	2	1	2.5	0.06	215.2	0.25
Mixed Chaparral (MCH)	6	8	437.4	9.8	37,881.8	44.5
Montane Chaparral (MCP)	1	0	-	-	46.2	0.1

Table 2.7-1. CWHR Habitat Acreages and Percentages Within the Study Area and Proposed Project Boundary (continued)

CWHR Habitat Type	Number of Sampling Points Planned ¹	Number of Sampling Points Actual ²	Acreage in Proposed Project Boundary ³	Percentage of Proposed Project Boundary	Acreage in Study Area ³	Percentage of Study Area
Sagebrush (SGB)	4	8	280.8	6.3	3,490.6	4.1
Herbaceous-Dominated Habitats						
Annual Grassland (AGS)	3	7	196.9	4.4	8,616.1	10.1
Fresh Emergent Wetland (FEW)	2	3	55.3	1.2	55.3	0.1
Pasture (PAS)	1	0	-	-	-	-
Perennial Grassland (PGS)	2	1	-	-	9.7	0.01
Wet Meadows (WTM)	3	1	20.9	0.5	30.2	0.04
Developed Habitats						
Urban (URB)	2	3	412.7	9.3	3,592.9	4.2
Non-Vegetated Habitats						
Barren (BAR)	2	1	222.6	5.0	645.4	0.8
Aquatics Habitats						
Lacustrine (LAC)	0	0	1,993.0	44.7	4,021.3	4.7
Other						
Unknown (UNK)	5	0	-	-	-	-
Total	66	65	4,459.4	100.0	85,159.2	100.0

Source: USFS 2018a and field data

Notes:

¹Number presented here represents the number of sample points planned for each habitat type based on acreage in study area and value to wildlife.

²Number presented here represents the number of sample points actually collected for each habitat type. Difference from planned number of points due to incorrect mapping and inaccessibility resulting from private property or unsafe conditions. In some cases of limited access, a sampled point had limited data collected (Habitat Element Checklist only, no vegetation plots). This is clarified in the habitat descriptions section below.

³All acreages exclude Angeles Tunnel.

2.7.2.2 Wildlife Movement

The Lower Quail Canal is bounded by an approximately 4.5-foot-tall barbed-wire fence, which is intact throughout most of the canal and acts as a barrier to small mammal passage. However, there are a couple of areas along the eastern fence line with at least a 2.5-foot clearance suitable for wildlife passage. The fence would be passable by most large mammals. For example, mule deer, mountain lion, and bobcat would be able to jump over the 4.5-foot tall fence. Other species would be able to find breaks in the fence or crawl under. Thus, the barbed wire fence does not present a significant barrier to wildlife movement. A single east-west drainage culvert that is approximately 4 feet in diameter runs under the canal. This culvert is adequately sized for small- to medium-sized mammals to pass through (although small mammals typically prefer vegetated culverts for passage); large mammals are not expected to use this culvert and likely circumvent the canal by moving along the fence line. The Licensees noted other potential barriers to wildlife movement along the canal, including a chain-link fenced area at the southern intake.

The upper foundation area and the bottom of the Castaic Penstocks are surrounded by chain-link fencing. The graded hill slope that the six penstock pipes travel down has concrete V-ditch culverts running perpendicular to the penstocks, as well as scattered erosional features, which exceeded the 2.5-foot clearance. These drainage ditches under the penstocks provide clearance for movement of wildlife. However, 7- to 9-foot-tall fencing on either side of the penstocks and around the top pad area would prevent mule deer, bighorn sheep, American badger, and coyote from jumping over, but may allow for other mammals, such as black bear, mountain lion, or bobcat, to climb over the fence.

Under existing conditions, most Project infrastructure, including the Lower Quail Canal, does not obstruct movement of wildlife. The tall fence and wide set of six side-by-side pipes that make up the Castaic Penstocks may obstruct the movement of large mammals. However, the Penstocks are only 2,400 feet long and are surrounded by large areas of open space that act as alternative movement corridors.

2.7.2.3 Incidental Observations

Four special-status wildlife species were incidentally observed during the CWHR field study, and included the following:

- A single adult loggerhead shrike (*Lanius ludovicianus*), a State Species of Concern (SSC) was observed perching on a rubber rabbitbrush (*Ericameria nauseosa*) near sampling point SGB2.
- A single adult northern harrier (*Circus hudsonius*; SSC) was observed flying through the Los Alamos Campground, near sampling point BAR8.

- pair of golden eagles (*Aquila chrysaetos*), which are protected under the Bald and Golden Eagle Act and a California Fully Protected species, were observed soaring over the western arm of Pyramid Lake.
- A single western pond turtle (*Emys marmorata*; SSC) was observed basking on the shore of Pyramid Lake, at the outlet of Piru Creek above Pyramid Lake near sampling point WTM59.

2.7.3 Associated Data Files

File Name	Data Description	File Type	File Location
CWHR_Habitat_Sample_Points.zip	Sample point locations from CWHR habitat mapping study	ZIP	Project Website
CWHR_Movement_Study_Data.zip	Data collected during wildlife movement study at Castaic Penstocks and Lower Quail Canal	ZIP	Project Website
CWHR_Habitat_Maps.pdf	Maps of CWHR habitat	PDF	Project Website
CWHR_Movement_Maps.pdf	Maps of survey findings from Lower Quail Canal and Castaic Penstocks	PDF	Project Website
SSWP_CWHR_datasheets_compiled.pdf	Survey forms for CWHR habitat study	PDF	Project Website
CWHR_Sample_Point_Photos (Folder w/ 632 jpg files)	All photos associated with CWHR sample points	JPG	Project Website
CWHR_Movement_Study_Photos (Folder)	All photos associated with CWHR movement study data collection	JPG	Project Website
CNDDDB_golden_eagle_CWHR.pdf	CNDDDB observation form golden eagle	PDF	Available upon request
CNDDDB_loggerhead_shrike_CWHR.pdf	CNDDDB observation form loggerhead shrike	PDF	Project Website
CNDDDB_northern_harrier_CWHR.pdf	CNDDDB observation form northern harrier	PDF	Project Website
CNDDDB_western_pond_turtle_CWHR.pdf	CNDDDB observation form western pond turtle	PDF	Project Website
CWHR_Habitat_Acreages_Table.xlsx	Summary of habitat acreages and percentages for the new license Project boundary and Study area	XLSX	Project Website
CWHR_Species_Table.pdf	Table of all special-status species determined to have the potential to occur within the new license Project boundary.	PDF	Project Website
CWHR_movement_photo_log	Photo log for movement study; photo locations associated with photo points shown on CWHR_Movement_Maps	PDF	Project Website

File Name	Data Description	File Type	File Location
CWHR_Habitat_Sample_Points_wPhotos.zip	Sample point locations and associated photos from CWHR habitat mapping study	ZIP	Available upon request
CWHR_Movement_Study_Data_wPhotos.zip	Data collected during wildlife movement study at Castaic Penstocks and Lower Quail Canal, including photos	ZIP	Available upon request

Key:
 CNDDDB = California Natural Diversity Database
 CWHR = California Wildlife Habitat Relationships

2.7.4 Variances from Study Methods, Schedule or Approach, and Unexpected Field Conditions

The following variances and/or abnormalities were encountered during the field surveys:

- The CWHR study plan originally stated that 60 points would be sampled; however, 66 sample points were planned prior to field efforts. This discrepancy between the study plan and how the study was conducted can be explained as follows: (1) five of the additional points were to adequately cover the sections of the buffer surrounding the proposed Project boundary but it was discovered that those sections have not been previously mapped by CalVeg and thus vegetation classifications needed to be determined from scratch; and (2) there was also one additional point included with the addition of primary Project roads and further refinement of the proposed Project boundary after the study plan was finalized.
- One survey point out of the 66 sample points was not surveyed due to complete inaccessibility (JUN33). This brought the total number of sampled points down to 65.
- In some cases, inaccessibility or small habitat patch size limited the number of plots that could be sampled at a given location. Limited plot data was collected at seven of the 65 sample locations, including: BOP10, CRC16, MHC41, MHW42, PJN50, SMC52, and VOW55. One to two plots were sampled at these locations, rather than the typical three.
- Data was collected for only one plot at Urban locations, as the majority of the cover in these areas was hardscape, which is easily visible and detectable on aerial photographs, and transect data provided little value to the Study as a whole.

These variances are considered minor and are not expected to have influenced the findings of the Study as a whole. Areas that were subject to limited sampling (Urban plots and the specific locations listed above) were sufficiently sampled to accurately represent the habitats at each area.

2.7.5 Remaining Work

The Study is complete, and no work remains.

2.8 ESA-LISTED PLANTS STUDY

2.8.1 Completed Work to Date

The Licensees completed Step 1 (Gather Data and Prepare for Field Effort). These activities included: updating species queries using the U.S. Fish and Wildlife Service Environmental Conservation Online System, the California Natural Diversity Database and the California Native Plant Society Inventory of Rare and Endangered Plants, gathering field protocols, planning field logistics, preparing field maps, and developing a preliminary field schedule. The majority of Step 2 (Conduct Field Surveys) is complete.

2.8.2 Key Accomplishments and Summary of Findings to Date

The completed work referenced above resulted in the following:

- Field surveys were floristic in nature, and all species observed were identified and recorded (see Associated Data Files section).
- None of the target ESA-listed plant species listed in the Study Plan, nor any other ESA-listed plants, were observed during field surveys shown in Table 2.8-1.
- The Study Area for this effort is the same as for the Botanical Resources Study (see Associated Data Files section).
- Some areas of steep terrain could not be surveyed by foot, but were evaluated through visual reconnaissance using binoculars (see Associated Data Files section). Furthermore, no incidental observations of federally listed, State listed, or California species of concern special-status wildlife species were observed during this study. A comprehensive list of incidental wildlife observations is provided in the Associated Data Files section.

Table 2.8-1. Special-Status Plants Known or with the Potential to Occur in the Study Area

Common Name/ Scientific Name	Status ¹	Flowering Period	Elevation Range (feet)	Habitats ²	Potential for Occurrence in the Project Area
Mt. Pinos onion (<i>Allium howellii</i> var. <i>clokeyi</i>)	1B.3, LPNF	April -June	4,265 -6,070	<ul style="list-style-type: none"> • Meadows and seeps (edges) • Pinyon and juniper woodland 	Potential habitat exists.
California androsace (<i>Androsace elongata</i> ssp. <i>acuta</i>)	4.2	March -June	492 – 4,282	<ul style="list-style-type: none"> • Chaparral • Cismontane woodland • Coastal scrub • Meadows and seeps • Pinyon and juniper woodland • Valley and foothill grassland 	Potential to occur in upland areas surrounding Quail Lake and Pyramid Lake.
Horn's milkvetch (<i>Astragalus hornii</i> var. <i>hornii</i>)	1B.1	May – October	197 – 2,789	<ul style="list-style-type: none"> • Lake margins with alkaline soils • Meadows and seeps • Playas 	Potential habitat exists. Potential to occur in wetland areas surrounding Pyramid Lake.
Round-leaved filaree (<i>California macrophylla</i>)	1B.2, BLM	March -May	49 -3,937	<ul style="list-style-type: none"> • Cismontane woodland (clay soils) • Valley and foothill grassland (clay soils) 	CNDDDB occurrences in Lebec, La Liebre Ranch, Whitaker Peak, and Warm Springs Mountain quadrangles. Potential to occur in upland areas surrounding Quail Lake.
Catalina mariposa lily (<i>Calochortus catalinae</i>)	4.2	February -June	49 -2,297	<ul style="list-style-type: none"> • Chaparral • Cismontane woodland • Coastal scrub • Valley and foothill grassland 	Potential habitat exists.
Club-haired mariposa lily (<i>Calochortus clavatus</i> var. <i>clavatus</i>)	4.3, ANF, LPNF	March -June	246 -4,265	<p>Typically occurs on serpentinite, clay, rocky soils in:</p> <ul style="list-style-type: none"> • Chaparral • Cismontane woodland • Coastal scrub • Valley and foothill grassland 	Potential habitat exists. Potential to occur in upland areas surrounding Pyramid Lake.
Slender mariposa lily (<i>Calochortus clavatus</i> var. <i>gracilis</i>)	1B.2, ANF, LPNF, BLM	March -November	1,050 -3,281	<ul style="list-style-type: none"> • Chaparral • Coastal scrub • Valley and foothill grassland 	CNDDDB occurrences in Black Mountain, Liebre Mountain, Newhall, Whitaker Peak, and Warm Springs Mountain quadrangles. Specifically identified by CNDDDB as occurring near the southwestern end of Elderberry Forebay. Potential to occur in upland areas surrounding Quail Lake and Pyramid Lake.
Late-flowered mariposa lily (<i>Calochortus fimbriatus</i>)	1B.3, ANF, LPNF	June -August	902 -6,250	<p>Often occurs on serpentinite soils in:</p> <ul style="list-style-type: none"> • Chaparral • Cismontane woodland • Riparian woodland 	Potential habitat exists. Potential to occur in upland areas surrounding Quail Lake.
Palmer's mariposa lily (<i>Calochortus palmeri</i> var. <i>palmeri</i>)	1B.2, ANF, LPNF, SBNF	April -July	2,329 -7,841	<p>Mesic areas, including:</p> <ul style="list-style-type: none"> • Chaparral • Lower montane coniferous forest • Meadows and seeps 	CNDDDB occurrences in Liebre Mountain, La Liebre Ranch, and Whitaker Peak quadrangles. Potential to occur in upland areas surrounding Quail Lake.

Table 2.8-1. Special-Status Plants Known or with the Potential to Occur in the Study Area (continued)

Common Name/ Scientific Name	Status ¹	Flowering Period	Elevation Range (feet)	Habitats ²	Potential for Occurrence in the Project Area
Plummer's mariposa lily (<i>Calochortus plummerae</i>)	4.2	May -July	328 -5,577	Granitic, rocky soils in: • Chaparral • Cismontane woodland • Coastal scrub • Lower montane coniferous forest • Valley and foothill grassland	Potential habitat exists. Potential to occur in upland areas surrounding Pyramid Lake.
Peirson's morning-glory (<i>Calystegia peirsonii</i>)	4.2	April -June	98 -4,921	• Chaparral • Cismontane woodland • Coastal scrub • Lower montane coniferous forest • Valley and foothill grassland	CNDDDB occurrences in Whitaker Peak quadrangle. Specifically mapped by CNDDDB in Project boundary in Castaic Creek area upstream of Castaic Powerplant. Potential to occur in upland areas surrounding Quail Lake and Pyramid Lake.
Mt. Gleason paintbrush (<i>Castilleja gleasonii</i>)	1B.2, CR, ANF, BLM	May -September	3,806 -7,119	• Chaparral • Lower montane coniferous forest • Pinyon and juniper woodland	CNDDDB occurrences Liebre Mountain quadrangle.
Island mountain-mahogany (<i>Cercocarpus betuloides</i> var. <i>blancheae</i>)	4.3	February - May	98 – 1,969	• Closed-cone coniferous forest • Chaparral	Potential habitat exists.
Mojave spineflower (<i>Chorizanthe spinosa</i>)	4.2	March - July	20 – 4,265	• Mojavean desert scrub • Playas	Potential habitat exists.
Monkey-flower savory (<i>Clinopodium mimuloides</i>)	4.2	June - October	1,001 – 5,906	• Streambanks, mesic areas • Chaparral	Potential habitat exists. Potential to occur in stream bank areas in the vicinity of Pyramid Lake (DWR 2014, Environmental Science Associates 2014a).
Paniculate tarplant (<i>Deinandra paniculata</i>)	4.2	March - November	82 – 3,084	Usually vernal mesic areas, sometimes sandy soils in: • Coastal scrub • Valley and foothill grassland • Vernal pools	Potential habitat exists.
Mt. Pinos larkspur (<i>Delphinium parryi</i> ssp. <i>purpureum</i>)	4.3, LPNF	May - June	3,281 – 8,530	• Chaparral • Mojavean desert scrub • Pinyon and juniper woodland	Potential habitat exists.
Umbrella larkspur (<i>Delphinium umbraculorum</i>)	1B.3, LPNF	April - June	1,312 – 5,249	• Chaparral • Cismontane woodland	CNDDDB occurrences Lebec quadrangle.
Tehachapi buckwheat (<i>Eriogonum callistum</i>)	1B.1	May - July	4,593 – 5,676	Openings, rocky soils, and limestone areas in chaparral	Potential habitat exists.
Fort Tejon woolly sunflower (<i>Eriophyllum lanatum</i> var. <i>hallii</i>)	1B.1, LPNF	May - July	3,494 – 4,921	• Chaparral • Cismontane woodland	CNDDDB occurrences Lebec quadrangle.
San Gabriel bedstraw (<i>Galium grande</i>)	1B.2, ANF, BLM	January - July	1,394 – 4,921	• Broadleaved upland forest • Chaparral • Cismontane woodland • Lower montane coniferous forest	Potential habitat exists.

Table 2.8-1. Special-Status Plants Known or with the Potential to Occur in the Study Area (continued)

Common Name/ Scientific Name	Status ¹	Flowering Period	Elevation Range (feet)	Habitats ²	Potential for Occurrence in the Project Area
Palmer's grappling hook (<i>Harpagonella palmeri</i>)	4.2	March -May	66 -3,133	On clay soils; open grassy areas within: • Chaparral • Coastal scrub • Valley and foothill grassland	Potential habitat exists.
Newhall sunflower (<i>Helianthus inexpectatus</i>)	1B.1	August -October	984 -984	Freshwater, seeps in: • Marshes and swamps • Riparian woodland	Potential habitat exists.
Los Angeles sunflower (<i>Helianthus nuttallii</i> ssp. <i>parishii</i>)	1A	August -October	33 -5,495	Marshes and swamps (coastal salt and freshwater)	Presumed extirpated, not likely to occur.
Vernal barley (<i>Hordeum intercedens</i>)	3.2	March -June	16 -3,281	• Coastal dunes • Coastal scrub • Valley and foothill grassland (saline flats and depressions) • Vernal pools	Potential habitat exists.
Southern California black walnut (<i>Juglans californica</i>)	4.2	March -August	164 -2,953	Alluvial areas in: • Chaparral • Cismontane woodland • Coastal scrub • Riparian woodland	Potential habitat exists.
Fragrant pitcher sage (<i>Lepechinia fragrans</i>)	4.2, ANF, SBNF	March -October	66 -4,298	• Chaparral	Potential habitat exists.
Ross' pitcher sage (<i>Lepechinia rossii</i>)	1B.2, ANF, LPNF	May -September	1,001 -2,592	• Chaparral	CNDDDB occurrences Whitaker Peak quadrangle.
Ocellated Humboldt lily (<i>Lilium humboldtii</i> ssp. <i>ocellatum</i>)	4.2	March -August	98 -5,906	Openings in: • Chaparral • Cismontane woodland • Coastal scrub • Lower montane coniferous forest • Riparian woodland	Potential habitat exists. Potential to occur in upland or riparian areas surrounding Pyramid Lake.
Sylvan microseris (<i>Microseris sylvatica</i>)	4.2	March -June	148 -4,921	• Chaparral • Cismontane woodland • Pinyon and juniper woodland • Valley and foothill grassland (serpentinite)	Potential habitat exists. Potential to occur in upland areas surrounding Quail Lake and Pyramid Lake.
Tehachapi monardella (<i>Monardella linoides</i> ssp. <i>oblonga</i>)	1B.3, LPNF	May -August	2,953 -8,104	• Lower montane coniferous forest • Pinyon and juniper woodland • Upper montane coniferous forest	Potential habitat exists.

Table 2.8-1. Special-Status Plants Known or with the Potential to Occur in the Study Area (continued)

Common Name/ Scientific Name	Status ¹	Flowering Period	Elevation Range (feet)	Habitats ²	Potential for Occurrence in the Project Area
Baja navarretia (<i>Navarretia peninsularis</i>)	1B.2, ANF, LPNF, SBNF	May -August	4,921 -7,546	Mesic areas, including: • Chaparral (openings) • Lower montane coniferous forest • Meadows and seeps • Pinyon and juniper woodland	CNDDDB occurrences in Lebec quadrangle.
Piute mountains navarretia (<i>Navarretia setiloba</i>)	1B.1	April -July	935 -6,890	Clay or gravelly loam in: • Cismontane woodland • Pinyon and juniper woodland • Valley and foothill grassland	CNDDDB occurrences in Lebec quadrangle. Potential to occur in upland areas surrounding Quail Lake.
Robbins' nemacladus (<i>Nemacladus secundiflorus</i> var. <i>robbinsii</i>)	1B.2, ANF, LPNF	April -June	1,148 -5,577	Occurs in openings in: • Chaparral • Valley and foothill grassland	Potential habitat exists. Potential to occur in upland areas surrounding Quail Lake and Pyramid Lake .
Short-jointed beavertail (<i>Opuntia basilaris</i> var. <i>brachyclada</i>)	1B.2, ANF, SBNF, BLM	April -August	1,394 -5,906	• Chaparral • Mojavean desert scrub • Pinyon and juniper woodland	CNDDDB occurrences in Newhall quadrangle.
Bakersfield cactus (<i>Opuntia basilaris</i> var. <i>treleasei</i>)	1B.1	April -May	394 -4,757	Sandy or gravelly areas in: • Cismontane woodland • Valley and foothill grassland	Potential habitat exists. Potential to occur in upland areas surrounding Quail Lake.
Adobe yampah (<i>Perideridia pringlei</i>)	4.3	April -July	984 -5,906	Serpentinite, often clay soils in: • Chaparral • Cismontane woodland • Coastal scrub • Pinyon and juniper woodland	Potential habitat exists. Potential to occur in upland areas surrounding Quail Lake and Pyramid Lake.
Hubby's phacelia (<i>Phacelia hubbyi</i>)	4.2	April -July	0 -3,281	Gravelly, rocky, and talus-slope areas in: • Chaparral • Coastal scrub • Valley and foothill grassland	Potential habitat exists.
Mojave phacelia (<i>Phacelia mohavensis</i>)	4.3	April -August	4,593 -8,202	Sandy or gravelly soils in: • Cismontane woodland • Lower montane coniferous forest • Meadows and seeps • Pinyon and juniper woodland	Potential habitat exists.
Chaparral ragwort (<i>Senecio aphanactis</i>)	2B.2	January -April	49 -2,625	Sometimes on alkaline soils in: • Chaparral • Cismontane woodland • Coastal scrub	Potential habitat exists. Potential to occur in upland areas surrounding Pyramid Lake.

Table 2.8-1. Special-Status Plants Known or with the Potential to Occur in the Study Area (continued)

Common Name/ Scientific Name	Status ¹	Flowering Period	Elevation Range (feet)	Habitats ²	Potential for Occurrence in the Project Area
San Bernardino aster (<i>Symphyotrichum defoliatum</i>)	1B.2, ANF, LPNF, SBNF, BLM	July -November	7 -6,693	Near ditches, streams, springs in: <ul style="list-style-type: none"> • Cismontane woodland • Coastal scrub • Lower montane coniferous forest • Meadows and seeps • Marshes and swamps • Valley and foothill grassland (vernally mesic) 	CNDDDB occurrences in Lebec quadrangle. Potential to occur in shoreline areas and adjacent wetlands of Quail Lake and Pyramid Lake.
Greata's aster (<i>Symphyotrichum greatae</i>)	1B.3, BLM	June -October	984 -6,594	Mesic areas, specifically: <ul style="list-style-type: none"> • Broadleafed upland forest • Chaparral • Cismontane woodland • Lower montane coniferous forest • Riparian woodland 	CNDDDB occurrences in Liebre Mountain and Whitaker Peak quadrangles. Potential to occur in upland areas surrounding Quail Lake and Pyramid Lake.
Lemmon's syntrichopappus (<i>Syntrichopappus lemmonii</i>)	4.3	April -June	1,640 -6,004	Sandy or gravelly soils in <ul style="list-style-type: none"> • Chaparral • Pinyon and juniper woodland 	Potential habitat exists. Potential to occur in upland areas surrounding Pyramid Lake.
Silvery false lupine (<i>Thermopsis californica</i> var. <i>argentata</i>)	4.3	April -October	2,182 -7,661	<ul style="list-style-type: none"> • Cismontane woodland • Lower montane coniferous forest • Pinyon and juniper woodland 	Potential habitat exists.

Sources: CDFW 2015, CNPS 2015, BLM 2015, USFS 2013

Notes:

¹CNPS Status:

1A = presumed extirpated in California and either rare or extinct elsewhere

1B = rare, threatened, or endangered in California and elsewhere

2A = presumed extirpated in California, but common elsewhere

2B = rare, threatened, or endangered in California, but more common elsewhere

3 = more information is needed

4 = plants of limited distribution

Threat Ranks (number following period):

1-Seriously threatened in California (over 80% of occurrences threatened / high degree and immediacy of threat)

2-Moderately threatened in California (20-80% occurrences threatened / moderate degree and immediacy of threat)

3-Not very threatened in California (less than 20% of occurrences threatened / low degree and immediacy of threat or no current threats known)

²Habitats² = habitats are limited to those types that occur within the Project vicinity

The following quadrangles were queried: Lebec, La Liebre Ranch, Black Mountain, Whitaker Peak, Warm Springs Mountain, Newhall, and Cobblestone Mountain

Key:

DWR = California Department of Water Resources

CR = California Rare

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2.8.3 Associated Data Files

File Name	Data Description	File Type	File Location
20181210_p2426_sswp_botanical_inventory_fnl	List of all plant species observed during 2018 botanical surveys	PDF	Project website
20181211_p2426_sswp_incidental_observations	Incidental wildlife observations during 2018 botanical surveys	Excel	Project website
SSWP_Botanical_Resources_Study_Area_8x11_20190129	Map depicting the Botanical Resources Study Area	PDF and JPG	Project website
SSWP_Inaccessible_Visual_Surveys_8x11_20190129	Map depicting inaccessible access in the Study Area	PDF and JPG	Project website

2.8.4 Variances from Study Methods, Schedule or Approach, and Unexpected Field Conditions

There was one variance from the FERC-approved Study. The Study was scheduled to be completed by December 2018. However, due to ongoing fieldwork, the Study is expected to be completed by July 2019. This variance will affect the Study schedule, but it is not expected to affect the overall Study because the same Study approach and methodology will be utilized as outlined in the ESA-Listed Plants Study Plan. Therefore, all outstanding information to be collected by July 2019 will not be provided in the Updated Study Report, but an updated data summary will be posted once the field results have undergone QA/QC. Final field results, with accompanying Geographic Information System figures, will be provided in the Draft License Application.

2.8.5 Remaining Work

Remaining work includes the following: Step 2 (Complete Field Surveys): Complete remaining early season botanical field surveys and Step 3 (Prepare Data): Issue final field results and data summary.

The Licensees expect to complete the Study in July 2019.

2.9 **ESA-LISTED AMPHIBIANS, CALIFORNIA RED-LEGGED FROG STUDY**

2.9.1 Completed Work to Date

The Study is complete. As required by the FERC-approved Study Plan, the Licensees completed Step 1 (Identify Potential Habitat), Step 2 (Conduct Field Reconnaissance and Surveys), and Step 3 (Prepare Results).

2.9.2 Key Accomplishments and Summary of Findings To Date

Known occurrences of California red-legged frog (CRLF; *Rana draytonii*) and the distribution of potential habitat were identified utilizing California Natural Diversity

Database (CNDDDB) records, as well as other known literature and museum sources. Known occurrences of CRLF and National Wetlands Inventory (NWI) surface water features within the Study area (i.e., the area within 1 mile of the Project boundary being proposed as part of the relicensing) were mapped using Geographic Information System (GIS). A desktop site assessment was then performed to characterize mapped aquatic and surrounding upland habitats, as well as additional potential aquatic habitats that may not be included in NWI data. Following the desktop assessment, a supplemental field site assessment was conducted at multiple locations based on access to collect additional information, including observations of amphibians and fish.

A total of 18 stream or pond locations within the Study area were assessed to determine whether they represent potential CRLF breeding habitat, for which the minimum criteria include the presence of standing or slow-moving water for at least 20 consecutive weeks beginning in the spring shown in Table 2.9-1. If the site does not meet the 20-week criterion, then the site is considered unsuitable for CRLF breeding.

Table 2.9-1. Locations Within Study Area Assessed for Potential CRLF Breeding Habitat

Site Number/ Site Name	Site Type	20-Week Criterion Met?	Additional Notes
1 Gorman Bypass Channel	Stream	Yes	Mostly dry when examined, except for a large, deep pool immediately below spillway, where largemouth bass (<i>Micropterus salmoides</i>), channel catfish (<i>Ictalurus punctatus</i>), and American bullfrogs (<i>Lithobates catesbeianus</i>) were observed.
2 Los Alamos Campground	Stream	No	Several shallow swales within a campground; dry when examined, with no hydrophytes or other evidence of persistent water.
3 Los Alamos and Gorman Creek confluence	Stream	Yes	Mostly seasonal or possibly perennial at confluence, with one shallow pool. Adjacent riparian habitat is dense. Young-of-year and adult Baja California chorus frogs (<i>Pseudacris hypochondriaca</i>) were observed.
4 Gorman Creek	Stream	Yes	Perennial (flow-supplemented), with occasional pools up to 4 feet deep. Adjacent riparian habitat is dense. Juvenile western toads observed.
5 Unnamed tributary to Pyramid Lake	Stream	No	Ephemeral drainage (wash) in incised channel and no apparent riparian vegetation (only scrub vegetation and scattered oaks); estimated gradient is less than 1 percent.
6 Piru Creek (above Pyramid Lake)	Stream	Yes	Piru Creek within Project boundary frequently inundated by the lake and mostly comprise non-pool habitat, or seasonally dry at other times. Riparian vegetation well developed, with willows and cattail.

Table 2.9-1. Locations Within Study Area Assessed for Potential CRLF Breeding Habitat (continued)

Site Number/ Site Name	Site Type	20-Week Criterion Met?	Additional Notes
7 Unnamed tributary to Pyramid Lake	Stream	No	Ephemeral drainage (wash) in wide sandy channel and no apparent riparian vegetation except at Pyramid Lake, where willows occur; estimated gradient less than 1 percent.
8 Posey Canyon	Stream	No	Ephemeral drainage (wash) with incised banks and no apparent riparian vegetation; estimated 2 percent gradient.
9 Piru Creek at Road 67	Stream	Yes	Perennial, with a large, separate, 3-foot-deep side channel pool; well-developed riparian vegetation. Numerous American bullfrogs and crayfish were observed, along with largemouth bass and other fish.
10 Castaic Creek	Stream/ Pond	No	Seasonal drainage in wide, sandy channel, likely dry by April, and mostly not vegetated. Also includes three sedimentation basins upstream of Elderberry Forebay.
11 Fish Canyon	Stream	No	Ephemeral drainage (wash), with gravel/cobble substrate, and mostly not vegetated; estimated 2 percent gradient.
12 Tributary to Elderberry Forebay	Stream	No	Ephemeral drainage (wash), with cobble/boulder substrate, and mostly not vegetated, except at Elderberry Forebay; estimated 2 percent gradient.
13 Tributary to Elderberry Forebay	Stream	No	Ephemeral drainage (wash), with cobble/boulder substrate, frequent channel migration, and mostly not vegetated; estimated 1 percent gradient.
14 Tributary to Elderberry Forebay	Stream	No	Ephemeral drainage (wash), with sand/gravel/cobble substrate, and mostly not vegetated; estimated 1 percent gradient.
15 Stock pond	Pond	Yes	A 0.65-acre seasonal impoundment on private property. A CNDDDB record indicated that Western spadefoot (<i>Spea hammondi</i>) larvae were found at this location in June 2003.
16 Charlie Canyon	Stream	No	Ephemeral drainage (wash) in incised channel; not vegetated; estimated 4 percent gradient. Off-road vehicle use evident.
17 San Francisquito Creek	Stream	No	Ephemeral drainage (wash) in wide, shallow, sparsely vegetated channel; mostly sand/gravel substrate; estimated gradient less than 1 percent. Downstream of CRLF critical habitat unit LOS-1.

Table 2.9-1. Locations Within Study Area Assessed for Potential CRLF Breeding Habitat (continued)

Site Number/ Site Name	Site Type	20-Week Criterion Met?	Additional Notes
18 Dry Canyon	Stream	No	Ephemeral drainage (wash) in incised channel, not vegetated; estimated gradient less than 1 percent.

Key:
CNDDDB = California Natural Diversity Database
CRLF = California red-legged frog

The results indicated that five sites within the Project boundary and one site on private property within one mile of the Project boundary met the minimum criteria for potential CRLF habitat. Predatory fish and American bullfrogs were observed at two of these sites: (1) a pool on the Gorman Bypass Channel, and (2) Piru Creek at the Road 67 crossing. Piru Creek downstream of Pyramid Lake outside of the Project boundary includes designated critical habitat, where there was a possible observation of CRLF larvae during a 2005 arroyo toad survey near Agua Blanca Creek; however, annual monitoring in the same area from 2010 through 2018 have resulted in no detections of any CRLF life stage.

Sites 5, 7, 8, 15, and 16 were not assessed in the field because of access issues including vehicle access issues, inability to gain access onto private property, and safety issues.

2.9.3 Associated Data Files

File Name	Data Description	File Type	File Location
20181126_sswp_REPORT_ESA_CRLF_AqHabitatSiteAssessment_Combined	Map of surface waters, critical habitat, CNDDDB occurrences, and site habitat assessment locations	PDF	Project website
20181114_SSWP_CRLF_Photo_appendix	Photo log	PDF	Project website
20181114_SSWP_ESA listed Amphibians_CRLF_Study_Habitat Assessment Sheets	CRLF habitat assessment datasheets with photos	PDF	Project website

Key:
CNDDDB = California Natural Diversity Database
CRLF = California red-legged frog

2.9.4 Variances from Study Methods, Schedule or Approach, and Unexpected Field Conditions

There were no variances in Study Methods, Schedule, or Approach from the FERC-approved Study Plan.

2.9.5 Remaining Work

None; this Study is complete.

2.10 ESA-LISTED RIPARIAN BIRD SPECIES, SOUTHWESTERN WILLOW FLYCATCHER, LEAST BELL'S VIREO, AND YELLOW-BILLED CUCKOO RIPARIAN HABITAT EVALUATIONS STUDY

2.10.1 Completed Work to Date

As required by the FERC-approved Study Plan, the Licensees completed Step 1 (Identify Study Areas), and preliminarily identified 36 patches of riparian vegetation from publicly available aerial imagery to merit a field assessment of habitat suitability, which was performed on April 5 and 6, 2018, for least Bell's vireo (LBVI, *Vireo bellii pusillus*) and southwestern willow flycatcher (SWFL, *Empidonax traillii extimus*), and June 4 for yellow-billed cuckoo (YBCU, *Coccyzus americanus occidentalis*). The field assessment verified that habitat patches contained necessary habitat characteristics (e.g., vegetation structure and plant species composition) and were large enough to potentially support these species. In addition, five small habitat patches at Elderberry Forebay, which were not initially identified from aerial imagery or viewed during the field assessment but were identified as potential habitat during Proper Functioning Condition studies, were subsequently noted and surveyed for the remaining 6 survey events. Nineteen of the 41 patches were found to be potential habitat for LBVI and SWFL based on habitat requirements and suitability and were thus designated as survey sites for both species. Nine of the 19 patches were also determined to be potential habitat for YBCU and were designated as survey sites for that species. The 19 SWFL and LBVI survey sites were distributed as follows: 2 sites at Quail Lake; 7 sites at Pyramid Lake, 1 site east of Interstate 5 within Liebre Gulch; 1 site on Piru Creek just below Pyramid Dam; 1 site encompassing all of Gorman Creek within the proposed Project boundary; and 7 sites within the Elderberry Forebay area. The 9 YBCU survey sites included: 1 site at Quail Lake; 3 sites at Pyramid Lake; 1 site east of Interstate 5 within Liebre Gulch; 1 site encompassing the entirety of Gorman Creek within the proposed Project boundary; 1 site below Pyramid Dam; and 2 sites at Elderberry Forebay. Collectively, the sites represented all potential habitat for the three species within the proposed Project boundary. Under Step 2: (Conduct Field Surveys), all potential SWFL habitat within the study area was surveyed following the U.S. Fish and Wildlife Service's (USFWS) accepted protocols and guidelines for project-related presence/absence surveys. Surveys were performed five times at each site: once during Period 1 (May 15 – May 31), twice during Period 2 (June 1 – June 24), and twice during Period 3 (June 25 – July 17). Survey visits to each site were timed at least five days apart. A Willow Flycatcher Survey and Detection Form was filled out for each SWFL survey.

All potential LBVI habitat within the study area was surveyed according to the guidelines stipulated by USFWS for presence/absence surveys, with the following exception: 8 survey visits were performed at each site, with at least 10 days between survey visits for each site, except at the 5 sites at Elderberry Forebay with small habitat patches (i.e.,

Elderberry Forebay 1-5), where only 6 survey visits were completed. The survey variance did not affect the study conclusions. See Section 2.10.4 below for details.

All potential YBCU habitat within the study area was surveyed consistent with the USFWS presence/absence survey protocol, with four survey visits to each site within three survey windows: June 15 – June 30, July 1 – July 30, and July 31 – August 15. The survey results for the three species were reported to USFWS and CDFW.

In total, biologists conducted surveys on 38 days between April 10, 2018 and August 3, 2018. Under Step 3 (Prepare Data), all survey methodology, results, field notes and data were compiled into a report which was submitted to the USFWS on September 20, 2018. All suitable habitat, survey areas, and survey results were mapped and submitted as a data file.

2.10.2 Key Accomplishments and Summary of Findings to Date

The survey results included detections of LBVI at Elderberry Forebay and willow flycatcher (WIFL) (subspecies not determined) at multiple locations, but no detections of YBCU at any of the survey sites. As detailed below, the LBVI and WIFL detections were consistent with non-breeding migrants.

2.10.2.1 LBVI

Two LBVI detections (auditory and/or visual) were recorded at two sites around Elderberry Forebay: one at Elderberry Forebay Site 2 on May 23 and one at Elderberry Forebay Site 1 on June 7. Although these two detections occurred at different sites at Elderberry Forebay, the sites are very close to one another (approximately 900 feet apart) and the detections were likely the same individual. This individual was probably a migrant, as it was not detected again during the remaining three survey passes. No nests or nesting behavior were observed.

2.10.2.2 WIFL

In total, 26 WIFL detections were recorded during the surveys, all within survey Period 1 and Period 2. These detections occurred at Quail Lake, Pyramid Lake, Gorman Creek, and Elderberry Forebay. Six WIFL detections were recorded at Quail Lake Site 2: three on May 22, two on June 5, and one on June 19. Although the last three detections were during survey Period 2, when early nesting activity may occur, no nests or nesting behavior were observed. Furthermore, no detections were recorded on subsequent survey visits at this or any other Quail Lake site. Three WIFL detections also occurred at three different sites at Pyramid Lake: Priest Cove on June 6, Piru Creek on June 6, and Bear Trap on May 24. Six WIFL detections were recorded along Gorman Creek, all during one survey pass on June 8. Eleven WIFL detections were recorded at various sites around Elderberry Forebay: two on May 8 and five on June 7 at the Forebay Peninsula; and four total detections on June 7 consisting of one WIFL detection each at Elderberry Forebay 1, Elderberry Forebay 2, Elderberry Forebay 3, and Elderberry Forebay 5. The detections occurred within the normal period of spring migration of the species in southern California. The absence of any detections or nests during survey

Period 3 indicates these birds were migrants and were a different subspecies of *Empidonax traillii*.

2.10.2.3 Incidental Observations

Other noteworthy species observed during the surveys include yellow warbler (*Dendroica petechia*), a California Department of Fish and Wildlife (CDFW) species of special concern. In addition, the surveyors detected Cooper’s hawk (*Accipiter cooperii*), which is on the CDFW watch list; and Nuttall’s woodpecker (*Picoides nuttallii*) and Lawrence’s goldfinch (*Spinus lawrencei*), listed as a “Bird Species of Concern” and on the American Bird Conservancy watch list. Yellow warblers were observed a total of four times, one observation each at four different locations including Gorman Creek, Quail Lake 1, Bear Trap, and Piru Creek. Detections of brown-headed cowbird (*Molothrus ater*), a species known to parasitize nests of both LBVI and SWFL, were documented (seen or heard) a total of 11 times during the surveys at the following sites: Gorman Creek, Liebre Gulch arm, Glory Hole, Piru Creek, below Pyramid Dam, Elderberry Forebay Peninsula, and Elderberry Forebay Site 4.

2.10.3 Associated Data Files

File Name	Data Description	File Type	File Location
2018_0918_toStantec_ESA_BirdsSurvey.zip	Survey Transects, study area, and survey sites.	ZIP	Available upon request
Bird_survey_maps.pdf	Maps of habitat	PDF	Available upon request
YBCU_Field_Forms.pdf	Survey forms	PDF	Available upon request

2.10.4 Variances from Study Methods, Schedule or Approach, and Unexpected Field Conditions

There was one variance to the FERC-approved Study plan. The survey protocol for LBVI requires that all potential habitat be surveyed a total of eight times. There were five sites at Elderberry Forebay (Elderberry Forebay 1, 2, 3, 4 and 5) associated with small patches of potential habitat not identified until May 1, 2018. Therefore, these sites were not surveyed during the first two survey periods for LBVI during the study. However, the sites were surveyed during the remaining six survey periods, during which time there was a detection of a single migrant LBVI at one of the Elderberry Forebay sites during the third survey period, and again at an adjacent site during the fourth survey period. Because the survey produced a positive result for presence of LBVI, it is not believed that the variance in protocol affected the outcome of the survey.

2.10.5 Remaining Work

The Study is ongoing and will be completed in August 2019. To complete the Study, additional road surveys are needed in six identified locations for LBVI and, in some cases, for SWFL and YBCU.

2.11 RECREATION FACILITIES DEMAND ANALYSIS AND CONDITION ASSESSMENT STUDY

2.11.1 Completed Work to Date

The Study is complete. In accordance with the FERC-approved Study, the Licensees completed the following three components: (1) Existing Facility Inventory, Condition Assessment, and Carrying Capacity Analysis; (2) Recreational Facilities Accessibility Assessment; and (3) a Recreation Demand Analysis. Note that the Facility Inventory Assessment and Facility Accessibility Assessment field work was completed concurrently. These components were conducted throughout the 14 Project recreation areas identified in the Study, along with the U.S. Department of Agriculture, Forest Service (USFS) non-Project, Frenchman's Flat dispersed use area, based on FERC's suggestions in their comments on the Study, because downstream areas are affected by Project operations. All survey sites are listed below and identified in figures included as an associated data file as applicable (SSWP_Recreation_Amenities_MapBook).

Pyramid Lake recreation facilities include:

- Emigrant Landing Boat Launch
- Emigrant Landing Entrance Area
- Emigrant Landing Swim and Picnic Area
- Emigrant Landing Picnic and Fishing Area One
- Emigrant Landing Picnic and Fishing Area Two
- Vista Del Lago Visitor Center
- Vaquero Day Use Area
- Spanish Point Boat-in Picnic Area
- Serrano Boat-in Picnic Area
- Bear Trap Boat-in Picnic Area
- Yellow Bar Boat-in Picnic Area
- Los Alamos Campground

- Los Alamos Group Campground

Quail Lake recreation facilities include:

- Quail Lake Day Use Area (parking, portable restrooms, fisherman access paths)

Additionally, as part of the Study, a USFS dispersed use site, Frenchman's Flat (non-Project) downstream of the Project along Piru Creek, was evaluated at the request of USFS and FERC.

A summary of completed work is as follows.

2.11.1.1 Existing Facility Inventory, Condition Assessment, and Carrying Capacity Analysis/Recreational Facilities Accessibility Assessment

The Existing Facility Inventory Condition Assessment, and Facilities Accessibilities Assessment were all conducted in tandem. After those steps were completed, a carrying capacity analysis was undertaken for the developed facilities. Completed work in conjunction with the first two study components are discussed below.

Step 1 (Conduct Site Condition Assessments) and Step 2 (Field Reconnaissance)

The Licensees conducted an inventory of recreation facilities and amenities that are provided throughout the 14 existing recreation facilities listed above, as well as the non-Project Frenchman's Flat dispersed use site. Each facility was inventoried for parking capacity, including location and number of parking spaces, boat and trailer parking spaces, accessible parking spaces, and other facilities, such as picnic and camping units.

Buildings inventoried in the Study included those identified by USFS. All buildings were evaluated for accessibility, health and safety needs, and general energy efficiency. A complete list of the buildings inventoried as part of the Study are included as part of an associated data file (SSWP_Recreation_Buildings_MapBook_20190307 and SSWP_Recreation_Buildings).

Paved and gravel surfaced roads providing access to recreation facilities and amenities were inventoried to document the condition of road surfaces, pull-outs, intersections, and other relevant information pertaining to features and their respective conditions. Global Positioning System data was collected at locations identified as being in poor condition and photographs were taken to show representative conditions of these areas. The roads were inventoried to include segments identified by USFS and recommended by FERC for inclusion, as listed in the June 14, 2017 Study Plan Determination. The complete list of roads inventoried is included in the associated data files (SSWP_Recreation_Roads_MapBook_20190417 and SSWP_Recreation_Roads).

The field researchers evaluated general use patterns by the public at each developed recreation site within the Project area. For each developed site, the field crews assessed the overall conditions of user-created sites and user-made trails.

An assessment of the accessibility features at the recreational facilities was also undertaken. All 14 sites were assessed for general conformance with guidelines associated with the Architectural Barriers Act Accessibility Standard, the Forest Service Outdoor Recreation Accessibility Guidelines, and the Forest Service Trail Accessibility Guidelines on National Forest Service lands, as well as Americans with Disabilities Act elements.

The condition of the recreation facilities listed above were assessed and characterized based on the conditions listed in Table 2.11-1.

Step 3 (Carrying Capacity Analysis)

Recreation carrying capacity types were assessed at each developed recreation site within the Project area. 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).

2.11.1.2 Recreation Demand Analysis Study Component

Subsequent to the inventory and supply-side information gathering steps, the next study component focused on recreation demand, and comprised of six steps: Step 1 (Observational Survey); Step 2 (Visitor Use Questionnaire or Recreation Intercept Survey); Step 3 (Review of Research Publications and Existing Information); Step 4 (Assessment of Regional Uniqueness and Significance of the Primary Recreation Opportunities within the Recreation Study Area); Step 5 (Interviews with User Groups and Recreation Providers); and Step 6 (Regional Demand Assessment).

Table 2.11-1. Conditions for Recreation Facility Characterization

Facility Type	Poor	Fair	Good	Excellent
<p>Roads & Parking (circulation and condition of surface paving)</p>	<p>Across most areas, need reconditioning or replacement. Markings worn and less evident. Current conditions could pose safety hazards (pedestrians, bikes, and vehicles) and uncomfortable transit across surface.</p>	<p>Some areas are problematic, but no major safety concerns. May need fresh line markings (note as such when warranted).</p>	<p>Maintained; no rehabilitation within next 5 to 10 years.</p>	<p>New condition; no maintenance required.</p>
<p>Recreation Site Building (condition, including restrooms; statement of condition is reflection of maintenance and observed energy efficiency of buildings)</p>	<p>Structures in disrepair requiring immediate or near-term attention. Potential for significant rehabilitation. Problems could include leaks and sagging roofs or warped exposed wood surfaces.</p>	<p>Some aspects need rehabilitation, such as painting or replacement of roofing or modernization. Repairs should be made but no immediate needs.</p>	<p>Structure appears in sound, well maintained condition. No significant problems observed.</p>	<p>New condition; no maintenance required.</p>
<p>Recreation Site Amenities (condition and functionality of shade structures, water spigots, lighting structures, fencing, trash receptacles, picnic tables, barbecues, grills, drinking fountains, docks, etc.)</p>	<p>Likely that facility amenity should be replaced in near term or at least major overhaul, rehabilitation. Little evidence of maintenance.</p>	<p>Amenity or components appear damaged, less functional, or in need of replacement. Could be accommodated through routine maintenance.</p>	<p>Amenity appears in sound, well maintained condition. No significant problems observed.</p>	<p>New condition; no maintenance required.</p>

Table 2.11-1. Conditions for Recreation Facility Characterization (continued)

Facility Type	Poor	Fair	Good	Excellent
Signs (presence/condition of Project and recreation signs, indicate content, form/structure, function and basic visibility, and style)	No information on sign. Sign does not exist (where it appears it once stood) and requires immediate repair or replacement, or is essentially dysfunctional in terms of likely utility or use/appeal to meet user needs. Sign structure is out of place with regard to style and appearance of other amenities.	Sign shows some damage or dilapidation; style not in conformance with other signs; structure requires maintenance; information present but requires updating because of poor readability (fading/markings) or relevance (outdated information).	Sign generally in good condition and well maintained. Information displayed is current and relevant for recreation users. No obvious disrepair or maintenance issues.	New condition; no maintenance required. Sign serves its intended purpose.
Access (paved trail, natural surface trail, sidewalks, and other access to recreation facilities)	Pavement is crumbling and degraded, and should be replaced or removed. Natural surface trails in poor condition; includes erosion and washouts preventing access to trail users.	Surface shows age and is degraded, but functioning. Some areas are problematic but no major safety concerns. Could be accommodated through routine maintenance.	Trail surface or sidewalk condition appears in sound, well maintained condition. No significant problems observed.	New condition; no maintenance required.
Accessibility Compliance (presence of accessible facilities)	Little or no consideration for people with disabilities access; clearly not consistent with ABAAS, FSORAG, FSTAG and ADA (non-USFS lands) guidelines.	Some accessible and accessible type facilities, but in disrepair or not up to date or current standards (e.g. slopes too steep, inadequate turning radius, poor approach surface, docks inaccessible).	Apparent high quality of accessibility. Facilities appear consistent with current standards.	New condition; facilities are built to the most current standards for ABAAS, FSORAG, FSTAG and ADA.

Key:
 ABAAS = Architectural Barriers Act Accessibility Standards
 ADA = Americans with Disabilities Act
 FSORAG = Forest Service Outdoor Recreation Accessibility Guidelines
 FSTAG = Forest Service Trail Accessibility Guidelines

Step 1 (Observational Survey) and Step 2 (Visitor Use Questionnaire)

Observation surveys and in-person intercept surveys were conducted between May 26, 2018, and April 6, 2019, as agreed upon between the Licensees and USFS. The surveys were conducted and completed on three random weekends, three random weekdays, and two holiday weekend days (Memorial Day), for a total of nine survey days. Survey staff performed surveys at nine of the 14 locations (see list below) in the morning and afternoon, for up to two hours per visit. Field work in 2018 was conducted as follows: May 26 and May 27 (Holiday weekend); June 28 (weekday); July 30 (weekday); August 24 (weekday); August 25 (weekend); October 20 and 21 (weekend). In 2019 a field survey was completed on April 6, 2019 (weekend).

The nine locations listed below were selected based on consultation with the Licensees and USFS:

- Site 1: Emigrant Landing Boat Launch
- Site 2: Emigrant Landing Picnic and Fishing Area One
- Site 3: Emigrant Landing Picnic and Fishing Area Two
- Site 4: Emigrant Landing Swim and Picnic Area
- Site 5: Frenchman's Flat Dispersed Use Site
- Site 6: Los Alamos Campground
- Site 7: Quail Lake
- Site 8: Vaquero Day Use Area
- Site 9: Vista del Lago (Visitor Center)

Some questions that were included in the intercept survey came from the 2005 satisfaction “gold” form from the USFS National Visitor Use Monitoring (NVUM) program. The questionnaire was crafted to collect information from recreationists about recreation, activity participation, accessibility needs, areas visited, group size, user conflicts, perceived crowding, visitor profile (i.e. male/female, age, race) and preferences, visual impressions, and satisfaction with or desire for recreational opportunities and facilities in the Study area.

Step 3 (Review of Research Publications and Existing Information)

The following publications were obtained for use in evaluating regional recreation demand in the license application recreation analysis: California Department of Parks and Recreation (DPR) Survey on Public Opinions and Attitudes (SOPA) on Outdoor Recreation in California 2012; and the California Statewide Outdoor Recreation Plan (SCORP). The survey results in the SOPA help show that “an understanding of the

outdoor recreation demands, patterns, preferences, and behaviors of California residents is essential to develop policies, programs, services, access, and projections of future use.” The SCORP provides guidance for recreation providers, including federal, State, local, and special district agencies.

Also evaluated were reports including DPR’s 2005 Park and Recreation Trends in California report, its 2007 California Outdoor Recreation Survey, and its 2012 Survey of Public Opinions and Attitudes on Outdoor Recreation in California.

Step 4 (Assessment of Regional Uniqueness and Significance of the Primary Recreation Opportunities within the Recreation Study Area)

The regional uniqueness of Pyramid Lake recreation opportunities and amenities were evaluated by comparing the recreation offerings and use to offerings and use at five other reservoirs greater than 900 surface acres within 70 linear miles of Pyramid Lake. These included Castaic Lake (and afterbay lagoon), Lake Piru, Lake Evans and Webb (connected water bodies part of the Buena Vista Aquatic Recreation Area), Lake Casitas, and Lake Cachuma.

Step 5 (Interviews with User Groups and Recreation Providers)

Interviews with Project stakeholders were conducted, and meeting notes were compiled. Structured interviews with recreation providers included staff from Rocky Mountain Recreation Company, Buena Vista Aquatic Recreation Center, the Los Angeles County Sherriff’s Office, USFS, Lake Casitas Recreation Area, Lake Piru Recreation Area, DPR, and Castaic Lake State Recreation Area.

Step 6 (Regional Demand Assessment)

An analysis of DWR recreation concessionaire visitation reports, along with USFS Recreation Demand and Use information, was undertaken to evaluate identified trends in uses and demand considerations focusing on recreation uses relevant to the Project area.

2.11.2 Key Accomplishments and Summary of Findings to Date

2.11.2.1 Existing Facility Inventory, Condition Assessment, and Carrying Capacity Analysis/ Recreational Facilities Accessibility Assessment

As discussed above, the Existing Facility Inventory Condition Assessment, and Facilities Accessibilities Assessment were all conducted in tandem. After those steps were completed a carrying capacity analysis was undertaken for the developed facilities. Findings are discussed below.

Recreation Inventory Component, Step 1 (Conduct Site Condition Assessments) and Step 2 (Field Reconnaissance)

Table 2.11-2 presents the findings of the recreation amenity inventory for the developed recreation facilities. In addition, user-created sites and trails were identified with evidence of dispersed camping uses found near the parking lot of Quail Lake and at the non-Project Frenchman's Flat dispersed use area. Additionally, during the observation surveys, camping was observed along the shore of Quail Lake, even though it is not an allowed use. A user-made trail was found connecting Vaquero Day Use Area and Spanish Point, as well as one leading downslope to Vaquero Day Use Area from Vista Del Lago Visitor Center. These user-made trails are overgrown and show some signs of erosion and vegetation trampling.

As part of the inventory of recreational facilities, an accessibility assessment was undertaken for the recreation facilities and access routes within the Study area. Findings show there are several facilities and accessible features at many of the 14 developed recreation facilities (Table 2.11-1). In general, there was a good distribution of accessibility facilities. However, only some facilities conformed closely to the USFS accessibility standards. Emigrant Landing Boat Launch, Vaquero Day Use Area, and Yellow Bar Boat-in Picnic Area provide the most comprehensive accessible facilities.

A listing of the condition findings by recreation area are provided in the associated data file (Recreation Facility Debrief). In general, most facilities were found to be in good or excellent condition as observed in the field. However, there were a few instances of signs, water faucets, and a campsite or picnic site that were found to be in fair or poor condition. Maps were created to show the amenities location throughout the project vicinity (SSWP_Recreation_Mapbook_20190417).

Recreation Inventory Component, Step 3 (Carrying Capacity Analysis)

A qualitative and quantitative analysis of carrying capacity of each developed facility was undertaken, and the results are summarized by recreation site in an associated data file (Recreation_Carry_Capacity). Findings show that 11 of the 14 recreation facilities are approaching capacity on some summer weekends; however, the capacity concerns were only identified at the peak use periods, and most of the time the facilities are fully accommodating the demand.

Table 2.11-2. Recreation Facilities Inventory List

Recreation Facility	Recreation Amenities
Quail Lake Day Use Area	<ul style="list-style-type: none"> Gravel parking area for approximately 37 vehicles, 3 portable restrooms, 3 trash containers, about 3 miles total of gravel surface shoreline trail system, and 3 informational signs
Los Alamos Campground	<ul style="list-style-type: none"> 93 individual camp sites with typically 1 picnic table and 1 fire ring per site, 3 ADA/accessible campsites, 4 ADA/accessible restrooms with flush toilets, 5 shade ramadas, 31 potable water spigots, 4 sinks, 16 bear-proof trash receptacles, and 2-lane RV/trailer dump station Each site is equipped with a parking spur to provide one standard parking space
Los Alamos Group Campground	<ul style="list-style-type: none"> 3 group camp sites, 15 tables, 3 shade ramadas, 3 grills, 3 campfire pits, 3 water spigots, 1 restroom building (unisex, flush toilets), 1 outdoor sink, 5 informational signs, and 3 dumpster trash receptacles Parking spaces for approximately 45 vehicles across all 3 sites
Emigrant Landing Entrance Station	<ul style="list-style-type: none"> 2 entrance station kiosks, 7 directional and information signs, boat inspection station, and 24 standard parking spaces
Emigrant Landing Boat Launch	<ul style="list-style-type: none"> 1 restroom (unisex, ADA/accessible, flush toilets), 2 floating restrooms, 16 information signs, 3 standard parking spaces, 5 ADA/accessible parking spaces (2 van accessible), 73 oversized parking spaces (RV, boat, or bus parking spaces), 1 drinking fountain, 1 boat ramp with 8 launching lanes, and 2 boat docks
Emigrant Landing Picnic and Fishing Area One	<ul style="list-style-type: none"> 22 picnic sites (21 shade structures, 22 grills, 2 ADA/accessible tables, 34 standard tables), 2 restroom buildings (unisex, flush toilets), 21 information and directional signs, 6 trash receptacles, 1 drinking fountain, fish cleaning station, 85 standard parking spaces, and 5 ADA/accessible spaces
Emigrant Landing Picnic and Fishing Area Two	<ul style="list-style-type: none"> 5 picnic sites, 5 shade ramadas (one has 3 combined shade ramadas counted as 1), 14 standard tables, 7 grills, 1 restroom building (unisex, flush toilets), 3 drinking fountains, 1 water spigot, 3 trash receptacles, 24 informational and directional signs, 1 pedestrian overlook structure, approximately 78 standard parking spaces, and 2 ADA/accessible spaces
Emigrant Landing Swim and Picnic Area	<ul style="list-style-type: none"> Swim beach with lifeguard tower; 31 picnic sites, 31 shade ramadas, 52 standard tables, 8 ADA/accessible tables, 34 grills, 2 restrooms (unisex, flush toilets), 13 information and directional signs, 5 water spigots, 2 drinking fountains, 7 trash receptacles, 133 standard parking spaces, and 2 ADA/accessible spaces
Vista del Lago Visitor Center	<ul style="list-style-type: none"> 1 Visitors Center building with interpretive exhibits and ADA/accessible restrooms, 143 regular parking spaces, 10 oversized parking spaces (RV, boat, or bus parking spaces), 6 ADA/accessible spaces (2 van accessible), 1 FERC informational sign, 2 other informational signs, 11 trash receptacles, 2 telescope viewers, 1 overview lookout structure (1 bench, 1 info sign), and multiple standard parking lot lights

Table 2.11-2. Recreation Facilities Inventory List (continued)

Recreation Facility	Recreation Amenities
Vaquero Day Use Area	<ul style="list-style-type: none"> Swim beach with lifeguard tower, 14 picnic sites (1 ADA/accessible site, 13 regular), 14 grills, 13 standard tables, 1 ADA/accessible table, 5 bear-proof trash receptacles, 5 water spigots, 1 drinking fountain, 1 fire pit, 2 restroom buildings (unisex, ADA/accessible), 1 lifeguard building, 138 standard parking spaces, and 8 ADA/accessible spaces (3 van accessible)
Spanish Point Boat-in Picnic Area	<ul style="list-style-type: none"> 12 picnic sites with 12 shade ramadas and 9 grills, 1 group barbeque site with 3 grills, 5 trash receptacles, 1 informational sign, 1 restroom building (vault toilets), 4 portal restrooms, 4 portable sinks, and 1 shoreline ski launch lane
Serrano Boat-in Picnic Area	<ul style="list-style-type: none"> 6 picnic sites, 6 grills, 8 standard tables, 1 restroom building (unisex, vault toilets), 2 trash receptacles, and 1 boat dock
Bear Trap Boat-in Picnic Area	<ul style="list-style-type: none"> 2 picnic sites, 3 shade ramadas, 3 tables, 2 grills, 2 trash receptacles, 2 restroom buildings (unisex, pit toilets), 1 information sign and 1 boat dock
Yellow Bar Boat-in Picnic Area	<ul style="list-style-type: none"> 10 picnic sites with 17 standard tables and 3 ADA tables, 10 shade ramadas, 2 ADA/accessible unisex restrooms (vault toilets), 2 trash receptacles, 1 information sign, 1 ADA/accessible ramp to dock, and 1 ADA/accessible boat dock
Non-Project USFS Dispersed Site – Frenchman’s Flat	<ul style="list-style-type: none"> 3 unimproved campsites, 3 picnic tables, 2 restrooms (vault toilets, one with 2 stalls and one with 1 stall), 7 information and directional signs, and 6 trash dumpsters

Key:

ADA = Americans with Disabilities Act

FERC = Federal Energy Regulatory Commission

RV = recreational vehicle

USFS = U.S. Department of Agriculture, Forest Service

2.11.2.2 Recreation Demand Study Component

The recreation demand analysis study component included further analysis and a compilation of data sets from the information collected. The survey information collection from the recreation demand study component Step 1 and Step 2 was compiled into one report, which is an associated data file (sswp_Obs and Intercept survey results) and the complete survey results are in associated date file (Intercept_Survey-Detailed Results).

Recreation Demand Study Component, Step 1 (Observational Survey) and Step 2 (Visitor Use Questionnaire)

The survey results included observations of users and their different activities. Since the observation surveys were conducted on different types of days (weekends, weekdays, and holidays) user counts reflect peak use, standard use, and slower times at the recreation areas. This data also shows which recreation areas are more desirable and receive more use. The most popular areas on weekends were Emigrant Landing Boat Launch, Emigrant Landing Picnic and Fishing Area One, Emigrant Landing Swim and Picnic Area, Frenchman's Flat Dispersed Use Site, Quail Lake, and Vaquero Day Use Area. Observation monitoring forms included site, weather, time, number of people observed, activities observed, number of cars and boats observed, number of groups, average group size, perceived crowding, observed or perceived user conflicts, languages observed, number of pets observed, and any additional notes. In total, there were 107 interviews conducted at 9 sites over a period of nine survey visits. This gave insight into what users' needs are and how the Project area is being utilized.

On observation dates in the Study area, fishing (from shore) was identified as the most popular activity (55 percent) in comparison to hiking/walking (63 percent) for the 2014 Los Padres NVUM survey. Picnicking was the second most popular activity (53 percent); in the 2014 Los Padres NVUM, viewing natural features was the most popular activity (46 percent). Swimming was the third most popular activity (33 percent); by comparison, the 2014 Los Padres NVUM survey listed relaxing as the third most popular activity (34 percent). The site with the most diversity of activities was Site 4: Emigrant Landing Swim and Picnic Area, followed by Site 2: Emigrant Landing Picnic and Fishing Area One and Site 1: Emigrant Landing Boat Launch. The sites with the least diversity of activities were Site 5: Frenchman's Flat Dispersed Use Site and Site 9: Vista del Lago (Visitor Center). See the associated data file (sswp_Obs and Intercept survey_results_2018_12_14) to find a complete breakdown of all observation surveys. Observed or perceived user conflicts, such as issues at parking lots and boat ramps between user groups, alcohol related conflicts, etc. were noted, if observed. The few user conflicts that were observed are as follows:

- Emigrant Landing Boat Launch - Trailers parked in wrong direction in parking lot
- Emigrant Landing Boat Launch - Some of the oversized parking spaces are not adequate length for the boat trailers

- Frenchman's Flat Dispersed Use Site - Loud shouting at campsite 1; observed odors indicating potential drug use

The intercept surveys reported that Site 4: Emigrant Landing Swim and Picnic Area received the most responses (27 intercept surveys), followed by Site 1: Emigrant Landing Boat Launch (13 intercept surveys), and Site 2: Emigrant Landing Picnic and Fishing Area One (14 intercept surveys).

The primary purpose of the visit of those surveyed was recreation at 92 percent. Two percent of respondents were only stopping in to use the bathroom and 6 percent were only passing through, and going somewhere else.

Refer to the associated data file (Intercept_Survey-Detailed_Results) to see a complete breakdown of each question asked from the intercept survey form.

Recreation Demand Study Component, Step 3 (Review of Research Publications and Existing Information)

Several documents were reviewed to help understand use levels, trends, and outdoor recreation preferences. Additional USFS planning documents were reviewed to help identify forest management in the Pyramid Lake area. Documents examined included:

- Serving Culturally Diverse Visitors to Forests in California: A Resource Guide, USDA Forest Service, Pacific Southwest Region, June 2009.
- Visitor Use Report, Los Padres NF, USDA Forest Service Region 5, National Visitor Use Monitoring, Data Collected FY 2014.
- Visitor Use Report, Angeles NF, USDA Forest Service Region 5, National Visitor Use Monitoring, Data Collected FY 2014.
- Recreation Visitor Research: Studies of Diversity, General Technical Report, October 2008.
- Survey on Public Opinions and Attitudes on Outdoor Recreation in California 2012, California Department of Parks and Recreation, Natural Resources Agency, State of California, January 2014.
- Outdoor Recreation Trends and Futures: A Technical Document Supporting Forest Services 2010 RPA Assessment.
- Park and Recreation Trends in California, 2005, An Element of the California Outdoor Recreation Planning Program. California Department of Parks and Recreation.
- Meeting the Park Needs of All Californians, 2015 Statewide Comprehensive Outdoor Recreation Plan. California Department of Parks and Recreation.

- Outdoor Recreation in California's Regions, 2013, Issues, Strategies, Actions and Supporting Research. An Element of the California Outdoor Recreation Planning Program, California Department of Parks and Recreation.
- Alternative Camping at California State Parks, A Report on Results of a 2009-2010 Visitor Survey and a 2010 Management and Maintenance Survey. California Department of Parks and Recreation, 2011.
- Rim of the Valley Corridor, Draft Special Resource Study and Environmental Assessment, National Park Service, U.S. Department of Interior, April 2015.
- Environmental Assessment Report, Hardluck Recreation Area Complex, Los Padres National Forest, Ventura and Los Angeles County, California, USDA Forest Service, Los Padres National Forest, December 1978.
- Land Management Plan, Part 2 Los Padres National Forest Strategy, USDA Forest Service, Pacific Southwest Region, September 2005.
- Land Management Plan, Part 3, Design Criteria for the Southern California National Forests, Angeles National Forest, Cleveland National Forest, Los Padres National Forest, San Bernardino National Forest. USDA Forest Services, Pacific Southwest Region, September 2005.
- Final Environmental Impact Statement, Volume 1 & 2 (APPENDICIES) Land Management Plans, Angeles National Forest, Cleveland National Forest, Los Padres National Forest, San Bernardino National Forest. September 2005.

Recreation Demand Study Component, Step 4 (Assessment of Regional Uniqueness and Significance of the Primary Recreation Opportunities within the Recreation Study Area)

The assessment of regional uniqueness and significance of the primary recreation opportunities within the Study area yielded useful information in terms of comparing and contrasting the recreation opportunities and offerings available for flat-water recreation resources in the Project region. In evaluating five reservoirs with large water-based recreation developments in the region, Pyramid Lake tends to fall in the middle with respect to water surface area available – an important factor to consider in overall carrying capacity of the lakes for boating and other uses. Pyramid Lake was found to be unique in its close proximity to a major highway (Interstate 5), its consistently high lake levels, and the allowance for all types of watercraft to access most parts of the lake. Results of the uniqueness evaluation are summarized in the associated data file, SSWP_Uniqueness_comparative_table.

Recreation Demand Study Component, Step 5 (Interviews with User Groups and Recreation Providers)

Structured interviews with recreation providers provided insights into recreation user needs and demand; based on the interviews, it was noted there is growing demand. Structured interviews with recreation providers included staff from Rocky Mountain Recreation Company, Buena Vista Aquatic Recreation Center, the Los Angeles County Sherriff's Office, USFS, Lake Casitas Recreation Area, Lake Piru Recreation Area, DPR, and Castaic Lake State Recreation Areas. Most interviews indicated a desire for more amenities in camping and day use recreation in the region (refer to the associated data file "20180603_SSWP_Recreation_Interviews_Combined" for summaries of the interviews). The interviews also provided insights into successful approaches and operations at similar recreation facilities to Pyramid Lake; some of the findings that involved management practices could be adapted at Pyramid Lake recreation facilities in the future.

Recreation Demand Study Component, Step 6 (Regional Demand Assessment)

The regional demand assessment yielded information based on an assessment of all Study findings to date and is summarized below. Findings will be elaborated on in the DLA. Project recreation visitation records were collected and summarized in the associated data file, SSWP_Annual_Visitation_Data_Figures_Pyramid_Lake.

Based on the last eight years of recreation visitation records, about 87 percent of all use is day use, and 13 percent is overnight use. Monthly visitation records since 2011 show a similar steady use pattern for day use and overnight use. Records for boating indicated by the number of boat and personal water craft (PWC) launches show a fairly steady pattern of use, with 2015 showing an increase in boat launches, while monthly PWC launches appear to be trending downward.

USFS also estimates recreation use on forests through the NVUM program. The most recent data for the Los Padres National Forest indicate total estimated annual recreation visits to the forest in 2014 was 938,000, in comparison to 635,000 visits in 2009. The NVUM reports show the total Angeles National Forest visits were estimated to be 2,880,000 in 2016, 3,636,000 in 2011, and 3,031,000 in 2006 (USFS 2018).

For population growth, the California Department of Finance projections were evaluated. The population of Los Angeles County was approximately 9.8 million people in 2010, an increase of 3.1 percent from approximately 9.5 million people in 2000. California Department of Finance projections indicate that population growth in Los Angeles County is expected to continue increasing by approximately 11.3 percent, to over 10.9 million people by 2030 (Table 2.11-3). Urban areas within the county contain more concentrated population densities.

Table 2.11-3. Historic and Forecasted Population and Population Density

Los Angeles County	2000 Census	2010 Census	Percent Change (2000 through 2010)	2020 Projection	2030 Projection	Percent Change (2010 through 2030)
Population (people)	9,519,338	9,818,605	3.1	10,435,991	10,930,986	11.3
Population Density (people/square mile) ¹	2,346	2,420		2,572	2,694	

Sources: U.S. Census Bureau 2000, 2010; California Department of Finance 2014

Other relevant recreation demand information found in the documents reviewed in Step 3 above are outlined as follows.

In the 2009 City of Los Angeles Recreation and Parks Department Community-wide Needs Assessment, the City found that the Caucasian population participates in a wide range of activities, including both team and individual sports on land and water. The report also noted that the Caucasian population has more of an affinity for outdoor non-traditional forms of recreation. The needs assessment report notes that Hispanic and Latino Americans place more emphasis on the extended family, often desiring to gather in large recreational groups with multiple activities available, so all age segments of the group can participate. There is a preference for large group pavilions with picnicking amenities and multi-purpose fields, often used for soccer games. These are all integral to the communal pastime shared by many Hispanics (City of Los Angeles 2009).

Based on a review of several USFS reports by Deborah J. Chavez, Patricia L. Winter, and James D. Absher from the USFS Pacific Southwest Research Station, recreation needs today are different from those in the past; most recreation visitors to southern California forests were by persons of Caucasian American backgrounds, but trends now point toward an increase in visitation by ethnically diverse visitors. Examples of the change in ethnic use patterns and preferences can help inform future demand needs and include the following findings:

- For picnicking, while Caucasian visitors traditionally stay just a few hours and bring foods made at home, Hispanic and Latino Americans often come early in the day and stay all day, often making foods from scratch right on the site.
- Hispanic and Latino Americans often participate in larger groups than can be accommodated with individual site picnic tables, so many traditional site layouts do not fit their patterns of use (Chavez et al. 2008).

In 2009, “Serving Culturally Diverse Visitors to Forest in California: A Resource Guide” was published by USFS. The report notes that despite California’s changing demographics, racial and ethnic groups are underrepresented public land visitors. More than a third of all U.S. Hispanic and Latino Americans, Asian Americans, and American

Indian populations live in California. Much of the federal outdoor recreation infrastructure was built many years ago and may need to be renovated and/or repositioned to better serve a wider range of culturally diverse visitors.

Relevant findings are as follows:

- In general, Californians want more amenities: water recreation, outdoor settings for larger groups, wider range of overnight camping facilities, and increase of shorter trails.
- There is a need for more large group shelters for picnics and more evenly distributed trash receptacles (verses large dumpsters).
- While national forests have seen an increase in new visitors in past years, there is a lack of ethnic diversity despite changes in area demographics.
- The lower socioeconomic classes under represented visitors to public lands.
- Outdoors are appreciated differently based on background (great diversity among Hispanic and Latino Americans and their recreational preferences).
- Visitors prefer clean and functioning toilets, picnic tables free of garbage and graffiti, and adequate lighting in campgrounds to feel safe.
- There is a need to have emergency telephones in campgrounds.
- There is a need for multilingual rangers.
- In the design of facilities, it is better to use icons in signage.
- Signs need to be bilingual with Spanish and English, and Hispanic and Latino Americans prefer site information be posted on site.
- Hispanic and Latino Americans tend to prefer forested sites with water features and amenities to support a day-long, extended-family social outing with extensive onsite meal preparation.
- Hispanic and Latino Americans enjoy picnicking, day hiking, camping, and large family gatherings in outdoor settings (Roberts et al. 2009).

2.11.3 Associated Data Files

File Name	Data Description	File Type	File Location
Intercept_Survey-Detailed_Results	Intercept Surveys complete results	PDF	Project Website
sswp_Obs and Intercept survey_results_	Recreation survey results	PDF	Project Website

File Name	Data Description	File Type	File Location
SSWP_Annual_Visitation_Data_Figures_Pyramid_Lake	Visitation records	EXCEL	Project Website
SSWP_Uniqueness_comparative_table	Table comparing Recreation areas	PDF	Project Website
20180603_SSWP_Recreation_Interviews_Combined	Notes from the interviews conducted	PDF	Project Website
SSWP_Recreation_Facility_Debrief	All recorded amenities and condition	PDF	Project Website
SSWP_Carry_Capacity	Recreation table detailing each recreation sites full carrying capacity	PDF	Project Website
SSWP_Recreation_Roads	Description of all identified recreation roads	PDF	Project Website
SSWP_Recreation_Buildings_Mapbook_20190307	Maps of identified buildings	PDF	Project Website
SSWP_Recreation_Roads_Mapbook_20190308	Maps of identified recreation roads	PDF	Project Website
SSWP_Recreation_Buildings	Photos of buildings and structure details.	PDF	Project Website
SSWP_Recreation_Mapbook_20190417	Maps of recreation amenities in the survey areas	PDF	Project Website

2.11.4 Variances from Study Methods, Schedule or Approach, and Unexpected Field Conditions

There were no variances in Study methods, schedule, or approach from the FERC-approved Study.

2.11.5 Remaining Work

None. This study is complete.

2.12 CULTURAL RESOURCES STUDY

2.12.1 Completed Work to Date

The study was underway during the period covered by this USR. The Licensees have completed the archaeological and historic built environmental tasks under Step 1 (Perform Archival Research) and Step 2 (Conduct Field Survey and Identify Resources) in the FERC-approved study plan. Step 3 (Identify and Assess Potential Project Effects on Identified Cultural Resources) is currently in progress.

2.12.2 Key Accomplishments and Summary of Findings to Date

The FERC-approved study plan was distributed to participating tribes and land managing agencies for review. All comments were addressed and the study plan was approved by reviewing parties prior to implementing the fieldwork. Licensees are in the process of assessing the field data gathered from fieldwork, but have documented 24 newly discovered cultural resources and 25 newly discovered isolated artifacts, in addition to previously recorded archaeological sites. Sixteen historical built resources related to the Project have also been identified and are in the process of being documented. Approximately 50 to 60 percent of the Area of Potential Effects (APE) was accessible and examined during the archaeological survey. The other 40 to 50 percent of the APE was not accessed due to steep, inaccessible slopes, dense brush, or covered by parking lots or other improvements or facilities. Quail Lake, Pyramid Lake, and Elderberry Forebay were all at Normal Maximum Water Surface Elevation (NMWSE) during the time of the field survey, thereby precluding access during the field effort to any lands normally inundated by the reservoirs. The cultural resources identified in the APE consist primarily of historic period occupation and use locations. Many previously recorded sites are located along the original river terraces and are inundated by reservoirs and therefore inaccessible.

2.12.3 Associated Data Files

The Licensees have not yet completed the final assessment and mapping steps of the study. Therefore, there are no data to report during the period covered by this USR. The Licensees anticipate that most data collected during this study will be confidential and treated as Privileged.

2.12.4 Variances from Study Methods, Schedule or Approach, and Unexpected Field Conditions

The schedule for the FERC-approved study targeted July 2017 for study initiation. The Study was delayed to allow for tribal consultation on the study plan. This variance will have no effect on the overall study or remaining work.

2.12.5 Remaining Work

Remaining work includes the following: (1) assess potential Project effects on identified cultural resources; (2) prepare a Privileged technical report of findings that documents the results of the study, including National Register of Historic Places evaluations for built resources and any archaeological resources that can be evaluated at the inventory level; and (3) issue a final field results and data summary report.

The Licensees expect to complete the study by July 2019.

2.13 TRIBAL RESOURCES STUDY

2.13.1 Completed Work to Date

The Licensees initiated the following steps: (1) Step 1 - Perform Archival Research, (2) Step 2 - Consult with Indian Tribes and Identify Resources, and (3) Step 3 - Conduct Site Visits. As part of Step 1, the Licensees initiated ethnographic archival literature research. As part of Steps 2 and 3, the Licensees and the Fernand o Tataviam Band of Mission Indians representatives conducted a field visit to nearby archaeological sites. The Licensees conducted tribal interviews during the field visit and continued to coordinate with the tribal chairperson and Tribal Historic Preservation Officer to obtain additional interviews and identify additional tribal members who may potentially wish to be interviewed. Following the field visit, additional interviews were conducted with additional tribal elders.

2.13.2 Key Accomplishments and Summary of Findings to Date

The Licensees have not identified any Traditional Cultural Properties, Indian Trust Assets, or other resources of importance to the tribes that would be affected by the Licensees' Proposal.

Prior to work commencing, the Licensees provided to participating Indian tribes and land managing agencies a copy of the FERC-approved Tribal Resources Study Plan. In addition, the Licensees and Fernand o Tataviam Band of Mission Indians executed a Non-Disclosure Agreement for confidential data potentially identified during the Study. Interviews conducted by the ethnographer during a January 2018 site visit provided initial discussions and information about family members or other tribal members who may have utilized the natural resources or locations near the Project Area of Potential Effects (APE) for traditional tribal practices. The members of the Fernand o Tataviam Band of Mission Indians who attended the site visit presented the Project information to the Tribal Council in late January 2018. The tribe was to determine if they had photographs relevant to the Study, and found that they do not have any relevant photographs. On April 3, 2018, the Fernand o Tataviam Band of Mission Indians identified tribal elders who were willing to be interviewed, resulting in interviews with eight additional tribal elders on May 16, and 17, 2018. The tribe indicated there may be other potential tribal elders interested in being interviewed, but no further interviews have occurred.

2.13.3 Associated Data Files

Data collected during this Tribal Resources Study are confidential and are treated as Privileged.

2.13.4 Variances from Study Methods, Schedule or Approach, and Unexpected Field Conditions

The schedule for the FERC-approved Study targeted July 2017 for Study initiation. Initiation was delayed to allow for tribal consultation on the Study plan. Additional delays

were due to scheduling interviews with tribal members, extending coordination required for the tribal site visits, and natural disasters (i.e., wildfires in Santa Clarita, California and Ventura County, California) in the Study vicinity. As a result, there is a variance to the Study completion date of October 2018.

2.13.5 Remaining Work

This Study was substantially complete in April 2019; however, additional tribal interviews were recently scheduled. Remaining work includes completing additional tribal interviews and developing a Privileged Tribal Resources Study Report. It is anticipated that the Study will be complete by the end of September 2019.

2.14 INDICATORS OF HYDROLOGIC ALTERATION (IHA) STUDY

2.14.1 Completed Work to Date

The Study is complete. The Licensees completed Step 1 (Develop With-Project and Without-Project Hydrology Records), Step 2 (Conduct Ramping Rate Analysis), Step 3 (Conduct the Indicators of Hydrologic Alteration [IHA] Analysis), and Step 4 (Conduct a Flood Frequency Analysis).

2.14.2 Key Accomplishments and Summary of Findings to Date

2.14.2.1 Step 1. With-Project and Without-Project Hydrology Records, and Pyramid Lake Average Daily Inflows and Outflows

The Licensees compiled average daily flow data from the two gages that measure inflow into Pyramid Lake (U.S. Geological Survey [USGS] gage 11109375, Piru Creek below Buck Creek near Pyramid Lake; and USGS gage 11109395, Cañada de Los Alamos above Pyramid Lake) and from the gage measuring outflow below Pyramid Lake (USGS gage 11109525, Piru Creek below Pyramid Lake near Gorman, CA). As described in a March 22, 1974 DWR memorandum, DWR and the United Water Conservation District (UWCD) agreed that an appropriate multiplier to account for portions of the Pyramid Lake watershed not tributary to the upper Piru Creek or Cañada de Los Alamos watersheds upstream of their gages is 10.8 percent. Therefore, the average daily flow from the ungaged portion of runoff into Pyramid Creek is calculated by multiplying the combined average daily flow of gages 11109375 and 11109395 by 10.8 percent.

The Licensees found that each of the USGS average daily flow data gage records were missing the following data: 365 days (9 percent out of the 4,018 days in the study period) at gage 11109395; 731 days (18 percent) at gage 11109525; and 1,826 days (45 percent) at gage 11109375. In addition, the Licensees found that the USGS gage records did not include hourly or sub-daily flow data. The Licensees completed the average daily flow datasets using DWR hardcopy records, and compiled hourly flow records using hardcopy flow records from the DWR archives.

DWR releases SWP water from Pyramid Lake each year for the UWCD. Those releases are recorded on Table 25 of DWR's State Water Project Operations Reports. This exercise yielded Figure 2.14-1, which shows average daily inflows and outflows from Pyramid Lake by year from water year (WY) 2007 through WY 2017. The figures show the portion of release allocated to UWCD separated from the other Pyramid Lake releases since it is a release, but it is not part of the natural inflow to Pyramid Lake; UWCD releases are from SWP water supplies.

2.14.2.2 Step 2 – Ramping Rate Analysis

The DWR hardcopy records described under Step 1 were also used to develop hourly time series for the two gages measuring inflow to Pyramid Lake; hourly flows measured at these two gages were added together to generate an hourly "Without-Project hydrology" dataset. DWR digital records of hourly Pyramid Lake operations, including Pyramid Lake water surface elevations, the Pyramid Lake spillway gate positions, and the total flow downstream for calendar years 2006 through 2017, were used to generate an hourly "With-Project hydrology" dataset. Hourly flows for discrete events from the Without-Project and With-Project hydrology datasets were used to compare ramping rates for 10 events within the period of record, including three events of DWR deliveries to the UWCD. The three events including deliveries to UWCD were for the periods of:

- November 20, 2007 through November 23, 2007;
- November 23, 2010 through November 30, 2010; and
- November 20, 2012 through November 30, 2012.

There were periods of missing data for the hourly Piru Creek flows below Pyramid Lake with the DWR digital records. Where data was missing, data from the California Data Exchange Center (CDEC) Pyramid (PYM) station was used to fill in gaps so that the full period of record of hourly data was available. Discrete events from this Pyramid Lake Natural Inflow time series were compared to corresponding events from the Pyramid Lake Release timeseries to conduct the ramping rate analysis.

Figure 2.14-2 shows hourly inflows, developed as described above from DWR hardcopy data, and outflows from Pyramid Lake from DWR's digital records and CDEC for 10 events between WY 2007 and WY 2014.

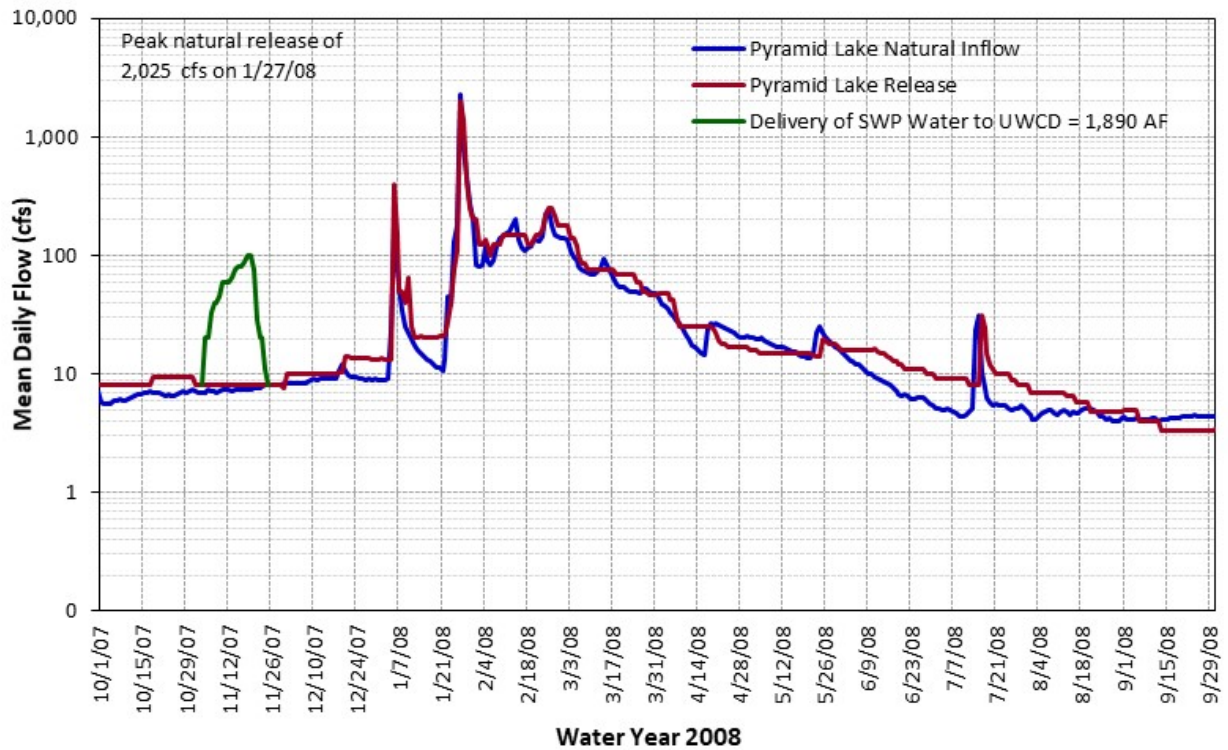
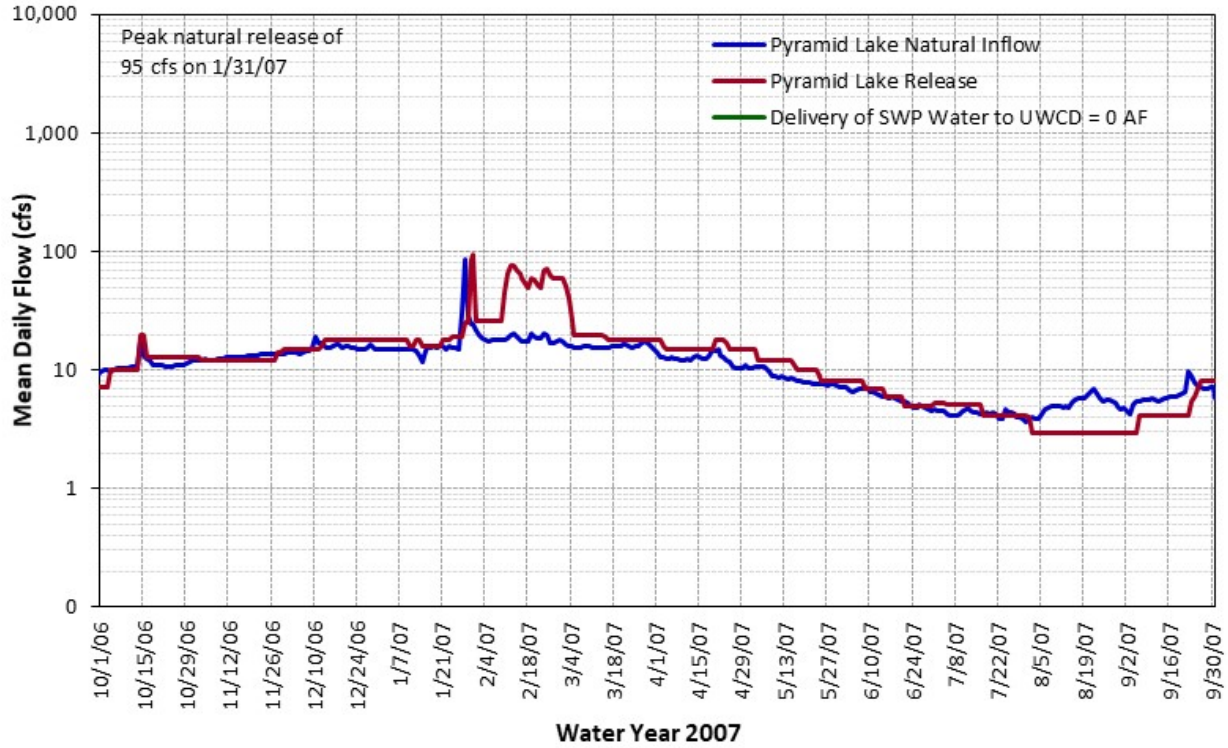


Figure 2.14-1. Average Daily Inflows and Outflows From Pyramid Lake By Year from Water Year 2007 Through Water Year 2017

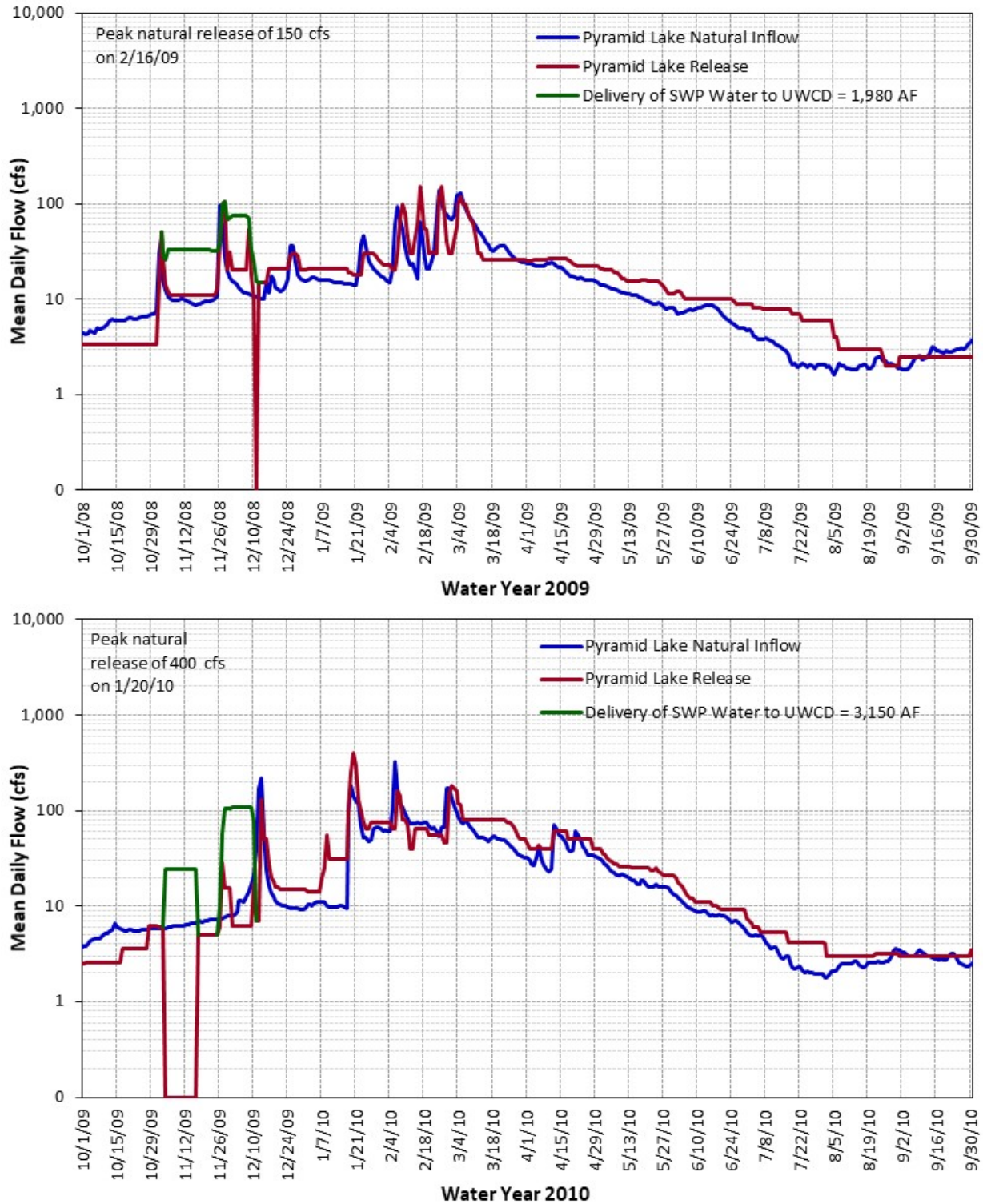


Figure 2.14-1. Average Daily Inflows and Outflows From Pyramid Lake By Year from Water Year 2007 Through Water Year 2017 (continued)

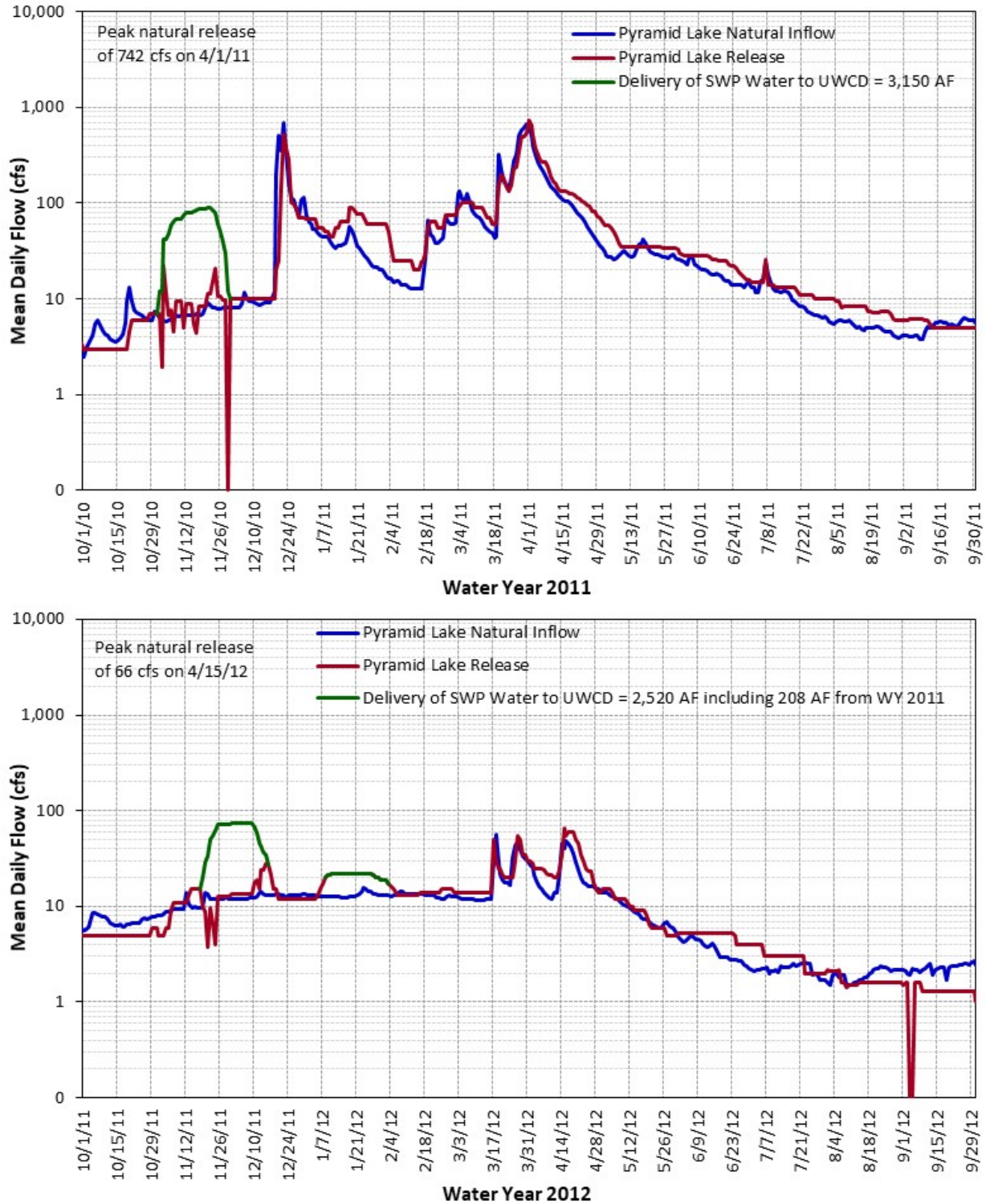


Figure 2.14-1. Average Daily Inflows and Outflows From Pyramid Lake By Year from Water Year 2007 Through Water Year 2017 (continued)

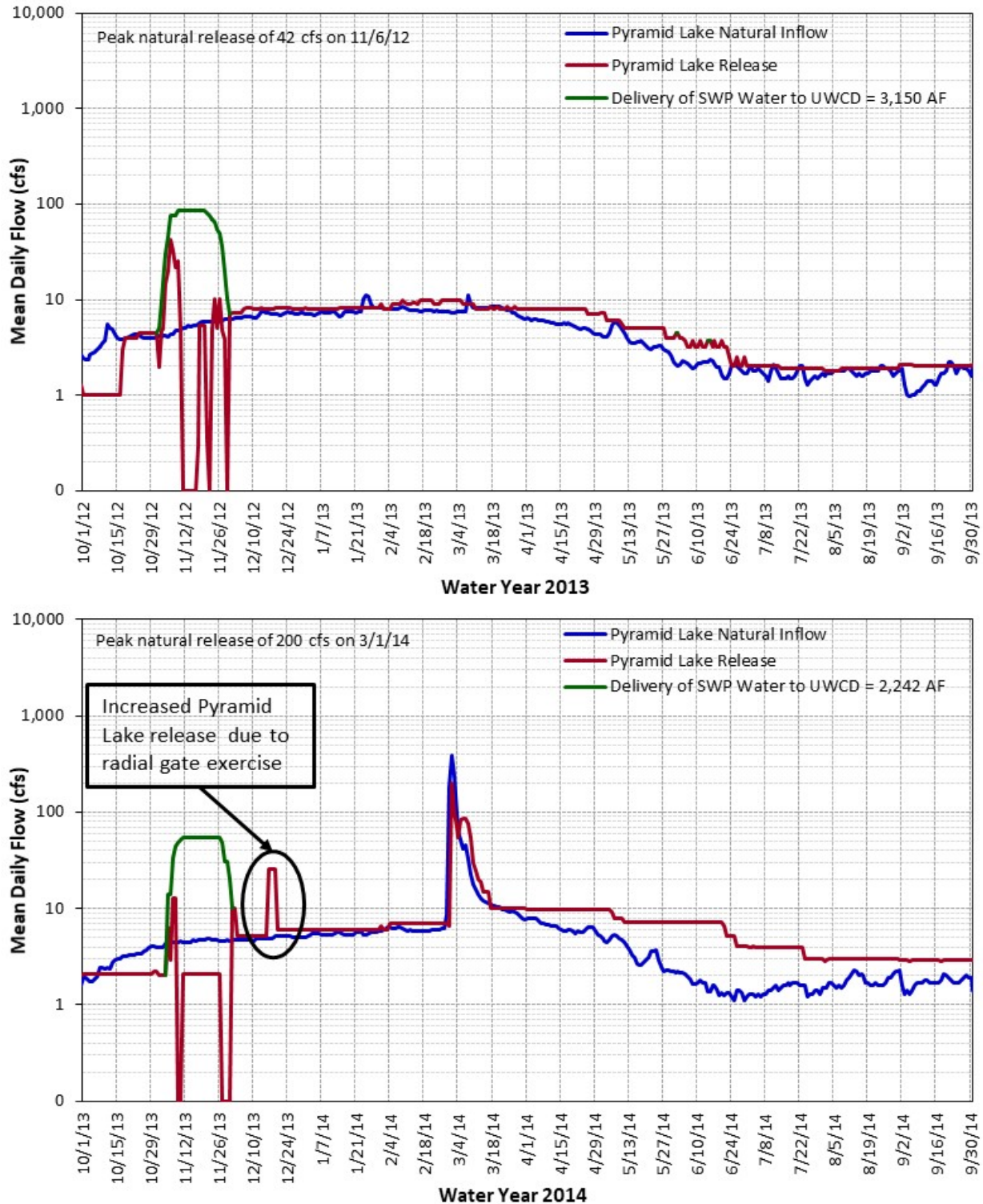


Figure 2.14-1. Average Daily Inflows and Outflows From Pyramid Lake By Year from Water Year 2007 Through Water Year 2017 (continued)

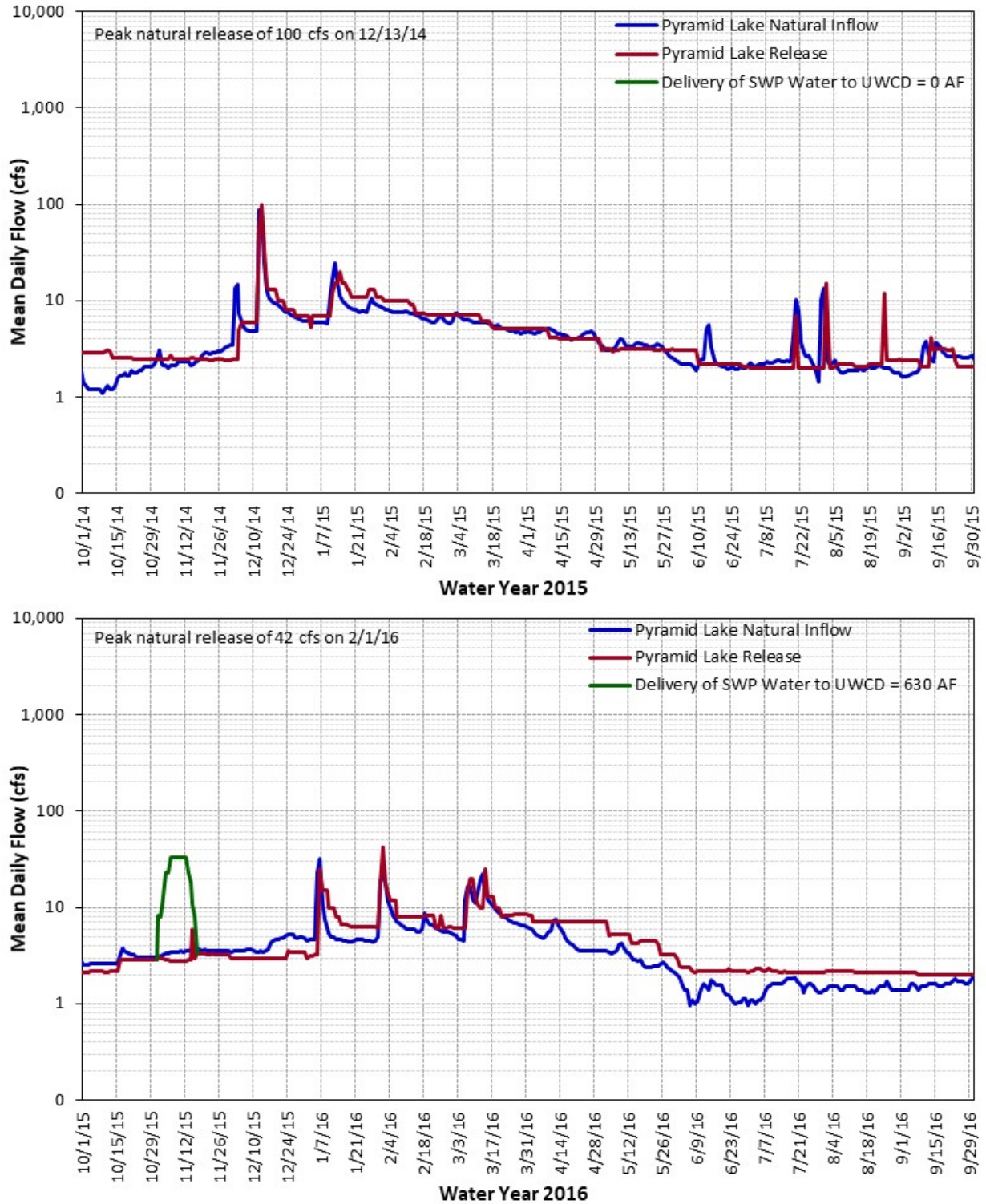
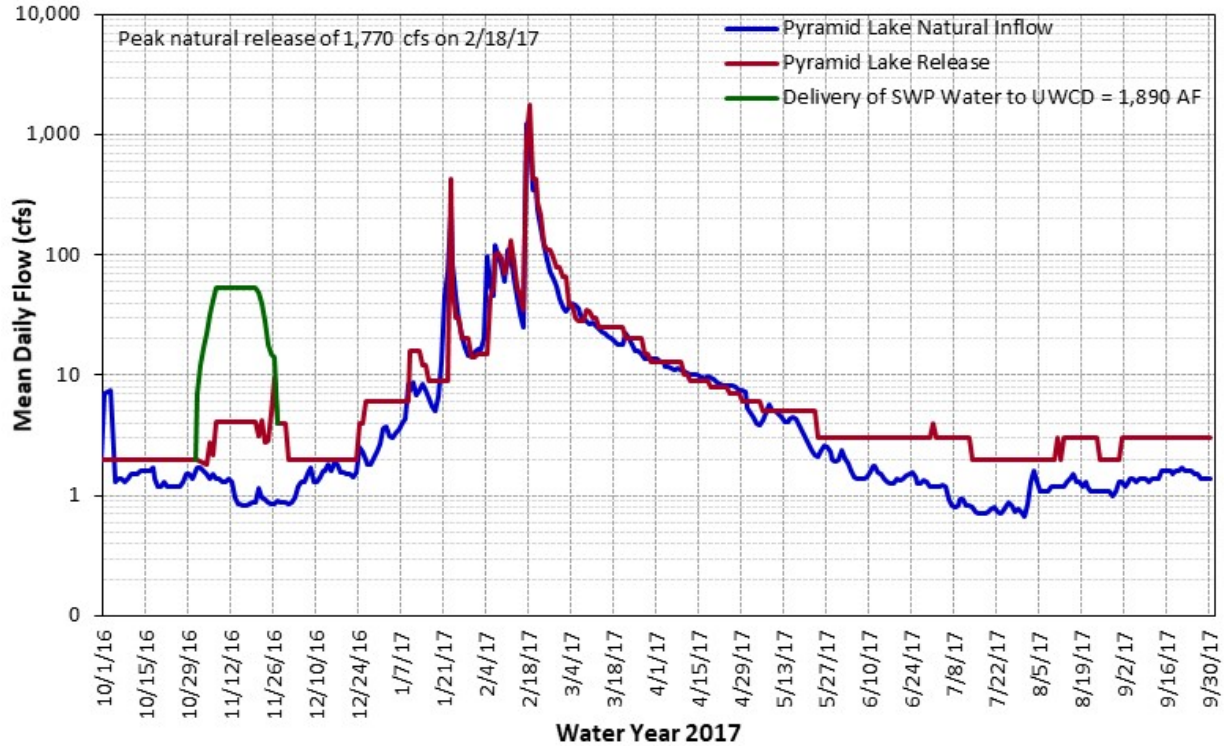


Figure 2.14-1. Average Daily Inflows and Outflows From Pyramid Lake By Year from Water Year 2007 Through Water Year 2017 (continued)



Note: Flow data are plotted on a logarithmic scale to better show both high and low values.

Key:
 AF = acre-feet
 cfs = cubic feet per second
 SWP = State Water Project
 UWCD = United Water Conservation District

Figure 2.14-1. Average Daily Inflows and Outflows From Pyramid Lake By Year from Water Year 2007 Through Water Year 2017 (continued)

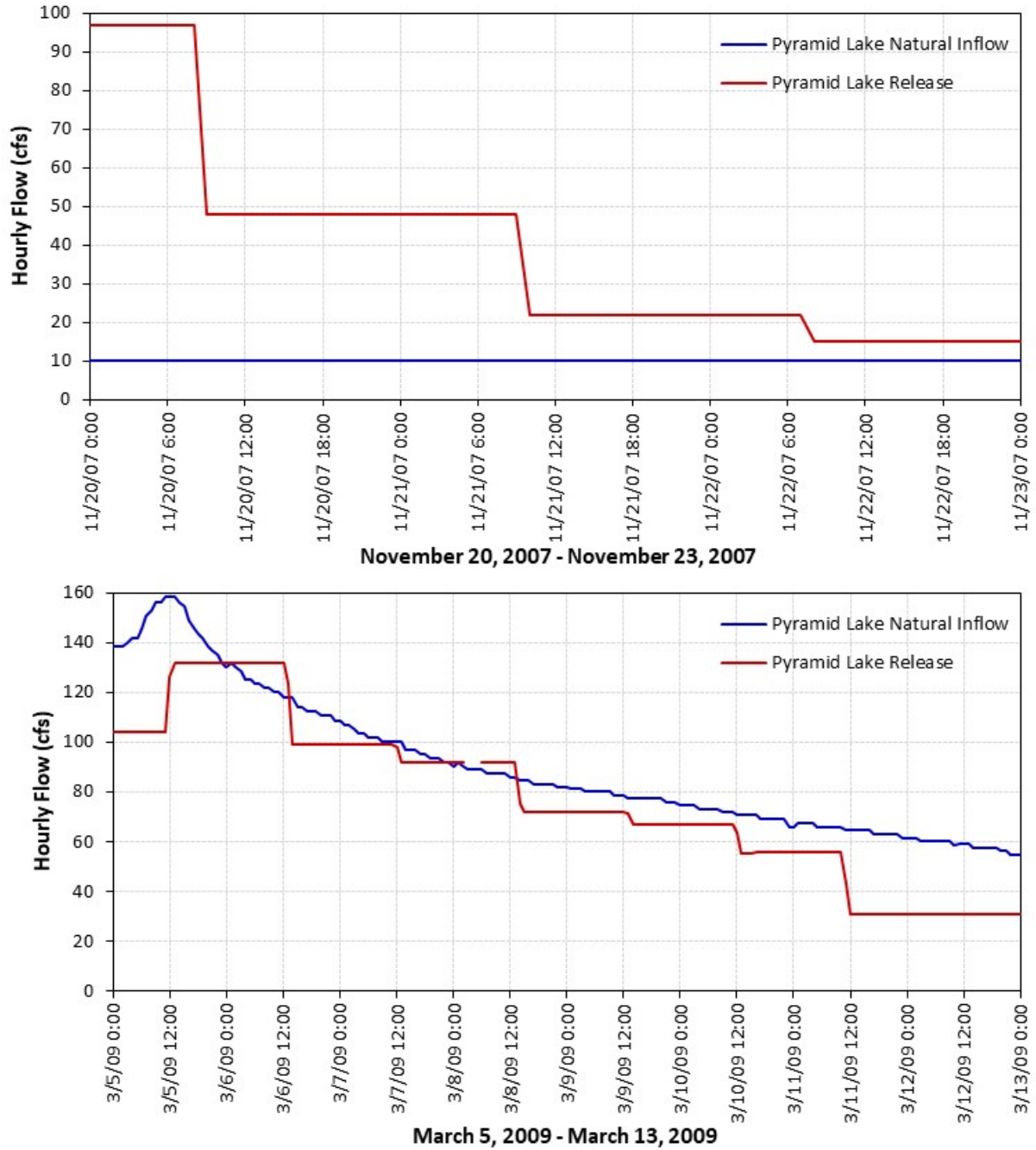


Figure 2.14-2. Hourly Inflows and Outflows from Pyramid Lake – 10 Events Between Water Year 2007 and Water Year 2014

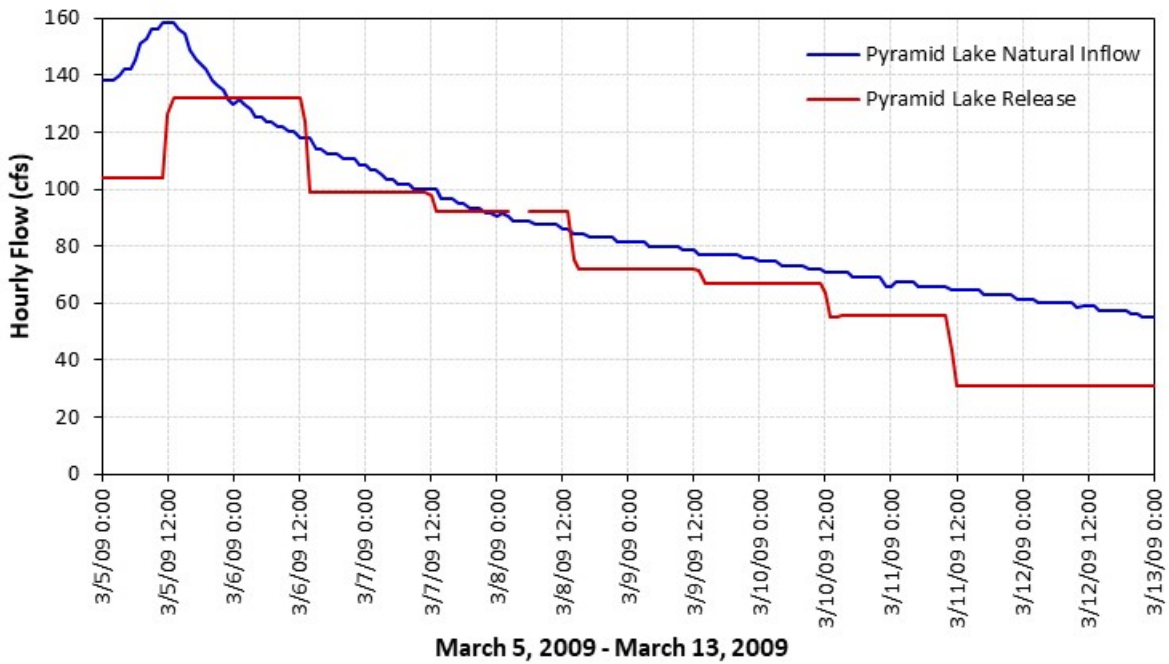
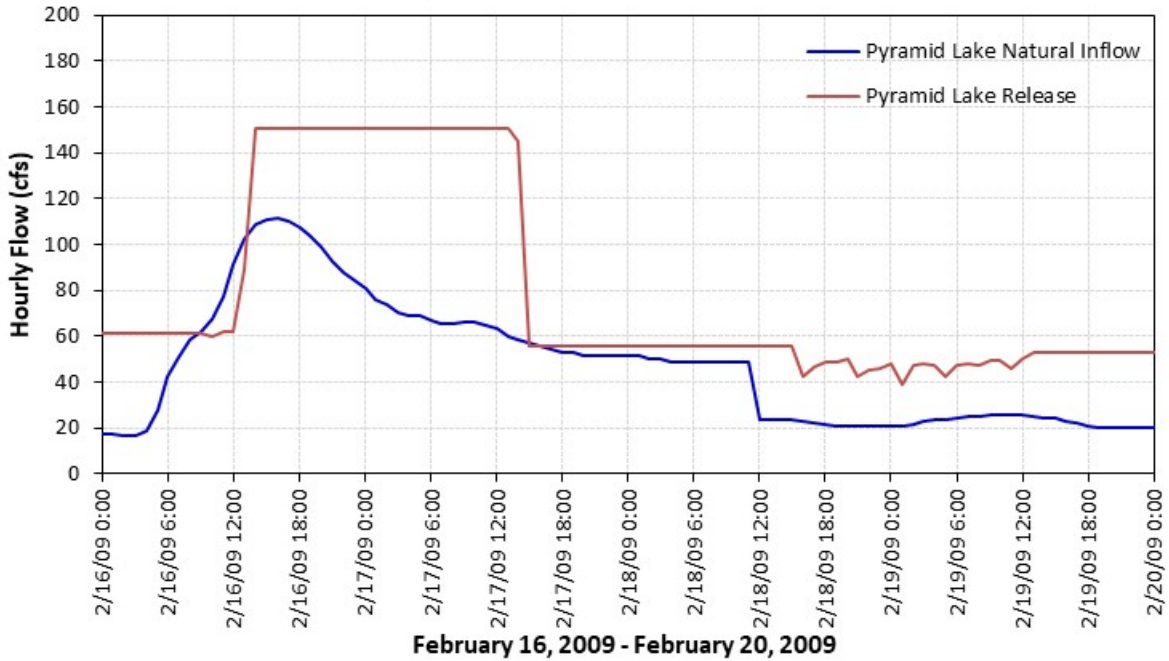
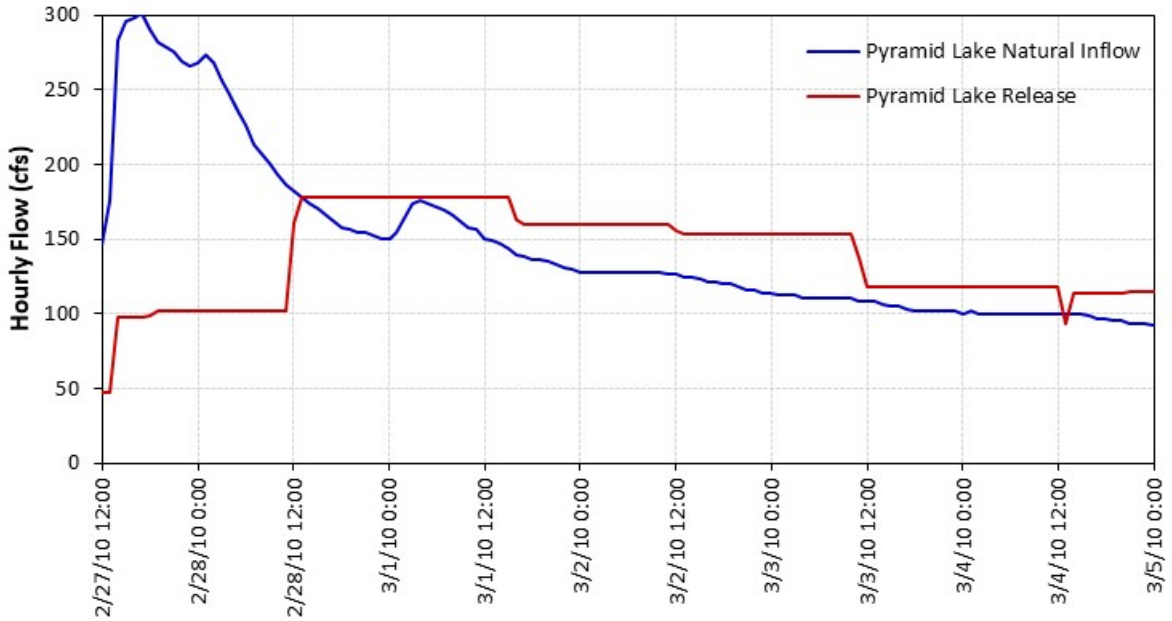
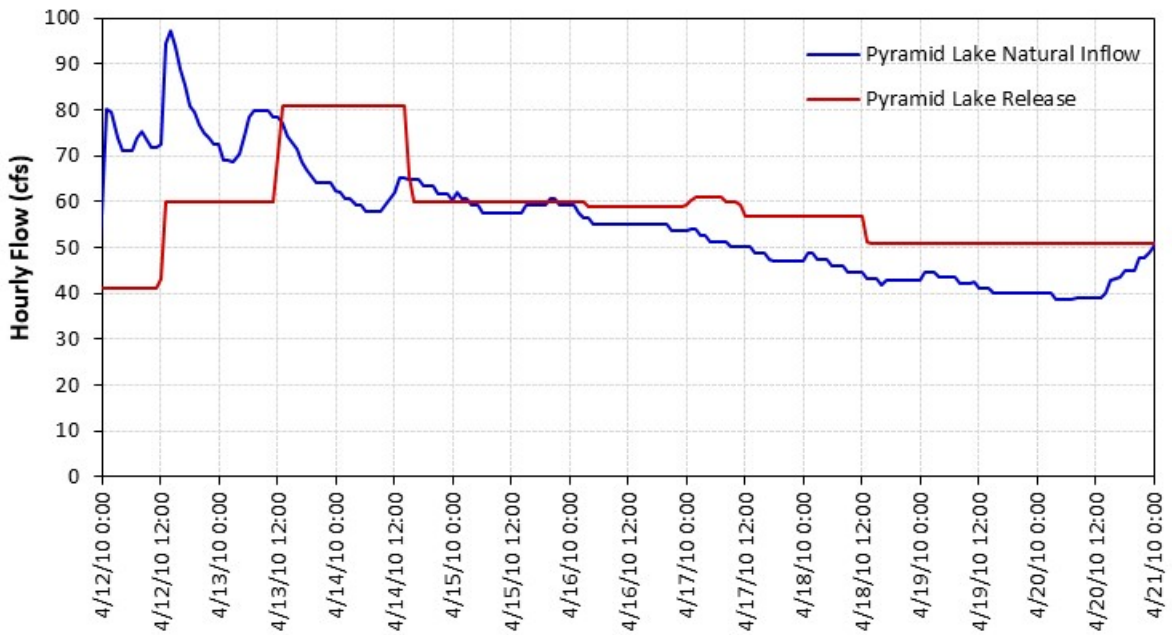


Figure 2.14-2. Hourly Inflows and Outflows from Pyramid Lake – 10 Events Between Water Year 2007 and Water Year 2014 (continued)



February 27, 2010 - March 5, 2010



April 12, 2010 - April 21, 2010

Figure 2.14-2. Hourly Inflows and Outflows from Pyramid Lake – 10 Events Between Water Year 2007 and Water Year 2014 (continued)

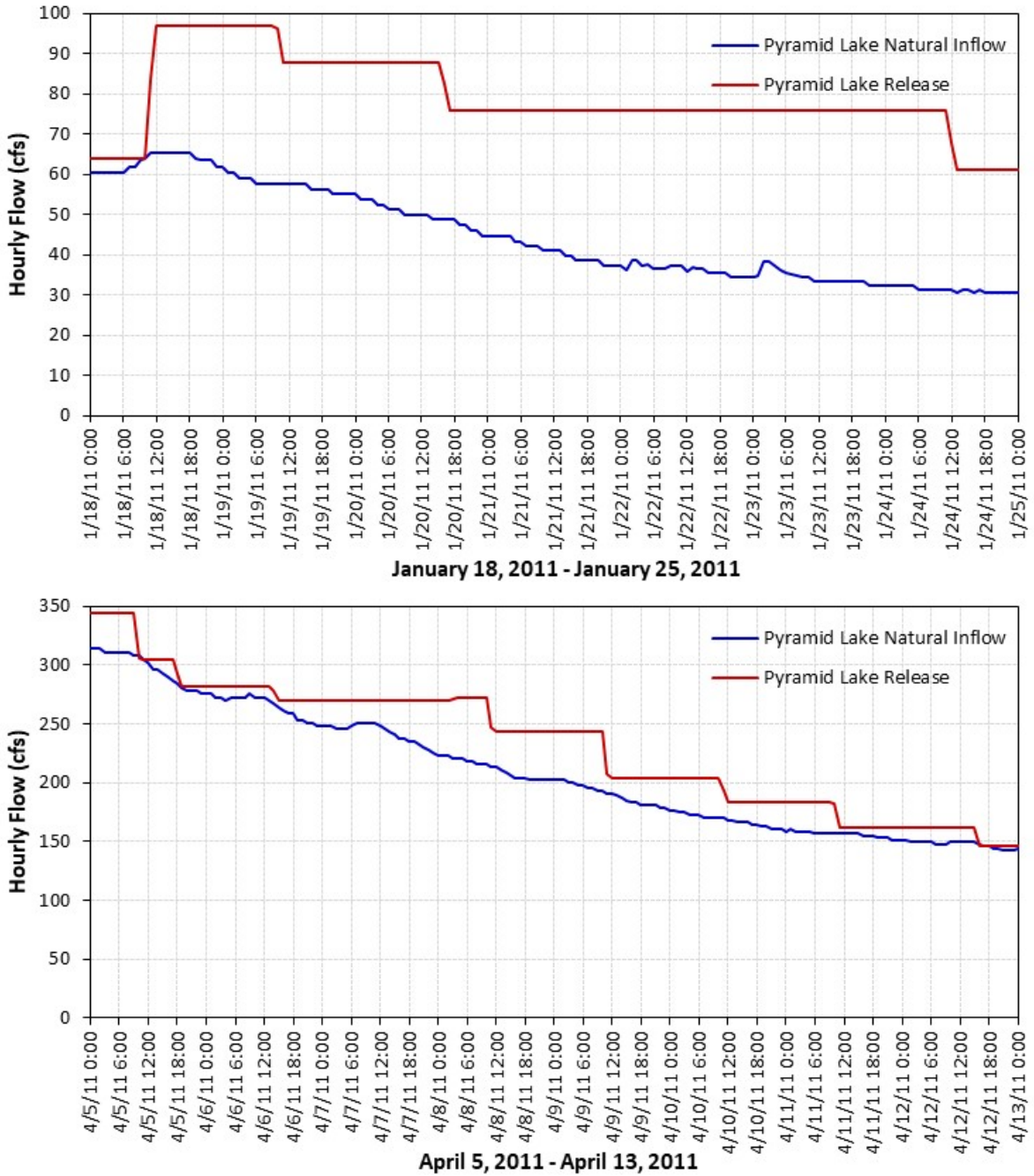
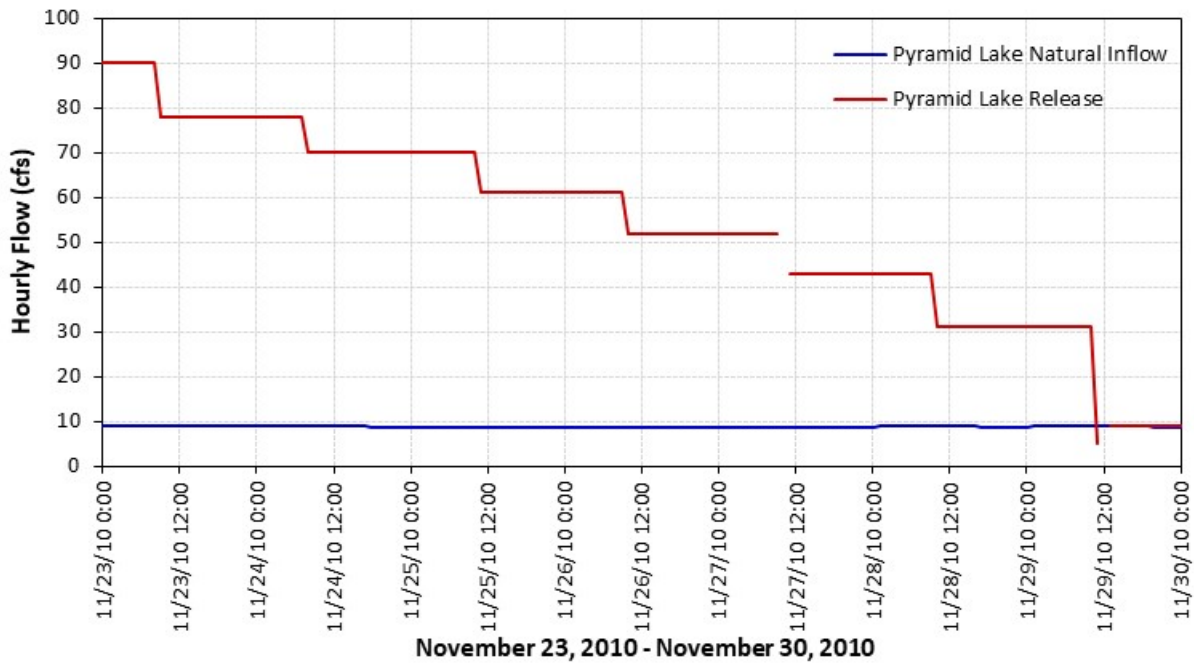
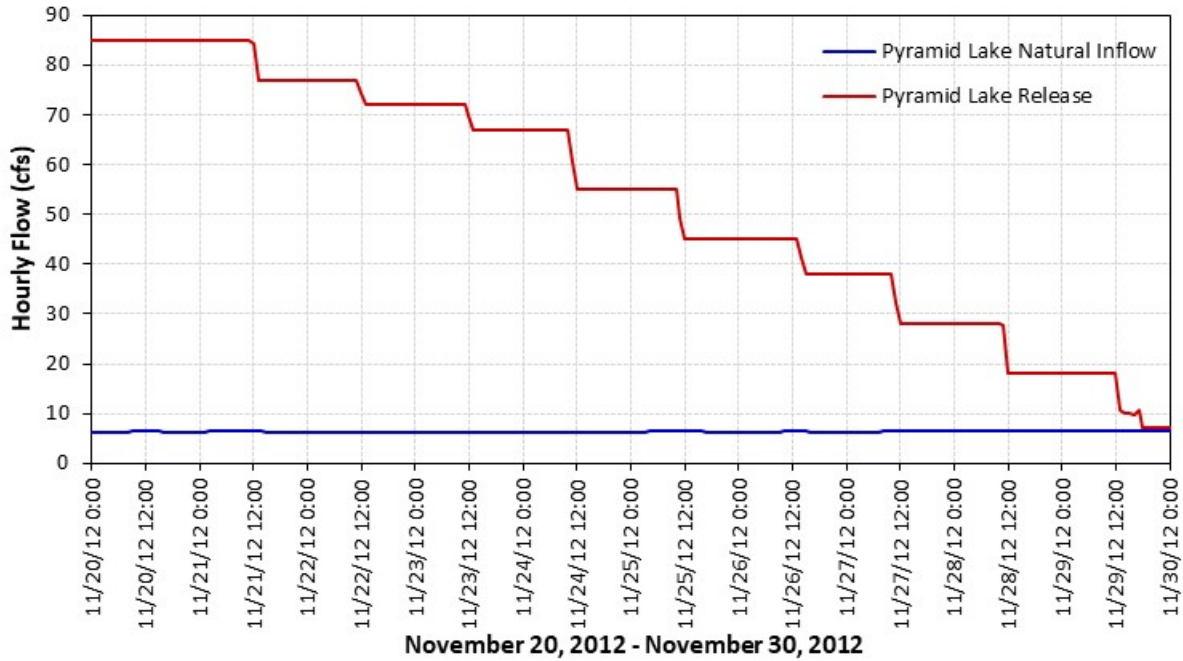


Figure 2.14-2. Hourly Inflows and Outflows from Pyramid Lake – 10 Events Between Water Year 2007 and Water Year 2014 (continued)



Key:
 cfs = cubic feet per second

Figure 2.14-2. Hourly Inflows and Outflows from Pyramid Lake – 10 Events Between Water Year 2007 and Water Year 2014 (continued)

The last figure, for November 20, 2012 through November 30, 2012, includes the flow reduction following a release for UWCD deliveries.

2.14.2.3 Step 3 – IHA Analysis

Following the compilation of the flow data and the GIS exercise from Step 1, the Licensees conducted an IHA run for WY 2007 through WY 2017. The IHA run provided information on median monthly flows; median magnitude and duration, and annual extreme conditions; median timing of annual extreme conditions; and median, duration, high, and low public flows. The IHA run showed that Without-Project median monthly flows from May through November are less than 10 cubic feet per second (cfs). Median monthly flows from December through April are less than 18 cfs. Except for September, October, and December, Without-Project median monthly flows are less than With-Project median monthly flows. The Without-Project and With-Project median flows in September, October, and December are 3.0 and 2.0 cfs, 6.0 and 2.4 cfs, and 10.1 and 10.0 cfs, respectively.

Under both Without-Project and With-Project conditions, the 1-, 3-, 7-, 30-, and 90-day median minimum flows are all less than 4 cfs. With-Project flows are slightly higher than the Without-Project flows. The Without-Project 1-, 3-, and 7-day median maximum flows are slightly higher than the With-Project flows. The Without-Project 30- and 90-day median maximum flows are slightly lower than the With-Project flows. The Without-Project and With-Project base flows are 0.16 and 0.10 cfs, respectively.

Under Without-Project conditions, August 3 is the median date for the low flow event. Under With-Project conditions, the median date is September 14. The median date for the high flow event is February 6 under Without-Project, and January 31 under With-Project. Under Without-Project, the median rise rate is 0.16 cfs and the median number of reversals is 102. Under With-Project, the median rise rate is 2.0 cfs and the median number of reversals is 32.

2.14.2.4 Step 4 – Flood Frequency Analysis

The Licensees compiled instantaneous annual peak flow data from the USGS (<https://nwis.waterdata.usgs.gov/usa/nwis/peak>) for USGS gages 11109375, 11109395, and 11109525, and subsequently used the USGS PeakFQ version 7.1 software to determine the flood frequency curves, including an estimate of flow for each annual exceedance probability/return period and then associated the 95 percent confidence upper and lower values for each of the three gages for return periods between 1 year and 500 years. The results for each gage are included in Table 2.14-1. Note that values for 11109395 and 11109375 are not necessarily additive since historical peak flow events upon which the flood frequencies are based may not have occurred at the same time.

Table 2.14-1. Annual Frequency Curves

Annual Exceedance Probability	Return Period (years)	11109395			11109375			11109525		
		95 Percent Confidence			95 Percent Confidence			95 Percent Confidence		
		Estimate (cfs)	Lower (cfs)	Upper (cfs)	Estimate (cfs)	Lower (cfs)	Upper (cfs)	Estimate (cfs)	Lower (cfs)	Upper (cfs)
0.995	1.005	2	1	4	2	0	8	8	2	20
0.99	1.01	2	1	5	4	1	14	11	3	26
0.95	1.053	6	2	12	19	5	50	28	9	59
0.9	1.111	10	4	20	44	13	102	47	18	93
0.8	1.25	21	10	36	115	43	244	91	40	166
0.6667	1.5	40	21	68	280	123	573	169	85	300
0.5	2.0	82	47	141	705	338	1,476	328	180	593
0.4292	2.33	112	65	196	1,029	502	2,223	434	242	805
0.2	5.0	367	208	752	4,117	1,929	11,000	1,255	686	2,806
0.1	10.0	841	441	2,029	10,150	4,361	33,130	2,594	1,316	6,978
0.04	25.0	2,107	986	6,288	26,180	9,958	108,700	5,726	2,599	19,440
0.02	50.0	3,889	1,667	13,520	47,900	16,680	234,200	9,644	4,024	38,590
0.01	100.0	6,840	2,692	27,490	82,010	26,270	466,200	15,520	5,967	72,490
0.005	200.0	11,590	4,199	53,540	133,600	39,530	873,100	24,120	8,571	130,400
0.002	500.0	22,300	7,262	122,700	239,800	64,380	1,859,000	41,460	13,330	269,200

Key:
cfs = cubic feet per second

2.14.3 Associated Data Files

File Name	Data Description	File Type	File Location
20180523_dwr_sswp_P2426_IHA	IHA Run Results – Using Without-Project and With-Project Hydrology Datasets for WY 2007 through WY 2017. Data access through IHA software version 7.1	ZIP	Project Website
20180523_dwr_sswp_P2426_IHA-PostProcessor	Summary of IHA Run Results – Using Without-Project and With-Project Hydrology Datasets for WY 2007 through WY 2017	ZIP	Project Website
20181102_dwr_sswp_P2426_Pyramid_Hourly_Outflow_Data	Microsoft Excel files showing PYSR Total Flows (2006 through 2014, including missing flow data)	ZIP	Project Website
20181102_dwr_sswp_P2426_Flood_FrequencyAnalysis	PeakFQ inputs and outputs for USGS gages 11109375, 11109395, and 11109525, and an Excel file with a summary of the results.	ZIP	Project Website
20170300_DWR_SSWP_Pyramid_Lake_Contributing_Watershed	GIS map showing Pyramid Lake drainage area including gaged and ungaged areas.	PDF	Project Website
20181206_DWR_SSWP_P2426_Ramping_Analysis	Hourly flow inflow and outflow data for Pyramid Lake, and hydrographs for hourly Pyramid Lake inflows and outflows for discrete ramping rate events	ZIP	Project Website
20181114_dwr_SSWP_P2426_Pyramid Lake Inflow-OutflowFigures	Microsoft Excel Binary Worksheet: Historical Data (daily 9/30/05 through 9/30/17), Annual Figures (of UWCD Deliveries), and Summary Table (WYs 2006-2017)	ZIP	Project Website
20161221_dwr_sswp_p2426_Piru_Creek_WY_2006	Piru Creek below Buck Creek, Primary Computation of Gage Height and Discharge WY 2006 (10/1/05 – 9/30/06).	PDF	Project Website
20161221_dwr_sswp_p2426_Piru_Creek_WY_2007	Piru Creek below Buck Creek, Primary Computation of Gage Height and Discharge WY 2007 (10/1/06 – 9/30/07).	PDF	Project Website
20161221_dwr_sswp_p2426_Piru_Creek_WY_2008	Piru Creek below Buck Creek, Primary Computation of Gage Height and Discharge WY 2008 (10/1/07 – 9/30/08).	PDF	Project Website
20161221_dwr_sswp_p2426_Piru_Creek_WY_2009	Piru Creek below Buck Creek, Primary Computation of Gage Height and Discharge WY 2009 (10/1/08 – 9/30/09).	PDF	Project Website

File Name	Data Description	File Type	File Location
20161221_dwr_sswp_p2426_Piru_Creek_WY_2010	Piru Creek below Buck Creek, Primary Computation of Gage Height and Discharge WY 2010 (10/1/09 – 9/30/10).	PDF	Project Website
20161221_dwr_sswp_p2426_Piru_Creek_WY_2011	Piru Creek below Buck Creek, Primary Computation of Gage Height and Discharge WY 2011 (10/1/10 – 9/30/11).	PDF	Project Website
20161221_dwr_sswp_p2426_Piru_Creek_WY_2012	Piru Creek below Buck Creek, Primary Computation of Gage Height and Discharge WY 2012 (10/1/11 – 9/30/12).	PDF	Project Website
20161221_dwr_sswp_p2426_Piru_Creek_WY_2013	Piru Creek below Buck Creek, Primary Computation of Gage Height and Discharge WY 2013 (10/1/12 – 9/30/13).	PDF	Project Website
20161222_dwr_sswp_p2426_Piru_Creek_WY_2014	Piru Creek below Buck Creek, Primary Computation of Gage Height and Discharge WY 2014 (10/1/13 – 9/30/14).	PDF	Project Website
20161222_dwr_sswp_p2426_Piru_Creek_WY_2015	Piru Creek below Buck Creek, Primary Computation of Gage Height and Discharge WY 2015 (10/1/14 – 9/30/15).	PDF	Project Website
20161222_dwr_sswp_p2426_Piru_Creek_WY_2016	Piru Creek below Buck Creek, Primary Computation of Gage Height and Discharge WY 2016 (10/1/15 – 9/30/16).	PDF	Project Website
20161221_dwr_sswp_p2426_Piru_Creek_WY_Rating_Table_9_09_2002	Rating Table Piru Creek below Buck Creek, WY 2002 (From 10/1/01).	PDF	Project Website
20161221_dwr_sswp_p2426_Piru_Creek_WY_Rating_Table_10_10_2013	Rating Table Piru Creek below Buck Creek, WY 2017 (From 10/1/13).	PDF	Project Website
20161222_dwr_sswp_p2426_Los_Alamos_WY_2006	Canada de los Alamos, Primary Computation of Gage Height and Discharge WY 2006 (From 10/1/05 – 9/30/06)	PDF	Project Website
20161222_dwr_sswp_p2426_Los_Alamos_WY_2007	Canada de los Alamos, Primary Computation of Gage Height and Discharge WY 2007 (From 10/1/06 – 9/30/07)	PDF	Project Website
20161222_dwr_sswp_p2426_Los_Alamos_WY_2008	Canada de los Alamos, Primary Computation of Gage Height and Discharge WY 2008 (From 10/1/07 – 9/30/08)	PDF	Project Website

File Name	Data Description	File Type	File Location
20161222__dwr_sswp_p2426_ _Los_Alamos_WY_2009	Canada de los Alamos, Primary Computation of Gage Height and Discharge WY 2009 (From 10/1/08 – 9/30/09)	PDF	Project Website
20161222_dwr_sswp_p2426_ Los_Alamos_WY_2010	Canada de los Alamos, Primary Computation of Gage Height and Discharge WY 2010 (From 10/1/09 – 9/30/10)	PDF	Project Website
20161222_dwr_sswp_p2426_ Los_Alamos_WY_2011	Canada de los Alamos, Primary Computation of Gage Height and Discharge WY 2011 (From 10/1/10 – 9/30/11)	PDF	Project Website
20161222_dwr_sswp_p2426_ Los_Alamos_WY_2012	Canada de los Alamos, Primary Computation of Gage Height and Discharge WY 2012 (From 10/1/11 – 9/30/12)	PDF	Project Website
20161222_dwr_sswp_p2426_ Los_Alamos_WY_2013	Canada de los Alamos, Primary Computation of Gage Height and Discharge WY 2013 (From 10/1/12 – 9/30/13)	PDF	Project Website
20161222_dwr_sswp_p2426_ Los_Alamos_WY_2014	Canada de los Alamos, Primary Computation of Gage Height and Discharge WY 2014 (From 10/1/13 – 9/30/14)	PDF	Project Website
20161222_dwr_sswp_p2426_ Los_Alamos_WY_2015	Canada de los Alamos, Primary Computation of Gage Height and Discharge WY 2015 (From 10/1/14 – 9/30/15)	PDF	Project Website
20161222_dwr_sswp_p2426_ Los_Alamos_WY_2016	Canada de los Alamos, Primary Computation of Gage Height and Discharge WY 2016 (From 10/1/15 – 9/30/16)	PDF	Project Website
20161221_dwr_sswp_p2426_ Los_Alamos_WY_Rating_Tab le_5_10_2008	Canada de los Alamos, Rating Table WY 2016 (From 10/1/08)	PDF	Project Website
20181206_DWR_SSWP_P24 26_Pyramid_Hydrology_Com plete	USGS Gage 11109375 – Daily average flow data from WY 2006 through WY 2017, with missing USGS gage data included. This version includes updated data from CDEC for hourly Pyramid (PYM) outflows.	HEC DSS	Project Website

Key:

HEC DSS = U.S. Army Corps of Engineers' Hydrologic Engineering Center Data Storage System

2.14.4 Variances from Study Methods, Schedule or Approach, and Unexpected Field Conditions

The FERC-approved Study Plan indicated that, as part of Step 1 (Develop With-Project and Without-Project Hydrology Records), the Licensees will develop With-Project and Without-Project daily average flow hydrology from WY 2006 through WY 2017. Upon detailed review of the hydrology data for WY 2006, it was evident that the Licensees had not yet fully developed their protocols for operating to Article 52 of the existing license “natural hydrology,” and that WY 2006 was not representative of its operations for Article 52. Accordingly, the period of record used for Step 1 started in WY 2007, rather than WY 2006. The analysis still includes 10 years covering a wide range of hydrologic conditions, including 2017, a very wet year. This is a variance from the FERC-approved Study Plan and did not affect the Study.

2.14.5 Remaining Work

None; the Study is complete.

2.15 SCENIC INTEGRITY STUDY

2.15.1 Completed Work to Date

The Study is complete. As required by the FERC-approved Study Plan, the Licensees have completed Step 1 (Identify Project Facilities and Features to Evaluate on National Forest Service Lands) and Step 2 (Information Gathering and Mapping).

In compliance with the Study Plan, the Licensees began consulting with the U.S. Department of Agriculture, Forest Service (USFS) on January 9, 2018, via telephone, and discussed the general approach for developing the preliminary Key Observation Points (KOP) and photographic protocols. Subsequently, as specified in the Study Plan, the Licensees examined existing aerial imagery (i.e., Google Earth/Maps) and Geographic Information System maps of the Project Area, developed a preliminary KOP list and maps, and provided these documents to USFS on October 18, 2018, for USFS staff to review in advance of a second consultation call.

The Licensees held the second consultation call on November 13, 2018, which included the Licensees’ five representatives (Matthew Paquette, Phil Horning, Kirby Gilbert, Doug Burr, and Bryan Rorie) and one USFS representative (Jose Henriquez-Santos, Angeles National Forest [ANF] Landscape Architect). During the consultation call, the Licensees and USFS made revisions to the preliminary KOP list and locations and added several new KOPs. The approximate location of the new KOPs were discussed and identified on maps during the call. USFS asked the Licensees if the USFS could review the KOP maps and provide any additional comments by November 16, 2018, and if the Licensees did not hear back from the USFS, then the KOPs as agreed to during the November 13, 2018, call would be the final preliminary KOP list. USFS did not have any comments for the Licensees by November 16, 2018. During the January and November 2018 consultation calls with USFS, the Licensees invited USFS staff to participate in the field evaluations to confirm the evaluation protocols. The Licensees

conducted the field evaluations on December 2 through December 4, 2018. During the field evaluations (December 3, 2018), the Licensees met with the USFS landscape architects in the field, confirmed the scenic evaluation protocols, and visited/conducted field evaluations at seven KOPs (i.e., PL03 through PL09) with views of Project facilities on National Forest System (NFS) lands.

2.15.2 Key Accomplishments and Summary of Findings to Date

Key Observation Point Location Development and Data Collection

Overall, the Licensees identified 36 preliminary KOPs in consultation with USFS prior to conducting the field evaluations and ultimately evaluated a total of 27 KOPs in the field. Refer to the following associated data files for:

1. Maps showing preliminary and final KOP locations
(*"20190319_dwr_sswp_p2426_FinalVsPreliminaryKOP"*);
2. Narrative explaining the development of the preliminary KOPs and the final KOPs as evaluated in the field
(*"20190212_dwr_sswp_p2426_Project_KOP_Prelim_Final_Narrative.xls"*);
3. Maps showing final KOP locations with view direction(s)
(*"20190319_dwr_sswp_p2426_FinalVsPreliminaryKOP"*); and
4. Photographs for each KOP
(*"20181220_dwr_sswp_p2426_Project_KOP_Photos"*)

During the field evaluations and in consultation with USFS, the Licensees documented the existing scenic integrity conditions of the Project facilities that were visible from publicly accessible viewpoints, with a focus on prominent or high visibility locations, particularly in the foreground view (i.e., up to 0.5 miles) and middleground view (i.e., 0.5 miles to 4 miles). For example, Pyramid Dam is visible from numerous locations in the Project vicinity; however, the field evaluations focused on the prominent views from high use/traffic areas and/or longer-duration viewpoints, such as the Vista del Lago Visitor Center, Spanish Point Boat-in Picnic Area, the reservoir surface (i.e., boater's perspective), and Interstate 5.

The Licensees collected site-specific data at each KOP, including the description of the KOP location, Project facilities visible from the KOP with land ownership, number and direction of views, photographs from each view, Global Positioning System coordinates, weather, distance zone (i.e., foreground, middleground, and background), view direction, viewer position (i.e., neutral, superior or inferior), typical viewer category, and a visual contrast description. For KOPs on NFS lands, the Licensees documented the existing or observed Scenic Integrity Objective (SIO) class based on the field evaluation, as well as the mapped SIO class per the Los Padres National Forest and ANF Land Management Plans. The KOP data evaluation log is provided in associated data file *"20181220_dwr_sswp_p2426_Project_KOP_Field_Evaluation_Log"*.

2.15.2.1 Quail Lake

Quail Lake, Quail Lake Outlet, and Lower Quail Canal (all located on State lands) are highly visible in the foreground, primarily from vehicles travelling along State Highway 138. Overall, Quail Lake has a natural appearance due to the presence of shrubs, grasses, and wetland vegetation along much of the shoreline, and especially as seen in middleground from State Highway 138 looking to the west. Quail Lake Outlet and Lower Quail Canal present high visual contrast due to the industrial, man-made structures with light gray and tan colors, smooth textures, and linear elements that do not borrow from the natural shapes and colors of the surrounding landscape.

2.15.2.2 Gorman Bypass Channel

Gorman Bypass Channel (located on State lands) is highly visible in the foreground, primarily from vehicles travelling southbound along Interstate 5. The bypass channel presents high visual contrast due to its long, linear, industrial, man-made structures with light gray color, and predominantly smooth concrete texture that do not borrow from the natural shapes and colors of the surrounding landscape. However, the bypass channel parallels southbound Interstate 5, which is the predominant man-made feature in the viewshed and presents much of the same type of visual contrast (i.e., long, linear, man-made freeway with contrasting pavement, guardrail, and road shoulder forms, shapes and colors).

2.15.2.3 Warne Powerplant and Transmission Line

The Warne Powerplant (located on State lands) is highly visible in the immediate foreground, primarily from vehicles travelling along Pyramid Lake Road and entering the Pyramid Lake Recreation Area (near the entrance station). From this up-close view, the powerplant presents high visual contrast due to the industrial, man-made structures with light tan, red and blue colors, smooth textures, and linear shapes that do not borrow from the natural shapes and colors of the surrounding landscape. Overall, Warne Powerplant is only seen from the roads and recreation sites located on the canyon floor and is predominantly screened by topography from recreationists at Emigrant Landing recreation sites, boaters on Pyramid Lake, and vehicles on Interstate 5.

Warne Transmission Line is also visible from the same viewpoint(s) as Warne Powerplant. The first two Warne Transmission Line towers in the switchyard (located on State lands) are consolidated structures that are tan in color, which blend well with the seasonally tan grasses behind the towers, resulting in a low visual contrast. The last visible tower is high above the canyon floor on NFS land to the east in a High SIO area. While this tower is more visible in silhouette with the sky, with a lattice tower design that has moderate visual contrast, the tower on NFS land is in a highly elevated location and is not naturally in the public's viewpoint, which is generally drawn along the roadway and in the canyon floor where Warne Powerplant is located.

2.15.2.4 Pyramid Lake

At Pyramid Lake, Pyramid Dam, the Spillway, and Angeles Tunnel Intake are the predominant Project facilities (all located on NFS land with a High SIO) visible to many of the Project recreation visitors. Most of the views are in the middleground (i.e., 0.5 to 4 miles) from Spanish Point Boat-in Picnic Area, Vista del Lago Visitors Center, and the reservoir surface (as seen by boaters). Foreground views (i.e., up to 0.5 miles) of these facilities are limited to reservoir boaters in close proximity to the Pyramid Dam area, particularly boaters south of Chumash Island.

Overall, Pyramid Dam, the Spillway, and Angeles Tunnel Intake present low to moderate visual contrast in the middleground views as the dam is the primary facility visible and the muted color and rock-based form blend with the surrounding landscape colors at this distance. However, in foreground views (i.e., mainly seen by reservoir boaters), the geometric shapes, straight lines, and smooth textures (spillway and tunnel intake structures) are more visible and do not blend with the surrounding dark green brush covered mountains in comparison to the middleground views seen by land-based visitors at Vista del Lago Visitors Center and Spanish Point Boat-in Picnic Area. In the immediate foreground for reservoir boaters, these facilities present high visual contrast, however, the dam and spillway are an expected part of a reservoir's visual landscape.

2.15.2.5 Angeles Tunnel

The Angeles Tunnel Surge Chamber (on NFS lands in a High SIO area) is visible in foreground and presents high visual contrast due to the light green color, smooth textures and materials, and large scale of the facility; and does not blend with the more rugged, irregular textures and darker green colors of the surrounding mountains. The strong visual contrast is noticeable for those on the low-use Templin Highway travel route. However, the viewing population for this facility is very limited, as Templin Highway is a dead-end/gated road with very limited public vehicular or foot/bicycle traffic.

2.15.2.6 Elderberry Forebay

Public access to the Castaic Penstocks, Powerplant, Switchyard, and associated facilities is closed to the public for safety reasons. Therefore, since public viewpoints of these facilities do not exist, these facilities were not evaluated for scenic integrity.

The downstream face of Elderberry Forebay Dam (located on State lands) is visible from the non-Project Castaic Lake to the south, primarily by reservoir boaters and land-based recreation users in middleground. The visual contrast is low due to the color and texture of the dam, which is similar to the tan and brown surrounding landscape. Dams such as this are an expected part of a reservoir's visual landscape.

2.15.2.7 Castaic Transmission Line

Castaic Transmission Line has limited prominent views, which occur primarily from the non-Project Castaic Lake area and in San Francisquito Canyon. Views of the Castaic

Transmission Line on NFS lands from the prominent public viewpoints (i.e., Interstate 5 and in San Francisquito Canyon) do not exist due to numerous ridges blocking the views.

In the non-Project Castaic Lake area, Castaic Transmission Line is visible from several non-Project road ways and recreation sites all on State, LADWP, or private land. One pair of transmission towers immediately below the non-Project Castaic Dam presents high visual contrast in the foreground due to the light color and geometric lattice work that does not match with the grass tans of fall or the light greens of spring. Overall, the Castaic Transmission Line towers present low visual contrast along much of the alignment, as views are in middleground and background, where the towers are faintly visible and the light colors blend with the surrounding ridges.

2.15.3 Associated Data Files

File Name	Data Description	File Type	File Location
20190319_dwr_sswp_p2426_FinalVsPreliminaryKOP	Maps showing preliminary and final KOP locations (6 pages, 11 x 17")	Adobe PDF	Project website
20181220_dwr_sswp_p2426_Project_KOP_Final_Prelim_Narrative	Narrative explaining the development of the preliminary KOPs and the final KOPs as evaluated in the field	Microsoft Excel	Project website
20190319_dwr_sswp_p2426_Project_KOP	Maps showing final KOP locations with view direction(s) (6 pages, 11 x 17")	Adobe PDF	Project website
KOP Photos	Photographs for each KOP (55 files)	JPEG	Project website
20181220_dwr_sswp_p2426_Project_KOP_Field_Evaluation_Log	KOP field evaluation log	Microsoft Excel	Project website

Key:
KOP = Key Observation Point

2.15.4 Variances from Study Methods, Schedule or Approach, and Unexpected Field Conditions

The FERC-approved Study targeted September 2017 for the field evaluations, and October to November 2017 for the data Quality Assurance/Quality Control, analysis and reporting. The field evaluations were conducted in December 2018 and the data Quality Assurance/Quality Control, analysis, and reporting occurred in January to February 2019. These schedule variances had no effect on the overall study.

2.15.5 Remaining Work

None; the study is complete.

2.16 WATER QUALITY AND TEMPERATURE STUDY

2.16.1 Completed Work to Date

The Study is complete. As required by the FERC-approved Study Plan, the Licensees have completed Step 1 (Select Water Quality Parameters), Step 2 (Select Sampling Locations), Step 3 (Collect Water Quality Samples), Step 4 (Collect Reservoir Profiles), and Step 5 (Install and Maintain Stream Temperature Loggers).

The Licensees collected water quality samples (Step 3) at nine locations throughout the Project: (1) Quail Lake near the center; (2) Quail Lake near the outlet; (3) Pyramid Lake near the dam; (4) Pyramid Lake in the William E. Warne Powerplant arm; (5) Pyramid Lake in the Piru Creek arm; (6) Pyramid reach, near the base of Pyramid Dam; (7) Pyramid reach, about 1.5 miles downstream of Pyramid Dam; (8) Pyramid reach, about 3.0 miles downstream of Pyramid Dam (near Frenchmen's Flat); and (9) Pyramid reach, upstream of Lake Piru near Blue Point Campground. At the five reservoir sampling locations in Quail Lake and Pyramid Lake, water quality samples were collected at two depths: near the surface and near the bottom. Pyramid reach samples were collected just below the surface.

Water quality samples were collected at all locations that were identified in the Study Plan in September 2017. The water quality parameters were divided into two categories: (1) basic water quality – in situ (six parameters); and (2) basic water quality – laboratory samples that included inorganic ions, nutrients, and metals (31 parameters). Each sample was collected in a laboratory-supplied clean container. Containers used during stream sampling and reservoir surface sampling were filled directly from the water, submerged approximately 6 inches below the surface while facing downstream to prevent organic material from flowing into the container. Sampling from near the bottom of the reservoir was done using a Kemmerer sampler designed for trace metals sampling. Containers for the deep water samples were filled directly from the sampler. The sampler was thoroughly cleaned with Alconox and distilled water between sample locations. While in the field and during shipping, samples requiring refrigeration were stored on ice until transferred to an appropriate laboratory refrigerator. Water samples analyzed for metals were collected using “clean hands” methods consistent with the U.S. Environmental Protection Agency’s Method 1669 sampling protocol. Quality control samples, including field blanks, equipment rinses, and field duplicates, were also collected per laboratory standards.

The Licensees also collected reservoir profiles in Quail Lake and Pyramid Lake at the same locations described above. Reservoir profiles were collected quarterly for one year beginning with the third and fourth quarters in 2017 (Quarter 3 in September 2017, and Quarter 4 in November 2017), and the first and second quarters in 2018 (Quarter 1 in February 2018, and Quarter 2 in May 2018). At each location, a Hydrolab MS5 (or similar) unit was used to collect depth, water temperature, dissolved oxygen (DO), pH, specific conductivity, and turbidity approximately every 10 feet from the surface to the bottom. Water temperature and dissolved oxygen were plotted against elevation in order to see variation over depth and season.

Finally, the Licensees installed long-term water temperature loggers at the four locations in Pyramid reach described above. Loggers were installed in late September 2017, and removed in late October 2018, which met the requirements of the Study. The loggers recorded water temperature at 15-minute intervals and were downloaded quarterly. Duplicate loggers were installed at each monitoring location for redundancy. Loggers were installed in durable housings and secured to nearby substrate to help prevent damage or loss during higher flows. Loggers were also installed discreetly, especially in areas of higher traffic (e.g., campgrounds), to prevent vandalism. The 15-minute interval water temperature data were combined to create plots and a database of daily minimum, average, and maximum water temperature for each location.

While not required by the FERC-approved Study Plan, the Licensees also collected water samples to be analyzed for *Escherichia coli* (*E. coli*) at the request of the State Water Resources Control Board. Samples were collected at two locations in Pyramid Lake: (1) near the dam and (2) in the Piru Creek arm during five sampling events in August and September 2018. The samples were collected within a single 30-day period including samples collected over the Labor Day weekend.

2.16.2 Key Accomplishments and Summary of Findings to Date

2.16.2.1 Water Quality Sampling

Water quality in Quail Lake showed little variation between locations and depths for all selected water quality parameters. The samples collected in Quail Lake were consistent with the Lahontan Regional Water Quality Control Board's (Lahontan RWQCB) Basin Plan Water Quality Objectives.

Water quality in Pyramid Lake showed little variation between locations and depths for all the parameters sampled. Two of the six water quality samples collected in Pyramid Lake were inconsistent with the Los Angeles Regional Water Quality Control Board's (Los Angeles RWQCB) Water Quality Control Plan for the Los Angeles Region (Basin Plan) Water Quality Objective of 5 milligrams per liter (mg/L) or greater for DO. The DO concentrations were 3.23 mg/L and 3.81 mg/L, and both occurred in samples collected in the hypolimnion of Pyramid Lake near the dam and in the Piru Creek arm in September 2017 when a slight thermocline was present. DO concentrations measured in the bottom 60 feet of the reservoir during the third quarter reservoir profile had values ranging from 4.77 mg/L to 0 mg/L.

Water quality in Pyramid reach below Pyramid Dam showed greater variability versus the reservoir samples. The total concentrations of alkalinity, barium, and total dissolved solid levels increased farther downstream of Pyramid Dam. Levels of organic carbon and phosphorous decreased with distance from Pyramid Dam. Concentrations of antimony, beryllium, cadmium, chromium, lead, and silver remained below laboratory detection limits throughout Pyramid reach samples. None of the samples collected in Pyramid reach were inconsistent with Los Angeles RWQCB's Basin Plan Water Quality Objectives.

Licensees collected water samples in Pyramid Lake near the dam and in the Piru Creek arm to be analyzed for *E. coli* (Table 2.16-1). The results were consistent across all sampling dates and locations. Total coliform measured over the maximum reporting limit (2,419.6 most probable number [MPN]/100mL) for 10 of the 12 samples with the remaining two measuring at 1,300 MPN/100mL and 1,200 MPN/100mL. *E. coli*, which was the parameter of interest during sampling, measured below the laboratory's method reporting limit of 1 MPN/100mL for 11 of the 12 samples. The one measurable result was 1 MPN/100mL.

Table 2.16-1. E. Coli Sampling Results for two Locations in Pyramid Lake, 2018

Sample Date	Sample Time	# Positive Wells		MPN/100 mL		Presence/Absence (P/A)	
		<i>E. coli</i> Small	<i>E. coli</i> Large	Total Coliform ¹	<i>E. coli</i> ²	Total Coliform	<i>E. coli</i>
Site 1 - near Pyramid Dam							
8/21/18	13:20	ND	ND	>2,419.6	<1	P	A
8/28/18 ³	12:51	ND	ND	>2,419.6	<1	P	A
8/28/18 ³	12:51	ND	ND	>2,419.6	<1	P	A
9/1/18	10:07	ND	ND	>2,419.6	<1	P	A
9/4/18	13:31	ND	ND	>2,419.6	<1	P	A
9/11/18	12:52	ND	ND	1,300	<1	P	A
Site 2 - Piru Creek Arm							
8/21/18	12:50	ND	ND	>2,419.6	<1	P	A
8/28/18 ³	11:50	ND	ND	>2,419.6	<1	P	A
8/28/18 ³	11:50	1	ND	>2,419.6	1	P	P
9/1/18	9:42	ND	ND	>2,419.6	<1	P	A
9/4/18	13:40	ND	ND	>2,419.6	<1	P	A
9/11/18	13:37	ND	ND	1,200	<1	P	A

¹2,419.6 MPN/100mL is the maximum recorded value of the test conducted.

²1 MPN/100mL is the method reporting limit for the test. Result of "< 1" are values less than the laboratory reporting limit.

³Two samples were collected at each location on 8/28/18 to serve as a duplicate sample for quality assurance protocols.

Key:

> = Greater than

< = Less than

MPN = Most probable number

mL = milliliters

P = Presence

A = Absence

ND = Non Detection

2.16.2.2 Reservoir Profiles

Considering Quail Lake's shallow depth (less than 30 feet deep at normal maximum water surface elevation [NMWSE]), no thermocline or other patterns typical of deeper lakes and reservoirs were detected. Water temperature and DO profiles are shown in Figures 2.16-1 and 2.16-2, respectively. The DO concentrations were consistent with the Lahontan RWQCB's Basin Plan Water Quality Objective. Specific conductivity ranged between 214 microsiemens per centimeter ($\mu\text{S}/\text{cm}$) and 547 $\mu\text{S}/\text{cm}$ over all depths and sample events. pH ranged between 7.69 and 8.52 over all depths and sample events. Quail Lake was at or near its NMWSE at the time of the data collection.

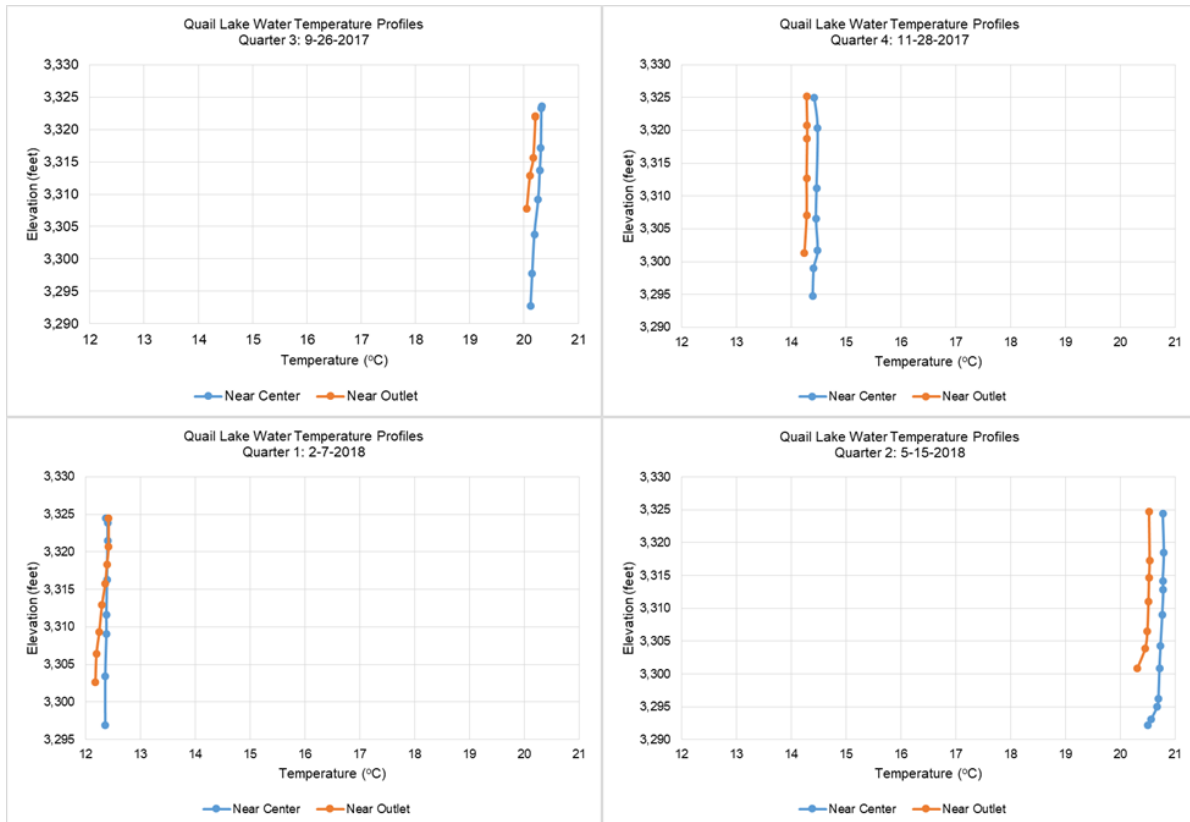


Figure 2.16-1. Quarterly Water Temperature Profiles for Two Locations in Quail Lake, 2017-2018

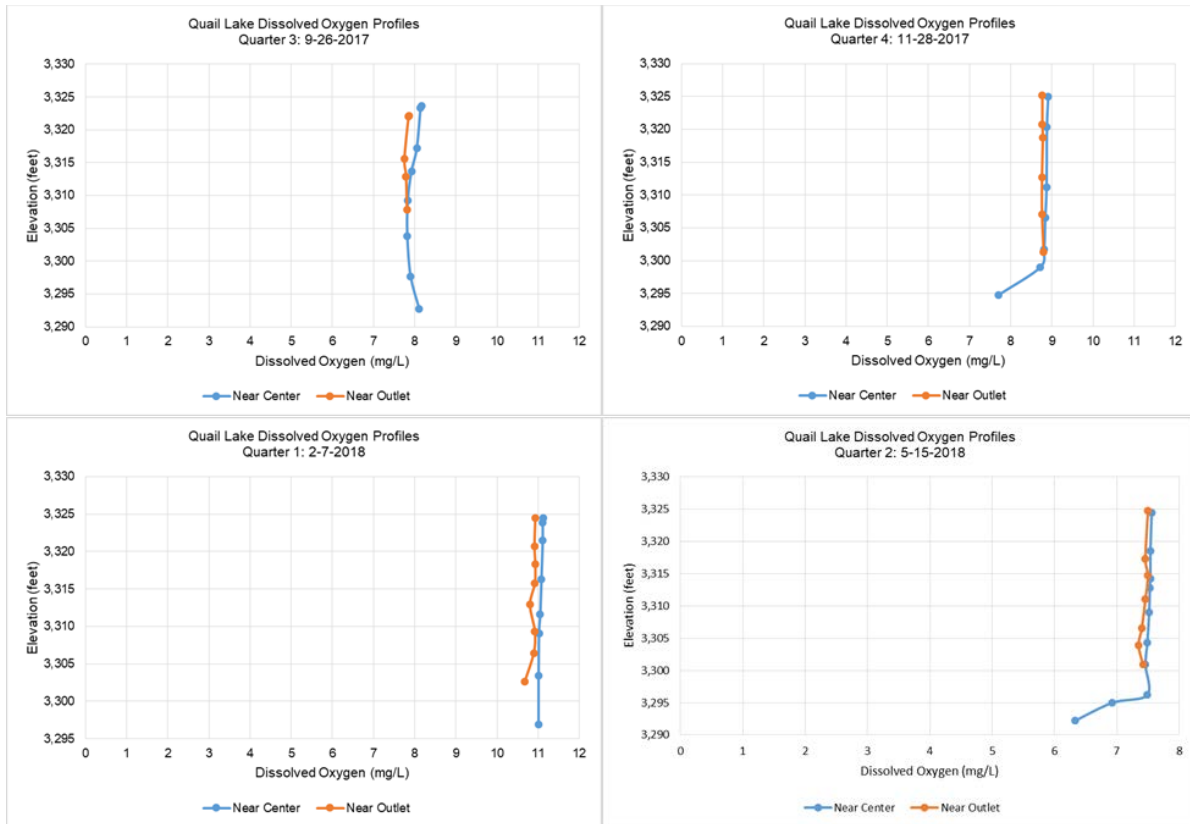


Figure 2.16-2. Quarterly Dissolved Oxygen Profiles for Two Locations in Quail Lake, 2017-2018

Surface water temperatures in Pyramid Lake ranged between 11 degrees Celsius (°C) and 23°C depending on the time of year and sample location. In general, there was no thermocline detected during the sampling events, except for a slight one during the third quarter sample (September 2017) (Figure 2.16-3). Surface DO concentrations ranged between 5.4 mg/L and 10.6 mg/L. DO concentrations tended to stay consistent throughout the water column. The only exception was the third quarter sample (September 2017), when DO concentrations reached near zero at a depth of 260 feet (Figure 2.16-4). pH values ranged between 6.7 and 8.5 across all depths, locations, and sample events. Specific conductivity ranged between 194 $\mu\text{S}/\text{cm}$ and 506 $\mu\text{S}/\text{cm}$ across all depths, locations, and sample events. Turbidity ranged from 0.5 Nephelometric Turbidity Units (NTU) to 30.4 NTU across all depths and locations, and was greatest near the bottom of the reservoir.

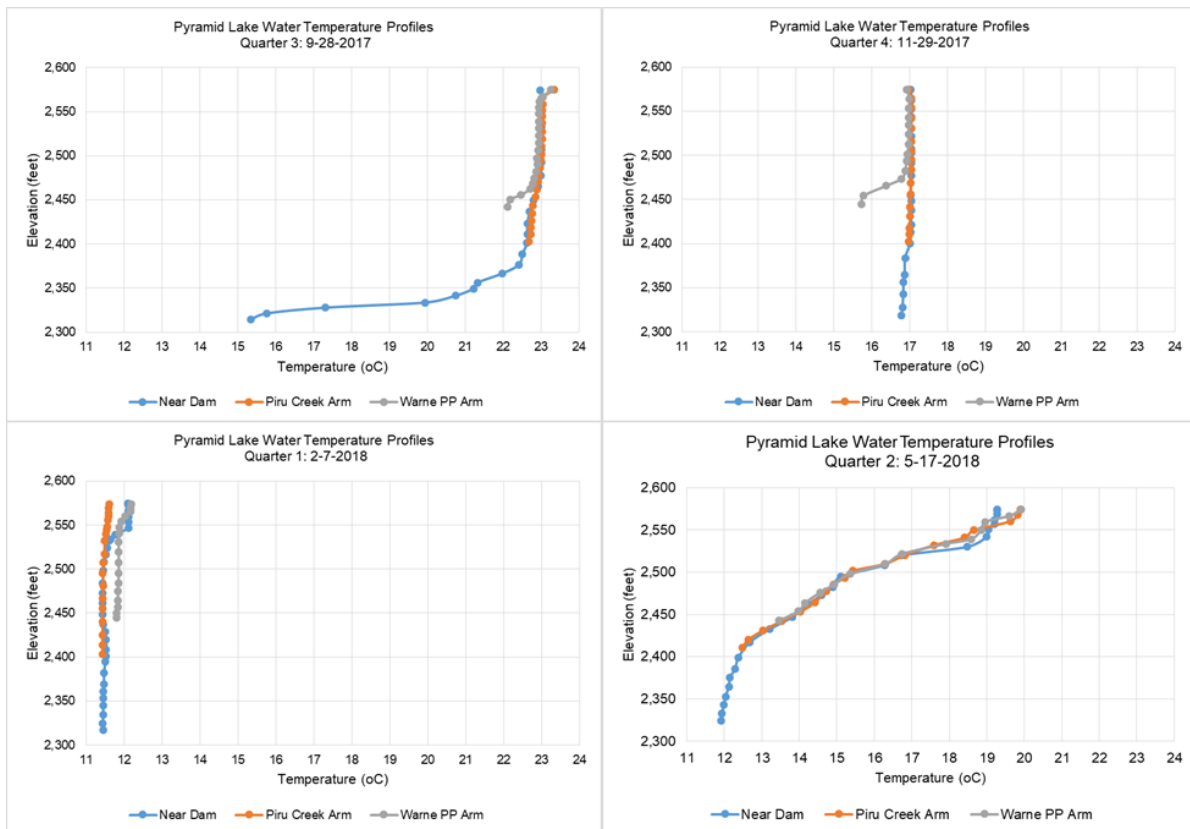


Figure 2.16-3. Water Temperature Profiles at Three Locations in Pyramid Lake, Quarterly 2017-2018

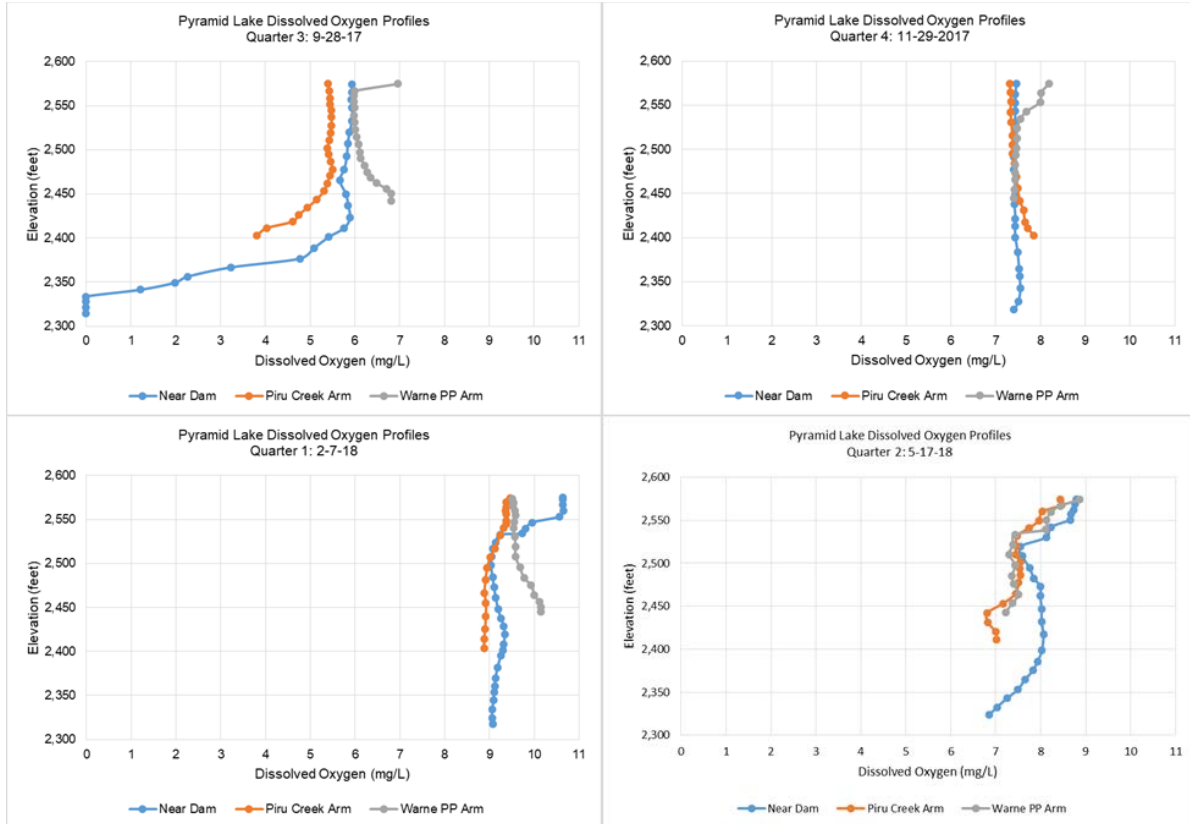


Figure 2.16-4. Dissolved Oxygen Profiles at Three Locations in Pyramid Lake, Quarterly 2017-2018

2.16.2.3 Water Temperature Monitoring

Water temperatures in Pyramid reach varied daily and seasonally at all locations. Water temperatures downstream of Pyramid Dam ranged between 10°C and just over 20°C, but showed very little diurnal fluctuation due to the consistent releases from Pyramid Dam (see Figure 2.16-5).

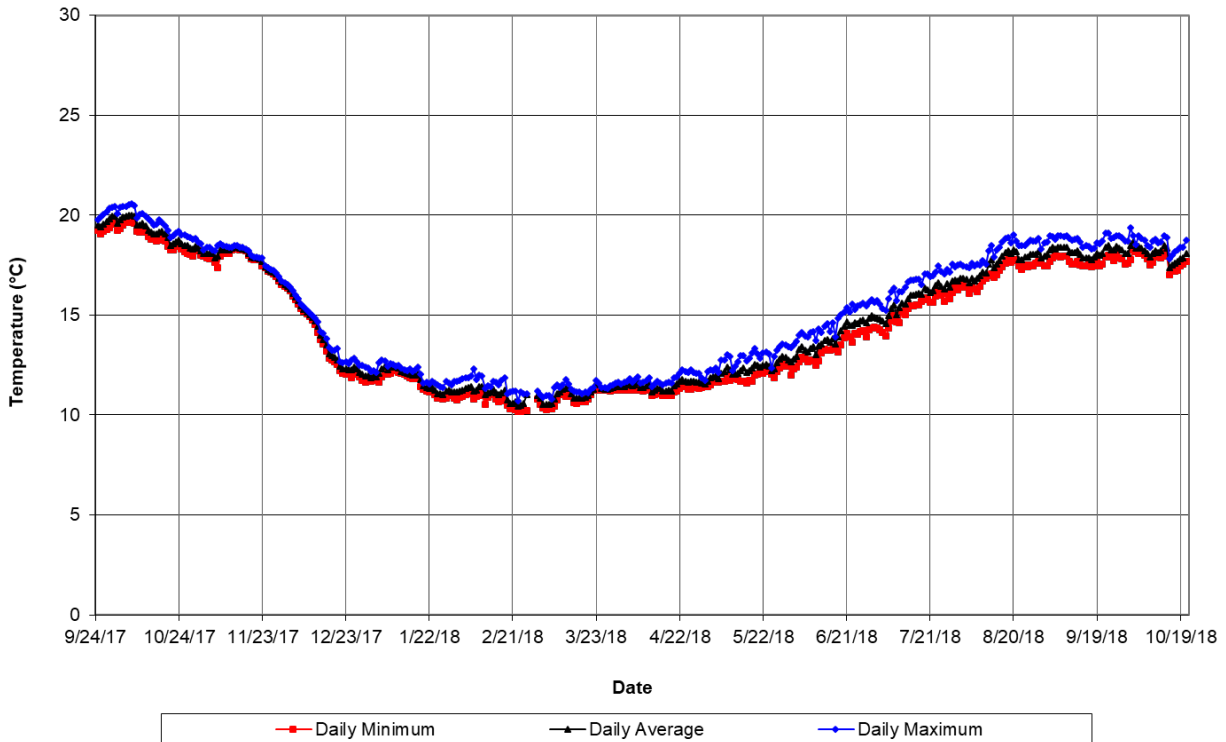


Figure 2.16-5. Daily Minimum, Average, And Maximum Water Temperatures at Pyramid Reach Downstream of Pyramid Dam

Water temperatures further downstream of Pyramid Dam showed more seasonal and diurnal variation compared to the station near the dam. The two monitoring locations 1.5 and 3.0 miles downstream of Pyramid Dam had very similar water temperatures, ranging between 6°C and 28.5°C (Figures 2.16-6 and 2.16-7). Despite the Licensees' efforts to have no data gaps (e.g., duplicate loggers, hidden from the public, robust housing), there is a data gap of 96 days (February 8, 2018 to May 14, 2018) at the location 3.0 miles downstream of Pyramid Dam, near Frenchmen's Flat (Figure 2.16-7), due to vandalism of the loggers. When the monitoring location was visited on May 14, 2018, both loggers were gone and one broken housing was found. Missing loggers were replaced with new loggers during the same site visit in order to continue data collection and were moved to a more secluded location. Water temperatures observed at the monitoring stations 1.5 and 3.0 miles below Pyramid Dam were very similar, with 98 percent of the daily average temperatures within 1°C and 65 percent of the daily average temperatures within 0.5°C.

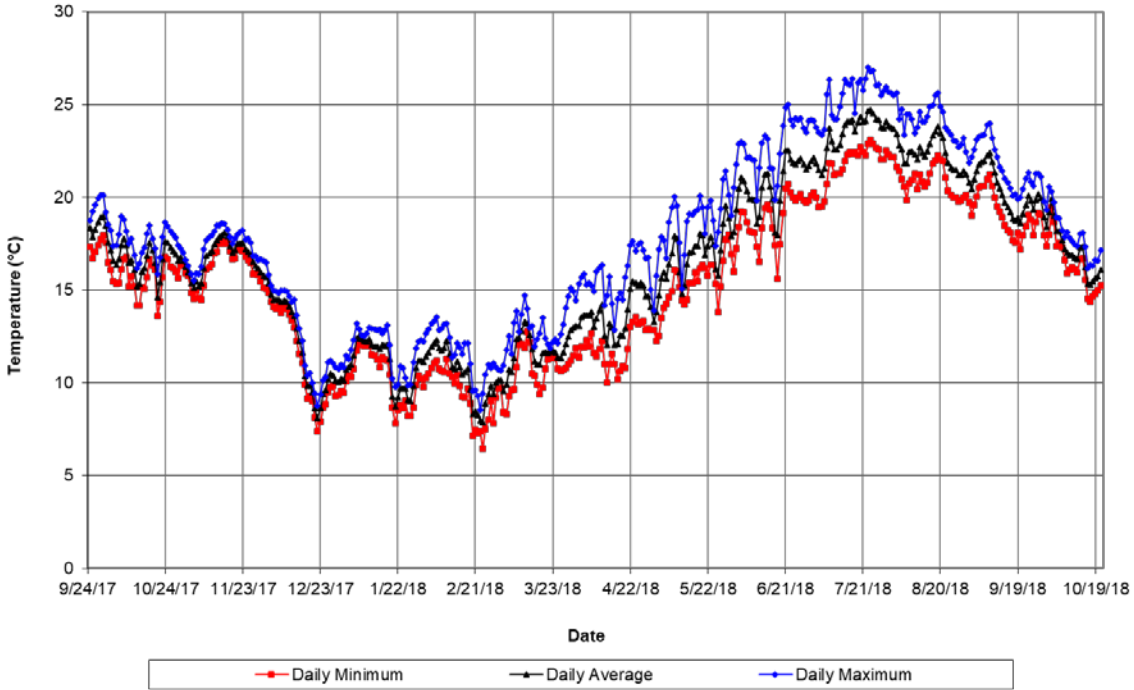
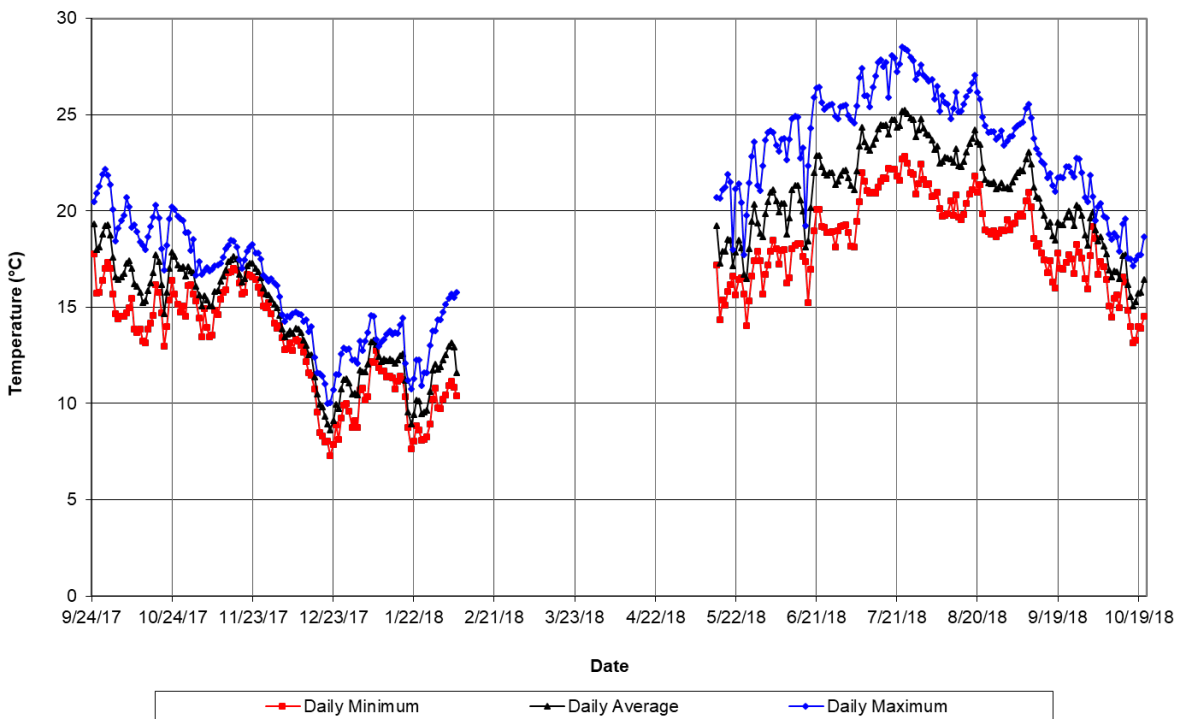


Figure 2.16-6. Daily Minimum, Average, and Maximum Water Temperatures at Piru Creek, 1.5 Miles Downstream of Pyramid Dam



Note: Data gap due to missing or malfunction data loggers.

Figure 2.16-7. Daily Minimum, Average, and Maximum Water Temperatures in Pyramid Reach, 3.0 Miles Downstream of Pyramid Dam, near Frenchmen's Flat

The most downstream water temperature monitoring location was approximately 18 miles downstream of Pyramid Dam near Blue Point Campground. Water temperatures ranged between 7.9°C and 26°C, and had daily variations up to 9°C during the monitoring period (Figure 2.16-8). While the water temperatures observed at this location showed similar seasonal variation to those observed at the upstream locations, temperatures were cooler than those observed upstream.

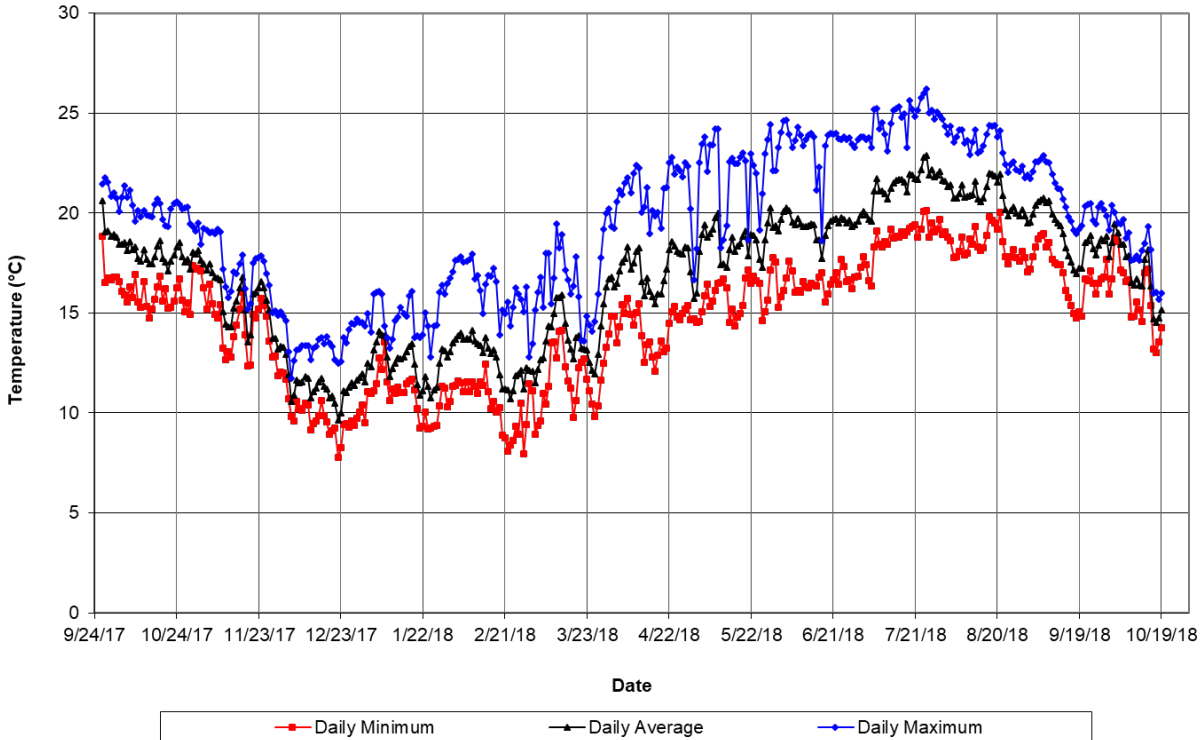


Figure 2.16-8. Daily Minimum, Average, and Maximum Water Temperatures at Pyramid Reach, 18 Miles Downstream of Pyramid Dam, near Blue Point Campground

2.16.3 Associated Data Files

File Name	Data Description	File Type	File Location
20181126_dwr_sswp_p2426_Project_Laboratory_Water_Quality_Data	Laboratory results for sampling at Pyramid Lake, Quail Lake, and Pyramid reach (14 locations)	Microsoft Excel	Project Website
20181126_dwr_sswp_p2426_Reservoir_Profile_Data	Raw reservoir profile data for Pyramid Lake (three locations) and Quail Lake (two locations)	Microsoft Excel	Project Website
20181126_dwr_sswp_p2426_Pyramid_Reach_Water_Temp_s	Raw 15-minute interval water temperature data and calculated daily minimum, average, and maximum for four locations in Pyramid reach	Microsoft Excel	Project Website

File Name	Data Description	File Type	File Location
20181130_dwr_sswp_p2426_Water_Quaility_Sampling_Locations	Map of water quality sampling locations	Adobe PDF	Project Website
20181220_dwr_sswp_p2426_Laboratory_Reports	Laboratory reports from water quality sampling, including bacteria sampling	Adobe PDF	Project Website

2.16.4 Variances from Study Methods, Schedule or Approach, and Unexpected Field Conditions

There were two variances to the FERC-approved Study. The Study Plan targeted collecting one complete year of water temperature data in Pyramid reach beginning in August 2017. The Licensees installed the loggers in September 2017 and kept them installed through October 2018. This variance had no effect on the overall Study because one year of monitoring was completed; it was simply shifted by one month.

The Study Plan also envisioned “continuous recording during the entire 365 days.” At the location near Frenchmen’s Flat (approximately 3.0 miles downstream of Pyramid Dam), there is a gap in the water temperature data record from February 8, 2018 to May 14, 2018. The data gap was due to vandalism of both the primary and secondary loggers installed at this location. When the loggers were visited during the quarterly downloads on May 14, 2018, both loggers were missing and pieces of one broken housing were found nearby. New loggers were installed during the same site visit and moved to a nearby location that was more secluded. Despite this data gap, water temperature in Pyramid reach can still be characterized using the other loggers installed, including one logger located 1.5 miles upstream of the logger with the data gap.

2.16.5 Remaining Work

None; the Study is complete.

2.17 FISH ENTRAINMENT RISK ASSESSMENT STUDY

2.17.1 Completed Work to Date

The Licensees completed the four steps in the FERC-approved study. Work completed includes characterization of intake structures for the Angeles Tunnel and Pyramid Dam, including calculations of intake velocities; determination of the likelihood that rainbow trout and largemouth bass would be near the intakes; and calculations of swim speeds of rainbow trout and largemouth bass.

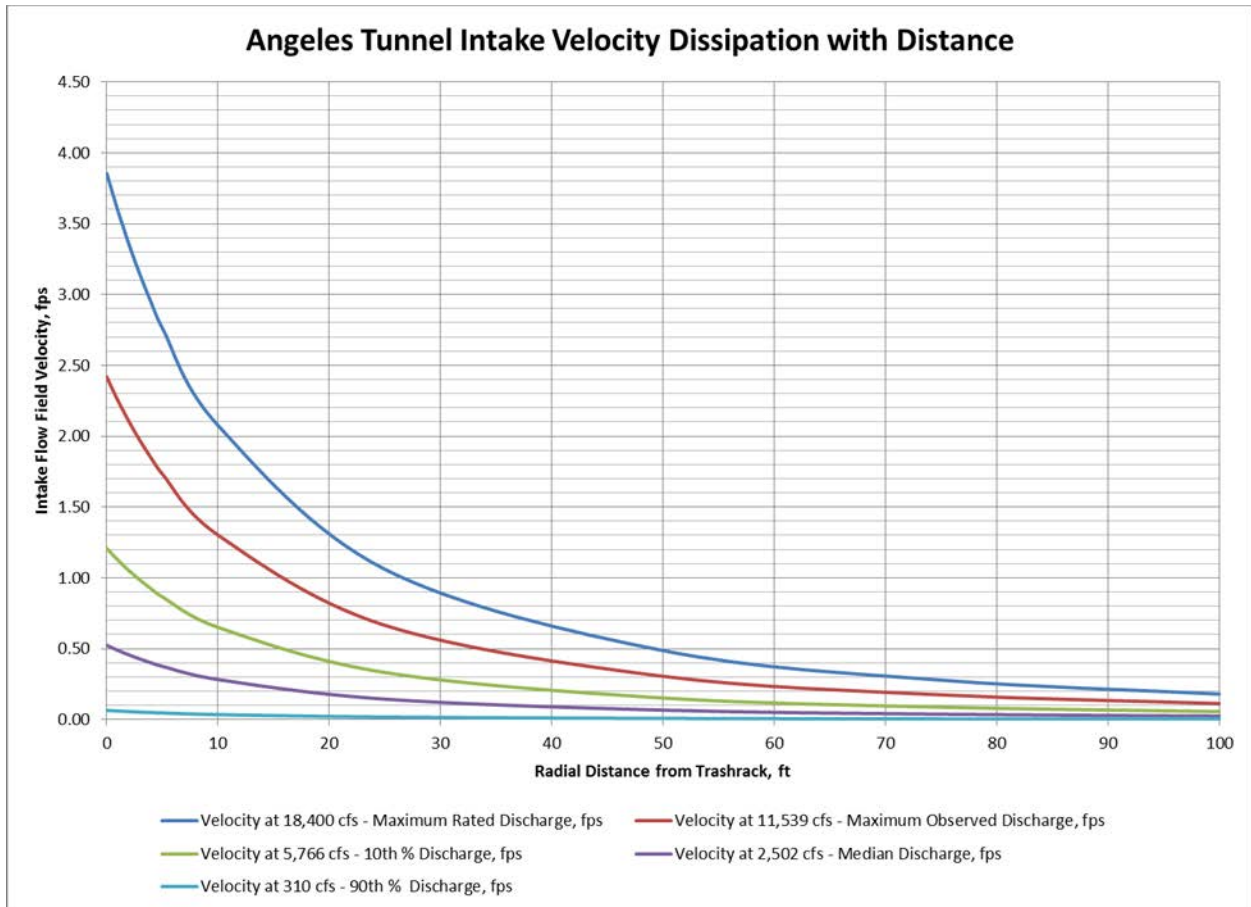
2.17.2 Key Accomplishments and Summary of Findings to Date

The Licensees found a very low likelihood that rainbow trout (*Oncorhynchus mykiss*) or largemouth bass would be entrained into the Angeles Tunnel or Pyramid Dam low-level intake for three reasons: (1) based on the species life history, it is unlikely they would be in the deep portions of Pyramid Lake where the two intakes are located; (2) in the unlikely case that individuals of these species were in the deep portions of the lake, it is unlikely they would be in the very small portions of the lake affected by the intakes; and (3) in the unlikely case that individuals of these species were in the deep portions of the lake and in the very small areas affected by these intakes, adult rainbow trout and largemouth bass can avoid being entrained because they each have swim speeds in excess of the intake velocities.

A review of existing literature found that all lifestages of both largemouth bass and rainbow trout, except for the adult lifestage of rainbow trout, prefer littoral habitat near the shallow edges of reservoirs. Rainbow trout adults may be found in the mid water portions of reservoirs, but rarely at depths of 200 feet where the Pyramid Lake intakes are located.

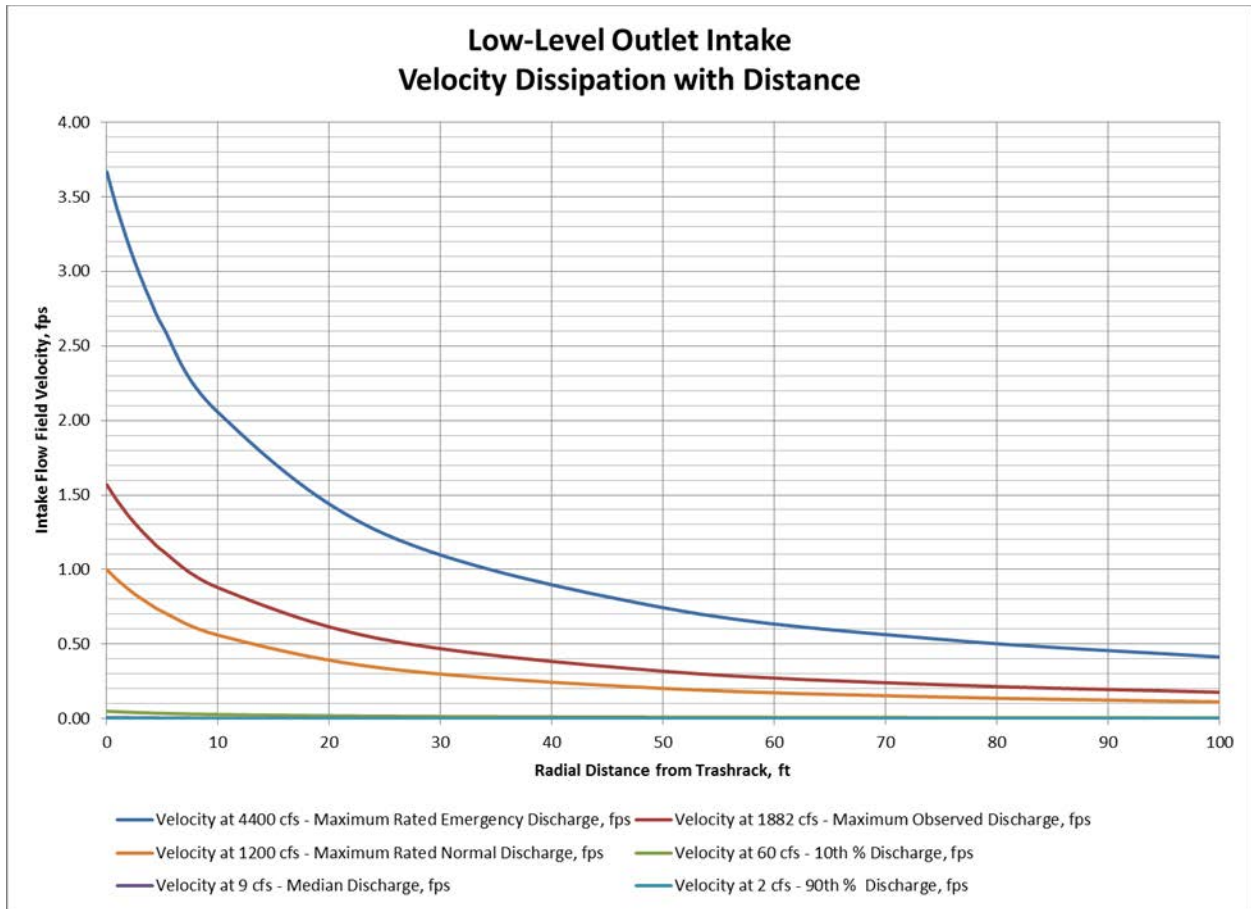
The Licensees used a hemispherical model of surface area to determine the area of influence of the intakes. The figures below show that each intake's area of influence is relatively limited in the deep portion of the lake (i.e., a velocity of less than 0.5 feet per second [fps] 40 to 80 feet away from the intake), and even at the intake itself, the maximum intake velocity is less than 3.8 fps.

In the very unlikely instance that an adult rainbow trout with burst swim speed ranging from 6.4 to 13.5 fps (Bell 1986) was in the vicinity of the intake structure, it can easily avoid being entrained. Similarly, in the very unlikely instance that an adult largemouth bass with burst swim speed of greater than 4.34 fps (Beamish 1978) was in the vicinity of the intake structure, it can easily avoid being entrained.



Key:
 % = percent
 cfs = cubic feet per second
 fps = feet per second
 ft = feet

Figure 2.17-1. Angeles Tunnel Intake Velocity Dissipation With Distance



Key:
 % = percent
 cfs = cubic feet per second
 fps = feet per second
 ft = feet

Figure 2.17-2. Low-Level Outlet Intake Velocity Dissipation With Distance

2.17.3 Associated Data Files

File Name	Data Description	File Type	File Location
20180405_dwr_sswp_p2426_Intake_Entrainment_Velocity_Calculations	Intake velocity calculations	Excel	Project Website

2.17.4 Variances from Study Methods, Schedule or Approach, and Unexpected Field Conditions

There have been no variances from the FERC-approved study.

2.17.5 Remaining Work

None; the Study is complete.

2.18 ESA-LISTED TERRESTRIAL WILDLIFE SPECIES – CALIFORNIA WILDLIFE HABITAT RELATIONSHIPS STUDY

2.18.1 Completed Work to Date

The Study is complete. The Licensees have completed Step 1 (Create Field Study Maps), and Step 2 (Conduct Field Habitat Assessments at Sampling Points and Incidentally Document ESA-Listed Terrestrial Wildlife). Study efforts completed were similar to work efforts performed by the Licensees under Study 4.1.7, *Special-Status Terrestrial Wildlife Species – California Wildlife Habitat Relationships Study*. A summary of completed work is as follows:

- Field study maps were developed under Step 1 for California Wildlife Habitat Relationships (CWHR) habitat types, sampling points, California Natural Diversity Database (CNDDDB) species occurrence records, and other known locations of Endangered Species Act (ESA)-listed species.
- Prior to field surveys, a total of 66 randomized locations representing 26 habitat types were identified (2 Blue Oak – Foothill Pine [BOP], 1 Blue Oak Woodland [BOW], 2 Coastal Oak Woodland [COW], 1 Desert Riparian [DRI], 2 Desert Wash [DSW], 1 Joshua Tree [JST], 2 Juniper [JUN], 1 Montane Hardwood – Conifer [MHC], 2 Montane Hardwood, 2 Montane Riparian, 3 Pinyon – Juniper, 1 Sierran Mixed Conifer [SMC], 2 Valley Oak Woodland [VOW], 2 Valley Foothill Riparian [VRI], 5 Chamise – Redshank Chaparral [CRC], 6 Coastal Scrub [CSC], 6 Mixed Chaparral [MCH], 1 Montane Chaparral [MCP], 4 Sagebrush [SGB], 3 Annual Grassland [AGS], 2 Fresh Emergent Wetland [FEW], 1 Pasture [PAS], 2 Perennial Grassland [PGS], 3 Wet Meadow [WTM], 2 Urban [URB], 2 Barren [BAR], and 5 locations in areas previously unmapped by the Classification and Assessment with Landsat of Visible Ecological Groupings [CalVeg]).
- A single CWHR Habitat Element Checklist datasheet was completed for each of the survey point locations.
- Three non-overlapping, 0.1-acre circular plots were sampled at each wooded habitat location, and three non-overlapping, 25-foot by 25-foot square plots were surveyed at each non-wooded (i.e., shrub or herbaceous-dominated) habitat location using the California Department of Fish and Wildlife (CDFW) CWHR System data forms.
- Photos were taken in the four cardinal directions from the center of each plot looking outwards. In the dataset, photo 1 = north, photo 2 = east, photo 3 = south, and photo 4 = west.
- Changes in vegetation boundaries from the CWHR habitat map were mapped in the field using an iPad, or in the office using ArcGIS.

- Any incidental observations of ESA-listed species were noted, and a California Native Species Field Survey Form was prepared for submittal to CDFW's CNDDDB program.
- Due to safety concerns, some areas were deemed inaccessible based on the presence of private property, steep slopes, unstable footing, dense vegetation, or inundation. As a result, data collection was restricted in these areas. These data collection restrictions are summarized below.
 - Inaccessibility due to safety concerns eliminated the possibility of collecting plot data at some locations. In these instances, an "over-the-fence" approach was implemented, which included the completion of a CWHR Habitat Element Checklist, as well as an estimation of percent cover by species. This modified assessment was conducted at 9 of the 65 sample locations: AGS7, BOW12, DRI26, DSW28, FEW29, FEW30, PAS46, PGS48, and PJN49.
 - Photos were generally taken in the four cardinal directions from the center of each plot looking outwards, except where site conditions prevented standing at those precise locations (e.g., steep slopes, unstable terrain, etc.). When locations were inaccessible, photos were taken from afar.

2.18.2 Key Accomplishments and Summary of Findings to Date

Study findings for CHWR habitat types are the same as those findings for Licensees' Special-Status Terrestrial Wildlife Species—California Wildlife Habitat Relationships Study. These included:

2.18.2.1 CWHR

- Based on updated mapping, a total of 26 habitat types occur in the Study area. Within the proposed Project boundary, a total of 18 CWHR habitat types, including Lacustrine, occur. The acreages of CWHR habitat types in the proposed Project boundary and Study area are summarized in Table 2.18-1. Refer to CWHR_Habitat_Maps.pdf (in Associated Data Files, listed below) for maps showing the sample locations, as well as the acreages and distribution of habitats within the study area.

Table 2.18-1. CWHR Habitat Acreages and Percentages Within the Study Area and Proposed Project Boundary

CWHR Habitat Type	Number of Sampling Points Planned ¹	Number of Sampling Points Actual ²	Acreage in Proposed Project Boundary ³	Percentage of Proposed Project Boundary	Acreage in Study Area ³	Percentage of Study Area
Tree-Dominated Habitats						
Blue Oak - Foothill Pine (BOP)	2	2	0.5	0.01	610.7	0.7
Blue Oak Woodland (BOW)	1	1	-	-	381.1	0.4
Coastal Oak Woodland (COW)	2	2	2.8	0.1	264.0	0.3
Desert Riparian (DRI)	1	2	51.5	1.2	65.4	0.08
Joshua Tree (JST)	1	1	0.2	0.004	5.4	0.01
Juniper (JUN)	2	0	-	-	144.5	0.2
Montane Hardwood - Conifer (MHC)	1	2	-	-	90.4	0.1
Montane Hardwood (MHW)	2	0	0.5	0.01	329.3	0.4
Montane Riparian (MRI)	2	0	-	-	12.1	0.0
Pinyon - Juniper (PJN)	3	0	5.1	0.1	572.3	0.7
Sierran Mixed Conifer (SMC)	1	0	-	-	80.1	0.1
Valley Oak Woodland (VOW)	2	2	-	-	307.0	0.4
Valley Foothill Riparian (VRI)	2	5	96.4	2.2	516.4	0.6
Shrub-Dominated Habitats						
Chamise - Redshank Chaparral (CRC)	5	6	135.2	3.0	9,391.8	11.0
Coastal Scrub (CSC)	6	9	545.1	12.2	13,784.0	16.2
Desert Wash (DSW)	2	1	2.5	0.06	215.2	0.25
Mixed Chaparral (MCH)	6	8	437.4	9.8	37,881.8	44.5
Montane Chaparral (MCP)	1	0	-	-	46.2	0.1
Sagebrush (SGB)	4	8	280.8	6.3	3,490.6	4.1

Table 2.18-1. CWHR Habitat Acreages and Percentages Within the Study Area and Proposed Project Boundary (continued)

CWHR Habitat Type	Number of Sampling Points Planned ¹	Number of Sampling Points Actual ²	Acreage in Proposed Project Boundary ³	Percentage of Proposed Project Boundary	Acreage in Study Area ³	Percentage of Study Area
Herbaceous-Dominated Habitats						
Annual Grassland (AGS)	3	7	196.9	4.4	8,616.1	10.1
Fresh Emergent Wetland (FEW)	2	3	55.3	1.2	55.3	0.1
Pasture (PAS)	1	0	-	-	-	-
Perennial Grassland (PGS)	2	1	-	-	9.7	0.01
Wet Meadows (WTM)	3	1	20.9	0.5	30.2	0.04
Developed Habitats						
Urban (URB)	2	3	412.7	9.3	3,592.9	4.2
Non-Vegetated Habitats						
Barren (BAR)	2	1	222.6	5.0	645.4	0.8
Aquatics Habitats						
Lacustrine (LAC)	0	0	1,993.0	44.7	4,021.3	4.7
Other						
Unknown (UNK)	5	0	-	-	-	-
Total	66	65	4,459.4	100.0	85,159.2	100.0

Source: USFS 2018a and field data

Notes:

¹Number presented here represents the number of sample points planned for each habitat type based on acreage in study area and value to wildlife.

²Number presented here represents the number of sample points actually collected for each habitat type. Difference from planned number of points due to incorrect mapping and inaccessibility resulting from private property or unsafe conditions. In some cases of limited access, a sampled point had limited data collected (Habitat Element Checklist only, no vegetation plots). This is clarified in the habitat descriptions section below.

³All acreages exclude Angeles Tunnel.

- Habitat was determined to be incorrectly mapped by CalVeg at 33 locations out of the 65 total locations sampled. As a result of this ground-truthing, it was determined that initial habitat mapping based on available CalVeg data was incorrect in just under 50 percent of the sampled cases. This indicates that portions of the Study area that were not ground truthed as part of this Study may be inaccurately mapped. However, most of these areas are largely inaccessible or located on the outer edges of the Study area, far from the proposed Project boundary. For the purposes of this Study, a conservative approach was taken and areas that were not directly observable were assumed to be correctly mapped.

- One of the CWHR habitat types, Pasture (PAS), previously mapped in the Study area, was eliminated. All areas previously mapped as PAS were surveyed in their entirety and changed to Annual Grassland (AGS).
- All five unknown sampling points in the previously unmapped (by CalVeg) area north of Quail Lake were surveyed and determined to be a mix of Annual Grassland (AGS) and Sagebrush (SGB) habitats. These data, along with surrounding mapped vegetation types, were used to extrapolate and fill in the entirety of the unmapped area.

2.18.2.2 Incidental Sightings

- No incidental observations of ESA-listed species occurred during the ESA-Listed Terrestrial Wildlife Species – California Wildlife Habitat Relationships Study.

2.18.2.3 ESA-Listed Terrestrial Species

- The updated list of CWHR habitat types was run through the CWHR Model (CWHR Version 9.0) and the following six ESA-listed terrestrial wildlife species were listed as having potential habitat within the proposed Project boundary:
 - Arroyo toad (*Anaxyrus [=Bufo] californicus*) – The CWHR identifies a general habitat association of arroyo toad with the following habitat types: Joshua Tree, Mixed Chaparral, Pinyon-Juniper, and Valley Foothill Riparian.
 - California red-legged frog (*Rana draytonii*) – The CWHR identifies a general habitat association of CRLF with the following habitat types: Annual Grassland, Blue Oak-Foothill Pine, Blue Oak Woodland, Coastal Oak Woodland, Coastal Scrub, Fresh Emergent Wetland, Lacustrine, Mixed Chaparral, Montane Hardwood, Montane Hardwood-Conifer, Montane Riparian, Perennial Grassland, Valley Oak Woodland, Wet Meadow, and Valley Foothill Riparian. Additional information about this species within the proposed Project boundary will be available in the data summary for the Licensees' ESA-Listed Amphibians, California Red-legged Frog Study.
 - California condor (*Gymnogyps californianus*) – The CWHR identifies a general habitat association of California condor with the following habitat types: Annual Grassland, Barren, Blue Oak-Foothill Pine, Blue Oak Woodland, Chamise-Redshank Chaparral, Coastal Oak Woodland, Coastal Scrub, Lacustrine, Mixed Chaparral, Montane Hardwood, Montane Hardwood-Conifer, Perennial Grassland, Pinyon-Juniper, Sagebrush, Sierran Mixed Conifer, and Valley Oak Woodland. Additional information about this species within the proposed Project boundary is available in the data summary for the Licensees' Special-Status Raptors Study.
 - Coastal California gnatcatcher (*Polioptila californica californica*) – The CWHR does not provide habitat relationships specific to coastal California

gnatcatcher separate from California gnatcatcher; however, associated habitats likely include Chamise-Redshank Chaparral, Coastal Scrub, and Mixed Chaparral.

- Least Bell's vireo (*Vireo bellii pusillus*) – The CWHR identifies a general habitat association of least Bell's vireo with one habitat type: Valley Foothill Riparian. Additional information about this species within the proposed Project boundary is available in the data summary for the Licensees' ESA-Listed Riparian Bird Species, Southwestern Willow Flycatcher, Least Bell's Vireo, and Yellow-Billed Cuckoo Habitat Evaluations Study.
- Western Distinct Population Segment of yellow-billed cuckoo (*Coccyzus americanus*) – The CWHR identifies a general habitat association of yellow-billed cuckoo with one habitat type: Valley Foothill Riparian. Additional information about this species within the proposed Project boundary is available in the data summary for the Licensees' ESA-Listed Riparian Bird Species, Southwestern Willow Flycatcher, Least Bell's Vireo, and Yellow-Billed Cuckoo Habitat Evaluations Study.

2.18.3 Associated Data Files

File Name	Data Description	File Type	File Location
CWHR_Habitat_Sample_Points.zip	Sample point locations from CWHR habitat mapping study	ZIP	Project website
CWHR_Habitat_Maps.pdf	Maps of CWHR habitat	PDF	Project website
SSWP_CWHR_datasheets_compiled.pdf	Survey forms for CWHR habitat study	PDF	Project website
CWHR_Habitat_Acreages_Table.xlsx	Habitat acreages and percentages within the study area	Excel	Project website
CWHR_Sample_Point_Photos (folder with 632 jpg files)	All photos associated with CWHR sample points	JPG	Project website

Key:

CWHR = California Wildlife Habitat Relationships

2.18.4 Variances from Study Methods, Schedule or Approach, and Unexpected Field Conditions

The completed work referenced above resulted in the following variances and/or unexpected conditions:

- The CWHR study plan originally stated that 60 points would be sampled; however, 66 sample points were planned prior to field efforts. This discrepancy between the study plan and how the study was conducted can be explained as follows: (1) five of the additional sampling points were added to adequately cover the sections of the buffer surrounding the proposed Project boundary but it was

discovered that those sections have not been previously mapped by CalVeg and thus original vegetation classifications needed to be determined; and (2) there was also one additional point included with the addition of identified primary Project roads and further refinement of the proposed Project boundary after the study plan was finalized.

- One survey point out of the 66 sample points was not surveyed due to complete inaccessibility (JUN33). This brought the total number of sampled points down to 65.
- In some cases, inaccessibility or small habitat patch size limited the number of plots that could be sampled at a given location. Limited plot data was collected at seven of the 65 sample locations, including: BOP10, CRC 16, MHC41, MHW42, PJN50, SMC52, and VOW55. One to two plots were sampled at these locations, rather than the typical three.
- Data was collected for one plot only at Urban locations, as the majority of the cover in these areas was hardscape, which is easily visible and detectable on aerial photographs, and transect data provided little value to the Study as a whole.

These variances are considered minor and did not influence the findings of the Study as a whole. Areas that were subject to limited sampling (Urban plots and the specific locations listed above) were sufficiently sampled to accurately represent the habitats at each area.

2.18.5 Remaining Work

The Study is complete. No work remains.

2.19 WHITEWATER BOATING STUDY

2.19.1 Completed Work to Date

The Study is complete. The Licensees completed Step 1 (Literature Search and Mapping), Step 2 (Hydrology Assessment), Step 3 (Conduct Structured Interviews), and Step 4 (Field Reconnaissance and Site Visit).

2.19.1.1 *Step 1 – Literature Search and Mapping*

A literature search and internet review were completed to document known whitewater boating characteristics and opportunities along the 18-mile-long reach of Piru Creek, from Pyramid Dam to Lake Piru. The reach analyzed is referred to as Pyramid reach. In addition, maps of key features of Pyramid reach and gradient profiles were created during Step 1 of the Study.

2.19.1.2 Step 2 – Hydrology Assessment

The Study utilized information from three different gages on Piru Creek to analyze flows discharged from Pyramid Dam into Piru Creek. A hydrologic record was developed from U.S. Geological Survey (USGS) gage 11109525, located immediately downstream of Pyramid Dam; USGS gage 11109600, located just above Lake Piru in Pyramid reach; a California Data Exchange Center (CDEC) gage at Pyramid Dam (PYM); and Project records on inflow and outflow. The current hydrologic record includes sub-daily flow information that was used for analysis in this Study.

Boaters and other recreationists can access hourly flow discharge data from the CDEC gage at Pyramid Dam. DWR records of supplemental flows were obtained to evaluate the recent past pattern of delivery of water to United Water Conservation District (UWCD) which, when available, is guided by Article 52 of the existing Project license. Article 52 allows for the release of up to 3,150 acre-feet (AF) of State Water Project (SWP) water annually between November 1 and the end of February each year.

2.19.1.3 Step 3 – Conduct Structured Interviews

Information was sought out from whitewater boating enthusiasts and stakeholders to obtain local knowledge of Pyramid reach regarding current recreation opportunities (including popular put-in and take-out areas), user preferences, and any known flow effects on whitewater boating for Pyramid reach. Interview candidates were selected from the whitewater boating community, and included user groups and other whitewater recreationists, including experts familiar with whitewater resources in the Project area. These candidates were interviewed to determine the types and locations of whitewater boating activities occurring within Pyramid reach, and the range of conditions (including flows) generally acceptable to whitewater boaters of various skill levels.

Interviews and meetings with stakeholders included questions about: (1) how people use the reach, with the goals of describing the character of recreation opportunities and identifying flow-dependent attributes; (2) whether participants can identify specific flows that affect the quality of opportunities; and (3) how to prioritize opportunities and identify recreation users' needs for improved access and flow information. Most interviews were conducted prior to visits to help inform the site visit participants with respect to observed river conditions and access points.

2.19.1.4 Step 4 – Field Reconnaissance and Site Visit

Field Reconnaissance

The purpose of the field reconnaissance was to characterize Pyramid reach in the context of its use as a whitewater recreation resource, and to assess whitewater boating conditions and opportunities. Prior to the field reconnaissance, a desktop Geographical Information System (GIS) opportunities analysis was performed to identify, map, and describe any existing and potential sites along Pyramid reach for access (put-in and take-out sites). This was completed by mapping the topography, local roads, vegetation cover, existing trails, and land ownership. The GIS analysis helped inform the physical

and spatial characteristics of potential whitewater boating resources, and determine and depict the characteristics of the reach.

Site Visit

Experienced whitewater boaters who were interviewed (Step 3) were invited to the field reconnaissance/site visit to assist with: (1) evaluating the quality of boating opportunities along the reach; (2) assessing the access to boating opportunities; (3) estimating potential flow ranges; and (4) identifying obvious hazards. Global Positioning System location data of likely put-in and take-out areas, parking, and general access to Pyramid reach was gathered during the site visit.

2.19.2 Key Accomplishments and Summary of Findings to Date

2.19.2.1 Step 1 – Literature Search and Mapping

A literature search and internet review examined existing literature, guidebooks, boater diaries, videos, and other available information related to whitewater boating, with the goal of obtaining information specifically about Piru Creek. The literature search identified runs, access points, and levels of whitewater boating difficulty along runs; boater demand; and the range of watercraft that may be able to boat Piru Creek. After reviewing a dozen published outdoor guide books relevant to southern California, only one was found to contain references to whitewater boating in Piru Creek. Additionally, five websites provided further information about Piru Creek whitewater boating opportunities. A summary of these resources follows.

- Best Whitewater in California: The Guide to 180 Runs by Lars Holbeck (1998). This is a comprehensive guidebook that includes information about Piru Creek. The book describes Piru Creek in Pyramid reach as Class III-IV level, or an intermediate to advanced level of difficulty, with optimum flow of 1,100 cubic feet per second (cfs) for running the reach (16 miles from Frenchman's Flat to Lake Piru). The guidebook describes Piru Creek as runnable for a few days after heavy winter storms. The book notes that the flow as released from Pyramid Lake is usually similar to the flow on upper Piru Creek, but that during boating (through Pyramid reach), by the time one reaches the take-out, the flow levels may double after heavy rains. This is due to the contribution of inflows from tributaries that feed into Piru Creek and then increase the flow throughout the run. The book warns potential boaters that, after heavy rains, if there is more than a few hundred cfs at the put-in, there may be too much water to navigate or portage (go around) at "the big rapids 2/3 of the way down the run."
- The American Whitewater (AW) website describes Piru Creek (between Pyramid Lake and Lake Piru) as a Class IV, advanced difficulty level (for normal flows). According to the website, the average gradient is stated as 67 feet per mile and the maximum gradient is estimated at 100 feet per mile. AW states that the reach "can be runnable for a few days immediately during and after large winter rain storms, or for longer periods during wet winters." Suggested put-in access is at

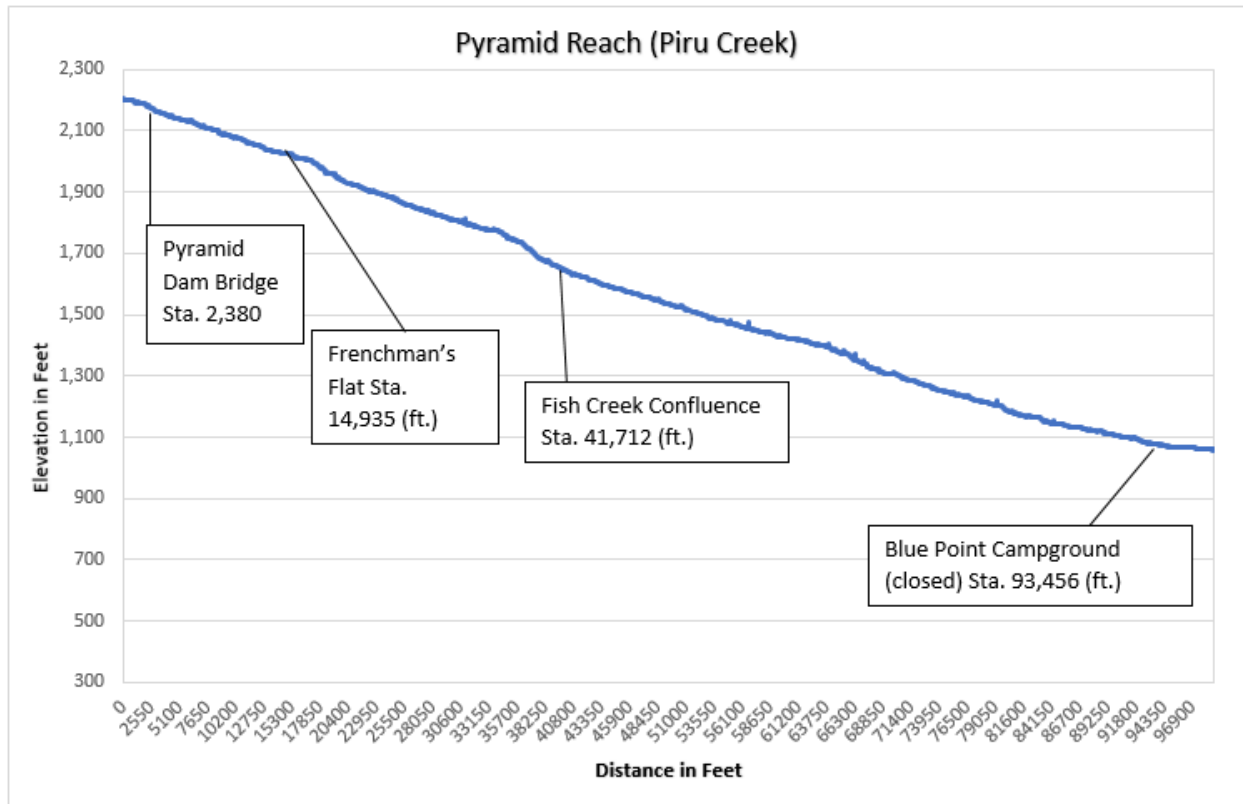
Frenchman's Flat and take-out is at the Lake Piru boat ramp. The AW website warns that there may be barbed wire across the creek at about 2 miles before the creek flows into Lake Piru. The website also states that at the end of the run, the river gets shallow and braided, which may require paddlers to drag their boats in places. The AW website is available at:

<https://www.americanwhitewater.org/content/River/detail/id/3154/>.

- There is a link on AW's website to a write-up by Gary Valle that describes Piru Creek from a kayaker's perspective (<http://www.sierraphotography.com/creeking/piru02.htm>). Valle describes a boat trip on March 9, 2005. The flow on that day was reported to have been 235 cfs below Pyramid Dam and 335 cfs upstream of Lake Piru. The website describes the reach as boatable for a few days in February and March, with water years that are average or above average for precipitation. The website also provides a link to the USGS gage above Frenchman's Flat (provides stage in real time) (https://waterdata.usgs.gov/ca/nwis/uv/?site_no=11109550) and a link to USGS recent daily mean flow data above Frenchman's Flat (https://waterdata.usgs.gov/ca/nwis/dv?referred_module=sw&format=html&period=31&site_no=11109550).
- Dreamflows.com lists flow information for boatable rivers and creeks (<http://www.dreamflows.com/alphaReaches.php?st=ca>). Piru Creek is listed and categorized as "yellow," meaning flow is generally considered low. This does not necessarily mean too low to run safely; many reaches are routinely run at flows that are generally considered low. Reach maps are available on the website with put-in/take-out locations, gauge locations, and rapid locations (<http://www.dreamflows.com/reachMap/index.php?rid=488&num=A>).
- California Wilderness Coalition website describes Piru Creek and states that Frenchman's Flat is a popular destination for anglers, picnickers, and families (<https://www.calwild.org/portfolio/fact-sheet-piru-creek-wild-scenic-river/>). The site also mentions that when seasonal flows are available, kayakers run the creek through the Sespe Wilderness.
- A website called BRT Insights – WW Kayaking & Hiking includes Piru Creek as a whitewater boating location (<http://brt-insights.blogspot.com/search?q=Piru>). The reach is described as Class IV, with the put-in at Frenchman's Flat and the take-out at Lake Piru. There is a link on the website that references a book called California River Maps – Atlas & Gazetteer by Delorme (2008), which includes Piru Creek (<http://brt-insights.blogspot.com/2009/08/california-river-maps-atlas-gazetteer.html>).

In addition to the literature search discussed above, Pyramid reach was mapped in a series of panels that displayed the river miles downstream of Pyramid Dam; tributaries, wilderness, and access features; and boundaries and designations of the Wild and Scenic River reach below Pyramid Dam. Additionally, a gradient map was generated to evaluate the gradients and profile characteristics of the 18-mile reach.

Maps that were prepared to identify the Project reach relative to the routes of access and other important features (e.g., Project dam/diversion, developed recreation facilities, and wilderness boundaries) can be found as the associated data file labeled “SSWP_Whitewater_Overview_Map.” The gradient profile of Pyramid reach (Figure 2.19-1) shows that the creek drops from approximately 2,200 feet to about 1,055 feet in just over 18 miles. This represents a gradient of roughly 58 feet per mile.



Note: Elevation in feet above mean sea level on Y axis, with distance downstream from Pyramid Dam in feet on X axis
Key:
ft.= feet
Sta. = Station

Figure 2.19-1. Gradient Profile of Pyramid Reach

2.19.2.2 Step 2 – Hydrology Assessment

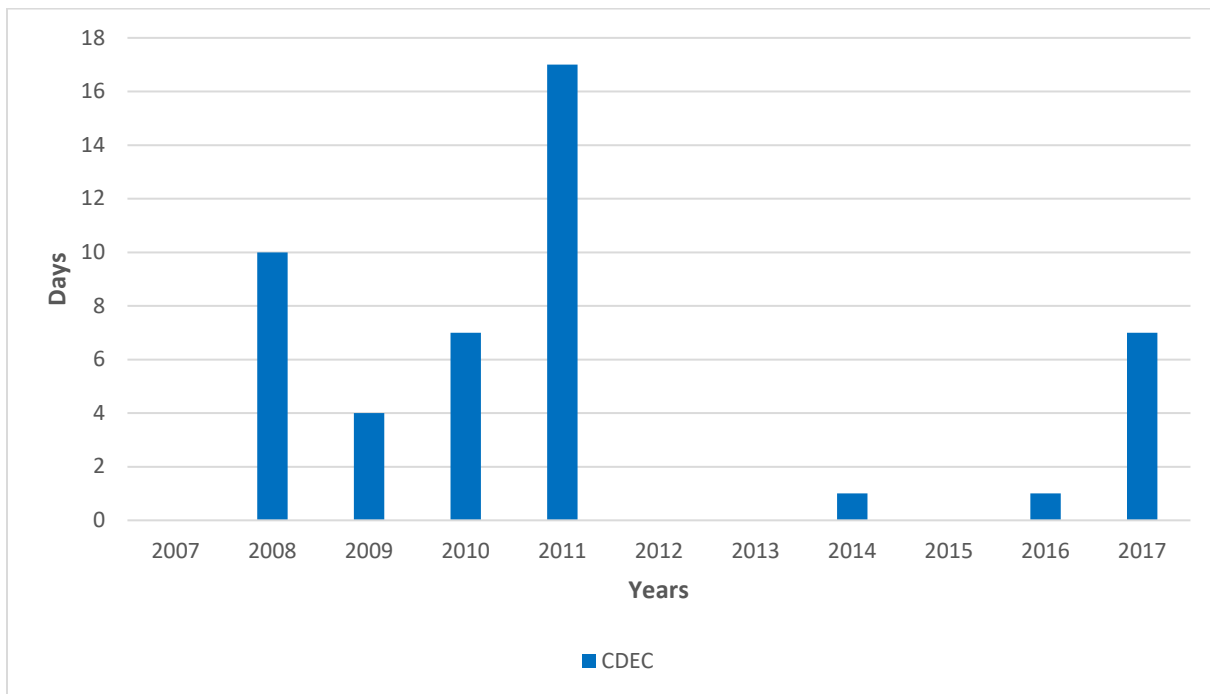
Water releases into Pyramid reach are generally equal to natural inflow into Pyramid Lake, consistent with Article 52 of the existing Project license, to avoid adverse effects on the federally endangered arroyo toad (*Anaxyrus californicus*), as described in the Licensees’ Pre-Application Document and the Revised Study Plan for South SWP Hydropower.

An estimated 200 cfs released from Pyramid Dam (based on information provided by AW and the boaters interviewed) was set as a minimum flow used to evaluate the number of days boating might be possible.

The analysis shows most boating flows are based on natural flows stemming from the upper Piru Creek basin that are released by the Licensees as part of Article 52, which requires Pyramid Lake inflows and outflows to be equal to the extent operationally feasible and consistent with safety requirements. Flows released from Pyramid Dam below 1,200 cfs are generally accomplished through a low-level outlet structure. Hourly flow information is available to the public in real time via CDEC’s gauging website at the gauge designated PYM (<http://cdec.water.ca.gov/dynamicapp/QueryF?s=PYM>).

The Licensees found that both USGS gages are managed by the Santa Maria USGS field office, and that USGS11190550 only records data during November through April, and does not record any data during the months May through October. This was determined to not significantly affect findings, since there likely would be few or no days with target flows during those summer months. The earliest CDEC sensor information available was October 24, 2007, and therefore the first few months of 2007 are not represented by the CDEC sensor data.

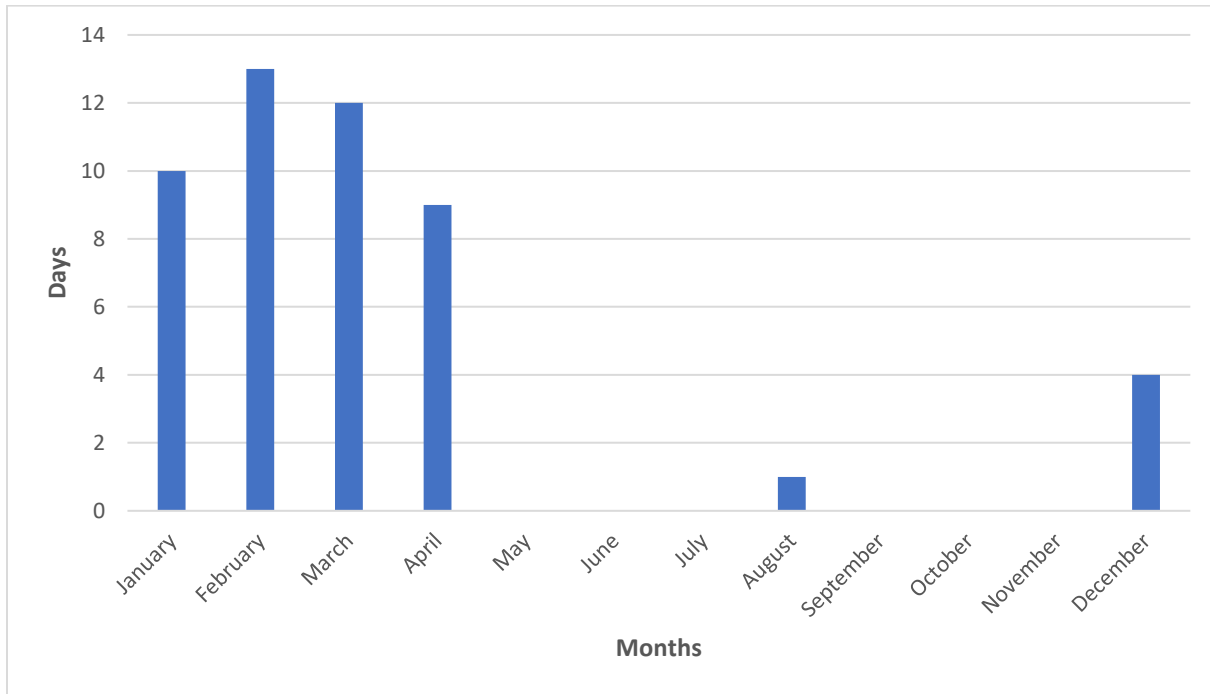
As shown in Figure 2.19-2, from 2007 through 2017, some years presented no opportunities for boating, while in other years, as many as 16 boating days may have been possible.



Source: CDEC PYM gauge records

Figure 2.19-2. Annual Number of Days with 200 Cubic Feet per Second Flows Released at Pyramid Dam (2007 through 2017)

Figure 2.19-3 presents the distribution of potentially boatable days by month for 2007 through 2017.



Source: CDEC PYM gauge records

Figure 2.19-3. Total Number of Days with 200 Cubic Feet per Second Flows Released at Pyramid Dam by Month (2007 through 2017)

In addition to the passing of natural flows above Pyramid Lake, supplemental flows are provided in Pyramid reach in most years as part of delivery of SWP water to UWCD. UWCD receives water as part of the Ventura County Watershed Protection District's (VCWPD) long-term water supply contract with DWR. While the VCWPD water supply contract is for 20,000 AF/year, UWCD is contracted to receive a maximum of 5,000 AF/year of the 20,000 AF. UWCD receives up to 3,150 AF of SWP water from Pyramid Lake, using Pyramid reach as a means of conveyance. Annual water deliveries are based on the amount of SWP water available each year and water deliveries are determined based on a proportional share divided among all SWP water contractors up to the maximum amount specified in the contract.

Since 2009, when Article 52 of the License was amended, SWP water deliveries have been carried out between the first of November and the end of February each water year to prevent releases from interfering with the breeding habits of the arroyo toad. During this timeframe, water deliveries may be made over a period of a few days, ramping flows up and down to simulate the hydrograph of a typical storm event, or they may be released more gradually over a longer period. Table 2.19-1 shows the amount of water delivered to UWCD for the period 2004 through 2014.

Table 2.19-1. Annual Deliveries to United Water Conservation District, 2004 through 2014

Year	Deliveries to United Water Conservation District (AF)	Months During Which Releases Occurred	Maximum Single-Day Release (cfs)	Average Single-Day Release (cfs)
2004	2,431	August, September	53	46.8
2005	0	--	--	--
2006	0	--	--	--
2007	1,890	November	182	90
2008	1,980	November, December	109	55
2009	3,150	November, December	200	112.5
2010	3,150	November	158	108.6
2011	2,520	November, December	120	93.3
2012	3,150	November	169	108.6
2013	2,258	March, June, November	103	53.8
2014	0	--	--	--

Key:
AF = acre-feet
cfs = cubic feet per second

Generally, deliveries to UWCD begin in early November. The releases usually follow a rough bell-curve shape, in which they begin at a low or moderate pace, gradually ramp up through mid-November, and then trickle back down through the end of November or December. No scheduled deliveries occurred during January or February for the years analyzed (2007 through 2017).

SWP water is generally delivered to UWCD in flows averaging between 40 and 110 cfs per day to accommodate some private landowners' wet crossings of lower Pyramid reach. UWCD has reported to DWR that these land owners can have difficulty accessing their property if flows in Pyramid reach are greater than 100 cfs. Although this does occur naturally, in the past, UWCD has scheduled delivery of their SWP contract water to keep flows low and not impede downstream land owners' access.

2.19.2.3 Step 3 – Conduct Structured Interviews

The Licensees identified 12 boaters who had indicated they had boated Pyramid reach at least once in the past. Interviews were conducted by phone or by email with those willing and available to participate. Of the 10 interviewed boaters, most said they had boated the reach more than 10 years ago. Most noted that they had boated following storm events, and all indicated they had put-in at Frenchman's Flat, running about six to 10 hours to get through to Blue Point Campground or beyond, and taken-out in Lake Piru. Some boaters discussed several short portages, including some large boulder

fields, log jams, and areas of brush extending heavily into the moving channel. Several noted the geologic setting as extremely interesting, enhancing their trip experiences. In terms of flow levels, most described entering Piru Creek at Frenchman's Flat between 200 and 400 cfs, but in most storms, Fish Creek, Michael Creek, and particularly Agua Blanca Creek contributed to substantial inflows leading some to have thought they entered Lake Piru on flows of 700 cfs or above. Many described the need to put-in at Frenchman's Flat at flows of about 200 cfs to not be overwhelmed by the tributary inflow contributions downstream. One boater noted he had boated Agua Blanca Creek previously. Most found the reach to be a Class III and Class IV level of difficulty, with a leaning toward the Class IV designation due to the one-way committed nature of the venture. None of the boaters indicated hiking out of the canyon was anything they would want to undertake. Rather, each felt it was better to pass through the whole canyon to Lake Piru once entering the creek at Frenchman's Flat. Documentation of the interviews can be found as the associated data file labeled "SSWP_Documentation_of_Interviews_with_Whitewater_boaters".

2.19.2.4 Step 4 – Field Reconnaissance and Site Visit

The Licensees performed three separate field reconnaissance efforts with experienced whitewater boaters to assess current channel conditions, potential put-in and take-out areas, and creek reaches that have favorable boating characteristics. Whitewater boating experts, including those who were interviewed, participated in the field reconnaissance. On August 25, 2018, a site visit was conducted with a small group consisting of one experienced boater who has boated Pyramid reach twice in the past, an experienced boater representative from AW, and the Licensees. The group scouted upper Pyramid reach from Frenchman's Flat to Pyramid Dam. The August 25, 2018 site visit resulted in observations by and discussions between the experienced boater and the AW representative:

- The upper reach was likely a good local boating resource when flows were high enough and boaters had some advance or real-time knowledge of the flow levels.
- The upper Pyramid reach section was likely less known as a potential boating resource prior to this trip. It was also discussed that boaters can access real-time flow information under current conditions through the CDEC gauging system.
- After viewing the creek channel and access conditions, the AW representative and experienced boater concluded the upper reach (alongside the old Golden State Highway) is a good potential boating resource under current conditions when natural flows are high enough.
- There was interest expressed in looking into the feasibility of boating on the scheduled water delivery flows that are typically released in the fall.

Following the field reconnaissance, a controlled flow test was scheduled and field visit arranged with seven experienced boaters, including boaters from the Los Angeles Kayak Club. There was no boating undertaken as this test was arranged in coordination

with AW to observe the conditions related to the potential for boating. The flow observation test coincided with a release of 1,100 AF to UWCD that had been scheduled for late November and early December 2018. On December 2, 2018, DWR began gradually ramping up flow releases to Pyramid reach in order to sustain a peak flow of about 200 cfs for four hours between 10:00 a.m. and 2:00 p.m. on December 7, 2018, for the flow observation test. During the flow observation test, participants were taken to five pre-arranged shoreline locations to evaluate upper Pyramid reach from Pyramid Dam to Frenchman’s Flat relative to its boating condition and potential. As a result of the flow observation test, boaters unanimously concluded boating in the upper reach is feasible with only a few portages. In particular they noted the potential for multiple runs and training opportunities if the flows could be scheduled in advance and released at a rate of between 200 and 250 cfs for several hours during weekend daylight periods.

Subsequent to the December 7, 2018 flow observation test, on January 9 and 10, 2019, experienced boaters and study staff conducted site visits to Pyramid reach; on the first day, from Frenchman’s Flat into the middle of the canyon, and on the second day, from Blue Point Campground to the middle of the canyon. During these field excursions, several areas of channel obstructions were noted; however, the overall assessment was generally positive in terms of judging whether advanced/expert boaters would be able to boat the reach when flows were above 200 cfs from Frenchman’s Flat to Lake Piru.

2.19.3 Associated Data Files

File Name	Data Description	File Type	File Location
20181012_SSWP_PiruCreek_Mapbook	Maps of Pyramid Reach.	PDF	Project website
20180825_Whitewater_Meeting_Materials	Documentation of the August 25, 2018 meeting.	PDF	Project website
20181207_Meeting_Materials	Documentation of the December 7, 2019 observation flow.	PDF	Project website
20190109-10_Meeting_Materials	Documentation of the January 10 – 11, 2019 field reconnaissance.	PDF	Project website
20180000_SSWP_Documentation_of_Interviews_with_Whitewater_boaters	Documentation of interviews conducted via phone and email.	PDF	Project website

2.19.4 Variances from Study Methods, Schedule or Approach, and Unexpected Field Conditions

There were no variances from the FERC-approved Study.

2.19.5 Remaining Work

None; the Study is complete.

2.20 SPECIAL-STATUS RAPTORS STUDY

2.20.1 Completed Work to Date

The Licensees completed Step 1 (Gather Data and Prepare for Field Efforts) and Step 2 (Conduct Special-Status Raptor Surveys). The Licensees conducted wintering bald eagle (*Haliaeetus leucocephalus*) surveys at Pyramid Lake and Quail Lake in December 2017, and January and February 2018. Bald eagle nesting surveys were conducted in March, May, and June 2018. Golden eagle (*Aquila chrysaetos*) occupancy surveys were conducted at Pyramid Lake in January and February 2018, and nesting/incubation surveys were conducted in March, May, and June 2018. The Licensees also conducted burrowing owl (*Athene cunicularia*) surveys at Quail Lake, Lower Quail Canal, the Gorman Creek, West Fork Liebre Gulch and Liebre Gulch arms of Pyramid Lake near Interstate 5, and Castaic Powerplant.

2.20.2 Key Accomplishments and Summary of Findings to Date

The Licensees observed and confirmed bald eagle wintering roost sites at Pyramid Lake and Quail Lake; golden eagle individuals also were observed at both locations. Two adult California condors (*Gymnogyps californianus*) were observed and confirmed flying over Pyramid Lake. California Natural Diversity Database (CNDDDB) forms for the burrowing owl, California condor and golden eagle sightings were submitted in April 2018. The Licensees did not observe suitably sized burrows for burrowing owl in the areas surveyed; therefore, follow-up surveys were determined not to be required, as provided in the FERC-approved study plan. However, an incidental sighting of a burrowing owl near Elderberry Forebay occurred during the Cultural Resources Study effort, near some rip-rap which provided suitable burrowing habitat for this species. No other suitable burrows were observed in other project areas. Other special-status raptor species observed include prairie falcon (*Falco mexicanus*), peregrine falcon (*Falco peregrinus*), Northern harrier (*Circus cyaneus*), and osprey (*Pandion haliaetus*). No nesting special-status raptor species were observed at any of the sites during the survey dates.

Although the turkey vulture is not considered a special-status raptor species, a single turkey vulture nest was observed in the Pyramid Lake area, specifically on Chumash Island, during the February 22, 2018 survey. A single adult turkey vulture was observed perched next to a scrape, with no eggs or hatchlings observed. The nest was not observed to be occupied or in use during subsequent visits.

Two night roosting habitats for wintering bald eagles were documented during the December, January, February, and March 2018 visits. On Pyramid Lake (Winter Roost Site #01), two adult bald eagles and one juvenile bald eagle were observed consistently roosting and foraging out of a stand of bigcone douglas fir trees on a north facing slope adjacent to the lake. At Quail Lake, in Winter Roost Site #02, one bald eagle was consistently roosting in a large cottonwood tree on the north side of the lake adjacent to the water's edge. This eagle was identified as the same individual in all four of the

winter observations, due to an inflammation in one eye (i.e., pox) that made it recognizable.

2.20.3 Associated Data Files

File Name	Data Description	File Type	File Location
_20180228_dwr_sswp_p2426_California_Condor_Pyramid_Lake_Photos	Photolog of February 28, 2018 citing of adult California Condors above Pyramid lake	PDF	Project Website
20180222_dwr_sswp_p2426_California_Condor_observation	Google Earth file with location of initial California Condor siting	KMZ	Available upon request
SSWP_Raptor_summary_table	Table summary of raptor observations	XLSX	Project Website
CNDDDB_FieldSurveyForm_B_UOW01_Rochon	CNDDDB form of burrowing owl observed at Elderberry Forebay	PDF	Available upon request
CNDDDB_FieldSurveyForm_C_ACO_Carnahan_Davis	CNDDDB form of California Condor observed at Pyramid Lake	PDF	Available upon Request
CNDDDB_FieldSurveyForm_G_OEA_01_Holson_Davis	CNDDDB form of Golden Eagle observed at Lower Quail Canal	PDF	Available upon Request
CNDDDB_FieldSurveyForm_G_OEA_02_Holson_Davis	CNDDDB form of Golden Eagle observed at Pyramid Lake	PDF	Available upon request
Dec. 2017 - June 2018 Special-Status Raptor Sitings	Google Earth file with location of Special-status Raptor observations	KMZ	Available upon request
12.17.SSWP_Raptor_Data_Forms	Set of field data forms completed for the 12.19.18 and 12.20.18 survey dates	PDF	Project Website
01.18.SSWP_Raptor_Data_Forms	Set of field data forms completed for the 01.09.18 and 01.10.18 survey dates	PDF	Project Website
02.18.SSWP_Raptor_Data_Forms	Set of field data forms completed for the 02.22.18 and 02.23.18 survey dates	PDF	Project Website
03.18.SSWP_Raptor_Data_Forms	Set of field data forms completed for the 03.15.18 and 03.16.18 survey dates	PDF	Project Website
05.18.SSWP_Raptor_Data_Forms	Set of field data forms completed for the 05.09.18 and 05.10.18 survey dates	PDF	Project Website
06.18.SSWP_Raptor_Data_Forms	Set of field data forms completed for the 06.12.18 and 06.13.18 survey dates	PDF	Project Website

2.20.4 Variances from Study Methods, Schedule or Approach, and Unexpected Field Conditions

There were no variances in Study Methods, Schedule, or Approach from the FERC-approved Study Plan.

2.20.5 Remaining Work

None; the Study is complete.

2.21 PYRAMID REACH BENTHIC MACROINVERTEBRATES STUDY

2.21.1 Completed Work to Date

The Study is complete. As required by the FERC-approved Study Plan, the Licensees completed all three steps of the Study: Steps 1 and 2 (Identify Sampling Segment Locations and Collect SWAMP Data), and Step 3 (Laboratory Processing). The Licensees selected three benthic macroinvertebrate (BMI) sampling sites: BMI Sampling Site 1 is located in the 2 mile-long section of Pyramid reach between Pyramid Dam and the concrete structure upstream of Frenchman’s Flat; BMI Sampling Site 2 is located within a mile downstream of Frenchman’s Flat, in the stream segment from the concrete structure upstream of Frenchman’s Flat to the confluence of Fish Creek; and BMI Sampling Site 3 is located upstream of the confluence with Agua Blanca Creek within the stream segment from Fish Creek to the normal maximum water surface elevation of Lake Piru (refer to Table 2.21-1). Sites were selected in collaboration with Resource Agencies, including a site visit on May 17, 2018. After receiving feedback from the agencies, the Licensees agreed to relocate two of the preliminary sampling sites (Site 1 and Site 3) from their original location. The Licensees filed a letter with FERC on August 1, 2018, describing these changes and the rationale for the new locations. FERC agreed with the selection of BMI Sampling Sites 1, 2, and 3 in the Study Plan Determination dated September 7, 2018.

Table 2.21-1. Pyramid Reach Benthic Macroinvertebrate Sampling Locations

Site	Upstream Coordinates	Downstream Coordinates	Site Description
BMI Sampling Site 1 (DS of Pyramid Dam)	34.635371° N, - 118.75689° W	34.63489° N, - 118.75497° W	Site 1 begins from River Mile (RM) 0.94 to RM 1.04 and extends 150 meters (m) long
BMI Sampling Site 2 (DS of Frenchman's Flat)	34.61117° N, - 118.74920° W	34.61032° N, - 118.75035° W	Site begins from RM 3.3 to RM 3.4 and extends 150 m long
BMI Sampling Site 3 (US of Agua Blanca Creek)	34.54669° N, - 118.77316° W	34.54669° N, - 118.77160° W	Site begins from RM 16.01 to RM 16.10 and extends 150 m long

Key:
DS = downstream
m = meters
US = upstream

BMI and habitat data were collected from June 25 to June 27, 2018, using the California State Water Resources Control Board's Surface Water Ambient Monitoring Program (SWAMP) Protocol (Ode et al. 2016). Sampling followed the reach-wide benthos methods for documenting and describing BMI assemblages and physical habitat. All sampling sites were 150 m in length with 11 "main" transects (A-K) interspersed with 10 "inter-transects," all of which were arranged perpendicularly to the primary direction of stream flow. Basic water quality parameters were collected, and physical habitat were characterized at each site. Data were collected at each transect pertaining to channel characteristics, substrate composition, riparian vegetation, instream habitat complexity, human influence, channel habitats, bank stability, and canopy cover.

BMI samples were collected at the 11 "main" transects by rubbing cobble and boulder substrates, and disturbing finer substrate upstream of a D-frame kicknet fitted with a 0.02-inch (in) diameter mesh net. Samples were preserved in 95 percent ethanol and were labeled to form a single composite sample for each sampling site. A replicate sample was collected at BMI Sampling Site 1 for quality assurance/quality control procedures per the SWAMP protocol.

Laboratory processing of BMI samples was conducted by EcoAnalysts, a qualified taxonomy laboratory, which complies with requirements outlined in the SWAMP protocol. The California Stream Condition Index (CSCI) scores were calculated using the BMI data. The California Department of Fish and Wildlife Aquatic Bioassessment Laboratory (ABL) conducted an external quality control review of sample identification completed by EcoAnalysts.

The CSCI, developed by the State Water Resources Control Board, is California's new statewide assessment tool that translates BMI data into a numerical measurement of stream health. The CSCI uses a large set of representative data to better account for a wider range of ecological variability (Rehn et al. 2015). Scores are calculated using two indices, a multi-metric index (MMI) and observed-to-expected (O/E) index. MMI scores reflect ecological structure and function and O/E scores measure taxonomic completeness (Rehn et al. 2015). The O/E index compares the observed versus expected BMI taxa and measures the biological condition of a site. Expected taxa are calculated using a statistical model. A stream's biological condition is quantified by the variance of the observed versus expected taxa. Degradation of a biological condition can be quantified by a loss of expected native taxa (Rehn et al. 2015). The MMI index combines several BMI metrics into a single measurement of biological condition. The metrics used to calculate MMI were chosen for their responsiveness to human disturbance and ability to differentiate between healthy and degraded conditions (Rehn et al. 2015).

The mean CSCI score of reference sites is 1. CSCI scores greater than 1 indicate more complex ecological functioning and taxonomic richness than predicted. As a stream's CSCI score approaches 0, it represents a stream's increased variance from reference conditions and a degradation of the stream's biological conditions (Rehn et al 2015). To ensure CSCI could be used as a statewide assessment tool, four CSCI thresholds were created (Table 2.21-2) to classify biological condition.

Table 2.21-2. CSCI Score Interpretation

CSCI Score	Interpretation
≥ 0.92	Likely Intact Conditions
0.91 to 0.81	Possibly Altered Conditions
0.79 to 0.63	Likely Altered
≤ 0.62	Very Likely Altered

Key:

≥ = greater than or equal to

≤ = less than or equal to

2.21.2 Key Accomplishments and Summary of Findings to Date

Table 2.21-3 and Table 2.21-4 summarize the sampling site characteristics and BMI results for BMI Sampling Sites 1, 2 and 3, respectively.

The CSCI score for the uppermost reach (BMI Sampling Site 1) fell into “likely altered” status for both the original sample and replicate sample (0.75 and 0.74, respectively). The CSCI score for BMI Sampling Site 2 was 1.07, indicating a “likely intact” status. BMI Sampling Site 3 scored 0.88, indicating a “possibly altered” status.

The ABL conducted an external quality control review of the BMI sample identification completed by EcoAnalysts. ABL calculated 11 Measurement Quality Objectives (MQO) from the BMI samples they checked. SWAMP provides standards for five selected MQOs where significant error in the MQO relates directly to errors in BMI metrics. If the designated MQO values exceed SWAMP standards, corrective action is necessary. EcoAnalyst’s BMI identification data were less than SWAMP standards for MQO values for all listed variables (Table 2.21-5) (Rehn et al. 2015).

Table 2.21-3. Pyramid Reach BMI Sampling Site Characteristics

Category	Metric	Site 1 (Downstream of Pyramid Dam)	Site 2 (Downstream of Frenchman's Flat)	Site 3 (Upstream of Agua Blanca Creek)
Water Quality	Water Temperature (°C)	21.23	24.72	22.15
	Dissolved Oxygen (mg/L)	9.35	7.97	7.44
	Specific Conductivity (µS/cm)	555	867	1056
	pH	7.97	7.94	7.99
	Reach Length (m)	150	150	150
	Flow (cfs)	2.6	1.3	0.3
Site Characteristics	Habitat Composition (% of Site)			
	Cascade/Falls	6	2	0
	Rapid	0	0	0
	Riffle	14	35	0
	Run	22	24	10
	Glide	0	5	48
	Pool	58	36	43
	Dry	0	0	0
	Dominant Thalweg Composition (% of Site)			
	Bedrock, Smooth	1	0	0
	Bedrock, Rough	0	3	0
	Boulder, Large	16	7	0
	Boulder, Small	30	16	1
	Cobble	15	5	2
	Gravel, Course	6	10	22
	Gravel, Fine	3	6	48
	Sand	5	11	13
	Fines	24	39	14
	Wood	1	2	0
Other	0	2	0	

Table 2.21-3. Pyramid Reach BMI Sampling Site Characteristics (continued)

Category	Metric	Site 1 (Downstream of Pyramid Dam)	Site 2 (Downstream of Frenchman's Flat)	Site 3 (Upstream of Agua Blanca Creek)
Transect Characteristics	Channel Conditions			
	Average Sample Plot Depth (cm)	20.3	14.6	9.9
	Average Wetted Width (m)	6.3	2.8	3.7
	Average Bankful Width (m)	10.3	7.4	9.3
	Average Bankful Height (m)	0.6	0.7	0.4
	Riparian Canopy Cover (%)	79	88	63

Key:

% = percent

°C = degrees Celsius

cfs = cubic feet per second

cm = centimeters

m = meter

mg/L = milligrams/liter

µS/cm = microsiemens per centimeter

Table 2.21-4. BMI Summary Statistics

Metric	Site 1 (Downstream of Pyramid Dam)	Site 1 (Downstream of Pyramid Dam) Replicate	Site 2 (Downstream of Frenchman's Flat)	Site 3 (Upstream of Agua Blanca Creek)
MMI Score	0.593	0.573	0.863	0.747
Clinger Percent Taxa	31.9	34.7	51.5	30.6
Clinger Percent Taxa predicted	55.1	55.1	55.3	56.5
Coleoptera Percent Taxa	0.0	0.0	11.3	14.2
Coleoptera Percent Taxa predicted	10.9	10.9	11.1	14.0
Taxonomic Richness	21.05	18.5	33.55	25.75
Taxonomic Richness predicted	29.2	29.2	29.3	30.1
EPT Percent Taxa	41.8	43.0	36.7	34.2
EPT Percent Taxa predicted	41.6	41.6	41.4	40.6
Shredder Taxa	0	0	0	1
Shredder Taxa predicted	1.63	1.63	1.61	1.53
Intolerant Percent	5.4	1.6	2.5	1.7
Intolerant Percent predicted	14.9	14.9	14.7	13.2

Key:

EPT = Ephemeroptera, Plecoptera, Trichoptera

MMI = multimetric index

Table 2.21-5. MQO Values and SWAMP Standards

Variable Name	Value	SWAMP Standard
Absolute Recount Error Rate	1.33 %	< 10%
Taxa ID Error Rate	6.56 %	< 10%
Individual ID Error Rate	1.33 %	< 10%
Lower Taxonomic Resolution Individual Error Rate	1.16 %	< 10%
Lower Taxonomic Resolution Count Error Rate	1.64 %	< 10%

Key:
% = percent
< = less than
ID = identification

There were no incidental observations of special-status species made during this study.

2.21.3 Associated Data Files

File Name	Data Description	File Type	File Location
Pyramid_reach_BMI_Taxonomy_Results	BMI Taxonomy Results	Microsoft Excel	Project Website
Pyramid_reach_BMI_QAQC_Taxonomy_Review	EcoAnalysts Quality Control Review Results	Microsoft Excel	Project Website
Pyramid_reach_BMI_Physical_Habitat_Data	Water chemistry and physical habitat data	PDF	Project Website
Pyramid_reach_BMI_Sampling_Site_Map	Maps with BMI and Stream Fish sites	PDF	Project Website

Key:
BMI = benthic macroinvertebrate

2.21.4 Variances from Study Methods, Schedule or Approach, and Unexpected Field Conditions

There were no variances in Study Methods, Schedule, or Approach from the FERC-approved Study Plan.

2.21.5 Remaining Work

None; the Study is complete.

2.22 PYRAMID LAKE TRIBUTARIES FISH PASSAGE BARRIERS STUDY

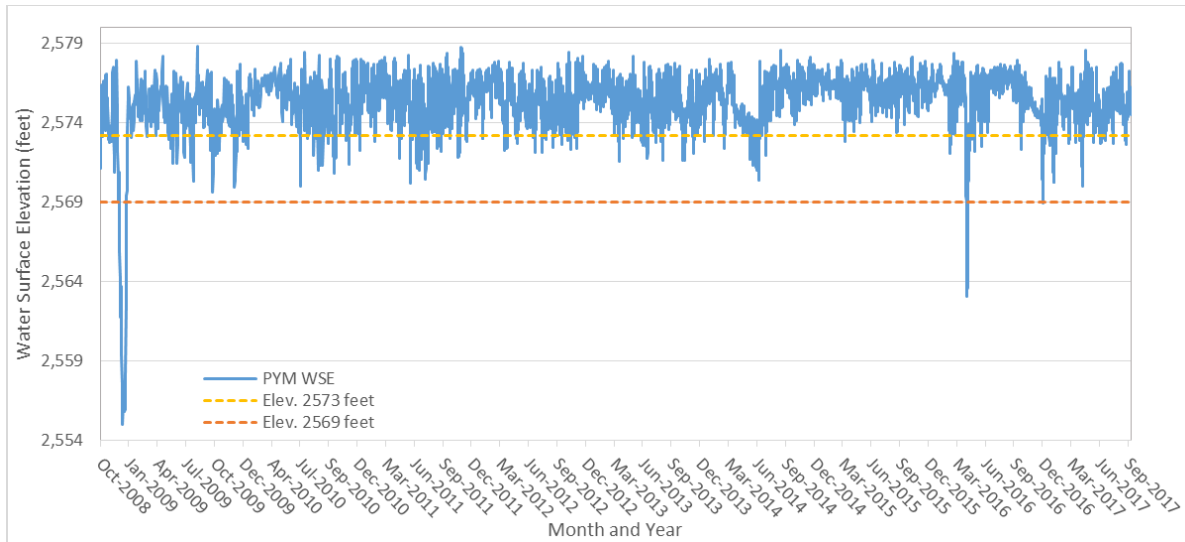
2.22.1 Completed Work to Date

The Study is complete. As required by the FERC-approved Study Plan, the Licensees have completed Step 1 (Complete Fish Passage Assessment), which is the only step in the Study. The Licensees evaluated Pyramid Lake operations and annual fluctuations in water surface elevations (WSE). For Piru and Gorman creeks and Carlos Canyon, the Licensees surveyed from the WSE at the time of the survey to the normal maximum water surface elevation (NMWSE) of the reservoir utilizing Real-Time Kinematic (RTK) Global Positioning System (GPS) survey equipment to measure channel bed and WSE; developed detailed longitudinal profiles; recorded dominant and sub-dominant substrate composition; and took photographs of representative habitat in each tributary. The fieldwork was conducted in July 2018, as recommended by the NMFS in its letter dated June 21, 2018. The Licensees used these data to assess the occurrence of barriers to upstream passage of rainbow trout (*Oncorhynchus mykiss*) in the surveyed area. As defined in the FERC-approved Study Plan, an upstream fish barrier is a leaping barrier, a shallow water barrier, or a velocity barrier for any life stage of rainbow trout.

2.22.2 Key Accomplishments and Summary of Findings to Date

Generally, the NMWSE of Pyramid Lake is 2,578 feet. Current operating agreements limit reservoir WSE fluctuations to the upper 19 feet of the reservoir. Actual Pyramid Lake WSEs typically fluctuate within the upper 9 feet of the reservoir between 2,578 feet and 2,569 feet. Further review of WSE data from the Pyramid Lake gage (PYM) during the nine-year period from October 2, 2008 to October 1, 2017, showed that 95 percent of the time, the reservoir's WSE was within 5 feet of the NMWSE, and on only two occasions was the WSE lower than 2,569 feet: (1) between December 3, 2008 and December 25, 2008; and (2) between April 24, 2016 and April 29, 2016 (Figure 2.22-1). Both instances were due to outages.

Surveyors completed channel topography mapping and other data collection efforts on July 24, and July 25, 2018. All analyses addressed below are discussed in the North American Vertical Datum of 1988 (NAVD 88) per the FERC-approved Study Plan. The NMWSE of 2,578 feet discussed above and described in the PAD and FERC-approved Study Plan references the National Geodetic Vertical Datum of 1929 and requires a VERTCON shift of 2.825 feet to NAVD 88. The shifted NMWSE is 2,580.8 feet NAVD 88. Reservoir WSE obtained from the PYM gage through the month of July 2018 averaged approximately 2,577 feet NAVD 88, which is 3.8 feet below NMWSE. During the fieldwork, Pyramid Lake was approximately 1.5 feet below NMWSE. Although not required by the FERC-approved Study Plan, because the tributaries were low gradient and to gather additional information, surveyors mapped the wetted channel below the WSE where reasonable and safe to do so, which was to a depth of approximately 2.5 feet. Results for each tributary are provided below.



Key:
 Elev. = Elevation
 PYM = Pyramid Lake gage
 WSE = water surface elevation

Figure 2.22-1. Pyramid Lake Water Surface Elevations (National Geodetic Vertical Datum 29) from October 2, 2008 to October 1, 2017

2.22.2.1 Piru Creek

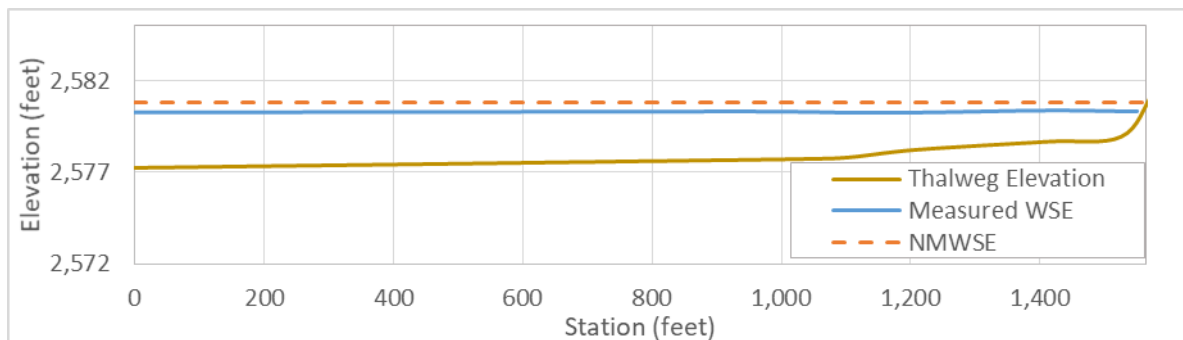
No barriers to upstream fish passage were identified in the area surveyed in Piru Creek. Surveyors mapped approximately 1,564 feet of the thalweg, from a low of 2,577.2 feet to a high of 2,580.8 feet NAVD 88. During the survey, the stream channel was dry from the WSE to the NMWSE. Approximately 1,537 feet were mapped in the wet, and 27 feet in the dry. The average gradient of the entire surveyed reach was 0.2 percent, with a high gradient of 4.8 percent at station 1,525 near the NMWSE. Sand was the exclusive substrate through all of the survey area. In the wetted portion of the channel surveyed, stream width was approximately 35 feet to 95 feet; whereas in the dry portion of the channel surveyed, stream width was estimated to be 2 feet to 5 feet. Much of the survey area in the wet was bordered by thick riparian vegetation consisting of willow (*Salix* sp.) and alder (*Alnus* sp.) with common reed (*Phragmites australis*) and other hydrophilic plants along the margins. The dry part of the survey area was bordered by thick patches of willow. No fish were observed in the wetted area surveyed. A map detailing the area surveyed is provided in Figure 2.22-2, below. A longitudinal profile of Piru Creek, including the measured WSE for the section of the stream surveyed, is presented in Figure 2.22-3. Representative photographs of the area surveyed in the wet and in the dry are provided in Figure 2.22-4 and Figure 2.22-5, respectively.



Note:
 The majority of the section of stream surveyed (from Station 0 to Station 1,537) was mapped in the wet with a maximum depth of about 2.5 feet.

Key:
 NMWSE = normal maximum water surface elevation
 RTK = Real-Time Kinematic
 WSE = water surface elevation

Figure 2.22-2. Piru Creek Area Surveyed on July 24, 2018, Including Thalweg Centerline and Longitudinal Profile Stationing



Key:
 NMWSE = normal maximum water surface elevation
 WSE = water surface elevation

Figure 2.22-3. Piru Creek Longitudinal Profile, Including Measured Water Surface Elevation for Section of Stream Surveyed



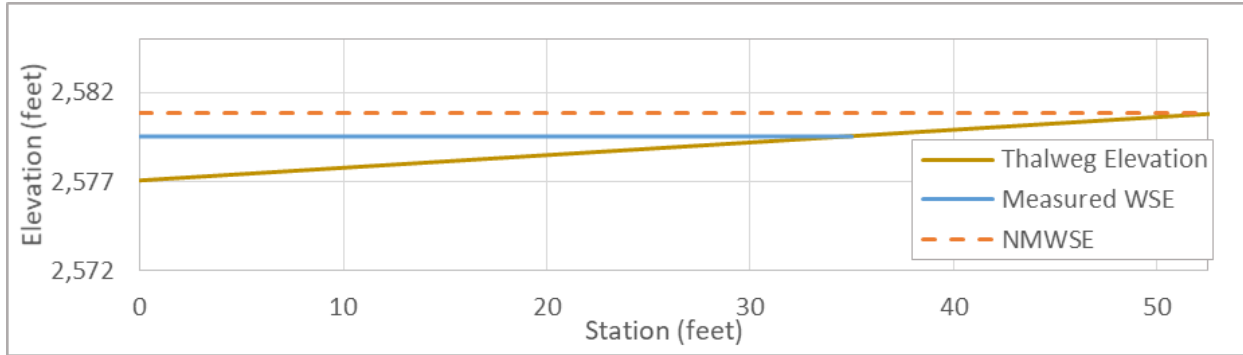
Figure 2.22-4. Representative Photograph Showing the Section of Piru Creek Below Pyramid Lake's Normal Maximum Water Surface Elevation Mapped in the Wet



Figure 2.22-5. Representative Photograph Showing the Section of Piru Creek Below Pyramid Lake's Normal Maximum Water Surface Elevation Mapped in the Dry

2.22.2.2 Carlos Canyon

No barriers to upstream fish passage were identified in the area surveyed in Carlos Canyon. Surveyors mapped 52.5 feet of the thalweg below the reservoir NMWSE, from a low of 2,577.1 feet NAVD 88. Approximately 34.2 feet were mapped in the wet, and 18.3 feet in the dry. The average gradient was 7.1 percent and remained constant. Sand was the exclusive substrate within the survey area. During the survey, the stream channel was dry from the WSE to the NMWSE. No fish were observed in the wet area surveyed. Figure 2.22-6 shows the Carlos Canyon longitudinal profile, including the measured reservoir WSE. Representative photographs of the area surveyed in the wet and in the dry are provided in Figure 2.22-7 and Figure 2.22-8, respectively.



Key:
NMWSE = normal maximum water surface elevation
WSE = water surface elevation

Figure 2.22-6. Carlos Canyon Longitudinal Profile Including Measured Reservoir Water Surface Elevation



Figure 2.22-7. Representative Photograph Showing the Section of Carlos Canyon Below Pyramid Lake's Normal Maximum Water Surface Elevation Mapped in the Wet



Figure 2.22-8. Representative Photograph Showing the Section of Carlos Canyon Below Pyramid Lake's Normal Maximum Water Surface Elevation Mapped in the Dry

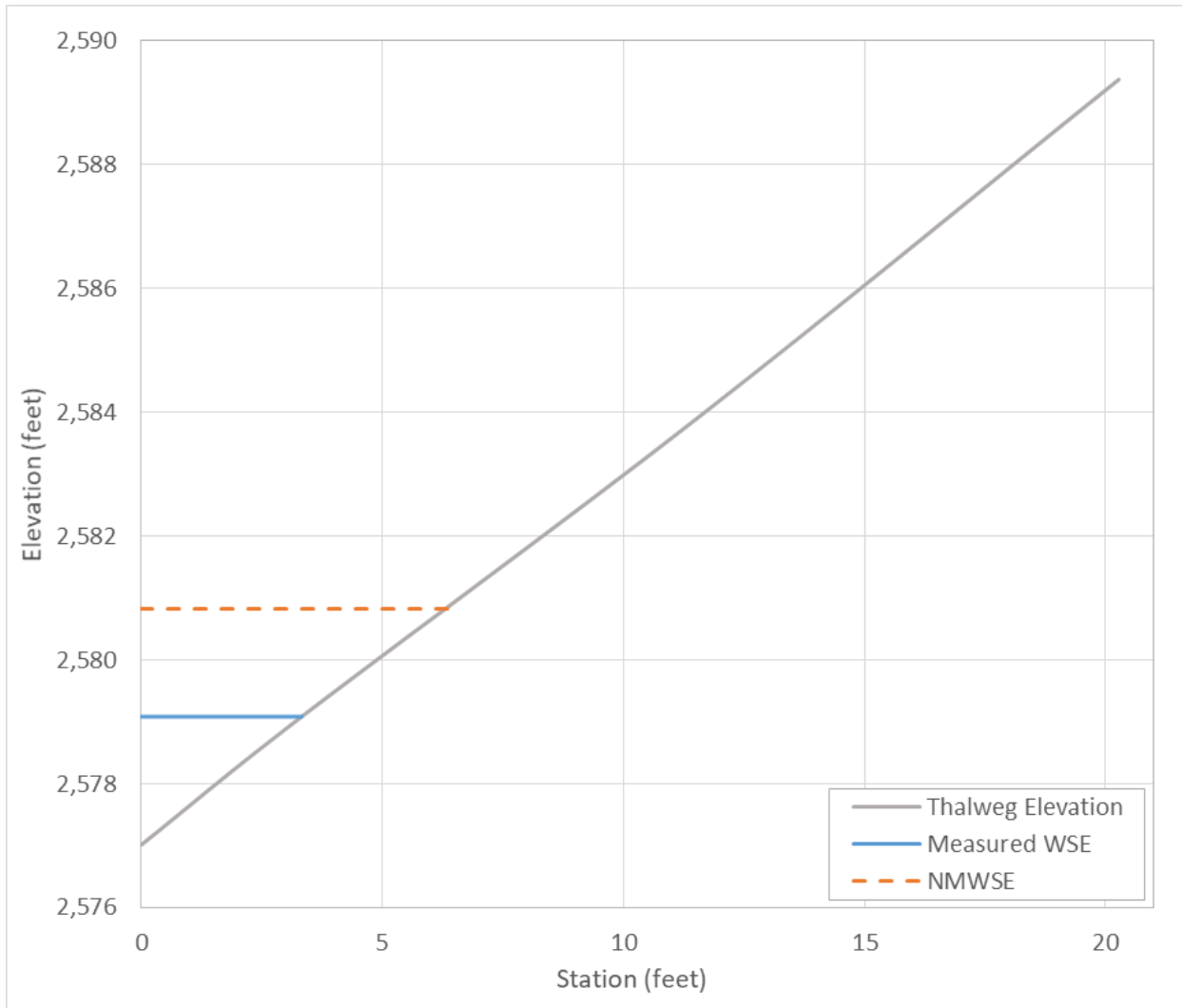
2.22.2.3 Gorman Creek

A single barrier to upstream fish passage was identified in the area surveyed in Gorman Creek. The barrier was a man-made 12-foot-high, sloped concrete drop structure located at the mouth of Gorman Creek to Pyramid Lake (Figure 2.22-9). Surveyors mapped in the wet approximately 6 feet of the thalweg from a low of 2,577 feet to a high of 2,580.8 feet NAVD 88 (Figure 2.22-10); none of the stream was mapped in the dry. The average gradient was 60.9 percent and it remained constant. Within 1,600 feet of Pyramid Lake, the stream channel is an engineered concrete structure. Approximately

0.5 cfs of stream flow was present in the tributary at the time of the survey. This flow fanned out over the drop structure and RTK GPS measured WSE is not discernable graphically from the channel thalweg. No fish were observed.



Figure 2.22-9. Representative Photograph Showing the Section of Gorman Creek below Pyramid Lake's Normal Maximum Water Surface Elevation Mapped in the Wet



Key:
 NMWSE = normal maximum water surface elevation
 WSE = water surface elevation

Figure 2.22-10. Gorman Creek Longitudinal Profile, Including Measured Reservoir Water Surface Elevation

2.22.2.4 Incidental Observations

Evidence of recent bear activity was observed during the surveys of Piru Creek and Carlos Canyon. At Piru Creek, this evidence appeared to be a week old. At Carlos Canyon, this evidence appeared to be a day or two old. There were no other incidental observations.

2.22.3 Associated Data Files

File Name	Data Description	File Type	File location
PYM_Gage_Data_and_Source_Figure_2008_through_2017	Nine years of reservoir gage WSE data obtained from CDEC	Excel	Project Website
PYM_Gage_Data_and_Source_Figure_July_24_and_25_2018	Two days of reservoir gage WSE data obtained from CDEC	Excel	Project Website
Pyramid_Lake_Tribs_Survey_Data_Export_and_Longitudinal_Profiles	RTK survey data and longitudinal profile figures	Excel	Project Website

Key:
 CDEC = California Data Exchange Center
 RTK = Real-Time Kinematic
 WSE = water surface elevation

2.22.4 Variances from Study Methods, Schedule or Approach, and Unexpected Field Conditions

There were no variances to the Study Plan, as modified by FERC’s June 14, 2017 and September 7, 2018 Study Plan Determinations.

2.22.5 Remaining Work

None; the Study is complete.

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3.0 LICENSEES' PROPOSED STUDY MODIFICATIONS AND NEW STUDIES

This section describes any Licensee-proposed modifications to FERC-approved studies in the Study Plan Determinations and Licensees' proposed new studies.

3.1 LICENSEES' PROPOSED STUDY MODIFICATIONS

With regard to requests for a study modification related to the Updated Study Report, 18 CFR § 5.15(f) states in part:

Any proposal to modify an ongoing study must be accompanied by a showing of good cause why the proposal should be approved as set forth in paragraph (d) of this section.

Paragraph (d) of Section 5.15 states:

Criteria for modification of approved study. Any proposal to modify an ongoing study pursuant to paragraphs (c)(1)-(4) of this section must be accompanied by a showing of good cause why the proposal should be approved, and must include, as appropriate to the facts of the case, a demonstration that:

- (1) Approved studies were not conducted as provided for in the approved study plan; or
- (2) The study was conducted under anomalous environmental conditions or that environmental conditions have changed in a material way.

The FERC-approved studies have not been conducted under anomalous conditions, nor have environmental conditions changed in a material way since FERC issued its Study Plan Determinations.

The studies have been performed in substantial conformance with the FERC-approved study plans. As described above, 8 of the 22 studies have no variances to the FERC-approved study plan, and 14 of the studies had one or more variances. Nine of the studies have variances related to schedule. Refer to the "Variances from Study Methods, Schedule or Approach, and Unexpected Field Conditions" discussion for each study in Section 2.0 of this USR for details regarding the variances from the FERC-approved study plans. As described above for each of these studies, these variances do not affect the overall information to be developed by the study. Therefore, at this time, the Licensees do not propose modifications to any of the 22 FERC-approved Relicensing Studies.

3.2 LICENSEES' PROPOSED NEW STUDIES

With regard to requests for a new study related to the Updated Study Report, 18 CFR § 5.15(f) states in part:

Any proposal for new information gathering or studies is subject to paragraph (e) of this section except that the proponent must demonstrate extraordinary circumstances warranting approval.

Paragraph (e) of Section 5.15 states:

Criteria for new study. Any proposal for new information gathering or studies pursuant to paragraphs (c)(1)-(4) of this section must be accompanied by a showing of good cause why the proposal should be approved, and must include, as appropriate to the facts of the case, a statement explaining:

- (1) Any material changes in the law or regulations applicable to the information request;
- (2) Why the goals and objectives of any approved study could not be met with the approved study methodology;
- (3) Why the request was not made earlier;
- (4) Significant changes in the project proposal or that significant new information material to the study objectives has become available; and
- (5) Why the new study request satisfies the study criteria in § 5.9(b).

Section 5.9(b) study criteria are:

- (1) Describe the goals and objectives of each study proposal and the information to be obtained;
- (2) If applicable, explain the relevant resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied;
- (3) If the requester is not a resource agency, explain any relevant public interest considerations in regard to the proposed study;
- (4) Describe existing information concerning the subject of the study proposal, and the need for additional information;
- (5) Explain any nexus between project operations and effects (direct, indirect, and/or cumulative) on the resource to be studied, and how the study results would inform the development of license requirements;
- (6) Explain how any proposed study methodology (including any preferred data collection and analysis techniques, or objectively quantified information, and a schedule including appropriate field season(s) and the duration) is consistent with generally accepted practice in the scientific community or, as appropriate, considers relevant tribal values and knowledge; and

- (7) Describe considerations of level of effort and cost, as applicable, and why any proposed alternative studies would not be sufficient to meet the stated information needs.

The Licensees are not aware of any material changes in laws or regulations, significant changes in the Project or significant new information that has come to light since FERC issued its Study Plan Determinations that would warrant a new study.

Therefore, at this time, the Licensees do not propose any new information gathering or new studies.

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4.0 ELECTION TO FILE A DRAFT LICENSE APPLICATION

In accordance with 18 CFR § 5.16(c), the Licensees advise FERC that they elect to file a Draft License Application.

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5.0 UPDATED STUDY REPORT MEETING

Pursuant to 18 CFR § 5.15(c)(2), the Licensees will hold a meeting with interested parties and FERC staff within 15 days following the filing of this USR. The purpose of this meeting is for the Licensees to answer questions about the results and status of the Relicensing Studies as described in this USR and to discuss proposals, if any, to modify FERC-approved studies or add new studies.

The Relicensing Participants agreed that the Licensees will hold the USR meeting as follows:

DATE: May 29, 2019

TIME: 9:00 am – 1:00 pm

LOCATION: Hilton Garden Inn, 199 N. 2nd Avenue, Arcadia, California 91006

A meeting agenda is provided below:

- Introductions
- Meeting Purpose
- Safety Moment
- Review of Relicensing Schedule
- Brief Overview of Study Progress
- Data Availability
- Study Status
- Variances
- Completed Studies:
 - Fish Entrainment Risk Assessment
 - Quail Lake Fisheries Assessment
 - Pyramid Reach Fish Populations
 - Special-Status Aquatic Amphibians and Semi-Aquatic Snakes
 - Special-Status Terrestrial Wildlife Species–California Wildlife Habitat Relationships
 - ESA-Listed Amphibians – California Red-legged Frog

- Recreation Facilities Demand Analysis and Condition Assessment
- Indicators of Hydrologic Alteration
- Scenic Integrity
- Water Quality and Temperature
- Whitewater Boating
- Special-Status Raptors
- Pyramid Lake Tributaries Fish Passage Barriers
- Aquatic Invasive Species
- ESA – Terrestrial Wildlife Species – California Wildlife Habitat Relationships
- Pyramid Reach Benthic Macroinvertebrates
- Studies In-Progress:
 - ESA-Listed Plants
 - ESA-Listed Riparian Bird Species, Southwestern Willow Flycatcher, Least Bell's Vireo, and Yellow-billed Cuckoo Riparian Habitat Evaluations
 - Botanical Resources
 - Non-Native Invasive Plants
 - Cultural Resources
 - Tribal Resources
- Study Progress Questions
- Plan to Prepare and File an USR Meeting Summary
- Adjourn

Within 15 days following the USR meeting, the Licensees will file a Meeting Summary with FERC. The summary will highlight the topics discussed at the meeting and identify changes, if any, to the Licensees' proposed modifications to the FERC-approved studies or new studies described in this USR. The Meeting Summary is not intended to be a meeting transcript or to characterize each party's position on a topic.

6.0 REFERENCES CITED

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