



Office of
Energy
Projects

March 2015

FERC/DEIS—0259

**DRAFT ENVIRONMENTAL IMPACT STATEMENT
FOR HYDROPOWER LICENSES**

Merced River Hydroelectric Project—FERC Project No. 2179-043—California

Merced Falls Hydroelectric Project—FERC Project No. 2467-020—California



Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
888 First Street, NE
Washington, D.C. 20426

March 2015

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FEDERAL ENERGY REGULATORY COMMISSION

WASHINGTON, D.C. 20426

OFFICE OF ENERGY PROJECTS

To the Agency or Individual Addressed:

Reference: Draft Environmental Impact Statement

Attached is the draft environmental impact statement (draft EIS) for the Merced River Hydroelectric Project No. 2179) and the Merced Falls Hydroelectric Project No. 2467). The Merced River Project is located on the main stem of the Merced River in Mariposa County, about 23 miles northeast of the city of Merced, California. It occupies 3,154.9 acres of federal land administered by the U.S. Department of Interior, Bureau of Land Management (BLM) as part of the Sierra Resource Management Area. The Merced Falls Project is located on the Merced River on the border of Merced and Mariposa Counties, California. It occupies approximately 1.0 acre of federal lands administered by BLM.

This draft EIS documents the view of governmental agencies, non-governmental organizations, affected Indian tribes, the public, the license applicants, and Federal Energy Regulatory Commission (Commission) staff. It contains staff evaluations of the applicants' proposals and the alternatives for relicensing the Merced River and Merced Falls Hydroelectric Projects.

Before the Commission makes licensing decisions, it will take into account all concerns relevant to the public interest. The draft EIS will be part of the record from which the Commission will make its decisions. The draft EIS was sent to the U.S. Environmental Protection Agency and made available to the public on or about April 15, 2015.

Copies of the draft EIS are available for review in the Commission's Public Reference Branch, Room 2A, located at 888 First Street, N.E., Washington D.C. 20426. The draft EIS also may be viewed on the Internet at www.ferc.gov/docs-filing/elibrary.asp. Please call (202) 502-8222 for assistance.

Any comments should be filed by May 29, 2015. Comments may be filed electronically via the Internet. See 18 Code of Federal Regulations 385.2001(a)(1)(iii) and the instructions on the Commission's web site: <http://www.ferc.gov/docs-filing/efiling.asp>. Commenters can submit brief comments up to 6,000 characters, without prior registration, using the eComment system at <http://www.ferc.gov/docs-filing/ecomment.asp>. You must include your name and contact information at the end of your comments. For assistance, please contact FERC Online Support. Although the Commission strongly encourages electronic filing, documents may also be paper-filed. To paper-file, mail an original and five copies to: Kimberly D. Bose, Secretary, Federal Energy Regulatory Commission, 888 First Street, NE, Washington, DC 20426.

Attachment: Draft Environmental Impact Statement

COVER SHEET

- a. Title: Relicensing the Merced River Hydroelectric Project, FERC Project No. 2179, and the Merced Falls Hydroelectric Project, FERC Project No. 2467
- b. Subject: Draft Environmental Impact Statement
- c. Lead Agency: Federal Energy Regulatory Commission
- d. Abstract:

The Merced River Project (FERC No. 2179-043) is located in Mariposa County, California. The existing project affects 3,154.9 acres of federal land administered by the U.S. Department of the Interior, Bureau of Land Management (BLM). It generates an average of about 387 gigawatt-hours (GWh) of energy annually.

The Merced Irrigation District (Merced ID) proposes to implement measures to protect and enhance environmental conditions. Merced ID proposes no new capacity and no new construction at the project.

The staff's recommendation is to relicense the project as proposed, with certain modifications, and additional measures recommended by the agencies.

The Merced Falls Project (FERC No. 2467-020) is located on the border of Merced and Mariposa Counties, California. It occupies 1.0 acre of federal land administered by BLM, and generates an average of about 14.4 GWh of energy annually.

Pacific Gas & Electric (PG&E) proposes to implement measures to protect and enhance environmental conditions. PG&E proposes no new capacity and no new construction at the project.

The staff's recommendation is to relicense the project as proposed, with certain modifications, and additional measures recommended by the agencies.
- e. Contact:

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- f. Transmittal: This draft environmental impact statement to relicense the Merced River and Merced Falls Hydroelectric Projects is being made available for public comment on or about April 15, 2015, as required by the National Environmental Policy Act of 1969¹ and the Commission's Regulations Implementing the National Environmental Policy Act (18 CFR, Part 380).
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¹ National Environmental Policy Act of 1969, amended (Pub. L. 91-190, 42 U.S.C. 4321-4347, January 1, 1970, as amended by Pub. L. 94-52, July 3, 1975, Pub. L. 94-83, August 9, 1975, and Pub. L. 97-258, §4(b), September 13, 1982).

FOREWORD

The Federal Energy Regulatory Commission (Commission), pursuant to the Federal Power Act (FPA)² and the U.S. Department of Energy Organization Act³ is authorized to issue licenses for up to 50 years for the construction and operation of non-federal hydroelectric development subject to its jurisdiction, on the necessary conditions:

That the project adopted...shall be such as in the judgment of the Commission will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, for the improvement and utilization of water-power development, for the adequate protection, mitigation, and enhancement of fish and wildlife (including related spawning grounds and habitat), and for other beneficial public uses, including irrigation, flood control, water supply, and recreational and other purposes referred to in section 4(e)...⁴

The Commission may require such other conditions not inconsistent with the FPA as may be found necessary to provide for the various public interests to be served by the project.⁵ Compliance with such conditions during the licensing period is required. The Commission's Rules of Practice and Procedure allow any person objecting to a licensee's compliance or noncompliance with such conditions to file a complaint noting the basis for such objection for the Commission's consideration.⁶

² 16 U.S.C. §791(a)-825r, as amended by the Electric Consumers Protection Act of 1986, Pub. L. 99-495 (1986), the Energy Policy Act of 1992, Pub. L. 102-486 (1992), and the Energy Policy Act of 2005, Pub. L. 109-58 (2005).

³ Pub. L. 95-91, 91 Stat. 556 (1977).

⁴ 16 U.S.C. §803(a).

⁵ 16 U.S.C. §803(g).

⁶ 18 C.F.R. §385.206 (2014).

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ACRONYMS AND ABBREVIATIONS

ACEC	area of critical environmental concern
AD	Anno Domini
Advisory Council	Advisory Council on Historic Preservation
APE	area of potential effects
Basin Plan	Water Quality Control Plan for the Sacramento River and the San Joaquin River Basins
BC	Before Christ
BLM	U.S. Department of Interior, Bureau of Land Management
BMI	benthic macroinvertebrate
BMP	best management practice
°C	degrees Celsius
California DEC	California Data Exchange Center
California DFA	California Department of Food and Agriculture
California DFW	California Department of Fish and Wildlife
California DWR	California Department of Water Resources
California OEHHA	California Office of Environmental Health Hazard Assessment
California SHPO	California State Historic Preservation Officer
Central Valley Water Board	Central Valley Regional Water Quality Control Board
cfs	cubic feet per second
CFR	Code of Federal Regulations
Commission	Federal Energy Regulatory Commission
Corps	U.S. Army Corps of Engineers
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
D ₅₀	median particle size
DO	dissolved oxygen
DPS	distinct population segment
EFH	Essential Fish Habitat
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
EPT	Ephemeroptera, Plecoptera, and Trichoptera
ESA	Endangered Species Act
°F	degrees Fahrenheit
FERC	Federal Energy Regulatory Commission
Forest Service	U.S. Department of Agriculture, Forest Service
FPA	Federal Power Act
FR	Federal Register
FWS	U.S. Department of the Interior, Fish and Wildlife Service
GIS	Geographic Information System
GWh	gigawatt-hour

Hornitos Bridge	Hornitos Road County Bridge
HPMP	Historic Properties Management Plan
kW	kilowatt
LWD	large woody debris
LWM	large woody material
mg/L	milligrams per liter
Merced Falls Project	Merced Falls Hydroelectric Project
Merced ID	Merced Irrigation District
Merced River Project	Merced River Hydroelectric Project
mm	millimeter
msl	mean sea level
MW	megawatt
MWh	megawatt-hour
National Register	National Register of Historic Places
NEPA	National Environmental Policy Act
NERC	North American Electric Reliability Corporation
NHPA	National Historic Preservation Act of 1966
NMWSE	normal maximum water surface elevation
NMFS	National Marine Fisheries Service
NTU	nephelometric turbidity unit
NWR	National Wildlife Refuge
ORV	off-road vehicle(s)
PA	Programmatic Agreement
Park Service	U.S. Department of the Interior, National Park Service
PG&E	Pacific Gas and Electric Company
ppb	parts per billion
RM	river mile
RST	rotary screw trap
SD1	Scoping Document 1
SD2	Scoping Document 2
TCP	traditional cultural property
µg/L	micrograms per liter
USGS	U.S. Department of the Interior, Geological Survey
Water Board	California State Water Resources Control Board
WQC	water quality certification
WUA	weighted usable area

EXECUTIVE SUMMARY

On February 26, 2012, Merced Irrigation District (Merced ID) filed an application for a new license with the Federal Energy Regulatory Commission (Commission) for the continued operation and maintenance of its 101.25-megawatt (MW) Merced River Hydroelectric Project. The Merced River Project is located on the main stem of the Merced River in Mariposa County, about 23 miles northeast of the city of Merced, California. It occupies 3,154.9 acres of federal land administered by the U.S. Department of the Interior, Bureau of Land Management (BLM). It generates an average of about 387 gigawatt-hours (GWh) of energy annually. Merced ID proposes no new capacity and no new construction at the project.

On February 8, 2012, Pacific Gas and Electric Company (PG&E) filed an application for a new license with the Commission for the continued operation and maintenance of its 3.4-MW Merced Falls Hydroelectric Project. The Merced Falls Project is located on the Merced River on the border of Merced and Mariposa Counties, California. It occupies 1.0 acre of federal land administered by BLM and generates an average of about 14.4 GWh of energy annually. PG&E proposes no new capacity and no new construction at the project.

The applications for the two projects are being processed together because they: (1) are located contiguously on the Merced River; (2) the Merced Falls Project's operation depends entirely on flows released by the upstream Merced River Project; and (3) downstream of the Merced River Project, the environmental effects of both projects are interrelated.

Project Description and Operation

Merced River Project

The Merced River Project consists of the following two developments (listed from upstream to downstream):

New Exchequer Development

The New Exchequer development is located on the Merced River at river mile (RM) 62.5 and consists of: (1) the New Exchequer dam—a rock structure with a reinforced concrete upstream face, 490 feet high and 1,220 feet long that impounds Lake McClure; (2) an ogee-type, concrete spillway with a 1,080-foot-long, ungated section and a 240-foot-long, gated section with six radial gates that are 40 feet wide and 30 feet high; (3) an earth-and-rock dike that is 62 feet high and 1,500 feet long; (4) an intake structure located upstream of the dam in Lake McClure; (5) a concrete-lined power tunnel that is 383 feet long and 18 feet in diameter; (6) a concrete-encased, steel penstock that is 982 feet long and 16 feet in diameter; (7) an above-ground concrete powerhouse that is 75 feet by 91 feet and discharges directly to the Merced River; and (8) a low-level outlet, consisting of a 945.5-foot long, 108-inch-diameter powerhouse bypass pipe with a

Howell-Bunger valve that runs from the New Exchequer power tunnel to McSwain reservoir north of the New Exchequer powerhouse. There is no transmission line associated with either development. Two PG&E-owned transmission lines connect the project to PG&E's interconnected system at the step-up transformer in the powerhouse switchyards.

Merced ID maintains four recreation areas at Lake McClure: (1) McClure Point, which includes a campground, picnic area, swim beach, marina, and boat ramp; (2) Barrett Cove, which includes a campground, swim beach, marina with two boat ramps, and overflow parking; (3) Horseshoe Bend, which includes a campground, swim beach, and boat ramp; and (4) Bagby, which includes a campground, boat ramp, and Shepherd's Point primitive area.

The New Exchequer development is operated in a seasonal store-and-release mode with the elevation of the impoundment fluctuating on an annual basis to retain snowmelt from springtime runoff for flood control, water supply, recreation, hydropower, and environmental purposes. In spring and summer, water levels are maintained relatively high for recreation at Lake McClure. From March through October, Merced ID releases water primarily for downstream water supply. These releases are also used for hydropower generation at the New Exchequer and McSwain powerhouses. The normal operational maximum and minimum reservoir elevations for Lake McClure are 867 feet and 630 feet, respectively.

The New Exchequer development diverts all flows from Lake McClure through the intake, power tunnel, penstock, powerhouse, and low-level outlet and then directly releases the flows to McSwain reservoir, which is part of the McSwain development.

McSwain Development

The McSwain development is located on the Merced River at RM 56.3, and consists of: (1) McSwain dam—an embankment structure with a central impervious core of rolled fill between shoulders of cobbles or crushed rock—that is 80 feet high and 1,620 feet long and impounds McSwain reservoir; (2) an ungated concrete overflow spillway that is 802 feet long; (3) an intake structure that is integral with the dam; (4) a concrete lined power tunnel that is 160 feet long and 15 feet in diameter that leads to; (5) a steel penstock that is 160 feet long and 15 feet in diameter; (6) an above-ground, concrete powerhouse that is 72 feet by 72 feet and discharges directly into the Merced River and (7) a low-level outlet, consisting of a 360-foot-long, 9-foot diameter steel powerhouse bypass pipe that runs from the McSwain power tunnel to Merced Falls reservoir with a fixed wheel gate at its upstream end and an 8-foot-diameter Howell-Bunger valve on its downstream end. There is no transmission line associated with the project. The project connects to PG&E's interconnected system at the step-up transformer in the powerhouse switchyard.

Merced ID maintains the McSwain recreation area at this development, which includes a campground, picnic area, group picnic area, informal day use area, swim beach, marina, and boat ramp.

The McSwain development is typically operated as a re-regulating afterbay⁷ for flows released from Lake McClure. This operation allows the New Exchequer powerhouse to be used to meet peak power demands or perform load-following functions while still maintaining a steady flow release to the lower Merced River. The normal operational maximum and minimum reservoir elevations for McSwain reservoir are 399.0 feet and 391.5 feet, respectively. Water surface elevations below the normal minimum do occur, but they are generally due to atypical operating conditions, such as unplanned outages, inspections, or work on the dam.

The McSwain development diverts all flows from McSwain reservoir through the intake, power tunnel, penstock, powerhouse, and low-level outlet, and then directly to the Merced Falls impoundment.

Merced Falls Project

The Merced Falls Project is located on the Merced River at RM 55 and consists of: (1) the 1-mile-long Merced Falls impoundment with approximately 900 acre-feet of storage capacity, a useable storage capacity of approximately 579 acre-feet, a total surface area of approximately 65 acres, and a normal impoundment elevation of 344 feet above mean sea level; (2) a 34-foot-high concrete gravity dam with a crest length of 575 feet; (3) three radial gates, each 20 feet long and 13.5 feet high; (4) a 1,000-foot-long earthen levee with a crest width of 8 feet; (5) an adjacent intake structure with a debris rack; (6) a non-operable fish ladder; and (7) powerhouse facilities consisting of a steel building housing a 3.4-MW turbine/generator unit and a vertical Kaplan-type four-blade turbine.

The Merced Falls project is operated in a run-of-river mode. Inflow to the project passes through the impoundment, which is kept at a constant water elevation and then either through the powerhouse or the dam's radial gates. Flows of up to approximately 1,750 cubic feet per second (cfs) are diverted through the powerhouse, and then discharged to the Merced River via the tailrace. When water inflows exceed 2,200 cfs, the project spills water through the radial gates. The main section of the dam, approximately 535.5 feet long, is topped with needle beams. During flood events with flows greater than 12,250 cfs, the needle beams can be dropped, allowing the 575-foot-long concrete section of the dam to act as a spillway.

⁷ The term afterbay as used here is a reservoir of a hydroelectric power plant at the outlet of the turbines.

Proposed Facilities

Neither Merced ID nor PG&E propose any upgrades or new project facilities.

Proposed Environmental Measures

Merced River Project

Merced ID proposes the following environmental measures:

General Measures (could apply to more than one resource area)

- Consult annually (at a minimum) with BLM regarding measures needed to ensure protection and use of resources on federal land administered by BLM and affected by the project.
- Consult with BLM regarding any potential future new facilities on federal land.
- Consult with BLM regarding any potential future new ground-disturbing activities on or directly affecting BLM lands that were not specifically addressed in the Commission's National Environmental Policy Act (NEPA) process.

Aquatic Resources

- Develop a plan to coordinate project operation with the downstream, run-of-river Merced Falls Project to assure implementation of flow-related measures at the two projects.
- Develop an erosion control and restoration plan at least 90 days in advance of initiating construction of project facilities on BLM-managed land.
- Develop a recreation facilities construction hazardous material spill prevention, control, and countermeasures plan at least 90-days in advance of initiating construction of recreation facilities.
- Deliver 15,000 acre-feet of water to Merced National Wildlife Refuge (NWR) at a single delivery point during Merced ID's irrigation season.
- Operate the project for flood control in accordance with the rules and regulations specified by the U.S. Army Corps of Engineers (Corps).
- Provide minimum flows (from 40 to 180 cfs as measured at Shaffer Bridge depending on time of year and water year type).

- Provide target flows (from 50 to 225 cfs as measured at Shaffer Bridge, depending on time of year and water year type).
- Limit all controllable flow rate changes above a base flow of 200 cfs during any 1-hour period to not more than double or less than half the amount of the controlled release from McSwain dam at the start of the change.
- Continue to determine water year type using Merced 60-20-20 Index.⁸
- Notify the California State Water Resources Control Board (Water Board), BLM, the U.S. Fish and Wildlife Service (FWS), the National Marine Fisheries Service (NMFS), and the California Department of Fish and Wildlife (California DFW) by March 10 of the second or subsequent dry/critically dry water year if Merced ID has drought concerns (i.e., if there may not be sufficient water to meet both environmental and irrigation demands). By May 1 of these same years (i.e., the second or subsequent dry/critically dry water years), consult with the agencies to discuss the project's operational plans to manage drought conditions and file a drought plan with the Commission with a request for expedited approval.
- Maintain the Lake McClure minimum pool at elevation 640 feet⁹ and the minimum pool of McSwain reservoir at or above elevation 388 feet, unless drawdowns are needed to maintain required minimum flows.

⁸ Merced ID established a five-level water year classification system for the Merced River. The 60-20-20 Index is based on the unregulated inflow to Lake McClure. The five-water year classifications are: wet, above normal, below normal, dry, and critical and are calculated as 60 percent of the current year's April through July inflow plus 20 percent of the current year's October through March inflow plus 20 percent of the previous year's index.

⁹ An elevation of 640 feet in Lake McClure corresponds to a volume of 115,000 acre-feet.

- Operate four water temperature monitoring recorders at suitable sites in the Merced River downstream of Crocker-Huffman diversion dam, as selected by a technical advisory committee.¹⁰
- Continuously monitor anadromous fish migrating into the Merced River at an Alaskan weir or similar device to be installed and operated from October 1 through December 31, using a VAKI Riverwater™ system, and identify the time and direction of migration, size, sex, marks, and other attributes. Monitor juvenile anadromous fish outmigration from the Merced River from January 1 through May 31 with a rotary screw trap (RST) and document the total number and, for a representative subsample of the catch, size, weight, and life stage.
- Establish a Merced River anadromous fish committee (also known as a technical advisory committee), consisting of representatives from NMFS, FWS, California DFW, the Water Board, and a non-governmental organization, that would meet four times a year to facilitate Merced ID's implementation of license conditions that pertain to monitoring anadromous fish. An annual report would be filed with the Commission by January 1 of each year documenting the activities of the committee during the previous calendar year.
- Implement the amended Aquatic Invasive Species Management Plan filed on April 23, 2014, and supplemented on September 5, 2014, to provide guidance for the prevention of aquatic invasive species in project reservoirs.
- Develop a large woody debris (LWD) management plan that excludes BLM-managed land from any stockpiling activities to provide LWD to the Merced River downstream of Crocker-Huffman diversion dam to enhance aquatic habitat.

¹⁰ Merced ID proposes to establish a Merced River anadromous fish committee to include, by invitation, representatives from NMFS, FWS, California DFW, the Water Board, and a non-governmental organization member selected by Merced ID that would participate at its own expense. Merced ID would organize four committee meetings each year to review the results of draft annual reports pertaining to Chinook salmon and *Oncorhynchus mykiss* (*O. mykiss*) downstream of Crocker-Huffman diversion dam and to identify potential modifications to monitoring methods and protocols. In this draft environmental impact statement (EIS), *O. mykiss* refers to both the anadromous (steelhead) and resident (rainbow trout) form of this species.

Terrestrial Resources

- Implement the Invasive Species Management Plan on federal land, filed with the final license application and amended on September 22, 2014.
- Implement the Vegetation Management Plan on federal land, filed with the final license application, as amended, to protect special-status plants and minimize project effects on sensitive habitats.
- Avoid the use of pesticides and herbicides on land administered by BLM without the prior written approval of BLM.
- Implement the Bald Eagle Management Plan, filed with the license application.
- Document all known bat roosts at project facilities, and if bats could be subject to human disturbance, install exclusion devices.
- Implement the Limestone Salamanders Sensitive Areas Management Plan, filed with the license application.
- Record observations of western pond turtles to conserve this special-status species and its habitats on BLM lands.

Threatened and Endangered Species

- Provide annual training for project operation and maintenance staff to identify special-status species and sensitive areas that should be protected and non-native species to be treated.
- On an annual basis, review special-status species lists and assess potential project effects on any newly listed special-status species, and if necessary, consult with the agencies to develop and implement protection measures.
- Avoid the use of burrow fumigants and rodenticides in habitat of the California tiger salamander and the San Joaquin kit fox when performing project maintenance activities.

Recreation Resources

- Implement the Recreation Facilities Plan, amended on September 22, 2014.
- Provide real-time recreation information on the California Data Exchange Center (California DEC), including:
 - flow information for the Merced River below Merced Falls, Dry Creek near the city of Snelling, and the Merced River near the cities of Snelling, Cressey, and Stevinson;
 - elevations for Lake McClure and McSwain reservoir; and

- flow information for the Merced River at Shaffer Bridge (U.S. Department of the Interior, Geological Survey [USGS] gage no. 11271290).
- Construct a parking area and install river access directional signage at the existing gravel-surfaced parking area at Merced Falls Road near Crocker-Huffman diversion dam.
- Develop a conceptual plan to align the existing Merced River Trail to a new trail segment that would follow along the shoreline of Lake McClure and McSwain reservoir.
- Annually stock rainbow trout, fingerling kokanee, and Chinook salmon in Lake McClure and McSwain reservoir for recreational fishing.

Land Use

- Implement the Transportation Management Plan, filed on September 22, 2014, to ensure project roads are adequately maintained.
- Implement the Fire Prevention and Response Plan, revised on September 22, 2014, to provide for management, reporting, and the prevention of wildfires at the project.

Cultural Resources

- Implement the Historic Properties Management Plan (HPMP) upon filing to manage project effects on properties eligible for listing on the National Register of Historic Places (National Register).

Aesthetic Resources

- Implement the Visual Resource Plan, filed on September 22, 2014, to ensure visual quality objectives at the project are met through monitoring and consultation.

Merced Falls Project

PG&E proposes the following environmental measures.

Aquatic Resources

- Conduct annual fall fish sampling in the reach of the Merced River downstream of Merced Falls dam and upstream of Crocker-Huffman dam (Merced Falls reach) to monitor fish populations.
- Continue to periodically rake the project's intake racks to clear them of LWD, and place the removed material on the debris chute at the dam to allow the debris to pass downstream.

Water Resources

- Develop and implement a long-term water quality monitoring program to monitor dissolved oxygen and temperature in the Merced Falls reach to confirm adherence to water quality standards.

Recreation

- Continue to operate and maintain the existing recreation facilities at the Merced Falls impoundment area, including the River's Edge Fishing Access area and the car-top boat launch at Merced Falls Fishing Access area.
- Develop and post directional and safety signage at the project's informal canoe portage trail.
- Develop a fish stocking plan in consultation with California DFW that includes stocking 11,000 adult-sized rainbow trout at the Merced Falls impoundment for the first 2 years following license issuance and a plan for stocking (schedule and type and amount of fish) for the rest of the license term.

Cultural Resources

- Implement the HPMP filed on October 6, 2014.

Alternatives Considered

This draft environmental impact statement (EIS) analyzes the effects of continued project operation and recommends conditions for any new licenses that may be issued for these projects. In addition to Merced ID's and PG&E's proposals, we consider three alternatives for each project: (1) Merced ID's and PG&E's proposals with staff modifications (staff alternative); (2) the staff alternative with all mandatory conditions filed by BLM and the Water Board; and (3) no action, meaning the projects would continue to be operated as they presently are with no changes.

Staff Alternative—Merced River Project

Under the staff alternative, the project would include most of Merced ID's proposed measures, as outlined above with the exception of Merced ID's proposed minimum and target flows, its proposed review of special-status species lists, and its proposal to consult annually with BLM regarding measures needed to ensure protection and use of resources on federal land administered by BLM and affected by the project. Under the staff alternative, the project would also include most of BLM's mandatory section 4(e) conditions and the Water Board's mandatory water quality certification conditions with the exception of the following due to cost and project nexus considerations: (1) annual funding costs incurred by BLM; (2) annual consultation to

review the project status for newly listed species; (3) a fish passage or habitat restoration plan; and (4) a review of federally listed and special-status species lists.

Under the staff alternative, the project would also include the following additional measures and modifications.

Aquatic Resources

- Expand the scope of the proposed technical advisory committee beyond measures that pertain only to anadromous fish downstream of Crocker-Huffman diversion dam (e.g., topics that pertain to resident fish, aquatic and terrestrial monitoring results, and actions that could affect BLM-managed land, including Lake McClure water level management); establish guidelines for conducting meetings that provide ground rules for decision making; and add BLM and the U.S. Department of the Interior, National Park Service (Park Service) to the entities invited to participate on the committee.
- Add the Water Board, BLM, FWS, California DFW, NMFS, and the Park Service to the entities invited to consult on the proposed coordinated operation plan for the projects.
- Add the Water Board, California DFW, and FWS to the entities invited to consult on the proposed site-specific erosion control and restoration plans and expand the plans to apply to all construction on land within the project boundary.
- Include, at a minimum, the following elements in the proposed erosion control and restoration plans: (1) a description of best management practices (BMPs) that would be applied in specific circumstances, (2) provisions for inspecting erosion control measures while they are in place, (3) emergency protocols for erosion and sedimentation control, (4) site stabilization techniques that would be used once construction is completed, and (5) a description of when and what type of water quality monitoring of surface waters would occur during and after ground-disturbing activities. Identifying such measures and protocols in the erosion control and restoration plans would assure that erosion does not unacceptably degrade water quality adjacent to construction and other ground-disturbance sites.
- In addition to monitoring ramping rates associated with releases from McSwain dam, monitor flows and stage at 1-hour intervals at the existing gage immediately downstream of Crocker-Huffman diversion dam and provide annual reports to the Commission from both gages after review by the technical advisory committee. Monitoring flows at both locations would document compliance with the recommended ramping rate at

McSwain dam and establish a relationship between the ramping rates at McSwain dam and the ramping rates downstream of Crocker-Huffman diversion dam and would provide data on whether or not the ramping rate protocol should be adjusted in the future.

- Include, at a minimum, the following elements in the proposed construction and non-routine maintenance hazardous material spill prevention, control, and countermeasure plans: (1) a description of the BMPs for contaminant control that would be applied in specific circumstances; (2) emergency protocols for spill containment and remediation; (3) the location of emergency cleanup equipment in the event of contaminant release; (4) identification of entities to be contacted in the event of a spill; (5) designated equipment refueling and maintenance areas; (6) provisions requiring equipment to be cleaned and inspected prior to entering a construction site; (7) post-spill water quality monitoring protocols; and (8) a listing of applicable local, state, and federal regulations that pertain to prevention of spills and protection of water quality. Identifying such measures and protocols in the hazardous materials spill prevention, control, and countermeasure plans would assure that surface water and groundwater are protected from contaminants.
- Use the Hughes method to determine water year type rather than the currently used and proposed Merced 60-20-20 Index to better designate water year types based on both forecasted and observed runoff and avoid biases on below normal water conditions.
- Release the instantaneous minimum flows as measured at Shaffer Bridge and shown in table 5-2 for the purpose of enhancing physical habitat, density-dependent conditions, and water temperature for Chinook salmon and *O. mykiss*.
- Maintain a minimum flow of 25 cfs at all times from New Exchequer dam to ensure that the channel is not dewatered.
- Develop a water temperature monitoring plan in consultation with the technical advisory committee and monitor water temperature at four to eight sites (rather than limiting the number of sites to four) from Crocker-Huffman diversion dam, downstream to Shaffer Bridge.
- Release a fall pulse flow of 1,000 cfs measured at Shaffer Bridge, during October or November until a total volume of 12,500 acre-feet is released to attract adult anadromous salmonids to the mouth of the Merced River and stimulate upstream migration to the primary spawning area between Crocker-Huffman diversion dam and Shaffer Bridge. The timing of the beginning of the release would be determined by the technical advisory committee.

- Release a spring pulse flow of 30,000 acre-feet during wet, above normal, and below normal water years. This spring pulse flow would consist of flows equal to or above 1,000 cfs, measured at Shaffer Bridge, of 9 days and peak flows that hold for 2 or 3 days, with a gradually ascending and descending hydrograph.
 - During dry and critically dry water years, release a spring pulse flow of 10,000 acre-feet.
 - After a minimum of two dry or critically dry water years, consult with the technical advisory committee and make recommendations to the Commission regarding whether anadromous fish outmigration data supports changing the 10,000 acre-feet pulse flow release. The spring pulse flow would stimulate outmigration of rearing anadromous salmonids and inundate riparian floodplains, which would provide benefits to salmonid habitat.
 - The timing of the onset of the spring pulse flow release would be determined by the technical advisory committee.
- Annually report Lake McClure stage and acre-feet of storage to the Commission to document compliance with water management measures and, when applicable, drought management plans.
- File the proposed drought plans, developed after two or more consecutive dry or critically dry water years, with the Commission for approval.
- Develop a drought management plan in consultation with the technical advisory committee that identifies the measures that would be considered to address droughts when they occur, decision paths regarding how management options for a specific drought would be decided, and a listing of Commission, BLM, and water quality certification (WQC) license conditions that would require variances with drought management options. Approval of this management plan would expedite approval of the proposed drought-specific plan, which would be time-sensitive.
- Develop a Merced NWR water delivery plan, in consultation with FWS and California DFW, to ensure to the extent practical, the delivery of 15,000 acre-feet of water to the refuge during times of the year when this water would provide the most benefit to wildlife.
- Develop, in consultation with the technical advisory committee, an anadromous fish monitoring plan that includes the attributes Merced ID proposes to monitor. Include in the plan the proposed monitoring station locations, the rationale for selecting those locations, and corrective actions that could be taken, including assisting with fish rescue efforts, if monitoring shows the project is adversely affecting anadromous fish.

- Add the technical advisory committee and California Department of Transportation to the entities invited to consult on the large woody material (LWM) management plan.
- Develop a gravel augmentation plan in consultation with the technical advisory committee that (1) provides for the annual placement of 2,600 cubic yards of gravel in the lower Merced River; (2) identifies the range of particle sizes to be used for augmentation; (3) identifies gravel harvesting sites; (4) includes provisions for restoring harvest sites to mitigate for any aesthetic or ecological impact associated with gravel harvesting; (5) includes the protocol for selecting augmentation sites between Merced Falls dam and Shaffer Bridge; (6) provides for monitoring and mapping augmented gravel; and (7) provides for annual reporting.
- Modify the Amended Aquatic Invasive Species Management Plan to include provisions for documenting observations of quagga and zebra mussels, New Zealand mudsnails, Asian clams, American bullfrog, Eurasian milfoil, Brazilian elodea and hydrilla; provide reports to the Commission regarding any incidental observations that rise to the level of needing follow-up management actions, and add California DFW and the Water Board to the entities invited to consult on revisions to the plan.

Terrestrial Resources

- Develop a protection plan for special-status bats after consultation with BLM, FWS, California DFW, and the Water Board to protect bats roosting at project facilities. The plan would include specific details about agency-recommended measures and proposed measures to document all known bat roosts at project facilities, the type and design of exclusion devices, and define appropriate metrics to evaluate the effectiveness of the measures.
- Modify the proposed Bald Eagle Management Plan to:
 - include educational information about bald eagle roost sites in public information;
 - describe activities that would be considered emergencies, and define why these activities would supersede bald eagle protection;
 - protect winter roost trees from vegetation management and future construction activities to reduce potential for degrading these areas; and
 - revise all protocols and methodologies to be consistent with the FWS National Bald Eagle Management Guidelines.

- Modify the Invasive Species Management Plan on federal land to:
 - stipulate that the measures in the plan apply to all land within the project boundary, including treatment measures for the existing population of perennial pepperweed on Merced ID land;
 - provide details about specific BMPs that would be implemented as part of the plan;
 - include notification to agencies of planned pesticide use; and
 - include descriptions of unexpected outbreaks that would not require notification prior to use of pesticides.
- Modify the Vegetation Management Plan on federal land to:
 - provide details about specific BMPs that would be implemented as part of the plan;
 - include maps in section 3.0 to show locations of elderberry plants and identify which plants show signs of occupancy by the valley elderberry longhorn beetle; and
 - include consultation with BLM, California DFW, and FWS during the planning phases for any new disturbance such as any potential future construction of new facilities and other project operation and maintenance activities that could disturb vegetation resources through excavation, grading, topsoil stripping, or other similar activities, to identify the need for pre-disturbance surveys and develop protection measures for any sensitive species in the disturbance area.
- Develop a protection plan for western pond turtles, including the proposed monitoring and reporting measures to protect western pond turtles from project effects such as water level fluctuations, traffic associated with project maintenance and recreation, and maintenance activities such as pesticide applications.
- Modify the Limestone Salamanders Sensitive Areas Management Plan to:
 - provide details about the specific BMPs that would be implemented as part of the plan; and
 - site new hiking trails or modifications to existing hiking trails outside of limestone salamander habitat.

Threatened and Endangered Species

- Develop a protection plan for the San Joaquin kit fox, including surveys and the development of protection and mitigation measures to minimize project-related effects (i.e., effects of rodenticides, potential effects on dispersal).

- Develop a protection plan for the vernal pool fairy shrimp and its habitat to reduce project effects (i.e., long-term habitat degradation).
- Develop a protection plan for federally listed plants potentially occurring in the project area to minimize project effects (i.e., project maintenance activities, recreation) on these plant species.
- Develop a protection plan for the California red-legged frog, foothills yellow-legged frog, and western spadefoot to reduce project effects (i.e., changes in water temperature, increases in the populations of predators, and pesticide use).
- Develop a protection plan for California tiger salamanders that includes a proposed measure to avoid use of pesticides in California tiger salamander habitat to protect the species from project effects (i.e., effects of rodenticides and burrow fumigants, vegetation maintenance, recreation activities, and vehicular traffic).

Recreation Resources

- Modify the proposed Recreation Facilities Plan, filed on September 22, 2014, to:
 - extend the proposed paved bicycle lane along the entire length of Lake McClure Road (7.8 miles) between County Road J16 and the proposed parking area from the McSwain shoreline trailhead;
 - remove the provision for a host site at the project's Horseshoe Bend recreation area campground;
 - identify the location of the three floating restrooms provided on Lake McClure, and include an operation and maintenance schedule and construction and rehabilitation measures (if needed) for each restroom; and
 - revise the implementation schedule to: begin construction no earlier than Labor Day and no later than Memorial Day to avoid the prime recreation season; begin construction at Bagby recreation area within 2 years of license issuance; begin construction of the project's non-motorized trails within 3 years of license issuance; begin rehabilitation planning at each campground within 3 years of license issuance (to be completed within 6 years of license issuance; and include a mid-license term rehabilitation assessment in the implementation schedule that would identify any facilities and or water systems in need of rehabilitation.

- Develop and implement a fish stocking plan that includes the type, size, and amount of fish to be stocked in Lake McClure and McSwain reservoir based on recreational use, angling demand, and state fish stocking management targets and an implementation schedule to ensure appropriate recreational fish stocking levels at the project for the license term.

Land Use

- Modify the Transportation Management Plan, filed on September 22, 2014, to include an inventory of all project roads and current road conditions, a detailed schedule of maintenance based on that inventory, relevant BMPs that would be implemented, a schedule for monitoring project road use over the term of the license, and a schedule for consultation with BLM and the California Department of Forestry and Fire Protection.

Aesthetics

- Modify the Visual Resource Plan, filed on September 22, 2014, such that it applies to all lands within the project boundary.

Staff Alternative—Merced Falls Project

Under the staff alternative, the project would be operated and maintained as proposed by PG&E with the modifications and additional measures described below. Our recommended modifications and additional environmental measures include, or are based on, recommendations and conditions made by federal and state resource agencies and Conservation Groups that have an interest in resources that may be affected by the operation of the proposed project.

Under the staff alternative, the project would include most of PG&E's proposed measures, as outlined above with the exception of PG&E's proposed modification to remove 4.8 acres from the project boundary (75.6 to 70.8 acres) at the northeastern shoreline of the Merced Falls impoundment. Under the staff alternative, the project would also include most of the Water Board's mandatory water quality certification conditions with the exception of the following due to cost and project nexus considerations: (1) a gravel augmentation plan for Merced Falls reach; (2) a fish passage plan; and (3) a review of federally listed and special-status species lists.

Under the staff alternative, the project would also include the following additional measures and modifications:

Aquatic Resources

- Participate in a Merced River technical advisory committee in conjunction with Merced ID to inform and coordinate the implementation of environmental measures.

- Develop a coordinated operation plan, in conjunction with Merced ID, for the Merced River and Merced Falls Projects in consultation with the technical advisory committee.
- Develop a LWD management plan in consultation with the technical advisory committee to provide habitat enhancement for aquatic species.
- Develop an annual fish monitoring plan in the reach of the Merced River downstream of Merced Falls dam and upstream of Crocker-Huffman dam (Merced Falls reach) in consultation with the technical advisory committee.

Terrestrial Resources

- Develop a control plan for noxious weeds and invasive plants, with a component for pest management and pesticide use.
- Develop and implement a management plan for bald eagles in consultation with BLM, FWS, California DFW, and the Water Board.

Threatened and Endangered Species

- Develop a protection plan for the valley elderberry longhorn beetle to minimize project effects on the valley elderberry longhorn beetle and its habitat.
- Develop a protection plan for the San Joaquin kit fox to reduce project-related and cumulative effects on the San Joaquin kit fox.
- Develop a protection plan for the California red-legged frog, foothills yellow-legged frog, and western spadefoot to reduce project effects on these species.

Recreation

- Operate and maintain all recreation facilities at the Merced Falls Fishing Access area, including one sign, restroom, parking area, and car-top boat launch, the informal angler trail along the northern shoreline, the two informal parking areas on either side of Hornitos Road County Bridge, and the informal canoe portage trail at the south end of Merced Falls dam.

Project Boundary

- Modify the project boundary to include the informal canoe trail on the south side of Merced Falls dam.

Staff Alternative with Mandatory Conditions

BLM filed preliminary conditions for the Merced River Project pursuant to section 4(e) of the FPA by letter dated July 22, 2014. The Water Board issued preliminary WQC conditions for the Merced River and Merced Falls Projects pursuant to section 401 of the Clean Water Act by letters dated July 22, 2014. We recognize that the Commission is required to include valid section 4(e) conditions and section 401 conditions in any licenses issued for the projects. The staff alternative with mandatory conditions includes the staff-recommended measures noted above as well as the mandatory conditions filed by BLM and the Water Board.

Public Involvement and Areas of Concern

Both Merced ID and PG&E used the Commission's Integrated Licensing Process to prepare their license applications. The intent of the Commission's pre-filing process under the Integrated Licensing Process is to initiate public involvement early in the project planning process and to encourage citizens, governmental entities, tribes, and other interested parties to identify and resolve issues prior to an application being formally filed with the Commission.

Merced River Project

As part of the pre-filing process, we distributed a scoping document (SD1) to interested parties on January 2, 2009, soliciting comments, recommendations, and information on the project. Scoping meetings were held in Merced, California, on January 28, 2009. We conducted a site visit on January 29, 2009. Based on discussions during the site visit and written comments filed with the Commission, we issued a second scoping document (SD2) on April 17, 2009. On March 24, 2014, we issued a notice that Merced ID's application to relicense the Merced River Project was ready for environmental analysis and requested conditions and recommendations.

The primary issues associated with relicensing the project are flow quantity and timing in the lower Merced River; the availability and enhancement of Chinook salmon and *O. mykiss* spawning and rearing habitat in the lower Merced River; water quality; protection and management for federally listed and special-status species; vegetation management; management of noxious weeds and invasive plants, including pest management and pesticide use; recreation access; maintenance of recreation sites; and maintenance of project roads.

Merced Falls Project

As part of the pre-filing process, we distributed SD1 to interested parties on April 24, 2009, soliciting comments, recommendations, and information on the project. Based on written comments filed with the Commission, we issued SD2 on August 6, 2009. On March 24, 2014, we issued a notice that the application was ready for environmental analysis and requested conditions and recommendations.

The primary issues associated with relicensing the project are coordination with Merced ID on project operation and the implementation of environmental measures; the incremental contribution of the project on water temperature and availability of fish habitat in the lower Merced River; protection and management of federally listed and special-status species; management of noxious weeds and invasive plants, including pest management and pesticide use; recreation access; and maintenance of recreation sites.

Staff Alternative Discussion

Merced River Project

Aquatic Resources

Implementation of the proposed site-specific and general erosion control and restoration plans and construction and non-routine maintenance hazardous materials spill prevention, control, and countermeasure plans with the additional staff-recommended elements would ensure that BMPs are in place and that project waters would be protected from sedimentation and contaminants during construction and non-routine maintenance that entails ground-disturbing activities.

Current and proposed minimum flows provide minimal habitat in the lower Merced River for Chinook salmon and *O.mykiss*. Under the staff alternative, the minimum flow regime would enhance habitat in the lower Merced River for Chinook salmon and *O. mykiss* while balancing Lake McClure water storage for irrigation and water temperature enhancements.

Spring pulse flows do not occur under existing conditions, nor does Merced ID propose spring pulse flows. Under the staff alternative, the implementation of spring pulse flows would inundate riparian floodplains during most water year types, providing young anadromous salmonids with access to additional cover and foraging habitat, thereby enhancing anadromous fish populations. Spring pulse flows would also stimulate riparian forest growth that could provide shade to the river channel and additional temperature enhancement for salmonids. During all water year types, a spring pulse flow would stimulate outmigration of rearing anadromous salmonids prior to the onset of harsh low flow, high temperature summer conditions.

Merced ID does not propose any fall pulse flow releases. Under the staff alternative, fall pulse flow releases would serve to attract adult anadromous salmonids to the mouth of the Merced River and stimulate upstream migration to the primary spawning area between Crocker-Huffman diversion dam and Shaffer Bridge.

The staff-recommended minimum flows and pulse flows downstream of Crocker-Huffman diversion dam would result in the diversion of less water for irrigation purposes, which could adversely affect agricultural interests served by Merced ID.

The project would continue to contribute to a lack of LWD/LWM in the lower Merced River. LWD/LWM provides important habitat for aquatic organisms.

Implementation of the proposed LWD/LWM management plan, with staff-recommended elements, would enhance physical habitat and other ecological conditions for Chinook salmon, *O. mykiss*, and other aquatic organisms that may provide forage for anadromous fish in the lower Merced River.

The project would continue to contribute to a lack of sediment, required by salmonids for spawning, in the lower Merced River. The staff-recommended gravel augmentation plan would enhance salmonid populations by introducing spawning-sized gravel to areas of the lower Merced River and would ensure that gravel harvest sites would be regraded after harvest to mitigate for any aesthetic impacts and reestablish a more natural floodplain topography at the harvest sites.

The proposed monitoring of anadromous fish and water temperature, with additional staff-recommended elements, would allow stakeholders to evaluate the effectiveness of environmental measures, such as minimum flow and pulse flow prescriptions. Additionally, monitoring would serve to trigger the need for additional protective measures if water temperatures become unusually stressful when anadromous fish are present.

Terrestrial Resources

Project operation, maintenance, and recreation activities would cause noise resulting in disturbance to nesting and roosting bald eagles, and vegetation management activities could also result in the removal of nest trees or roost trees. Under the staff alternative, the proposed Bald Eagle Management Plan would be revised to include a public education component and to be consistent with FWS guidelines for eagle management. Operation and maintenance of the project and construction of any new facilities could disturb vegetation resources through excavation, grading, topsoil stripping, or other similar activities, could contribute to the spread and establishment of invasive plants. Project maintenance activities, such as vegetation maintenance and pesticide applications, could adversely affect sensitive plants and wildlife. Under the staff alternative: (1) the Invasive Species Management Plan would be modified to require advance notification to agencies regarding planned pest management and pesticide use; (2) the Vegetation Management Plan would be modified to (i) provide details about specific BMPs that would be implemented as part of the plan, (ii) include maps showing locations of elderberry plants with signs of occupancy by the valley elderberry longhorn beetle, (iii) require consultation with BLM, California DFW, and FWS during the planning phases for any new disturbance to identify the need for pre-disturbance surveys and (iv) develop protection measures for any sensitive species in the disturbance area; and (3) the Limestone Salamander Monitoring Plan would be modified to site new hiking trails outside of limestone salamander habitat. Because special-status bat species roosting in project facilities could be disturbed by human presence, the staff alternative would include a protection plan for special-status bats. The staff alternative would also include a protection plan for western pond turtles to conserve western pond turtles observed on project lands.

Threatened and Endangered Species

The Central Valley steelhead, federally listed as threatened, occurs within the San Joaquin River and likely occurs in the Merced River downstream of Crocker-Huffman diversion dam. Staff-recommended measures, including increased minimum flows, fall and spring pulse flows, and gravel augmentation would enhance (1) fall attraction flows for adult steelhead; (2) spawning substrate; (3) water temperature during spring rearing and smoltification; (4) off-channel habitat, floodplain connectivity, and juvenile emigration triggers with spring pulse flows; and (5) physical habitat. With these measures, continued operation of the Merced River Project is not likely to adversely affect the Central Valley steelhead.

Five federally listed animal species and five federally listed plant species occur or potentially occur in the project area: San Joaquin kit fox (*Vulpes macrotis mutica*), California red-legged frog (*Rana aurora draytonii*), California tiger salamander (*Ambystoma californiense*), valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), and vernal pool fairy shrimp (*Branchinecta lynchi*); Keck's checkerbloom (*Sidalcea keckii*), Layne's ragwort (*Packera layneae*), Chinese Camp brodiaea (*Brodiaea pallida*), Mariposa pussypaws (*Calyptridium pulchellum*), and California vervain (*Verbena californica*). The project area overlaps with about 1 acre of critical habitat for the vernal pool fairy shrimp, and also with one recovery unit identified for the California red-legged frog.

Project operation supports habitat for bullfrogs and predatory fishes, which would adversely affect California red-legged frogs through increased predation. Herbicide applications also could adversely affect this species. The use of rodenticides and burrow fumigants to control rodents on project lands would adversely affect the San Joaquin kit fox and California tiger salamander. The California tiger salamander also could be adversely affected by vehicular traffic and foot traffic from recreation and vegetation maintenance. Project maintenance activities, such as pesticide use and vegetation maintenance, would adversely affect Keck's checkerbloom, Layne's ragwort, Chinese Camp brodiaea, Mariposa pussypaws, and California vervain, in addition to the valley elderberry longhorn beetle by affecting its obligatory host plant, the elderberry shrub. Project maintenance activities and vehicular traffic would adversely affect vernal pool fairy shrimp and could modify adjacent habitats by causing long-term habitat degradation. With the development and implementation of the various staff-recommended plans, the Merced River Project is not likely to adversely affect San Joaquin kit fox, California red-legged frog, California tiger salamander, valley elderberry longhorn beetle, vernal pool fairy shrimp, Keck's checkerbloom, Layne's ragwort, Chinese Camp brodiaea, Mariposa pussypaws, and California vervain.

Recreation, Land Use, and Aesthetics

Numerous recreational opportunities exist at the Merced River Project. Implementing Merced ID's proposed Recreation Facilities Plan with the staff-recommended modifications would enhance recreation opportunities further and ensure operation and adequate maintenance of existing and proposed recreational facilities at the project. Implementing Merced ID's proposed measures to implement off-road vehicle (ORV) road closures, improve existing trails, and provide more trail access at the project would ensure safe, reliable access over the term of the license. Development and implementation of the staff-recommended fish stocking plan would ensure that fish stocking continues at the project reservoirs and would allow for changes in stocking numbers based on recreational use and state stocking targets.

Implementation of the proposed Transportation Management Plan, Fire Prevention and Response Plan, and Visual Resource Plan would ensure that project roads are maintained to applicable standards; improve the prevention, management, and coordination of potential wildfires; and improve overall visual quality at the project.

Merced Falls Project

Aquatic Resources

The project is located immediately downstream of Merced ID's Merced River Project and would continue to operate run-of-river, thus maintaining its operational dependence on the upstream Merced River Project. Under the staff alternative, PG&E would develop a coordinated operations plan that would ensure effective cooperation between Merced ID and PG&E in the implementation of any operational scenarios, such as flow releases to the lower Merced River, or maintenance-related reservoir drawdowns. Additionally, PG&E would participate in a technical advisory committee in conjunction with Merced ID, which would ensure coordination between the licensees for the Merced River and Merced Falls Projects and adaptively manage resources during the term of the licenses. PG&E's current LWD management practices do not effectively document the quantity or timing of LWD removal from the project intake and do not address the biological significance of its placement back into the Merced River channel. Under the staff alternative, PG&E would develop a LWD management plan to more effectively manage the removal and subsequent placement of LWD for the benefit of aquatic species in the project area.

Terrestrial Resources

Project maintenance activities and recreation could adversely affect sensitive plants and wildlife occurring in the project area. Vegetation maintenance, such as trimming, clearing, and herbicide applications, and recreation could adversely affect sensitive plants, and the use of rodenticides and insecticides in the project area could affect sensitive wildlife. Under the staff alternative, a control plan for noxious weeds and invasive plants integrated with pest management and pesticide use would reduce effects

on sensitive plants and wildlife. Project maintenance activities and recreation activities could disturb bald eagles nesting and roosting in the project area. Under the staff alternative, a bald eagle protection plan would be developed, which would minimize the effects of project maintenance and recreation activities on nesting and roosting bald eagles.

Threatened and Endangered Species

The Central Valley steelhead, federally listed as threatened, occurs within the San Joaquin River and likely occurs in the Merced River downstream of Crocker-Huffman diversion dam. The proposed project with staff-recommended measures would have minimal incremental effects on downstream environmental variables because the project would continue to operate run-of-river. Therefore, we conclude that the Merced Falls Project as proposed with staff-recommended measures, is not likely to adversely affect the Central Valley steelhead.

Three federally listed terrestrial species have the potential to occur in the project area: the endangered San Joaquin kit fox; the threatened California red-legged frog; and the threatened valley elderberry longhorn beetle. The project reservoir may be a dispersal barrier for the San Joaquin kit fox and the opening of the dam for fish passage, per FWS' recommendation, may also affect kit fox dispersal. Project operations that increase bullfrogs and predatory fishes would adversely affect California red-legged frogs dispersing to the project area by increasing predation. Project maintenance activities (i.e., herbicide applications) could also affect California red-legged frogs dispersing to the project area. Project maintenance and recreation activities may affect habitat for the valley elderberry longhorn beetle. Developing and implementing the various staff-recommended plans would protect these three species, as well as other threatened and endangered species potentially occurring within the project area. Thus, we conclude that the Merced Falls Project as proposed with staff-recommended measures is not likely to adversely affect the California red-legged frog or the threatened valley elderberry longhorn beetle.

Recreation

Although there are only a few recreational facilities located at the Merced Falls impoundment, operating and maintaining these facilities would ensure public access to recreational opportunities at the project over the term of the license. Additionally, providing public access and maintaining the informal canoe trail on the south side of Merced Falls dam would eliminate potential trespassing issues and create additional recreational boating access at the project.

No-Action Alternative

Under the no-action alternative, Merced ID and PG&E would continue to operate under the terms and conditions of the existing licenses, and no new environmental protection, mitigation, or enhancement measures would be implemented.

Conclusions

Based on our analysis, we recommend licensing the project as proposed by Merced ID and PG&E with some staff modifications and additional measures.

In section 4.2 of the EIS, we estimate the likely cost of alternative power for each of the three alternatives identified above. For the Merced River Project, our analysis shows that during the first year of operation under the no-action alternative, project power would cost \$12,527,000, or \$32.4 per megawatt-hour (MWh) less than the likely alternative cost of power. Under the proposed action alternative, project power would cost \$1,795,000 or \$4.6/MWh less than the likely alternative cost of power. Under the staff alternative, project power would cost \$1,077,000 or \$2.9/MWh more than the likely alternative cost of power.

For the Merced Falls Project, our analysis shows that during the first year of operation under the no-action alternative, project power would cost \$596,000 or \$41.41/MWh more than the likely alternative cost of power. Under the proposed action alternative, project power would cost \$621,000 or \$43.1/MWh more than the likely alternative cost of power. Under the staff alternative, project power would cost \$655,000,000 or \$45.4/MWh more than the likely alternative cost of power.

We chose the staff alternative as the preferred alternative because: (1) the projects would provide a dependable source of electrical energy for the region; (2) the generation comes from a renewable resource that does not contribute to atmospheric pollution, including greenhouse gases; and (3) the recommended environmental measures proposed by Merced ID and PG&E, as modified by staff, would adequately protect and enhance environmental resources affected by the projects. The overall benefits of the staff alternatives would be worth the cost of the environmental measures.

We conclude that issuing new licenses for the Merced River and Merced Falls Projects, with the environmental measures we recommend, would not be major federal actions significantly affecting the quality of the human environment.

DRAFT ENVIRONMENTAL IMPACT STATEMENT

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
Washington, D.C.

Merced River Hydroelectric Project
FERC Project No. 2179-043—California

Merced Falls Hydroelectric Project
FERC Project No. 2467-020—California

1.0 INTRODUCTION

1.1 APPLICATION

1.1.1 Merced River Project

On February 26, 2012, Merced Irrigation District (Merced ID) filed an application for new license with the Federal Energy Regulatory Commission (Commission). The Merced Hydroelectric Project is located on the main stem of the Merced River in Mariposa County, about 23 miles northeast of the city of Merced, California (figures 1-1 and 1-2). The two Merced ID reservoirs (McClure and McSwain) are capable of impounding about 1,029,497 acre-feet of usable storage. The two powerhouses (New Exchequer and McSwain) have an authorized installed capacity of 101.25 megawatts (MW) of power. The Merced River Project occupies 3,154.9 acres of federal land administered by the U.S. Department of the Interior, Bureau of Land Management (BLM). It generates an average of about 387 gigawatt-hours (GWh) of energy annually. Merced ID proposes no new capacity and no new construction.

1.1.2 Merced Falls Project

On February 8, 2012, Pacific Gas and Electric Company (PG&E) filed an application for new license with the Commission. The 3.4-MW Merced Falls Hydroelectric Project is located on the Merced River on the border of Merced and Mariposa Counties, California (figures 1-2, 1-3, and 1-4). The project occupies 1.0 acre of federal land administered by BLM. It generates an average of about 14.4 GWh of energy annually. PG&E proposes no new capacity and no new construction.

The existing licenses for both the Merced River and Merced Falls Projects expired on February 28, 2014.

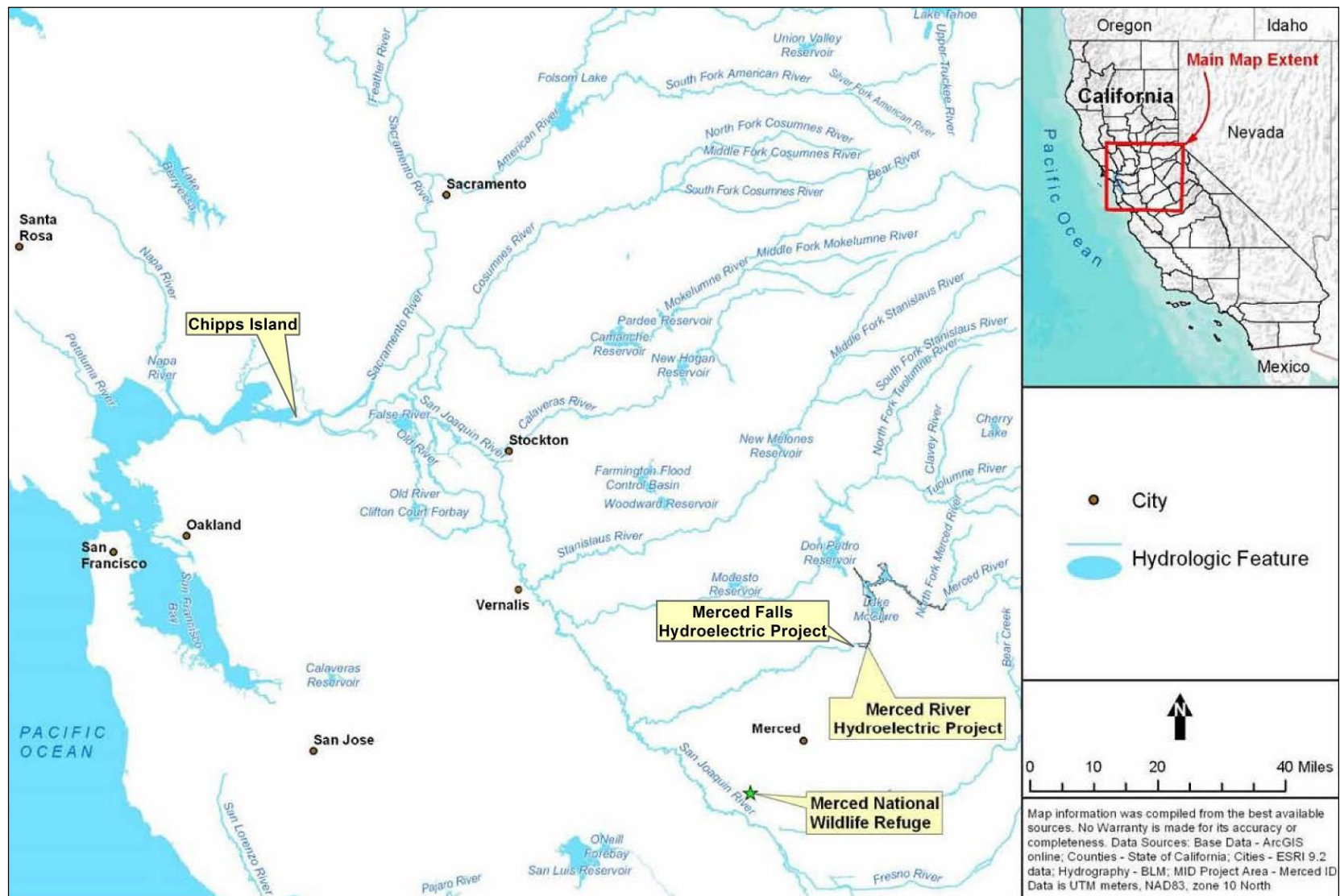


Figure 1-1. Location of Merced River Hydroelectric Project (Source: Merced ID, 2012a, as modified by staff).

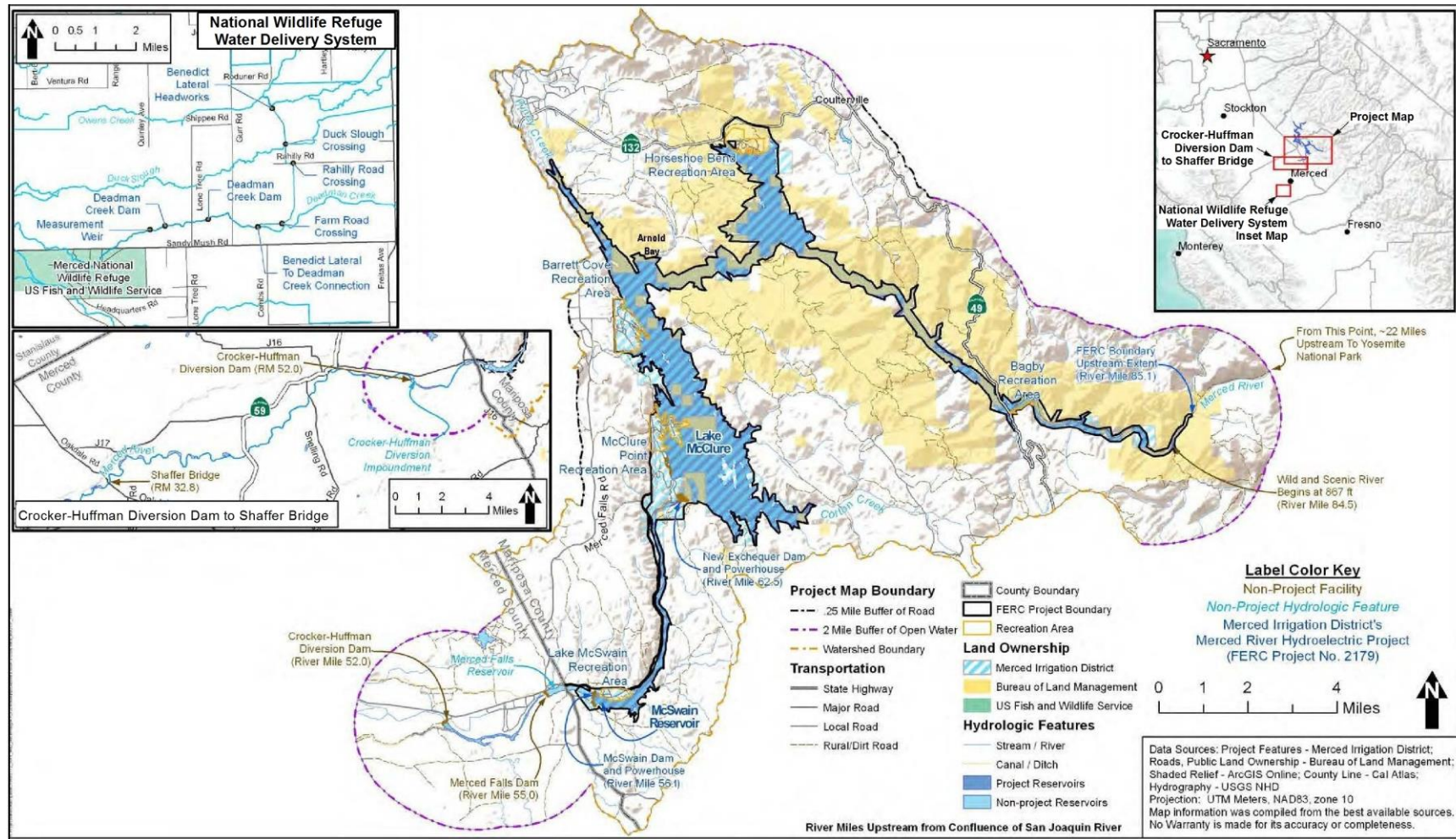


Figure 1-2. Merced River and Merced Falls Hydroelectric Projects and vicinity (Source: Merced ID, 2012a, as modified by staff).

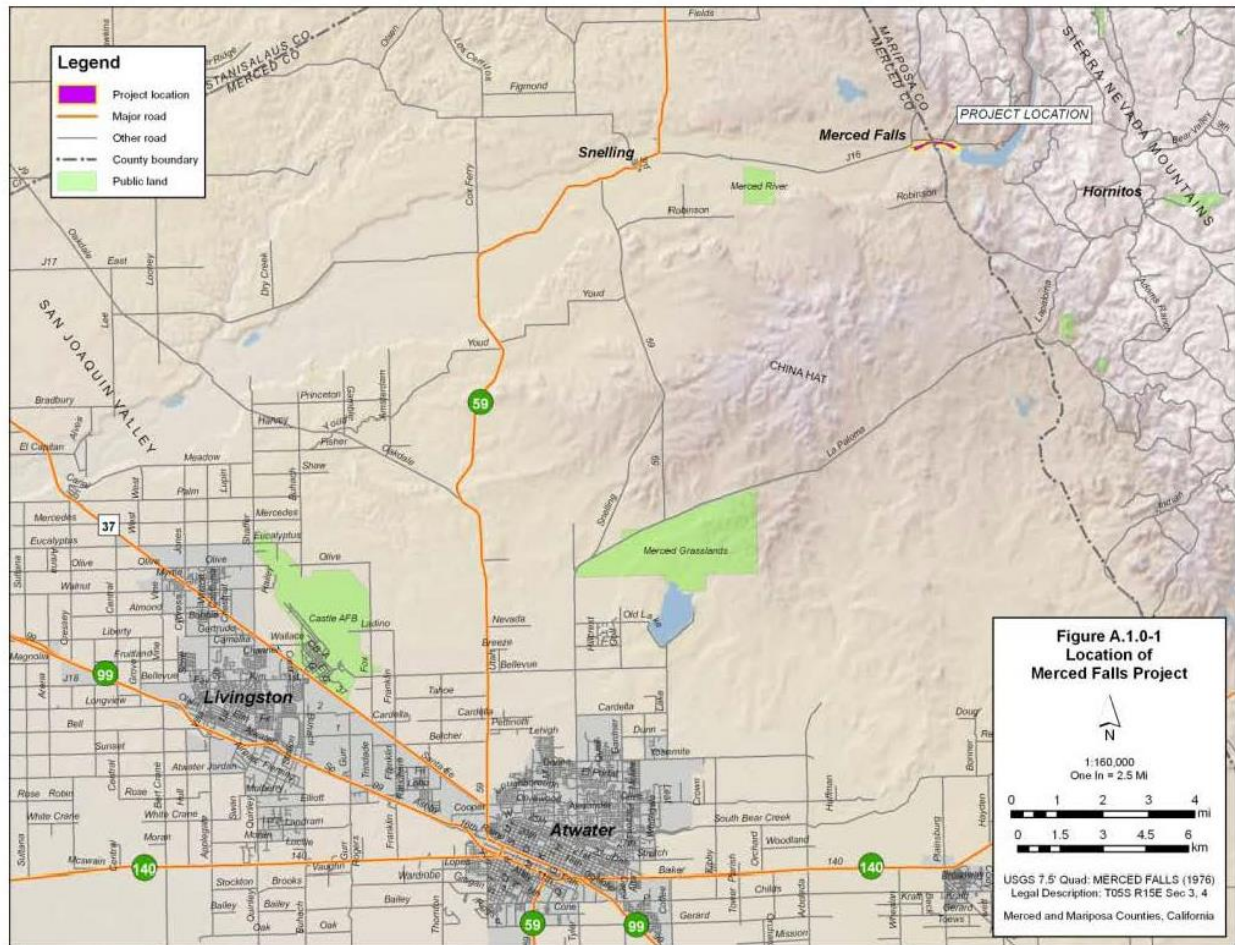


Figure 1-3. Location of the Merced Falls Hydroelectric Project (Source: PG&E, 2012).

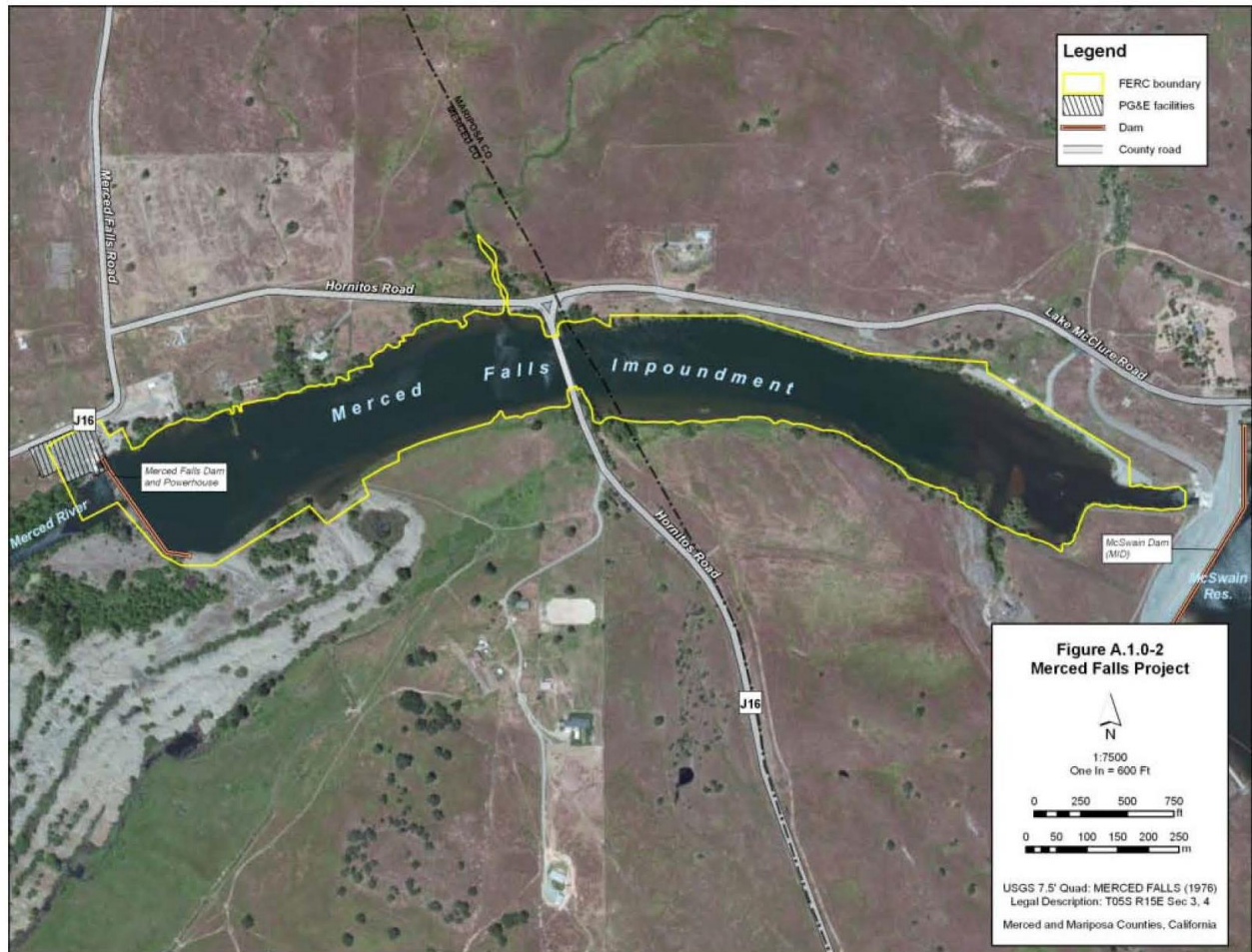


Figure 1-4. Merced Falls Hydroelectric Project (Source: PG&E, 2012).

1.2 PURPOSE OF ACTION AND NEED FOR POWER

1.2.1 Purpose of Action

The purpose of both the Merced River and Merced Falls Projects is to continue to provide a source of hydroelectric power and provide irrigation and domestic water to the local communities. Therefore, under the provisions of the Federal Power Act (FPA), the Commission must decide whether to issue a license to Merced ID for the Merced River Project and to PG&E for the Merced Falls Project, and what conditions should be placed on any licenses issued. In deciding whether to issue a license for a hydroelectric project, the Commission must determine that the project will be best adapted to a comprehensive plan for improving or developing a waterway. In addition to the power and developmental purposes for which licenses are issued (such as flood control, irrigation, or water supply), the Commission must give equal consideration to the purposes of: (1) energy conservation; (2) the protection of, mitigation of damage to, and enhancement of fish and wildlife resources; (3) the protection of recreational opportunities; and (4) the preservation of other aspects of environmental quality.

Issuing new licenses for the Merced River and Merced Falls Projects would allow Merced ID and PG&E, respectively, to generate electricity at the projects for the term of the new licenses, making electric power from a renewable resource available to their customers.

This draft environmental impact statement (EIS) assesses the effects associated with operation of the projects and alternatives to the proposed projects. It also includes recommendations to the Commission on whether to issue new licenses, and if so, includes the recommended terms and conditions to become a part of any licenses issued.

In this draft EIS, we assess the environmental and economic effects of continuing to operate the projects: (1) as proposed by the applicant, and (2) with our recommended measures. We also consider the effects of the no-action alternative. Important issues for the Merced River Project that are addressed include: establishing an appropriate flow regime in the Merced River, including downstream of Crocker-Huffman diversion dam; the need to modify releases from New Exchequer powerhouse to enhance downstream water temperatures; the need to enhance anadromous fish habitat and provide upstream and downstream fish passage; protection of wildlife from project-related effects; control of invasive species; the need for new or enhanced existing recreational facilities; and protection of cultural resources. Important issues for the Merced Falls Project that are addressed include: coordination of operations and environmental measures with the upstream Merced River Project; the need to enhance fish habitat and provide upstream fish passage; protection of wildlife from project-related effects; the need for new or enhanced existing recreational facilities; and protection of cultural resources.

1.2.2 Need for Power

The Merced River and Merced Falls Projects would provide hydroelectric generation to meet part of California's power requirements, resource diversity, and capacity needs. The Merced River Project has an authorized installed capacity of 101.25 MW and would generate approximately 387 GWh per year. The Merced Falls Project has an authorized installed capacity of 3.4 MW and would generate approximately 14.4 GWh per year.

The North American Electric Reliability Corporation (NERC) annually forecasts electrical supply and demand nationally and regionally for a 10-year period. The Merced River and Merced Falls Projects are located in the Western Electricity Coordinating Council region, California/Mexico subregion, of the NERC. According to NERC's 2014 forecast, net internal summer and winter demand requirements for the California/Mexico subregion are projected to grow at rates of 0.25 percent and 0.37 percent, respectively, from 2015 through 2024 (NERC, 2014). NERC projects that resource summer capacity margins (generating capacity in excess of demand) will range between 15.31 percent in 2015 and 20.95 percent in 2024, including planned new capacity additions. NERC projects that winter capacity margins will range between 34.61 percent in winter 2013/2014 and 29.15 percent in winter 2024/2025.

We conclude that power from the Merced River and Merced Falls Projects would help meet the need for power in the California\Mexico subregion in both the short and long term. The projects provide low-cost power that displaces generation from non-renewable sources. Displacing the operation of non-renewable facilities may avoid some power plant emissions, thus creating an environmental benefit.

1.3 STATUTORY AND REGULATORY REQUIREMENTS

Licenses for the Merced River and Merced Falls Projects are subject to numerous requirements under the FPA and other applicable statutes. We describe the major regulatory requirements for both projects below.

1.3.1 Merced River Project

1.3.1.1 Federal Power Act

Section 18 Fishway Prescriptions

Section 18 of the FPA states that the Commission is to require construction, operation, and maintenance by a licensee of such fishways as may be prescribed by the Secretaries of Commerce or the U.S. Department of the Interior. Interior and the National Marine Fisheries Service (NMFS), by letters dated July 22, 2014, request that a reservation of authority to prescribe fishways under section 18 be included in any license issued for the project.

Section 4(e) Conditions

Section 4(e) of the FPA provides that any license issued by the Commission for a project within a federal reservation will be subject to and contain such conditions as the Secretary of the responsible federal land management agency deems necessary for the adequate protection and use of the reservation. BLM filed preliminary conditions by letter dated July 22, 2014, pursuant to section 4(e) of the FPA. These conditions are described under section 2.2.1.5, *Modifications to Applicant's Proposal—Mandatory Conditions*.

Alternative Section 4(e) Conditions under the Energy Policy Act of 2005

The Energy Policy Act of 2005 provides parties to this licensing proceeding the opportunity to propose alternatives to preliminary conditions. On August 21, 2014, the Commission received a copy of Merced ID's filing to BLM proposing alternative 4(e) conditions in response to BLM preliminary section 4(e) conditions. Merced ID's 26 alternative 4(e) conditions are divided into five groups: (1) conditions that have no nexus to BLM-managed land (four conditions); (2) conditions that require Merced ID to develop plans for which little, if any, detail or guidance regarding the plan to be developed is provided (six conditions); (3) conditions that require Merced ID to develop plans, for which some level of detail regarding the plan to be developed is provided (four conditions); (4) conditions that require Merced ID to develop a plan and for which BLM's condition included a plan (three conditions); and (5) conditions that are unrelated to plans (nine conditions). The Merced ID alternative conditions that pertain to environmental effects are analyzed within the corresponding resource areas in section 3.0, *Environmental Analysis*, and section 5.1, *Comprehensive Development and Recommended Alternative*.

Section 10(j) Recommendations

Under section 10(j) of the FPA, each hydroelectric license issued by the Commission must include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project. The Commission is required to include these conditions unless it determines that they are inconsistent with the purposes and requirements of the FPA or other applicable law. Before rejecting or modifying an agency recommendation, the Commission is required to attempt to resolve any such inconsistency with the agency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

California Department of Fish and Wildlife (California DFW) timely filed on July 21, 2014, and NMFS and the U.S. Fish and Wildlife Service (FWS) timely filed, on July 22, 2014, recommendations under section 10(j), as summarized in table 5-5, in section 5.3.1, *Fish and Wildlife Agency Recommendations*. On October 22, 2014, California DFW filed an amendment to its 10(j) recommendations. In section 5.3, we also discuss how we address the agency recommendations and comply with section 10(j).

1.3.1.2 Clean Water Act

Under section 401 of the Clean Water Act (CWA), a license applicant must obtain certification from the appropriate state pollution control agency verifying compliance with the CWA. On May 21, 2014, Merced ID applied to the California State Water Resources Control Board (Water Board) for 401 water quality certification (WQC) for the Merced River Project. The Water Board received this request on May 21, 2014. The Water Board has not yet acted on the request although it filed preliminary WQC conditions on July 22, 2014. The WQC is due by May 20, 2015.

1.3.1.3 Endangered Species Act

Section 7 of the Endangered Species Act (ESA) requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of the critical habitat of such species. Our analyses of project impacts on threatened and endangered species are presented in section 3.3.1, *Aquatic Resources* (for Central Valley steelhead) and section 3.3.3, *Threatened and Endangered Species*, and our recommendations in section 5.1, *Comprehensive Development and Recommended Alternative*.

The Central Valley steelhead, federally listed as threatened, occurs within the San Joaquin River and likely occurs in the Merced River downstream of Crocker-Huffman diversion dam. Designated critical habitat for this species includes the Merced River downstream of the diversion dam, San Joaquin River, and the Sacramento-San Joaquin Delta (letter from S. Edmondson, FERC Hydropower Branch Supervisor, NMFS, Sacramento, California, to K.D. Bose, Secretary, FERC, Washington, D.C., July 22, 2014). Compared to existing conditions, the proposed project with staff-recommended measures would enhance (1) fall attraction flows for adult steelhead; (2) spawning substrate; (3) water temperature during spring rearing and smoltification; (4) off-channel habitat, floodplain connectivity, and juvenile emigration triggers with spring pulse flows; and (5) physical habitat with increased minimum instream flows. Consequently, we conclude that the Merced River Project as proposed with staff-recommended measures, is not likely to adversely affect the Central Valley steelhead. We will request NMFS concurrence with our conclusion.

Five federally listed animal species and five federally listed plant species occur or potentially occur in the project area: San Joaquin kit fox (*Vulpes macrotis mutica*), California red-legged frog (*Rana aurora draytonii*), California tiger salamander (*Ambystoma californiense*), valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), and vernal pool fairy shrimp (*Branchinecta lynchi*); Keck's checkerbloom (*Sidalcea keckii*), Layne's ragwort (*Packera layneae*), Chinese Camp brodiaea (*Brodiaea pallida*), Mariposa pussypaws (*Calyptidium pulchellum*), and California vervain (*Verbena californica*). The project area overlaps with about 1 acre of critical habitat for the vernal pool fairy shrimp and with one recovery unit identified for the California red-

legged frog (letter from P. Sanderson Port, U.S. Department of Interior, San Francisco, CA, to K.D. Bose, Secretary, FERC, Washington, D.C., July 22, 2014).

We conclude that relicensing of the Merced River Project, as proposed with staff-recommended measures, is not likely to adversely affect the San Joaquin kit fox, California red-legged frog, California tiger salamander, valley elderberry longhorn beetle, vernal pool fairy shrimp, Keck's checkerbloom, Layne's ragwort, Chinese Camp brodiaea, Mariposa pussypaws, and California vervain. We will seek concurrence from FWS with issuance of this draft EIS.

1.3.1.4 Coastal Zone Management Act

Under section 307(c)(3)(A) of the Coastal Zone Management Act (CZMA), 16 U.S.C. § 1456(3)(A), the Commission cannot issue a license for a project within or affecting a state's coastal zone unless the state CZMA agency concurs with the license applicant's certification of consistency with the state's CZMA program, or the agency's concurrence is conclusively presumed by its failure to act within 180 days of its receipt of the applicant's certification.

The project is not located within the state-designated Coastal Management Zone boundary, which extends from a few city blocks to 5 miles inland from the sea and it would not affect California's coastal resources. Therefore, the project is not subject to California's coastal zone program review, and no consistency certification is needed for the action.

1.3.1.5 National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA) requires that every federal agency "take into account" how each of its undertakings could affect historic properties. Historic properties are districts, sites, buildings, structures, traditional cultural properties (TCPs), and objects significant in American history, architecture, engineering, and culture that are eligible for inclusion in the National Register of Historic Places (National Register).

To meet the requirements of section 106, the Commission intends to execute a Programmatic Agreement (PA) with the California State Historic Preservation Officer (California SHPO) for the protection of historic properties from the effects of operation and maintenance of the Merced River Project. The terms of the PA would ensure that Merced ID addresses and treats all historic properties identified within the project's area of potential effects (APE) through the implementation of a final Historic Properties Management Plan (HPMP) expected to be filed with the Commission by the end of December 2014, with staff modifications, if needed. Compliance with the executed PA would be a condition of any order issuing a license.

1.3.1.6 Wild and Scenic Rivers Act

Section 7(a) of the Wild and Scenic Rivers Act requires federal agencies to make a determination as to whether the operation of the Merced River Project under a new license would invade the area or unreasonably diminish the scenic, recreational, and fish and wildlife values present in the designated river corridor. Public Law 102-432 (October 23, 1992) designated the segments of the Merced River as a Wild and Scenic River, which extend from the main stem of the Merced River from its sources (including Red Peak Fork, Merced Peak Fork, Triple Peak Fork, and Lyell Fork on the south side of Mount Lyell) in Yosemite National Park downstream to the normal maximum water surface elevation (NMWSE) of Lake McClure (elevation 867 feet National Geodetic Vertical Datum of 1929¹¹), and the South Fork Merced River from its source near Triple Divide Peak in Yosemite National Park to the confluence with the main stem of the Merced River. The Wild and Scenic River is managed by BLM; U.S. Department of the Interior, National Park Service (Park Service); and the U.S. Department of Agriculture, Forest Service (Forest Service) to protect and enhance the free-flowing condition, water quality, and outstanding remarkable values for which the river was designated while providing for public recreation and resource uses that do not adversely affect or degrade those values. The project would not affect any segments of the Merced River designated under the Wild and Scenic Rivers Act because none occur downstream of the project.

1.3.1.7 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act requires federal agencies to consult with National Oceanic and Atmospheric Administration Fisheries on all actions that may adversely affect Essential Fish Habitat (EFH). No EFH has been designated within the Merced River Project boundary. However, the extent of potential existing project effects on EFH (the EFH action area) includes the lowermost 52 miles of the Merced River (i.e., downstream of Crocker-Huffman diversion dam) and 118 miles of the San Joaquin River from the Merced River confluence downstream to Vernalis (Pacific Fisheries Management Council, 1999). EFH in the lower Merced River is designated for Chinook salmon spawning, rearing, and migration, and EFH in the San Joaquin River is designated for Chinook salmon migration. Our analyses of project impacts on Chinook salmon EFH is presented in section 3.3.1, *Aquatic Resources* (for Central Valley steelhead) and our recommendations in section 5.1, *Comprehensive Development and Recommended Alternative*.

¹¹ All elevations in this EIS are in National Geodetic Vertical Datum of 1929 unless otherwise noted.

Compared to existing conditions, the proposed project with staff-recommended measures would enhance: (1) fall attraction flows for adult Chinook salmon; (2) spawning substrate; (3) water temperature during spring rearing and smoltification; (4) off-channel habitat, floodplain connectivity, and juvenile emigration triggers with spring pulse flows; and (5) physical habitat with increased minimum instream flows. Consequently, we conclude that the Merced River Project, as proposed with staff-recommended measures, would not adversely affect EFH. As such, no consultation is required with NMFS.

1.3.2 Merced Falls Project

1.3.2.1 Federal Power Act

Section 18 Fishway Prescriptions

Section 18 of the FPA states that the Commission is to require construction, operation, and maintenance by a licensee of such fishways as may be prescribed by the Secretaries of Commerce or the U.S. Department of the Interior. NMFS and FWS, by letters dated July 22, 2014, request that a reservation of authority to prescribe fishways under section 18 be included in any license issued for the project.

Section 10(j) Recommendations

Under section 10(j) of the FPA, each hydroelectric license issued by the Commission must include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project. The Commission is required to include these conditions unless it determines that they are inconsistent with the purposes and requirements of the FPA or other applicable law. Before rejecting or modifying an agency recommendation, the Commission is required to attempt to resolve any such inconsistency with the agency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

California DFW, timely filed on July 21, 2014, and NMFS and FWS timely filed, on July 22, 2014, recommendations under section 10(j), as summarized in table 5-6, in section 5.3.1, *Fish and Wildlife Agency Recommendations*. In section 5.3, we also discuss how we address the agency recommendations and comply with section 10(j).

1.3.2.2 Clean Water Act

Under section 401 of the CWA, a license applicant must obtain certification from the appropriate state pollution control agency verifying compliance with the CWA. PG&E applied to the Water Board for 401 WQC for the Merced Falls Project. The Water Board received this request on May 20, 2014. The Water Board has not yet acted on the request although it filed preliminary WQC conditions on July 22, 2014. The WQC is due by May 20, 2015.

1.3.2.3 Endangered Species Act

Section 7 of the ESA requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of the critical habitat of such species. Our analyses of project impacts on threatened and endangered species are presented in section 3.3.1, *Aquatic Resources*, and section 3.3.3, *Threatened and Endangered Species*, and our recommendations in section 5.1, *Comprehensive Development and Recommended Alternative*.

As described above, for the Merced River Project in section 1.3.1.3, *Endangered Species Act*, the Central Valley steelhead, federally listed as threatened, occurs within the San Joaquin River and likely occurs in the Merced River downstream of Crocker-Huffman diversion dam. The proposed project with staff-recommended measures would have minimal incremental effects on downstream environmental variables. Consequently, we conclude that the Merced Falls Project as proposed with staff-recommended measures, is not likely to adversely affect the Central Valley steelhead. We will request NMFS concurrence with our conclusion.

Three federally listed animal species occur or potentially occur in the project area: San Joaquin kit fox, California red-legged frog, and valley elderberry longhorn beetle. No critical habitat for these species occurs in the immediate vicinity of the project.

We conclude that relicensing of the Merced Falls Project, as proposed with staff-recommended measures, is not likely to adversely affect the San Joaquin kit fox, California red-legged frog, and valley elderberry longhorn beetle. We will seek concurrence from FWS with issuance of this draft EIS.

1.3.2.4 Coastal Zone Management Act

Similar to the Merced River Project, the Merced Falls Project is not located within the state-designated Coastal Management Zone boundary, which extends from a few city blocks to 5 miles inland from the sea, and the project would not affect California's coastal resources. Therefore, the project is not subject to California's coastal zone program review, and no consistency certification is needed for the action.

1.3.2.5 National Historic Preservation Act

Section 106 of the NHPA requires that every federal agency "take into account" how each of its undertakings could affect historic properties. Historic properties are districts, sites, buildings, structures, TCPs, and objects significant in American history, architecture, engineering, and culture that are eligible for inclusion in the National Register.

To meet the requirements of section 106, the Commission intends to execute a PA with the California SHPO for the protection of historic properties from the effects of operation and maintenance of the Merced Falls Project. The terms of the PA would

ensure that PG&E addresses and treats all historic properties identified within the project's APE through implementation of a HPMP filed on October 6, 2014, with staff modifications, if needed. Compliance with the executed PA would be a condition of any order issuing a license.

1.3.2.6 Wild and Scenic Rivers Act

Section 7(a) of the Wild and Scenic Rivers Act requires federal agencies to make a determination as to whether the operation of the Merced Falls Project under a new license would invade the area or unreasonably diminish the scenic, recreational, and fish and wildlife values present in the designated river corridor. As noted above, segments of the Merced River have been designated wild and scenic. However, similar to the Merced River Project, the Merced Falls Project would not affect any segments of the Merced River designated under the Wild and Scenic Rivers Act because none occur downstream of the project.

1.3.2.7 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fisheries Conservation and Management Act requires federal agencies to consult with NMFS on all actions that may adversely affect EFH. In the case of the Merced Falls Project, EFH has not been officially designated within the project area. In section 1.3.1.7, *Magnuson-Stevens Fishery Conservation and Management Act*, we describe the extent of Chinook salmon EFH in the lower Merced River. Our analyses of Merced River Project impacts on Chinook salmon EFH in the lower Merced River is presented in section 3.3.1, *Aquatic Resources* (for Central Valley steelhead) and our recommendations in section 5.1, *Comprehensive Development and Recommended Alternative*.

1.4 PUBLIC REVIEW AND COMMENT

The Commission's regulations (18 Code of Federal Regulations [CFR], sections 5.1–5.16) require that applicants consult with appropriate resource agencies, tribes, and other entities before filing an application for a license. This consultation is the first step in complying with the Fish and Wildlife Coordination Act, the ESA, the NHPA, and other federal statutes. Pre-filing consultation must be complete and documented according to the Commission's regulations.

1.4.1 Merced River Project

1.4.1.1 Scoping

Before preparing this EIS, we conducted scoping to determine what issues and alternatives should be addressed. A scoping document (SD1) was distributed to interested agencies and others on January 2, 2009. Two scoping meetings, both advertised in the local newspaper, were held on January 28, 2009, in Merced, California, to request oral comments on the project. A court reporter recorded all comments and

statements made at the scoping meetings, and these are part of the Commission's public record for the project. In addition to comments provided at the scoping meetings, the following entities provided written comments:

<u>Commenting Entity</u>	<u>Date Filed</u>
Park Service	February 27, 2009
Water Board	March 2, 2009
Merced River Conservation Committee - Ralph Mendershausen	March 2, 2009
Mariposa County	March 2, 2009
Rick W. Jones	March 3, 2009
Golden West Women Flyfishers	March 3, 2009
Merced ID	March 3, 2009
Friends of the River	March 3, 2009
Merced River Conservation Committee	March 3, 2009
California Sportfishing Protection Alliance	March 3, 2009
BLM	March 4, 2009
NMFS	March 4, 2009

A revised scoping document (SD2), addressing these comments, was issued on April 17, 2009.

1.4.1.2 Interventions

On March 24, 2014, the Commission issued a notice that Merced ID's application to relicense the Merced River Project was ready for environmental analysis. The Commission set May 23, 2014, as the deadline for filing protests and motions to intervene. On April 24, 2014, the Commission granted a 60-day extension of time, until July 22, 2014, for filing protests and motions to intervene. In response to the notice, the following entities filed motions to intervene:

<u>Intervenor</u>	<u>Date Filed</u>
PG&E	May 30, 2012
Water Board	April 14, 2014
California DFW	April 29, 2014
Conservation Groups	May 22, 2014
U.S. Department of the Interior	May 22, 2014

1.4.1.3 Comments on the Application

A notice requesting conditions and recommendations was issued on March 24, 2014. The following entities commented:

<u>Commenting Agency and Other Entity</u>	<u>Date Filed</u>
California DFW	July 21, 2014
FWS	July 22, 2014
Conservation Groups	July 22, 2014
BLM	July 22, 2014
NMFS	July 22, 2014
Water Board	July 29, 2014
City of Merced	September 3, 2014

The applicant filed reply comments on September 5, 2014, and amendments to its application on September 22, 2014. In addition to the above comments 243 comment letters from members of the public were filed in response to the notice. A list of the commenters and the filing date of their letters are provided in appendix C.

1.4.2 Merced Falls Project

1.4.2.1 Scoping

Before preparing this EIS, we conducted scoping to determine what issues and alternatives should be addressed. SD1 was distributed to interested agencies and others on April 24, 2009. It was noticed in the Federal Register (FR) on April 24, 2009. The following entities provided written comments:

<u>Commenting Entity</u>	<u>Date Filed</u>
Merced River Conservation Committee	June 22, 2009
PG&E	June 22, 2009
NMFS	June 22, 2009
Water Board	June 22, 2009

A revised scoping document (SD2), addressing these comments, was issued on August 6, 2009.

1.4.2.2 Interventions

On March 24, 2014, the Commission issued a notice that PG&E's application to relicense the Merced Falls Project was ready for environmental analysis. The Commission set May 23, 2014, as the deadline for filing protests and motions to

intervene. On April 24, 2014, the Commission granted a 60-day extension of time, until July 22, 2014, for filing protests and motions to intervene. In response to the notice, the following entities filed motions to intervene:

<u>Intervenor</u>	<u>Date Filed</u>
Water Board	April 14, 2014
California DFW	April 29, 2014
Merced ID	May 20, 2014
Conservation Groups	May 22, 2014
U.S. Department of Interior	May 22, 2014

1.4.2.3 Comments on the Application

A notice requesting conditions and recommendations was issued on March 24, 2014. The following entities commented:

<u>Commenting Agency and Other Entity</u>	<u>Date Filed</u>
FWS	July 22, 2014
NMFS	July 22, 2014
Conservation Groups	July 22, 2014
California DFW	July 22, 2014
Water Board	July 22, 2014

The applicant filed reply comments on September 5, 2014.

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2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 NO-ACTION ALTERNATIVE

The no-action alternative is the baseline from which to compare the proposed action and all action alternatives that are assessed in the environmental document. Under the no-action alternative, the projects would continue to operate under the terms and conditions of their current licenses.

2.1.1 Merced River Project

The Merced River Project was constructed from 1964 to 1967 and placed in service in 1966. Merced ID owns and operates the project, consisting of two developments located in Mariposa County, California, within the Merced River drainage. The project's reservoirs—Lake McClure and McSwain reservoir—are capable of impounding 1,029,497 acre-feet of usable storage. The two powerhouses have an authorized installed capacity of 101.25 MW of power. The project includes no transmission lines. The project includes five recreational areas.

2.1.1.1 Existing Project Facilities

The Merced River Project includes two developments—New Exchequer Development and McSwain Development. Reservoir and powerhouse characteristics are shown in tables 2-1 and 2-2, below.

Table 2-1. Water storage characteristics of Merced River Hydropower Project reservoirs (Source: Merced ID, 2012a, as modified by staff).

Characteristics	Lake McClure	McSwain Reservoir
Drainage area (square miles)	1,035	1,055
Normal maximum/minimum water surface elevation (feet)	867.0/630.0	399.0/391.5
Gross storage at NMWSE (acre-feet)	1,024,600	9,730
Usable storage at NMWSE(acre-feet)	1,021,600	7,897
Surface area at NMWSE (acres)	7,110	310
Length (miles)	19.0	6.3
Maximum width (miles)	1.8	0.2
Maximum depth (feet)	427	66
Shoreline length (miles)	82.0	12.5

Note: NMWSE – normal maximum water surface elevation

Table 2-2. Characteristics of powerhouses associated with the Merced River Hydropower Project (Source: Merced ID, 2012a, as modified by staff).

Reservoir Name	Powerhouse Capacity (MW)	Number of Units	Type of Units	Minimum/Maximum Discharge (cfs)
Lake McClure	94.5	1	Vertical Francis	200/3,200
McSwain reservoir	9.0	1	Vertical Kaplan	600/2,700

Note: cfs – cubic feet per second, MW – megawatt

New Exchequer Development

The New Exchequer development is the upstream facility and consists of: (1) New Exchequer dam—a rock structure with a reinforced concrete upstream face, 490 feet high and 1,220 feet long that impounds Lake McClure; (2) an ogee-type, concrete spillway with a 1,080-foot-long, ungated section and a 240-foot-long, gated section with six radial gates that are 40 feet wide and 30 feet high; (3) an earth-and-rock dike that is 62 feet high and 1,500 feet long; (4) an intake structure located upstream of the dam in Lake McClure; (5) a concrete-lined power tunnel that is 383 feet long and 18 feet in diameter; (6) a concrete-encased, steel penstock that is 982 feet long and 16 feet in diameter; (7) an above-ground concrete powerhouse that is 75 feet by 91 feet and discharges directly to the Merced River; (8) a low-level outlet, consisting of a 945.5-foot long, 108-inch-diameter powerhouse bypass (a steel pipe) that runs from the New Exchequer power tunnel to McSwain reservoir north of the New Exchequer powerhouse with a 108-inch-diameter Howell-Bunger valve; and (9) an interconnection to the grid at the step-up transformer in the powerhouse switchyard. The development is located on Merced ID (7,577.5 acres), BLM (3,134.7 acres), and private (13.2 acres) land (Merced ID, 2012b).

Merced ID maintains four recreation areas at Lake McClure: (1) McClure Point, which includes a campground, picnic area, swim beach, marina, and boat ramp; (2) Barrett Cove, which includes a campground, swim beach, marina with two boat ramps, and overflow parking; (3) Horseshoe Bend, which includes a campground, swim beach, and boat ramp; and (4) Bagby, which includes a campground, boat ramp, and Shepherd's Point primitive area (considered part of the Bagby recreation area). See table 3-22 in section 3.3.4, *Recreation Resources*, for a listing of the amenities provided at these sites.

McSwain Development

McSwain development is the downstream facility, consisting of: (1) McSwain dam—an embankment structure with a central impervious core of rolled fill between shoulders of cobbles or crushed rock—that is 80 feet high and 1,620 feet long and

impounds McSwain reservoir; (2) an ungated concrete overflow spillway that is 802 feet long; (3) an intake structure that is integral with the dam; (4) a concrete-lined power tunnel that is 160 feet long and 15 feet in diameter that leads to; (5) a steel penstock that is 160 feet long and 15 feet in diameter; (6) an above-ground, concrete powerhouse that is 72 feet by 72 feet and discharges directly into the Merced River; and (7) a low-level outlet, consisting of a 360-foot-long, 9-foot diameter powerhouse bypass pipe that runs from the McSwain power tunnel to Merced Falls reservoir with a fixed wheel gate at the upstream end of the bypass and an 8-foot-diameter Howell-Bunger valve on its downstream end. There is no transmission line associated with the project. The project connects to PG&E's interconnected system at the step-up transformer in the powerhouse switchyard. The development is located on Merced ID (907.5 acres) and BLM (20.2 acres) land (Merced ID, 2012b).

Merced ID maintains the McSwain recreation area at this development, which includes a campground, picnic area, group picnic area, informal day use area, swim beach, marina, and boat ramp. See table 3-22 in section 3.3.4, *Recreation Resources*, for a listing of the amenities provided at this site.

Crocker-Huffman Diversion Dam

Crocker-Huffman diversion dam is located 4.3 miles downstream of Merced ID's McSwain dam and 3.0 miles downstream of PG&E's Merced Falls dam. Merced ID owns Crocker-Huffman diversion dam and operates it as part of Merced ID's water delivery system, but the dam is not included as part of the Merced River Project. The concrete gravity dam is approximately 725 feet long and 22 feet high (Vogel, 2007), and diverts approximately 2,000 cubic feet per second (cfs) of water into Merced ID's Main Canal (irrigation canal).

Refuge Water Delivery Facilities

Article 45 of the existing license requires that Merced ID provide to FWS up to 15,000 acre-feet of project water and return flow to the Merced National Wildlife Refuge (NWR). The refuge, located about 30 miles southeast of McSwain dam, is part of the San Luis National Wildlife Refuge Complex (see figures 1-1 and 1-2). It encompasses 10,262 acres of wetlands, native grasslands, vernal pools, and riparian areas and was established in 1951 under the federal Lea Act¹² to attract wintering waterfowl from adjacent farmland where their foraging was causing crop damage.

To provide this water, in the early 1990s, Merced ID made eight modifications, each of which was incorporated into the project license (but not included in the project boundary), to Merced ID's existing Benedict lateral canal, which is part of Merced ID's

¹² 16 USC §695–695c; 62 Stat. 238.

water supply delivery system, composed of non-project facilities. The eight modifications, from upstream to downstream, include:

- Benedict lateral headworks,
- Benedict lateral duck slough crossing,
- Benedict lateral Rahilly Road crossing,
- Benedict lateral Farm Road crossing,
- Benedict lateral to Deadman Creek connection,
- Deadman Creek dam and flashboard risers (Station 77+73),
- Deadman Creek dam and flashboard risers (Station 142+00), and
- a measurement weir.

2.1.1.2 Existing Project Boundary

The project boundary encompasses the two project reservoirs and project roads, infrastructure, and recreation areas. Along the reservoir shorelines, most of the project boundary consists of a metes and bounds survey line that generally follows an elevation contour above the maximum water surface elevation. The project boundary location around the reservoirs provides a buffer of at least 50 horizontal feet from the maximum water surface elevation at all but about 0.75 mile of the 114-mile project boundary (letter from B. Kelly, Deputy General Manager, Water Resources, Merced ID, to the Commission, filed on September 13, 2013). The project boundary encompasses a 100-foot corridor of land along portions of project roads that extend beyond the larger contiguous project footprint (e.g., Lake McClure Road near its intersection with County Road J16). The recreational facilities located within the project boundary include the McClure Point, Barrett Cove, Horseshoe Bend, and Bagby recreation areas on Lake McClure and the McSwain recreation area on McSwain reservoir.

The New Exchequer development includes 7,577.5 acres of Merced ID land, 3,134.8 acres of public land managed by BLM, and 13.2 acres of private land. The McSwain development includes 927.5 acres of Merced ID land. Overall, the project includes 8,505.3 acres of Merced ID land, 3,134.8 acres of public land managed by BLM, and 13.2 acres of private land (Merced ID, 2012b, Merced ID, 2014b).

2.1.1.3 Project Safety

The project has been operating for more than 46 years under the existing license, and during this time, Commission staff has conducted operational inspections focusing on the continued safety of the structures, identification of unauthorized modifications, efficiency and safety of operations, compliance with the terms of the license, and proper maintenance. In addition, an independent consultant has inspected and evaluated the project every 5 years, and a consultant's safety report has been filed for Commission

review. As part of the relicensing process, the Commission staff would evaluate the continued adequacy of the proposed project facilities under a new license. Special articles would be included in any license issued, as appropriate. Commission staff would continue to inspect the project during the new license term to ensure continued adherence to Commission-approved plans and specifications, special license articles related to construction (if any), operation and maintenance, and accepted engineering practices and procedures.

2.1.1.4 Existing Project Operation

Historically, Merced ID has operated Lake McClure to retain snowmelt from springtime runoff for flood control, water supply, recreation, hydropower, and environmental purposes. During winter storms, the project attenuates high flows (e.g., those in excess of about 3,200 cfs) that would otherwise pass downstream of the project and stores this water in Lake McClure. During the drier months of July through November, the project augments flows in the lower Merced River compared to those that would occur without the project. In spring and summer, water levels are maintained relatively high for recreation at Lake McClure. From March through October, Merced ID releases water primarily for downstream water supply. These releases are also used for hydropower generation at New Exchequer and McSwain powerhouses. The normal maximum and minimum reservoir elevations for Lake McClure are 867 feet and 630 feet, but, typically, the reservoir is operated within a range of 842 feet to 780 feet.

In September and October, Merced ID releases water from storage when necessary to achieve a level of storage that allows for the required flood space, and storage is maintained at or below this level through mid-March. In the spring, depending on the snowpack and runoff forecasts, Merced ID begins to refill Lake McClure with the snowmelt runoff. During drier years and drier periods, water levels may consistently stay below the required flood-space level because water supply and recreation needs drive reservoir storage more than flood control requirements.

McSwain reservoir is typically operated as a re-regulating afterbay¹³ for flows released from Lake McClure. This operation allows the New Exchequer powerhouse to be used to meet peak power demands or perform load-following functions while still maintaining a steady flow release to the lower Merced River. The normal maximum and minimum reservoir elevations for McSwain reservoir are 399.0 feet and 391.5 feet. Water surface elevation excursions below the normal minimum reservoir elevation do occur, but they are generally due to atypical operating conditions, such as unplanned outages, inspections, or work on the dam.

¹³ The term afterbay as used here is a reservoir of a hydroelectric power plant at the outlet of the turbines.

Historically, Merced ID has operated New Exchequer and McSwain powerhouses as base-load plants with seasonal peaking capabilities; these peaking capabilities were primarily exercised at New Exchequer powerhouse. McSwain powerhouse is operated to re-regulate flows released by the New Exchequer powerhouse by providing flows that are more indicative of inflows to Lake McClure with releases dependent on the requirements for downstream water supply at, and downstream of, Crocker-Huffman diversion dam. Both project powerhouses are operated on-site by Merced ID from a centralized control center at New Exchequer dam and powerhouse, and have Automatic Generation Control capability.

The New Exchequer development diverts all flows from Lake McClure through the intake, power tunnel, penstock, and powerhouse and then directly releases the flows to McSwain reservoir. The McSwain development diverts all flows from McSwain reservoir through the intake, power tunnel, penstock, and powerhouse and then directly to the Merced River and to Merced Falls reservoir.

2.1.1.5 Existing Environmental Measures

Merced ID currently provides environmental measures and implements plans and agreements at the Merced River Project.

FERC License Requirements

- Operate the project in full compliance with the U.S. Army Corps of Engineers' (Corps) document entitled: *New Exchequer Dam and Reservoir, Merced River, California; Water Control Manual; Appendix VII to Master Water Control Manual, San Joaquin River Basin, California*, dated October 1981, adhering to the year-round flood control limits in Lake McClure for rain flood space and to the March through July flood control limits for snow melt flood space, or conditional space (as required by license article 39).
- In an agreement with the Corps, provide for the operation of the project for flood control in accordance with rules and regulations prescribed by the Secretary of the Army (license article 39).
- Provide minimum streamflows in the Merced River downstream from the project reservoirs according to the following schedule (license article 40):
 - Downstream from New Exchequer dam, maintain a minimum flow of 25 cfs at all times.
 - At Shaffer Bridge (River Mile [RM] 32.8), 23.8 miles downstream from New Exchequer dam, maintain a minimum streamflow, as follows:

Period	Normal Year (cfs)	Dry Years (cfs)
June 1 through October 15	25	15
October 16 through October 31	75	60
November 1 through December 31	100	75
January 1 through May 31	75	60

- To the extent possible from November 1 through December 31, regulate the Merced River streamflow downstream from the New Exchequer development between 100 and 200 cfs, except during dry years when the streamflow is maintained between 75 and 150 cfs, as measured at Shaffer Bridge (license article 41).
- Operate the power plants to avoid rapid fluctuation of the Merced River. At Crocker-Huffman diversion, restrict the rate of change of release during any 1-hour period to no more than double nor less than one-half the amount of release as the start of the change, and during emergency periods, endeavor to make releases in a manner that is not detrimental to fish (license article 42).
- From October 16 through December 31, make all releases at New Exchequer dam, from the outlets at or below elevation 485 feet insofar as physically possible (license article 43).
- Maintain the water surface elevation of New Exchequer reservoir (Lake McClure) as high as possible from April through October consistent with the primary purposes of the reservoir and maintain a minimum pool of no less than 115,000 acre-feet in Lake McClure, except when a drawdown is needed to maintain minimum streamflow as required by license article 40 (license article 44).
- Cooperate with the Bureau of Sport Fisheries and Wildlife of FWS to determine means of providing up to 15,000 acre-feet of project water and return flow waters to the Merced NWR (license article 45).
- Within 1 year from the effective date of the license, prepare and file with the Commission for approval a proposed recreational use plan that includes recreational improvements, which may be provided by others in addition to the improvements that Merced ID plans to provide (license article 47). Exhibit R drawings (filed in 1963 and most recently revised in 2007) depict four recreation areas at Lake McClure (Horseshoe, Bagby, McClure, and Barrett Cove) and the McSwain recreation area at McSwain reservoir. The recreation areas include campgrounds, boat launches, picnic areas, swimming areas, and parking.

Measures in Other Agreements and Contracts

In addition to the current license requirements (noted above), four agreements and contracts include various streamflow-related requirements. These agreements and contracts, and the terms and conditions in the agreements and contracts, which are not part of the existing license, include the following:

- California Department of Fish and Game (now California DFW) Memorandum of Understanding—Merced ID is required to supplement flows in the Merced River in October by providing 12,500 acre-feet of water in addition to the project’s minimum flow requirement in that month.
- Water supply deliveries in Lake McClure (no expiration date)—Merced ID makes three small diversions from Lake McClure for water supply: (1) Lake Don Pedro Community Service District withdraws from a location just north of Barrett Cove Marina up to about 5,000 acre-feet of water annually for water supply; (2) the Merced ID recreation facilities annually withdraw less than 1,000 acre-feet of water at three locations along Lake McClure; and (3) the McClure Boat Club, a small development adjacent to the project, diverts about 25 acre-feet at a point near the development. (The diversions are so minor that they do not affect project operations, and Merced ID anticipates that the diversions will continue unchanged.)
- Cowell Agreement (no expiration date)—Merced ID provides releases from Crocker-Huffman diversion dam up to the following flows for use by the Cowell Agreement diverters at 11 locations: 100 cfs in March; 175 cfs in April; 225 cfs in May; 250 cfs from the first day in June until the natural flow of the Merced River falls below 1,200 cfs; 225 cfs flow for the next 31 days; 175 cfs flow for the next 31 days; 150 cfs for the next 30 days; and 50 cfs thereafter or the natural inflow into Lake McClure, whichever is less, through the last day of February.
- Davis-Grunsky Agreement with the State of California (expires December 31, 2017)—Merced ID provides a continuous flow of between 180 cfs and 220 cfs in the Merced River between Crocker-Huffman diversion dam and Shaffer Bridge.

2.1.2 Merced Falls Project

2.1.2.1 Existing Project Facilities

The existing Merced Falls Project consists of: (1) a concrete gravity dam with a structural height of 34 feet and a crest length of 575 feet; (2) three radial gates, each 20 feet long and 13.5 feet high; (3) a 1-mile-long project impoundment with approximately 900 acre-feet of storage capacity, a useable storage capacity of

approximately 579 acre-feet, a total surface area of approximately 65 acres, and a normal impoundment elevation of 344 feet above mean sea level (msl); (4) powerhouse facilities consisting of a steel building housing a 3.4- MW turbine/generator unit and a vertical Kaplan-type four-blade turbine; (5) a 1,000-foot-long earthen levee with a crest width of 8 feet; (6) an adjacent intake structure with a debris rack; and (7) a non-operable fish ladder.

The project has a dependable capacity of 1.7 MW and an annual average generation of approximately 14.4 GWh.

2.1.2.2 Existing Project Boundary

The project boundary includes about 75.6 acres. The project boundary generally follows the shoreline of the impoundment at the 344-foot msl elevation contour line and encloses lands on which the powerhouse and switchyard are located. On the northeast edge of the Merced Falls impoundment, the project boundary rises above the 344-foot msl elevation contour to include a small strip (approximately 4.8 acres) of reservoir shoreline that encompasses a fishing access site owned and operated by Merced ID. PG&E owns 20.5 acres of land within the project boundary that includes lands around the project dam, powerhouse, and the Merced Falls fishing access site. Merced ID owns a majority of the remaining acreage on which PG&E possesses flowage rights. Approximately 1 acre of federal lands administered by BLM is within the project boundary.

2.1.2.3 Project Safety

The project has been operating for more than 46 years under the existing license and during this time, Commission staff has conducted operational inspections focusing on the continued safety of the structures, identification of unauthorized modifications, efficiency and safety of operations, compliance with the terms of the license, and proper maintenance. In addition, the project has been inspected and evaluated every 5 years by an independent consultant and a consultant's safety report has been submitted for Commission review. As part of the relicensing process, Commission staff would evaluate the continued adequacy of the proposed project facilities under a new license. Special articles would be included in any license issued, as appropriate. Commission staff would continue to inspect the project during the new license term to assure continued adherence to Commission-approved plans and specifications, special license articles relating to construction (if any), operation and maintenance, and accepted engineering practices and procedures.

2.1.2.4 Existing Project Operation

The Merced Falls Project is operated in a run-of-river mode dependent on water outflow from Merced ID's upstream Merced River Project. Inflow to the project passes through the impoundment, which is kept at a constant water elevation and then flows either through the powerhouse or the dam's radial gates. Flows of up to approximately

1,750 cfs are diverted through the powerhouse, and then discharged to the Merced River via the tailrace. When water inflows exceed 2,200 cfs, the project spills water through the radial gates. The main section of the dam, approximately 535.5 feet long, is topped with needle beams. During flood events with flows greater than 12,250 cfs, the needle beams can be dropped, allowing the 575-foot-long concrete section of the dam to act as a spillway.

2.1.2.5 Existing Environmental Measures

FERC License Requirements

- Minimize soil erosion and siltation on lands adjacent to the stream resulting from construction and operation of the project (license article 14).
- Construct, maintain, and operate such recreational facilities as prescribed by the Commission or upon the recommendation of the Secretary of the Interior or other interested state or federal agency (license articles 12, 39, and 40).
- Allow free public access, to a reasonable extent, to project waters and adjacent project lands owned by the licensee for the purposes of navigation and recreation. The licensee may also permit construction by others of wharves, access roads, landings, and other facilities, subject to the payment of reasonable rent (license article 13).

Voluntary Measures

- Under license article 28, the licensee is required to install stream gages as deemed necessary by the Commission. However, no stream gaging has been specifically required by the Commission. Nevertheless, PG&E has installed gaging instruments above and below the dam.

2.2 APPLICANT'S PROPOSAL

2.2.1 Merced River Project

2.2.1.1 Proposed Project Facilities

Generating Facilities

Merced ID does not propose to add any new generating facilities or to modify existing generating facilities.

Water Delivery Facilities

Merced ID proposes to remove the eight facilities associated with the delivery of water to the Merced NWR from the project but retain them in operation outside of the

license. Merced ID proposes to continue to provide water to the Merced NWR under the new license but believes the minor facilities that were constructed in the early 1990s are not needed as part of the license because Merced ID now has a number of alternative water delivery options to the refuge and the facilities now also provide water to Merced ID's water customers. Merced ID states that providing water to the refuge is no longer the sole purpose of the facilities and that the original facilities added for this purpose are no longer the primary method of delivering water to the refuge.

Recreation Facilities

In addition to operating and maintaining the existing recreation facilities and reconstructing the existing and proposed recreation facilities at the end of their useful lives, Merced ID proposes the following modifications to the existing recreational facilities, construction of one new recreation area, and construction of one new access point to the lower Merced River.

- Reconstruct existing recreation development components (e.g., campsites, restrooms, and parking areas) to comply with accessibility guidelines.
- Provide at McClure Point recreation area:
 - concrete boat launch ramp, restroom, and paved parking area at the existing informal boat launch;
 - aerator in the swimming area;
 - up to 10 park model cabins with picnic tables and pedestal grills;
 - group day use area with shelter, picnic tables, pedestal grills, and restroom;
 - additional sand at the existing swimming area and up to 10 additional picnic tables and pedestal grills; and
 - up to two floating swim platforms.
- Provide at Barrett Cove recreation area:
 - aerator in the swimming area;
 - additional sand at the existing swimming area and up to 15 additional picnic tables and pedestal grills;
 - sand lot volleyball court and playground at the swimming area; and
 - up to 12 park model cabins with picnic tables and pedestal grills.
- Provide at Horseshoe Bend recreation area:
 - 1-mile-long, non-motorized loop trail and information board;
 - aerator in the swimming area;

- additional sand at the existing swimming area and up to 10 additional picnic tables and pedestal grills;
- swim platform;
- sand lot volleyball court and playground at the swimming area;
- host site at the campground with septic system, power, and water; and
- up to 10 park model cabins with picnic tables and pedestal grills.
- Provide at Bagby recreation area:
 - interpretive and educational displays at the boat launch parking area and campground.
- Provide at Shepherd’s Point primitive area:
 - gravel parking area with 10 spaces, including at least 2 trailer spaces;
 - two-unit vault restroom; and
 - take-out trail or path from the reservoir/river to the parking area.
- Construct upstream takeout facility at Sherlock Creek recreation area:¹⁴
 - gravel parking area with 10 spaces;
 - two-unit vault restroom; and
 - take-out trail or path from reservoir/river to the parking area.
- Provide at McSwain recreation area:
 - non-motorized shoreline trail between the day use area and New Exchequer dam (about 4.1 miles, native surfaced);
 - information board at existing, native-surfaced parking areas and directional signs on Lake McClure Road;
 - up to 12 park model cabins;
 - paved bicycle lane (about 5 miles) on Lake McClure Road from County Road J16 to near New Exchequer dam;
 - additional sand at the existing swimming area and extend beach to the east by up to 50 percent; and
 - up to two swim platforms.

¹⁴ Merced ID proposes to develop an upstream take-out facility at Sherlock Creek only if BLM is able to secure public access to Mosher Road and ensures the road condition is suitable for vans/buses with trailers.

- Construct the new Mack Island non-motorized recreation area:
 - non-motorized trails (paved and unpaved) for bicycle and pedestrian use;
 - trailhead parking area with restroom;
 - pedestrian bridge to Mack Island;
 - up to 10 primitive campsites on Mack Island with shoreline trail access;
 - up to two swim platforms; and
 - watercraft restriction area between west shore of Mack Island and reservoir shoreline to the west.
- Maintain existing Merced River Trail from the project boundary to the Bagby trailhead and provide:
 - interpretive and educational display at Bagby trailhead;
 - pedestrian bridge over Merced River near Sherlock Creek; and
 - new trail segment on the south side of Merced River to the Bagby recreation area.¹⁵
- Construct a parking area with an unspecified capacity and install river access directional signage at the existing gravel-surfaced parking area at Merced Falls Road near Crocker-Huffman diversion dam (proposed as part of Merced ID measure RR2).

2.2.1.2 Proposed Project Boundary

Merced ID proposes the following changes to lands within the project boundary:

- Add 215.59 acres of land that would encompass the proposed Mack Island non-motorized recreation area at Lake McClure (New Exchequer development). Merced ID owns the land to be added to the project boundary.
- Add 1.06 acres of land that would encompass the main access road for the McSwain powerhouse (McSwain development). Merced ID owns the land to be added to the project boundary.

¹⁵ Merced ID proposes to construct and maintain the pedestrian bridge and south side trail only if all lands necessary have legal access through ownership or easements to allow public access to Bagby recreation area and BLM agrees to construct a bridge across the North Fork of the Merced River to allow safe public crossing during spring snow melt off and storm events.

- Remove 22.60 acres of McSwain development land that overlaps with PG&E's Merced Falls Project boundary because this land is not necessary for the continued operation and maintenance of the Merced River Project and is already under Commission jurisdiction of the Merced Falls Project. Merced ID owns the land to be removed from the project boundary.
- Remove 8.04 acres of McSwain development land that is not necessary for encompassing the extent of the McSwain reservoir spillway channel because this land is not necessary for the continued operation and maintenance of the McSwain reservoir spillway and spillway channel. Merced ID owns the land to be removed from the project boundary.

After these modifications to the project area, the New Exchequer development would include 7,793.09 acres of Merced ID land (a net increase of 215.59 acres). The McSwain development would include 877.92 acres of Merced ID land (a net reduction of 29.58 acres). The proposed project would include a total of 8,671.01 acres of Merced ID land, 3,154.9 acres of land managed by BLM, and 13.2 acres of private land.

2.2.1.3 Proposed Project Operation

Merced ID proposes to continue to operate the project as it has for the past 10 years, including making no changes to existing minimum flow release conditions.

2.2.1.4 Proposed Environmental Measures

Merced ID proposes the following environmental measures (Merced ID designations for proposed measures are in parenthesis):

General Measures (could apply to more than one resource area)

- Consult annually (at a minimum) with BLM regarding measures needed to ensure protection and use of resources on federal land administered by BLM and affected by the project (GEN1).
- Consult with BLM regarding potential future new facilities on federal land (GEN5).
- Consult with BLM regarding potential future new ground-disturbing activities on or directly affecting BLM lands that were not specifically addressed in the Commission's National Environmental Policy Act (NEPA) process (GEN4).

Aquatic Resources

- Develop a plan to coordinate operation with the downstream, run-of-river Merced Falls Project to assure implementation of flow-related measures at the two projects (GEN6).

- Develop an erosion control and restoration plan at least 90 days in advance of initiating construction of project facilities on BLM-managed land (G&S1).
- Develop a recreation facilities construction hazardous material spill prevention, control, and countermeasures plan at least 90 days in advance of initiating construction of recreation facilities (WR1).
- Deliver 15,000 acre-feet of water to Merced NWR at a single delivery point during Merced ID's irrigation season (WR2).
- Operate the project for flood control in accordance with the rules and regulations specified by the Corps (WR3).
- Provide minimum flows (from 40 to 180 cfs as measured at Shaffer Bridge depending on time of year and water year type) (AQR1, parts 1 and 4).
- Provide target flows (from 50 to 225 cfs as measured at Shaffer Bridge, depending on time of year and water year type) (AQR1, parts 1 and 4).
- Limit all controllable flow rate changes above a base flow of 200 cfs during any 1-hour period to not more than double or less than half the amount of the controlled release from McSwain dam at the start of the change (AQR1, part 2).
- Determine water year type as currently determined (AQR1, part 3).
- Notify the Water Board, BLM, FWS, NMFS, and California DFW by March 10 of the second or subsequent dry/critically dry water year if Merced ID has drought concerns (i.e., if there may not be sufficient water to meet both environmental and irrigation demands). By May 1 of these same years (i.e., the second or subsequent dry/critically dry water year), consult with these same agencies to discuss the project's operational plans to manage the drought conditions and file a drought plan with the Commission with a request for expedited approval (AQR1, part 5). Implement the drought plan unless notified otherwise by the Commission.
- Maintain the Lake McClure minimum pool of 115,000 acre-feet (approximate elevation 640 feet) and the minimum pool of McSwain reservoir at or above elevation 388 feet, unless further drawdowns are needed to maintain required minimum flows (AQR2).
- Operate four water temperature monitoring recorders at suitable sites in the Merced River downstream of Crocker-Huffman diversion dam, as selected by a technical advisory committee (T&E1).
- Continuously monitor anadromous fish migrating into the Merced River at an Alaskan weir or similar device to be installed and operated from October 1 through December 31, using a VAKI Riverwater™ system, and

identify the time and direction of migration, size, sex, marks, and other attributes. Monitor juvenile anadromous fish outmigration from the Merced River from January 1 through May 31 with a rotary screw trap (RST) and document the total number and, for a representative subsample of the catch, size, weight, and life stage (T&E2).

- Establish a Merced River anadromous fish committee that would meet four times a year and invite NMFS, FWS, California DFW, the Water Board, and a representative of a non-governmental organization selected by Merced ID to join the committee. The purpose of the committee would be to facilitate Merced ID's implementation of license conditions that pertain to monitoring anadromous fish. An annual report would be filed with the Commission by January 1 of each year documenting the activities of the committee during the previous calendar year (T&E3, mislabeled T&E2 by Merced ID).
- Implement the amended Aquatic Invasive Species Management Plan filed with the Commission on April 23, 2014, and supplemented on September 5, 2014 to provide guidance for the prevention of aquatic invasive species in project reservoirs (AQR4).
- Develop a large woody debris (LWD) management plan that excludes BLM-managed land from any stockpiling activities to provide LWD to the Merced River downstream of Crocker-Huffman diversion dam for the purpose of enhancing habitat for aquatic organisms (G&S2).

Terrestrial Resources

- Implement the Invasive Species Management Plan on federal land, filed with the final license application and amended on September 22, 2014 (TR1).
- Implement the Vegetation Management Plan on federal land, filed with the final license application, as amended, to protect special-status plants and minimize project effects on sensitive habitats (TR2).
- Avoid the use of pesticides and herbicides on land administered by BLM to control undesirable woody and herbaceous vegetation, aquatic plants, insects, rodents, and undesirable fish without the prior written approval of BLM (TR3).
- Implement the Bald Eagle Management Plan, filed the final license application (TR4).
- Document all known bat roosts at project facilities, and if bats could be subject to human disturbance, install exclusion devices (TR5).

- Implement the Limestone Salamanders Sensitive Areas Management Plan, filed with the final license application (TR6).
- Record the incidental observations of western pond turtles.

Threatened and Endangered Species

- Provide annual employee training regarding the identification of special-status, non-native species, and sensitive areas that are known to occur in the project area and their locations in the project boundary (GEN2).
- Review special-status species lists annually and assess new species on federal land, and if necessary, consult with agencies to develop and implement protection measures (GEN3).
- Avoid the use of burrow fumigants and rodenticides in habitat of the California tiger salamander and the San Joaquin kit fox.

Recreation Resources

- Implement the Recreation Facilities Plan, amended on September 22, 2014.
- Provide real-time recreation information on the California Data Exchange Center (California DEC) (RR2), including:
 - flow information for the Merced River below Merced Falls, Dry Creek near the city of Snelling, the Merced River near the cities of Snelling, Cressey, and Stevinson (existing measure);
 - elevations for Lake McClure and McSwain reservoir (existing measure); and
 - flow information for the Merced River at Shaffer Bridge (U.S. Department of the Interior, Geological Survey [USGS] gage no. 11271290).
- Construct a parking area and install river access directional signage at the existing gravel-surfaced parking area at Merced Falls Road near Crocker-Huffman diversion dam (RR2).
- Develop a conceptual plan to align the existing Merced River Trail to a new trail segment that would follow along the shoreline of Lake McClure and McSwain reservoir.
- Annually stock rainbow trout, fingerling kokanee, and Chinook salmon in Lake McClure and McSwain reservoir for recreational fishing (AQR3).

Land Use

- Implement the Transportation Management Plan, filed on September 22, 2014, to ensure project roads are adequately maintained.
- Implement the Fire Prevention and Response Plan, revised on September 22, 2014, to provide for management, reporting, and the prevention of wildfires at the project.

Cultural Resources

- Implement the HPMP upon filing to manage project effects on properties eligible for listing on the National Register (CR1).

Aesthetic Resources

- Implement the Visual Resource Plan, filed on September 22, 2014, to ensure visual quality objectives are met at the project through monitoring and consultation.

2.2.1.5 Modifications to Applicant's Proposal—Mandatory Conditions

The following mandatory conditions have been provided and are evaluated as part of the applicant's proposal.

Section 4(e) Land Management Conditions

The following preliminary mandatory conditions have been provided by BLM under section 4(e) and are included in appendix D. We consider preliminary conditions 7 and 27 through 50 to be administrative and therefore not analyzed in our EIS. The remaining conditions are resource-specific and analyzed in this EIS.

- Condition 1: Consult annually with BLM and other interested agencies regarding status of implementation of license conditions affecting BLM-managed land including, monitoring results, review of any non-routine maintenance, foreseeable changes to the project, discussion of needed protection for newly listed sensitive species, upcoming maintenance, and any planned pesticide use.
- Condition 2: Establish a consultation group to provide a forum for Merced ID to consult with resource agencies and other interested parties on topics not addressed in condition 1, including development of plans that may be included in a new license and proposed temporary or permanent modifications to license conditions. The consultation group would establish mutually agreeable process guidelines for conducting effective and efficient meetings that would occur at least four times a year.

- Condition 3: Annually perform employee awareness training to familiarize Merced ID operations and maintenance staff with special-status species, non-native invasive plants, and sensitive areas known to occur within or adjacent to the project boundary.
- Condition 4: Develop a coordinated operations plan with the licensee of the Merced Falls Project and with resource agencies to assure implementation of flow-related measures in the two project licenses.
- Condition 5: Develop an erosion control and restoration plan for actions affecting BLM-managed land within or adjacent to the project boundary for BLM approval and file the plan with the Commission at least 90-days in advance of initiating construction of recreation or other project facilities.
- Condition 6: Develop a large woody material (LWM) management plan in consultation with BLM, California DFW, FWS, NMFS, and the Water Board that: (1) addresses the location of LWM collection in Lake McClure and McSwain reservoir; (2) describes potential options for moving LWM to locations downstream of Crocker-Huffman diversion dam; and (3) identifies suitable locations downstream of Crocker-Huffman diversion dam where LWM can be placed within the active channel and be passively mobilized by 2 to 5 year high flow events or where it would be appropriate to anchor LWM in the active channel and floodplain.
- Condition 8: Develop an aquatic invasive species management and monitoring plan for BLM approval after consultation with California DFW, FWS, and the Water Board that initially addresses zebra and quagga mussels, New Zealand mudsnail, Eurasian milfoil, hydrilla, didymo, and Asian clams. The plan should include provisions for: (1) a public education program; (2) developing best management practices (BMPs) for individual operation and maintenance activities that have the potential to introduce aquatic invasive species into a project reservoir; (3) conducting a specific monitoring program for quagga and zebra mussels, including surface surveys, veliger sampling, and artificial substrate monitoring; and (4) incidental observation monitoring of quagga and zebra mussels, New Zealand mudsnail, Asian clams, Eurasian milfoil, hydrilla, didymo, and American bullfrog.
- Condition 13: Develop and implement a management plan for the California red-legged frog in the Piney Creek core area after consultation with California DFW, FWS, and the Water Board that addresses conservation and habitat needs for the red-legged frog. The plan should include provisions to: (1) identify sites where deleterious non-native predators are present; (2) prioritize where control efforts should take place;

(3) control/eliminate deleterious non-native species/predators (plants, vertebrates) for all known occurrences of the California red-legged frog on BLM land, using methods that are determined to be the most effective; and
4) identify suitable habitat within watersheds that includes a mosaic of breeding habitat interspersed with a matrix of barrier-free dispersal habitat.

- Condition 14: Develop and implement a management plan for the foothill yellow-legged frog after consultation with California DFW, FWS, and the Water Board to address water temperatures and potential temperature effects on foothill yellow-legged frogs at the confluence of Sherlock Creek and the Merced River. Monitoring should be conducted once in each water year type for first 10 years and once every 5 years thereafter.
- Condition 17: Develop and implement a riparian vegetation monitoring plan for BLM approval after consultation with California DFW, FWS, and the Water Board that addresses the conservation and restoration of riparian habitats and ensures proper functioning and advanced ecological status of riparian vegetation and associated stream channels and floodplains.
- Condition 19: Coordinate an annual recreation meeting with interested resource groups (at minimum, BLM) to discuss the management, public safety, protection, and utilization of project recreation facilities and resources.
- Condition 20: Develop and implement a Merced River Trail conceptual plan after consultation with BLM for the Merced River Trail from McSwain dam to the Bagby recreation area.
- Condition 21: Enter into an agreement to provide annual funding to BLM for the operation, maintenance, management, and administration costs of BLM-administered lands in and around the Merced River Project.
- Condition 22: Develop and implement, upon BLM approval, a recreation facilities plan for the Merced River Project for the operation, maintenance, and monitoring of recreation use at the project.
- Condition 23: Close off illegal off road vehicle (ORV) access at Piney Creek to prevent illegal ORV use on project lands.
- Condition 24: Implement a HPMP, upon BLM and Commission approval.
- Condition 25: Implement a fire prevention and response plan, upon BLM approval, to protect project resources and facilities, provide public safety, and develop fire response protocols.
- Condition 26: Implement a visual resource plan, upon BLM approval, addressing procedures to address visual resources impacted by the project.

Water Quality Certification Conditions

The following preliminary mandatory WQC conditions have been provided by the Water Board, and are included in appendix E. We consider preliminary conditions 22 and 30 through 49 to be administrative and therefore not analyzed in our EIS. The remaining conditions are resource-specific and analyzed in this EIS.

- Condition 1: Organize a Merced River anadromous fish committee comprising Merced ID, PG&E, NMFS, FWS, California DFW, the Water Board, and a non-governmental organization.
- Condition 2: The Water Board reserves the right to condition the project with minimum instream flows in light of the whole record.
- Condition 3: Consult with the relevant resource agencies for any activity not addressed in the NEPA or California Environmental Quality Act document or WQC document that may adversely affect water quality to determine if supplemental NEPA or California Environmental Quality Act documents and/or a WQC amendment are required.
- Condition 4: Develop a gravel augmentation plan in consultation with the committee specified in condition 1 that provides for augmentation consistent with the annual gravel amount trapped behind New Exchequer and McSwain dams.
- Condition 5: Develop, within 1 year of license issuance in consultation with FWS and California DFW, a monitoring plan for bald and golden eagles.
- Condition 6: Develop, within 1 year of license issuance, a monitoring and conservation plan for vernal pool fairy shrimp.
- Condition 7: Develop, within 1 year of license issuance, a monitoring and conservation plan for California tiger salamanders.
- Condition 8: Develop, in consultation with the committee specified in condition 1, a fish passage or habitat restoration plan that would result in fish passage over Crocker-Huffman, McSwain, and New Exchequer dams or decreasing water temperature in and downstream of the project.
- Condition 9: Develop a drought plan, in consultation with the committee specified in condition 1 that provides overarching guidance for operations during an emergency drought and/or multiple critically dry years and specifies license or WQC variances the Merced ID may request.
- Condition 10: Develop, within 1 year of license issuance, a monitoring and conservation plan for the California red-legged frog, foothill yellow-legged frog, and western spadefoot toad.

- Condition 11: Develop, within 1 year of license issuance, a monitoring and conservation plan for the valley elderberry longhorn beetle.
- Condition 12: Consult annually with BLM, the committee specified in condition 1, and the Park Service regarding the status of implementation of license conditions, including study and monitoring results; review of any non-routine maintenance; foreseeable changes to the project and associated resource plans; discussion of needed protection for newly listed sensitive species; and upcoming operation and maintenance plans.
- Condition 13: Consult with BLM, the Park Service, and the Water Board within 3 months of license issuance and annually for the term of the license to conduct an annual review of endangered and special-status species lists to determine if any species added to the lists would be adversely affected by the project, and if so, develop and implement a species-specific study plan.
- Condition 14: Develop a LWM plan in consultation with the committee specified in condition 1.
- Condition 15: The Water Board reserves the right to condition the project with a new value for the minimum pool requirement in Lake McClure in light of the whole record.
- Condition 16: Develop a fish stocking plan in consultation with the committee specified in condition 1. Beginning the first year after license, annually stock fish in Lake McClure with a minimum of 32,000 to 70,000 of catchable sized fish and 39,000 to 95,000 fingerlings. Annually stock fish in McSwain reservoir with 1,000 to 2,000 catchable-sized rainbow trout.
- Condition 17: Develop, in consultation with California DFW, an aquatic invasive species management plan that includes: (1) a statement of goals and objectives; (2) a description of proposed monitoring protocols; (3) a detailed monitoring and reporting schedule; (4) a plan for corrective measures and timetable for implementation if data indicate the presence of aquatic invasive species; and (5) protective measures that would prevent introduction of aquatic invasive species in the project area.
- Condition 18: Develop a pesticide use plan within 6 months of license issuance.
- Condition 19: Develop, in consultation with the committee specified in condition 1, a water temperature monitoring plan that includes: (1) a statement of goals and objectives; (2) a description of proposed monitoring protocols at four to eight monitoring locations; (3) a comprehensive description of factors that may affect water temperature and whether those

factors are associated with project operations; (4) a detailed monitoring and reporting schedule; and (5) a plan for corrective measures and a timetable for implementation if data indicate that the project may be increasing water temperature and/or adversely affecting water quality.

- Condition 20: Develop, in consultation with the committee specified in condition 1, an anadromous fish monitoring plan that includes: (1) a statement of goals and objectives; (2) a description of proposed monitoring protocols; (3) a comprehensive description of factors that may adversely affect state or federally listed anadromous fish and whether those factors are associated with project operations; (4) a detailed monitoring and reporting schedule; (5) a plan for corrective measures and a timetable for implementation if data indicate that the project may be affecting anadromous fish or their habitat; and (6) protective measures.
- Condition 21: A) Develop a transportation management plan that includes: (1) a map and inventory roads associated with the project using a geographic information system (GIS); and (2) a road inventory and B) Conduct road monitoring and maintenance, including at least annual monitoring and inspection of project road conditions, as well as inspection of drainage structures and runoff patterns after major storm events.
- Condition 23: Implement measures to control erosion, excessive sedimentation, and turbidity prior to the commencement of and through any ground-clearing activities, excavation, or any other project activities that could result in erosion or sediment discharges to surface waters.
- Condition 24: Keep waters free from changes in turbidity due to project activities that cause nuisance or adversely affect beneficial uses.
- Condition 25: Pre-wash all imported riprap, rocks, and gravels used for construction within or adjacent to any water sources.
- Condition 26: Prevent construction material, debris, spoils, soil, silt, sand, bark, slash, sawdust, rubbish, steel, or other inorganic, organic, or earthen material, and any other substances from any project-related activity from entering surface waters.
- Condition 27: Prevent unset cement, concrete, grout, damaged concrete, concrete spoils, or water used to clean concrete surfaces from contacting or entering surface waters.
- Condition 28: Wash all equipment prior to transport to the project site and keep it be free of sediments, debris, and foreign matter. Steam-clean any equipment used in direct contact with surface water prior to use. Inspect all equipment using gas, oil, hydraulic fluid, or other petroleum products for leaks prior to use and monitor them for leakage. Position stationary

equipment over drip pans or other types of containment. Maintain spill and containment equipment onsite at all locations where such equipment is used or staged.

- Condition 29: Keep onsite containment for storage of chemicals classified as hazardous away from watercourses and include secondary containment and appropriate management as specified in California regulations.

2.2.2 Merced Falls Project

2.2.2.1 Proposed Project Facilities

PG&E is not proposing any new or upgraded facilities or structural changes to the project.

2.2.2.2 Proposed Project Boundary

PG&E proposes to modify the project boundary by removing approximately 4.8 acres of PG&E-owned lands, which it indicates are not needed for project purposes. The proposed 4.8-acre reduction in land encompassed by the project boundary is the result of PG&E redrawing the boundary along the north side of the project impoundment, east of the county highway bridge, to match the impoundment's high water mark; this results in the removal from the project of a strip of PG&E-owned land adjacent to the impoundment and facilities owned, operated, and maintained by Merced ID (parking lot, restrooms) within the Merced Falls Fishing Access area.

2.2.2.3 Proposed Project Operation

PG&E is not proposing any changes to project operation. The Merced Falls Project would continue to operate in run-of-river mode dependent on water outflow from Merced ID's upstream Merced River Project.

2.2.2.4 Proposed Environmental Measures

Aquatic Resources

- Conduct annual fall fish sampling in the reach of the Merced River downstream of Merced Falls dam and upstream of Crocker-Huffman dam (Merced Falls reach) to monitor fish populations (new proposal from September 5, 2014, response to comments).
- Continue to periodically rake the project's intake racks to clear them of LWD, and place the removed material on the debris chute at the dam to mobilize downstream.

Water Resources

- Develop and implement a long-term water quality monitoring program in the Merced River downstream of Merced Falls dam and upstream of Crocker-Huffman diversion dam to monitor dissolved oxygen (DO) and temperature.

Recreation

- Continue to operate and maintain existing recreation facilities at the Merced Falls impoundment area, including the River's Edge Fishing Access area and the car-top boat launch at Merced Falls Fishing Access area.
- Develop and post directional and safety signage at the informal canoe portage trail.
- Develop a fish stocking plan in consultation with California DFW that includes stocking 11,000 adult-sized rainbow trout at the Merced Falls impoundment for the first 2 years following license issuance and a plan for stocking (schedule and type and amount of fish) for the rest of the license term.

Cultural Resources

- Implement the HPMP, filed on October 6, 2014.

2.2.2.5 Modifications to Applicant's Proposal—Mandatory Conditions

The following mandatory conditions have been provided and are evaluated as part of the applicant's proposal.

Water Quality Preliminary Certification Conditions

The following preliminary mandatory WQC conditions have been provided by the Water Board, and are included as appendix F. We consider preliminary conditions 10 through 36 to be administrative conditions and standard conditions to protect water quality and beneficial uses, and therefore not analyzed in our EIS. The remaining conditions [preliminary conditions 2 through 9] are project-specific, and specify the following conditions for the licensee:

- Condition 2: Develop a pesticide use plan, within 6 months of license issuance, in consultation with California DFW, FWS, NMFS, and the Water Board.
- Condition 3: Submit a gravel augmentation plan within 1 year of license issuance, in consultation with California DFW, FWS, and NMFS. The amount of gravel augmented should be consistent with the amount of gravel trapped annually behind Merced Falls dam.

- Condition 4: Submit a fish passage plan if:
 - Fish passage resumes at Crocker-Huffman diversion dam; and
 - Resumption of fish passage at Merced Falls dam is recommended after consultation with NMFS, California DFW, and FWS.
- Condition 5: Submit an eagle monitoring and conservation plan within 1 year of license issuance, developed in consultation with FWS, California DFW, and BLM.
- Condition 6: Develop a monitoring and conservation plan, within 6 months of license issuance in consultation with FWS, California DFW, and BLM, for the valley elderberry longhorn beetle.
- Condition 7: Review lists of endangered and special-status species within 6 months of license issuance, and every 5 years thereafter. For any newly added species in the project area that could be adversely affected by the project, consult with FWS, California DFW, Water Board, and NMFS to develop a species-specific study plan.
- Condition 8: Hold a meeting, beginning 1 year after license issuance, every 5 years with resource agencies, and open to tribes and the public to provide updates to all monitoring and data required by the WQC.
- Condition 9: Develop and implement a plan to monitor and identify locations of the California red-legged frog, foothill yellow-legged frog, and western spadefoot toad within 1 year of license issuance.

2.3 STAFF ALTERNATIVE

2.3.1 Merced River Project

Under the staff alternative, the project would include the following revisions to the proposed project or additional measures.

Aquatic Resources

- Expand the scope of the proposed technical advisory committee beyond measures that pertain only to anadromous fish downstream of Crocker-Huffman diversion dam (i.e., topics that pertain to resident fish, aquatic and terrestrial monitoring results, and actions that could affect BLM-managed land, including Lake McClure water level management); establish guidelines for conducting meetings that provide ground rules for decision making; and add BLM and the Park Service to the entities invited to participate on the committee.

- Add the Water Board, BLM, FWS, California DFW, NMFS, and the Park Service to the entities invited to consult on the coordinated operations plan for the Merced River and Merced Falls Projects.
- Add the Water Board, California DFW, and FWS to the entities invited to consult on site-specific erosion control and restoration plans and expand the plans to apply to all construction on all land within the project boundary.
- Include, at a minimum, the following elements in the proposed erosion control and restoration plans: (1) a description of BMPs that would be applied in specific circumstances, (2) provisions for inspecting erosion control measures while they are in place, (3) emergency protocols for erosion and sedimentation control, (4) site stabilization techniques that would be used once construction is completed, and (5) a description of when and what type of water quality monitoring of surface waters would occur during and after ground-disturbing activities. Identifying such measures and protocols in the erosion control and restoration plans would assure that erosion does not unacceptably degrade water quality adjacent to construction and other ground-disturbance sites.
- In addition to monitoring ramping rates associated with releases from McSwain dam, monitor flows and stage at 1-hour intervals at the existing gage immediately downstream of Crocker-Huffman diversion dam and provide annual reports to the Commission from both gages after review by the technical advisory committee. Monitoring flows at both locations would document compliance with the recommended ramping rate at McSwain dam and to establish a relationship of ramping rates at McSwain dam to the ramping rates downstream of Crocker-Huffman diversion dam to provide data on whether or not the ramping rate protocol should be adjusted in the future.
- Include, at a minimum, the following elements in the construction and non-routine maintenance hazardous material spill prevention, control, and countermeasure plans: (1) a description of the BMPs for contaminant control that would be applied in specific circumstances, (2) emergency protocols for spill containment and remediation, (3) the location of emergency cleanup equipment in the event of contaminant release, (4) identification of entities to be contacted in the event of a spill, (5) designated equipment refueling and maintenance areas, (6) provisions requiring equipment to be cleaned and inspected prior to entering a construction site, (7) post-spill water quality monitoring protocols, and (8) a listing of applicable local, state, and federal regulations that pertain to prevention of spills and protection of water quality. Identifying such measures and protocols in the hazardous materials spill prevention,

control, and countermeasure plans would assure that surface water and groundwater are protected from contaminants.

- Use the Hughes method to determine water year type rather than the proposed Merced 60-20-20 Index¹⁶ to better designate water year types based on both forecasted and observed runoff that would avoid biased water year designations to below normal conditions.
- Release the staff-recommended instantaneous minimum flows as measured at Shaffer Bridge and shown in table 5-2 rather than the proposed minimum and target flows.
- Maintain a minimum flow of 25 cfs at all times from New Exchequer dam to ensure that the channel is not dewatered.
- Develop a water temperature monitoring plan in consultation with the technical advisory committee and monitor water temperature at four to eight sites (rather than limiting the number of sites to four) from Crocker-Huffman diversion dam, downstream to Shaffer Bridge.
- Release a fall pulse flow of 1,000 cfs, as measured at Shaffer Bridge, during October or November until a total volume of 12,500 acre-feet is released to attract adult anadromous salmonids to the mouth of the Merced River and stimulate upstream migration to the primary spawning area between Crocker-Huffman diversion dam and Shaffer Bridge. The timing of the beginning of the release would be determined by the technical advisory committee.
- Release a spring pulse flow of 30,000 acre-feet during wet, above normal, and below normal water years that would consist of flows equal to or above 1,000 cfs, as measured at Shaffer Bridge, for 9 days and peak flows that hold for 2 or 3 days, with a gradually ascending and descending hydrograph.
 - During dry and critically dry water years, release a spring pulse flow of 10,000 acre-feet.

¹⁶ Merced ID established a five-level water year classification system for the Merced River. The 60-20-20 Index is based on the unregulated inflow to Lake McClure. The five-water year classifications are: wet, above normal, below normal, dry, and critical and are calculated as 60 percent of the current year's April through July inflow plus 20 percent of the current year's October through March inflow plus 20 percent of the previous year's index.

- After a minimum of two dry or critically dry water years, consult with the technical advisory committee and make recommendations to the Commission regarding whether anadromous fish outmigration data supports changing the 10,000 acre-feet pulse flow release.
- The timing of the onset of the spring pulse flow release would be determined by the technical advisory committee.
- Annually report Lake McClure stage and acre-feet of storage to the Commission to document compliance with water management measures and, when applicable, drought management plans.
- File the drought plans developed after two or more consecutive dry or critically dry water years as proposed with the Commission for approval.
- Develop a general drought management plan in consultation with the technical advisory committee that identifies the measures that would be considered to address droughts when they occur, decision paths regarding how management options for a specific drought would be decided, and a listing of Commission, BLM, and WQC license conditions that would require variances with drought management options. Approval of this plan would expedite approval of the drought-specific plan, which would be time-sensitive.
- Develop a Merced NWR water delivery plan in consultation with FWS and California DFW to ensure to the extent reasonably practical, the delivery of 15,000 acre-feet of water to the refuge during times of the year when this water would provide the most benefit to wildlife.
- Develop, in consultation with the technical advisory committee, an anadromous fish monitoring plan that includes the attributes Merced ID proposes to monitor. Include in the plan the proposed monitoring station locations, the rationale for selecting those locations, and corrective actions that could be taken, including assisting with fish rescue efforts, if monitoring shows the project is adversely affecting anadromous fish.
- Add the technical advisory committee and California Department of Transportation to the entities invited to consult on the LWM management plan.
- Develop a gravel augmentation plan in consultation with the technical advisory committee that (1) provides for the annual placement of 2,600 cubic yards of gravel in the lower Merced River; (2) identifies the range of particle sizes to be used for augmentation; (3) identifies gravel harvesting sites; (4) includes provisions for restoring harvest sites to contours expected in a natural riparian floodplain forest to mitigate for any aesthetic

or ecological impact associated with gravel harvesting; (5) includes the protocol for selecting augmentation sites between Merced Falls dam and Shaffer Bridge; (6) provides for monitoring and mapping augmented gravel; and (7) provides for annual reporting.

- Modify the amended Aquatic Invasive Species Management Plan to include provisions to document incidental observations of quagga and zebra mussels, New Zealand mudsnails, Asian clams, American bullfrog, Eurasian milfoil, Brazilian elodea, and hydrilla; provide reports regarding any incidental observation that rise to the level of needing follow-up management actions, to the Commission. Add California DFW and the Water Board to the entities invited to consult on revisions to the plan.

Terrestrial Resources

- Develop a protection plan for special-status bats after consultation with BLM, FWS, California DFW, and the Water Board to protect bats roosting at project facilities. The plan would include specific details about agency-recommended measures and proposed measures to document all known bat roosts at project facilities, the type and design of exclusion devices, and would define appropriate metrics to evaluate the effectiveness of the measures.
- Modify the Bald Eagle Management Plan to:
 - include educational information about bald eagle roost sites in public information;
 - describe activities that would be considered emergencies, and define why these activities would supersede bald eagle protection;
 - protect winter roost trees from vegetation management and future construction activities to reduce potential for degrading these areas; and
 - revise all protocols and methodologies to be consistent with the FWS National Bald Eagle Management Guidelines.
- Modify the Invasive Species Management Plan on federal to:
 - stipulate that the measures in the plan apply to all land within the project boundary, including treatment measures for the existing population of perennial pepperweed on Merced ID land;
 - provide details about specific BMPs that would be implemented as part of the plan;
 - include notification to agencies of planned pesticide use; and
 - include descriptions of unexpected outbreaks that would not require notification prior to use.

- Modify the Vegetation Management Plan on federal land (TR2, as amended) to:
 - provide details about specific BMPs that would be implemented as part of the plan;
 - include maps in section 3.0 to show locations of elderberry plants and identify which plants show signs of occupancy by the valley elderberry longhorn beetle; and
 - include consultation with BLM, California DFW, and FWS during the planning phases for any new disturbance such as any potential future construction of new facilities and other project operation and maintenance activities that could disturb vegetation resources through excavation, grading, topsoil stripping, or other similar activities, to identify the need for pre-disturbance surveys and develop protection measures for any sensitive species in the disturbance area.
- Develop a protection plan for western pond turtles, including the proposed monitoring and reporting measures to protect western pond turtles from project effects such as water level fluctuations, traffic associated with project maintenance and recreation, and maintenance activities such as pesticide applications.
- Modify the Limestone Salamanders Sensitive Areas Management Plan to:
 - provide details about specific BMPs that would be implemented as part of the plan
 - site new hiking trails or modifications to existing hiking trails outside of limestone salamander habitat.

Threatened and Endangered Species

- Develop a protection plan for the San Joaquin kit fox, including surveys and the development of protection and mitigation measures to minimize project-related and cumulative effects (i.e., effects of rodenticides, potential effects on dispersal).
- Develop a protection plan for vernal pool fairy shrimp and its habitat to reduce project effects on fairy shrimp and its associated habitat (i.e., long-term habitat degradation).
- Develop a protection plan for federally listed plants potentially occurring in the project area to minimize project effects (i.e., project maintenance activities, recreation) on these plant species.

- Develop a protection plan for the California red-legged frog, foothills yellow-legged frog, and western spadefoot to reduce project effects such as changes in water temperature, increases in the populations of predators, and pesticide use.
- Develop a protection plan for California tiger salamanders that includes a proposed measure to avoid use of pesticides in California tiger salamander habitat to protect the species from project effects (i.e., effects of rodenticides and burrow fumigants, vegetation maintenance, recreation activities, and vehicular traffic).

Recreation Resources

- Modify the Recreation Facilities Plan, filed on September 22, 2014, to:
 - extend the proposed paved bicycle lane along the entire length of Lake McClure Road (7.8 miles) between County Road J16 and the proposed parking area from the McSwain shoreline trailhead;
 - remove the provision for a host site at the project's Horseshoe Bend recreation area campground;
 - identify the location of the three floating restrooms provided on Lake McClure and include the operation and maintenance schedule and construction and rehabilitation measures (if needed) for each restroom; and
 - revise the implementation schedule to: begin construction no earlier than Labor Day and no later than Memorial Day to avoid the prime recreation season; begin construction at Bagby recreation area within 2 years of license issuance; begin construction of the project's non-motorized trails within 3 years of license issuance; begin rehabilitation planning at each campground within 3 years of license issuance (to be completed within 6 years of license issuance); and include a mid-license term rehabilitation assessment in the implementation schedule that would identify any facilities and or water systems in need of rehabilitation.
- Develop and implement a fish stocking plan that includes the type, size, and amount of fish to be stocked in Lake McClure and McSwain reservoir based on recreational use, angling demand, and state fish stocking management targets and an implementation schedule to ensure appropriate recreational fish stocking levels at the project for the license term.

Land Use

- Modify the Transportation Management Plan, filed on September 22, 2014, to include an inventory of all project roads and current road conditions, a detailed schedule of maintenance based on that inventory, relevant BMPs that would be implemented, a schedule for monitoring project road use over the term of the license, and a schedule for consultation with BLM and the California Department of Forestry and Fire Protection.

Aesthetics

- Modify the Visual Resource Plan, filed on September 22, 2014, such that it applies to all lands within the project boundary.

2.3.2 Merced Falls Project

Under the staff alternative, the project would include the following revisions to the proposed project or additional measures:

Aquatic Resources

- Participate in a Merced River technical advisory committee in conjunction with Merced ID to inform and coordinate the implementation of environmental measures.
- Develop a coordinated operation plan in conjunction with Merced ID for the Merced River and Merced Falls Projects in consultation with the technical advisory committee.
- Develop a LWD management plan in consultation with the technical advisory committee to provide habitat enhancement for aquatic species.
- Develop an annual fish monitoring plan in the Merced Falls reach in consultation with the technical advisory committee.

Terrestrial Resources

- Develop a control plan for noxious weeds and invasive plants, integrated with pest management and pesticide use.
- Develop and implement a management plan for bald eagles in consultation with FWS, California DFW, and the Water Board.

Threatened and Endangered Species

- Develop a protection plan for the valley elderberry longhorn beetle to minimize project effects on the valley elderberry longhorn beetle and its habitat.
- Develop a protection plan for the San Joaquin kit fox to reduce project-related and cumulative effects on the San Joaquin kit fox.
- Develop a protection plan for the California red-legged frog, foothills yellow-legged frog, and western spadefoot.

Recreation

- Operate and maintain all recreation facilities at the Merced Falls Fishing Access area, including one sign, restroom, parking area, and car-top boat launch, the informal angler trail along the northern shoreline, the two informal parking areas on either side of Hornitos Road County Bridge (Hornitos Bridge), and the informal canoe portage trail at the south end of Merced Falls dam.

Project Boundary

- Modify the project boundary to include the informal canoe trail on the south side of Merced Falls dam.

2.4 STAFF ALTERNATIVE WITH MANDATORY CONDITIONS

We recognize that the Commission is required to include valid section 4(e) conditions and section 401 conditions in any license issued for the project.

2.4.1 Merced River Project

The staff alternative with mandatory conditions includes staff-recommended measures along with the mandatory conditions that we did not include in the staff alternative: (1) provide annual funding in a contributed funds account to offset operation, maintenance, management, and administration costs incurred by the BLM; (2) annual consultation to review the project status and plans, results of studies, necessary modifications to plans, and protection measures for newly listed species; (3) a fish passage or habitat restoration plan that would result in fish passage over Crocker-Huffman, McSwain, and New Exchequer dams or decrease water temperature in and downstream of the project; and (4) review the lists of federally listed and special-status species and evaluate potential project effects on newly listed species.

2.4.2 Merced Falls Project

The staff alternative with mandatory conditions includes staff-recommended measures along with the mandatory conditions that we did not include in the staff alternative: (1) gravel augmentation in the Merced Falls reach; (2) a fish passage plan; and (3) annual consultation to review the project status and plans, results of studies, necessary modifications to plans, and protection measures for newly listed species.

2.5 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

We considered several alternatives to the applicant's proposals, but eliminated them from further analysis because they are not reasonable in the circumstances of either case. They are: (1) issuing a non-power license; (2) federal government takeover of the projects; and (3) retiring the projects.

2.5.1 Issuing a Non-Power License

A non-power license is a temporary license that the Commission will terminate when it determines that another governmental agency will assume regulatory authority and supervision over the lands and facilities covered by the non-power license. At this point, no agency has suggested a willingness or ability to do so. No party has sought a non-power license and we have no basis for concluding that the project should no longer be used to produce power. Thus, we do not consider issuing a non-power license to either the Merced River Project or the Merced Falls Project a realistic alternative to relicensing in these circumstances.

2.5.2 Federal Government Takeover of the Projects

We do not consider federal takeover to be a reasonable alternative. Federal takeover and operation of the projects would require Congressional approval. While that fact alone would not preclude further consideration of this alternative, there is no evidence to indicate that federal takeover should be recommended to Congress. No party has suggested federal takeover would be appropriate, and no federal agency has expressed an interest in operating the projects.

2.5.3 Retiring the Projects

Project retirement could be accomplished with or without dam removal. Either alternative would involve denial of the relicense application and surrender or termination of the existing license with appropriate conditions. No participant has suggested that dam removal would be appropriate in either case, and we have no basis for recommending it.

The New Exchequer, McSwain, and Merced Falls dams and associated reservoirs serve other important purposes including recreation, irrigation, and flood control, regardless of whether power is produced. Thus, dam removal is not a reasonable

alternative to relicensing the Merced River Project or the Merced Falls Project with appropriate protection and enhancement measures.

The second project retirement alternative would involve retaining the dams and disabling or removing equipment used to generate power. Project works would remain in place and could be used for historic or other purposes. This would require us to identify another government agency with authority to assume regulatory control and supervision of the remaining facilities. No agency has stepped forward, and no participant has advocated this alternative. Nor have we any basis for recommending it. Because the power supplied by the projects is needed, a source of replacement power would have to be identified. In these circumstances, we do not consider removal of the electric generating equipment at the Merced River and Merced Falls Projects to be a reasonable alternative.

3.0 ENVIRONMENTAL ANALYSIS

In this section, we present: (1) a general description of the project vicinity; (2) an explanation of the scope of our cumulative effects analysis; and (3) our analysis of the proposed action and other recommended environmental measures. Sections are organized by resource area. Under each resource area, historic and current conditions are first described. The existing condition is the baseline against which the environmental effects of the proposed action and alternatives are compared, including an assessment of the effects of proposed mitigation, protection, and enhancement measures, and any potential cumulative effects of the proposed action and alternatives. Staff conclusions and recommended measures are discussed in section 5.1, *Comprehensive Development and Recommended Alternative*.¹⁷

3.1 GENERAL DESCRIPTION OF THE RIVER BASIN

The main stem of the Merced River forms in Yosemite National Park at an elevation of approximately 8,200 feet just east of the border of Mariposa and Madera Counties, California, in the central Sierra Nevada, and then flows west, meandering through Yosemite Valley before plunging into the steep canyon of the Merced Gorge (figure 3-1). Upstream of Lake McClure, the Merced River Basin is steep, rugged, sparsely populated, and mostly occupied by conifer forests. Portions of the South Fork Merced River, which drains into the Merced River about 16 miles upstream of the project, and the main stem of the Merced River from its sources to Lake McClure at RM 84.5 (a total of 81 miles) are managed by BLM, the Park Service, and the Forest Service as a designated Wild and Scenic River corridor. The North Fork Merced River drains into the Merced River about 0.5 mile upstream of the Merced River Project boundary. Flow in the river upstream of Lake McClure is unrestricted, except that the Mariposa County Public Utility District withdraws for consumptive purposes up to 5,000 acre-feet of water from Saxon Creek, located approximately 10 miles upstream of Lake McClure.

The Merced River at New Exchequer dam (at RM 62.4) has a drainage area of approximately 1,035 square miles. Lake McClure, which is formed by New Exchequer dam and inundates about 19 miles of the Merced River, is deep, has a retention time of about a year, and thermally stratifies. Lake McClure has a NMWSE of elevation 867 feet and a gross storage capacity of 1,024,600 acre-feet. The portion of Lake McClure just north of New Exchequer dam near the McClure Point recreation area is the most open expanse of water in the reservoir, and has two named arms—the Temperance arm and the Cotton arm—named for the creeks that enter the reservoir. The second open expanse of

¹⁷ Unless otherwise indicated, information for the Merced River and Merced Falls Projects is taken from the applications for license for these projects, Merced ID, 2014a and PG&E, 2012, respectively.

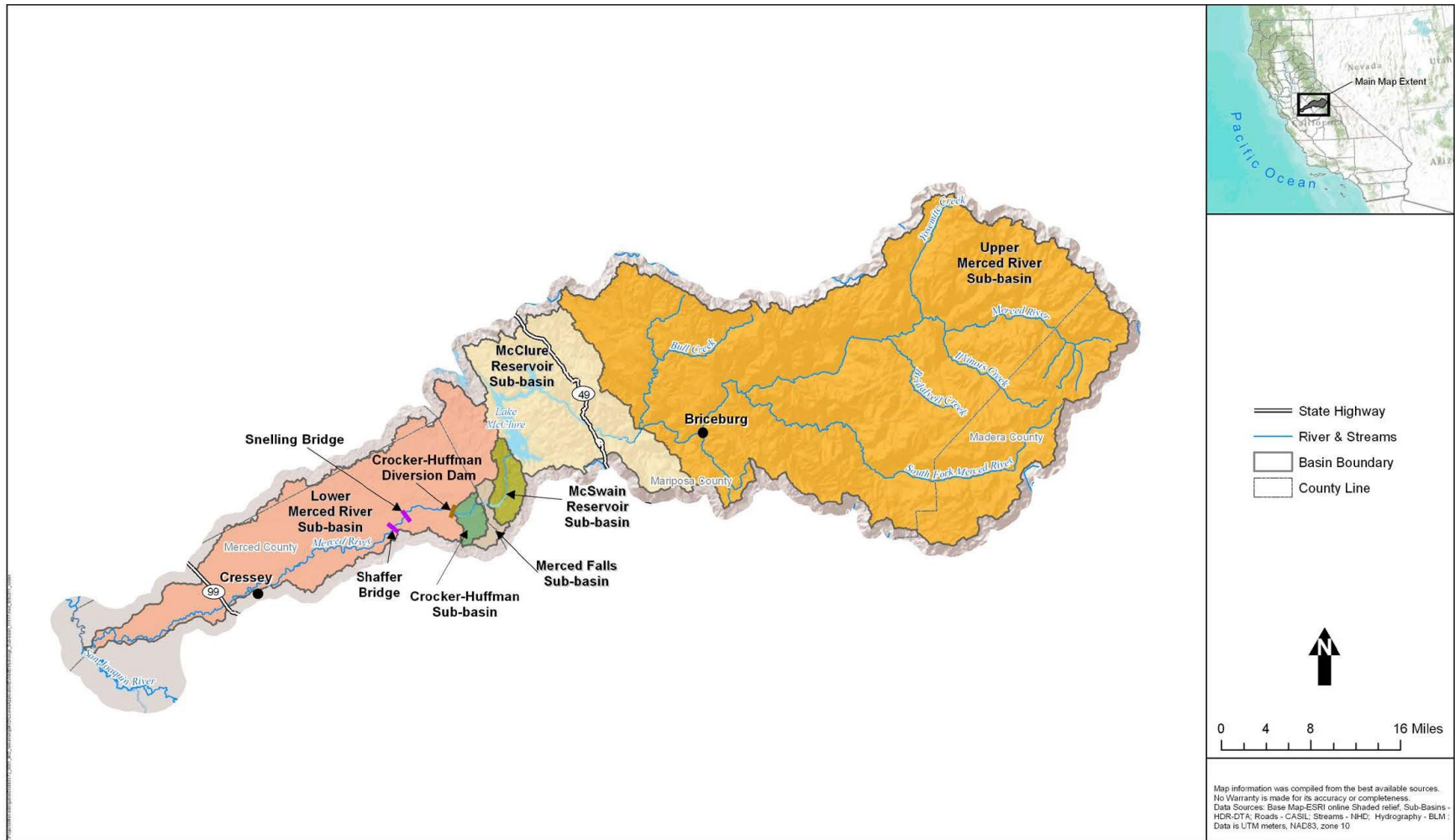


Figure 3-1. Merced River Basin and subbasins (Source: Merced ID, 2012a).

Lake McClure is in the northeast corner of the reservoir near the Horseshoe Bend recreation area. The remainder of the reservoir occupying the canyon is narrow, and generally less than 1,000 feet across. Besides the Merced River and Temperance and Cotton creeks, named tributaries into Lake McClure include Maxwell, Piney, Sherlock, and Willow creeks.

Most of the land surrounding Lake McClure consists of oak woodland vegetation with grasses, oaks, chapparal, and gray pine. Very few residences occur along the shoreline of Lake McClure.

Downstream of New Exchequer dam and powerhouse, water flows directly into the 6.3-mile-long reservoir formed by McSwain dam at RM 56.1. McSwain reservoir regulates peaking power releases from the New Exchequer powerhouse and has a retention time of a few days under typical operations, which allows for only weak thermal stratification. McSwain reservoir is a long, narrow reservoir occupying the western-most steep-walled canyon carved by the Merced River before the river enters the plains of California's Central Valley (see figure 1-2). There are no appreciable diversions from the reservoir, and there are no tributaries into McSwain reservoir. The portion of the Merced River Basin upstream of McSwain reservoir comprises approximately 1,055 square miles, adding about 16.5 square miles to the drainage area upstream of New Exchequer dam. Land surrounding McSwain reservoir is primarily vegetated with chaparral and grasses.

Immediately downstream of McSwain reservoir lies Merced Falls reservoir, which has a storage capacity of about 579 acre-feet of water at a NMWSE of 344 feet, and inundates 1.1 miles of the river (see figure 1-4). The reservoir is formed by Merced Falls dam at RM 55.0. Merced Falls reservoir and dam, as well as the 3.6-MW Merced Falls powerhouse at the base of the dam, are part of PG&E's Merced Falls Project. One significant withdrawal occurs from PG&E's Merced Falls reservoir—up to 100 cfs of water is withdrawn at the northside canal for water supply purposes. Merced ID owns and operates the northside canal as part of its water supply system, but the facilities are not a part of either the Merced River or Merced Falls Projects (i.e., the canal is a non-jurisdictional facility).

From Merced Falls dam, water flows about 3 miles downstream to Crocker-Huffman diversion dam at RM 52.0. The diversion dam forms an impoundment that is about 1.5 miles long, relatively shallow, and has a retention time on the order of hours or days, depending on flow conditions. Up to 2,000 cfs of water is withdrawn from Crocker-Huffman diversion dam impoundment into the Main Canal for water supply purposes. Water is also drawn from Crocker-Huffman diversion dam impoundment by California DFW's Merced River fish hatchery and the privately owned Calaveras Trout Farm, Inc. The land surrounding this section is vegetated with oaks and grasses with scattered residences.

The Merced River flows about 19 miles from Crocker-Huffman diversion dam (RM 52.0) to Shaffer Bridge (RM 32.8). This section of river has been extensively

affected by water withdrawals, agricultural water returns, and land use activities, most notably dredger mining for gold. The major water withdrawals are associated with the Cowell Agreement water users and riparian water users (described in section 2.1.1.5, *Existing Environmental Measures*) who have the right to divert up to approximately 94,000 acre-feet of water annually from this section of river, and have maintained 11 channel diversions since the mid-1800s.

The Merced River between Shaffer Bridge and the San Joaquin River (RM 0) has a very simple channel shape. The lower section of the river (RM 0 to RM 8.0) is mostly a single, u-shaped channel that is situated between high, sandy banks. The floodplain is much narrower than it was before the agriculture and suburban development that now exists along the shoreline. From RM 8.0 to RM 19.0, the river is confined between levees, revetments, and bank armoring that maintain the river's position and create a trapezoidal-shaped channel. The uppermost section of the river (RM 19.0 to RM 32.8) has been mined for aggregate, leaving deep holes next to the channel that can capture, slow, and warm water. Bank revetments also limit channel movement across an agricultural/developed floodplain.

Dry Creek, which is the only major tributary in this reach and enters the river downstream of Shaffer Bridge at RM 31.9, supplies large quantities of sand to the Merced River. The sand transported from Dry Creek combined with erosion of the sandy soils along the shoreline has produced a sand-bedded main stem channel downstream of Dry Creek.

The Merced River ultimately flows into the San Joaquin River near the Stanislaus County/Merced County border, just north of California DFW's North Grasslands Wildlife Area. At the confluence with the San Joaquin River, the drainage area of the Merced River is approximately 1,328 square miles.

The Merced River Basin climate is highly varied due to the vast differences in topography from the headwaters of the Merced River in the central Sierra Nevada to the western portion of watershed in the valley floor. Project facilities lie in the foothills between the lowlands of California's Central Valley and the high country of the Sierra Nevada. Climate in the foothills is characteristic of a mixed-elevation Mediterranean climate with warm, dry summer days and cool nights, and cool, wet winters with occasional snowfall in small amounts.

Annual mean precipitation at the National Weather Service station at New Exchequer dam (no. 042920) is 19.75 inches, 80 percent of which falls from November through March. The summer months of June through August produce less than 2 percent of the total annual average precipitation. The remaining 18 percent of precipitation occurs during April, May, September, and October. The closest National Weather Service air temperature monitoring station at a similar climate and elevation as the projects is at the Electra powerhouse on the Mokelumne River, north of the projects at elevation 700 feet (no. 042728). July air temperatures at this monitoring station range from an average high of 97.2 degrees Fahrenheit (°F) (36.2 degrees Celsius [°C]) to an

average low of 56.3°F (13.5°C). The average high temperature for January is 56.9°F (13.8°C) while the average low temperature is 34.0°F (1.1°C). The annual average high and low temperatures are 76.2°F (24.5°C) and 44.6°F (7°C), respectively.

Lands within the Merced River Basin have a patchwork of ownership. Of the 700,000 acres of the Merced River Watershed upstream of New Exchequer dam, more than 300,000 acres lie within Yosemite National Park. The Park Service manages the land within Yosemite National Park. Of the remaining Merced River Basin upstream of the project, more than 270,000 acres are managed by the Forest Service as a part of the Stanislaus and Sierra national forests, or are administered by BLM as federal lands.

The project vicinity is located at the southern end of California's famed Mother Lode region, which shaped the region's economy in the mid- to late-1800s. Since the end of the California gold rush, the economic base has grown to include agriculture and tourism with mining playing a greatly reduced role in the area's economic viability. The presence of Yosemite National Park in the eastern half of Mariposa County is an important contributor to the area's economy, which is based primarily on government employment, retail sales, services, tourism, and agriculture.

3.2 SCOPE OF CUMULATIVE EFFECTS ANALYSIS

According to the Council on Environmental Quality's regulations for implementing NEPA (40 CFR §1508.7), a cumulative effect is the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions. Cumulative effects can result from individually minor but collectively significant actions taking place over time, including hydropower and other land and water development activities.

Based on our review of the Merced River license application and agency and public comments, we identified water quantity, water quality (primarily DO, temperature, and total suspended solids), aquatic habitat, and Central Valley steelhead (*Oncorhynchus mykiss*), which is federally listed as threatened, as having the potential to be cumulatively affected by the proposed project in combination with other past, present, and foreseeable future activities.

Based on our review of the Merced Falls license application and agency and public comments, we identified water quality, aquatic habitat, and Central Valley steelhead (*O. mykiss*),¹⁸ as having the potential to be cumulatively affected by the proposed project in combination with other past, present, and foreseeable future activities.

¹⁸ In this draft EIS, *O. mykiss* refers to both the anadromous (steelhead) and resident (rainbow trout) form of this species.

We selected water quantity because water used for hydroelectric generation at the Merced River Project is also used for irrigation and supplies the Merced NWR through Merced ID's water distribution system. Water flowing through the Merced River and Merced Falls Projects is also diverted by numerous other entities besides Merced ID for various purposes in accordance with the Cowell Agreement and other water rights. In addition, use of Lake McClure for flood control in accordance with the Corps' document *New Exchequer Dam and Reservoir, Merced River, California; Water Control Manual; Appendix VII to Master Water Control Manual, San Joaquin River Basin, California* (required by article 39 of the current license) shifts the timing of flow releases to river reaches downstream of New Exchequer dam. The amount of un-diverted water influences the quality of aquatic habitat and the upstream extent of saline water from the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta).

Operation of the Merced River Project, especially releases from Lake McClure, can affect water temperature and DO. The impoundment of water diversions, diversions from the river, and return of irrigation water to the river can exacerbate these effects in downstream reaches of the Merced River. Water quality in downstream river reaches can also be affected by increases in total suspended solids associated with erosion (from project-related and other sources), mining activities, and habitat restoration efforts.

We selected aquatic habitat as a cumulatively affected resource because various dams block access of migratory fish to aquatic habitat and prevent downstream transport of sediment and LWD, which are key components of aquatic habitat. Agricultural and instream mining activities have greatly altered the physical river channel, further limiting the diversity of available habitat for aquatic biota.

We selected Central Valley steelhead as a cumulatively affected resource because many historical and current factors influence the abundance of this threatened species in the Merced and San Joaquin Rivers. Historical factors that have influenced Central Valley steelhead populations include the construction of Crocker-Huffman, Merced Falls, McSwain, and New Exchequer dams without provisions for upstream and downstream fish passage, removal of spawning gravel associated with aggregate and gold mining, and agricultural encroachment on the river channel. Ongoing factors that potentially affect Central Valley steelhead include numerous diversions from the Merced River at and downstream of Crocker-Huffman diversion dam, altered flow regimes due to upstream hydropower and flood control operations, predation by non-native fish such as striped bass, ocean growth and mortality from fishing and other factors, competition for available habitat by native and hatchery-reared fall Chinook salmon, and gravel augmentation and other lower Merced River stream enhancement initiatives.

3.2.1 Geographic Scope

The geographic scope of analysis for cumulatively affected resources defines the physical limits or boundaries of the effects of the proposed action on the resources.

Because the proposed action can affect resources differently, the geographic scope for each resource may vary.

For water quantity, we define the geographic scope of analysis as the main stem of the Merced River from the upstream end of Lake McClure to the confluence of the San Joaquin River and the San Joaquin River from the confluence of the Merced River to the confluence of the Sacramento River at Chipps Island, near Pittsburg, California. For water quality and aquatic habitat, we define the geographic scope of analysis as the main stem of the Merced River from the upstream end of Lake McClure to Shaffer Bridge, about 19 miles downstream of Crocker-Huffman diversion dam. For Central Valley steelhead, we define the geographic scope of analysis as the estimated 107 miles of habitat that was originally available to migratory anadromous fish in the Merced River, including 51 miles upstream of Crocker-Huffman diversion dam and 56 miles downstream of Crocker-Huffman diversion dam (California HSRG, 2012). We also include the San Joaquin River from the confluence of the Merced River to the confluence of the Sacramento River at Chipps Island.

3.2.2 Temporal Scope

The temporal scope of analysis includes a discussion of the past, present, and future actions and their effects on water quantity, water quality, aquatic habitat, and Central Valley steelhead. Based on the potential term of a license, the temporal scope looked 30 to 50 years into the future, concentrating on the effects on water, aquatic habitat, and Central Valley steelhead from reasonably foreseeable future actions. The historical discussion is limited, by necessity, to the amount of available information for each resource. We identified the present resource conditions based on the license application, agency comments on the draft license application, and comprehensive plans.

3.3 PROPOSED ACTION AND ACTION ALTERNATIVES

In this section, we discuss the effect of the project alternatives on environmental resources. For each resource, we first describe the affected environment, which is the existing condition and baseline against which we measure effects. We then discuss and analyze the specific site-specific and cumulative environmental issues.

Only the resources that would be affected, or about which comments have been received, are addressed in detail in this EIS. We have not identified any substantive issues related to socioeconomics associated with the proposed action, and, therefore, socioeconomics is not assessed in this EIS. Project-related construction, operation, and maintenance have the potential to influence erosion and sediment transport. The primary expected effect of erosion and sediment transport would be on water quality (e.g., suspended sediments and turbidity) and aquatic habitat. We therefore discuss these potential effects in section 3.3.1, *Aquatic Resources*, rather than in a separate geology and soils section. We present our recommendations in section 5.1, *Comprehensive Development and Recommended Alternative*.

3.3.1 Aquatic Resources

3.3.1.1 Affected Environment

Water Quantity

Merced River Project

Water Storage and Hydrology—The Merced River Project includes two reservoirs for water storage—Lake McClure and McSwain reservoir (see figure 1-2). The two reservoirs are contiguous, having no free-flowing river between the two developments. Water from Lake McClure is released from New Exchequer powerhouse directly into McSwain reservoir. From McSwain reservoir, water impounded by the Merced River Project is released from McSwain powerhouse directly into PG&E’s Merced Falls reservoir. Downstream of Merced Falls reservoir, water flows about 3 miles to Crocker-Huffman diversion dam. Water quantity as it pertains to the Merced Falls Project and the lower Merced River (downstream of Merced Falls dam) is described below in the *Merced Falls* and *Lower Merced River* sections, respectively.

Lake McClure has a gross storage capacity of 1,024,600 acre-feet and a usable storage capacity of 1,021,600 acre-feet. McSwain reservoir has 9,730 acre-feet of gross storage and a usable storage capacity (for power generation) of 7,897 acre-feet. Under the existing license, Lake McClure has a minimum pool requirement of 115,000 acre-feet (which equates to an elevation of about 640 feet) unless further drawdowns are needed to meet minimum flow requirements, but McSwain reservoir has no minimum pool requirement. See table 2-1 for additional details regarding the two project reservoirs.

The project attenuates high flows in the Merced River from winter storms and spring runoff and stores the water in Lake McClure. Figures 3-2 through 3-7 show this high spring flow attenuation compared to simulated unregulated¹⁹ flows. Merced ID has historically operated Lake McClure to retain snowmelt from springtime runoff for flood control, water supply, recreation, hydropower, and environmental purposes. In spring and summer, water levels in Lake McClure are maintained relatively high for recreation purposes, with releases from March through October made for downstream water supply and hydropower generation at New Exchequer and McSwain powerhouses. This release pattern results in higher flows during the drier months of July through October compared to unregulated flows (see figures 3-2 through 3-7). In spring, depending on the snowpack and runoff forecasts, Merced ID begins to refill Lake McClure with the snowmelt runoff. The water surface elevation of Lake McClure fluctuates by about 58 feet in a typical wet water year and about 79 feet in a typical dry water year.

¹⁹ We use the term unregulated to mean flows that are not controlled by dams and diversions from the river. Stakeholders refer to this as “unimpaired” flows.

Hydrology statistics for the Merced River in and downstream of the project, based on historical daily mean flow data, are shown in table 3-1. Merced ID defines wet, normal, and dry water years as roughly the 10, 50, and 90 percent exceedance values for the unregulated annual runoff in the Merced River at New Exchequer dam. Merced ID established a five level water year classification for the Merced River using the same methods as used for the San Joaquin Valley Water Year Hydrologic Classification, but for the Merced River, it is based on the unregulated inflow to Lake McClure. The five water year classifications are: wet, above normal, below normal, dry, and critical and are calculated as 60 percent of the current year's April through July inflow plus 20 percent of the current year's October through March inflow plus 20 percent of the previous year's index. The numerical breakpoints (in millions of acre-feet) for the five water year classifications are:

- Wet: ≥ 0.65
- Above Normal: > 0.53 and < 0.65
- Below Normal: > 0.42 and ≤ 0.53
- Dry: > 0.36 and ≤ 0.42
- Critical: ≤ 0.36

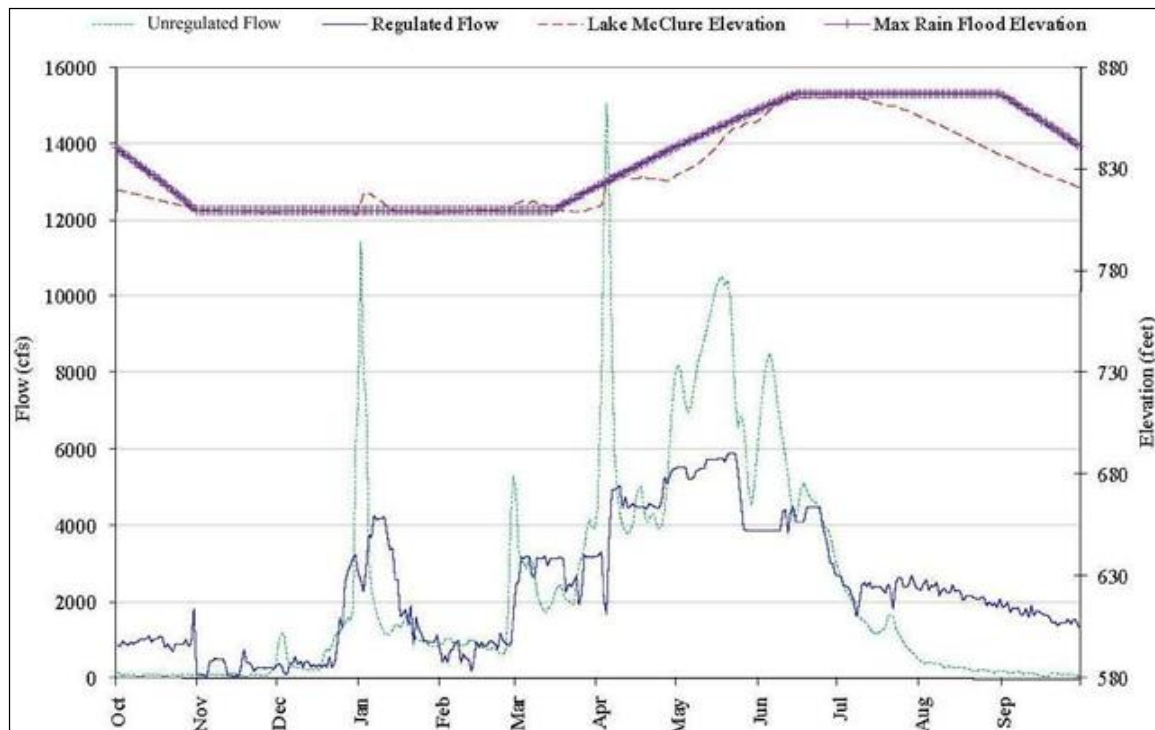


Figure 3-2. Mean daily releases from New Exchequer powerhouse and dam, Merced ID's synthesized mean daily unregulated flow at New Exchequer dam, and Lake McClure daily reservoir elevations in water year 2006, a representative wet water year (Source: Merced ID, 2012a, as modified by staff).

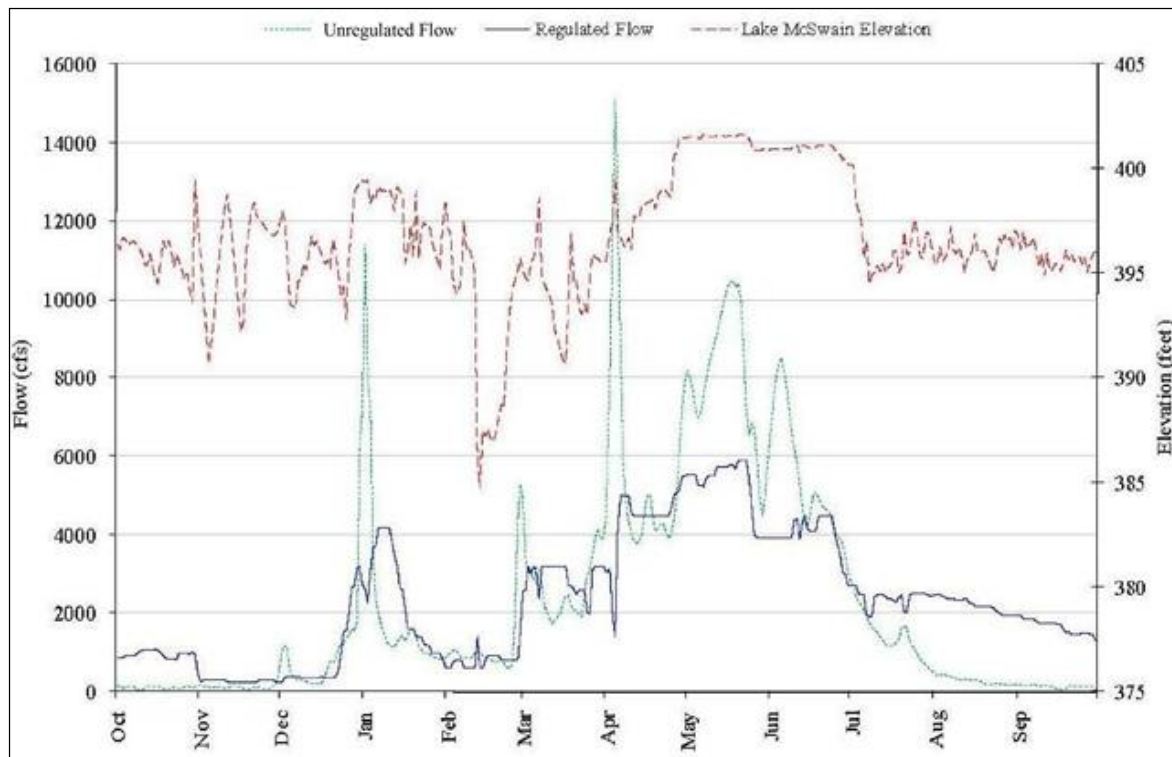


Figure 3-3. Mean daily releases from McSwain powerhouse and dam, Merced ID's synthesized mean daily unregulated flow at McSwain dam, and McSwain reservoir daily reservoir elevations in water year 2006, a representative wet water year (Source: Merced ID, 2012a, as modified by staff).

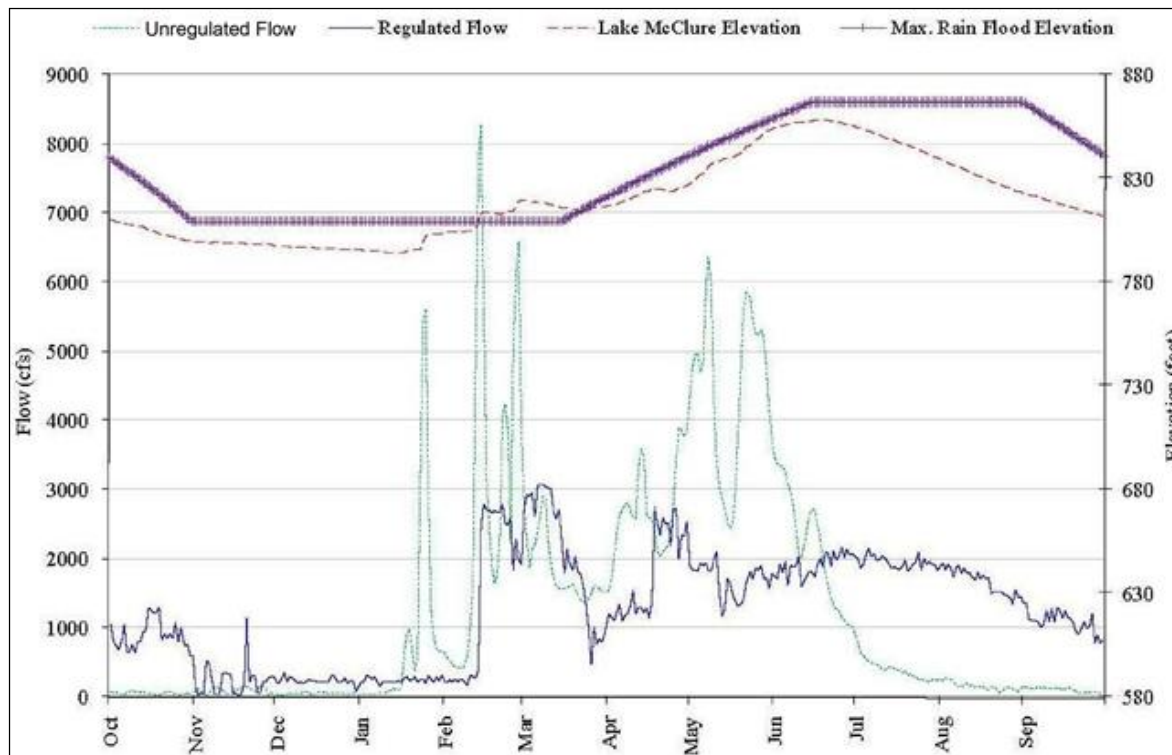


Figure 3-4. Mean daily releases from New Exchequer powerhouse and dam, Merced ID's synthesized mean daily unregulated flow at New Exchequer dam, and Lake McClure daily reservoir elevations in water year 2000, a representative normal water year (Source: Merced ID, 2012a, as modified by staff).

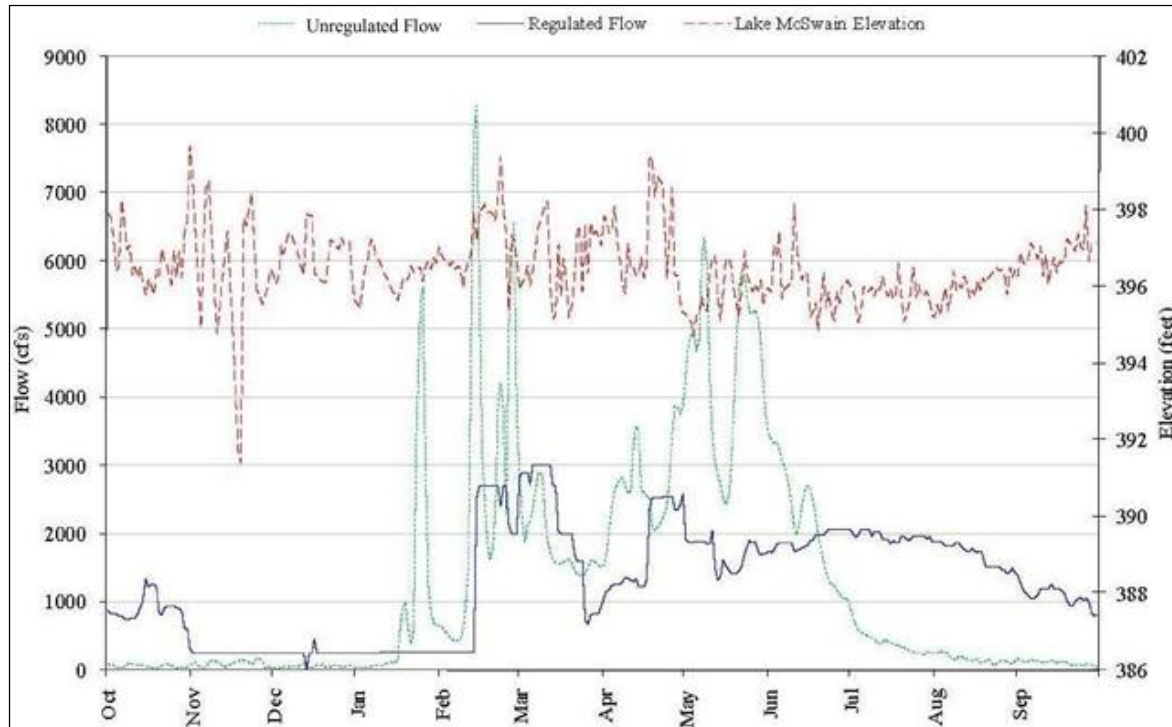


Figure 3-5. Mean daily releases from McSwain powerhouse and dam, Merced ID's synthesized mean daily unregulated flow at McSwain dam, and McSwain reservoir daily reservoir elevations in water year 2000, a representative normal water year (Source: Merced ID, 2012a, as modified by staff).

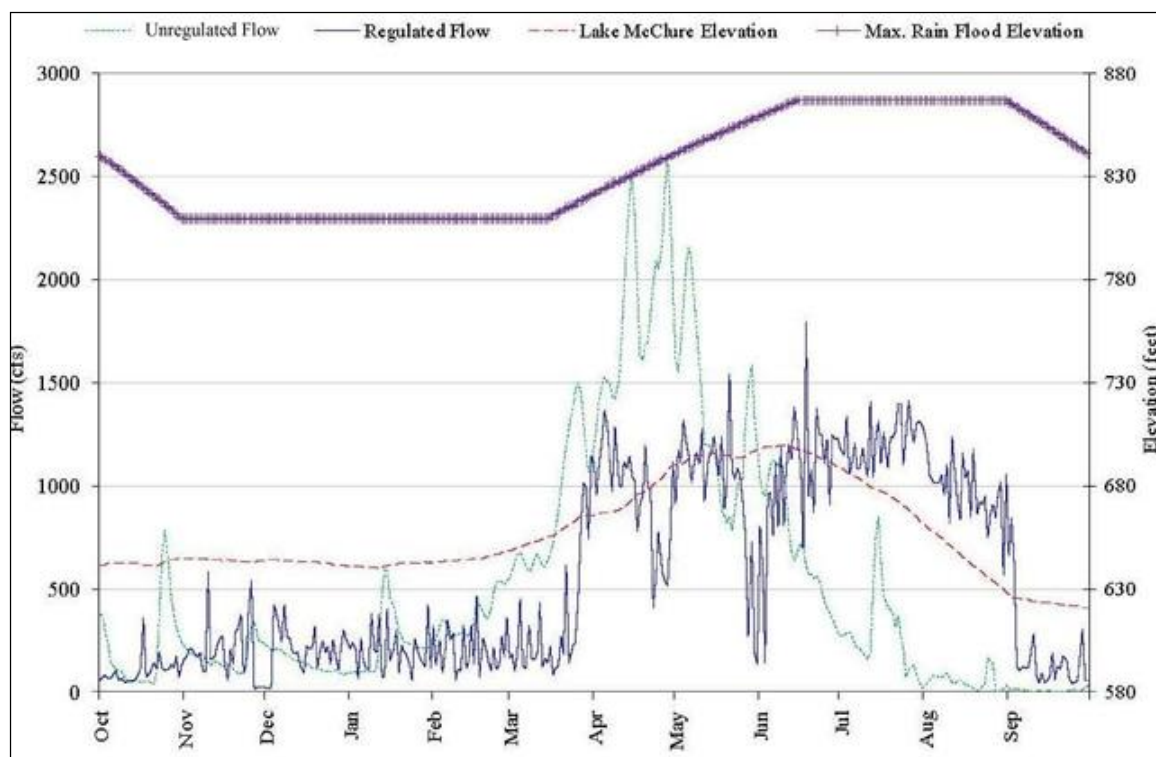


Figure 3-6. Mean daily releases from New Exchequer powerhouse and dam, Merced ID's synthesized mean daily unregulated flow at New Exchequer dam, and Lake McClure daily reservoir elevations in water year 1990, a representative dry water year (Source: Merced ID, 2012a, as modified by staff).

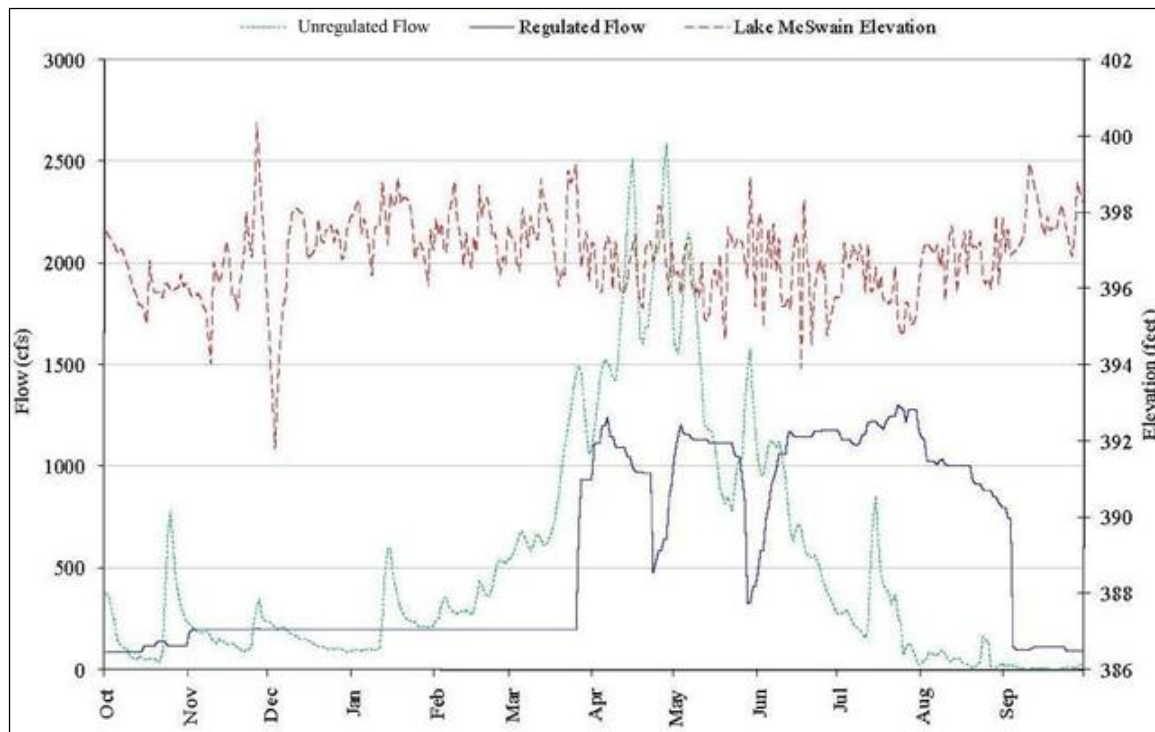


Figure 3-7. Mean daily releases from McSwain powerhouse and dam, Merced ID's synthesized mean daily unregulated flow at McSwain dam, and McSwain reservoir daily reservoir elevations in water year 1990, a representative dry water year (Source: Merced ID, 2012a, as modified by staff).

Table 3-1. Hydrology for selected sites associated with the Merced River Project (Sources: Merced ID, 2010a; USGS, 2014, both as modified by staff).

Exceedances and Summary Statistics	Flow (cfs) for Water Years 1974–2006												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
Inflow to Lake McClure^a													
20%	220	364	498	1,499	2,056	2,534	3,333	5,866	4,841	1,588	463	220	2,431
50%	95	146	199	414	741	1,634	2,564	2,715	578	200	130	87	535
80%	24	71	84	136	475	1,120	1,884	753	191	59	36	19	113
Average	160	339	630	1,408	1,674	1,998	2,591	4,095	3,062	1,143	297	175	1,462
Maximum	3,765	5,645	20,421	43,964	27,551	22,244	22,525	14,335	13,913	10,326	3,006	3,070	43,964
Minimum	16	23	38	50	106	176	412	450	87	37	18	16	16
Lake McClure Powerhouse^b													
20%	1,404	530	564	601	1,118	2,050	2,890	3,111	2,896	2,330	2,296	1,401	2,195
50%	707	267	273	244	235	1,040	1,698	1,987	2,002	1,821	1,364	669	1,185
80%	72	83	122	80	149	504	1,338	1,617	1,701	1,383	875	53	240
Average	911	359	538	813	998	1,299	1,969	2,426	2,375	2,157	1,764	1,334	1,414
Maximum	4,135	2,995	4,546	8,087	7,996	5,406	7,113	7,121	7,882	7,872	2,859	4,133	8,087
Minimum ^c	0	0	0	0	6	5	14	24	146	707	6	0	0

Exceedances and Summary Statistics	Flow (cfs) for Water Years 1974–2006												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
Lake McSwain Powerhouse^b													
20%	1,324	500	500	500	1,100	1,999	2,799	3,122	2,899	2,251	2,313	1,324	2,224
50%	713	245	250	235	235	1,036	1,700	2,007	2,075	1,825	1,338	650	1,200
80%	150	200	200	180	200	500	1,349	1,655	1,738	1,370	890	150	235
Average	928	372	546	825	1,012	1,314	1,981	2,443	2,400	2,182	1,782	1,349	1,430
Maximum	4,139	3,049	4,499	8,090	7,998	5,498	7,187	7,198	7,998	7,998	2,949	4,139	8,090
Minimum	0	17	25	38	14	120	144	243	485	950	146	80	0
Merced River below Merced Falls Dam (USGS 11270900)													
20%	1,436	508	515	502	1,100	2,060	2,784	3,090	2,822	2,200	2,220	1,432	2,180
50%	721	251	253	243	239	1,010	1,650	1,970	2,010	1,760	1,280	663	1,170
80%	140	197	195	174	198	522	1,300	1,600	1,720	1,320	860	148	239
Average	939	374	539	828	1,018	1,318	1,944	2,387	2,333	2,131	1,722	1,305	1,405
Maximum	4,100	2,950	4,490	8,020	7,920	5,340	7,040	7,100	7,820	7,830	2,800	4,020	8,020
Minimum	72	115	163	101	106	106	149	244	438	883	123	71	71

Exceedances and Summary Statistics	Flow (cfs) for Water Years 1974–2006												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
Crocker-Huffman Diversion Dam^d													
20%	811	427	448	491	873	1,864	2,031	1,602	992	396	769	808	852
50%	211	238	246	241	238	253	319	297	244	225	213	198	250
80%	115	182	185	139	164	196	228	221	188	172	129	117	173
Average	491	335	489	783	961	1,030	1,145	1,060	784	482	307	370	685
Maximum	3,185	2,337	4,588	8,345	7,965	5,136	5,340	5,304	4,752	5,898	1,155	3,212	8,345
Minimum	28	86	139	78	75	75	24	83	86	73	83	32	24
Merced River near Stevinson CA (USGS 11272500)^e													
20%	761	508	530	1,018	834	1,720	2,284	1,558	1,130	423	710	810	865
50%	290	252	249	304	283	277	310	290	214	214	303	300	268
80%	84	196	201	213	207	189	164	133	71	74	81	89	147
Average	517	393	523	783	730	1,103	1,238	1,106	825	455	272	394	694
Maximum	3,200	2,740	4,260	6,850	5,900	6,750	5,750	5,360	5,490	5,600	1,340	2,080	6,850
Minimum	4	15	144	57	20	67	20	26	10	1	2	7	1

^a Data from Merced ID (2010a), Operations Model CD file titled *2010-12-27 Merced Ops Model_V3.xlsm*.

^b Data compiled from Merced ID (2012a), Operations Model CD file *2010-03-26 Calculation of Acc-Dep Terms.xls* as the sum of discharge through powerhouse plus spill or bypass flow. The New Exchequer powerhouse has a capacity of 3,200 cfs and McSwain powerhouse has a capacity of 2,700 cfs; flows in excess of these values are largely due to spillage.

^c Merced ID's simulated minimum inflows to Lake McClure showed no flows during many months. To provide a more representative indication of minimum inflows we used actual USGS data from an historic USGS gage at Bagby. Minimum daily flow values are from USGS gage no. 11268500 Merced River at Bagby CA (located upstream of Lake McClure) for water years 1922–1966.

^d Data from Merced ID (2010a), Operations Model CD file titled *2010-03-26 Calculation of Acc-Dep Terms.xls*.

^e No data available for water years 1996–2001.

McSwain reservoir is typically operated as a re-regulating afterbay for flows released from Lake McClure. This operation allows Merced ID to use the New Exchequer powerhouse to meet peak power demands or to perform load-following functions while still maintaining a steady flow release to downstream reservoirs and subsequently to the lower Merced River. The water surface elevation of McSwain reservoir typically fluctuates up to 7.5 feet during normal operations.

Pursuant to article 39 of its existing license, Merced ID operates the Merced River Project in compliance with the Corps' document entitled: *New Exchequer Dam and Reservoir, Merced River, California; Water Control Manual; Appendix VII to Master Water Control Manual, San Joaquin River Basin, California*, dated October 1981. This manual sets year-round flood control limits for Lake McClure rain flood space and March through July flood control limits for snowmelt flood space, or conditional space (table 3-2). During drier water years and periods, water levels in Lake McClure may be consistently below the required flood-space level, resulting in water supply and recreation considerations driving reservoir storage more than flood control requirements.

Table 3-2. Maximum end-of-month storage in Lake McClure for flood control (Source: Merced ID, 2012a).

Month	Rain-Flood Storage Limit (acre-feet)	Snowmelt Flood (Conditional) Storage Limit (acre-feet)
January	674,600	None
February		
March 1–March 15		
March 16–March 31	Linear increase from 674,600 to 1,024,600	Linear reduction from 674,600 to 624,600
April		624,600
May 1–May 15		
May 16–May 31		Linear increase from 624,600 to 1,024,600
June 1–June 15		
June 16–June 30	1,024,600	None
July		
August		
September	Linear reduction from 1,026,600 to 674,600	
October		
November/December	674,600	

Water Withdrawals and Water Rights—Merced ID diverts water from the Merced River at two locations: the northside canal (at Merced Falls reservoir) and the Main Canal (at Crocker-Huffman diversion dam) (see figure 1-2). Merced ID owns and operates Crocker-Huffman diversion dam and the associated Main Canal as part of its water supply system, but the facilities are not part of its Merced River Project or PG&E's Merced Falls Project. Annually, about 520,000 acre-feet of water, which is about half the usable storage in Lake McClure, is released from the project and diverted by Merced ID at the northside and Main Canals. The diversion canals lead to a network of downstream canals that deliver water primarily for irrigation and also for groundwater recharge, municipal and industrial uses, water transfers, and environmental purposes. Irrigation diversions from the northside and Main Canal normally occur from March through October.

Pursuant to article 45 of the existing license, operation of the Merced River Project currently includes a required annual diversion of up to 15,000 acre-feet of water to Merced NWR. The refuge is located about 30 miles southeast of McSwain dam. To provide this water, in the early 1990s, Merced ID made eight modifications to its water supply delivery system, each of which was incorporated into the project license (but not included in the project boundary). These modifications are listed in section 2.1.1.1, *Existing Project Facilities*. Merced ID also has a commitment to annually provide to the Stevenson Water District with up to 26,400 acre-feet of irrigation water, which is used to service both Stevenson and Merquin Water Districts.

Merced ID has a riparian water rights claim for the natural flow of the Merced River at both the New Exchequer and McSwain powerhouses. These riparian claims are documented with the Water Board through Statements of Water Diversion and Use numbers 15475 and 15476. Merced ID also holds pre-1914 and adjudicated rights originally held by the Exchequer Gold Mine Company and the Crocker-Huffman Land Company, as well as post-1914 appropriative water rights obtained directly by Merced ID for the purpose of operating the project. In addition, Merced ID has water right licenses 2685, 6047, and 16186 (Applications 1224, 10572, and 11395, respectively) for irrigation, domestic use, recreational, and other purposes.

Merced Falls Project

Water Storage and Hydrology—The Merced Falls Project includes a single reservoir—Merced Falls reservoir (see figure 1-4), located immediately downstream of Merced ID's McSwain dam. PG&E has no storage rights; therefore, the Merced Falls Project must operate in a run-of-river mode so that all inflow to the impoundment minus the water being diverted by existing irrigation withdrawals passes through the project either via the turbine or through the radial gates. As such, outflow from the project is dictated by releases from Merced ID's upstream Merced River Project and irrigation withdrawals (discussed above), typically result in limited flow available for generation from October through mid-March.

The project uses outflow of between approximately 500 and 1,750 cfs provided by the upstream Merced River Project to generate hydroelectric power. When outflow from the Merced River Project is below 500 cfs, flows are spilled via the radial gates. When water inflows exceed the powerhouse capacity, up to 12,100 cfs, excess flow is released through the radial gates. Currently, flows in excess of 12,100 cfs do not occur at Merced Falls, because Merced ID regulates the upstream reservoirs.

The current license for the project does not directly stipulate minimum flow requirements. Article 38 of the current license requires PG&E to coordinate operations with Merced ID's upstream Merced River Project. As a run-of-river project, the Merced Falls Project does not control inflow from Merced ID's upstream operations. Currently, flows in excess of 12,100 cfs do not occur at Merced Falls, because Merced ID regulates the upstream reservoirs (figure 3-8).

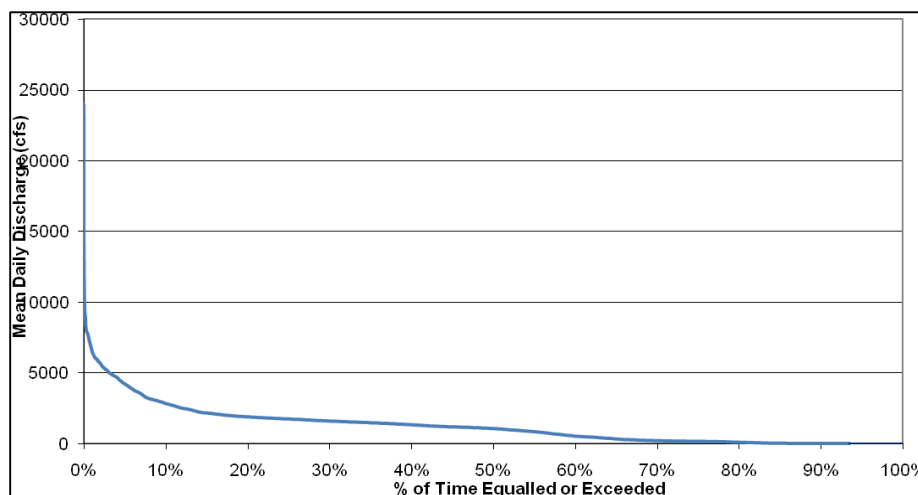


Figure 3-8. Annual flow duration curve for the Merced Falls Project for the period of record (January 1, 1916 to September 30, 2009) (Source: PG&E, 2012, as modified by staff)

Lower Merced River

This section describes conditions related to water quantity in the lower Merced River downstream of the Merced Falls Project and Crocker-Huffman diversion dam.

Water Storage and Hydrology—Crocker-Huffman diversion dam is located at RM 52.0, about 3 miles downstream of Merced Falls dam. Crocker-Huffman diversion dam forms an impoundment that is about 1.5 miles long, relatively shallow, and has a storage volume of about 300 acre-feet (Vogel, 2007), which would result in a typical water retention time of less than a day.

Merced ID's existing license specifies minimum streamflow requirements in the Merced River downstream of Crocker-Huffman diversion dam, as measured at Shaffer

Bridge. Table 3-3 shows the minimum flow requirements for Merced ID under the existing license. The existing license also requires Merced ID to maintain a flow within the range of 100 and 200 cfs, measured at Shaffer Bridge, from November 1 through December 31, except during dry years when a flow between 75 and 150 cfs is required. In addition, the existing license requires Merced ID to minimize flow fluctuations downstream of Crocker-Huffman diversion dam by restricting the rate of change of release during any 1-hour period to no more than double or no less than one-half the amount of release at the start of the change. During emergency periods, Merced ID must endeavor to make releases from Crocker-Huffman diversion dam in a manner that would not be detrimental to fish.

Table 3-3. Current minimum flow requirements in the Merced River downstream of Crocker-Huffman diversion dam, as measured at Shaffer Bridge (Source: Merced ID, 2012a).

Period	Normal Years (cfs)	Dry Years (cfs)
June 1 through October 15	25	15
October 16 through October 31	75	60
November 1 through December 31	100	75
January 1 through May 31	75	60

Several other agreements outside of the existing project license also influence flows in the Merced River downstream of Crocker-Huffman diversion dam. These agreements are as follows:

- A 2002 Memorandum of Understanding with California Department of Fish and Game (now California DFW), as amended in 2003, requires Merced ID to supplement flows in the Merced River in October by providing 12,500 acre-feet²⁰ of water, as measured at Shaffer Bridge, in addition to the project's minimum flow requirement in that month.
- Under the Davis-Grunsky Agreement with the State of California, Merced ID is committed to providing a continuous flow of 180 to 220 cfs in the Merced River between Crocker-Huffman diversion dam and Shaffer

²⁰ This volume would correspond to a rate of about 204 cfs for every day in October.

Bridge from November through March every year. The agreement expires on December 31, 2017.

- The 1926 Cowell Agreement requires Merced ID to provide releases from Crocker-Huffman diversion dam up to the following flows for use by the Cowell Agreement diverters at 11 locations: 100 cfs in March; 175 cfs in April; 225 cfs in May; 250 cfs from the first day in June until the natural flow of the Merced River falls below 1,200 cfs; 225 cfs flow for the next 31 days; 175 cfs flow for the next 31 days; 150 cfs for the next 30 days; and 50 cfs thereafter or the natural inflow into Lake McClure, whichever is less, through the last day of February.

Water Withdrawals—Up to 2,000 cfs of water is withdrawn from Crocker-Huffman diversion dam impoundment into the Main Canal for water supply purposes. The diversion substantially reduces the flow in the Merced River from an annual mean of 1,389 cfs in the Merced River downstream of Merced Falls dam to an annual mean of 655 cfs in the Merced River downstream of Crocker-Huffman diversion dam. Water is also drawn from the Crocker-Huffman diversion dam impoundment by California DFW's Merced River fish hatchery and the privately owned Calaveras Trout Farm, Inc. The hatchery uses, on average, about 3 cfs from February through March and 7 cfs from April through January, while the trout farm uses about 48 cfs year-round. The majority of the fish hatchery and trout farm withdrawals are returned to the Merced River.

Downstream of Crocker-Huffman diversion dam, the Merced River flows about 19 miles to Shaffer Bridge (RM 32.8). This section of the river contains seven main channel diversions, with users holding diversion rights of up to about 94,000 acre-feet of water annually. The diversions, most of which are unscreened, are made via small, annually-constructed wing dams in the main river channel. Numerous agricultural water returns are present in this section of river, although information regarding the rate or volume of the returns is not available.

In the 32.8 river miles from Shaffer Bridge downstream to its confluence with the San Joaquin River, additional water withdrawals and agricultural returns affect the Merced River. An inventory of water diversions identified more than 100 non-project diversions in this section of the river, many of which are unscreened pumps used mainly to supply water for agricultural use. Agricultural returns in this section of the river include non-project canal spills that discharge excess irrigation water and storm flows from adjacent watersheds (e.g., the Tuolumne River) into the Merced River. Like the water diversions, these canal returns are ungaged and the amount of water diverted and returned to the Merced River has not been quantified. One major tributary, Dry Creek, enters the river about 1 mile downstream of Shaffer Bridge, but inflow from this creek is minimal except during substantial rainfall events in the Central Valley area that occur mainly during the winter (California DEC, 2013).

Water Quality

In the *Water Quality Control Plan for the Sacramento and San Joaquin Basins* (Basin Plan), the Central Valley Regional Water Board (Central Valley Water Board) designates existing and potential beneficial uses and water quality objectives for the Merced River Project, the Merced Falls Project, and the river upstream and downstream of the projects (Central Valley Water Board, 2011). Existing designated, beneficial uses of surface waters in Lake McClure and McSwain reservoir are: irrigation, hydropower generation, contact and non-contact recreation, warm and cold freshwater habitat, and wildlife habitat. Municipal and domestic water supply is designated as a potential beneficial use. Existing designated, beneficial uses from McSwain reservoir downstream to the San Joaquin River are: municipal and domestic water supply, stock watering, industrial process and service supply, hydropower generation, contact and non-contact recreation, warm and cold freshwater habitat, migration of warmwater and coldwater aquatic organisms, spawning of warmwater and coldwater fishes, and wildlife habitat. Table 3-4 shows the Basin Plan water quality objectives to support these designated beneficial uses.

Table 3-4. Water quality objectives to support designated beneficial uses in the project area (Source: Central Valley Water Board, 2011).

Water Quality Objective	Description
Temperature	The natural receiving water temperature of interstate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Water Quality Control Board that such alteration in water temperature does not adversely affect beneficial uses. In waters designated as cold freshwater habitat, increases in water temperatures must be less than 5.0°F above natural receiving-water temperature.
Bacteria	In waters designated for contact recreation, fecal coliform concentration must be: (1) less than a geometric mean of 200 per 100 milliliters water based on a minimum of five samples collected in any 30-day period, and (2) less than 400 per 100 milliliters of water in at least 90 percent of all samples taken in a 30-day period.
Biostimulatory substances	Water shall not contain biostimulatory substances that promote aquatic growth in concentrations that cause nuisance or adversely affect beneficial uses.

Water Quality Objective	Description
Chemical constituents	Waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses. At minimum, waters designated for use as domestic or municipal supply shall not contain concentrations of chemical constituents in excess of the maximum contaminant levels specified in Title 22 of the California Code of Regulations, which are incorporated by reference into the Basin Plan.
Color	Water shall be free of discoloration that causes a nuisance or adversely affects beneficial uses.
DO	The DO concentrations shall not be reduced below the following minimum levels at any time. • Waters designated as warm freshwater habitat: 5.0 mg/L • Waters designated as cold freshwater habitat: 7.0 mg/L • Waters designated as spawning habitat: 7.0 mg/L In the Merced River from Cressey (~RM 29.0) to New Exchequer dam, DO concentrations shall not be reduced below 8.0 mg/L year-round, and downstream of Cressey to the confluence with the San Joaquin River DO concentrations shall not be reduced below 7.0 mg/L year-round. The monthly median of the average daily DO concentration shall not fall below 85 percent of saturation in the main water mass, and the 95 percentile concentration shall not fall below 75 percent of saturation.
Floating material	Water shall not contain floating material in amounts that cause nuisance or adversely affect beneficial uses.
Oil and grease	Waters shall not contain oils, greases, waxes, or other materials in concentrations that cause nuisance, result in a visible film or coating on the surface of the water or on objects in the water, or otherwise adversely affect beneficial uses.

Water Quality Objective	Description
Pesticides	Waters shall not contain individual pesticides or a combination of pesticides in concentrations that adversely affect beneficial uses. Waters designated for use as domestic or municipal supply shall not contain concentrations of pesticides in excess of the limiting concentrations set forth in Title 22 of the California Code of Regulations.
pH	The pH of surface shall neither be depressed below 6.5 nor raised above 8.5.
Sediment and settleable material	The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause a nuisance or adversely affect beneficial uses. Waters shall not contain substances in concentrations that result in deposition of material that causes nuisance or adversely affect beneficial uses.
Suspended material	Waters shall not contain suspended material in concentrations that cause a nuisance or adversely affect beneficial uses.
Taste and odor	Water shall not contain taste- or odor-producing substances in concentrations that impart undesirable tastes and odors to domestic or municipal water supplies, fish flesh or other edible products of aquatic origin, or that cause nuisance or otherwise adversely affect beneficial uses. ^a
Toxicity	All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life. Compliance with this objective will be determined by analysis indicator organisms, species diversity, population density, growth anomalies, and biotoxicity tests as specified by the Regional Water Quality Control Board.

Water Quality Objective	Description
Turbidity	Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases in turbidity attributable to controllable water quality factors shall not exceed the following limits: • Where natural turbidity is between 0 and 5 NTUs, increases shall not exceed 1 NTU. • Where natural turbidity is between 5 and 50 NTUs, increases shall not exceed 20 percent. • Where natural turbidity is between 50 and 100 NTUs, increases shall not exceed 10 NTU. • Where natural turbidity is greater than 100 NTU, increases shall not exceed 10 percent.
Notes: DO – dissolved oxygen, °F – degrees Fahrenheit, °C – degrees Celsius, mg/L – milligrams per liter, NTU – nephelometric turbidity unit	
^a Taste and odor limits for drinking water are provided as secondary maximum contaminant levels in Title 22 of the California Code of Regulations.	

The Merced River, including project reservoirs and the river downstream of the project, is listed under section 303(d) of the CWA as water quality limited for the following pollutants and stressors (Water Board, 2010):

- Water temperature
- *Escherichia coli* (E. coli)
- Mercury
- Chlorpyrifos
- Diazinon
- Group A pesticides²¹
- Unknown toxicity

²¹ Group A pesticides consist of aldrin, dieldrin, chlordane, endrin, heptachlor, heptachlor epoxide, hexachlorocyclohexanes (including lindane), endosulfan, and toxaphene (Water Board, 2006a).

The listed sources for these pollutants are: agriculture (chlorpyrifos, diazinon, and Group A pesticides), resource extraction (mercury), and unknown source (water temperature, E. coli, and unknown toxicity).

Merced River Project

Based on California DFW water temperature and DO profile data collected from 2004 through 2011, Lake McClure water typically stratifies throughout the year, although the thermocline is often weakly defined in the winter (figures 3-9 to 3-11). The thermocline is typically situated between 25 and 75 feet below the water surface. From May through September (and occasionally October), surface water temperatures (up to 50 feet below the water surface) often exceed 20.0°C (68.0 °F), decreasing through the thermocline to 9.0 to 12.0°C (48.2 to 53.6°F) in bottom waters. The reservoir can fully mix in some years during December through February (e.g., in 2007), although often a weak thermocline appears during winter months in deeper waters (75 to 100 feet below the water surface), located just above the low-level intake (elevation 495 feet). Winter water temperatures in Lake McClure typically range from 10.0 to 15.0°C (50.0 to 59.0°F) with only slight (1 to 2°C) differences between surface and bottom water temperatures.

Merced ID estimated the volume of usable cold water (i.e., water temperature less than or equal to the 15.0°C (59.0°F) isotherm and located above the intake elevation) in Lake McClure during a recent normal (2010), wet (2006), and dry (2008) water year (table 3-5). The estimated amount of usable cold water below the 15.0°C (59.0°F) isotherm varies by time of year, reservoir operations, and water year type, as shown in figures 3-9 through 3-11.

Table 3-5. Estimated usable cold-water storage volume (acre-feet) in Lake McClure below the 15.0°C (59.0°F) isotherm (Source: Merced ID, 2012a).

2010 (Normal WY)		2006 (Wet WY)		2008 (Dry WY)	
March	August	December	August	December	August
502,641	477,581	642,196	411,263	230,942	25,810

Note: WY – water year

Unlike Lake McClure, McSwain reservoir typically stratifies during the spring (i.e., April through May) and mixes in the fall (i.e., October through November) (figures 3-12 through 3-14). The McSwain reservoir thermocline can make up a substantial fraction of the water column, extending 10 to 30 feet down from the surface. During summer months, water temperatures within surface waters (0 to 15 feet) of McSwain reservoir are variable (12.0 to 20.0°C or 53.6 to 68.0°F) with bottom water temperatures ranging from 9.0 to 14.0°C (48.2 to 57.2°) throughout the year.

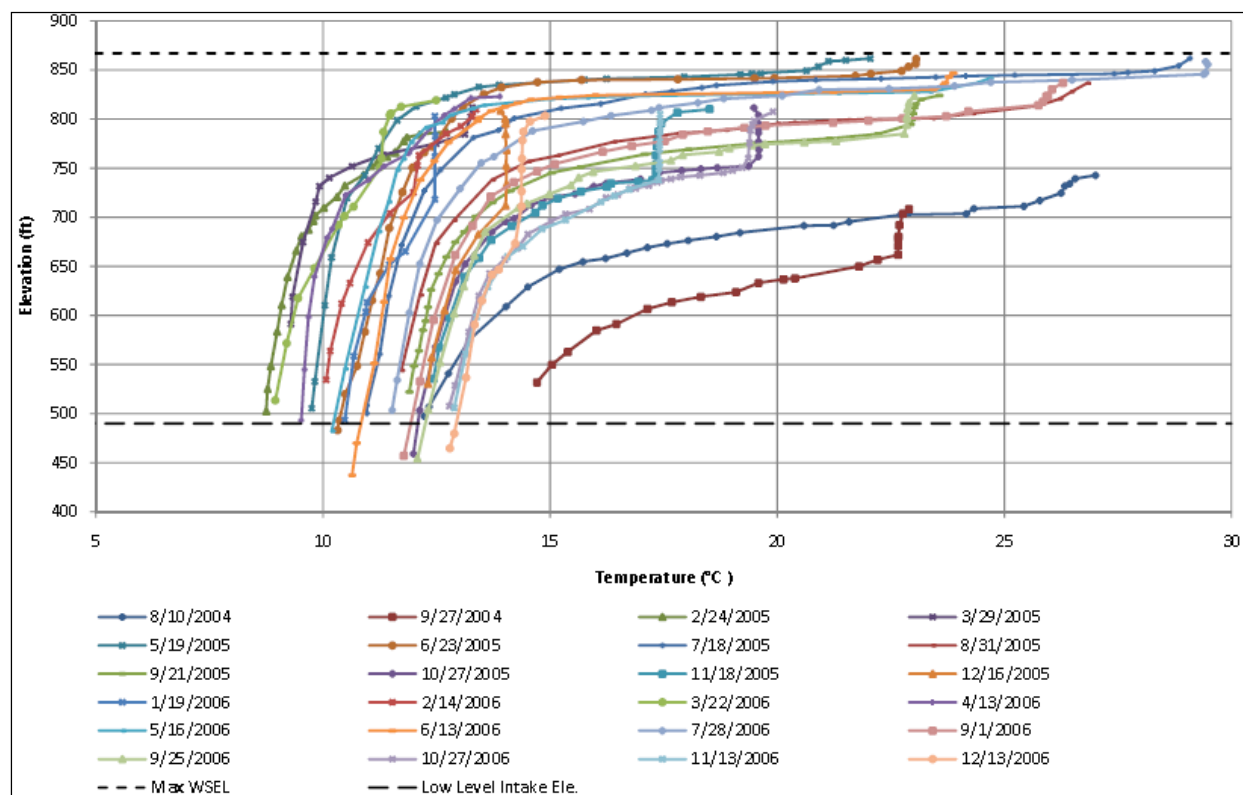


Figure 3-9. Water temperature in Lake McClure near the dam (August 2004 through December 2006) (Merced ID, 2011a).

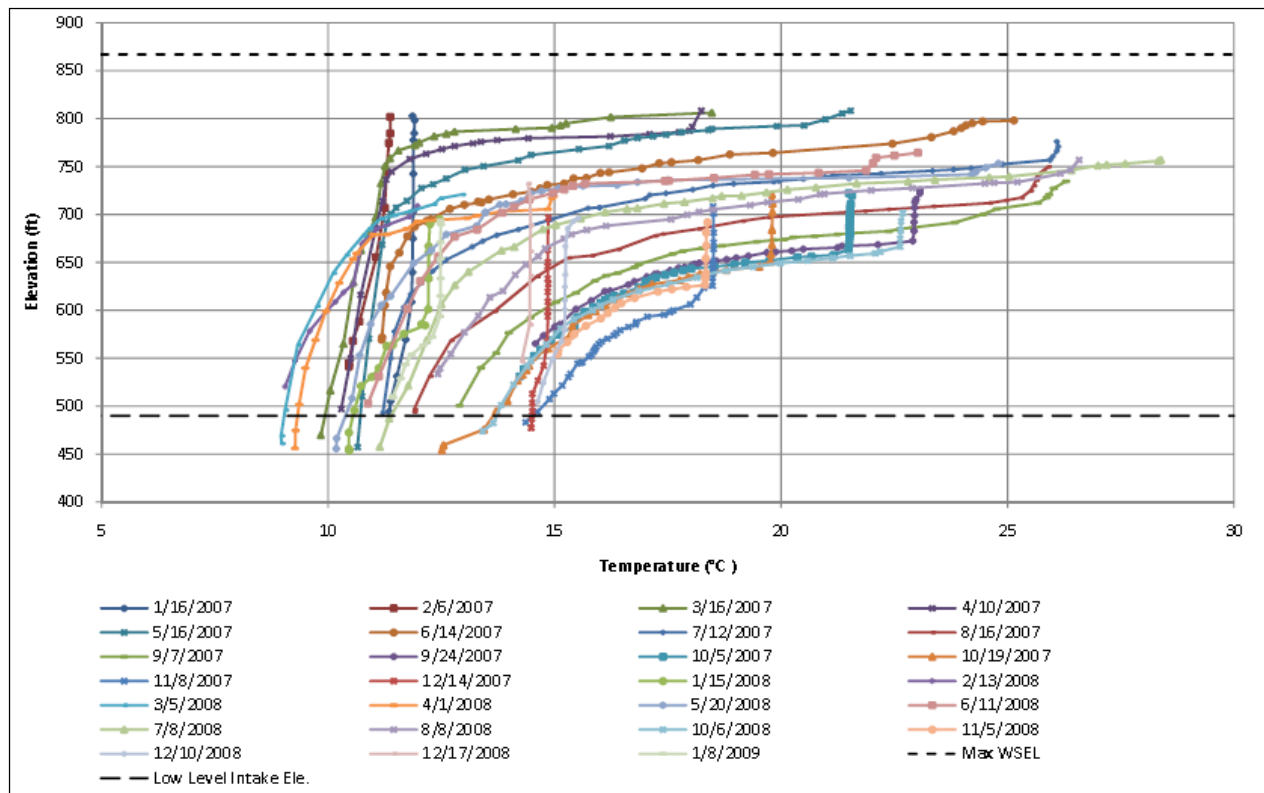


Figure 3-10. Water temperature in Lake McClure near the dam (January 2007 through January 2009) (Merced ID, 2011a).

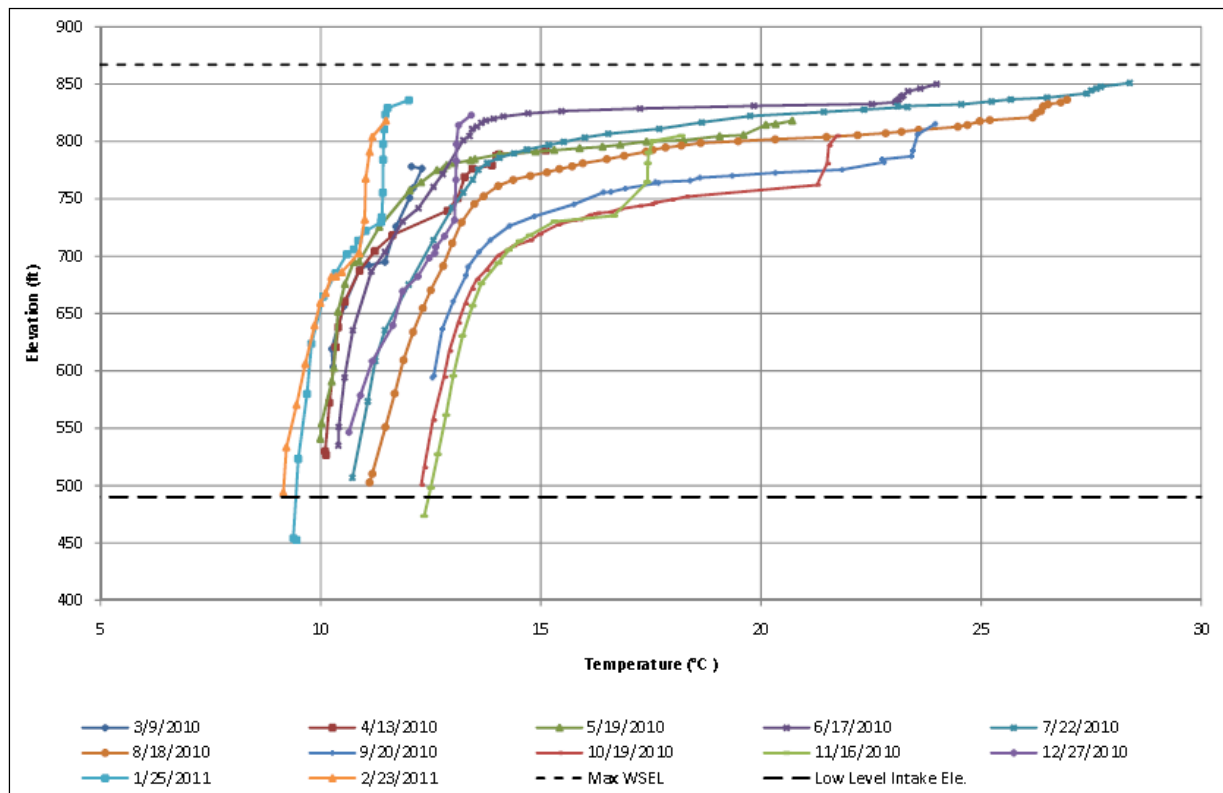


Figure 3-11. Water temperature in Lake McClure near the dam (March 2010 through February 2011) (Merced ID, 2011a).

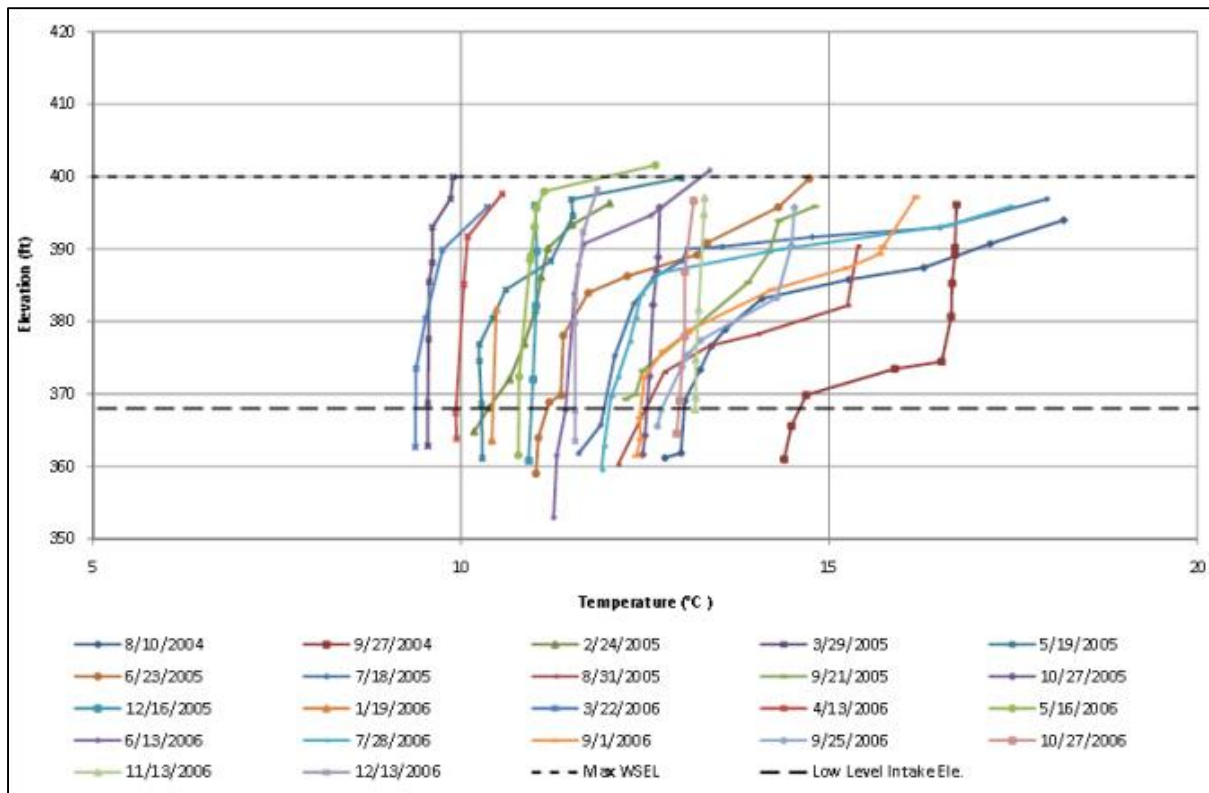


Figure 3-12. Water temperature in McSwain reservoir near the dam (August 2004 through December 2006) (Merced ID, 2011a).

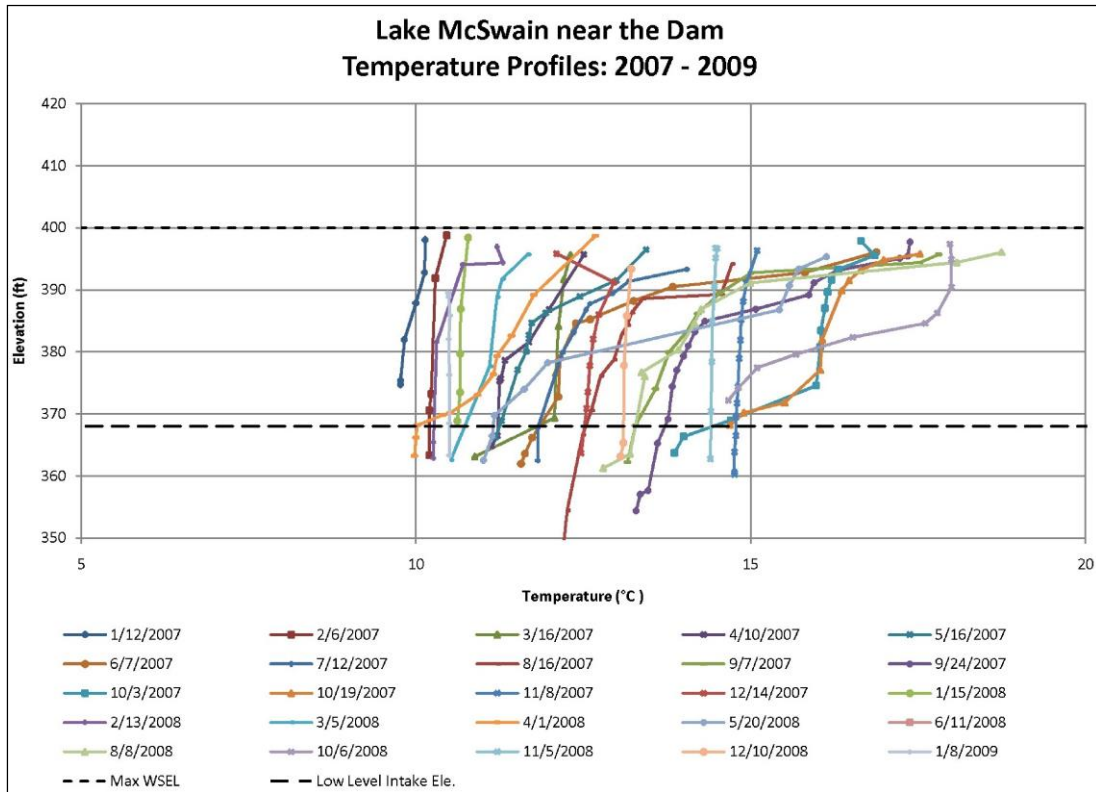


Figure 3-13. Water temperature in McSwain reservoir near the dam (January 2007 through January 2009) (Merced ID, 2011a).

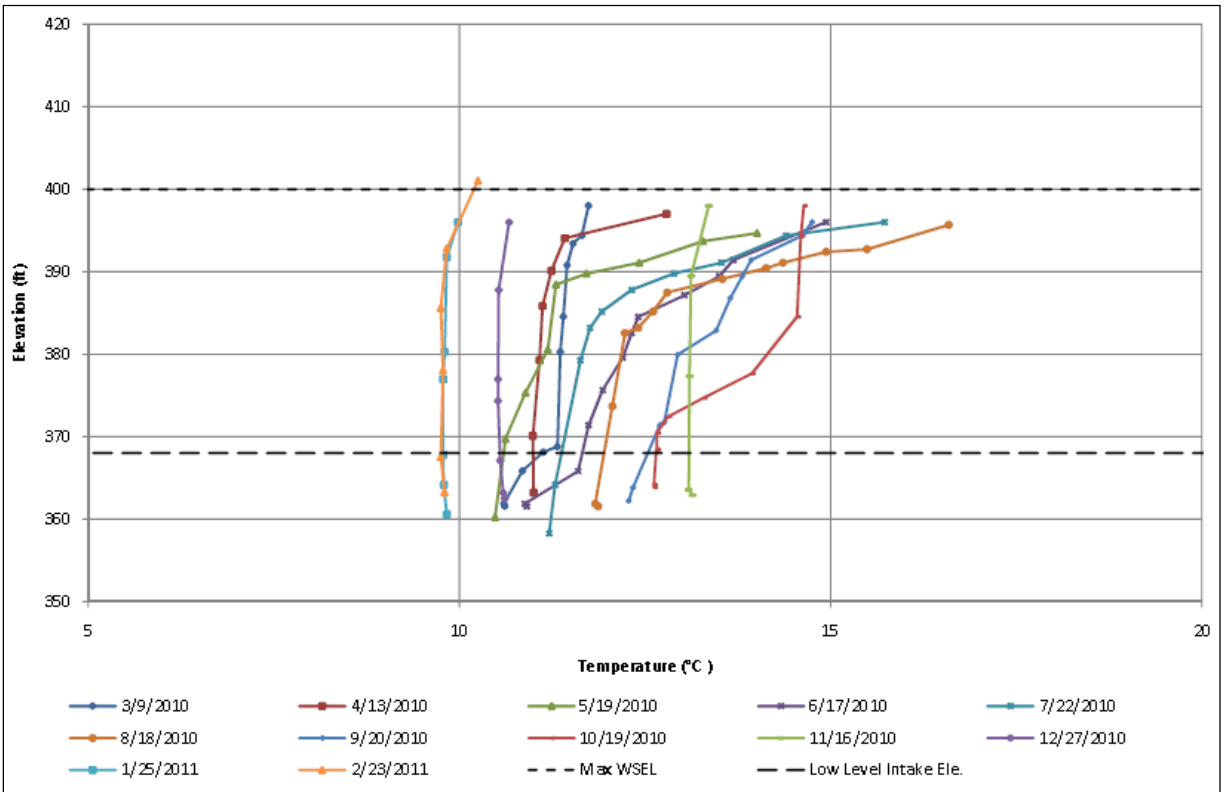


Figure 3-14. Water temperature in McSwain reservoir near the dam (March 2010 through February 2011) (Merced ID 2011a).

DO profiles in Lake McClure exhibit a complex pattern (figures 3-15 through 3-17). DO concentrations in surface waters are typically 6 to 8 milligrams per liter (mg/L) year-round but can become supersaturated at times (e.g., August 2005 and May 2006), likely the result of photosynthetic activity by phytoplankton during daylight hours. DO concentrations typically decrease rapidly with depth through the thermocline, frequently dropping as low as 2 to 4 mg/L near the bottom of the thermocline. This pattern suggests that a concentration of organisms (such as zooplankton) present in the middle to lower depths of the thermocline is decreasing DO concentrations via respiration. Below the thermocline, DO concentrations increase with depth, typically to levels between 4 and 8 mg/L at the elevation of the low level intake. At greater depths, DO concentrations are highly variable, at times dropping to levels well below 4 mg/L (e.g., August 2005, July 2010, and November 2010).

In the relatively shallow McSwain reservoir, DO exhibits less variation with depth, consistent with observed thermal stratification patterns. The highest DO concentrations (9 to 11 mg/L) are typically found in January through March, when the water is cold and generally well mixed (figures 3-18 through 3-20). The lowest DO concentrations typically occur in August through November, when measured values are typically less than 7 mg/L throughout the water column. Data collected in 2010 is the exception to this pattern, with most values measuring greater than 8 mg/L (see figure 3-20).

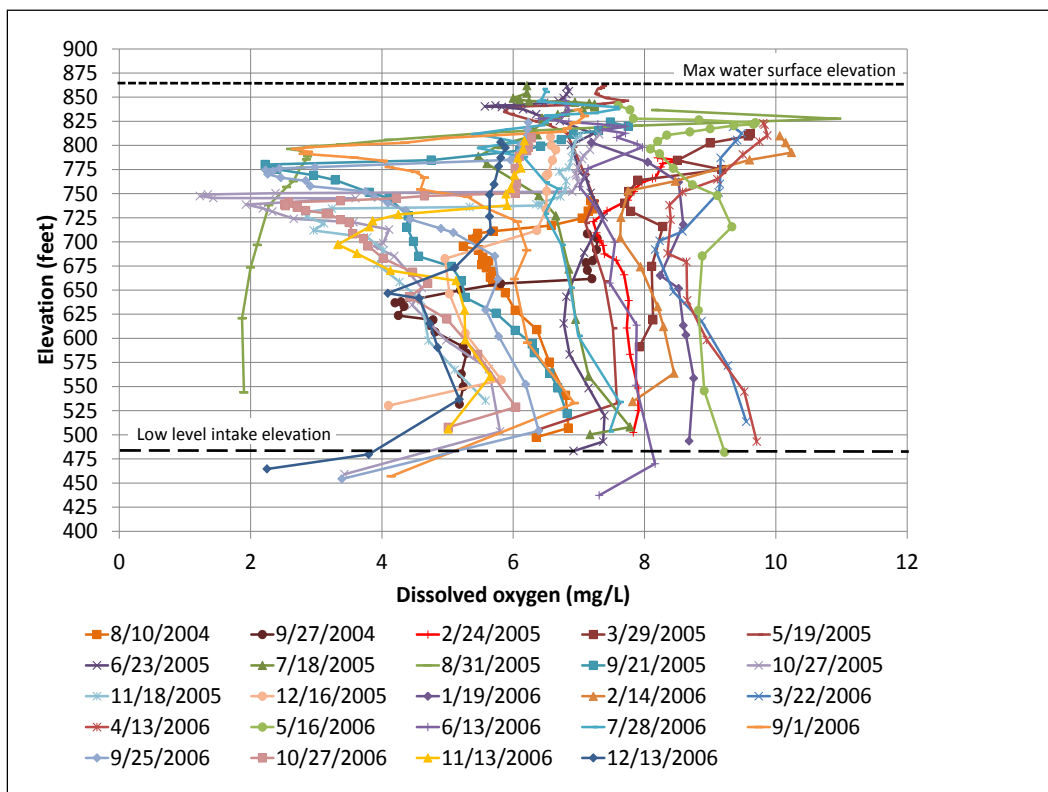


Figure 3-15. Dissolved oxygen in Lake McClure near the dam (August 2004 through December 2006) (Source: Merced ID, 2011b).

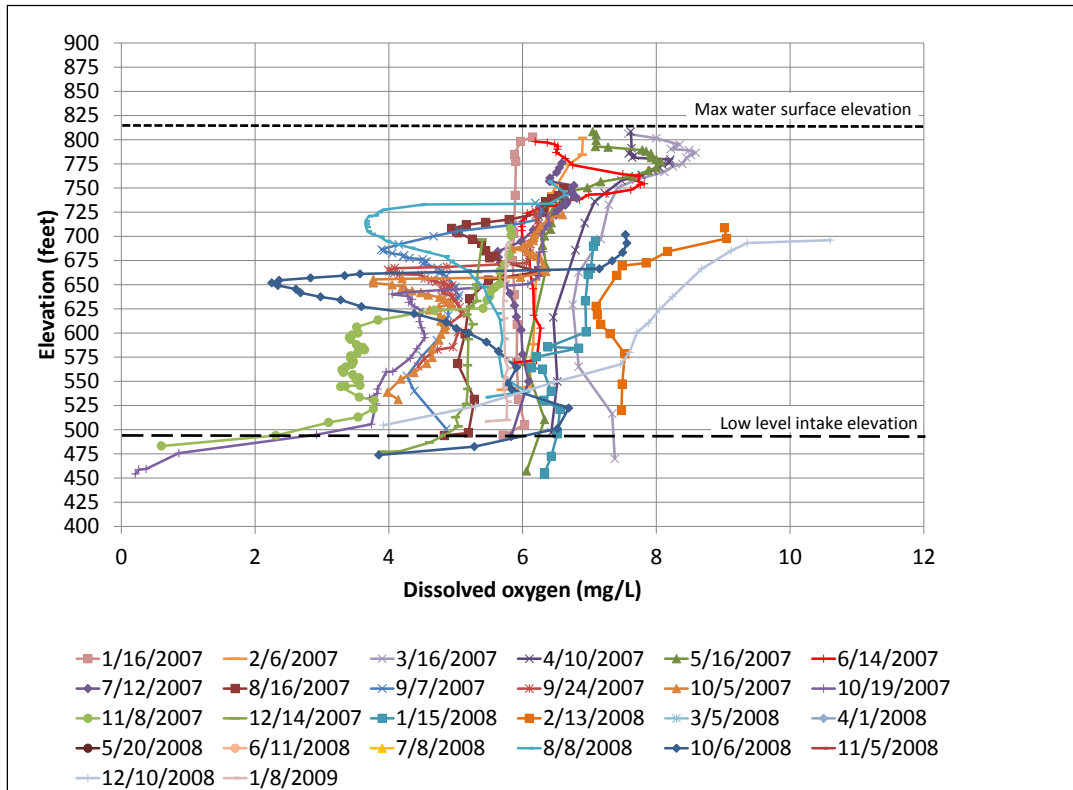


Figure 3-16. Dissolved oxygen in Lake McClure near the dam (January 2007 through January 2009) (Source: Merced ID, 2011b).

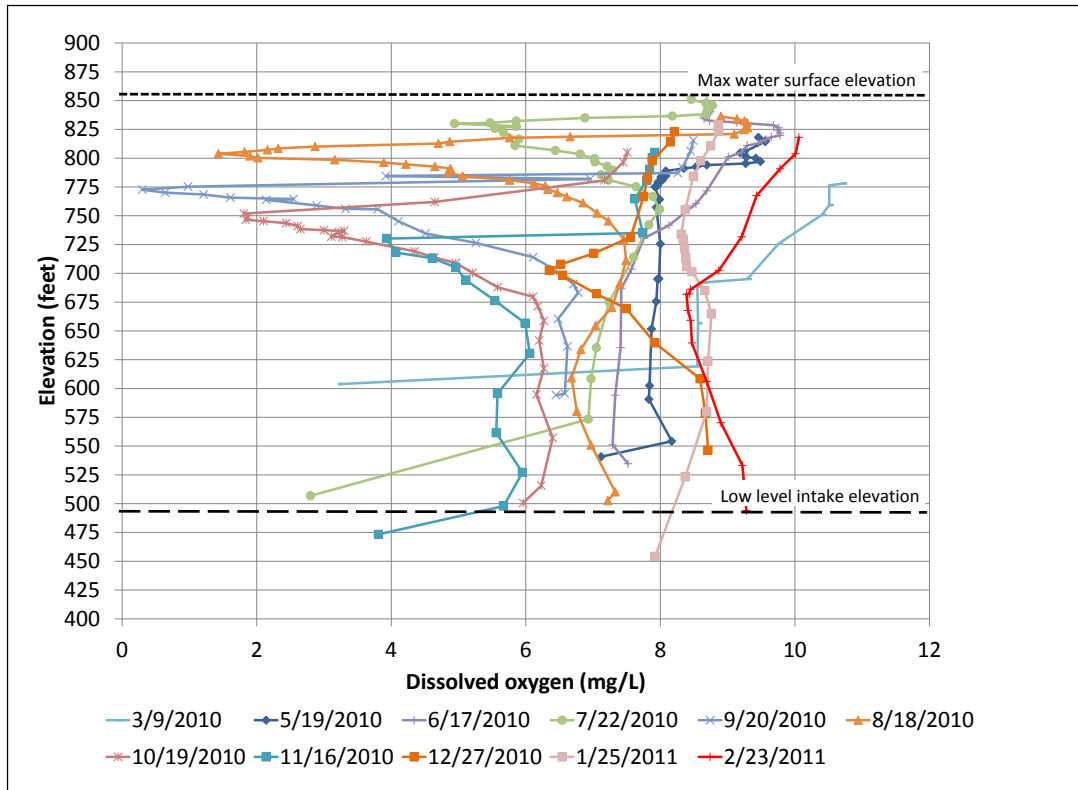


Figure 3-17. Dissolved oxygen in Lake McClure near the dam (March 2010 through February 2011) (Source: Merced ID, 2011b).

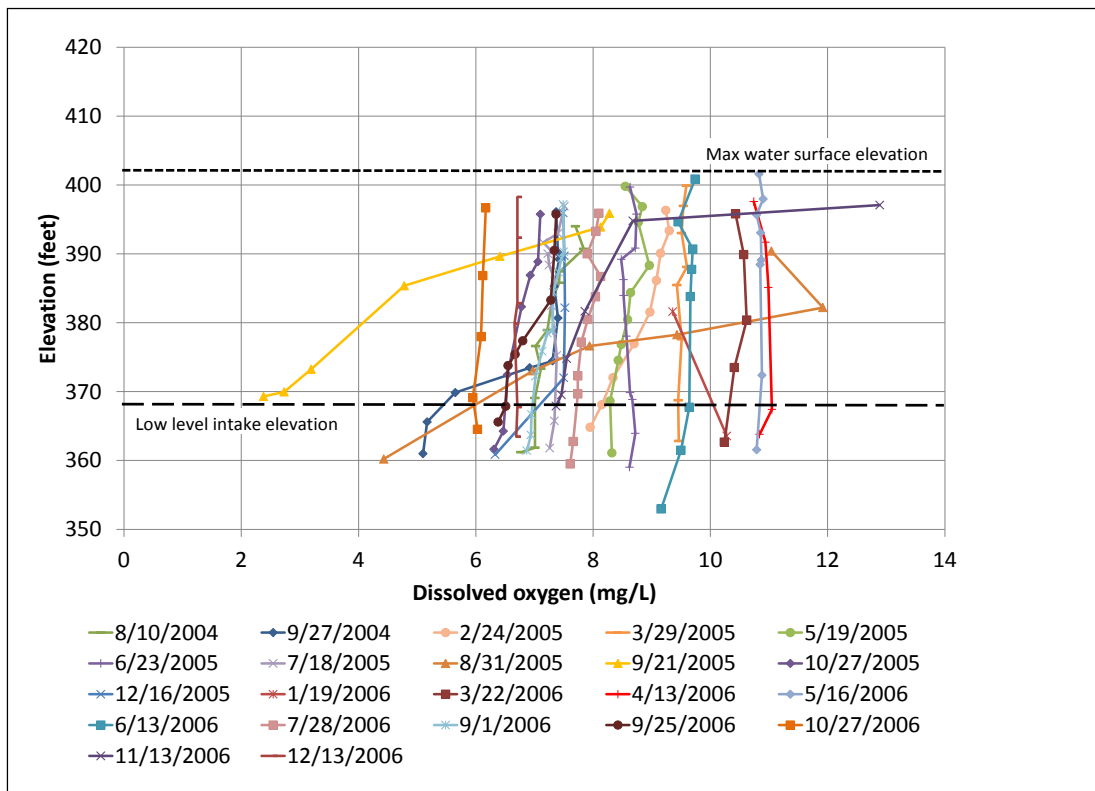


Figure 3-18. Dissolved oxygen in McSwain reservoir near the dam (August 2004 through December 2006) (Source: Merced ID, 2011b).

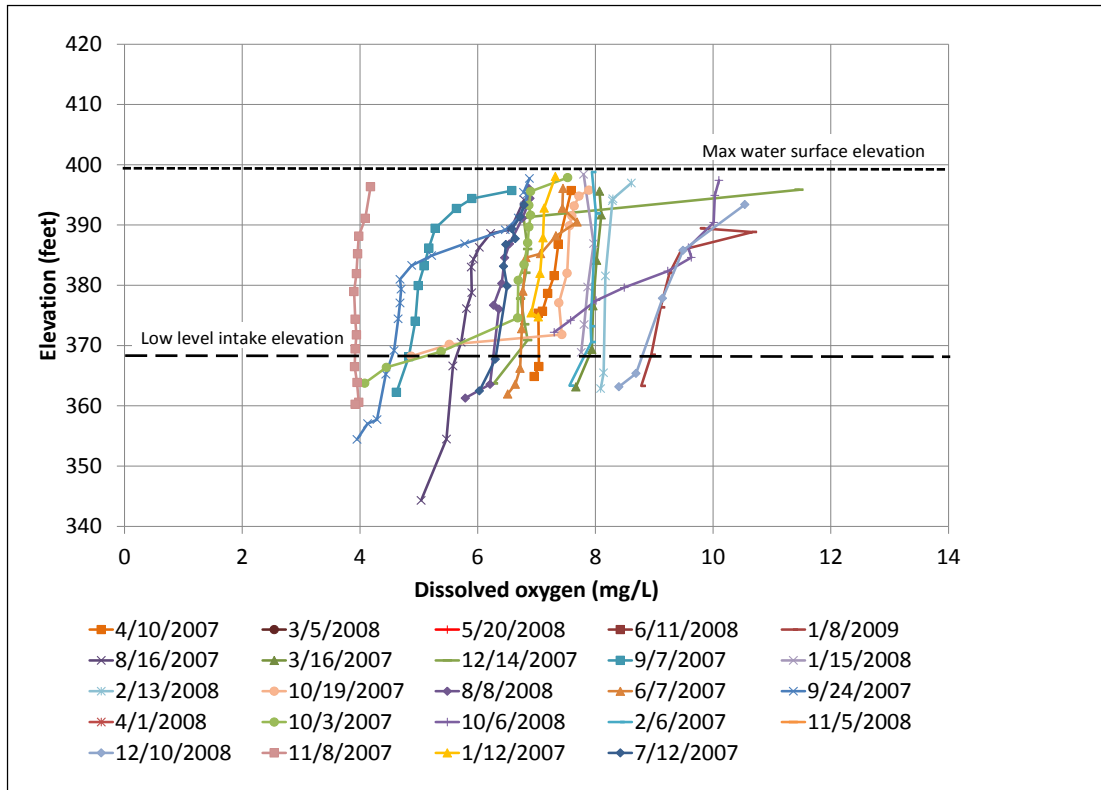


Figure 3-19. Dissolved oxygen in McSwain reservoir near the dam (January 2007 through January 2009) (Source: Merced ID, 2011b).

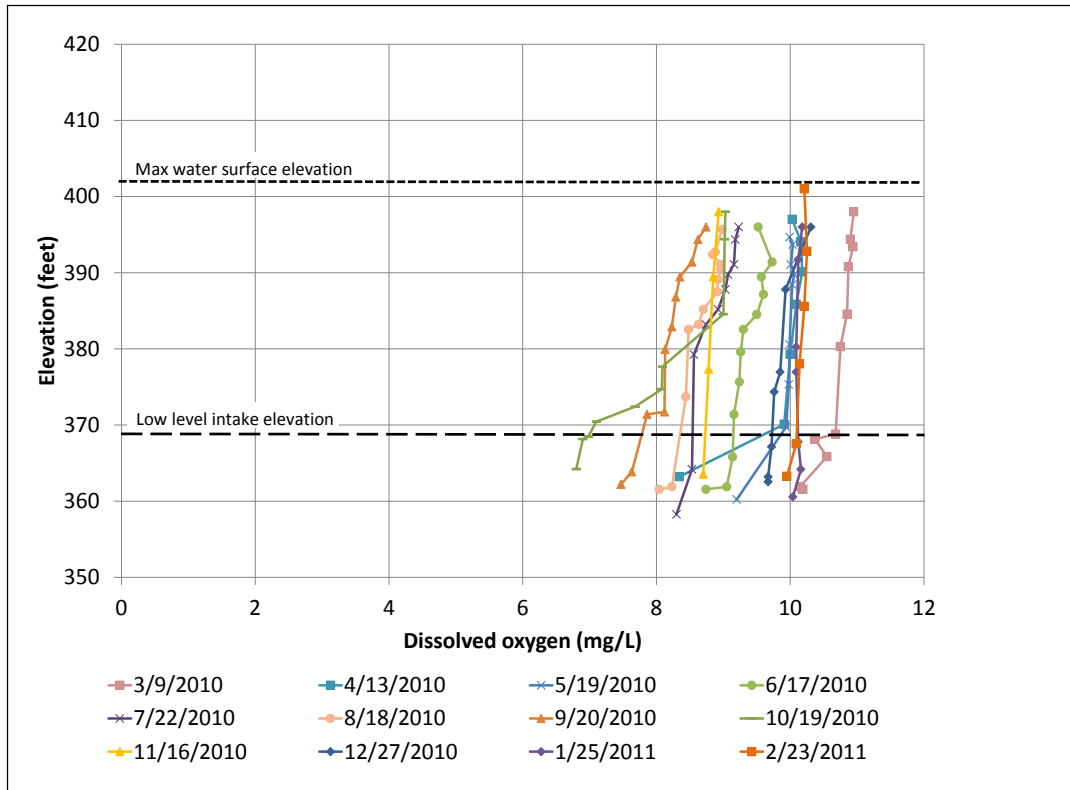


Figure 3-20. Dissolved oxygen in McSwain reservoir near the dam (March 2010 through February 2011) (Source: Merced ID, 2011b).

Overall, results from the 2010 and 2011 relicensing studies are consistent with historic studies and indicate that water quality in the project reservoirs generally conforms to regulatory water quality objectives and standards with the exception of DO. Merced ID reports that the project reservoirs are mesotrophic to oligotrophic, indicating moderate to low productivity, and that this condition is consistent with other lower-elevation reservoirs in the Sierra Nevada (Merced ID, 2012b). Based on data reported for spring and summer 2010, water samples in Lake McClure and McSwain reservoir exhibited moderate to high clarity and relatively low turbidity (i.e., Secchi depth measurements of about 7 to 20 feet [2 to 6 meters] and average turbidity readings <14 nephelometric turbidity unit [NTU]). Combined with the DO profile data, the water clarity and turbidity data indicate the project reservoirs experience a moderate level of primary productivity, and therefore, would likely be classified as mesotrophic. No algal blooms were observed and nutrient concentrations were generally low, with measured concentrations of nitrate, nitrite, ammonia, total Kjeldahl nitrogen, orthophosphorus, and total phosphorus at or near the analytical method reporting limits for the majority of samples. No bacterial counts from samples collected near recreational sites were reported above water quality objectives. Most other analytes were reported as non-detectable to just above analytical reporting limit concentrations. None of the 303(d)-listed agricultural pesticides (chlorpyrifos, diazinon and Group A pesticides) were detected at commercially available reporting limits. In addition to instances of DO below water quality objectives in the two project reservoirs, other periodic inconsistencies with the Basin Plan were documented for pH, metals and toxicity, as described below.

Water quality was monitored in surface and bottom waters during spring and summer 2010 at two locations in Lake McClure (near the dam and head of reservoir) and one location in McSwain reservoir (near the dam), for a total of 12 samples. Of these, three samples did not meet the water quality objective for pH, including: the spring bottom water sample from Lake McClure at the head of the reservoir (pH = 6.08), and both spring and summer bottom water samples from McSwain reservoir near the dam (pH = 6.03 and 6.19, respectively) (Merced ID, 2012b). Additionally, one sample collected in the bottom waters of Lake McClure near the dam during summer 2010 exhibited a dissolved copper concentration of 1.99 micrograms per liter ($\mu\text{g/L}$), which is slightly greater than the California Toxics Rule (hardness-dependent) value of 1.5 $\mu\text{g/L}$ (40 CFR §131). The remaining 11 samples exhibited dissolved copper concentrations ranging from 0.32 $\mu\text{g/L}$ to 1.27 $\mu\text{g/L}$ (Merced ID, 2012b).

Water column total mercury concentrations were well below the primary maximum contaminant level for drinking water (0.002 mg/L; California DPH, 2008) at all spring and summer sampling locations in the project reservoirs. Methylmercury was detected in numerous fish tissue samples from Lake McClure and McSwain reservoir during various studies occurring from 2007 to 2010 (including one additional set of samples from Lake McClure in 1984) and reported to the California Office of Environmental Health Hazard Assessment (California OEHHA), which is the agency solely responsible for evaluating the potential public health risks of chemical

contaminants in sport fish and issuing state advisories. California OEHHA has established guidelines relating to fish contaminant goals and advisory tissue levels in state water bodies (Klasing and Brodberg, 2008). Based on available data for Lake McClure and McSwain reservoir, California OEHHA determined that tissue concentrations exceed the threshold of 440 parts per billion (ppb) methylmercury (wet-weight) for several fish species. Accordingly, California OEHHA has issued health advisories for consumption of spotted bass, largemouth bass, catfish, and Chinook salmon in Lake McClure and spotted bass and largemouth bass in McSwain reservoir, for women between the ages of 18 and 45 years old and children (California OEHHA, 2013, 2012).

Merced Falls Project

Water temperature data collected from 1998 to 2008 throughout the Merced River by Merced ID and California DFW report average daily water temperatures in the Merced Falls Project impoundment ranged between 49°F and 60°F (9.4°C and 15.5°C).

From 2006 through 2008, water quality sampling conducted in the reach downstream of Merced Falls dam recorded DO levels ranging from 6.3 mg/L in spring of 2007 to 12.3 mg/L in spring of 2008. Additional water quality monitoring data collected during August 2008, indicated that Merced Falls Project waters met or exceeded the stated DO objective. Continuous DO monitoring was conducted in the Merced Falls impoundment through deployment of a Hydrolab Datasonde 5. The Datasonde was deployed near the water's surface (at a depth of 1.6 meters) at the upstream face of Merced Falls dam from August 17, 2011, to August 31, 2011. Results showed that DO levels never dropped below 8 mg/L, the Basin Plan's numeric water quality objective for instantaneous measurements downstream of New Exchequer dam. The median percent saturation was above the monthly saturation objective of 85 percent.

Water quality in the Merced Falls impoundment surpassed state standards and most constituents were at non-detectable levels or just above reporting limits.

Lower Merced River

Daily average water temperatures measured at four locations in the Merced River between Briceburg (RM 87.9) and the San Joaquin confluence are shown for a representative wet water year (2006) and dry water year (2008) in figure 3-21 and figure 3-22, respectively. In general, temperatures at Crocker-Huffman diversion dam (RM 52.0), the current upstream limit of anadromous fish habitat, ranged from approximately 8.0 to 17.0°C (46.4 to 62.6°F) annually during both water year types.

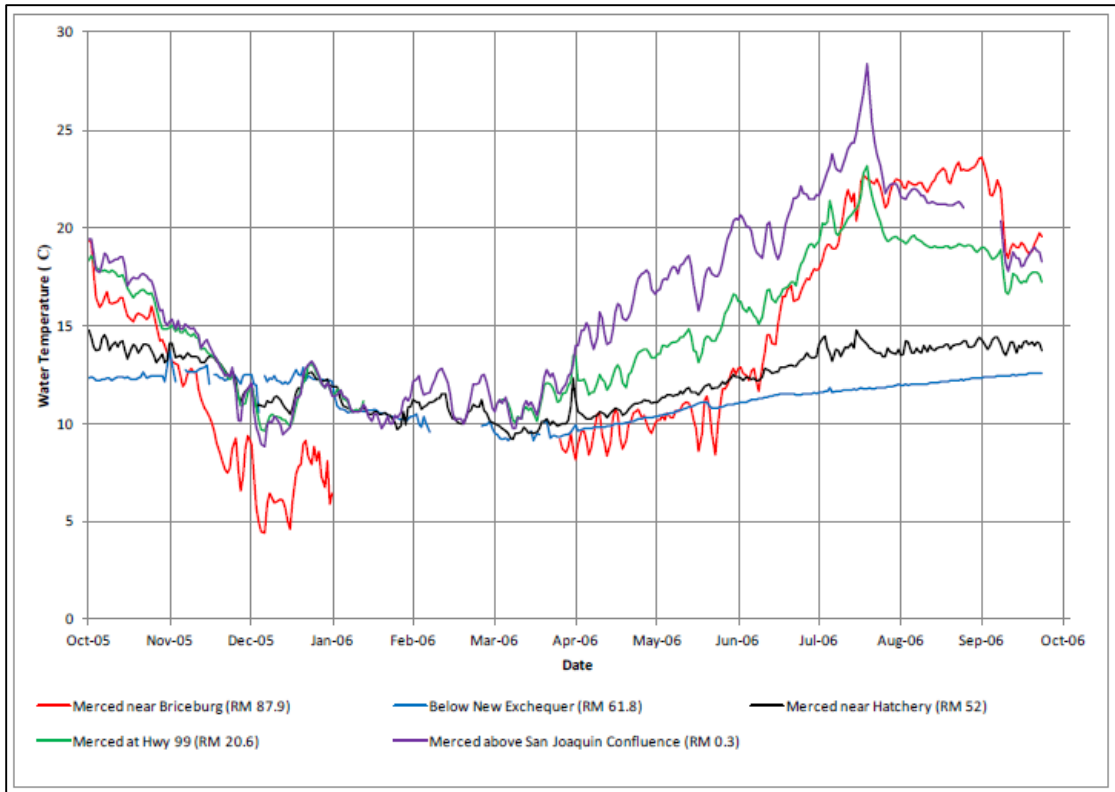


Figure 3-21. Daily average water temperatures recorded in the Merced River between Briceburg (RM 87.9) and the San Joaquin River confluence in water year 2006, a representative wet water year (Source: Merced ID, 2012a).

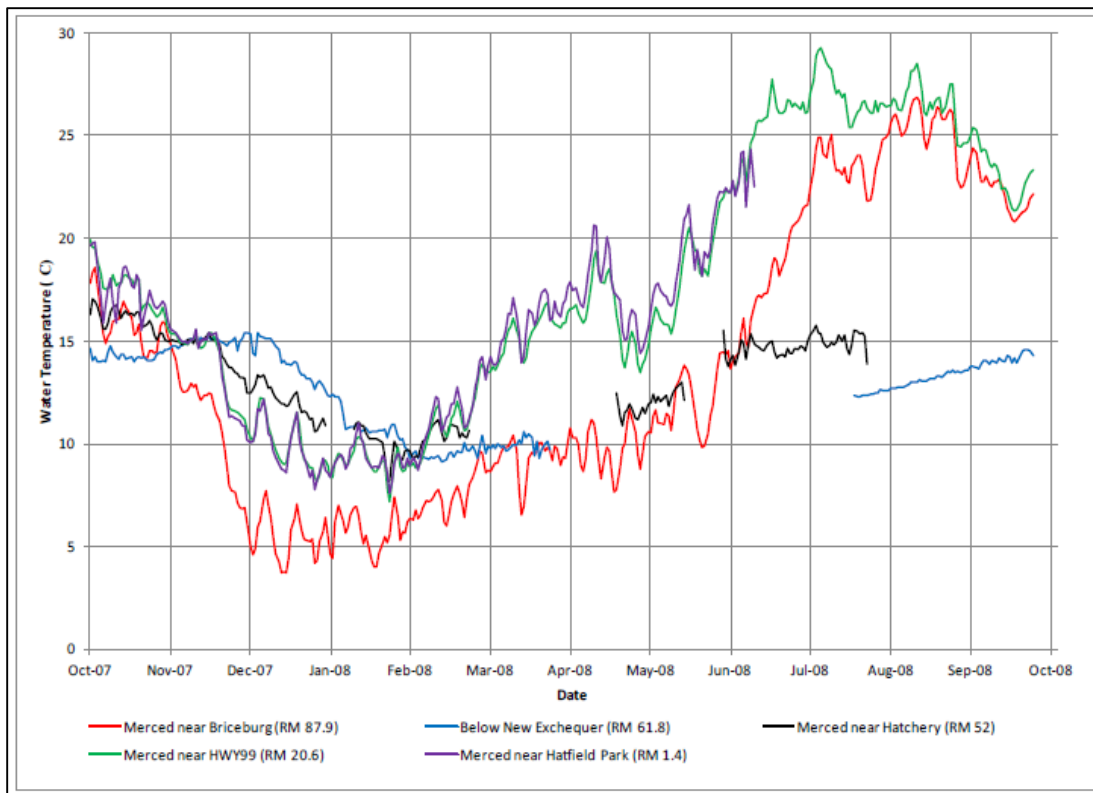


Figure 3-22. Daily average water temperatures recorded in the Merced River between Briceburg (RM 87.9) and the San Joaquin River confluence in water year 2008, a representative dry water year (Source: Merced ID, 2012a).

During the 2010 and 2011 relicensing studies, DO measurements were collected at the following four locations in the lower Merced River: immediately downstream of Crocker-Huffman diversion dam (RM 52.0), downstream of Snelling Bridge (RM 46.5), near Shaffer Bridge (RM 32.8), and at River Road upstream of the San Joaquin confluence (RM 1.5). In summer 2011, all of the DO readings immediately downstream of Crocker-Huffman diversion dam and at Snelling Bridge met the 8 mg/L objective that is applicable upstream of Cressey, while 26 percent did not meet the objective at Shaffer Bridge and 8 percent of the readings measured at River Road did not meet the 7.0 mg/L objective that is applicable downstream of Cressey. In fall 2011, all of the DO readings met the 8 mg/L objective immediately downstream of Crocker-Huffman diversion dam, at Snelling Bridge, and at Shaffer Bridge. Less than 1 percent of the readings measured at River Road did not meet the 7.0 mg/L objective.

For fish tissue samples collected to date (2003 through 2006) from the lower Merced River, nearly all were below the 440 ppb (wet-weight) threshold for methylmercury concentrations and have not prompted California OEHHA to issue fish ingestion health advisories. Two adult largemouth bass samples collected in 2005 from Hatfield State Park (RM 2.0) exceeded the threshold (503 ppb and 944 ppb) (Merced ID, 2012c).

Toxicity tests using various surface water samples collected in 2000, 2002, 2004, and 2006 from the lower Merced River were toxic to some of the laboratory test organisms. Because the toxicity response was not correlated with a specific chemical or other water quality parameter, the lower Merced River was included on the CWA §303(d) list for unknown toxicity.

Stream Geomorphology

The Merced River channel within and downstream of the Merced River and Merced Falls Projects has been substantially altered from its historical state due primarily to dredging associated with gold mining, dam and reservoir construction, and reduction in peak flows. Before mining and hydroelectric development began, the Merced River in the vicinity of the projects was a complex of multiple channels that became simplified over time as sediment was excavated from the streambed during mining operations and placed alongside in large rows, raising the floodplain and depleting the channels of sediment (Stillwater Sciences, 2001; URS, 2004). The dams that were constructed in the years following—Merced Falls dam in 1901, Crocker-Huffman dam in 1910, Old Exchequer dam in 1926, McSwain dam in 1966, and New Exchequer dam in 1967—collectively captured and stored a large amount of sediment, leading to downstream bed coarsening, narrowing, straightening, and further channel consolidation (Merced ID, 2011a).

Erosion in relationship to project roads, reservoir shorelines, or stream channel banks was not raised as a significant issue during project scoping (FERC, 2009).

Merced River Project

Sediment Capture in Reservoirs—Approximately 29.8 million tons of sediment was deposited in Lake McClure between 1967 and 2008, or 727,000 tons per year. Merced ID assumed 5 to 10 percent of the total sediment mass in Lake McClure was coarse (typically > 0.08 inch [2 millimeters (mm)] in diameter) and was transported as bedload. Given this assumption, about 36,000 to 73,000 tons of bedload was deposited annually in Lake McClure. McSwain reservoir has a sediment deposit estimated at 1.2 million tons, or 29,000 tons per year, which is only about 4 percent of that supplied to Lake McClure. Assuming the same ratio of coarse-to-total sediment as at Lake McClure, bedload yield below McSwain dam could be up to 1,400 tons per year, an order of magnitude less than is supplied to Lake McClure based on sediment accumulated there since 1967. These values suggest that sediment supply (including gravel suitable for salmonid spawning) to reaches of the Merced River downstream of McSwain dam has been substantially reduced. The reach from New Exchequer dam downstream to Merced Falls dam is entirely impounded, leaving no areas of flowing channel where bank erosion could supply sediment to replace that captured in the reservoir.

Large Wood—Merced ID's removal of wood from project reservoirs is not documented, but only low quantities appear to reach the dam. Lake McClure does not appear to be receiving much large wood. Large wood supplied to the reservoir may sink

before reaching New Exchequer dam or it is stored on shorelines or in tributary deltas. Large wood pieces are similarly rare at the downstream end of McSwain reservoir—Merced ID reports that an average of only two logs per year are pulled from the face of the dam and burned.

Merced Falls

The water level of the approximate 1-mile-long Merced Falls impoundment does not fluctuate, the majority of the project shoreline is vegetated, and much of the shoreline is armored with bedrock. Therefore, erosion, as it relates to the contribution of sediment in the project area, is likely minimal.

Existing information indicates very little sediment in the Merced Falls impoundment, presumably due to sediment captured by the New Exchequer and McSwain dams upstream of the Merced Falls Project. Any sediment reaching the Merced Falls Project is likely limited to small particles (less than 1 mm in size).

Lower Merced River

Sediment Supply and Channel Substrate—The stream channel between Merced Falls dam and Crocker-Huffman diversion dam is only about 1.5 miles long and is the only area available to supply sediment to the channel via fluvial bank erosion upstream of Crocker-Huffman dam. Because the landscape through which this reach flows is relatively flat, and high-flow events have been substantially reduced in frequency and magnitude, very little sediment enters the channel. Crocker-Huffman diversion dam intercepts the majority of the limited amount of coarse sediment originating downstream of New Exchequer dam. The reaches downstream of Merced Falls dam and Crocker-Huffman diversion dam are thus likely supplied with very little sediment.

Surface particle sizes downstream of Crocker-Huffman diversion dam were found by Vogel (2007) to be relatively large, and the substrate as a whole in potential anadromous salmonid spawning areas is composed largely of cobbles (2.5 to 10.1 inch [64 to 256 mm] diameter) and boulders (> 10.1 inch [256 mm] in diameter).

The estimated D_{50} (median particle size) of the bed surface in reaches downstream of Crocker-Huffman diversion dam ranges from 1.1 to 5.3 inches (28 to 134 mm) and D_{84} (value for which 84 percent of the particles are finer) from 2.7 to 10.6 inches (68 to 270 mm) (California DWR, 1994; Vick, 1995; Stillwater Sciences, 2004, 2001). Grain sizes just downstream of Crocker-Huffman diversion dam were smaller than farther downstream, having a median of 0.9 to 1.2 inches (24 to 31 mm) (Stillwater Sciences, 2006). To mobilize the bed downstream of Crocker-Huffman diversion dam would require an estimated 4,800 cfs flow—a 5-year recurrence interval flow under existing conditions (Stillwater Sciences, 2001).

The bed downstream of Crocker-Huffman diversion dam is bedrock or contains a cobble armor layer with banks of immobile dredger tailings (Stillwater Sciences, 2006, 2001; URS, 2004). As a result, the channel bed and formerly active bars have become

static, and riparian vegetation is encroaching upon them (Stillwater Sciences, 2002). Vick (1995) estimated that riparian encroachment had reduced channel width in the reach from Crocker-Huffman diversion dam to RM 15.0 by an average of 85 feet, or 33 percent of the mean 1937 channel width. As a result, the area of aquatic habitat in the Merced River has been reduced, and the river channel is currently characterized by a simplified cross section with no active bars and no clearly defined low flow channel.

The sediment sampling results indicated that the reach downstream of Merced Falls dam was moderately armored, as was the reach downstream of Crocker-Huffman diversion dam (Merced ID, 2011c). No significant differences were found in particle size ratios above and below Crocker-Huffman diversion dam. Bedrock appeared to be limiting further channel incision in both reaches and irrigation diversions downstream of the dam appeared to have little influence on armoring. Local gravel augmentation reduced armoring in portions of the channel, but only adjacent to and just downstream of the augmentation sites (Merced ID, 2011c).

Large Wood—Large wood of the size capable of influencing channel morphology is largely absent in the lower Merced River. Large wood was surveyed in the reach downstream of Merced Falls dam by Merced ID as part of its Instream Flow Study habitat mapping efforts; no wood in the channel met the minimum diameter of 6 inches and the minimum length of $>1/2$ bankfull width of the channel for pieces to be considered capable of influencing channel morphology or storing sediment, but some (<10 pieces) meeting the criteria were found perched on the channel margin or submerged within the backwater formed by Crocker-Huffman diversion dam.

Any large wood delivered to Crocker-Huffman diversion dam is a result of Merced River flows upstream—high flows transport fallen trees from the riparian zone and carry them downstream, whereas larger pieces are trapped at the dam. About once every 3 years, Merced ID removes an average of 6 to 10 logs or branches of 8 to 16 inches in diameter, with some pieces occasionally much larger (Merced ID, 2012a).

Fishery Resources

Fishery resources described in this section include reservoir and stream fish populations in and downstream of project reservoirs. The federally listed Central Valley steelhead is listed as threatened or endangered under the federal ESA are discussed separately in section 3.3.3, *Threatened and Endangered Species*.

Merced River Project

Merced ID performed a study of reservoir fish populations in 2010 to supplement existing information on fish in Lake McClure and McSwain reservoir. The study documented reservoir fish captured by electrofishing and gillnetting and those reported caught by anglers. The reservoir fish study also assessed fish passage from the reservoirs into tributaries, risk of fish entrainment, bass nesting habitat, and spawning habitat. This

information is based on the reservoir fish study and available information from other sources, including reservoir fish stocking reports.

Fish Populations—Fishes documented in Merced ID's 2010 survey of Lake McClure included 5 native and 15 non-native (introduced) species. The native fishes found in Lake McClure were resident rainbow trout,²² Sacramento sucker, landlocked Chinook salmon, prickly sculpin, and Sacramento pikeminnow (table 3-6). Introduced threadfin shad and black bass (bass in the genus *Micropterus*, including largemouth, spotted, and bass that could not be identified to species) dominate the warmwater fishery in Lake McClure. Rainbow trout, landlocked Chinook salmon, and kokanee,²³ all of which are annually stocked in the reservoir, dominate the coldwater fishery. Salmon and other fishes in Lake McClure can move upstream into the upper Merced River reach or into tributaries to spawn, but downstream movement out of the reservoir is limited to passage through the powerhouse or over the spillway during spill events. The relative condition factor for fish in Lake McClure, which was derived from length and weight data of fish captured in the reservoir by boat electrofishing, indicates that most species were of a healthy weight for their length. The relative condition factor provides a general indication of the fish condition and health, where a value greater than or equal to 1.0 indicates fish of average or better condition (Merced ID, 2011d).

Fishes documented in Merced ID's 2010 survey of McSwain reservoir included 6 native and 12 non-native species. Native Sacramento sucker and rainbow trout were the most abundant species. The relatively cold temperature and short residence time of water in McSwain reservoir provides favorable habitat for these coldwater species. Rainbow trout are stocked annually in the reservoir. The other native species found in McSwain reservoir were hitch, riffle sculpin, prickly sculpin, and Sacramento pikeminnow (table 3-7). As in Lake McClure, the relative condition factor for fish in McSwain reservoir indicates that the seven species with a reportable condition factor were of a healthy weight for their length. McSwain reservoir is bounded on the upstream end by New Exchequer dam and downstream by McSwain dam, neither of which has fish passage facilities. Movement of fish out of McSwain reservoir is, therefore, limited to small tributary streams flowing directly into the reservoir and downstream passage through the project powerhouse or over the spillway during spill events.

²² Resident rainbow trout is a catchall designation for hundreds of nonanadromous wild rainbow trout (*O. mykiss*) populations that exist throughout California and are either derived naturally from steelhead or, more likely, are of mixed hatchery and native origin (Moyle, 2002).

²³ Kokanee are nonanadromous sockeye salmon, which, in California, have been established through introduction (Moyle, 2002).

Table 3-6. Summary of relative abundance, length, weight, and relative to condition factor for fish species collected in Lake McClure in 2010 (Source: Merced ID, 2012a).

Species ^a	Number	Percent of Catch by Number	Length (millimeters)			Weight (grams)			Mean Relative Condition Factor ^b
			Minimum	Maximum	Mean	Minimum	Maximum	Mean	
Threadfin shad	4,175	50.8	20	121	71	< 1	32	6	0.87
Spotted bass	1,655	20.1	33	548	198	< 1	3,100	231	0.96
Largemouth bass	691	8.4	47	572	197	1	4,600	312	0.96
Bluegill	524	6.4	31	272	84	< 1	440	15	1.01
Common carp	365	4.4	208	662	488	200	5,500	2,179	1.26
Green sunfish	255	3.1	30	123	76	< 1	38	9	1.15
Channel catfish	125	1.5	58	720	375	2	6,550	1,121	1.04
Black crappie	115	1.4	55	340	146	2	750	72	0.97
Rainbow trout ^c	108	1.3	232	470	346	110	1,080	481	1.35
Kokanee	50	0.6	210	430	362	130	960	563	1.38
Goldfish	38	0.5	202	405	363	173	5,800	1,656	1.06
White catfish	42	0.5	29	490	314	< 1	1,400	626	0.97
Sacramento sucker ^c	19	0.2	104	623	418	16	1,800	1,067	1.30
White crappie	17	0.2	50	350	206	2	650	241	0.95
Unknown bass	13	0.2	22	36	29	--	--	--	--

Species ^a	Number	Percent of Catch by Number	Length (millimeters)			Weight (grams)			Mean Relative Condition Factor ^b
			Minimum	Maximum	Mean	Minimum	Maximum	Mean	
Chinook salmon ^c	11	0.1	270	500	409	270	1,660	969	0.90
Prickly sculpin ^c	8	0.1	38	71	51	< 1	4	2	--
Sacramento pikeminnow ^c	6	0.1	247	790	488	145	7,250	2,053	--
Golden shiner	2	< 0.1	103	105	104	13	14	14	--
Brown bullhead	1	< 0.1	330	330	330	575	575	575	--
Redear sunfish	1	< 0.1	71	71	71	7	7	7	--
Total	8,211	100	--	--	--	--	--	--	--

^a Species are listed in descending order of numerical abundance in the catch.

^b Species with 10 or less individuals or poor fit regressions did not have a reportable condition factor.

^c This species is a native species.

Table 3-7. Summary of relative abundance, length, and weight of all fish species collected at McSwain reservoir in 2010 (Source: Merced ID, 2012a).

Species ^a	Number	Percent of Catch by Number	Length (millimeters)			Weight (grams)			Mean Relative Condition Factor ^b
			Minimum	Maximum	Mean	Minimum	Maximum	Mean	
Sacramento sucker ^c	1,235	71.1	19	556	248	0	1,900	280	1.39
Rainbow trout ^c	230	13.2	227	555	340	129	1,800	451	0.98
Golden shiner	75	4.3	140	278	181	36	330	95	1.24
Prickly sculpin ^c	72	4.1	34	113	70	1	19	4	0.98
Spotted bass	39	2.2	87	460	197	6	2,050	276	0.94
Channel catfish	24	1.4	77	650	297	5	6,400	867	0.94
Threadfin shad	21	1.2	55	140	118	1	39	27	1.95
Hitch ^c	10	0.6	50	212	148	1	120	62	--
Largemouth bass	8	0.5	75	422	235	5	1,600	494	--
Brown trout	6	0.3	412	522	463	1,000	2,050	1,423	--
Kokanee	4	0.2	180	249	215	82	190	126	--
Riffle sculpin ^c	4	0.2	75	91	86	5	10	8	--
Bluegill	2	0.1	112	113	113	27	32	29	--
Red shiner	2	0.1	45	47	46	1	1	1	--

Species ^a	Number	Percent of Catch by Number	Length (millimeters)			Weight (grams)			Mean Relative Condition Factor ^b
			Minimum	Maximum	Mean	Minimum	Maximum	Mean	
Green sunfish	1	< 0.1	156	156	156	100	100	100	--
Black crappie	1	< 0.1	76	76	76	6	6	6	--
Sacramento pikeminnow ^c	1	< 0.1	535	535	535	1,680	1,680	1,680	--
White catfish	1	< 0.1	325	325	325	706	706	706	--
Total	1,736	100	--	--	--	--	--	--	--

^a Species are listed in descending order of numerical abundance in the catch.

^b Species with 10 or less individuals or poor fit regressions did not have a reportable condition factor.

^c This species is a native species.

Prior to dam construction, anadromous fishes, including federally listed Central Valley steelhead and spring-run Chinook salmon, fall-run and late fall-run Chinook salmon, and Pacific lamprey migrated upstream to spawn in the Merced River upstream of the current location of the project dams and reservoirs. The extent of spawning and rearing habitat for steelhead and spring-run Chinook salmon, which are believed to have migrated upstream as far as El Portal and possibly into Yosemite National Park (NMFS, 2014, Yoshiyama et al., 2001), has been reduced by up to 50 miles in the mainstem Merced River and 7 miles in the South Fork of the Merced River. The historical upstream extent of habitat for fall-run and late fall-run Chinook salmon and Pacific lamprey is unknown. Habitat for resident native species that currently occur both upstream and downstream of the project, such as Sacramento pikeminnow, hardhead, and Sacramento sucker, has been fragmented by project and non-project dams, effectively isolating the historical populations into disconnected sub-populations upstream and downstream of the dams.

Special-status Fish Species—No special-status fish species have been documented in Lake McClure or McSwain reservoir. However, hardhead, which is considered a species of special concern by California DFW, has been documented in the Merced River upstream of Lake McClure. Hardhead are known to occupy reservoirs in the Sierra Nevada foothills, and no migration barriers exist between Lake McClure and the Merced River upstream. However, hardhead are susceptible to predation by non-native predatory fish, such as black bass, which may reduce or eliminate hardhead from otherwise suitable reservoirs (Moyle, 2002). The Chinook salmon and rainbow trout found in Lake McClure and McSwain reservoir are landlocked varieties that are not considered part of the special-status populations of anadromous Chinook salmon and steelhead that occur in the lower Merced River downstream of migration barriers.

Spawning Habitat—Merced ID conducted surveys in 2010 to assess reservoir and tributary spawning habitat for fish in Lake McClure. Of the 21 surveyed tributaries surveyed, six were found to have adequate flow and habitat to be used by stream-spawning reservoir fish. These six tributaries included the Merced River and five smaller tributaries to Lake McClure (Cotton, Maxwell, Piney, Sherlock, and Willow Creeks). No passage barriers were documented in the surveyed portion of the Merced River or the five tributaries, and suitable spawning gravel was present in each. Warmwater fishes, including largemouth bass, bluegill, and green sunfish, were the most prevalent species in the Merced River and the five suitable spawning tributaries. Rainbow trout and other native species, including Sacramento sucker and sculpin, were found in low numbers. Water temperature and stream size appeared to be the primary factor determining species composition and number. Instantaneous water temperature measured in Cotton, Maxwell, Piney, and Willow creeks ranged from 54.0 to 61.0 °F (12.2 to 16.1°C) in March and April 2010 and from 66.5 to 80.5°F (19.2 to 26.9°C) in late June 2010 (Merced ID, 2011d, Attachment 3-1F). Water temperatures in the Merced River upstream of Lake McClure and in Sherlock Creek, both of which were measured only during fish surveys in August 2010, were 72.0 to 75.0°F (22.2 to 23.8°C) in the Merced

River and 77.0°F (25.0°C) in Sherlock Creek. Estimated stream discharge during fish sampling in summer 2010 was 215 cfs in the Merced River and 2 cfs or less in each of the five smaller tributaries (Merced ID, 2011d, Attachment 3-1F). Fish abundance and the number of species were greater in the Merced River than in the other surveyed tributaries.

The reservoir spawning assessment documented black bass nests and additional suitable bass spawning habitat in Lake McClure. Habitat conditions (i.e., bottom substrate, cover, and water temperature) and typical reservoir operations (i.e., increasing spring water level; see figures 3-2, 3-4, and 3-6 in the *Water Quantity* subsection) appear conducive to reproductive success by black bass and other warmwater fish species in Lake McClure. Spawning by largemouth bass, an abundant species of black bass in Lake McClure, typically begins in March or April when water temperatures reach 59.0 to 60.0°F (15.0 to 15.5°C) and may continue through June in water temperatures up to 75.2°F (24.0°C) (Moyle, 2002). Reduced hatching success or complete brood failure can occur if nests are dewatered by declining water levels. The observation of black bass fry and threadfin shad fry during the nesting surveys further indicated that these species spawn successfully in Lake McClure.

Tributary and bass nest surveys were not conducted at McSwain reservoir, but age-0 (young-of-the-year) fish of numerous species (e.g., spotted bass, sucker, threadfin shad, and largemouth bass) were collected during the population surveys, indicating there was access to viable spawning habitat in the reservoir and/or tributaries and successful reproduction in 2010. Most of these fishes were warmwater species. Age-0 rainbow trout were not collected in McSwain reservoir, which may indicate limited or no natural rainbow trout reproduction in 2010.

Upstream and Downstream Fish Passage—The project's two dams, New Exchequer dam and McSwain dam, have no fish passage facilities and prevent volitional fish movement upstream and downstream. No upstream fish passage occurs at either dam, and downstream passage at the two project dams is limited to passage through the powerhouses, through the Howell-Bunger valve at New Exchequer dam, and over the spillways during spills. No data are available about how often or how many fish pass downstream from project reservoirs as a result of spills or entrainment, or the actual survival of entrained fish. However, in 2010, Merced ID assessed the potential for fish entrainment into both of the powerhouse intakes. Results suggest that most of the reservoir fish that are expected to occur in deep water near the intakes have swimming speeds that exceed the maximum approach velocity of water entering the intakes and should be able to avoid involuntary entrainment.

In Lake McClure, the powerhouse intake structure is located at the base of New Exchequer dam at a depth of 382 feet below the NMWSE of the reservoir. In rare events when the reservoir's water surface elevation drops substantially, the intake depth can be as shallow as 100 to 150 feet below the surface. Based on a 10 percent discharge exceedance through the powerhouse of 2,912 cfs using data from 1970 to 2006,

calculated approach velocities at the intake can be as great as approximately 2.1 feet per second. Entrainment probability is a function of proximity to the intake and a fish's ability to avoid entrainment by swimming faster than the intake approach velocity. Gillnetting near the dam at depths up to 100 feet showed relatively low fish abundance; only kokanee (n=12), largemouth bass (n=3), rainbow trout (n=1), and spotted bass (n=5) were collected in deepwater habitat near New Exchequer dam. Merced ID's calculation of estimated swim speeds for kokanee, largemouth bass, and rainbow trout suggests that these species have sustained swimming speeds that exceed the maximum reported approach velocity of 2.1 feet per second and thus could avoid entrainment. The burst speed of all species significantly exceeded calculated approach velocities. If a fish were to become entrained and pass through the turbines, Merced ID's review of literature describing Francis turbines similar to those used at New Exchequer powerhouse suggests that the potential for survival would be 81.0 to 99.6 percent.

In McSwain reservoir, the powerhouse intake structure is located about 70 feet upstream of McSwain dam at a depth of 30 to 40 feet, depending on water levels. Based on a 10 percent discharge exceedance through the powerhouse of 2,900 cfs using data from 1970 to 2006, calculated approach velocities at the powerhouse intake can be as high as approximately 2.7 feet per second. Gillnet sampling in McSwain reservoir in 2010 found primarily Sacramento sucker in deep water near the reservoir bottom. Kokanee are present in the reservoir and may occur in deep water, but they were only found in mid-water (50 percent of maximum depth) sampling. Although the maximum calculated approach velocity of 2.7 feet per second exceeds the estimated sustained swimming speed of 2.4 feet per second for adult Sacramento suckers, it is significantly less than the sucker's estimated burst speed of 12.3 to 13.5 feet per second (Stamp and Golden, 2005). Other species for which swimming speed was estimated (largemouth bass, rainbow trout, kokanee) have sustained swimming speeds that exceed the maximum approach velocity at the McSwain powerhouse intake. Merced ID's review of literature describing Kaplan reaction turbines similar to those used at McSwain powerhouse suggests that if a fish were to become entrained and pass through the turbines, the potential for survival would be 88.0 to 96.1 percent.

Merced Falls

Fish Populations—Fish populations in the impoundment were sampled using boat electrofishing and gill netting in four quarterly sampling efforts during 2010–2011. Five fish species were collected during July 2010, October 2010, February 2011, and April 2011 boat electrofishing surveys: Sacramento sucker (*Catostomus occidentalis*), rainbow trout (*O. mykiss*), hitch (*Lavinia exilicauda*), prickly sculpin (*Cottus asper*), and Kern Brook lamprey (*Lampetra hubbsi*).

Overall, Sacramento sucker was the most abundant species collected. All Kern Brook lamprey collected were ammocoetes (95 to 142 mm). Only three fish species were collected during July 2010, October 2010, February 2011, and April 2011 gill net

surveys: Sacramento sucker, rainbow trout, and hitch. Again, Sacramento sucker was the most abundant species collected.

Although not detected during surveys, other non-native fish species that have been found in Lake McClure, and may also occur in the Merced Falls Project impoundment, include largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), black crappie (*Pomoxis nigromaculatus*), and white crappie (*Pomoxis annularis*).

Special-status Fish Species—As described in greater detail below, the Kern brook lamprey (*Entosphenus hubbsi*) is a small, non-anadromous lamprey endemic to the San Joaquin River Basin. It is considered a species of special concern by California DFW.

Habitat—The Merced Falls impoundment exhibits a stable, shallow-water, lentic habitat, exhibiting no riverine-type geomorphic features (riffles, runs, or pools).

Upstream and Downstream Fish Passage—A fish ladder at Merced Falls dam was operated to allow upstream access for anadromous species until 1971, when operation was discontinued after the construction of Merced ID's McSwain dam, which eliminated upstream spawning resources. As described below, Crocker-Huffman diversion dam situated downstream of the Merced Falls Project is considered the upstream limit for anadromous fish passage in the Merced River.

Lower Merced River

Fish Populations—In the Merced River between Merced Falls dam and Crocker-Huffman diversion dam, Sacramento sucker, sculpin, lamprey, and resident rainbow trout (all native species) were the most abundant species found in surveys by PG&E (2011a) and Stillwater Sciences (2008). Lamprey observed in the reach included the Kern brook lamprey, which is considered a species of special concern by California DFW. More information on Kern brook lamprey is provided in the following subsection, *Special-status Fish Species*.

In the lower Merced River from Crocker-Huffman diversion dam downstream to the San Joaquin River confluence, 29 fish species were observed during seasonal fish surveys conducted from summer 2006 through spring 2008. Twelve of the observed fish species are native to the Merced River drainage and 17 species are introduced. The most abundant species were the introduced western mosquitofish and spotted bass, and the native Sacramento sucker, hardhead, and Sacramento pikeminnow, which together comprised 82 percent of the fishes observed or captured (Stillwater Sciences, 2008). Hardhead, considered a species of special concern by California DFW, is discussed in the following subsection, *Special-status Fish Species*.

Crocker-Huffman diversion dam lacks functional fish passage facilities and is considered the upstream limit for anadromous fish passage in the Merced River. Three anadromous species were present downstream of Crocker-Huffman diversion dam at relatively low abundance, including the native fall-run Chinook salmon and Pacific lamprey and the introduced striped bass. Fall-run Chinook salmon, considered a species

of special concern by California DFW, is discussed in more detail in the following subsection, *Special-status Fish Species*. *O. mykiss* were also observed in the sampling reach immediately downstream of Crocker-Huffman diversion dam (RM 44.7 to RM 51.3), but the sampling methods did not allow for absolute distinction between the anadromous form (steelhead) and the resident form (rainbow trout). Nevertheless, NMFS considers *O. mykiss* in the Merced River downstream of Crocker-Huffman diversion dam to be part of the Central Valley steelhead distinct population segment (DPS), which is listed as threatened under the ESA. Steelhead are discussed in more detail in section 3.3.3, *Threatened and Endangered Species*. Three other special-status fish species were found in the lower Merced River during the 2006 to 2008 seasonal fish surveys: Kern brook lamprey, hardhead, and Sacramento splittail. Each is considered a species of special concern by California DFW and is discussed in more detail below.

Special-status Fish Species—Special-status fish species include those listed under the California ESA as endangered or threatened, those considered by California DFW to be species of special concern or fully protected species, and those classified as sensitive species by BLM. This section summarizes the most recent available information on populations of special-status fish species found in the project areas and in the Merced River downstream of the projects.

Kern brook lamprey: The Kern brook lamprey (*Entosphenus hubbsi*) is a small, non-anadromous lamprey endemic to the San Joaquin River Basin. It is considered a species of special concern by California DFW. One ammocoete (immature life stage) of this species was reported in the Merced River between Merced Falls dam and Crocker-Huffman diversion dam by Stillwater Sciences (2008), and an unknown number of ammocoetes was reported in this section of the Merced River by PG&E (2011a). A total of 36 adult lamprey and ammocoetes were also found in the lower Merced River between Crocker-Huffman diversion dam and the San Joaquin River confluence during seasonal sampling from 2006 to 2008 by Stillwater Sciences (2008). Specific age classes could not be determined for Kern brook lamprey found in the lower river, but most were larger individuals up to 5.9 inches (150 mm) in length. Adults spawn in spring in gravel riffles. Ammocoetes are found in sand and mud where water is shallow and slow-moving and summer water temperatures are generally less than 77.0°F (25.0°C).

Pacific lamprey: The Pacific lamprey (*Entosphenus tridentatus*) is a widely distributed, anadromous lamprey that is considered a sensitive species by BLM. A total of 72 Pacific lamprey ammocoetes ranging from 2.0 to 6.9 inches (51 to 175 mm) in length were found in the Merced River during fish surveys conducted from 2006 to 2008. Of the total, five were found between Merced Falls dam and Crocker-Huffman diversion dam, and the rest were found downstream of Crocker-Huffman diversion dam. No adults were found during the surveys. Based on available data from the American River (Hannon and Deason, 2008), spawning in San Joaquin River tributaries, including the Merced River, is expected to occur between early January and late May with peak spawning typically occurring in early April. Spawning typically occurs in gravel riffles at water temperatures between 53.6 and 64.4°F (12.0 to 18.0°C), and embryos hatch in

approximately 19 days at 59.0°F (15.0°C) (Moyle, 2002). Ammocoetes bury themselves in shallow eddies and backwaters where they rear in silt, sand, and mud.

Chinook salmon: The Chinook salmon (*Oncorhynchus tshawytscha*) in the lower Merced River belongs to the Central Valley fall-run and late fall-run evolutionarily significant unit, and is considered a species of special concern by California DFW. Most Merced River Chinook salmon exhibit a fall-run life history with adults typically entering the Merced River to spawn from October through December. Fry emergence occurs from January through March, and fry rear in the river for a short time before moving downstream as juveniles or smolts from January through May.

The Merced River fall-run Chinook salmon population is supported by both natural in-river production and artificial production from the Merced River Hatchery, operated by California DFW. The hatchery, located immediately downstream of Crocker-Huffman diversion dam, produces an average of 972,344 fall-run Chinook salmon annually. Since 2000, approximately 50 percent of the production has been released at the hatchery, and the remainder is released at downstream locations in the San Joaquin and Merced Rivers, as well as other tributaries to the San Joaquin River (California HSRG, 2012).

The abundance of returning adults (i.e., escapement) has fluctuated since 1970 with peaks in the early 1980s and early 2000s and a downward trend between 2000 and 2010 (figure 3-23). During the most recent period of peak abundance (2000 to 2002), the percentage of hatchery-origin fish in the total escapement is estimated to have ranged from 65 percent to greater than 95 percent (Mesick, 2010). Annual captures of outmigrant fry using RSTs have ranged from 12,964 in 2004 (86 days of trapping) to 127,632 in 2001 (153 days of trapping). The mean daily catch was 151 fish/day in 2004 and 834 fish/day in 2001.

Fall-run Chinook salmon historically migrated upstream to spawn in the Merced River at least as far as the vicinity of present-day Lake McClure (Yoshiyama et al., 2001). Currently, Crocker-Huffman diversion dam is the downstream-most migration barrier to Chinook salmon. Merced Falls dam, McSwain dam, and New Exchequer dam are also fish migration barriers and their reservoirs inundate former riverine habitat that Chinook salmon historically used (Yoshiyama et al., 2001, 1998).

Chinook salmon spawning and most juvenile rearing in the lower Merced River currently is restricted to the 10-mile-long reach downstream of Crocker-Huffman diversion dam (RM 42.0 to RM 52.0). Chinook salmon spawning does not occur in the lower Merced River downstream of the Highway 59 bridge (RM 42.0) or in the lower San Joaquin River downstream of the Merced River confluence. The lowermost 42 miles of the Merced River and the San Joaquin River from the Merced River confluence downstream to the delta function primarily as a migration corridor for adult and juvenile Chinook salmon. Results of California DFW redd surveys conducted from 2001 through 2004 indicate that approximately 45 to 80 percent of redds observed in the Merced River

occurred between RM 45.2 and RM 52.0. Additional habitat characteristics for Chinook salmon in the lower Merced River are described later in the *Fish Habitat* subsection.

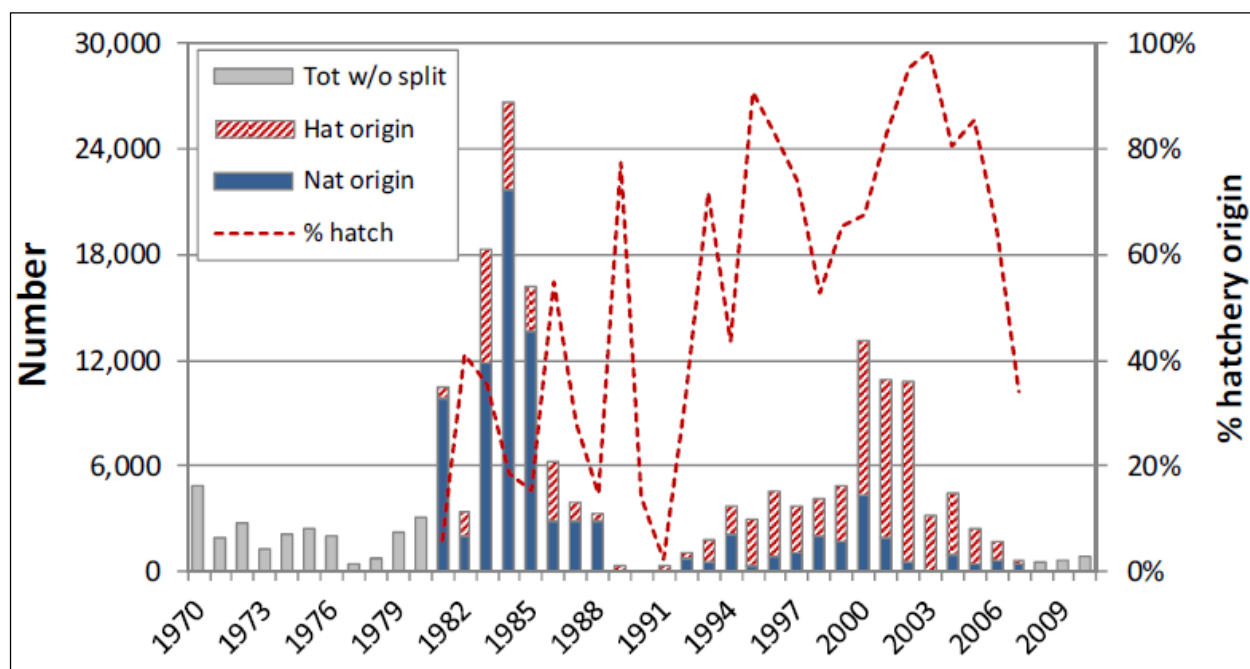


Figure 3-23. Estimated fall-run Chinook salmon escapement in the Merced River from 1970 through 2010, showing fish of natural and hatchery origin for years 1981 through 2007. The dashed line shows the estimated percentage of hatchery-origin fish in the aggregate escapement, as estimated by Mesick (2010) (Source: California HSRG, 2012).

The Pacific Fisheries Management Council has designated the Merced River downstream of Crocker-Huffman diversion dam as EFH for Chinook salmon spawning, rearing, and migration.

Hardhead: The hardhead (*Mylopharodon conocephalus*) is a large member of the minnow family that is native to California. It is generally found in larger low- to middle-elevation streams in the Sacramento and San Joaquin Watersheds. California DFW considers it a species of special concern. The hardhead has been documented in the Merced River upstream of Lake McClure and downstream of Crocker-Huffman diversion dam (Stillwater Sciences, 2008). It inhabits deep pools and runs with slow velocities and prefers water temperatures between 75.2 and 82.4°F (24.0 to 28.0°C) (Moyle, 2002). This species can tolerate warmer water temperatures than salmonids, and it occupies a transitional zone where distribution overlaps with both warmwater and coldwater fish species (Moyle, 2002). Moyle (2002) reports that the hardhead has relatively poor swimming ability at low temperatures, which keeps it from surmounting velocity barriers that are passable by salmonids. It spawns primarily in April and May, but spawning may

extend into August in some streams (Moyle, 2002). Spawning behavior has not been documented and water temperature tolerances for spawning adults, eggs, and larvae are unknown. In the 2006 to 2008 fish surveys, the hardhead was relatively abundant both upstream and downstream of the project, comprising 7.8 percent and 8.3 percent of the total fish abundance in the upper Merced River and lower Merced River, respectively. Hardhead observed in the lower Merced River surveys ranged from young-of-the-year to approximately age 2+.

Sacramento splittail: The Sacramento splittail (*Pogonichthys macrolepidotus*) is a native minnow found in estuarine habitats and low-elevation rivers in the Sacramento-San Joaquin River systems. California DFW considers it a species of special concern. During periods of high spring river flow, adult splittail can migrate long distances upstream from the Sacramento-San Joaquin Delta to spawn on inundated floodplains, including those in the lower reaches of San Joaquin River tributaries. Adults migrate upstream during winter and spring, and most spawning occurs in March and April in areas of flooded vegetation. The Sacramento splittail is tolerant of high salinity (up to 29 parts per thousand) and low DO (less than 1 mg/L), and it is typically found in water temperatures ranging from 41 to 75°F (5.0 to 23.8°C) (Moyle, 2002). This species was observed in the lower Merced River during spring fish surveys in 2007 and 2008 between the San Joaquin River confluence and RM 26.6 (Stillwater Sciences, 2008). Sacramento splittail observed in the lower Merced River surveys ranged from 7.9 to 14.8 inches (201 to 375 mm) in length and were likely adult fish in the 2+ through 5+ age classes, according to the age/length relationships from Moyle (2002).

Fish Habitat—Aquatic habitat conditions in the Merced River between Merced Falls dam and Crocker-Huffman diversion dam and in the reaches downstream of Crocker-Huffman diversion dam are heavily influenced by the upstream dams and by water withdrawals at and downstream of Crocker-Huffman diversion dam. The river between Merced Falls dam and Crocker-Huffman diversion dam is deep and confined between its banks with highly variable flows (100 cfs to 10,000 cfs), resulting in highly variable aquatic habitat conditions and a relatively low fish species diversity. Downstream of Crocker-Huffman diversion dam, reduced instream flows, land use activities such as mining and agriculture, instream dredging, and other factors have degraded spawning, rearing, and migratory habitat for anadromous salmonids in the Merced River and migratory habitat in the San Joaquin River. The combined effects of gold dredging, flow regulation, elimination of coarse sediment supply by dams, and land use developments have converted the Merced River's primary spawning reach (RM 42.0 to RM 52.0) from a historically complex, multiple-channel system to a simplified, single-thread system with a narrow floodplain adjacent to the channel. Lack of coarse sediment supply caused by instream mining and capture in upstream reservoirs has produced a channel characterized by long deep pools that are scoured to bedrock or to a coarse, armored cobble layer. Resulting conditions include reduced riparian vegetation, increased sedimentation from adjacent land uses, reduced spawning gravel recruitment, and degraded water quality. In and downstream of the primary spawning reach, habitat

alterations have reduced habitat suitability for salmonids and other native fishes while creating a hospitable environment for introduced fishes, including predatory fish such as black bass. Numerous habitat restoration and gravel augmentation projects have been implemented in the primary spawning reach to restore and enhance spawning and rearing conditions for salmonids and reduce habitat suitability for introduced fish. Between 1990 and 2010, approximately 11,706 tons of gravel were added to the main augmentation site immediately downstream of Crocker-Huffman diversion dam.

Suitable habitat for salmonids and many other native fish species is currently concentrated in the reach extending from Crocker-Huffman diversion dam downstream to approximately RM 45.0. Surveys conducted in 2003 and 2004 identified approximately 19 percent of the total wetted main and secondary channel areas in this reach as likely high quality salmonid rearing habitat (Stillwater Sciences, 2006). Backwaters and riffle margins provide complex habitat and velocity refuge for rearing salmon in this reach, and instream rooted aquatic vegetation provides cover for rearing salmonids. Small woody debris and overhanging vegetation, as well as cobble, boulders, and small amounts of large woody provide rearing cover.

Merced ID evaluated the relationships between flow and fish habitat (1) in the Merced River from Merced Falls dam to Crocker-Huffman diversion dam, and (2) from Crocker-Huffman diversion dam (RM 52.0) to Shaffer Bridge (RM 32.8) using the one-dimensional Physical Habitat Simulation Model (PHABSIM). Merced ID evaluated habitat suitability at several flows for a suite of species in each study reach using existing criteria or criteria developed for the study.

In the reach between Merced Falls dam and Crocker-Huffman diversion dam, habitat conditions were measured at four flows (265 cfs, 780 cfs, 2,120 cfs, and 3,150 cfs) at 19 transects in the 1.26-mile riverine (i.e., flowing) section immediately downstream of Merced Falls dam and 6 transects in the 1.74-mile impoundment section located in the slow-flowing portion of the reach immediately upstream of Crocker-Huffman diversion dam. Four of the six fish species documented in the reach were divided into two guilds based on habitat preference: a lamprey guild (Pacific lamprey and Kern brook lamprey) and a sculpin guild (riffle sculpin and prickly sculpin). The other two study species in the reach were rainbow trout and Sacramento sucker.

Species in the riverine sub-reach between Merced Falls dam and Crocker-Huffman diversion dam displayed a typical trend in weighted usable area (WUA) for all life stages where habitat suitability is lowest at very low flows, rises to a peak, and then decreases gradually or flattens out as flows increase. For fry, juvenile, and adult rainbow trout (figure 3-24) and juvenile Sacramento sucker (figure 3-25), habitat continues to gradually increase at very high flows. This second rise in habitat may be a result of flow overtopping low banks at certain transects and recruiting new habitat, or it may be an artifact of the model, in which modeled low velocities along the stream margin are unrealistically propagated as flows increase. The WUA trends are a direct function of the

channel forms (i.e., low floodplain elevations) and vegetated stream margins (i.e., low margin velocities) measured in this section of the Merced River.

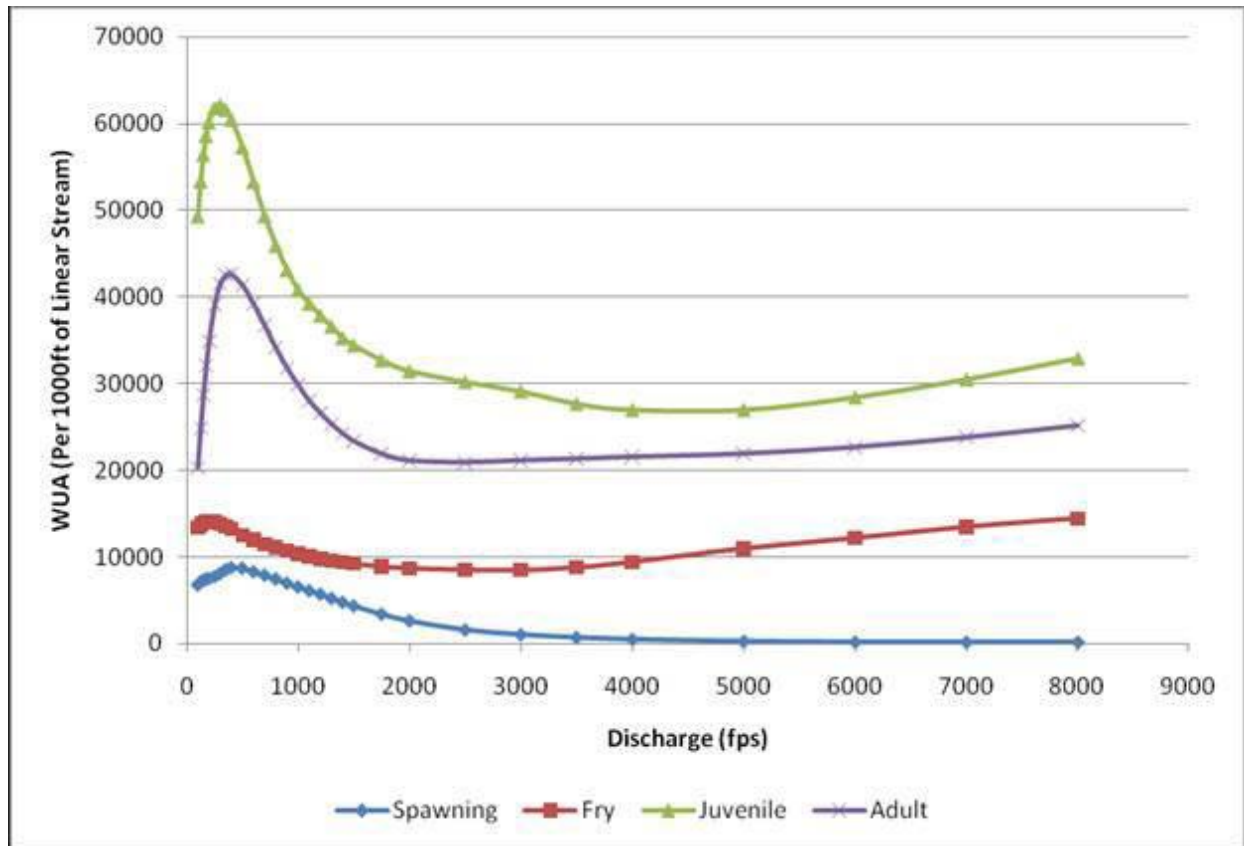


Figure 3-24. Habitat suitability (weighted usable area) for all rainbow trout life stages in the riverine sub-reach downstream of Merced Falls dam (Source: Merced ID, 2014a).

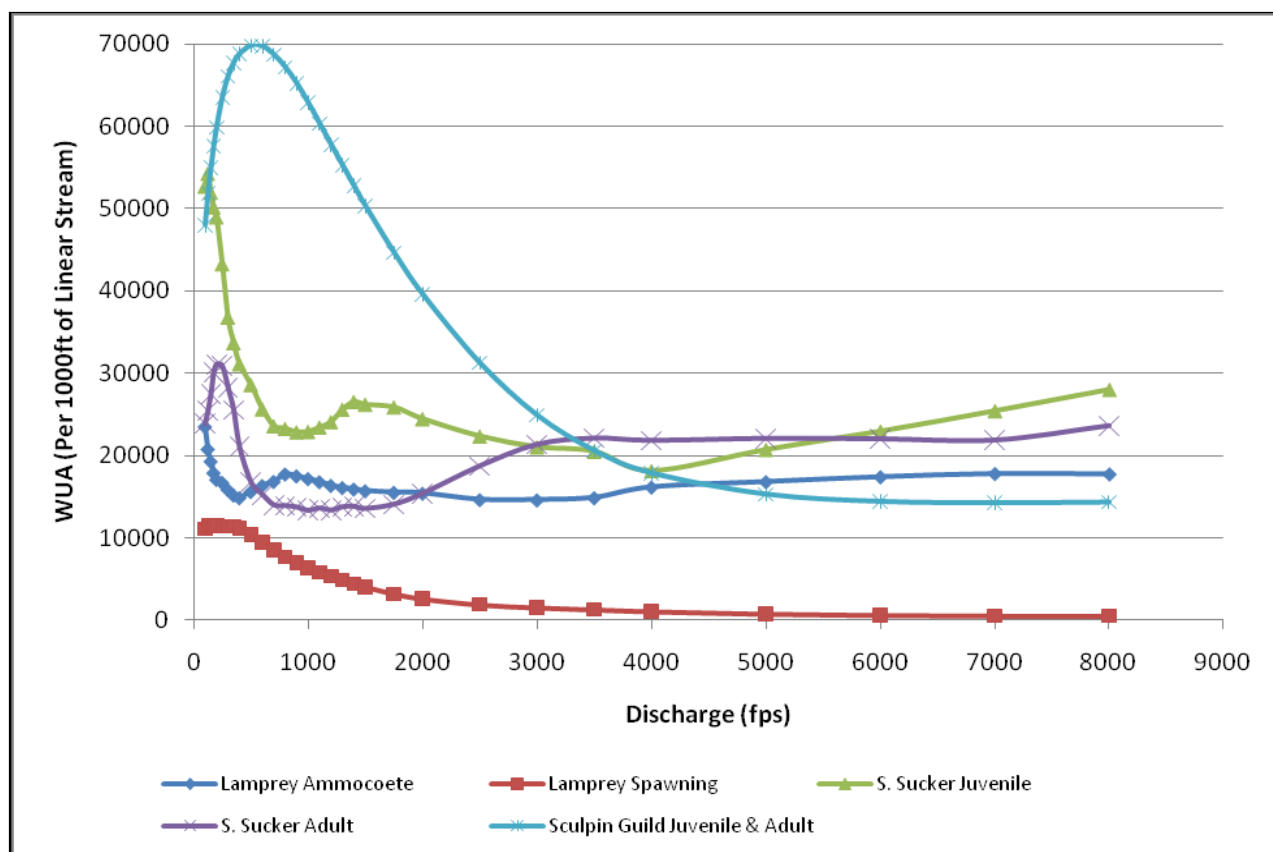


Figure 3-25. Habitat suitability (weighted usable area) for the lamprey guild, Sacramento sucker, and sculpin guild in the riverine sub-reach downstream of Merced Falls dam (Source: Merced ID, 2014a).

In the impoundment sub-reach between Merced Falls dam and Crocker-Huffman diversion dam, the WUA trend for many species' life stages is atypical, remaining relatively flat as flows increase. Adult and juvenile rainbow trout, lamprey ammocoete, and the sculpin guild are the exceptions. The habitat area for adult and juvenile rainbow trout is greatest from 500 to 1,500 cfs and declines at higher flows (figure 3-26). The habitat area for lamprey ammocoetes is greatest at the lowest flow modeled (194 cfs), declines until flows reach 2,750 cfs, then stabilizes and remains relatively constant at higher flows (figure 3-27). The habitat area for the sculpin guild rises to a peak at 1,750 cfs and decreases gradually thereafter. At approximately 3,000 cfs, water overtops the banks in the lower portion of the impoundment and additional shallow, low-velocity habitat becomes available. As a result, the habitat area shows an increase at high flows for rainbow trout fry and juvenile, lamprey ammocoete, and Sacramento sucker juvenile life stages. However, Merced ID states that the observed increase in habitat for these life stages at very high flows could also be an artifact and limitation of the model, in which modeled low velocities along the stream margin are unrealistically propagated as flows increase.

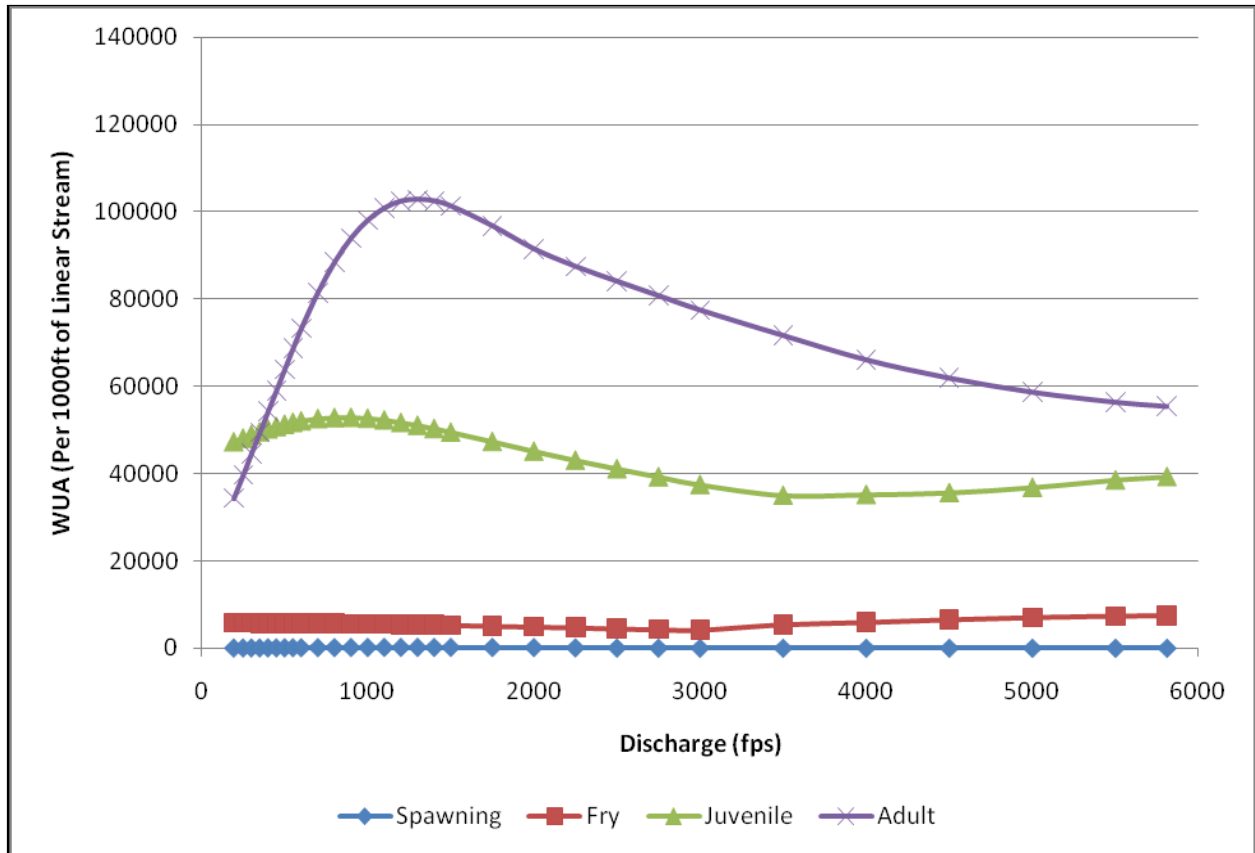


Figure 3-26. Habitat suitability (weighted usable area) for rainbow trout, in the impoundment sub-reach downstream of Merced Falls dam (Source: Merced ID, 2014a).

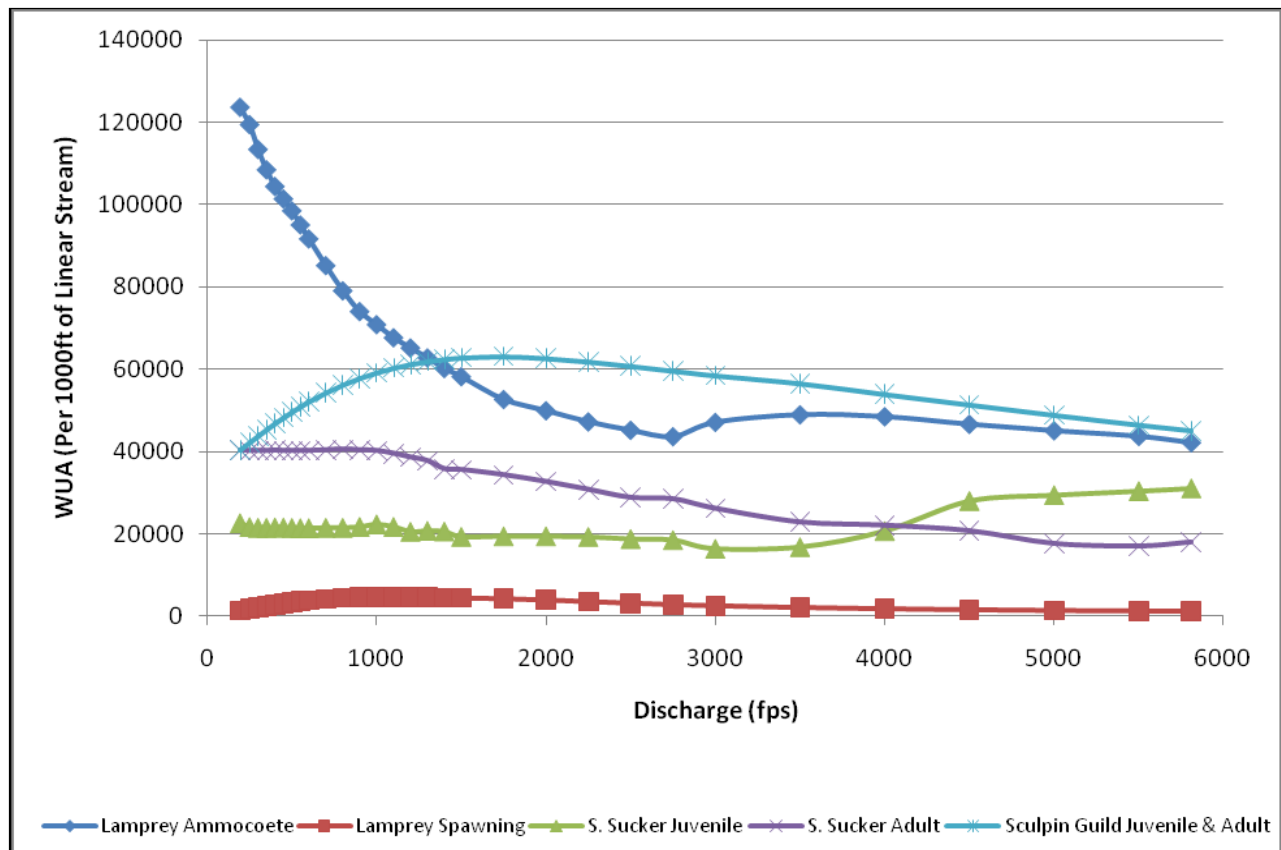


Figure 3-27. Habitat suitability (weighted usable area) for lamprey ammocoete, Sacramento sucker juvenile and adult, and sculpin guild juvenile and adult in the impoundment sub-reach downstream of Merced Falls dam (Source: Merced ID, 2014a).

Downstream of Crocker-Huffman diversion dam, the study area included three sub-reaches from Crocker-Huffman diversion dam (RM 52.0) downstream to Shaffer Bridge (RM 32.8) with a total of 65 PHABSIM transects. Sub-reach 1 extends from RM 32.8 to 42.0, sub-reach 2 extends from RM 42.0 to 46.4, and sub-reach 3 extends from RM 46.4 to 52.0. Hydraulic simulations were conducted for flows ranging from 74 to 5,823 cfs (Merced ID, 2013a). The study included (1) a 1-dimensional PHABSIM analysis of flow-habitat relationships for steelhead, fall-run Chinook salmon, hardhead, and Sacramento splittail, (2) an analysis incorporating the PHABSIM and water temperature modeling results, and (3) an evaluation of the relationship between river discharge and hydraulic connectivity with off-channel areas that provide habitat for predatory black bass (Merced ID, 2013a).

For most species and life stages, WUA results downstream of Crocker-Huffman diversion dam showed a bimodal pattern with distinct maxima in the amount of usable habitat at flows within active channel discharges and at much higher flows that overtop the banks and inundate floodplains (Merced ID, 2013a). For example, the peak habitat

area for steelhead and Chinook salmon generally occur at flows < 500 cfs and > 3,000 cfs with some variations depending on life stage and sub-reach (figures 3-28 through 3-36). For lower flows in the range of the active channel discharge, reach-averaged discharges that produce the maximum amount of habitat ranged from approximately 90 cfs (i.e., steelhead and Chinook fry) to greater than 520 cfs (i.e., steelhead spawning). Merced ID surmised that the bimodal character of the WUA functions was likely caused by a significant increase in habitat recruitment when flows inundated the vegetated riparian zones, and in sub-reach 2 (RM 42.0 to RM 46.4) when flows inundated the expansive engineered floodplain (figures 3-28 and 3-29). On inundated floodplains in particular, water velocities stay low and depths often do not exceed suitability criteria.

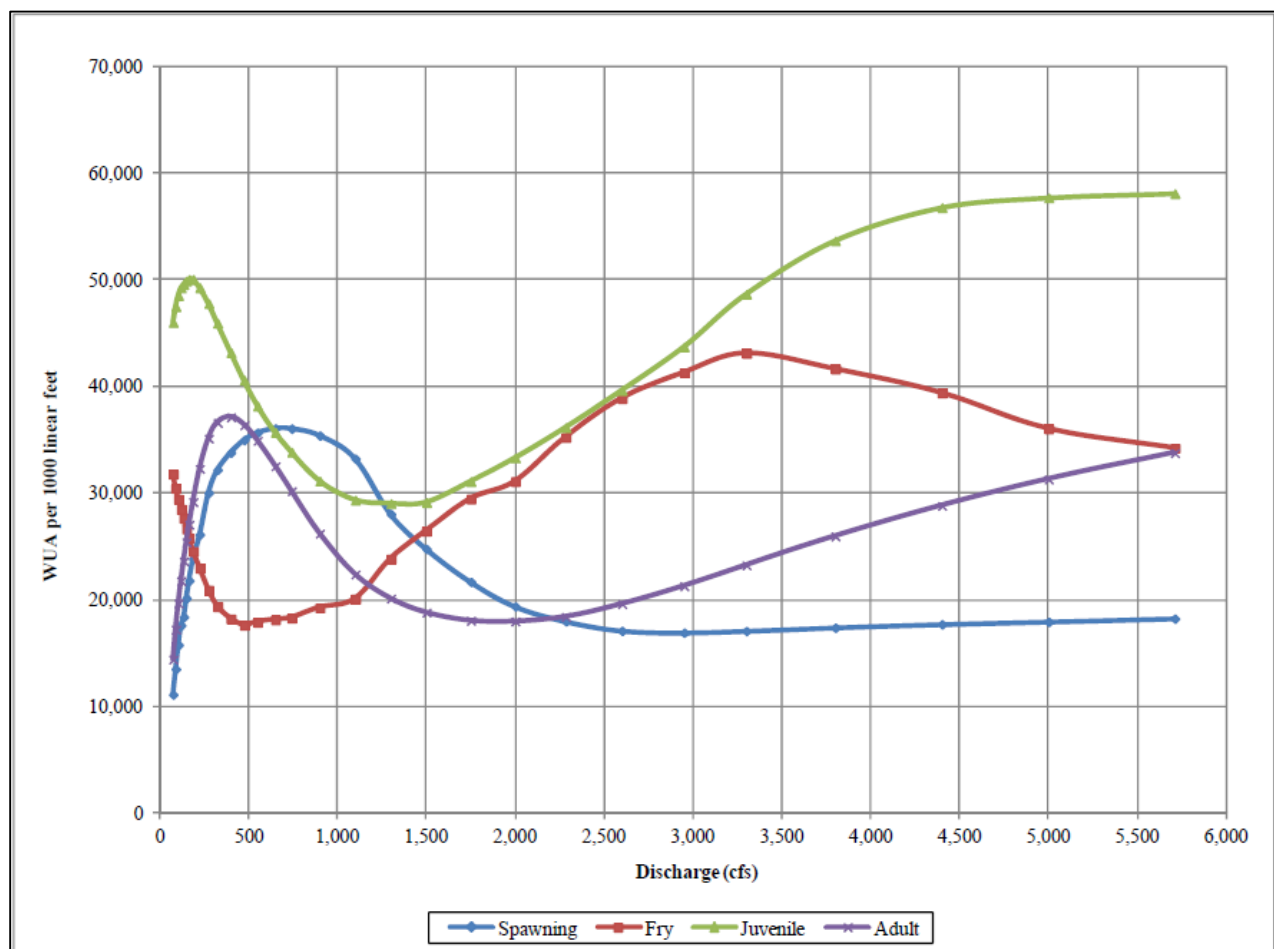


Figure 3-28. Habitat suitability (weighted usable area) for steelhead in sub-reach 1 downstream of Crocker-Huffman diversion dam (Source: Merced ID, 2014a).

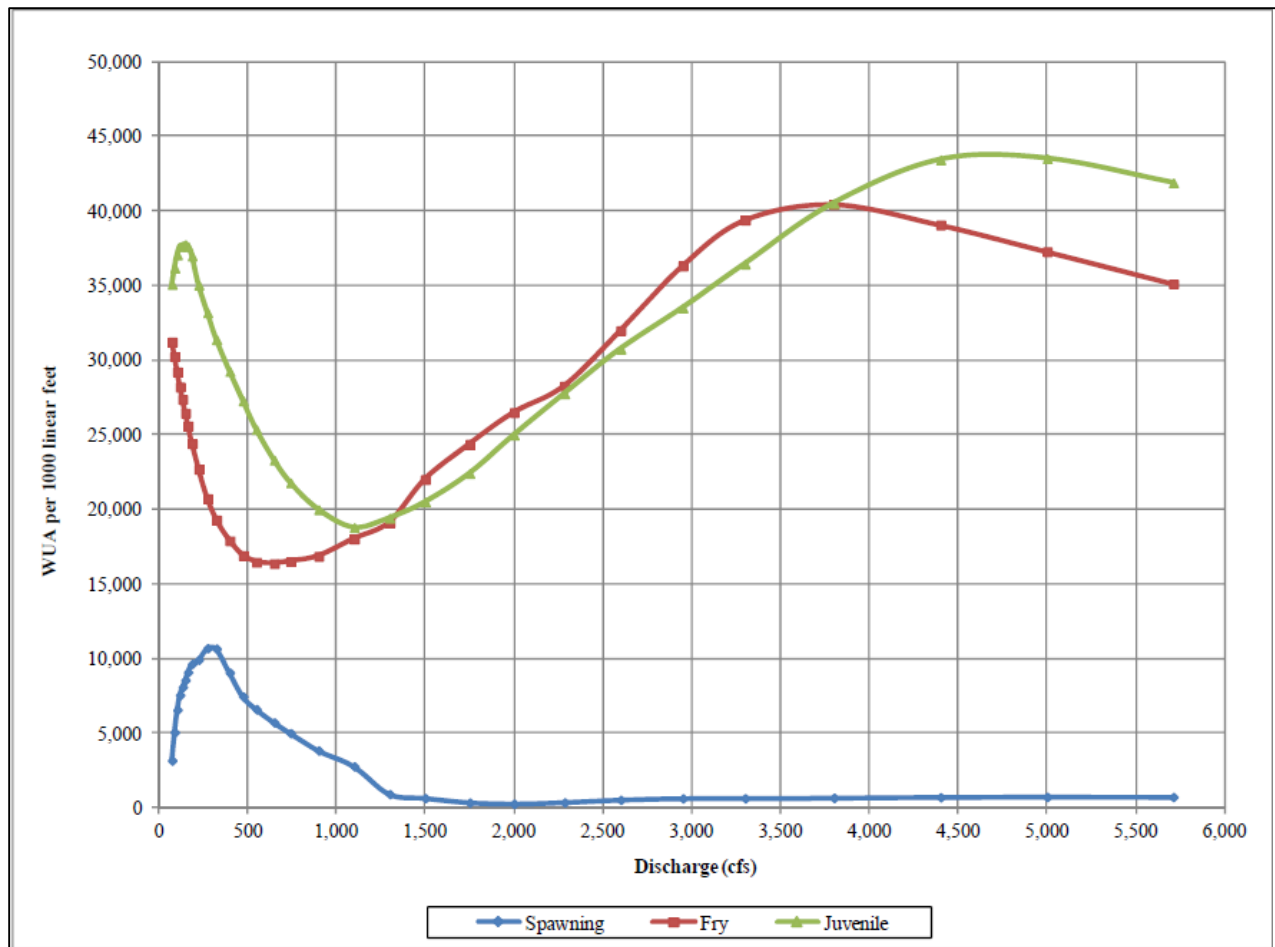


Figure 3-29. Habitat suitability (weighted usable area) for Chinook salmon in sub-reach 1 downstream of Crocker-Huffman diversion dam (Source: Merced ID, 2014a).

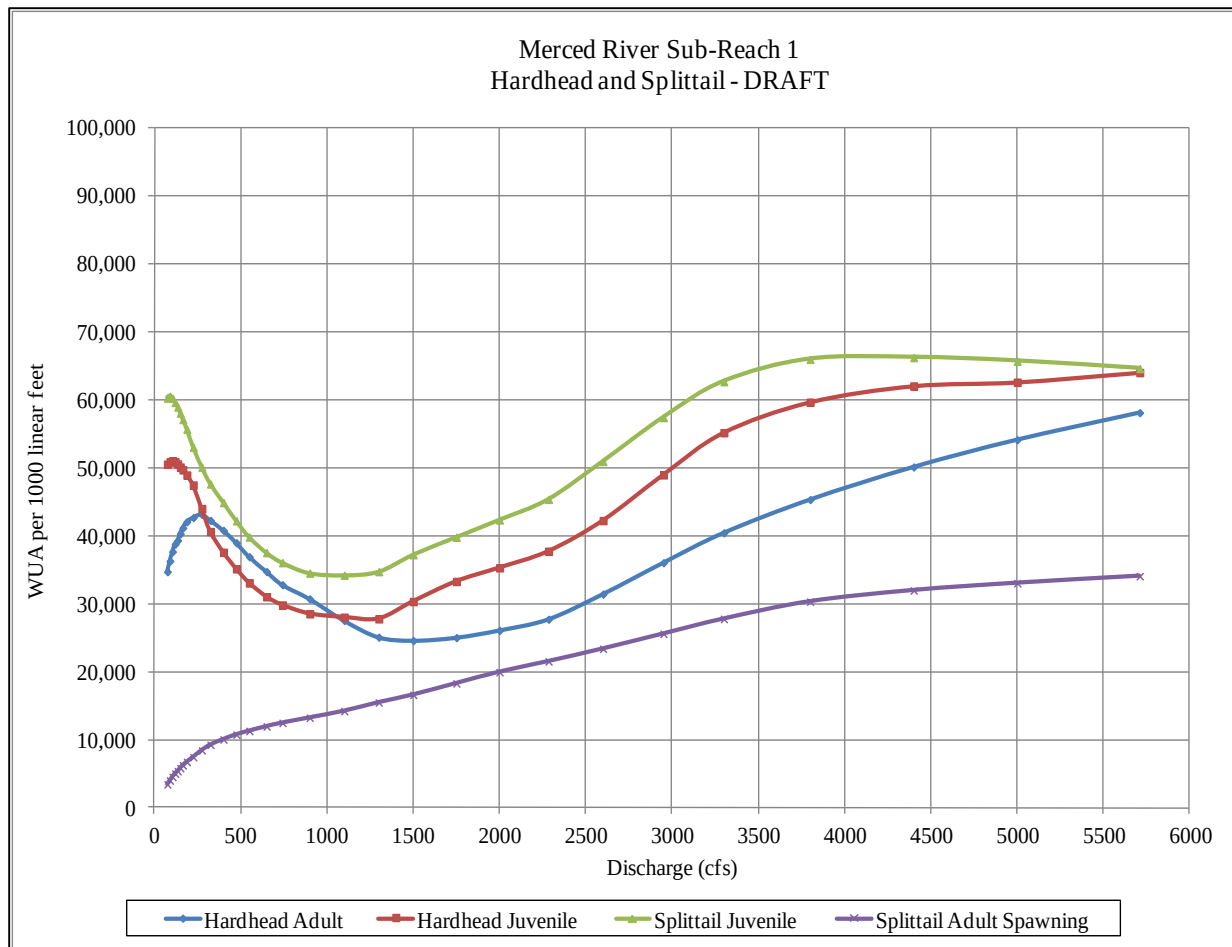


Figure 3-30. Habitat suitability (weighted usable area) for hardhead and Sacramento splittail in sub-reach 1 downstream of Crocker-Huffman diversion dam (Source: Merced ID, 2014a).

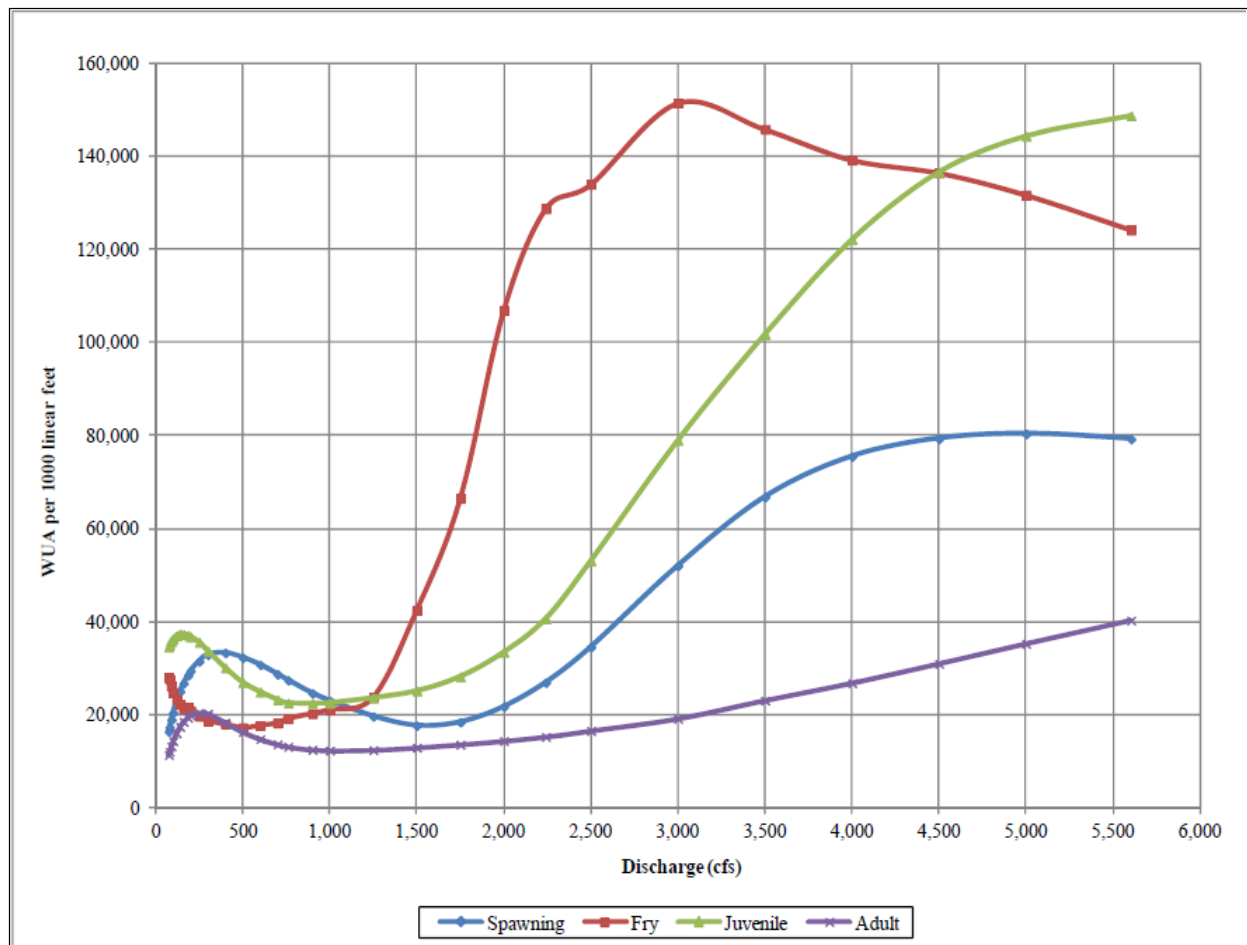


Figure 3-31. Habitat suitability (weighted usable area) for steelhead in sub-reach 2 downstream of Crocker-Huffman diversion dam (Source: Merced ID, 2014a).

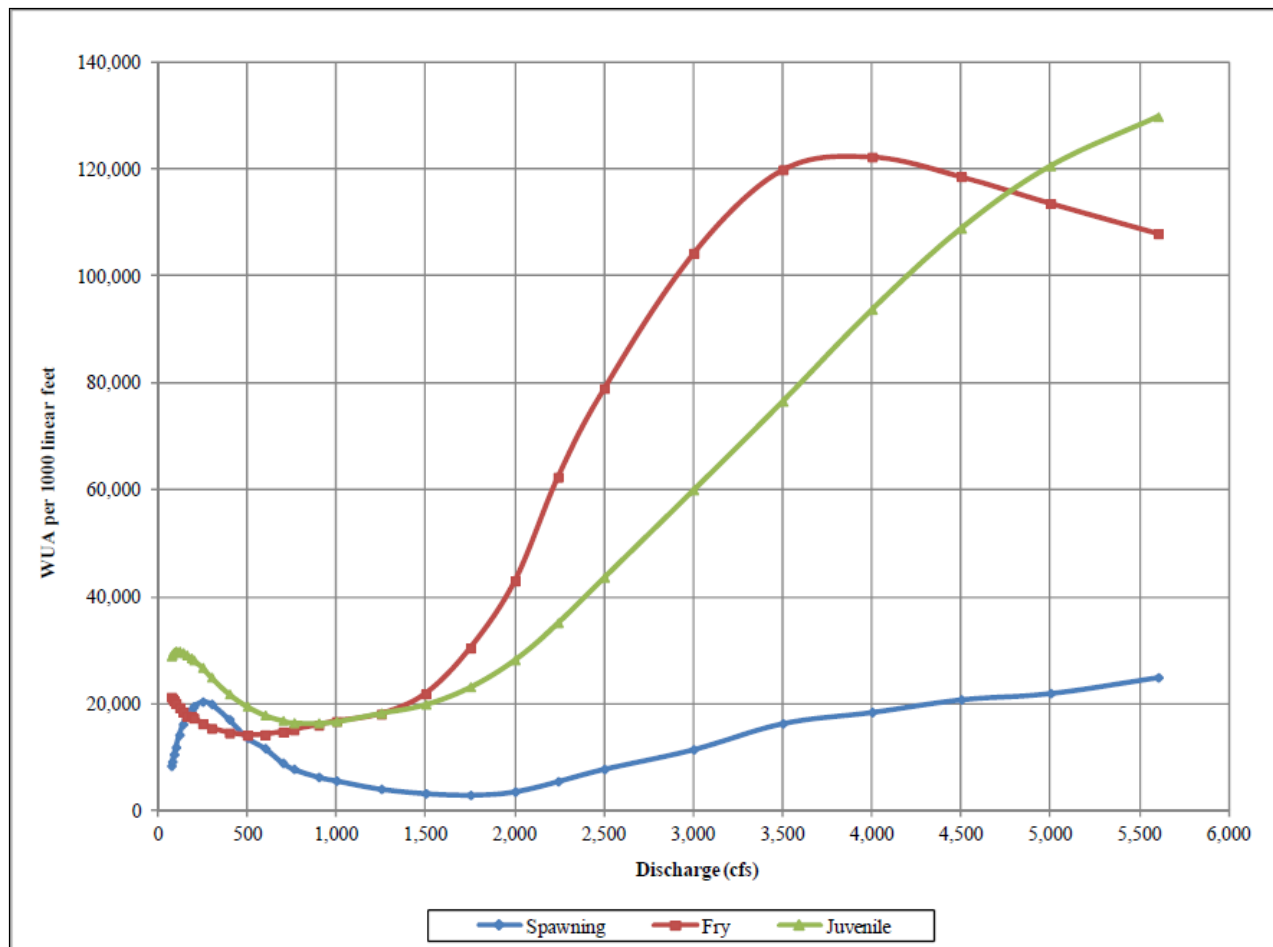


Figure 3-32. Habitat suitability (weighted usable area) for Chinook salmon in sub-reach 2 downstream of Crocker-Huffman diversion dam (Source: Merced ID, 2014a).

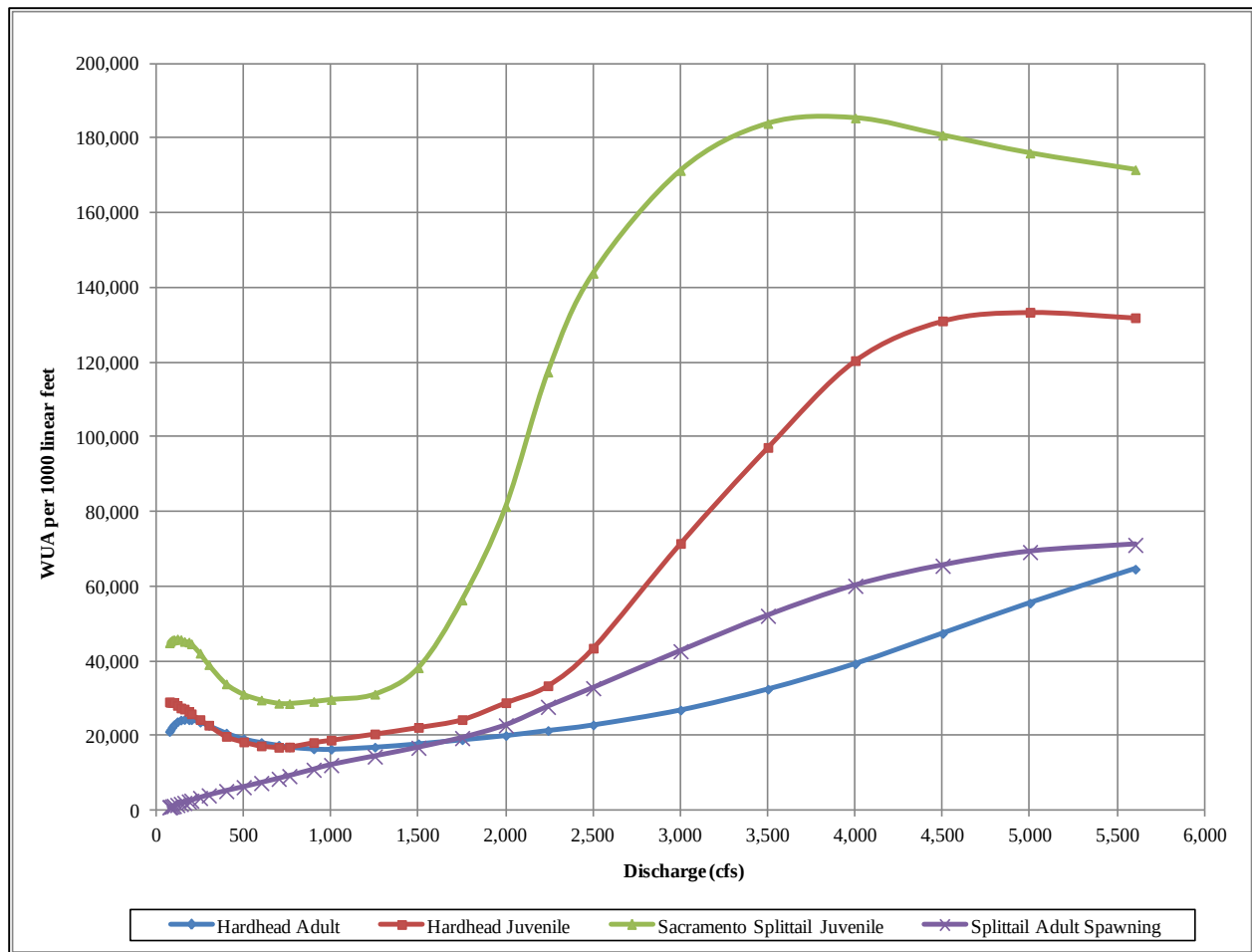


Figure 3-33. Habitat suitability (weighted usable area) for hardhead and Sacramento splittail in sub-reach 2 downstream of Crocker-Huffman diversion dam (Source: Merced ID, 2014a).

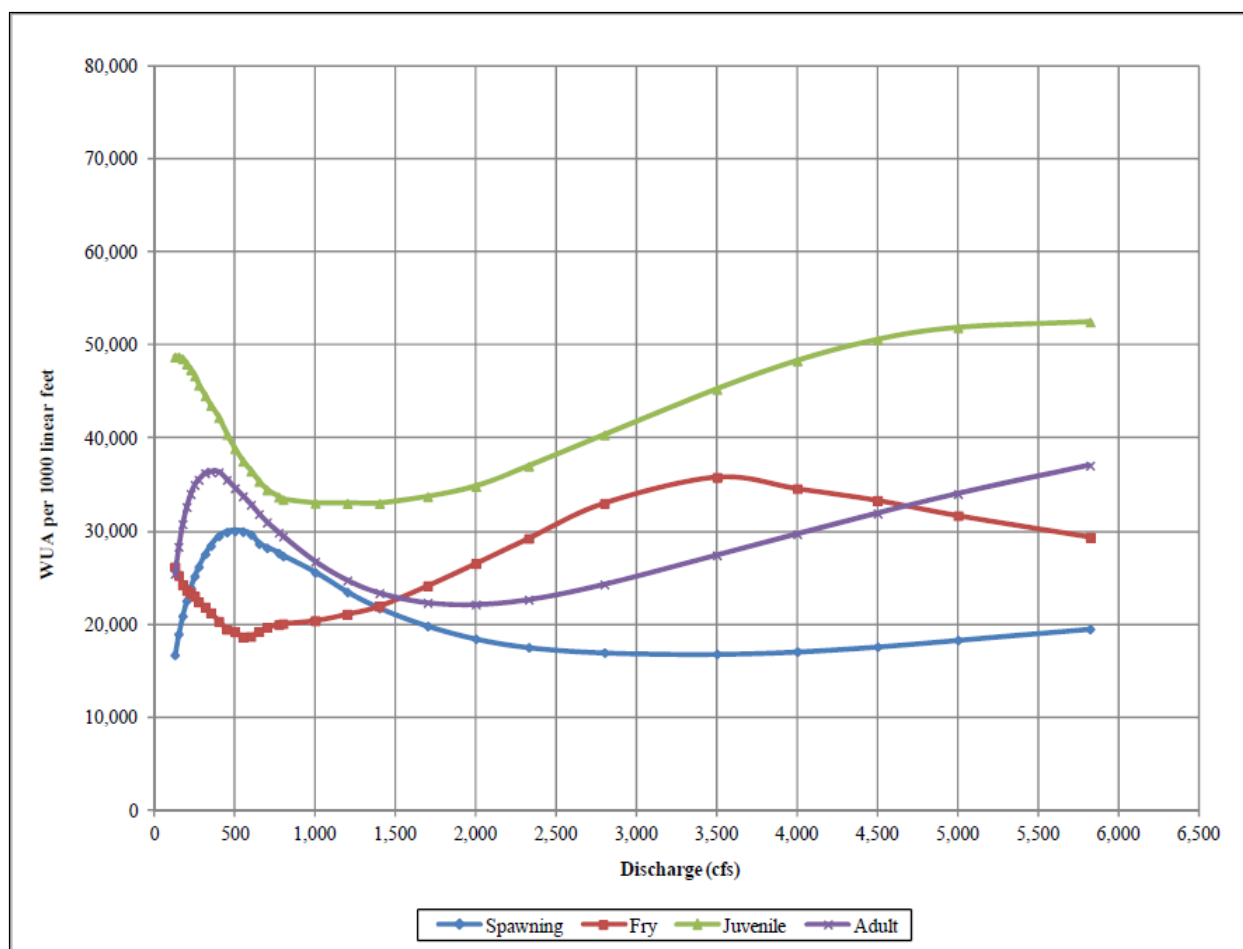


Figure 3-34. Habitat suitability (weighted usable area) for steelhead in sub-reach 3 downstream of Crocker-Huffman diversion dam (Source: Merced ID, 2014a).

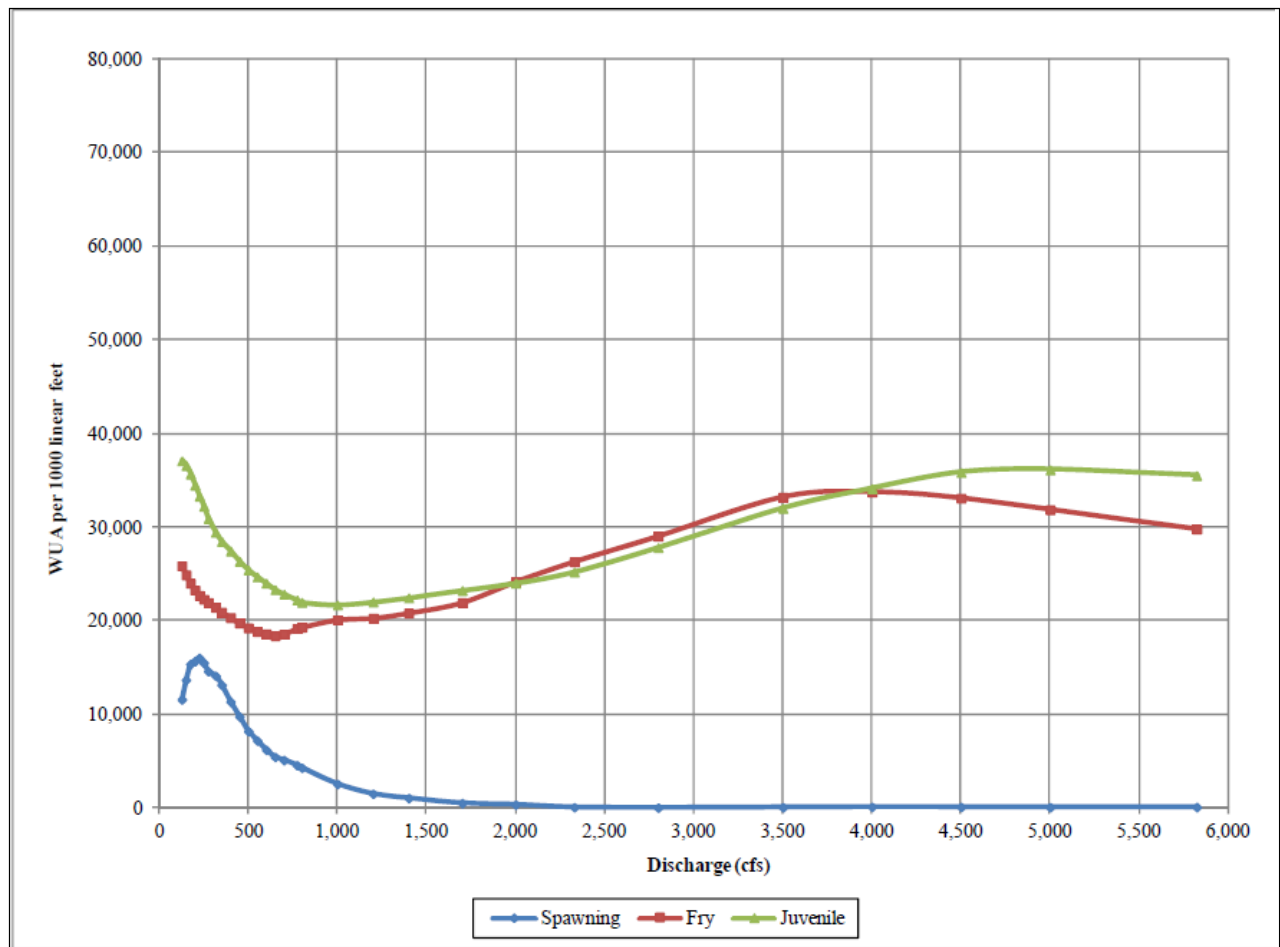


Figure 3-35. Habitat suitability (weighted usable area A) for Chinook salmon in sub-reach 3 downstream of Crocker-Huffman diversion dam (Source: Merced ID, 2014a).

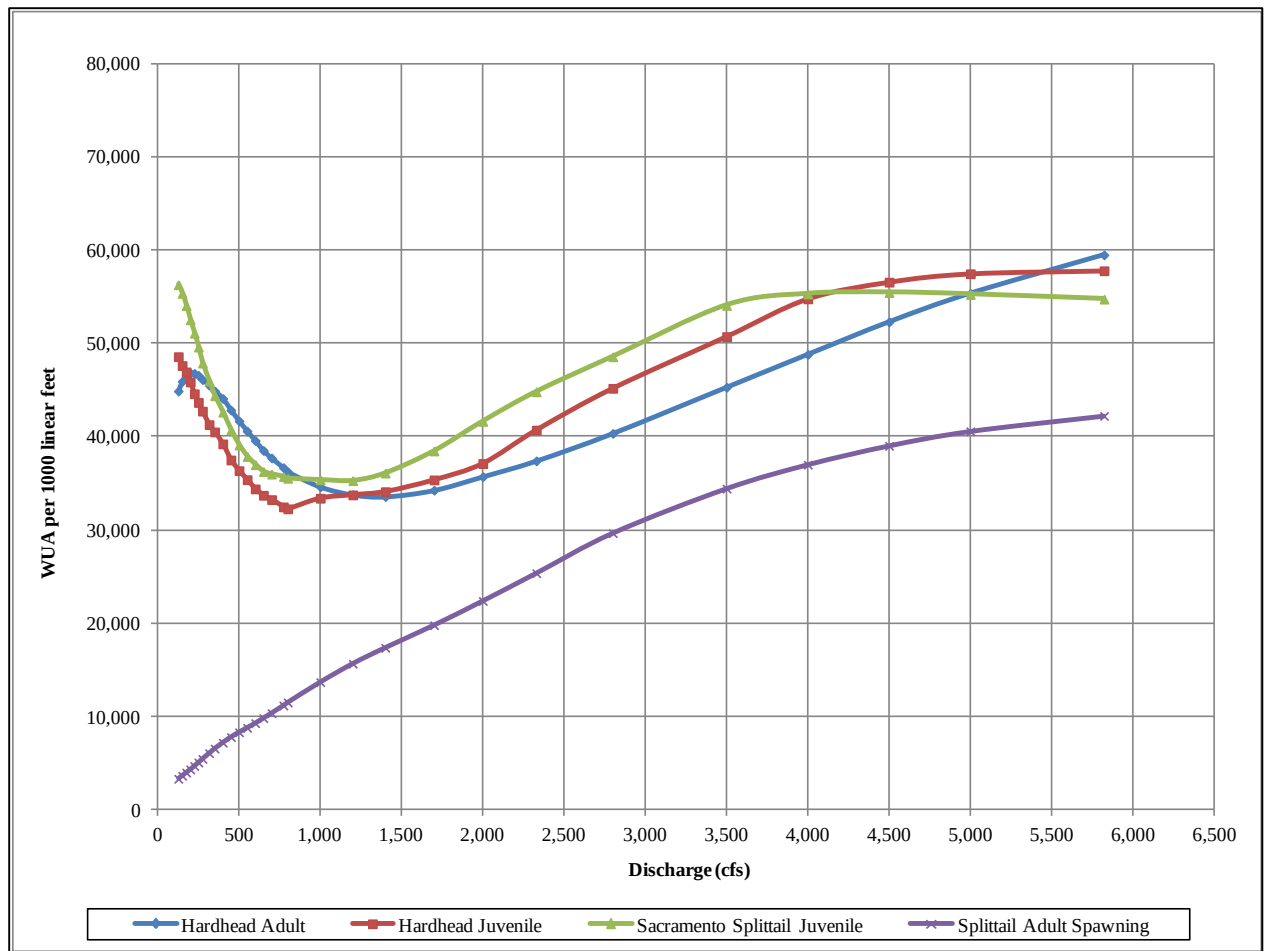


Figure 3-36. Habitat suitability (weighted usable area) for hardhead and splittail in sub-reach 1 downstream of Crocker-Huffman diversion dam (Source: Merced ID, 2014a).

Evaluation of the effects of water temperature on usable habitat indicated that significant reductions in habitat suitability for Chinook salmon and steelhead occurred downstream from Crocker-Huffman diversion dam as a result of increasing water temperatures. Water temperature thresholds for all steelhead and Chinook salmon life stages (EPA, 2003) were exceeded in at least 1 month at Crocker-Huffman diversion dam. At the Shaffer Bridge evaluation point, more than 40 percent of months analyzed showed habitat reductions of 50 percent or greater. The spawning life stages, which are the most sensitive to elevated water temperatures, showed the most significant reduction in habitat suitability. Water temperature thresholds for Chinook salmon spawning were exceeded 100 percent of the time in September and October at all hydrologic nodes from Crocker-Huffman diversion dam downstream to Shaffer Bridge, resulting in no suitable spawning habitat during these months (Merced ID, 2013a). Suitable temperatures for Chinook salmon spawning were achieved only 10 to 14 percent of the time in November, equating to a loss of usable habitat of 86 to 90 percent during the peak month for spawning. Temperature thresholds for steelhead spawning in March and April were exceeded approximately half of the time, effectively reducing usable spawning habitat by about 50 percent during the peak steelhead spawning period (Merced ID, 2013a).

Habitat for black bass, which often occupy off-channel and backwater habitat (e.g., abandoned dredger mining pits), became connected to the main channel downstream of Crocker-Huffman diversion dam at a range of flows. Of 79 potential off-channel bass habitat units identified, 12 were hydraulically connected to the main channel at the maximum discharge that occurs from Crocker-Huffman diversion dam during a normal water year (2,236 cfs)²⁴ (Merced ID, 2013a). Nine of the 12 off-channel units had connections occur at discharges of 700 cfs or higher and were connected up to 40 percent of the time for each month on record. Three of the 12 off-channel units had connections established at flows less than 369 cfs and a range of inundation frequency from 18 percent in the summer to 77 percent in May (Merced ID, 2013a). Salmon fry, juveniles, and smolts may be more vulnerable to predation where and when the off-channel habitats that support high densities of predatory black bass become hydraulically connected to the main channel habitats used by rearing and out-migrating salmonids. Under these circumstances, predation rates are elevated because: (1) the bass from the off-channel habitats gain access to the main channel habitats used by salmonids, and (2) salmonids can enter and become trapped in the off-channel habitats where bass densities are high.

Elevated water temperature is a primary factor that can limit in-river and hatchery Chinook salmon production in the Merced River. As discussed earlier in this section under *Water Quality*, the lower Merced River is on the CWA 303(d) list as impaired for temperature. Merced ID compared water temperature monitoring data collected from 1991 through 2010 at seven locations between RM 52.0 and RM 13.0 with the U.S.

²⁴ Based on historical gage data from water year 1969 to 2006.

Environmental Protection Agency's (EPA) (2003) recommended 7-day average daily maximum water temperature criteria for salmonids to evaluate the frequency with which the criteria were exceeded for each fall-run Chinook salmon life stage. Merced ID's conclusions regarding existing conditions were:

- During the October through December upstream migration period, the 18.0°C (64.4°F) criterion for adult salmon migration was exceeded 4 to 10 percent of the time at locations between RM 52.0 and RM 33.0, and 23 percent of the time at RM 13.0.
- During the October through March spawning and incubation period, the 13.0°C (55.4°F) criterion to protect salmon spawning, incubation, and fry emergence life stages was exceeded 39 to 54 percent of the time between RM 52.0 and RM 13.0.
- During the January through May juvenile rearing, emigration, and smolting period, the 16.0°C (60.8°F) juvenile rearing criterion was not exceeded at any location during January, and in February it was exceeded only at RM 41.9 (3 percent of the time) and RM 13.0 (8 percent of the time). From March through May, the 16.0°C (60.8°F) juvenile rearing criterion was exceeded at RM 46.3 and all locations downstream from 4 to 90 percent of the time. The juvenile rearing criterion was never exceeded at RM 52.0 during the January through May evaluation period.
- During the January through May juvenile rearing, emigration, and smolting period, the 15.0°C (59.0°F) smoltification criterion was exceeded in January only at RM 41.9 (1 percent of the time). In February, the 15.0°C (59.0°F) criterion was exceeded at RM 44.2 and downstream locations from 4 to 15 percent of the time. In March and April, the 15.0°C (59.0°F) criterion was exceeded at RM 46.3 and all downstream locations from 20 to 81 percent of the time. In May, the 15.0°C (59.0°F) smoltification criterion was exceeded at all locations from 12 to 100 percent of the time.

Low DO levels can also reduce habitat suitability for salmonids and other coldwater fish species. Merced ID monitored DO in summer and fall 2010 between Merced Falls dam and Crocker-Huffman diversion dam and in summer and fall 2011 downstream of Crocker-Huffman diversion dam to evaluate compliance with Basin Plan objectives (Merced ID, 2012c). Results of DO monitoring, including the frequency of compliance with Basin Plan objectives for salmonids and other coldwater fishes, are discussed in the *Water Quality* subsection.

Aquatic Invertebrates

Merced River Project

No known studies or reports regarding aquatic invertebrates in Lake McClure or McSwain reservoir are available. The USGS monitors and reports accounts of invasive mollusk species as part of the nonindigenous aquatic species information program and provides real-time updates on its website (USGS, 2013). Invasive mollusk species identified by the nonindigenous aquatic species website include Asian clam (*Corbicula fluminea*), quagga mussel (*Dreissena rostriformis bugensis*), zebra mussel (*Dreissena polymorpha*), and New Zealand mud snail (*Potamopyrgus antipodarum*). According to the nonindigenous aquatic species website, there are no reported accounts of these species within the Merced River Project boundaries.

Merced Falls

A benthic macroinvertebrate (BMI) study was previously conducted by Stillwater Sciences (2008) downstream of the project. This study sampled BMIs in fall 2006, spring/summer 2007, and fall 2007 approximately 1.5 miles downstream of the dam. Using multi-habitat composite samples, and using several metrics, including measures of Ephemeroptera, Plecoptera, and Trichoptera (EPT taxa) (the orders of insects—noted to be intolerant of impaired water quality and degraded habitat) and percent collectors and filterers among BMIs, the study found the sample site to be healthy, comparable to other sites at similar elevations. Noteworthy results from this study were that New Zealand mudsnails were absent from this reach, and the BMI index trends showed no obvious community impairment from water management.

Lower Merced River

BMI from the lower Merced River have been the subject of studies designed to evaluate the associations between invertebrate assemblages and environmental variables in a broad-scale ecoregion analysis by Brown and May (2000) and in an analysis focused on San Joaquin river tributaries (Markiewicz et al., 2003). Other studies were directly intended to monitor BMI in the lower Merced River to establish baseline conditions related to restoration projects (Stillwater Sciences 2008, 2006). These studies used BMI from the orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) (EPT) as a metric to indicate environmental conditions. EPT taxa are considered intolerant of water quality impairment and habitat degradation (Barbour et al., 1999).

Results from these studies show EPT taxa to be present at all sites sampled in the lower Merced River. Brown and May (2000) found a combined total of 20 BMI taxa at two lower Merced River sites, including seven EPT taxa. Markiewicz et al. (2003) reported that two upstream sampling sites in the lower Merced River (at the Highway 59 bridge [RM 42.0] and the Oakdale Road bridge [RM 32.4]) recorded the highest overall percent EPT scores when compared with other San Joaquin River tributary sampling sites

in the study. The study also showed that the Oakdale Road site, located downstream of an agricultural drainage (Ingalsbe Slough), had higher percent insect and percent amphipod scores than the upstream site, suggesting little or no degradation from the slough. The downstream-most site sampled, located at Hatfield Park (RM 1.4) showed a considerable portion of the BMI community was composed of EPT and other insects. These results suggest that the water quality impairment of the lower Merced River due to pesticides, unknown toxicity, and water temperature²⁵ was not severe enough to exclude these taxa.

Combined results of the baseline monitoring studies conducted between 2005 and 2008 from RM 53.5 (1.5 miles downstream of the Merced Falls dam) downstream to RM 1.0 showed that total taxonomic richness ranged from 16 to 55 taxa, and the number of EPT taxa ranged from 4 to 22. Species composition showed low inter-site variability and no upstream to downstream trends in richness, composition, or tolerance metrics. Tolerance metrics indicated moderately tolerant BMI assemblages. At least two EPT taxa were included in the top five numerically dominant taxa at each monitoring site. In addition to their use as bioindicators, BMI are an essential component of the food web in aquatic habitats. They cycle nutrients in their aquatic environment by feeding on algae and organic detritus and by preying on a wide range of small organisms and are an important food resource for fish, amphibians, reptiles, birds, and mammals. The Stillwater Sciences (2006) study showed that the majority of dominant taxa observed were likely available as a food source for juvenile Chinook salmon.

There are no known studies or surveys in the lower Merced River specifically targeting mollusks. However, mollusks have been identified in most of the BMI sampling dating back to 1994. Bivalves collected in the lower Merced River include the Asian clam, western pearlshell mussel, and fingernail clam (*Pisidium* sp.). Gastropods collected include the ancyloid snail (*Ferrissia* sp.), ram's horn snails (*Helisoma* sp. and *Planorbella* sp.), sprite snail (*Menetus* sp.), gyro snail (*Gyraulus* sp.), and *Physa* sp. (Brown and May, 2000; Stillwater Sciences, 2008, 2006). Of these, only the Asian clam is considered an invasive species (Sousa et al., 2008).

Although the New Zealand mud snail was not documented in BMI studies in the lower Merced River, the nonindigenous aquatic species monitoring program lists four records of New Zealand mud snail occurring in the lower Merced River from 2010 through 2013, all of which are located between Crocker-Huffman diversion dam (RM 52.0) and the Highway 59 bridge (RM 42.0) (USGS, 2013).

²⁵ The Merced River, including the project reservoirs and the river downstream of the project, is on the 2010 EPA 303(d) list of water quality limited segments due to pollution by pesticides, unknown toxicity, and water temperature (see *Water Quality*).

3.3.1.2 Environmental Effects

Merced River Project

Coordination between Resource Agencies and Stakeholders

Merced ID proposes to establish a Merced River Anadromous Fish Committee to include, by invitation, representatives from NMFS, FWS, California DFW, the Water Board, and a non-governmental organization member selected by Merced ID that would participate at its own expense. Merced ID would organize four committee meetings each year to review the results of draft annual reports pertaining to Chinook salmon and *O. mykiss* downstream of Crocker-Huffman diversion dam and to identify potential modifications to monitoring methods and protocols (excepting monitoring duration), as follows:

- March—Review draft adult monitoring study; review flow and temperature history and projections.
- May—Evaluate and complete adult monitoring report in preparation for the following fall monitoring; review temperature history and emigration monitoring results and late-spring temperature conditions.
- August—Review draft juvenile monitoring study; finalize fall monitoring; discuss finalization of juvenile monitoring plan, including plans for the following winter-spring monitoring.
- October—Finalize juvenile monitoring annual report and identify any modifications to the following winter-spring monitoring, including implementation approach.

BLM specifies in preliminary 4(e) condition 2 that Merced ID form a consultation group that meets four times a year to discuss resource plans, monitoring, and project-related issues within and outside BLM's jurisdiction that are not addressed in the annual meeting, and the implementation of license conditions affecting BLM-managed land. BLM also specifies that the group should establish mutually agreeable guidelines for conducting effective and efficient meetings. The Water Board specifies in preliminary WQC condition 1 that Merced ID organize an anadromous fish committee. NMFS [10(j) recommendation 7] recommends Merced ID establish an anadromous fish committee similar to that proposed, but adds that a technical advisory plan should be established that defines membership, meeting responsibilities, ground rules for consensus-based decision making, and a process for implementing the decisions. FWS [10(j) recommendation 5] recommends that Merced ID establish a technical advisory committee that would provide study plan and fishery report oversight and approve entities conducting field work. California DFW [10(j) recommendation 1] recommends that Merced ID establish a Merced ecological resource committee to review and evaluate implementation of license measures and monitoring plans and results; the committee would meet quarterly for at least the first 5 years of a new license, and would not be restricted to anadromous fish.

Similarly, the Conservation Groups recommend the establishment of an ecological resource group that meets at least annually to discuss monitoring reports and plans.

Our Analysis

The topics proposed for discussion by Merced ID at each of the four annual meetings illustrate the complexity of balancing multiple variables to achieve satisfactory environmental protection and enhancement while meeting a primary purpose of the project, which is to supply water for irrigation. Proposed and recommended flow releases and measures to provide suitable temperatures for salmonids downstream of Crocker-Huffman diversion dam require balancing many factors, including the water year type (which could change during the course of a year); the volume of cold water in Lake McClure that can be used for downstream temperature moderation (which varies from year to year); and the total volume of water in Lake McClure that can be used by irrigators. Balancing also requires interpreting the results of monitoring studies of incoming adult and outmigrating juvenile salmonids to assess the effectiveness of ongoing measures. Establishing a committee to assess ongoing study results and project operations would provide an effective forum for making decisions regarding future project operations within the constraints of a new license.

Providing a framework within which a committee operates would help to ensure that meetings are conducted in an orderly manner and make productive use of participants' time. We agree that establishing a technical advisory plan or process guidelines, as NMFS recommends and BLM specifies, that defines membership attributes, including the selection of an appropriate non-governmental organization representative, ground rules for decision making, and a process for implementing decisions would provide a useful framework within which the committee could effectively operate.

Merced ID proposes, NMFS recommends, and the Water Board specifies that the role of the technical committee be restricted to topics pertaining to anadromous fish. FWS expands the scope of the committee by recommending that the committee focus on fisheries topics, which could include anadromous and resident fish. California DFW and the Conservation Groups expand the scope further by including all ecological studies and monitoring as topics to be addressed by the committee. BLM broadens the scope to include issues that could affect BLM-managed land but are not covered during its specified annual consultation (discussed in section 3.3.2.2, *Terrestrial Resources*). As previously discussed, many of the environmental measures associated with this project focus on enhancing habitat for anadromous fish downstream of Crocker-Huffman diversion dam. Consequently, we expect the primary topic at any technical committee meeting to be related to anadromous fish. However, actions related to flows and maintaining downstream water temperatures would also have a bearing on the management of the water levels in Lake McClure, which would influence the resident fish community and adjacent riparian and wetland habitat. We conclude that having the committee focus exclusively on anadromous fish could preclude appropriate discussions

of inter-related resident fish and other ecological topics. Such additional discussions by a committee could also potentially include issues that could have a direct or indirect effect on BLM-managed land, such as recreational facilities.

Coordinated Operation between the Merced River and Merced Falls Projects

Flows released from the Merced River Project for environmental and irrigation purposes must pass through the Merced Falls Project before reaching the irrigation diversion point at Crocker-Huffman diversion dam. Although the Merced Falls Project operates in a run-of-river mode, where inflow to the project equals outflow, there are circumstances that could occur, such as routine maintenance events, that could have a bearing on the multi-purpose releases from Crocker-Huffman diversion dam to the lower Merced River and irrigation flows into the Main Canal.

Merced ID proposes to develop and implement a coordinated operation plan for the Merced River and Merced Falls Projects to assure implementation of flow-related measures at the two projects. Merced ID would develop the plan in consultation with the licensee of the Merced Falls Project and would file it with the Commission within 1 year of license issuance. BLM [preliminary 4(e) condition 4] specifies that Merced ID develop the proposed plan, but adds BLM, FWS, California DFW, the Park Service, NMFS, and the Water Board to the list of consulted entities as interested parties to project flow-related measures. BLM also specifies that the plan be provided to the consulted agencies, and filed with the Commission within 90 days of license issuance. California DFW [10(j) recommendation 2] recommends that Merced ID develop the proposed plan and file it with the Commission, California DFW, the Water Board, FWS, and NMFS within 90 days of license issuance.

Our Analysis

As indicated in the previous section, releases from the Merced River Project at McSwain dam are intended to fulfill a balanced approach to meeting the complex needs of both irrigators and anadromous fish. Achieving the intended goals of releases from McSwain dam rely on passing those flows in a consistent run-of-river mode from the Merced Falls Project. A coordinated operation plan for the Merced River and Merced Falls Projects would document the process by which flows released at McSwain dam would be available for intended purposes at Crocker-Hoffman diversion dam. Although developing this plan is likely to entail technical discussions about the fine points of project operation, inviting interested parties to provide input on the draft plan could provide valuable insights that enhance its effectiveness.

Protecting Water Quality and Aquatic Habitat from Erosion during Project Construction, Operation, and Maintenance

Construction of new recreation facilities, modification of existing recreation facilities, or other ground-disturbing activities could increase soil erosion and fine sediment delivery to project waterways. Fine sediment can adversely affect water quality

and associated aquatic habitat by increasing turbidity and total suspended solids. Accumulation of fine sediment in aquatic substrate can adversely affect fish spawning success and limit habitat suitability for many aquatic invertebrates.

Merced ID proposes to develop an erosion control and restoration plan in consultation with BLM for erosion and restoration actions carried out by Merced ID on or affecting BLM land that is in or adjacent to the project boundary. Merced ID would file the BLM-approved plan with the Commission at least 90 days in advance of initiating construction of recreation or other project facilities. Merced ID indicated that the plan was not included in the license application because Merced ID expected the plan to be specific for work approved by the Commission in any new license issued, which would not be known until the Commission issues a new license and would be specific regarding the construction approach proposed by Merced ID's contractor.

The Water Board includes the following measures pertaining to the protection of water quality and aquatic habitat from erosion and sedimentation in its preliminary WQC conditions:

- Preliminary WQC condition 23: Control measures for erosion, excessive sedimentation and turbidity should be implemented and in place at the commencement of and throughout any ground clearing activities, excavation, or any other project activities that could result in erosion or sediment discharges to surface waters. Erosion control blankets, liners with berms, and/or other erosion control measures should be used for any stockpile of excavated material to control runoff resulting from precipitation, and prevent material from contacting or entering surface waters.
- Preliminary WQC condition 24: Waters should be free of changes in turbidity (due to project activities) that cause nuisance or adversely affect beneficial uses. Increases in turbidity attributable to project controllable water quality factors should not exceed the limits in the Central Valley Basin Plan.

BLM preliminary 4(e) condition 5 is identical to Merced ID's proposed measure. No other entity filed measures pertaining to erosion and sedimentation control.

Our Analysis

Merced ID proposes to rehabilitate and construct new recreation facilities at Lake McClure and McSwain reservoir (see table 3-24 under *Implementation Schedule for Recreation Enhancements*). Such construction is likely to require ground-disturbing activities that if left unchecked, could result in erosion and associated water quality and habitat degradation to the project reservoirs and, potentially, reaches downstream of New Exchequer and McSwain dams. Developing Merced ID's proposed erosion control and restoration plan, in consultation with appropriate agencies, and providing it to the Commission for approval at least 90 days prior to initiating ground-disturbing activities could serve as an effective tool to minimize potential erosion and sedimentation. We recognize that each ground-disturbing activity that may be approved by the Commission

in a new license would require site-specific erosion control measures that consider local topography and soils. Such details are typically incorporated into the final design for ground-disturbing activities. Review and approval of such final designs, including proposed erosion control measures, by agencies and the Commission would provide appropriate oversight of site-specific erosion control techniques.

However, Merced ID provides no details regarding what would be included in its proposed plan for each ground-disturbing activity. Consequently, we have no basis to conclude whether or not this proposed measure would be effective in controlling erosion. An effective erosion control and restoration plan could include the following: (1) a description of BMPs for erosion control that would be applied in specific circumstances; (2) provisions for inspecting erosion control measures while they are in place; (3) emergency protocols for erosion and sedimentation control (e.g., steps that would be taken if control measures fail during a storm event); (4) techniques that would be used to stabilize sites once construction is completed; and (5) a description of when and what type of water quality monitoring of surface waters would occur during and after ground-disturbing activities. Identifying such measures and protocols in the proposed erosion control and restoration plan would assure that erosion does not unacceptably degrade water quality adjacent to construction and other ground-disturbance sites. We note that Merced ID's proposed Vegetation Management Plan (discussed in section 3.3.2.2, *Terrestrial Resources*) includes provisions for identifying and protecting sensitive areas, including riparian zones and wetlands, and revegetation and monitoring of disturbed sites following completion of construction and other ground-disturbing activities.

Any ground-disturbing activity, including non-routine maintenance, has the potential to result in erosion and sedimentation. By replacing its original measure with BLM preliminary 4(e) condition 5, Merced ID has appropriately expanded the scope to include all construction and non-routine maintenance activities that could result in ground disturbance to ensure water quality and aquatic habitat are protected from sedimentation caused from erosion. However, it still would restrict the plan to activities on BLM-managed land. Any project-related ground-disturbing activities have the potential to cause erosion and sedimentation. Consequently, site-specific erosion control plans would be appropriate for activities anywhere within the project boundary, not just on BLM-managed land.

Merced ID proposes to develop its proposed erosion control and restoration plan in consultation with BLM. Erosion has the potential to influence both aquatic and terrestrial resources. Consultation with the Water Board, California DFW, and FWS, in addition to BLM, would provide a reasonable balance of input regarding appropriate erosion control measures.

Protecting Water Quality from Contaminants during Project Construction, Operation, and Maintenance

Construction of new project facilities, modification of existing project facilities, and routine and non-routine maintenance could affect water quality if pollutants (e.g., fuels, lubricants, herbicides, pesticides, and other hazardous materials) are discharged into project waterways.

To minimize potential contamination of project waters, Merced ID proposes to develop a recreation facilities hazardous material spill prevention, control, and countermeasures plan (measure WR1) in consultation with appropriate agencies. Merced ID would file the plan with the Commission, including evidence of consultation, at least 90 days in advance of initiating construction for recreation facilities. Merced ID indicated that the plan was originally not included in the license application because it expected the plan to be specific for work approved by the Commission in any new license issued, which would not be known until the Commission issues a new license, and would be specific regarding the construction approach proposed by Merced ID's contractor.

The Water Board specifies the following measures pertaining to the protection of water quality and aquatic habitat in its preliminary WQC conditions:

- Preliminary WQC condition 25: (1) all imported riprap, rocks, and gravels used for construction within or adjacent to any watercourses should be pre-washed; (2) wash water generated on-site should not contact or enter surface waters; and (3) wash water generated on-site should be contained and disposed of in compliance with state and local laws, ordinances, and regulations.
- Preliminary WQC condition 26: (1) construction material, debris, spoils, soil, silt, sand, bark, slash, sawdust, rubbish, steel, or other inorganic, organic, or earthen material, and any other substances from any project-related activity should be prevented from entering surface waters; (2) all construction debris and trash should be contained and regularly removed from the work area to the staging area during construction activities; and (3) upon project completion, all project-generated debris, building materials, excess material, waste, and trash should be removed from all the project sites for disposal at an authorized landfill or other disposal site in compliance with state and local laws, ordinances, and regulations.
- Preliminary WQC condition 27: (1) no unset cement, concrete, grout, damaged concrete, concrete spoils, or wash water used to clean concrete surfaces should contact or enter surface waters; (2) any area containing wet concrete should be completely bermed and isolated with a berm constructed of sandbags or soil and lined with plastic to prevent seepage; (3) no leachate from truck or grout mixer cleaning stations should percolate into project area soils; (4) concrete trucks or grout mixers should be cleaned so that wash water and associated debris is captured, contained, and disposed of in compliance with

state and local laws, ordinances, and regulations; (5) washout areas should be of sufficient size to completely contain all liquid and waste concrete or grout generated during washout procedures; and (6) hardened concrete or grout should be disposed at an authorized landfill, in compliance with state and local laws, ordinances, and regulations.

- Preliminary WQC condition 28: (1) all equipment should be washed prior to transport to the project site and be free of sediment, debris, and foreign matter; (2) any equipment used in direct contact with surface water should be steam cleaned prior to use; (3) all equipment using gas, oil, hydraulic fluid, or other petroleum products should be inspected for leaks prior to use and monitored for leakage; (4) stationary equipment (e.g., motors, pumps, and generators) should be positioned over drip pans or other types of containment; and (5) spill and containment equipment (e.g., oil spill booms, sorbent pads) should be maintained onsite at all locations where such equipment is used or staged.
- Preliminary WQC condition 29: onsite containment for storage of chemicals classified as hazardous should be away from watercourses and include secondary containment and appropriate management as specified in California Code of Regulations, title 27, section 20320.

Our Analysis

Merced ID proposes to rehabilitate and construct new recreation facilities at Lake McClure and McSwain reservoir (see table 3-24 under *Implementation Schedule for Recreation Enhancements*). Such construction is likely to require the use of on-site hazardous materials and contaminants associated with construction equipment that if left unchecked, could result in water quality and habitat degradation to the project reservoirs and, potentially to reaches downstream of New Exchequer and McSwain dams. Developing Merced ID's proposed site-specific hazardous materials spill prevention, control, and countermeasure plan, in consultation with appropriate agencies, and filing it with the Commission for approval at least 90 days prior to initiating any activities that could lead to water contamination could serve as an effective method for minimizing potential contamination of project waters. We recognize that each construction activity that may be approved by the Commission in a new license would require site-specific contaminant control measures that consider local topography, soils, and the specific equipment that would be used by Merced ID's contractors. Such details are typically incorporated into the final design for activities involving potential water contamination. Review and approval of such final designs, including proposed contaminant control measures, by agencies and the Commission would provide appropriate oversight of site-specific contaminant control techniques.

However, Merced ID provides no details regarding what would be included in its proposed plan for each activity that may involve use of contaminants. Consequently, we have no basis to conclude whether or not this proposed measure would be effective in controlling the release of contaminants. An effective hazardous materials spill

prevention, control, and countermeasure plan could include the following: (1) a description of the BMPs for contaminant control that would be applied in specific circumstances; (2) emergency protocols for spill containment and remediation; (3) the location of emergency cleanup equipment in the event of contaminant release; (4) identification of entities to be contacted in the event of a spill; (5) designated equipment refueling and maintenance areas; (6) provisions requiring equipment to be cleaned and inspected prior to entering a construction site to ensure it is in proper functioning condition; (7) post-spill water quality monitoring protocols to ensure remediation measures are effective; and (8) a listing of applicable local, state, and federal regulations that pertain to prevention of spills and protection of water quality. Identifying such measures and protocols would assure that surface water and groundwater are protected from contaminants.

Any activity, not just those associated with recreation facility construction, involving heavy equipment, including non-routine maintenance, has the potential to release contaminants into project waters. In addition, maintenance of all project facilities typically requires on-site storage and use of hazardous materials. Expanding the scope of site-specific hazardous materials spill prevention, control, and countermeasure plans to all land within the project boundary would assure measures are in place to protect project groundwater and surface water.

Merced ID proposes that its hazardous material spill prevention, control, and countermeasures plan be developed in consultation with appropriate agencies. The agencies to be consulted are not specified. Release of hazardous materials has the potential to influence both aquatic and terrestrial resources. Consultation with the Water Board, California DFW, BLM, and FWS would provide a reasonable balance of input regarding appropriate contaminant control measures.

Determining Water Year Type

Precipitation and runoff patterns vary considerably in the San Joaquin River Basin, and aquatic communities have adapted to these variances. Water management in this region accounts for this variability by establishing water year types that guide water allocation decisions. The water year type determination at the Merced River Project would govern how instream flow releases are adjusted based on meteorological conditions. Several different approaches to establishing water year types have been developed.

Merced ID proposes to implement measure AQR1 (part 3) to determine water year type, following its existing methods to dictate instream flow releases. It would determine water year type beginning within 90 days of license issuance and continuing in subsequent years in February, March, April, and May. Merced ID would calculate a water supply index for the Merced River based on unregulated runoff below Merced Falls (i.e., inflow to Lake McClure) using the same methods currently used for the San Joaquin Valley Water Year Hydrologic Classification (San Joaquin Valley 60-20-20 Index),

which was developed by the Water Board for the San Joaquin River Basin as part of its Bay-Delta regulatory activities (Water Board 2006b). Five water year types would be established within this index: wet, above normal, below normal, dry, and critically dry. The water year types would be calculated as 60 percent of the current year's April through July inflow plus 20 percent of the current year's October through March inflow plus 20 percent of the previous year's index. Merced ID would begin using its proposed approach to determining water year type within 90 days of license issuance. For each year, water year type would initially be established in February and updated in March, April, and May. From May 15 to February 14 of the following year, Merced ID would base water year type on California Department of Water Resources' (California DWR) forecast published in May. Merced ID states that the water-supply indices for February and March would be calculated using the 90 percent exceedance forecast for unregulated runoff and the April and May indices would be calculated using the 75 percent exceedance forecast for unregulated runoff. Additional details on the "Merced 60-20-20 Index" are presented above in section 3.3.1.1, *Affected Environment, Water Quantity, Merced River Project, Water Storage and Hydrology*.

NMFS [10(j) recommendation 1.1A(7)] and California DFW [10(j) recommendation 3A] recommend that Merced ID incorporate the "Hughes method" to determine water year type for instream flow releases. NMFS and California DFW state that Merced ID's approach to water year determination using a 90 percent exceedance forecast for February and March and 75 percent exceedance forecast for April and May creates overly conservative predictions of inflows. California DFW estimates that this would result in drier than actual water year operations being implemented for February and March 40 percent of the time and for April and May, 25 percent of the time. The Hughes method is based on the water year forecast of unimpaired runoff of the Merced River below Merced Falls published near the beginning of each month from February through May in California DWR's Bulletin 120. Unlike the Merced 60-20-20 Index that factors current and past-year conditions, the Hughes method does not rely on carry over storage within Lake McClure. NMFS and California DFW note that the Merced 60-20-20 Index provides a disincentive for water conservation by reducing environmental flows when carry-over storage is low. California DFW recommends that the water year types be defined as having the following numerical breakpoints (in thousands of acre-feet) based on unregulated inflow to Lake McClure reported for water years 1901 to 2012:

- Wet: $\geq 1,307$ (75th percentile of record)
- Above normal: > 919 (median) and $< 1,307$
- Below normal: > 546 (25th percentile) and ≤ 919
- Dry: > 339 (5th percentile) and ≤ 546
- Critical: ≤ 339

California DFW also recommends that Merced ID perform an update to the water year type determination at the end of the water year using California DWR's "October

update,” which, if published, uses observed monthly unregulated runoff for the river rather than forecasted runoff.

FWS [amended 10(j) recommendation 3(A1)] recommends that water year type be determined using the Merced 60-20-20 Index, but provides no background for this recommendation. The Conservation Groups recommend that Merced ID determine water year types based on the Merced 60-20-20 Index as proposed in measure AQR1, with one change. They recommend that Merced ID determine water year type for February through May based on 75 percent exceedance forecasts instead of the more conservative 90 percent exceedance forecast for February and March proposed by Merced ID, for which they state is more appropriately reserved for short-term drought management. The Conservation Groups agree that including the previous year’s conditions and an index specific to the Merced River “...have strong arguments in their favor,” although they consider the Merced 60-20-20 Index to be more conservative than the Hughes method.

Our Analysis

As defined by California DWR, the Merced River Watershed is part of the San Joaquin Valley hydrologic region. The water year classification within this region is based on the sum of unregulated (unimpaired) flow at: Stanislaus River below Goodwin reservoir (i.e., inflow to New Melones reservoir), Tuolumne River below La Grange (i.e., inflow to New Don Pedro reservoir), Merced River below Merced Falls (i.e., inflow to Lake McClure), and San Joaquin River inflow to Millerton Lake). The San Joaquin Valley water year classification by numerical breakpoints is presented in table 3-8.

Adopting the Merced 60-20-20 Index water-year type classification proposed by Merced ID under measure AQR1 (table 3-8) and recommended by FWS, rather than the classification values used for the regionally broader San Joaquin Valley 60-20-20 Index, accounts for the unique hydrology of the Merced River Watershed, which typically receives less precipitation than the Tuolumne and Stanislaus Watersheds to the north. The numerical breakpoints selected by Merced ID for its proposed classification are based on the more recent portion of the unregulated runoff record. In contrast, California DFW’s recommended breakpoints (table 3-8) are based on a time period more than double that considered by Merced ID (1901–2012). California DFW’s longer view of the hydrologic record encompasses many more representative wet and dry cycles, which results in higher value numerical breakpoints for the non-dry years compared with the values used for Merced ID’s breakpoints. California DFW and NMFS state that this approach would result in about half of all water years being classified as above normal, with the other half being classified as being below normal. In its license application, Merced ID does not present the proportional distribution of above normal and below normal water years in the historic record using its proposed numerical breakpoint system.

Table 3-8. Comparison of alternative water-year type classifications.

Water year type	San Joaquin Valley 60-20-20 Index Classification^a	Merced ID's Proposed Merced 60-20-20 Index Classification	California DFW's Recommended Classification (Hughes Method)
	(in thousands acre-feet)		
Wet	>3,800	>650	>1,307
Above Normal	>3,100 and <3,800	>530 and <650	>919 and <1,307
Below Normal	>2,500 and <3,100	>420 and <530	>546 and <919
Dry	>2,100 and <2,500	>360 and <420	>339 and <546
Critical	<2,100	<360	<339

^a Source: Water Board 2006b.

Merced ID's proposal and NMFS and California DFW's recommendation to base water year type on California DWR's forecast of unregulated runoff of the Merced River would both follow an accepted approach implemented in similar watersheds contributing to the San Joaquin and Sacramento Valleys. The agencies and the Conservation Groups agree in their comments that the Merced 60-20-20 Index as proposed by Merced ID would result in more conservative water-year type estimates than would the Hughes method. Specifically, calculation of the February and March indices and the April and May indices using California DWR's 90 and 75 percent exceedance forecasts, respectively, instead of the median (50 percent exceedance) forecast would produce lower runoff estimates that are biased towards ascribing below normal conditions. Additionally, incorporating updated, observed unregulated runoff volumes published by California DWR in October, when available, would improve water year type determination throughout the water year and into the subsequent one compared with the forecast-based determination proposed in AQR1.

Based on our analysis, adoption of the water year type determination recommendations of NMFS and California DFW would accomplish the following: (1) continued adherence to the California DWR's forecasts for annual unregulated runoff in the Merced River during February, March, April, and May, (2) incorporation of updated observed runoff (full natural flows), when available, rather than complete reliance on forecast-based water year type, and (3) use of type classifications (numerical breakpoints) based on a quartile-based distribution of the full hydrologic record for the watershed. This measure would be potentially subject to adjustment following any future update to the Bay-Delta Plan by the Water Board or to environmental flow programs informed by a technical advisory committee.

Minimum Instream Flows

Merced ID proposes to implement measure AQR1 to (1) provide minimum and target streamflows downstream of the project to Shaffer Bridge (tables 3-9 and 3-10), (2) compute water-year types, and (3) monitor instream-flow compliance. Merced ID's proposed minimum streamflows, which are defined as required streamflows depending on water-year type, would be maintained at all times. Merced ID's proposed target streamflows, which are greater than the proposed minimum streamflows, would be maintained in good faith. Both the minimum and target streamflows would be monitored by Merced ID at Shaffer Bridge. Flow measurements and compliance determinations would be based on instantaneous (i.e., 15-minute recordings) and mean daily recordings for minimum and target streamflows, respectively. For compliance purposes, the instantaneous minimum flow in any day would be at least 90 percent of the designated minimum flow for that day. Failure to satisfy a target streamflow would not be reportable to the Commission, unless the deviation occurs on more than 20 percent of the days in any one calendar month.

Both the minimum and target streamflow measures proposed by Merced ID would be subject to temporary modification if required by equipment malfunction, in emergencies, or during events outside of Merced ID's control. Merced ID would make all reasonable efforts to promptly resume performance of the flow requirements within 48 hours of the modification. Where facility modification is required to implement the efficient release of minimum and target streamflows, Merced ID would submit applications for permits within 1 year after license issuance and complete the facility modifications as soon as reasonably practicable, but no later than 2 years after receipt of all required permits and approvals. Prior to completion of such required facility modifications and within 90 days after license issuance, Merced ID would make a good faith effort to provide the specified minimum and target streamflows within the capabilities of the existing facilities.

The Water Board [preliminary WQC condition 2] reserves its right to condition the project with minimum instream flows in light of the whole record, but does not specify a minimum flow. The Water Board considers the whole record to include, but not be limited to, the Commission's record (i.e., recommendations by the resource agencies), the final EIS document, and the final California Environmental Quality Act document.

Table 3-9. Proposed and recommended minimum and target flows (cfs) by water year type during the irrigation season (March through October) as measured at Shaffer Bridge (Source: staff).

Entity	Wet	Above Normal	Below Normal	Dry	Critically Dry
Merced ID (minimum)					
March-May	120	120	120	120	80
June-Oct 15	160	120	60	60	40
Oct 16-Oct 31	180	160	140	100	80
Merced ID (target)					
March-May	150	150	150	150	100
June-Oct 15	200	150	75	75	50
Oct 16-Oct 31	225	200	175	125	100
NMFS (minimum without fish passage)					
Mar 1-15	500	450	300	225	200
Mar 16-31	550	500	300	225	200
Apr 1-15	600	600	400	250	200
Apr 16-30	800	700	400	250	200
May 1-15	1,200	1,000	600	250	200
May 16-31	1,000	800	400	350	350
June 1-15	800	600	350	350	350
June 16-Sep 15	500	450	350	350	350
Sep 16-Oct 15	250	250	200	200	200
Oct 16-Oct 31	200	200	200	150	150

Entity	Wet	Above Normal	Below Normal	Dry	Critically Dry
FWS (target)a					
Mar	248-1,146	248-1,146	248-1,146	248-1,146	248-877
Apr	1,176-2,044	150-1,176	125-1,176	125-646	125
May	2,074-2,972	150-160	150-160	150-160	150-160
June	225-2,472	225	225	225	225
July	340-350	340-350	340-350	340-350	340-350
Aug	320-330	320-330	320-330	320-330	320-330
Sep	280-320	280-320	280-320	280-320	280-320
Oct 1-15	180	180	180	100	100
Oct 16-19	1,200	1,200	1,200	1,200	1,200
Oct 20-25	1,200	1,200	1,200	100	100
Oct 26-31	175	175	125	100	100
California DFW (minimum)					
Mar 1-15	270	270	270	240	200
Mar 16-31	410	410	370	370	310
Apr 1-15	590	590	620	510	560
Apr 16-30	790	790	780	570	570
May 1-15	1,140	1,140	1,190	870	1,040
May 16-31	1,580	1,580	2,060	1,420	200
June 1-15	2,330	2,330	200	200	200
June 16-30	200	200	200	200	200
Jul-Oct 15	200	200	200	200	200

Entity	Wet	Above Normal	Below Normal	Dry	Critically Dry
Oct 16-Oct 31	275	250	225	150	140
Conservation Groups (minimum)					
Mar-June	60% of unregulated (1,520-2,905 cfs) ^b or 220 cfs, whichever is higher; irrigation deliveries 75% of demand	60% of unregulated (347–980 cfs) or 220 cfs, whichever is higher; irrigation deliveries 75% of demand			Irrigation deliveries 50% of demand but 40% if preceded by a critically dry year and 30% if storage in Lake McClure is less than 200,000 acre-feet on April 1
Mar-May			60% of unregulated (980–1,629 cfs) or 220 cfs, whichever is higher; irrigation deliveries 75% of demand		180
Mar-Apr				60% of unregulated (672–1,130 cfs) or 180 cfs, whichever is higher; irrigation deliveries 60% of demand	
May-June				180	
June			220		
July-Oct	200	200	175	150	150

^a FWS target flows reflect amended flow recommendations, filed with the Commission on October 22, 2014.

^b To provide an approximation of the flows associated with 60 percent unregulated flows, we used the inflows to Lake McClure shown in table 3-1 with the 20 percent exceedance representing wet water years, the 50 percent exceedance representing above and below normal water years, and the 80 percent exceedance representing dry and critically dry water years. Actual values would vary from these approximations.

Table 3-10. Proposed and recommended minimum and target flows (cfs) by water year type during non-irrigation season (November-February) as measured at Shaffer Bridge (Source: staff).

Agency	Wet	Above Normal	Below Normal	Dry	Critically Dry
Merced ID (minimum)					
Nov-Jan	180	160	140	100	80
Feb	120	120	120	120	80
Merced ID (target)					
Nov-Jan	225	200	175	125	100
Feb	150	150	150	150	100
NMFS (minimum without fish passage)					
Nov-Jan	200	200	200	200	200
Feb 1-14	400	350	300	200	200
Feb 15-28	450	400	300	200	200
FWS (target)^a					
Nov-Feb	175	175	125	100	100
California DFW (minimum)					
Nov-Jan 15	275	250	225	150	140
Jan 16-Feb	400	400	400	400	400

Agency	Wet	Above Normal	Below Normal	Dry	Critically Dry
Conservation Groups (minimum)					
Nov-Jan	220	220	220	180	180
Feb	60% of unregulated (1,235 cfs) ^a or 220 cfs, whichever is higher; irrigation deliveries 75% of demand	60% of unregulated (445 cfs) or 220 cfs, whichever is higher; irrigation deliveries 75% of demand	220; irrigation deliveries 75% of demand	180; irrigation deliveries 60% of demand	180; irrigation deliveries 50% of demand but 40% if preceded by a critically dry year

^a FWS target flows reflect amended flow recommendations, filed with the Commission on October 22, 2014.

^b To provide an approximation of the flows associated with 60 percent unregulated flows, we used the inflows to Lake McClure shown in table 3-1 with the 20 percent exceedance representing wet water years, the 50 percent exceedance representing above and below normal water years, and the 80 percent exceedance representing dry and critically dry water years. Actual values would vary from these approximations.

NMFS [10(j) recommendation 1.1A(1)] recommends that Merced ID provide minimum instream flows, as measured at Shaffer Bridge, by dates and water year type following one of two flow schedules. The flow schedules both range between 150 and 1,200 cfs depending on time period and water year type, but differ depending on whether Merced ID provides fish passage at Crocker-Huffman diversion dam—higher flows are recommended between late spring and late summer for the fish-passage scenario in all water year types (tables 3-9 and 3-10 for the no-fish passage recommended flows). NMFS [10(j) recommendation 1.1A(5)] and the Conservation Groups both recommend that required flow releases made by Merced ID at Crocker-Huffman diversion dam for Cowell Agreement diversions would be in addition to the minimum flow requirements (see section 2.1.1.5, *Existing Environmental Measures*).

FWS [amended 10(j) recommendation 3(A1)] recommends that Merced ID provide instream flow targets, as measured at Shaffer Bridge, by day and water year type (tables 3-9 and 3-10).²⁶ The recommended flows, which include pulse flows and other recommended flow changes, range from 100 to 2,972 cfs. A technical advisory committee would have the ability to modify the timing of the flow releases as necessary.

California DFW [10(j) recommendation 3B(a)] recommends that Merced ID provide a minimum flow of 25 cfs below New Exchequer dam at all times. It also recommends that Merced ID provide an instantaneous minimum flow, as measured at Shaffer Bridge, between 140 and 2,600 cfs depending on date and water year type (tables 3-9 and 3-10). Embedded in this minimum flow recommendation are extended late spring pulse flows intended to stimulate salmonid outmigration prior to high temperature summer conditions. During periods of drought, Merced ID would notify the resource agencies by March 10 of any potential concerns related to meeting the recommended flow releases, provide the Commission with any comments provided by the resource agencies, and implement revised operations upon receiving Commission and all other necessary regulatory approvals.

The Conservation Groups recommend that Merced ID provide minimum instream flows ranging from at least 150 to 220 cfs, as measured at Shaffer Bridge, according to time periods, water year type, and reservoir levels (tables 3-9 and 3-10). The recommendation also includes various irrigation delivery percentages that would depend on water year type ranging from 30 to 75 percent of demand. The instream flow requirement at Shaffer Bridge would drop to 100 cfs in all months until 130,000 acre-feet of storage at Lake McClure is re-established. Flows would be released as a percent of unregulated flow as applicable, with no 5 day running average being less than 50 percent of unregulated flow, and no 14-day running average being less than 60 percent of unregulated inflow to Lake McClure. As we indicate in tables 3-9 and 3-10, when the 60

²⁶ FWS does not define “flow targets,” or how they may differ from minimum flows.

percent of unregulated inflow criteria is applied from February through June, the minimum flows would range from about 347 to 2,905 cfs.

NMFS [10(j) recommendation 1.1B(1–4)] recommends that the minimum instream flow compliance point would be at a new river gage at Shaffer Bridge capable of measuring flows up to 6,000 cfs.²⁷ Measurement methodology and compliance standards at all existing and new gages would follow guidelines specified in NMFS’ recommendation.

Our Analysis

Release of minimum or target instream flows to the lower river influences aquatic habitat availability and water temperatures. Merced ID developed a simulated flow scenario for water years 1970–2006 based on existing baseline conditions, the proposed measure (AQR1), and each of the flow recommendations using the project relicensing operations model. Simulated flow at Shaffer Bridge (RM 32.8) was used as a comparison point to evaluate flow conditions in the Merced River from downstream of Crocker-Huffman diversion dam, which include both the irrigation season (March through October) and the non-irrigation season (November through February).

Tables 3-9 and 3-10 clearly show that the proposed and recommended minimum and target flow regimes are all substantially different. Balancing the different resource values associated with each flow regime represents a complex series of tradeoffs (e.g., enhancing temperature conditions for specific fish species and lifestages with the limited amount of cold pool water in Lake McClure, enhancing physical habitat for specific life stages of anadromous fish, providing flows that encourage juvenile outmigration because the temperature regime is unlikely to be favorable, and conserving water for irrigation purposes) to derive a reasonable flow regime.

The proposed measure (AQR1) is generally consistent with baseline conditions throughout the period of record. In most instances, large flood control releases that occur with similar timing and magnitude under the baseline and proposed measure either do not occur, occur with lower magnitude, or occur at different times under the other flow recommendations.

Flow recommendations by NMFS result in consistently higher flows during summer months in each year compared to baseline conditions. The FWS and California DFW flow recommendations result in consistently higher flows during most months of most years compared to baseline conditions. Although the Water Board did not specify a flow regime in its preliminary WQC condition, the Water Board’s potential flow

²⁷ Although not explicitly stated in the recommendation, we assume NMFS intended Merced ID to be responsible for installing and maintaining this new gage at Shaffer Bridge.

requirements²⁸ would be generally higher than baseline conditions during the spring and early summer and lower during fall and winter. Flow recommendations by the Conservation Groups result in generally higher flows in most years, with a variable pattern of spring flows associated with flow releases based on a percentage of unregulated flow.

Merced ID evaluated habitat availability for anadromous salmonids, including Central Valley steelhead and fall-run Chinook salmon in the Merced River downstream of Crocker-Huffman diversion dam based on an Effective Habitat Analysis that included results from PHABSIM model output for various life stages in conjunction with output from the project relicensing operations and water temperature models. Results were developed to show the percent of habitat that becomes unavailable based on thermal requirements of various species and life stages as defined by EPA (2003) guidelines. This analysis was performed using existing minimum instream flow requirements as baseline conditions and included minimum instream flows proposed by Merced ID along with flows referred to in comments by the Water Board and flow recommendations by NMFS, FWS, California DFW, and the Conservation Groups.

Table 3-11 presents the percentage of maximum habitat that is unavailable under existing baseline conditions and for the proposed and recommended flow regimes. The modeling results shown in table 3-11 show variable habitat availability by flow regime and modeled life stage for Central Valley steelhead and fall run Chinook salmon. The results indicate that conditions for Central Valley steelhead juvenile rearing using the EPA (2003) guideline of 16.0°C (60.8°F) are currently the most affected, especially during the summer, and that these conditions remain largely unchanged under all flows analyzed.

Results of the Effective Habitat Analysis indicated that implementation of Merced ID's proposed, FWS' amended, or NMFS' recommended flow regimes would not result in any tangible enhancements (i.e., effective habitat would increase by 4 percent or less) to anadromous salmonid habitat compared to baseline conditions. Merced ID's and FWS' amended flow regimes increase the amount of unavailable habitat for steelhead spawning and incubation by 5 percent compared to existing conditions. Increases in unavailable habitat of 8 percent and 5 percent for Chinook salmon spawning and incubation would result from implementation of the Water Board and FWS flow regimes, respectively.

²⁸ Based on a Water Board comment in its Draft Bay-Delta Draft Substitute Environmental Document, the Water Board's potential flow requirements for the project would be 35 percent of unimpaired flow from February through June annually and baseline conditions for the remaining months.

[illegible]

			Percent of Habitat that is Unavailable over the Life Stage Period (expressed as % of the maximum)						
Species	Life Stage	Life Stage Timing	Environmental Baseline	Merced ID Proposed	Water Board ^a	Conservation Groups	FWS (amended)	NMFS	California DFW
Fall-run Chinook Salmon	Spawning and egg incubation	October through March	60%	64%	68%	62%	65%	64%	62%
	Fry rearing	January through May	63%	62%	58%	56%	60%	62%	57%
	Juvenile rearing	January through May	65%	64%	60%	59%	61%	61%	59%

^a Water Board results are based on a flow scenario developed by Merced ID that incorporates 35 percent of unimpaired flow from February through June annually and baseline conditions for remaining months as provided by a Water Board comment reflecting potential flow requirements released in the Water Board's Draft Bay-Delta Draft Substitute Environmental Document.

^b EPA (2003) guidelines designate a 16.0°C (60.8°F) threshold for “core” juvenile salmonid populations defined as moderate to high density.

^c EPA (2003) guidelines designate an 18.0°C (64.4°F) threshold for “non-core” juvenile salmonid populations defined as moderate to low density.

The greatest habitat enhancement when compared to existing conditions (and Merced ID's proposed flow regime) is evident for steelhead fry rearing under California DFW's flow regime, when unavailable habitat decreases from 70 percent to 54 percent during the spring. Lesser enhancements would also be achieved by the Conservation Groups' (58 percent unavailable habitat for steelhead fry rearing) and Water Board's (61 percent unavailable habitat for steelhead fry rearing) recommended flow regimes. Other reductions of from 5 to 7 percent in unavailable habitat (an enhancement) for Chinook salmon fry and juvenile rearing would be achieved by the Water Board's, Conservation Groups', and California DFW's suggested or recommended flow regimes.

Not reported in table 3-11 are the effects of each flow regime on the availability of the remaining water for irrigation purposes. Based on Merced ID's modeling, its proposed flows would result in reduced canal deliveries compared to irrigation demand in 6 of the 36 years modeled, which is the same as existing conditions. The FWS' recommended and Water Board's suggested flow regimes would result in reduced canal deliveries in 12 of 36 years; NMFS' recommended flows would result in reduced canal deliveries in 19 of 36 years; California DFW's recommended flows would result in reduced canal deliveries in 22 of 36 years, and the Conservation Groups' recommended flow regime would result in reduced canal deliveries in all 36 years that were modeled.

We consider the approach to establishing an appropriate minimum flow regime presented in the California DFW rationale document for its 10(j) recommendations (California DFW, 2014a) to be a reasonable framework on which to build a minimum flow regime compared to approaches provided by FWS, NMFS, and the Conservation Groups. California DFW provides significant detail (12 pages) on its recommended flows for the entire year. FWS and NMFS' rationale does not cover the entire year, and the Conservation Groups embed irrigation restrictions into most of its flow recommendations. The California DFW flow regime seeks to: (1) enhance physical Chinook salmon spawning and incubation habit during late fall and early winter when water temperatures are not overly constraining; (2) consider density-dependent variables as fry emerge from spawning gravel in late January through February; (3) enhance water temperatures for smoltification during the spring; and (4) provide reasonable physical habitat for *O. mykiss* juveniles and adults during the summer.

The California DFW recommended flow regime from October 16 through January 15 is intended to enhance Chinook salmon spawning and incubation habitat (California DFW, 2014a). California DFW's recommended minimum flows during this time for wet, above normal, and below normal water years (225 to 275 cfs) would provide about 80 to 100 percent of the maximum WUA, depending on the specific reach between Crocker-Huffman diversion dam and Shaffer Bridge (Merced ID, 2013a). However, providing a minimum flow of 175 cfs during wet and above normal water years (which is the same as the FWS recommended target flow from October 16 through February 28 and comparable to Merced ID's proposed 180 and 160 cfs during wet and above normal water years from October 16 through January 31) would provide about 73 to 96 percent of maximum WUA and conserve Lake McClure water for use later in the year compared to

the higher minimum flows during comparable water years recommended by NMFS, California DFW, and the Conservation Groups. The California DFW recommended minimum flows of 150 and 140 cfs during dry and critically dry water years would provide about 67 to 85 percent and 65 to 80 percent of the maximum WUA, respectively, and we consider this to be a reasonable enhancement when water is scarce. Applying the 150 cfs minimum flow to below normal water years, which we also consider to be representative of relatively scarce available water, would also represent a reasonable enhancement compared to existing conditions. Merced ID's proposed minimum flow from October 16 through January of 100 and 80 cfs during dry and critically dry water years would only provide 48 to 55 percent and less than 37 percent of the maximum WUA, respectively. Although this would represent an enhancement compared to the existing 60 cfs minimum flow, it would be unlikely for such a minor increase in potential Chinook salmon spawning and incubation habitat to result in tangible biological benefits to the community in the Merced River.

California DFW presents data that indicates that upon emergence, Chinook salmon fry survival is density dependent, with lower survival rates associated with higher densities (California DFW, 2014a). Increasing flows reduce density and enhance survival. Survival of newly emerged fry between January 16 and the end of February would be between 60 and 100 percent for initial fry densities of 1,000,000 to 100,000, respectively, with flows of 400 cfs. This is the basis for the California DFW recommended minimum flow of 400 cfs during this period, regardless of water year type. Considering that minimum flows that would support spawning and incubation would be scaled back by most proposed and recommended flow regimes during less than wet water year types, we consider it appropriate to scale back the initial recommended flow of 400 cfs accordingly to conserve Lake McClure water for later use. Flows of 350 and 300 cfs during above normal and below normal water years, respectively, would still provide from about 98 to 100 percent fry survival assuming a starting density of 100,000 fry (which we consider a reasonable assumption because of the low escapement of Chinook salmon of natural origin during recent years; see figure 3-22). These minimum flows are consistent with the recommended NMFS minimum flows for the first half of February in above normal and wet water years and exceed the Merced ID proposed and FWS recommended minimum flows for January and February. Continuing the California DFW recommended late fall-early winter minimum flow of 150 and 140 cfs during dry and critically dry water years from mid-January to the end of February would provide about 92 and 91 percent fry survival, respectively, assuming a starting density of 100,000 fry. We consider this to represent a reasonable enhancement that would conserve water for later use when water is scarce.

During March and April, the California DFW minimum flow regime focuses on attempting to achieve the EPA temperature guideline of 16°C (60.8°F) for Chinook salmon and steelhead rearing and emigration (California DFW, 2014a). During wet and above normal water years, the recommended minimum flows achieve this objective from the Crocker-Huffman diversion dam to Shaffer Bridge, but in below normal water years,

the California DFW minimum flow modeling results show the goal would be achieved down to RM 38, in dry water years to RM 45, and critically dry water years to RM 46.5 (about 3.5 miles downstream of the diversion dam). The reach from Crocker-Huffman diversion dam to RM 45.0 currently includes some of the best salmonid spawning and rearing habitat in the lower Merced River. However, we find two flows recommended by California DFW to be unnecessary. During the April 1 through April 15 time frame, a higher minimum flow of 620 cfs would not be necessary during below normal water years to achieve the EPA guideline of 16°C (60.8°F) at RM 38.0 considering that a minimum flow of 590 cfs would achieve the guideline downstream to Shaffer Bridge (RM 32.5). For other 2-week periods during March and April, California DFW modeling shows that decreasing minimum flows as water years become drier would achieve the temperature goal at the designated river locations. Similarly, during April 1 through April 15, the California DFW recommended flow of 560 cfs during critically dry water years is not necessary to achieve the temperature goal at RM 46.5 considering that a minimum flow of 510 cfs would achieve the goal down to RM 45.0. We find that minimum flows of 560, 560, and 510 cfs during below normal, dry, and critically dry water years, respectively, from April 1 through April 15, would likely achieve appropriate water temperature enhancements comparable to the California DFW analogous flows of 620, 510, and 560 cfs, while conserving water during below normal and critically dry water years. Monitoring water temperature would confirm our findings. We further discuss water temperature in the following section, *Managing and Monitoring Water Temperatures*. NMFS and the Conservation Groups' minimum flow regimes during March and April are generally higher than those recommended by California DFW, and although higher flows could further enhance the lower Merced River temperature regime, it would come at the cost of reduced water storage in Lake McClure, which means that there would be less water available during the irrigation season and reduced cold pool water for late spring temperature enhancement.

During May, most stakeholders recommend a pulse flow or high minimum flows that would inundate riparian floodplains and serve to stimulate young salmonid outmigration. The FWS target flow recommendation would inundate floodplains for 69 days from late March through early June in wet water years, 27 days in late March through mid-April in above normal water years, 12 days in late March through early April in below normal water years, and 5 days in late March during dry water years. These high spring flows are discussed under *Pulse Flows*; however, during any such pulse or high flow releases, there would likely be water temperature enhancements in the lower Merced River unless the cold pool storage in Lake McClure had been expended during previous flow releases. Extending the California DFW recommended minimum flows for the April 16 through April 30 time frame into May until the beginning of a spring pulse flow would maintain any enhanced temperature condition if there is sufficient cold pool storage available.

With the relatively high spring minimum flows described previously, we expect there to be little if any Lake McClure cold pool water available to provide temperature

enhancements to the lower Merced River during the summer. Assuming most Chinook salmon juveniles and smolt emigrate from the lower Merced River with a spring pulse flow, we focus on flows that provide suitable physical habitat for *O. mykiss* juveniles and adults, some of which are likely to remain in the lower Merced River throughout the summer. A minimum flow of 200 cfs that begins at the conclusion of a spring pulse flow (which we assume would be on June 1) and continues until October 15 or the start of a fall adult Chinook salmon attraction pulse flow would provide 90 to 98 percent of the maximum WUA for juvenile and adult *O. mykiss* (Merced ID, 2013a). This summer minimum flow is recommended by California DFW and comparable to the minimum flows recommended by the Conservation Groups. However it is lower than most of the minimum or target flows recommended by NMFS and FWS. It is unclear what additional habitat value higher summer minimum or target flows would provide, and higher flows would further deplete water storage in Lake McClure.

As stated previously in this section, establishing an appropriate minimum flow regime in the lower Merced River entails attempting to balance habitat values with the water demands of irrigators. This is especially difficult when the supply of available water is limited during dry or critically dry water years. In recognition of this, we conclude that a reasonable guiding principal in establishing an appropriate minimum flow during dry or critically dry water years would be to have no minimum flow exceed the average monthly unregulated flow (table 3-12). These represent the flows that would occur without the Merced River or Merced Falls Projects.

The minimum flow compliance point in the current license is an existing gage at Shaffer Bridge. The reach upstream of Shaffer Bridge to Crocker-Huffman diversion dam currently includes the best spawning and rearing habitat for fall run Chinook salmon, as well as numerous water diversion points. Therefore, we consider Shaffer Bridge to be an appropriate compliance point for a minimum flow regime because protective flows would be in the channel regardless of diversions that may occur upstream of Shaffer Bridge, including those associated with the Cowell Agreement. NMFS does not elaborate on why a new compliance gage capable of measuring up to 6,000 cfs would be necessary to measure project-related flows. No entity has offered a flow-related measure with a maximum flow provision.

California DFW [10(j) recommendation 3B(a)] recommends that Merced ID provide a minimum flow of 25 cfs below New Exchequer dam at all times. This is identical to what is required by article 40 of the current license. Merced ID contends that McSwain reservoir backs up to New Exchequer dam and there is no need for an instream flow requirement. However, although McSwain reservoir may back up to the base of New Exchequer dam when McSwain reservoir is at full pool, this is likely not the case when McSwain reservoir is drawn down, which figures 3-3, 3-5, and 3-7 show occurs during typical wet, normal, and dry water years. During drawdowns, a short riverine section exists and releasing a minimum flow of 25 cfs would ensure that this channel is not dewatered.

Table 3-12. Average monthly unregulated flow by year type (cfs) (Source: Merced ID, 2014a).

	Wet	Above Normal	Below Normal	Dry	Critically Dry
October	180	240	130	100	120
November	430	540	370	220	130
December	900	900	640	340	190
January	2,700	1,200	1,300	390	220
February	2,900	2,100	850	560	470
March	3,200	1,700	1,200	1,000	1,000
April	3,500	2,300	1,700	2,200	1,600
May	5,900	5,100	3,600	3,000	1,800
June	5,400	2,500	2,700	1,000	900
July	2,300	600	570	220	230
August	560	230	150	70	60
September	320	130	90	60	60

Managing and Monitoring Water Temperatures

The water quality objective for temperature in the Basin Plan specifies, “*at no time or place shall the temperature of any COLD water be increased by more than 5°F above natural receiving water temperature.*” Water temperatures at Crocker-Huffman diversion dam generally range from approximately 8.0 to 17.0°C (46.4 to 62.6°F) annually during both wet and dry water year types (see figures 3-21 and 3-22). The lower Merced River is listed under CWA section 303(d) as impaired for temperature. Under current conditions, warm water temperatures reduce habitat suitability for Chinook salmon and steelhead downstream of Crocker-Huffman diversion dam, particularly for spawning. Temperatures in this reach exceeded thresholds for Chinook salmon spawning 100 percent of the time in September and October, resulting in no suitable spawning habitat. During November, the peak month for fall-run Chinook salmon spawning, suitable temperatures occurred only 10 to 14 percent of the time, with 86 to 90 percent of spawning habitat unsuitable because of high water temperatures. Temperature thresholds for steelhead spawning during March and April were exceeded about 50 percent of the time. NMFS considers *O. mykiss* in the Merced River downstream of Crocker-Huffman diversion dam to belong to the California Central Valley steelhead DPS, which is federally listed as threatened. Critical habitat includes the Merced River downstream from Crocker-Huffman diversion dam.

Based on Merced ID's modeling studies, the Merced River Project affects water temperatures in the main channel of the lower Merced River from Crocker-Huffman diversion dam (RM 52.0) downstream to Shaffer Bridge during the off-irrigation season (November through February). During the irrigation season, the project and other disturbances to the channel (e.g., diversions and agricultural return) contribute to cumulative increases in water temperature. Merced ID proposes to implement water temperature monitoring (T&E1) at four locations (determined by a technical advisory committee) from Crocker-Huffman diversion dam to Shaffer Bridge.

The Water Board [preliminary WQC condition 19] specifies that Merced ID develop a water temperature monitoring plan in consultation with a technical advisory committee that includes provisions for the installation of four to eight water temperature monitoring devices. The plan would include: (1) a statement of goals and objectives; (2) a description of monitoring protocols; (3) a description of factors that may affect water temperature and identification of the ones that are project-related; (4) monitoring and reporting schedules; and (5) a plan for corrective actions if data indicate that project operations are increasing water temperature. The Water Board [preliminary WQC condition 8] also specifies that Merced ID develop a fish passage or habitat restoration plan in consultation with a technical advisory committee. We address fish passage in a separate subsection. The habitat restoration plan would be developed within 1 year of license issuance and designed to decrease water temperatures in and downstream of the project.

NMFS [10(j) recommendation 8] recommends that water temperature and flows be measured at 10 locations ranging from RM 62.0 to a location between Shaffer Bridge and the confluence with the San Joaquin River. NMFS states that measuring flow at temperature monitoring stations is important because temperature is related to flow and having both would better enable interpretation of the monitoring results given the many diversions that occur in the lower Merced River.

FWS [10(j) recommendation 5(j)] recommends that Merced ID continuously monitor water temperature at about 5-mile intervals between New Exchequer dam (RM 62.0) and Shaffer Bridge (RM 32.8), which would include six locations. FWS [10(j) recommendations 3(A3) and 5 (G and H)] also recommends that Merced ID conduct a riparian microclimate study and collect data for calibrating a HEC-5Q water temperature model analysis to determine the optimum length and width of riparian forest in the 10 miles from Merced Falls dam to a point 1.2 miles downstream of the Snelling Road Bridge needed to achieve temperature objectives downstream of Crocker-Huffman diversion dam.

California DFW [10(j) recommendation 9(7)] recommends that Merced ID include in an overall monitoring plan (other parameters would also be included in this plan) provisions for continuously monitoring water temperature at RMs 62.0, 56.0, 52.0 (below Crocker-Huffman diversion dam), 46.5, 45.0, 42.0, 38.0, and 32.8 (Shaffer Bridge).

NMFS, California DFW, and FWS recommend increasing flow releases to maintain the following 7-day average of daily maximums (7DADM) water temperature criteria downstream of Crocker-Huffman diversion dam:

- NMFS [10(j) recommendation 1.1A(3a)] recommends maintaining a 7DADM water temperature of <18.0°C (64.4°F) at the Highway 59 bridge (RM 42.0).
- California DFW [10(j) recommendation 3C] recommends maintaining a 7DADM from January to February 14 of 13.0°C (55.4°F) at Shaffer Bridge (RM 32.8) during wet and above normal water years, RM 38.0 in below normal water years, RM 45.0 in dry water years, and 46.5 (Snelling) in critically dry water years. From February 15 through June 15, California DFW recommends maintaining a 7DADM of 16.0°C (60.8°F) at Shaffer Bridge in wet and above normal water years; from February 15 through May 31 at 16.0°C (60.8°F) at RM 38.0 in below normal water years and RM 45.0 in dry water years; and from February 15 through May 15 at 16.0°C (60.8°F) at RM 46.5 (Snelling) in critically dry water years. California DFW's recommended flow regime is designed to meet these temperature criteria, but it states that during unusual meteorological conditions, it may be necessary to release additional flows to meet the recommended criteria.
- FWS [amended 10(j) recommendation 3(A1a)] recommends maintaining a 7DADM of <18.0°C (64.4°F) at Snelling Bridge (RM 46.5) from April 1 to October 31 to the extent possible.

NMFS [10(j) recommendation 1.1A(3c)] recommends developing a long-term water temperature improvement plan that includes a feasibility study of potential options for decreasing water temperature downstream of Crocker-Huffman diversion dam, including: (1) installing an underground pipe for New Exchequer dam that bypasses McSwain reservoir and/or Merced Falls reservoir; (2) modifying the McClure outlet structure to allow water withdrawal from varying depths; and (3) developing engineering alternatives that do not require large volumes of water.

California DFW [10(j) recommendation 4] also recommends that Merced ID prepare a long-term water temperature management plan. The plan would include: (1) developing a long term strategy for meeting seasonal temperature objectives for Chinook salmon and *O. mykiss* ranging from 13.0°C (55.4°F) to 18.0°C (64.4°F) during the time frames included in the recommendation; (2) a feasibility study on submerged pipes capable of delivering at least 200 cfs to a location downstream of Crocker-Huffman diversion dam; (3) measures to prolong and stabilize the irrigation delivery season; (4) measures to restore the natural channel morphology, floodplain habitats, and riparian forest in the approximately 10-mile reach downstream of Crocker-Huffman diversion dam; (5) provisions to provide coldwater refugia when water temperatures exceed objectives for more than 14 days; and (6) evaluating the effects on instream flow releases

of implementing alternatives, and the estimated funding and schedule needed for the alternatives.

Our Analysis

In general, although the project directly affects flows and temperatures in the lower Merced River downstream of Crocker-Huffman diversion dam, the ability of the project to reduce water temperatures during the irrigation season (March through October) is limited by non-hydroelectric project withdrawals, which account for up to 52 percent of the average annual unregulated discharge from the watershed and limit availability of water for instream flows (Stillwater Sciences, 2002). Past disturbance to the channel, floodplain, and riparian habitat and other factors also limit the project's ability to reduce water temperatures during the irrigation season. During the non-irrigation season (November through February), little to no water is diverted at Crocker-Huffman diversion dam, and the magnitude and duration of releases from New Exchequer dam directly affect flows and water temperature in the lower Merced River and the amount of water stored for the remainder of the year. Increasing flows to reduce water temperatures in the spring and early summer generally reduces storage for coldwater releases in the summer and fall from Lake McClure. This relationship is a major factor when attempting to balance flow releases to meet temperature criteria for protecting coldwater species such as steelhead and Chinook salmon.

Increasing flow releases to maintain lower 7DADM water temperatures at various locations downstream of Crocker-Huffman diversion dam, as recommended by NMFS, California DFW, and FWS, depends on the volume of cold water stored in Lake McClure, and in many cases, would require large volumes of water for relatively minor increases in the number of days that temperature criteria would be met downstream in dry and critically dry water years. Merced ID's temperature modeling illustrates that meeting temperature criteria would generally require flows exceeding those recommended by the agencies and that increasing flow releases earlier in the season reduces coldwater storage for lowering temperatures in the summer and fall.

Table 3-13 compares the EPA 7DADM water temperature guideline exceedances under existing conditions and the proposed and recommended flow regimes for all life stages of Central Valley steelhead and fall-run Chinook salmon from below Crocker-Huffman diversion dam to Shaffer Bridge. The table shows that generally, flows under the environmental baseline and the proposed project would provide similar temperature regimes in the lower Merced River. A minor exception occurs for Chinook salmon upstream migration, where the proposed flow regime has the lowest exceedance percentage of nearly all flows analyzed (although the Conservation Groups' flow regime results are comparable to Merced ID's flow regime results). The reason for this is that the other flow regimes call for higher flow releases throughout the year and by September, the start of the adult Chinook salmon upstream migration period, most of the cold water in Lake McClure is gone. In contrast, the exceedances for Chinook salmon upstream migration for the NMFS and California DFW flow regimes are greater than

what currently occurs under existing conditions. This is because both agencies focus on spring flows that would increase growth of steelhead and Chinook salmon and stimulate outmigration before summer. Consequently, the exceedances for steelhead smoltification and juvenile Chinook salmon rearing and emigration are by far the lowest for the California DFW flow regime, and, to a lesser extent, the NMFS flow regime.

Overall, table 3-13 shows the pros and cons of each flow regime that result from differing approaches to balancing competing demands for available water. It also shows the challenges of attempting to meet the EPA temperature guidelines for salmonids.

NMFS recommends maintaining a 7DADM water temperature of $<18.0^{\circ}\text{C}$ (64.4°F) at the Highway 59 bridge (RM 42.0); however, based on Merced ID's modeling results, NMFS' minimum flow recommendations would not be adequate to meet its recommended water temperature criteria 18 percent of the time. Therefore, flows greater than the NMFS recommended minimum flows would be necessary to meet NMFS' recommended water temperature criteria.

California DFW acknowledges that achieving EPA water temperature objectives in the lower Merced River throughout the entire year does not appear feasible given current facilities and constraints. Consequently, in an effort to narrow the temporal scope of the EPA objectives to the most critical time periods, it developed temporal water temperature objectives for different Chinook salmon and Central Valley steelhead life stages. In summary, the performance standard for Chinook salmon and steelhead spawning and incubation would be 13.0°C (55.4°F), which would apply from January 1 through February 14, and for Chinook salmon juvenile core rearing 16.0°C (60.8°F), which would apply from February 15 through May 15 or to June 15, depending on water year type. We agree that adjusting temperature objectives to reflect the limitations and constraints of achieving ideal conditions in the lower Merced River, as California DFW has done, would set more realistic goals for all parties responsible for restoration of this important salmonid habitat. We expect the California DFW recommended minimum flows to achieve these objectives during the spring to the extent possible. However, during the irrigation season, water temperature in the lower Merced River is influenced by non-project factors such as flow diversions. It is unclear how often unusual meteorological events would occur that would result in the need to release flows in excess of the recommended minimum flows to meet salmonid temperature criteria. We therefore have no basis to determine the effects on irrigators or project generation associated with any such excess flow releases. Consequently, although monitoring water temperature in the lower Merced River is important, requiring Merced ID to release flows that would achieve specific temperature objectives may not be directly related to a project effect and, in some instances, may not be possible.

Table 3-13. Comparison of 7DADM simulated water temperature guideline exceedance between the environmental baseline conditions and proposed and recommended flow regimes for all life stages of Central Valley steelhead and fall-run Chinook salmon between Crocker-Huffman diversion dam (RM 52.0), Snelling Bridge (RM 46.4), Highway 59 Bridge (RM 42.0), and Shaffer Bridge (RM 32.8) (Source: Merced ID, 2014b,c,d).

Species	Life Stage	Life Stage Timing	EPA (2003) Guideline (7DADM °C)	Location	Percent of Time EPA (2003) Guideline Exceeded						
					Environmental Baseline	Merced ID Proposed	Water Board ^a	Conservation Groups	FWS	NMFS	California DFW
Central Valley Steelhead	Adult upstream migration	October through April	18°C	Below CHD ^b	1%	1%	1%	30%	2%	8%	1%
				Snelling Bridge	1%	1%	2%	1%	2%	8%	2%
				Highway 59 Bridge	3%	3%	3%	1%	4%	8%	3%
				Shaffer Bridge	11%	10%	5%	84%	10%	10%	5%
				Below CHD	5%	4%	10%	15%	6%	14%	13%
	Adult rearing	Year-round	18°C	Snelling Bridge	24%	16%	24%	21%	11%	16%	22%
				Highway 59 Bridge	35%	31%	29%	31%	29%	18%	30%
				Shaffer Bridge	44%	43%	35%	438%	44%	40%	35%
				Below CHD	34%	35%	29%	29%	32%	29%	27%
				Snelling Bridge	36%	37%	32%	32%	34%	32%	31%
	Spawning and egg incubation	December through May	13°C	Highway 59 Bridge	38%	38%	36%	35%	35%	36%	35%

Species	Life Stage	Life Stage Timing	EPA (2003) Guideline (7DADM °C)	Location	Percent of Time EPA (2003) Guideline Exceeded						
					Environmental Baseline	Merced ID Proposed	Water Board ^a	Conservation Groups	FWS	NMFS	California DFW
	Juvenile rearing and emigration	Year-round	16°C (core)	Shaffer Bridge	44%	45%	43%	44%	45%	44%	44%
				Below CHD	29%	27%	32%	436%	27%	27%	33%
				Snelling Bridge	42%	41%	37%	40%	43%	36%	37%
				Highway 59 Bridge	48%	48%	42%	44%	50%	46%	39%
				Shaffer Bridge	54%	55%	51%	50%	54%	54%	47%
				Below CHD	5%	4%	10%	13%	6%	14%	13%
	Juvenile rearing and emigration	Year-round	18°C (non-core)	Snelling Bridge	24%	16%	24%	26%	11%	16%	22%
				Highway 59 Bridge	35%	31%	29%	34%	29%	18%	30%
				Shaffer Bridge	44%	43%	35%	40%	44%	40%	35%
				Below CHD	64%	59%	69%	81%	51%	46%	73%
	Juvenile over-summer rearing	June through September	16°C	Snelling Bridge	85%	83%	78%	86%	84%	66%	82%
				Highway 59 Bridge	90%	90%	86%	88%	91%	88%	87%
				Shaffer Bridge	95%	95%	93%	91%	95%	95%	91%

Species	Life Stage	Life Stage Timing	EPA (2003) Guideline (7DADM °C)	Location	Percent of Time EPA (2003) Guideline Exceeded						
					Environmental Baseline	Merced ID Proposed	Water Board ^a	Conservation Groups	FWS	NMFS	California DFW
Fall-run Chinook Salmon	Smoltification	October through May	14°C	Below CHD	40%	41%	33%	36%	39%	36%	32%
				Snelling Bridge	43%	44%	38%	38%	41%	39%	35%
				Highway 59 Bridge	45%	46%	42%	40%	43%	42%	39%
				Shaffer Bridge	49%	50%	48%	47%	48%	48%	47%
				Below CHD	9%	8%	17%	27%	12%	31%	16%
	Adult upstream migration	September through December	18°C	Snelling Bridge	27%	18%	32%	23%	19%	31%	27%
				Highway 59 Bridge	33%	30%	36%	32%	31%	32%	35%
				Shaffer Bridge	38%	37%	41%	439%	42%	48%	42%
				Below CHD	43%	45%	43%	44%	44%	45%	43%
				Snelling Bridge	44%	45%	44%	45%	46%	46%	44%
	Spawning and egg incubation	October through March	13°C	Highway 59 Bridge	45%	46%	45%	45%	47%	47%	45%
				Shaffer Bridge	48%	49%	48%	548%	51%	50%	49%
				Below CHD	5%	4%	0%	34%	4%	1%	0%
	Juvenile rearing and	January through	16°C	Below CHD							

Species	Life Stage	Life Stage Timing	EPA (2003) Guideline (7DADM °C)	Location	Percent of Time EPA (2003) Guideline Exceeded						
					Environmental Baseline	Merced ID Proposed	Water Board ^a	Conservation Groups	FWS	NMFS	California DFW
	emigration	May		Snelling Bridge	16%	16%	1%	8%	13%	5%	0%
				Highway 59 Bridge	25%	25%	6%	14%	21%	11%	1%
				Shaffer Bridge	31%	33%	21%	21%	25%	22%	14%

^a Water Board results are based on a flow scenario developed by Merced ID that incorporates 35 percent of unimpaired flow from February through June annually and baseline conditions for remaining months as provided by a Water Board comment reflecting potential flow requirements released in its Draft Substitute Environmental Document.

^b CHD = Crocker-Huffman diversion dam

The long-term water temperature improvement plans recommended by NMFS and by California DFW contain some elements pertaining to engineering options to deliver colder water from Lake McClure to downstream of Crocker-Huffman diversion dam that have already been studied by Merced ID and presented in its reservoir water temperature management and feasibility study. In Technical Memorandum 2-5 (Merced ID, 2014e) Merced ID concludes that:

- Providing abbreviated compliance with modified temperature objectives similar to those recommended by California DFW between February and September would require about 800,000 to 1,000,000 acre-feet of water, which is nearly 100 percent of the average annual inflow to Lake McClure.
- Installing a temperature control device that allows releases to be made from three different depths in Lake McClure may provide a minor increase in the ability to meet temperature objectives in wet years, minimal ability to increase the frequency of meeting temperature objectives in normal years, and no ability to significantly decrease downstream water temperatures in dry and critically dry years.
- Construction of a pipe to deliver water released from Lake McClure to Crocker-Huffman diversion dam would require from 7.5 to 10-miles of construction. Reducing the amount of cold water released into McSwain reservoir would increase the temperature of water released from McSwain dam, which could cancel out the beneficial temperature effects to the lower Merced River.
- Construction of a cold water channel through McSwain reservoir to reduce the warming of water as it passes through the reservoir may enhance the average daily water temperature of releases from McSwain dam, but would reduce the degree of mixing within the reservoir and increase the temperature of the remaining water. If mixing is limited during certain times of the day, such as when peaking flows are released from New Exchequer powerhouse, it could result in highly variable daily water temperatures of water released at McSwain dam.
- Reconfiguring releases from Lake McClure so that higher volumes of water are released at certain times of year to reduce heating of water as it moves downstream would require tradeoffs in temperature management. For example, higher releases in the spring could benefit the lower Merced River temperature regime, but at the cost of reduced ability to meet temperature objectives in late summer and fall.

Merced ID concludes that none of the alternatives analyzed were feasible and defined feasible as “being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors.”

FWS recommends conducting a riparian microclimate study and collecting data for calibrating a HEC-5Q water temperature model analysis to determine the optimum length and width of riparian forest needed to achieve temperature objectives downstream of Crocker-Huffman diversion dam (we discuss aspects of the FWS' recommendation regarding establishing a riparian forest canopy in the *Habitat Restoration and Management* section). We agree that establishing a riparian forest canopy adjacent to the Merced River from Crocker-Huffman diversion dam to Shaffer Bridge could help to decrease water temperatures compared to existing conditions. In its April 1, 2011, study determination letter, the Commission concludes that the primary reason for the absence of a riparian forest is in-channel and floodplain dredger and aggregate mining, not operation of the hydroelectric project. Consequently, having Merced ID be responsible for conducting modeling to determine the optimal configuration for a restored floodplain forest would be more like a research study not directly related to hydropower operation. A properly timed spring pulse flow, discussed under *Pulse Flows*, would create optimal conditions for germination of riparian cottonwood trees, which eventually would provide shading and some water temperature relief. Enhanced floodplain configuration could also result from implementation of gravel augmentation, discussed in *Spawning Habitat Enhancement*, which could also serve to foster establishment of riparian vegetation. Both of these measures would address project-related cumulative effects, whereas establishing the ideal riparian forest width may or may not lead to meaningful water temperature enhancements.

With regard to California DFW's recommendation that Merced ID evaluate the feasibility of prolonging and stabilizing the irrigation delivery season to provide the benefit of shorter residence times, Merced ID did evaluate reducing the residence time downstream of Lake McClure by releasing larger volumes of water from New Exchequer dam (Merced ID, 2014e). California DFW does not provide sufficient detail for us to analyze how prolonging and stabilizing of irrigation deliveries by using irrigation storage capacity downstream of the project would enhance the temperature regime of the lower Merced River. Therefore, we have no basis to recommend that Merced ID evaluate the feasibility of this measure.

Merced ID modeling indicates that the divergent stakeholder flow recommendations to reduce temperature would have relatively small effects compared to environmental baseline and proposed project flows, and the recommended flows would still be inadequate to meet applicable temperature criteria. Most of the recommended alternatives would increase the frequency of water supply shortages and increase temperatures in summer and fall of some water years due to the high flows necessary for release in the spring to lower temperatures. Achieving temperature and physical anadromous fish habitat enhancements depends on water available for flow releases during different times of the year and the amount of storage in Lake McClure.

Regardless of the outcome of recommendations regarding flow regimes, minimum pool levels, and temperature management, water temperature monitoring of some kind as proposed, specified, and recommended by the stakeholders would be appropriate to

document conditions in the project-affected reach downstream of Crocker-Huffman diversion dam to Shaffer Bridge and its relationship to anadromous fish habitat. Although monitoring water temperature upstream of Crocker-Huffman diversion dam would have some value for interpreting downstream results, releases from New Exchequer dam have a relatively short residence time in McSwain reservoir, Merced Falls reservoir, and the Crocker-Huffman impoundment.

Any temperature management measures included in a new license would most likely pertain to the Crocker-Huffman to Shaffer Bridge reach. As such, monitoring water temperature immediately downstream of Crocker-Huffman diversion dam at or near the existing gage near Snelling would document conditions at the upstream limit of anadromous fish habitat. Monitoring water temperature at the existing gage at Shaffer Bridge would document conditions at the downstream end of the project-affected reach. The diversions that occur within this reach are not project-related, but monitoring water temperature at intermediate locations would help to interpret whether temperature measurements at Shaffer Bridge are related to non-project factors such as irrigation returns. Overall, monitoring water temperature at several locations would provide data on whether project-related flow releases from Lake McClure are achieving expected water temperature enhancements within the limitations of the available cold water pool and enable such effects to be separated from non-project effects. Ultimately, when combined with flow and anadromous fish monitoring, this monitoring would provide a basis for evaluating the need for future adjustments to the project flow regime. Developing the water temperature monitoring plan specified in preliminary WQC condition 19 would allow four to eight temperature monitoring gages to be placed at locations agreed upon by a technical advisory committee. Placement of gages at the upstream and downstream end of the project-affected reach would enable temperature to be correlated with associated flows because there are currently flow gages located at these two locations. Provisions in the plan specified in preliminary WQC condition 19 would also enable identification of factors that may affect water temperature and which factors are project related. In addition, if monitoring shows that project operation is increasing water temperatures, provisions for developing a plan for corrective actions are included. The Water Board preliminary WQC condition 8 would have Merced ID develop a plan for decreasing water temperatures in the lower Merced River without necessarily establishing a relationship to project operation. The Water Board's approach specified in preliminary WQC condition 19 bases corrective actions on monitoring results and a linkage to project operation. We find this approach to basing corrective actions on monitoring results and a linkage to project operation to be reasonable. Monitoring flows at interim locations or downstream of Shaffer Bridge, as recommended by NMFS, would not have a relationship to hydroelectric project operation.

Pulse Flows

Pulse flows are defined as discrete water releases into the lower Merced River to benefit the upstream migration of adult salmonids during the fall, and downstream migration of juvenile/smolt salmonids during the spring. Additionally, pulse flow releases that inundate the floodplain are designed to promote recruitment of riparian tree species. Merced ID currently releases an October pulse flow of 12,500 acre-feet in addition to the required minimum flows (which range from 15 to 75 cfs in October) under a Memorandum of Understanding with California DFW, but this measure is not included in the current license for the project. Merced ID does not propose fall or spring pulse flow releases.

NMFS [10(j) recommendation 1.1A(2)] recommends a spring pulse flow with a variable flow volume based on water year type, ranging from 10,000 acre-feet in dry and critically dry years to 60,000 acre-feet in wet years. The dry and critically dry year spring pulse flows are designed to provide outmigration pulses for juvenile and smolt salmonids. The pulse flows during wetter water years are designed to have a gradual ascending and descending hydrograph beginning in May, up to 9 days of floodplain inundation to provide salmonid rearing and foraging habitat and promote riparian forest recruitment, and 2 to 3 days of peak discharge. The peak discharges would be intended to provide channel maintenance flows, mobilize sediments, reduce or stop the rate of vegetation encroachment into the channel, and promote LWD recruitment from local channel banks. NMFS also recommends a fall pulse flow volume of 12,500 acre-feet in all water year types. NMFS recommends that the pulse flow timing and duration be determined annually by a technical advisory committee. NMFS recommends that any spring and fall pulse flows be in addition to minimum flows that may be included in a new license.

FWS [amended 10(j) recommendation 3(A1)] recommends a fall pulse flow of 1,200 cfs with a total volume of 19,830 acre-feet in below normal to wet years and a total volume of 7,932 acre-feet in dry and critically years. FWS does not recommend a discrete spring pulse flow during wet, above normal, below normal, and dry water years but rather includes a gradually increased minimum flow that begins in March, peaks in late March, April, or May, depending on water year type, then gradually decreases to a base minimum flow in spring or early summer (table 3-14). FWS further recommends that a technical advisory committee establish spring pulse flows for outmigrating juvenile salmonids during dry and critically years. In addition, FWS recommends that when possible during above normal and wet water years, flows should inundate floodplain surfaces for at least 5 days beginning in late May or early June.

California DFW [10(j) recommendation 3D] recommends a spring floodplain inundation flow in cfs over a 2-day period between March 14 and March 28 in below normal, above normal, and wet water year types, with no requirement in dry and critically dry years. The spring floodplain inundation flow volume (as converted from cfs) varies by water year type and includes: 15,840 acre-feet (4,000 cfs per day) in wet years,

11,880 acre-feet (3,000 cfs per day) in above normal years, and 7,920 acre-feet (2,000 cfs per day) in below normal years. In addition, California DFW's minimum flow recommendation, discussed in the previous section, includes an extended pulse flow of from 2 to 6 weeks. The 2 week pulse flows that would occur in May of dry and critically dry years are intended to stimulate salmonid outmigration prior to the summer months when water temperature becomes stressful under all flow scenarios. The 3 to 6 week pulse flows during wet, above normal, and below normal water years would serve the outmigration function but also open up floodplain habitat for salmonid rearing and foraging. California DFW [10(j) recommendation 3E] recommends adult Chinook attraction flows of 1,000 cfs over varying periods during October and November in all water year types. The attraction flow volumes vary by water year type and include; 23,760 acre-feet (12 days) in wet and above normal years, 17,820 acre-feet (9 days) in below normal years, and 11,880 acre-feet (6 days) in dry and critically dry years.

The Conservation Groups recommend a spring pulse flow volume of 20,000 acre-feet in critically dry years unless storage in Lake McClure is less than 200,000 acre-feet, in which case the pulse flow would be 5,000 acre-feet, and an annual fall pulse flow volume of 12,500 acre-feet in all water year types. The Conservation Groups do not state that spring or fall pulse flow releases should be in addition to the minimum flow that may be included in a new license. Although the Conservation Groups do not recommend a discrete spring pulse flow during wet, above normal, below normal, or dry water years, by tying their minimum flow during the spring to a percentage of inflow to Lake McClure, the flows would gradually increase until April or May and then gradually decrease after that, similar to the inflow to Lake McClure pattern shown in table 3-1.

Our Analysis

Pulse flows recommended by FWS, NMFS, California DFW, and the Conservation Groups are variable in terms of both volume and how they are defined. We converted all recommended pulse flows to acre-feet to enable an equal comparison of the recommendations (table 3-14). In general, the recommendations are more similar for fall pulse flows where they range from 7,932 to 13,881 acre-feet in dry years and from 12,500 to 19,830 acre-feet in wet years. The recommendations of NMFS and the Conservation Groups would represent a continuation of existing conditions under the Memorandum of Understanding with California DFW, with a constant fall attraction flow release regardless of water year type. California DFW and FWS recommend providing 1,000 or 1,200 cfs, respectively, for varying numbers of days depending on water year types, which equates to 11,880 to 23,760 acre-feet, for California DFW's recommendation and 7,932 to 19,830 acre-feet for FWS' recommendation. The primary purpose of fall pulse flows is to attract anadromous fish to upstream spawning areas of the Merced River. California DFW notes its reason for its recommended maximum pulse flow of 1,000 cfs is to (1) avoid floodplain inundation, which would not be desirable during the spawning season, and (2) keep spawning Chinook salmon in the channel proper. Fall floodplain inundation is atypical during the Chinook salmon spawning period and if redds should be constructed in the inundated floodplain during a short-term

attraction flow release, they would be dewatered when the flows recede. The reduction in the fall pulse flow duration during dry and critically dry water years embedded in the California DFW and FWS recommendations, respectively, would allow the preservation of water and associated cold pool storage in Lake McClure while at the same time would provide the benefits of fall pulse flows to attract adult Chinook salmon to the mouth of the Merced River.

We agree with the rationale of the agencies and Conservation Groups that a fall pulse flow release would continue to attract adult Chinook salmon to the Merced River for spawning. We also concur that pulse flows should not be such that over bank flows occur to ensure that spawning occurs in the channel proper and therefore should be restricted to no more than 1,000 cfs. Releases of 1,000 cfs would need to occur for between 6 and 7 days to reach the current, NMFS, and Conservation Groups' recommended fall block pulse flow of 12,500 acre-feet. If block flows do not include the volume associated with minimum flows, as NMFS recommends, it may be possible to extend the number of days of releases of up to 1,000 cfs for salmon attraction, but it would deplete the available storage in Lake McClure for later use. Similarly, increasing the number of days that fall pulse flows are released to 10 or 12 days, as FWS and California DFW recommend during wet, above normal, and below normal water years, could result in enhanced salmon attraction. However, it would also result in an additional depletion in the volume of water in Lake McClure. We consider the value of carrying over as much water as possible for use for habitat enhancement in the lower Merced River and irrigation during a following year to outweigh the potential increased attraction of Chinook salmon that could be achieved with an additional 3 to 6 days of fall releases. However, monitoring salmonid upstream migration in the lower Merced River, discussed in detail later, would provide data to assess the effectiveness of any fall pulse flow releases that may be included in a new license and provide a basis for adjustments, if necessary.

Recommended discrete spring pulse flow volumes range from 7,920 to 10,000 acre-feet in dry years and from 15,840 to 60,000 acre-feet in wet years (table 3-14). In general, NMFS and California DFW recommend higher pulse flows during wetter water years with the objective of providing at least some floodplain inundation that would enhance riparian floodplain vegetation development and increase food availability for rearing native salmonids. In contrast, FWS and the Conservation Groups only recommend discrete spring pulse flows during the driest water years, although an extended spring pulse flow is embedded in the FWS and California DFW minimum flow recommendations. The basis for this approach given by the Conservation Groups and California DFW is that a late spring pulse flow would facilitate successful outmigration of those salmonids that are able to survive through the spring, prior to encountering low flow and high temperature conditions during the summer. Similarly, FWS states that by providing relatively cold water (i.e., cooler than 15°C) to the lower Merced River during the spring, smoltification of juvenile salmon and steelhead would be expedited, and outmigration would occur prior to low flow, high temperature conditions that promote

disease and predation by warmwater predators. We consider the stated reasons for these approaches to be valid and selecting the most appropriate spring pulse flow approach necessitates balancing environmental benefits against the effects on available storage in Lake McClure for use during the primary irrigation season.

Table 3-14. Stakeholder recommendations for discrete spring and fall pulse flow volumes (acre-feet)

Agency	Season	Wet	Above Normal	Below Normal	Dry	Critically Dry
NMFS	Spring	60,000	50,000	30,000	10,000	10,000
	Fall	12,500	12,500	12,500	12,500	12,500
FWS	Spring	N/A	N/A	N/A	N/A	N/A
	Fall	19,830	19,830	19,830	7,932	7,932
California DFW	Spring ^a	15,840	11,880	7,920	45,064	30,942
	Fall	23,760	23,760	17,820	11,880	11,880
Conservation Groups	Spring	N/A	N/A	N/A	N/A	20,000
	Fall	12,500	12,500	12,500	12,500	12,500

^a California DFW includes a discrete 2-day pulse flow in wet (4,000 cfs/day), above normal (3,000 cfs/day), and below normal water years (2,000 cfs/day), and a 2 week pulse flow of 1,420 cfs in dry water years and 1,040 cfs in critically dry water years within its minimum flow recommendation shown in table 3-9; we converted this to acre-feet in this table for comparison purposes.

N/A = not applicable; however, FWS and the Conservation Groups embed extended spring pulse flows in their minimum flow recommendations shown in table 3-9.

We agree that during all but dry and critically dry water years, a spring pulse flow that achieves some floodplain inundation would enhance development of floodplain vegetation, including cottonwoods and other riparian trees and shrubs that could provide shade to the channel during warmer months when water temperature limits the suitability of lower Merced River salmonid habitat. It would also provide rearing and foraging overbank habitat for juvenile salmonids that would be confined to the channel proper without such pulse flows. Although California DFW's recommended 2-day pulse flow in March would provide young salmonids with access to floodplain cover and food sources, a short term pulse flow could also expose fish that occupy the floodplain to stranding as flows recede into the channel proper.

If a spring pulse flow is to be implemented, we consider the overall approach taken in the NMFS pulse flow recommendation to be reasonable. This would entail a gradual increase of flows to a 2 or 3 day maximum followed by a gradual decrease in

flows to stimulate germination of cottonwood and other riparian vegetation with the goal of up to 9 days of floodplain inundation. We recognize that there is natural variability in the magnitude of spring pulse flows during different water years and mimicking this variability would be ideal. However, the lower Merced River is regulated and if the floodplain inundation and channel maintenance objectives can be achieved with a release of 30,000 acre-feet (the below normal water year NMFS recommendation), we are not convinced that the additional 20,000 to 30,000 acre-feet recommended for above normal and wet water years, respectively, would warrant the additional loss of Lake McClure water storage. We also note that, as mentioned for the NMFS recommended fall pulse flow, requiring that any spring pulse flow volume be in addition to the minimum flows that may be included in a new license would deplete the supply of water stored in Lake McClure.

Both the spring pulse flows embedded in the FWS and California DFW minimum flow recommendations would result in substantial periods of floodplain inundation. Assuming floodplain inundation occurs at flows above 1,000 cfs, the FWS recommendation would result in more than 2 months of floodplain inundation in a wet water year, nearly a month in an above average water year, nearly 2 weeks in a below normal water year, and 5 days in a dry water year. The California DFW recommendation would result in about 6 weeks of floodplain inundation in wet and above normal water years and 4 weeks of floodplain inundation in a below normal water year. We do not dispute the environmental benefits that such extended periods of floodplain inundation would achieve, but we are not convinced that the volume of water necessary to achieve these benefits warrant the additional loss of Lake McClure water storage.

If a spring pulse flow is released in wet, above normal, or below normal water years, such releases could also serve the dual purpose of stimulating salmonid outmigration prior to stressful summer flow and temperature conditions, if timed appropriately. A technical advisory committee could serve a valuable function in providing input on the timing of any spring pulse flow.

We also agree with the stakeholders that during dry or critically dry water years, when spring floodplain inundation flows are not released, a short-term pulse flow would likely stimulate salmonid emigration from the lower Merced River prior to stressful summer conditions. The range of critically dry water year flows to achieve this objective offered by stakeholders is broad: 10,000 acre-feet by NMFS, 20,000 acre-feet by the Conservation Groups, and 30,942 by California DFW. We expect that if a critically dry water year pulse flow is effective in stimulating salmonid outmigration, a similar release during dry water years would achieve the same outcome. We have no data to support which of these flows would result in a meaningful stimulation of salmonid outmigration. It is possible that a release of 10,000 acre-feet in dry or critically dry water years could be configured to effectively stimulate outmigration of salmonids prior to the summer. Again, input from a technical advisory committee regarding the duration and magnitude of the release would increase the likelihood of success and conserve Lake McClure water compared to spring pulse releases of 20,000 or 30,942 acre-feet recommended by the

Conservation Groups and California DFW, respectively. Monitoring outmigration, as proposed by Merced ID and stakeholders, during dry or critically dry pulse flow releases, would provide a measure of effectiveness and a basis for adjusting future dry and critically dry water year pulse releases.

Ramping Rates

Rapid changes in river flow associated with hydroelectric project operations may adversely affect aquatic resources. If water recedes in a project-affected stream reach faster than it naturally would, adverse effects can include fish stranding in shallow, low-gradient areas and off-channel habitat (causing immediate or delayed mortality); temporary loss of habitat or loss of habitat access; and dewatering of fish redds, amphibians, aquatic insects, and plant life (Hunter, 1992). Rapid changes in stream flow (both increases and decreases) also can affect fish behavior that could reduce survival or growth. Limits governing the rate and timing of project-induced river stage changes (ramping rates) are often established to protect aquatic organisms from these project-related effects. A ramping rate is the rate of change in stage resulting from regulated discharges. For the Merced River Project, pulse flow releases and flood control releases are most likely to result in rapid changes in river flows that may warrant establishment of ramping rates.

Under normal project operation, flood control or irrigation releases have the potential to result in rapid increases or decreases in flows. In these events, for all controllable flow rate changes above a base flow of 200 cfs, Merced ID proposes to restrict the rate of change of release from McSwain dam during any 1-hour period to not more than double (upramping) or less than one-half (downramping) the amount of the controlled release from the reservoir at the start of the change, with noted exceptions for emergency situations.

NMFS [10(j) recommendation 1.1B(7)] recommends that minimum instream flow upramping and downramping rates occur evenly over a 24-hour period, with a maximum of 500 cfs per 24-hour period in all water years, with the exception of spring pulse flows in above normal and wet water years, when downramping rates are recommended to occur evenly over a 24-hour period at a maximum of 100 cfs per day (about 1 inch per day) to promote riparian seedling survival. The compliance point is not specified. FWS [amended 10(j) recommendation 3A1] also recommends this gradual downramp of 100 cfs per day as measured at Shaffer Bridge in late May or early June during above normal and wet water years.

California DFW [10(j) recommendation 3G] recommends a ramping rate for increasing flows that restricts the rate of change to not more than double the amount of the release during any 1-hour period. For decreasing flows, California DFW recommends the rate of change be no more than 2 inches per hour as measured at the existing gage near Snelling Bridge, downstream of Crocker-Huffman diversion dam, and

at flows above 200 cfs, the rate of change in any one 24-hour period, the flow rate should not drop by more than 500 cfs.

Our Analysis

Flow releases for hydroelectric project operation occur at New Exchequer and McSwain dams. These releases flow directly into impoundments, which minimize adverse effects typically associated with upramping and downramping in riverine habitat. The rate of change in flows downstream of Crocker-Huffman diversion dam is influenced by both hydroelectric project flow releases from McSwain dam and diversions for irrigation into the Main Canal, a non-jurisdictional facility. Therefore, California DFW and FWS' recommended downramping compliance point downstream of the diversion dam, and any other ramping rate compliance point downstream of Crocker-Huffman diversion dam would measure both the rate of change of releases from McSwain dam, which would be subject to the Commission's jurisdiction, and gate operation at the Main Canal in response to changing flows, which would not be subject to the Commission's jurisdiction.

Merced ID's proposed upramping and downramping rate compliance point would be at the outflow from the McSwain powerhouse and there would be no ambiguity regarding the Commission's ability to document and enforce any ramping rates that may be included in a new license. California DFW's recommended upramping rate (not more than double the flows during any 1 hour) and compliance point is the same as Merced ID's. Merced ID's proposed and California DFW's recommended upramping rate would serve to control the increases in flow associated with the onset of the irrigation season and any pulse flows that may be included in a new license. The benefits of the upramping rate recommended by NMFS (a maximum increase of 500 cfs evenly spread over a 24-hour period) are difficult to evaluate because as worded, it would only pertain to changes in minimum instream flows and the compliance point is not specified. Few increases in the minimum flows proposed or recommended by any entity change by more than 500 cfs between any designated release periods.

Merced ID's proposed downramping rate would restrict the rate of change within a 1-hour period to not less than one-half the amount of the controlled release at the start of the change. Similar to the proposed upramping rate, the point of outflow from McSwain powerhouse would be the compliance point. This is similar to article 42 of the current license, which requires Merced ID to restrict the rate of change of release during any 1-hour period to not less than one-half the amount of release at the start of the change at Crocker-Huffman diversion dam. The Merced Falls Project operates in a run-of-river mode, so flow changes at McSwain powerhouse essentially reflect the flow changes that reach Crocker-Huffman diversion dam.

California DFW recommends a downramping rate of no more than 2-inches per hour as measured downstream of Crocker-Huffman diversion dam. To support its recommended ramping rate, California DFW relies on the work of Hunter (1992), which concludes that in unregulated river systems, aquatic biota are rarely exposed to drops in

stage of more than 2-inches per hour and therefore are not adopted to more excessive stage changes. In addition, California DFW notes that a controlled downramping rate in late spring that approximates a natural recession rate promotes recruitment of willows and cottonwoods to riparian floodplains. Both California DFW and NMFS' recommended spring downramping rates would achieve this goal. California DFW states that under Merced ID's proposed downramping rate, using the maximum release of 6,000 cfs allowed by the current Corps' flood control rules, flows could be dropped by 3,000 cfs in 1 hour and by 1,500 cfs during the next hour with no ecological rationale.

Controlling downramping rates can reduce the potential for aquatic biota stranding and, in the spring, stimulate the growth of riparian trees and shrubs. However, the downramping rates that occur in Merced River downstream of Crocker-Huffman diversion dam are a function of releases from McSwain powerhouse and operation of the gates for irrigation purposes at the Main Canal. Only releases from the McSwain powerhouse are within the Commission's ability to regulate. Our review of typical releases from McSwain powerhouse during a normal and dry water year indicates that the maximum range of decreases in flow during a relatively short period of time is from 650 to 1,000 cfs (see figures 3-5 and 3-7). Therefore the scenario that California DFW presents is unlikely to occur except in emergency situations. Implementing Merced ID's proposed downramping rate would provide control over flows that reach Crocker-Huffman diversion dam. The ramping rates further downstream would be influenced by the rate of additional flow diversions and returns associated with non-project facilities and natural attenuation of flows, making it more difficult to establish a direct relationship with the downramping protocol when compared to using the existing gage near Snelling. However, we have no data to assess how this current operating mode translates into downramping rates downstream of the diversion dam. Monitoring flows and the downramping rate at the existing gage near Snelling immediately downstream of Crocker-Huffman diversion dam, as California DFW recommends, would provide the Commission with data regarding the downramping protocol and whether adjustments to that protocol may be needed in the future to reduce stranding risk and stimulate floodplain revegetation.

Project Reservoir Management

The volume of water required in Lake McClure affects Merced ID's ability to address water supply, carryover storage, and power generation needs associated with managing the project reservoirs. The volume of water in Lake McClure also affects Merced ID's ability to achieve minimum instream flows, pulse flows, and water temperature objectives. Establishing a minimum pool elevation sets the minimum volume of water available for downstream water uses. Maintaining relatively high reservoir water levels enhances recreation use of the project reservoirs. McSwain reservoir operates as a re-regulating afterbay for flows released from Lake McClure resulting in relatively stable releases at McSwain dam.

Merced ID proposes to make a good faith effort to maintain Lake McClure's water surface elevation as high as possible from April through October, consistent with the primary purposes of the reservoir, and to maintain a minimum pool of not less than 115,000 acre-feet (which equates to an elevation of about 640 feet), except for drawdown necessary to maintain minimum and target streamflows. This is nearly identical to operation under article 44 of the current license. At McSwain reservoir, Merced ID proposes to make a good faith effort to operate the reservoir for recreational purposes in such a manner that at no time would the reservoir be drawn down below elevation 388 feet except for drawdowns necessary to maintain minimum streamflows and as necessary for repairs.

The Water Board [preliminary WQC condition 15] reserves the right to condition the project with a minimum pool requirement for Lake McClure in light of the whole record, but does not yet specify a minimum pool. The Water Board [preliminary WQC condition 9] also specifies that Merced ID submit a drought plan within 1 year of license issuance. The plan would provide overarching guidance for operation during an emergency drought and/or multiple critically dry years and would be created in consultation with a committee. The plan would include Commission license or water quality certification variances that Merced ID may request. No further details were provided as to the content of the plan.

NMFS [10(j) recommendation 1.1A(8)] recommends a contingency for multiple consecutive dry and/or critically dry water years that would modify project operation. Merced ID would notify the resource agencies of drought concerns by March 10 of the second or subsequent dry/critically dry water year. By May 1 of these same years, Merced ID would consult with the resource agencies to discuss operational plans to manage the drought conditions. Following this consultation, Merced ID would file a drought plan with the Commission. Merced ID states in its response letter of September 5, 2014, that it accepts NMFS' recommendation, and on September 22, 2014, filed its revised, proposed measure with the Commission that includes a provision for contingency planning during a multi-year drought that is nearly identical to the NMFS recommendation.

FWS [amended 10(j) recommendation 3(A1)] recommends Merced ID maintain a minimum pool of 130,000 acre-feet (an elevation of about 650 feet) in Lake McClure. Once the minimum pool storage drops below 130,000 acre-feet, all irrigation diversions would cease and the only flow releases from Lake McClure would be to maintain designated minimum instream flows. The Conservation Groups make a similar recommendation.

California DFW [10(j) recommendation 3F] recommends Merced ID maintain Lake McClure as high as possible from April through October, with a target minimum pool of no less than 200,000 acre-feet (an elevation of about 680 feet) on September 30 of each year, by maintaining a minimum pool of no less than 265,000 acre-feet (an elevation of about 710 feet) at all times by ceasing all irrigation diversions, except for

drawdowns as necessary to maintain minimum instream flows. Additionally, California DFW recommends that Merced ID submit an annual draft plan to the Commission describing planned operation to maintain Lake McClure levels, including the estimated delivery pattern needed to achieve a 200,000 acre-feet minimum pool target by the end of September, with a final operation plan submitted annually to the Commission by May 15. California DFW further recommends that when a dry or critically dry water year is immediately preceded by a dry or critically dry water year, Merced ID should notify the agencies by June 1 of any potential concerns related to meeting the required Lake McClure minimum pool, and implement revised operation upon Commission approval.

No stakeholders made any recommendations relating to the minimum pool at McSwain reservoir.

Our Analysis

Merced ID provided model results that compare water supply, carryover storage, and power generation for its proposed measure and the stakeholder recommended flow regimes and minimum pool elevations to existing baseline conditions. The Merced ID model runs were developed without considering any additional flow measures that could be necessary to meet either NMFS, FWS, or California DFW water temperature objectives. California DFW also provided model output of reservoir operations based on its recommendation and compared results to existing baseline conditions, although detailed model documentation was not included. The Merced ID model runs provide results summarized over a 36-year period of record (1970–2006). The California DFW model results were presented using 2004 as a reference year.

Table 3-15 shows predictions of water supply shortage and carryover storage in Lake McClure for the Merced ID proposed measure along other stakeholder recommendations and compares them to baseline conditions. Water supply shortages increase when Lake McClure is operated under California DFW’s recommended minimum pool volume of 200,000–265,000 acre-feet compared with operation under the baseline volume of 115,000 acre-feet (which is also Merced ID’s proposed minimum pool). The Conservation Groups’ flow regime builds into the measure irrigation delivery restrictions based on water year type and results in the greatest total water delivery shortage of any alternative proposed or recommended. Carryover storage in Lake McClure is substantially reduced under all recommended minimum pool requirements and flow regimes compared with the Merced ID proposed measure and the baseline conditions.

Table 3-15. Predicted water supply shortage and carryover storage compared to baseline conditions (Source: Merced ID, 2014b,c,d).

Water Year Type	Water Supply Shortage (acre-feet)	Lake McClure Carryover Storage (acre-feet)
Merced ID proposed measure compared to baseline		
Wet	0	-11,000
Above normal	0	-16,000
Below normal	0	-17,000
Dry	0	-29,000
Critically dry	<2,000	-12,000
Total^a	0	-15,000
FWS amended recommendation compared to baseline		
Wet	4,000	-86,000
Above normal	0	-73,000
Below normal	7,000	-184,000
Dry	0	-202,000
Critically dry	69,000	-108,000
Total^a	24,000	-115,000
California DFW recommendation compared to baseline		
Wet	7,000	-70,000
Above normal	32,000	-360,000
Below normal	100,000	-244,000
Dry	276,000	-230,000
Critically dry	278,000	-8,000
Total^a	138,000	-135,000
NMFS recommendation compared to baseline		
Wet	16,000	-154,000
Above normal	9,000	-289,000
Below normal	119,000	-293,000
Dry	167,000	-358,000
Critically dry	198,000	-212,000

Water Year Type	Water Supply Shortage (acre-feet)	Lake McClure Carryover Storage (acre-feet)
Total^a	101,000	-234,000
Water Board suggested regime compared to baseline^b		
Wet	1,000	-59,000
Above normal	0	-128,000
Below normal	28,000	-246,000
Dry	0	-246,000
Critically dry	93,000	-87,000
Total^a	34,000	-121,000
Conservation Groups' recommendation compared to baseline		
Wet	126,000	-91,000
Above normal	133,000	-204,000
Below normal	138,000	-65,000
Dry	186,000	-86,000
Critically dry	155,000	9,000
Total^a	144,000	-73,000

^a In Merced ID's table, the term "total" refers to the total of all modeled water year types based on actual flows from 1970 through 2005. These values represent a weighted average of all water year types combined.

^b Water Board results are based on a flow scenario developed by Merced ID that incorporates 35 percent of unimpaired flow from February through June annually and baseline conditions for remaining months as provided by a Water Board comment reflecting potential flow requirements released in its Draft Substitute Environmental Document.

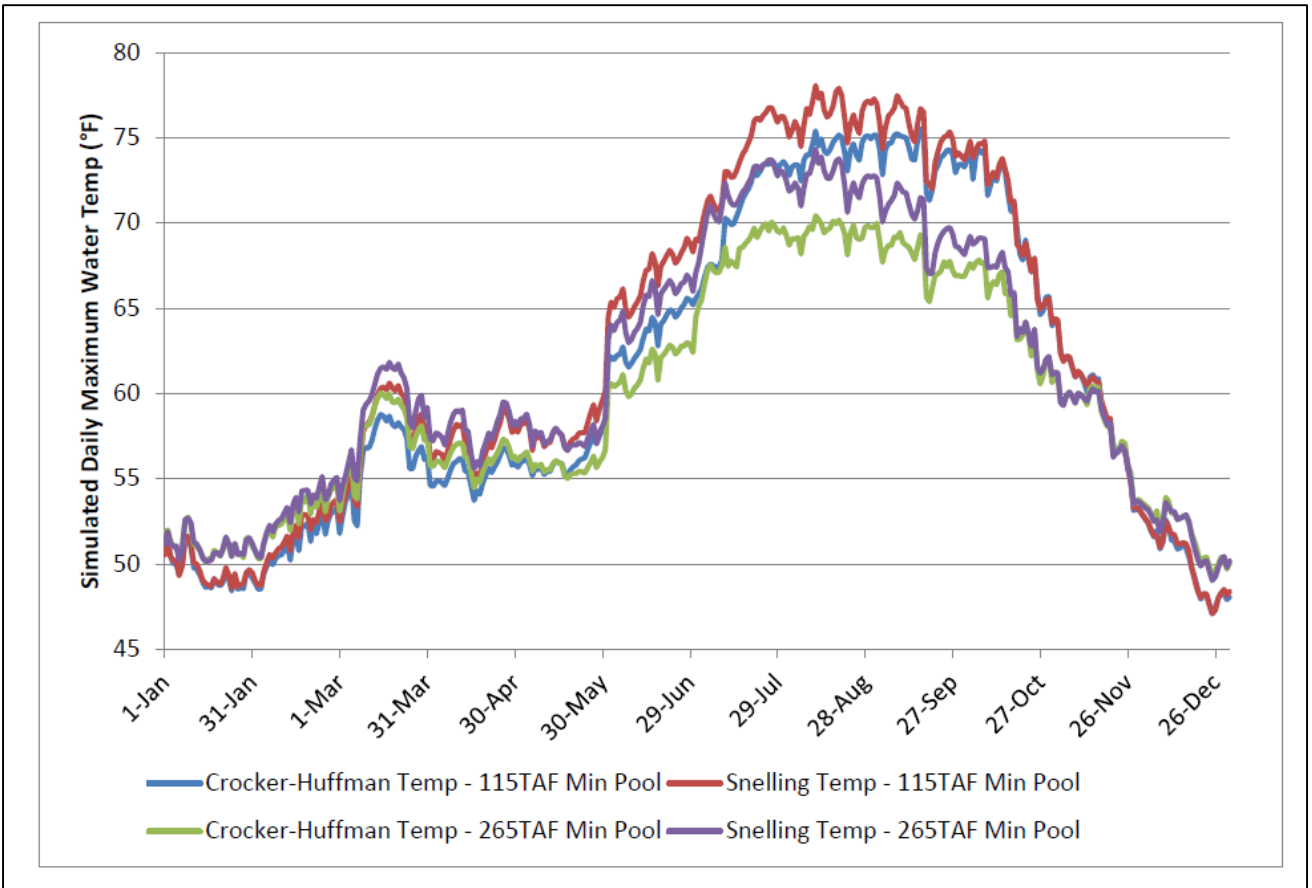
Under baseline conditions and the Merced ID proposed measure, Lake McClure reaches maximum storage (reservoir is filled) ten times over the 36-year period of record. Based on Merced ID's modeling results, this total is predicted to be reduced to six under FWS' flow and minimum pool recommendation, five under the NMFS flow recommendation, four under the Water Board's suggested flow and California DFW's flow and minimum pool recommendation, and Lake McClure would not fill in any of the 36 years under the Conservation Groups' flow and minimum pool recommendation.

Average annual power generation under existing conditions is about 387 GWh. With Merced ID's proposed flow and minimum pool levels, annual generation is predicted to increase to about 389 GWh. The flow and minimum pool recommendations

of stakeholders would decrease predicted average generation to the following amounts: FWS—377 GWh; Water Board—375 GWh; Conservation Groups—358 GWh; California DFW—352 GWh; and NMFS—346 GWh).

Merced ID's modeling results show that maintaining a higher minimum pool than 115,000 acre-feet in Lake McClure would negatively affect water supply, carryover storage, and power generation in all water year types. Additional flow requirements that may be necessary to reach target temperatures downstream of Crocker-Huffman diversion dam would only increase these effects. We discuss water temperature effects in a separate section, *Managing and Monitoring Water Temperature*.

Merced ID's proposed measure (AQR2) would maintain a minimum pool requirement of 115,000 acre-feet in Lake McClure and provide conditions similar to baseline conditions. Increasing the minimum pool as recommended by the agencies would serve to retain more coldwater pool in Lake McClure that would enable somewhat cooler temperatures to be maintained downstream of Crocker-Huffman diversion dam compared to existing conditions or Merced ID's proposed measure. Figure 3-37 shows the effect of preserving the cold pool volume by stopping irrigation diversions when storage drops below 265,000 acre-feet during a critically dry water year (2004), as California DFW recommends. Water temperature immediately downstream of the diversion dam and at the Snelling Bridge are 3 to 5°F cooler from mid-July to mid-October compared to Merced ID's proposed measure. However, water temperatures during this time frame would still be well above the 18.0°C (64.4°F) 7DADM EPA guideline for adult steelhead rearing and juvenile rearing and emigration and the 16.0°C (60.8°F) guideline for juvenile over-summer rearing shown in table 3-13.



Note: TAF Min Pool = thousands of acre-feet minimum pool.

Figure 3-37. Comparison of lower Merced River water temperatures in 2004 (a critically dry water year) under 115,000 acre-feet (Merced ID's proposed measure) and 265,000 acre-feet (California DFW) recommended measure) minimum pool alternatives at Crocker Huffman diversion dam (RM 52) and Snelling Bridge (RM 46.5). (Source: California DFW, 2014a)

Maintaining the recommended higher Lake McClure storage level would have an effect on the water available for delivery to irrigators. To illustrate this effect, we reviewed Lake McClure storage volumes for summer 2014, a critically dry water year within a severe drought (letter from H. EITal, Deputy General Manager, Water Supply/Rights, Merced ID, to T.J. LoVullo, FERC, Chief, Aquatic Resources Branch, Division of Hydropower Administration and Compliance, filed on October 10, 2014). Our analysis only provides a general concept of the effect on irrigation diversions because in 2014, Merced ID released the minimum flow of 15 cfs required by the current license. Releases of higher minimum flows as recommended by the agencies would result in the storage meeting the trigger for cessation of irrigation flows sooner. The Conservation Groups' recommended minimum flow would have irrigation diversions equal to 30 to 40 percent of demand in 2014. This would serve to preserve some storage

in Lake McClure, but would occur at the expense of irrigators. Under California DFW's recommendation, irrigation diversions would have stopped after July 4, 2014, and under the FWS and Conservation Groups' recommendations, after September 23, 2014. Deliveries of irrigation water would have continued through September with Merced ID's proposed minimum pool trigger for curtailing irrigation diversions.

Dry, warm summers create stressful conditions for salmonids in the lower Merced River and for irrigators that depend on the water supply that had been provided by Merced ID long before the project was operated for hydroelectric power generation. We acknowledge that preserving the cold pool in Lake McClure could be used to create slightly less stressful water temperature conditions for salmonids in the lower Merced River, as shown in figure 3-37. Irrigation diversions have the most value to irrigators during the driest years. Curtailing all irrigation diversions at the beginning of the summer would have a substantial effect on irrigated cropland and the associated agricultural community. Whether this adverse economic effect would be worth a marginally enhanced water temperature regime in the lower Merced River is questionable. Completely shutting down irrigation diversions when a target storage level is reached transfers all of the costs of any environmental benefits that such an approach would achieve to the irrigators. The recommended approach of the Conservation Groups would entail a reduction in irrigation deliveries that escalates during dry years but is never reduced to less than 30 percent of demand. Consequently, the irrigators would not bear the entire cost of enhanced lower Merced River habitat enhancements that relate to available water storage in Lake McClure.

California DFW recommends that Merced ID annually submit a draft operation plan to the Commission by March 1 and a final operation plan by May 15 that includes the estimated delivery pattern needed to achieve the 200,000 acre-feet end of September minimum pool target. If a minimum pool level should be specified in a new license, we would expect Merced ID to comply with any such condition. How Merced ID operates its project to comply with a minimum pool requirement would be up to them. However, if Merced ID is not able to meet a minimum pool requirement, the Commission would expect a report to be filed documenting the reasons for not meeting a specified minimum pool. Consequently, we find that there would be no need to file an annual operation plan with the Commission as California DFW recommends.

Adoption of the Water Board's preliminary WQC condition 9 to develop a drought plan in consultation with a technical advisory committee would provide overarching guidance for operation during an emergency drought and/or multiple critically dry years. We prefer this proactive approach rather than waiting until a drought is imminent or in progress to develop all of the details regarding how each drought would be managed. In addition, NMFS' [10(j) recommendation 1.1A(8)] recommendation, now also proposed by Merced ID, for a contingency for multiple, consecutive dry and/or critically dry water years that may entail modifications to project operation would ensure prompt notification of drought concerns to the resource agencies, and effective consultation and development of appropriate emergency operational plans. California DFW's recommendation

regarding operation during a multi-year drought would be accommodated by the NMFS recommendation.

Merced ID's proposed measure to make a good faith effort to maintain the water level in Lake McClure as high as possible from April through October and the minimum pool at McSwain reservoir pertain primarily to recreation and is therefore discussed in section 3.3.4.2, *Recreation Resources*.

Flood Protection

In accordance with article 39 of its existing license, Merced ID operates the project in compliance with the Corps' document entitled *New Exchequer Dam and Reservoir, Merced River, California; Water Control Manual; Appendix VII to Master Water Control Manual, San Joaquin River Basin, California* dated October 1981. This manual sets year-round flood control limits in Lake McClure for rain flood space, and March through July flood control limits for snowmelt flood space or conditional space (table 3-2).

Merced ID proposes (WR3) to continue operating the project for flood control in accordance with the rules and regulations specified by the Corps. No other entity offered environmental measures pertaining to flood control.

Our Analysis

The proposed measure by Merced ID (WR3) would provide continued reservoir operation and flood protection in accordance with the Corps' flood protection standards and guidelines. Merced ID currently releases water from Lake McClure to provide as much storage space as possible in Lake McClure when it anticipates that a storm or snowmelt runoff event may lead to potential downstream flooding if uncontrolled releases occur at the New Exchequer spillway. The current operating procedures are effective in minimizing uncontrolled releases from the spillway; there have been no spillway flows since the project began operating under the criteria specified in the Corps' 1981 manual.

Water Supply to the Merced National Wildlife Refuge

Article 45 of its existing license requires Merced ID annually to provide up to 15,000 acre-feet of project water to the Merced NWR. This water is intended to mitigate for the inundation of wildlife habitat associated with the construction of the project, primarily at New Exchequer dam.

Merced ID proposes to provide 15,000 acre-feet of water annually to the Merced NWR, unless otherwise agreed to in advance by FWS, to continue to mitigate for wildlife habitat inundated by Lake McClure. Water would continue to be delivered within the Merced ID irrigation season (March 1 through October 30). The current delivery flow rate of not to exceed 45 cfs and the current measurement point (at the weir in Deadman Creek) would remain unchanged. Merced ID would notify FWS at the onset of the

irrigation season after which FWS would provide Merced ID with a preliminary water delivery schedule. Consistent with the current agreement, Merced ID includes a provision for FWS to request changes to the preliminary flow schedule within the irrigation season, with 48-hours notice.

FWS and California DFW make identical recommendations [10(j) recommendations 1 and 12, respectively] that Merced ID provide 15,000 acre-feet of water annually to the Merced NWR and include a delivery schedule that includes monthly deliveries ranging from 600 to 2,700 acre-feet throughout the year at the same delivery point, with a delivery flow rate not to exceed 55 cfs. Both agencies include a provision that Merced ID may reduce scheduled deliveries to 75 percent of requested amounts during designated critically dry water years and pay Merced NWR for the deep well pumping costs to compensate for the 25 percent delivery reduction. In addition, both agencies recommend that Merced ID install a device for delivering water to the Snobird Unit of Merced NWR along Bear Creek. Merced ID would deliver water to the Snobird Unit after Merced NWR is at capacity in areas serviced by the Merced NWR lift pumps at Deadman Creek, as determined by refuge staff. The Conservation Groups recommend Merced ID provide full deliveries of 15,000 acre-feet annually to the Merced NWR.

Our Analysis

Both FWS and California DFW recommend specific monthly deliveries to the Merced NWR with maximum deliveries occurring from September through December to facilitate winter refuge flooding. Merced ID, in its letter filed on September 5, 2014, states that water is available for delivery to the Merced NWR only during the irrigation season (March 1 through October 31), and that providing water to the NWR from November through February is not possible because of the need for flood control (water levels in Yellowstone Lake, upstream of Lake McClure are kept low in the winter to capture spring high flows), dewatering the canals for maintenance, and health and safety considerations.

On May 22, 1992, the Commission ordered Merced ID to implement a plan for installing a water delivery system to provide 15,000 acre-feet to the entire refuge as required by article 45 of the current license.²⁹ Included in the order was a provision to construct a 0.5-mile-long canal from Deadman Creek to the northeast corner of the Merced NWR. According to FWS, this canal was only used for one season and was ineffective in providing water to the refuge. FWS installed lift pumps on Deadman Creek to address the shortfall of water to this portion of the refuge; however, during years when capital to operate the pumps is unavailable, the northeast portion of the refuge does not receive water. FWS reports that from 2006 through 2013, actual deliveries to the Merced

²⁹ 59 FERC 62,195

NWR never reached the 15,000 acre-feet specified in the current license and ranged from 9,130 to 12,271 acre-feet (average of 10,501 acre-feet). In addition, FWS reports that Merced ID sold an average of 4,929 acre-feet of water per year to the U.S. Bureau of Reclamation and FWS for delivery to the San Luis NWR during September through February. FWS states that at least some of this water originated from Yellowstone Lake and that some of it passed to the San Luis NWR through the Snobird Unit of the Merced NWR. FWS points to this as evidence that it is possible for Merced ID to provide water for Merced NWR's purposes during periods outside the irrigation season. We note that if the water delivery data provided by FWS is accurate, the amount of water sold to the San Luis NWR would have enabled full delivery to be achieved if it had been delivered to the Merced NWR.

The agencies and Merced ID also differ in how deliveries should be adjusted in drier water years. The agencies include a provision for a reduction in water provided to Merced NWR in critically dry water years but with Merced ID reimbursing FWS for the cost of pumping groundwater to make up for the shortfall. Merced ID makes no such provision in its proposed measure, but in its response to the agencies 10(j) recommendations, states that if Merced ID reduces water deliveries to irrigators during dry and critically dry water years, deliveries to the Merced NWR should also be reduced in an equal proportion.

The groundwater resources in the Central Valley are under increasing demand because of the limited availability of surface water (California DWR, 2014). We consider it uncertain that groundwater would be available to compensate for reduced deliveries by Merced ID during dry or critically dry water years, or that groundwater use for compensation would be recommended in future years. If irrigation water available for delivery by Merced ID to farmers is decreased because of increased flows to the Merced River downstream of Crocker-Huffman diversion dam, it would likely result in increased demand for groundwater by farmers to make up for this shortfall.

There is no disagreement between the agencies and Merced ID that Merced ID should continue to provide 15,000 acre-feet of water to the Merced NWR as required under the current license. However, there remains disagreement regarding whether it is possible or feasible to deliver a portion of this total outside of the irrigation season. We agree with the agencies rationale that providing water to the refuge throughout the year would have environmental benefits. One of the factors that influences whether or not water can be delivered to the refuge outside of the irrigation season involves assessing a complex system of irrigation conduits that currently are not related to hydropower operation. It is also unclear based on the available information whether the agency recommendation to provide "a device for delivering water to the Snobird Unit of Merced NWR along Bear Creek" would be necessary to achieve the goal of delivering 15,000 acre-feet of water to the refuge. We conclude that the most effective means to resolve this disagreement is for the entities most familiar with the system, Merced ID, FWS, and California DFW, to further consult regarding the feasibility of providing water to the Merced NWR outside the irrigation season. It is also evident that for license compliance

purposes, there is a need to enhance documentation of how much water is delivered each year to the Merced NWR and the basis for the delivery estimates.

Developing a Merced NWR water delivery plan, in consultation with FWS and California DFW, to ensure the delivery of 15,000 acre-feet to the refuge during times of the year when this water would provide the most benefit to wildlife would, after Commission approval, provide the Commission with a basis to maintain appropriate oversight of this environmental measure. Plan elements could include the following:

- Provisions to conduct a feasibility study for providing the recommended monthly volumes of water to the Merced NWR on a year-round basis, including an assessment of adverse and beneficial effects, estimated costs for any needed infrastructure changes, and a report with a recommendation regarding proposed actions.
- An assessment of whether an enhancement of water delivery to the Snobird Unit of the Merced NWR is needed to achieve the overall annual or monthly water delivery objectives.
- A clear statement regarding where water delivery to the Merced NWR would be measured and the means for measuring and reporting monthly deliveries to the agencies and the Commission.
- An evaluation of the environmental effects on the refuge if monthly deliveries are curtailed during dry or critically dry water years and make-up water is obtained via groundwater, and the ramifications if there are future restrictions on the use of groundwater in the Central Valley.

Fish Passage

Crocker-Huffman diversion dam (RM 52.0) represents the upstream barrier to resident and anadromous fish in lower Merced River. Merced ID owns and operates the diversion dam and the Main Canal as part of its water supply system and both facilities are not related to hydropower operation. Crocker-Huffman diversion dam is equipped with a fish ladder that has been non-operational since 1971 and would require replacement or retrofit to meet current standards for fish passage. Merced ID does not propose any measures relating to fish passage above Crocker-Huffman diversion dam.

The Water Board [preliminary WQC condition 8] specifies that Merced ID either develop a fish passage plan to allow for passage upstream of Crocker-Huffman, McSwain, and New Exchequer dams, or, develop a habitat restoration plan to decrease water temperatures in and downstream of the project.

FWS [10(j) recommendation 2] recommends Merced ID, in coordination with PG&E, develop a salmonid conservation, rescue, and passage plan to include: (1) planning, permitting, design, scheduling, costs, construction implementation, and monitoring of anadromous and resident salmonid passage at Crocker-Huffman diversion dam; (2) screening at the Merced ID Main Canal; (3) water filtration for the existing

hatchery; (4) refrigeration facilities at the existing hatchery for protecting salmonids from sub-lethal and lethal water temperatures resulting from project operation; and (5) cooperating with California DFW in trapping and hauling local wild fish when temperatures in the lower Merced River are expected to be stressful.

NMFS [10(j) recommendation 1.1A(3c)] recommends that until a long-term water temperature improvement plan is developed, Merced ID should provide fish with access to the cold water habitat upstream of Crocker-Huffman diversion dam. California DFW [10(j) recommendation 6] makes a similar recommendation but adds the option of using self-contained water temperature controlled holding units.

The Conservation Groups recommend that Merced ID: (1) open the Crocker-Huffman fish ladder on a temporary basis for seasonal use by *O. mykiss* when fall-run Chinook salmon are not present and develop monitoring and reporting protocols to quantify fish passage at this dam; (2) develop a plan for infrastructure needed for long-term upstream and downstream *O. mykiss* passage at Crocker-Huffman diversion dam including transporting adult anadromous fish upstream of Lake McClure and young anadromous fish from upstream of Lake McClure to downstream of the diversion dam; (3) evaluate the suitability of habitat in the upper Merced River Watershed for reintroducing spring-run Chinook salmon and steelhead, including a literature review, field studies to fill data gaps, and a habitat feasibility evaluation report; (4) conduct an engineering study to define capture and transport options for moving adult and juvenile anadromous fish to and from habitat upstream of Lake McClure; and (5) develop a plan for reintroduction of anadromous fish to the upper Merced River Watershed, including project description, conceptual drawing of facilities, costs, known and potential funding sources, and a time line for implementation.

Our Analysis

As discussed in the Commission's April 1, 2011, study plan determination letter, anadromous fish do not pass upstream of the Merced Falls dam, which is downstream of the first project dam, McSwain dam, and therefore are not present in Lake McClure or the upper Merced River. The Crocker-Huffman diversion dam and any associated features, including the Main Canal, are not related to hydropower operation and are not included in the existing license.

The Conservation Groups made similar requests in 2009 and 2011 to study habitat in the upper Merced River for anadromous fish reintroduction suitability. In its April 1, 2011, study plan determination letter, Commission staff determined that there is no relationship of Merced River Hydroelectric Project operation on fish habitat upstream of Lake McClure. Commission staff further noted that the suitability of upstream habitat for anadromous salmonids, as it relates to recovery planning under NMFS guidelines, pertains to management decisions and actions that most appropriately fall under NMFS' jurisdiction. We agree with the previous staff findings.

Recommendations pertaining to the hatchery and water temperature downstream of Crocker-Huffman diversion dam are addressed in separate subsections.

Entrainment

Some fish entrainment is likely to occur at powerhouse intakes in both Lake McClure and McSwain reservoir. Neither Merced ID nor the stakeholders propose any measures related to entrainment at the project powerhouse intakes. However, FWS [10(j) recommendation 2] and the Conservation Groups recommend that Merced ID install a screen at the Main Canal to prevent fish from being entrained into the canal.

Our Analysis

In Lake McClure, the powerhouse intake structure is located at the base of New Exchequer dam at a depth of 382 feet below the NMWSE of the reservoir. In rare events when the reservoir's water surface elevation drops substantially, the intake depth can be as shallow as 100 to 150 feet below the surface. Based on a 10 percent discharge exceedance through the powerhouse of 2,912 cfs using data from 1970 to 2006, calculated approach velocities at the intake can be as great as approximately 2.1 feet per second. Entrainment probability is a function of proximity to the intake and a fish's ability to avoid entrainment by swimming faster than the intake approach velocity. Gillnetting near the dam at depths up to 100 feet showed relatively low fish abundance; only kokanee (n=12), largemouth bass (n=3), rainbow trout (n=1), and spotted bass (n=5) were collected in deepwater habitat near New Exchequer dam. Merced ID's calculation of estimated swim speeds for kokanee, largemouth bass, and rainbow trout suggests that these species have sustained swimming speeds that exceed the maximum reported approach velocity of 2.1 feet per second and thus could avoid entrainment. The burst speed of all species significantly exceeded calculated approach velocities. If a fish were to become entrained and pass through the turbines, Merced ID's review of literature describing Francis turbines similar to those used at New Exchequer powerhouse suggests that the potential for survival would be 81.0 to 99.6 percent.

In McSwain reservoir, the powerhouse intake structure is located about 70 feet upstream of McSwain dam at a depth of 30 to 40 feet, depending on water levels. Based on a 10 percent discharge exceedance through the powerhouse of 2,900 cfs using data from 1970 to 2006, calculated approach velocities at the powerhouse intake can be as high as approximately 2.7 feet per second. Gillnet sampling in McSwain reservoir in 2010 found primarily Sacramento sucker in deep water near the reservoir bottom. Kokanee are present in the reservoir and may occur in deep water, but they were only found in mid-water (50 percent of maximum depth) sampling. Although the maximum calculated approach velocity of 2.7 feet per second exceeds the estimated sustained swimming speed of 2.4 feet per second for adult Sacramento suckers, it is significantly less than the sucker's estimated burst speed of 12.3 to 13.5 feet per second (Stamp and Golden, 2005). Other species for which swimming speed was estimated (largemouth bass, rainbow trout, kokanee) have sustained swimming speeds that exceed the maximum

approach velocity at the McSwain powerhouse intake. Merced ID's review of literature describing Kaplan reaction turbines similar to those used at McSwain powerhouse suggests that if a fish were to become entrained and pass through the turbines, the potential for survival would be 88.0 to 96.1 percent.

Based on results from the Merced ID fish entrainment study that show low potential for entrainment at project powerhouse intakes and relatively high survival rates for any fish that may be entrained, we find no basis for Merced ID to implement any protective measures at the project powerhouse intakes. As discussed in the previous section, the Main Canal is not a feature of the Merced River hydropower project, nor does is there any information that suggests that Merced ID's proposed project operation or maintenance activities would increase existing entrainment rates at the Main Canal; therefore, we find no basis for Merced ID to screen the Main Canal.

Spawning Habitat Enhancement

Availability and composition of river gravels influences suitability of spawning habitat for anadromous and resident fish. For example, salmonids deposit their eggs in redds created within gravel. Coarse gravel also provides substrate for growth of algae and invertebrates, both of which are important components of the aquatic food web.

Merced ID proposes no specific measures to address enhancing spawning habitat through gravel augmentation. The Water Board [preliminary WQC condition 4] specifies that Merced ID develop a gravel augmentation plan in consultation with a technical committee and submit the plan to the Water Board's Deputy Director within 1 year of license issuance. The Water Board also specifies that the amount of gravel augmented should be consistent with the amount of gravel annually trapped behind New Exchequer and McSwain dams. No further details were provided as to the content of the plan.

FWS [10(j) recommendation 4] recommends that Merced ID add approximately 2,600 cubic yards³⁰ of spawning-sized gravel annually between Crocker-Huffman diversion dam and Shaffer Bridge (RMs 52.0 to 32.8). Gravel augmentation sites would be selected each year based on monitoring and recommendations of a technical committee.

NMFS [10(j) recommendation 2] recommends that Merced ID add 20,000 tons of cleaned coarse sediment annually between Crocker-Huffman diversion dam and Shaffer Bridge to support the FWS' Anadromous Fish Restoration Program's Central Valley salmonid habitat doubling goal. Source aggregate would be harvested to create new

³⁰ The recommended volume of 2,600 cubic yards is derived from the Merced River Corridor Restoration Plan (Stillwater Sciences 2002), within which it was estimated that the equivalent weight would be 2,200 ton, based on the riverine sediments having an estimated dry bulk density of approximately 0.9 ton per cubic yard.

floodplain areas, and augmented in-channel sediments would be placed to increase local floodplain inundation by raising the channel bed. Harvested fine sediments would be used to support riparian recruitment on created floodplain habitats. Following the initial large-scale gravel augmentations, an annual maintenance augmentation would be added to the river reaches. Details of gravel-augmentation particle-size ranges, locations, and configurations in the river reaches would be developed in consultation with a technical committee and coordinated with LWD enhancement actions.

California DFW [10(j) recommendation 6] recommends that Merced ID develop a spawning gravel and floodplain habitat restoration plan that includes provisions for initially adding 50,000 cubic yards of cleaned spawning gravel downstream of Crocker-Huffman diversion dam, followed by annual replenishment of 2,600 cubic yards. The spawning gravels and cobbles would be harvested from the nearby dredger tailings and placed in the river to create riffles and influence geomorphic processes. Sediment harvesting would be conducted to create new floodplain areas and increase local floodplain inundation.

The Conservation Groups recommend that Merced ID develop and implement a gravel augmentation and rehabilitation plan in consultation with a technical committee, and that the plan describe potential locations of gravel collection for the river reaches between Merced Falls dam and Shaffer Bridge, and potential geographic and physical options for initially placing 20,000 cubic yards and thereafter annually placing between 2,600 and 10,400 cubic yards. The plan would address legal constraints on gravel placement and the permits that would be needed. The draft plan would be reviewed by the committee prior to submission to the Commission.

FWS [10(j) recommendation 5(K)], California DFW [10(j) recommendation 9(8)], and the Conservation Groups all recommend that Merced ID develop an aquatic monitoring program that includes provisions for monitoring sediment sizes between Crocker-Huffman diversion dam and Shaffer Bridge to determine if the prescribed gravel-augmentation rates are sufficient and to indicate where gravels would be needed to maintain spawning habitat quality. Additionally, spawner use of gravel-augmented and nearby control sites would be monitored for at least 5 years. The Conservation Groups also recommend that Merced ID annually monitor the locations, quantity, quality, and durations of placed gravel, as well as subsequent geomorphic distributions (e.g., movement, representative gravel quality, and bedload morphological change) and additions of suitable anadromous salmonid spawning and rearing habitat by individual reach. Monitoring results would be annually documented in a draft report to be provided to the technical committee for review and subject to revision prior to submission to the Commission.

Our Analysis

Pre-application studies indicated that New Exchequer and McSwain dams have cut-off access to historical spawning grounds in the upper reaches of the Merced River and have captured sediment that would otherwise move downstream to the lower reaches

where limited spawning habitat remains. Within these reaches, habitat quality is affected by the legacy hydrologic and geomorphic changes associated with historic dredging for gold and aggregate resources, and dam and reservoir construction and operation. Although dredging activities have ceased and peak-flow reduction is unavoidable, coarse-sediment entrapment behind the dams inhibits replenishment of riverine gravels considered vital for maintaining geomorphic features (i.e., gravel bars and riffles) and, therefore, suitable spawning opportunities in the lower reaches.

The two project dams have collectively intercepted a large amount of sediment that has contributed in part to bed coarsening, channel narrowing and simplification, and spawning-habitat loss in downstream reaches. Merced ID estimated the annual sediment capture behind New Exchequer dam to be 727,000 tons per year, with an estimated bedload³¹ fraction accounting for 36,000 to 73,000 tons per year. Merced ID estimated sediment deposited behind McSwain dam to be 29,000 tons per year, with an estimated bedload fraction amounting to 1,500 to 2,900 tons per year. Taken together, the sediment supply delivered annually to the downstream reaches has been substantially reduced. Other sediment sources are limited in these reaches; there are no streambank sources of sediment in the impounded reach between New Exchequer and McSwain dams, and only minimal sources occur between Merced Falls dam and Crocker-Huffman diversion dam. Merced ID has acknowledged that the project has continued to provide flows adequate to move sediment and mobilize (i.e., re-work) the river bed despite the extensive legacy effects of mining in the river channel.

Merced ID does not currently have a policy regarding placement of gravel downstream of New Exchequer and McSwain dams. Sediment augmentation projects implemented in recent years by California DFW and California DWR have included floodplain integration, pool filling and gravel augmentation, and riffle construction. For example, the Merced River Gravel Augmentation Project implemented immediately downstream of Crocker-Huffman diversion dam added approximately 8,000 tons of gravel between 1990 and 2003 (California DWR, 2004).

Our analysis indicates that development and implementation of a spawning-gravel augmentation plan is warranted in the project area. Implementation of the Water Board's preliminary WQC condition 4, with modifications, that specifies that a plan be developed in consultation with a technical committee and include provisions to strategically place gravel substrates downstream of Crocker-Huffman diversion dam would enhance spawning and riparian habitat.

³¹ Bedload is assumed to account for 5 to 10 percent of the total sediment load (Stillwater Sciences 2001), and is roughly equivalent to the fraction of sediment accounted for by gravel-sized materials.

However, there are differences in the various quantities and composition of gravel offered to augment the lower reaches. From the Water Board's specified condition, the amount of gravel to be added should be consistent with the amount trapped behind the dams, which equates to between approximately 37,500 and 75,900 tons per year. NMFS recommends adding 20,000 tons annually throughout the four reaches downstream of Crocker-Huffman diversion dam over an approximate 30-year period, followed by 3,000 tons per year as an annual maintenance supply intended to balance out the transport capacity of the regulated flow regime. California DFW recommends initially adding 50,000 cubic yards (~42,000 tons) and then placing 2,600 cubic yards (~2,200 tons) per year thereafter for annual replenishment. FWS' recommendation includes annual augmentation of 2,600 cubic yards (~2,200 tons) but not a larger initial amount. The Conservation Groups' recommendation includes an initial placement of 20,000 cubic yards (~17,000 tons) followed by annual augmentation so that there is no net loss of spawning habitat thereafter (estimated to be from 2,600 to 10,400 cubic yards or ~2,200 to 8,800 tons). There are pros and cons associated with each of the proposed augmentation amounts and directly addressing them during plan development would allow each to be considered while simultaneously balancing potentially conflicting resource values. Our analysis indicates that gravel augmentation amounts equal to at least the transport capacity of the supply-limited lower reaches, estimated to be 2,600 cubic yards (~2,200 tons) per year, would offset the ongoing coarse-sediment entrapment behind the project dams that has a direct effect on spawning-habitat quantity. A larger initial placement of coarse sediments in the lower reaches would potentially benefit spawning habitat; however, doing so would address legacy effects not necessarily attributed wholly to past project effects and certainly not influenced by future project-related operation, construction, and maintenance activities.

Obtaining the gravel to be placed in the lower reaches from the existing dredger-tailings piles along the river, as recommended by California DFW and the Conservation Groups, would potentially make implementation relatively efficient, as opposed to importing gravels from outside of the project area, which could result in off-site environmental effects at the harvest site. Harvesting gravels here would also serve to create a more natural floodplain.

The plan, with input from a technical committee, would therefore consider the appropriate sources, quantities, composition, and augmentation sites of gravels to place in the lower reaches to ultimately benefit spawning habitat. Monitoring and mapping existing and augmented spawning gravels, as recommended by FWS, California DFW, and the Conservation Groups, would provide an indication of the performance of the augmentations and inform the need for future augmentation projects.

Managing Large Woody Material

LWM provides habitat structure in streams and can influence sediment storage and channel morphology through its effects on flow, water velocity, and sediment transport. LWM provides cover and holding habitat for fish, serves as substrate for the growth of

algae and invertebrates (which are important components of the aquatic food web), and affects patterns of sediment deposition and scouring. Loss of LWM can result in reduced complexity of aquatic habitat and reduced carrying capacity for aquatic biota.

Merced ID proposes to develop a LWM management plan (measure G&S2) to provide LWM to the Merced River downstream of Crocker-Huffman diversion dam within 1 year of license issuance and in consultation with California DFW. The plan would:

- describe existing locations of LWM collection in Lake McClure and McSwain reservoir;
- describe potential options for moving LWM collected in Lake McClure and McSwain reservoir into the Merced River downstream of Crocker-Huffman diversion dam;
- identify suitable locations in the Merced River downstream of Crocker-Huffman diversion dam where LWM can be placed within the active channel and be passively mobilized by 2- to 5-year high-flow events; and
- prevent use of BLM-administered land, and particularly the Piney Creek red-legged frog core area, to stockpile or otherwise dispose of LWM material that Merced ID removes from the surface of Lake McClure or McSwain reservoir.

Merced ID further proposes that the plan would not include requirements to anchor or otherwise stabilize LWM in the channel, and the scope of work under the plan would be such that Merced ID would not be required to obtain any approvals other than from the Commission for plan implementation. Merced ID would consult with the Corps and if the Corps expresses a concern regarding the effects of LWM on safety or maintenance of downstream bridges or railroad trestles, Merced ID would modify the plan to avoid any such issues. Merced ID would file the plan, including evidence of consultation with California DFW and the Corps, with the Commission for approval.

NMFS [10(j) recommendation 3] recommends that Merced ID implement LWD³² enhancements in the four river reaches between Crocker-Huffman diversion dam and Shaffer Bridge (RMs 52.0–32.8). Merced ID would routinely count and acquire LWD from project reservoirs and roads, and from nearby dredge tailings where sediment harvesting would occur. Boat surveys of the upper reaches of Lake McClure would be conducted within weeks of any large peak flow (i.e., greater than 1.5-year return interval). Collection and storage of LWD would avoid reducing the size or structural complexity of individual pieces, and stockpiles would be secured to minimize illegal

³² NMFS defines LWD as structurally sound logs, with or without root wads, that are equal to or greater than 3-feet long and equal to or greater than 8-inches in diameter at 5 feet from the large end.

firewood cutting, theft, or other non-designated consumptive uses. The technical committee would be consulted regarding placement of LWD in the reaches downstream of Crocker-Huffman diversion dam following guidelines specified in NMFS' condition. A spatial inventory of existing LWD in these reaches would be created and housed within a GIS database. The inventory would be updated annually to account for manually placed LWD pieces, and comprehensively throughout the reaches during water years with a high-flow event of at least 4,000 cfs. Annual reports on status of LWD management and monitoring would be provided to the Commission and used for adaptive management.

The Conservation Groups recommend that Merced ID develop a LWD management plan that includes the three elements proposed by Merced ID but also state that the plan should include consultation with state and federal agencies regarding effects of LWD on safety or maintenance of bridges and an evaluation of the efficacy, costs, and permitting requirements of providing permanent anchorage to the placed LWD. Much of the remainder of the recommended measure is similar to that recommended by NMFS. Additionally, the Conservation Groups recommend that Merced ID secure state or local approvals for implementation (e.g., Section 1600 Streambed Alteration Agreement from California DFW), develop the plan under the guidance of a technical committee, and file the plan, including evidence of consultation with the technical committee, with the Commission within 6 months of license issuance.

BLM preliminary 4(e) condition 6 includes the same elements proposed by Merced ID. BLM also specifies its preference that Merced ID transport LWM past the dams over any other approach. Finally, BLM specifies that Merced ID acquire approval from California DFW, BLM, FWS, the Water Board, and NMFS on its LWM management plan before submitting the plan for Commission approval, and that the plan be implemented within 90 days of its approval by the Commission. The Water Board [preliminary WQC condition 14] specifies that Merced ID develop a LWM plan in consultation with a committee and submit it to the Water Board's Deputy Director within 1 year of license issuance. No further details were provided as to the content of the plan.

Our Analysis

Pre-application studies indicate that LWM is uncommon at the New Exchequer dam and reservoirs downstream, most likely because LWM transported into Lake McClure (most often during storm flows) sink or wash up on the reservoir shoreline before reaching the dam. Loss of LWM due to storage in Lake McClure is unavoidable. LWM input from the adjacent oak woodlands downstream of Lake McClure is also limited, and hardwood recruited to stream channels tends to be relatively small and short-lived in the channel. The resulting lack of LWM in waters downstream of New Exchequer and McSwain dams does not substantially affect the channel morphology of these reaches because they are impounded. The Merced River downstream of Crocker-Huffman diversion dam is riverine, and LWM is scarce in the lower Merced River.

Merced ID does not currently have a policy regarding collection of LWM from Lake McClure. It reports that LWM does not accumulate at New Exchequer dam. At McSwain dam, only about two logs per year originating from sources local to Lake McSwain are removed at the trash rack and burned.

Because LWM is scarce in the lower Merced River, placement of any LWM in these reaches would provide some benefits to riparian and aquatic plants and animals. Providing new substrate for algae and invertebrate colonization would increase habitat diversity and the structural diversity of the channel could possibly increase through creation of sediment storage sites or through local scour that may create pools. Rearing salmonids may benefit from the effects of increased cover even if storage of LWM in the channel is relatively short lived. The degree of habitat improvement would depend on the amount of LWM collected in the reservoirs and placed in the lower Merced River under Merced ID's proposed plan or the alternative plans offered by the agencies and Conservation Groups. Habitat improvement would also depend on the characteristics of the material collected, which would influence its longevity in the channel.

Our analysis indicates that changes in LWM management are warranted in the project area. Implementation of Merced ID's measure G&S2, with modifications, would lead to development of LWM and LWD management plan designed to identify sources of LWM collection in the project reservoirs, develop viable options for storing and transporting collected LWM, and identify suitable locations for LWM placement downstream of Crocker-Huffman diversion dam to benefit aquatic and riparian habitats. Monitoring and mapping the location of LWD and LWM placed between Crocker-Huffman diversion dam and Shaffer Bridge, as recommended by NMFS and the Conservation Groups, would provide an indication of the stability of these enhancements and inform the need for future LWD and LWM placement projects.

However, the various approaches offered for managing LWD and LWM differ. For example, NMFS and Conservation Groups recommend searching for wood rafts following high flow events and, if found, towing logs to a location where they can be securely stockpiled until decisions on placement projects in the lower Merced River can be made by the technical committee. BLM expresses concern with this approach and states that LWD or LWM could not be stockpiled on BLM-managed land because of concerns about associated habitat degradation at the storage sites. We expect these same concerns to be valid with stockpiling large quantities of LWD and LWM near much of the entire shoreline of both project reservoirs. In addition, stockpiles of wood may have an aesthetic effect that could detract from the experience of visitors to project recreation sites. There are pros and cons associated with both approaches and directly addressing them during plan development would consider and balance potentially conflicting resource values.

Merced ID states that it should not be required to anchor LWM at deposition sites along the lower Merced River to simulate natural conditions. NMFS and the Conservation Groups recommend that the feasibility of anchoring LWD at deposition

sites be considered. A decision regarding anchoring or not anchoring LWD should include consideration of potential adverse effects on downstream bridges and other structures, and the potential for increased flooding during high flow events if LWD should accumulate at bridges because they are not anchored securely. Consultation with appropriate state and federal agencies, including the California Department of Transportation and the Corps would inform such decisions. Including the results of that consultation in a plan would document the basis for the decisions.

Development of a LWM and LWD management plan in consultation with a technical advisory committee would ensure that management and monitoring of collected and placed LWM satisfies biological needs and regulatory requirements. In response to Merced ID's request that it implement its plan with only Commission approval, the federal and state resource agencies, not the Commission, would determine if additional permits or approvals would be needed for implementation of a Commission-approved plan.

Habitat Restoration and Management

Habitat restoration and enhancement projects have the potential to benefit aquatic biota as well as terrestrial vegetation and improve geomorphic processes in the lower Merced River. Merced ID does not propose any measures specifically relating to habitat restoration and enhancement projects along the lower Merced River.

FWS [amended 10(j) recommendations 3(A2) and 3(A3)] recommends habitat restoration and enhancement measures for the lower Merced River. For the 10-mile reach between Merced Falls dam and RM 45.2 (1.2 miles downstream of Snelling Road), FWS recommends that Merced ID restore a dense, riparian tree canopy in at least a 30-meter-wide zone on each side of the river to reduce water temperature by planting root stock, cuttings, or nursery stock using native tree species from the riparian corridor; protecting the plantings from beaver depredation; and, for restoration on lands not federally or state-owned, obtaining conservation easements and conveying them to an FWS-approved entity. For the reach from Shaffer Bridge to the confluence with the San Joaquin River, FWS recommends that Merced ID enhance at least 10 miles of habitat based on recommendations of a technical advisory committee and where conservation easements can be acquired to protect the restored habitat. FWS gives examples of potential habitat restoration projects, including addition of LWM, floodplain and riparian restoration, removal of riprap, and restoration of gravel mine pits. In 10(j) recommendations 5(I) and 9(9), FWS and California DFW recommend that Merced ID conduct long-term monitoring of riparian vegetation at floodplain restoration sites. The Conservation Groups make an identical recommendation. In addition to the recommendations described here, additional stakeholder habitat restoration recommendations are discussed in subsections *Managing and Monitoring Water Temperature*, *Managing Large Woody Material*, and *Spawning Habitat Enhancement* (i.e., gravel augmentation).

NMFS [10(j) recommendation 6] recommends that Merced ID implement NMFS' Ecosystem Adaptive Management Process and actions related to habitat enhancements from Crocker-Huffman diversion dam to Shaffer Bridge. This process would entail collating the annual reports specified in applicable license conditions, and in consultation with a technical advisory committee, holistically assessing the information to determine if respective goals and objectives have been achieved; and, if goals and objectives are not achieved, determining adjustments needed to achieve habitat anadromous fish habitat restoration goals. In addition, in 10(j) recommendation 7.1(C), NMFS recommends that Merced ID establish a restoration implementation fund and use an independent financial advisor to manage, track, and report on the fund's progress. Interest from the fund would be used to support habitat restoration projects recommended by a technical advisory committee.

Our Analysis

We do not dispute the environmental benefit to aquatic and riparian habitat of restoring a dense riparian tree canopy along the Merced River. However, in its April 1, 2011, study plan determination, Commission staff concluded existing information indicates that non-project-related dredger and aggregate mining has elevated the floodplain downstream of Crocker-Huffman diversion dam from its original position, indicating that non-project variables affect the establishment of over-floodplain flows, which serve an important function in maintaining floodplain vegetation. In addition, Commission staff noted that the extensive aggregate mining both in the floodplain and the channel have created in-channel or captured mining pits. We agree with the staff's previous findings.

In its April 1, 2011, study plan determination, Commission staff found that the effects of hydroelectric project operation are outweighed by other non-project factors downstream of Shaffer Bridge. We agree with staff's previous findings and find no basis to recommend that Merced ID be responsible for any habitat enhancement measures downstream of Shaffer Bridge. Although FWS gives examples of the types of projects that could be considered in this downstream reach, it does not specify which types of activities would actually take place. Therefore, we have no basis to evaluate the environmental benefits of this aspect of FWS' recommendation.

The NMFS recommendation that Merced ID be responsible for implementing the Ecosystem Adaptive Management Process seems to reiterate the purposes of a technical advisory committee, previously discussed. Major functions of such a committee include review of information pertaining to environmental measures that may be included in a new license, including those that pertain to enhancement of anadromous fish habitat, and developing recommendations for future actions to be considered by other stakeholders. The Commission would ultimately determine if any conditions of a new license need to be adjusted based on recommendations from Merced ID and other stakeholders to more effectively achieve the stated goals of environmental measures.

NMFS recommends that Merced ID establish a restoration implementation fund and use the interest from the fund for activities recommended by a technical advisory committee. Given that NMFS has not specified how funds would be used, we are unable to analyze the environmental consequences of the recommended fund. Furthermore precisely how Merced ID plans to fund any environmental measures that may be included in a new license is not within the Commission's purview.

Fish Population Monitoring

Recent surveys of resident fish species found in both project reservoirs and in the Merced River, summarized in the affected environment section, provide baseline conditions of species diversity and relative abundance. Resident fish species found in project-affected waters are largely maintained by various stocking programs (in reservoirs) or natural reproduction in both reservoirs and riverine habitats. Merced ID does not propose, and no other entity offers, any measures relating to the monitoring of resident fish populations in project-affected waters.

Existing monitoring of fish populations in project-affected waters is currently focused on anadromous salmonids occurring in the lower Merced River downstream of Crocker-Huffman diversion dam (RM 52.0). Historical monitoring to estimate fall-run Chinook salmon escapement is still being conducted by California DFW and includes carcass surveys, spawning distribution, scale and otolith collection and analysis, length, sex, coded-wire-tag, and fecundity data and analysis. Since 1999, RSTs have been deployed to monitor Chinook salmon juvenile outmigration. RST configuration, sampling locations, and survey dates have varied slightly throughout the years. The current trap configuration uses a pair of RSTs at Hopeton (RM 37.5) and a pair at Stevinson (RM 4.8) from January 1 through June 15. In fall 2012, Merced ID operated a fish counting weir in the lower Merced River at RM 4.6. The counting weir included a VAKI Riverwater™ system to monitor the timing, abundance, and composition of fish passing through the weir and was designed to estimate the escapement of adult Chinook salmon migrating upstream into the Merced River. Both the RSTs and counting weir also provided information on other anadromous species, including Central Valley steelhead, and other resident fish species, including rainbow trout and state-listed species of concern such as native hardhead and Sacramento splittail. There are no provisions for monitoring anadromous fish populations in the current license.

Merced ID proposes to monitor anadromous salmonids downstream of Crocker-Huffman diversion dam (measure T&E2). The Merced ID monitoring program would use one RST and one counting weir to be located based on recommendations from a Merced River technical committee and contingent on land owner approval. The counting weir would operate annually from October 1 through December 31 to monitor adult Chinook salmon and *O. mykiss* migrating upstream into the Merced River and would acquire data on time, direction of migration, size, sex, and marks such as adipose fin clips. For all other fish species passing through the weir, Merced ID would collect data on time, direction of movement, number, species, and size. The RST would be operated

annually from January 1 through May 31 to monitor juvenile Chinook salmon and *O. mykiss* migrating downstream from the spawning reaches in the lower Merced River and would acquire data on individual size, weight, and life stage from a representative sample of the catch.

The Water Board [preliminary WQC condition 20] specifies that Merced ID develop an anadromous fish monitoring plan that includes: (1) a statement of the goals and objectives; (2) a description of the proposed monitoring protocols; (3) a description of factors that could adversely affect California and federally listed species and whether the factors are related to project operation; (4) a monitoring and reporting schedule; (5) a plan for corrective actions if monitoring shows the project is adversely affecting anadromous fish or their habitat; and (6) protective measures.

NMFS, FWS, and California DFW [10(j) recommendations 4, 5(A-F), and 9(1-6), respectively] and the Conservation Groups recommend similar measures pertaining to anadromous fish monitoring. Compared with Merced ID's proposed measure, these measures would include an expanded set of monitoring activities. The primary differences include (1) continuing existing California DFW carcass surveys, including data collection and analysis of scales, otoliths, length, sex, wire tags, and fecundity for fall-run Chinook salmon; (2) conducting RST sampling at both currently monitored upstream and downstream sites (although the Conservation Groups only recommend RST sampling at one location); and (3) conducting annual snorkel surveys of the *O. mykiss* population. Additionally, California DFW [10(j) recommendation 3F] includes a provision that Merced ID prepare, implement, and fund a fisheries protection management plan that includes salmonid habitat and fish population monitoring to be approved by California DFW, FWS, NMFS, and the Water Board. California DFW notes that the plan should include a fish rescue component comparable to the drought emergency response planning and implementation that it conducted in the spring and summer of 2014.

Our Analysis

We find that the Merced ID measure provides reasonable monitoring for adult and juvenile anadromous salmonids; however, Merced ID does not specify the locations of the upstream or downstream monitoring stations. Developing an anadromous fish monitoring plan to include elements specified by the Water Board, in consultation with a technical committee, would provide documentation of specific monitoring, consultation, and reporting procedures that would be implemented. We recognize the additional value that conducting carcass surveys, scale and otolith analysis, and fecundity determinations of adult anadromous fish would provide for resource management purposes, but we do not see how this information relates to the hydroelectric project operation or how it could be used to inform any project modifications. The Commission reached a similar conclusion regarding carcass surveys and fecundity determinations in its April 1, 2011, study plan determination when it noted that correlating the results of such studies to hydroelectric project variables would be difficult.

Similarly, conducting additional snorkel surveys to monitor the *O. mykiss* population would supplement the monitoring proposed by Merced ID. However, during six seasonal fish sampling efforts conducted between summer 2006 to spring 2008 using snorkel surveys, seining, and backpack and boat-mounted electrofishing units, a total of 110 *O. mykiss* were observed. This included 73 *O. mykiss* resident rainbow trout observed in the Crocker-Huffman diversion dam impoundment that were most likely resident because there is no upstream passage facilities at the diversion dam and 37 *O. mykiss* observed downstream of the diversion dam that could have been either anadromous or resident (Stillwater Sciences, 2008). Of the 37 *O. mykiss* observed by all collection methods in the reach downstream of the diversion dam, 30 were observed during snorkel surveys (an average of 5 per survey). The anadromy of any observed *O. mykiss* during snorkel surveys could not be determined and we expect very few *O. mykiss* to be observed based on the results of previous studies. Therefore, it is unclear how snorkel surveys could further inform decisions regarding the status of lower Merced River steelhead beyond what would be achieved by Merced ID's proposed RST and counting weir monitoring, which would detect upstream and downstream migrating fish.

Although monitoring is an important component for protecting these species, it does not in and of itself provide for adequate protection. However, monitoring anadromous fish, combined with water temperature monitoring, discussed in *Managing and Monitoring Water Temperature*, in the project-affected reach could form the basis for establishing immediate and long-term protection strategies for anadromous fish as developed by a Merced River technical committee with approval by the Commission and implemented by Merced ID. Protection strategies could include a provision for fish salvage when water temperatures in the reach between Crocker-Huffman diversion dam and Shaffer Bridge become overly stressful. If such a provision is included in a monitoring plan, the entities responsible for each element of the fish salvage program should be identified. We expect the need for adjustments to hydroelectric project operation or facilities would be identified within the first 10 years of a new license, unless substantial changes to project operation occur within that period.

Merced River Fish Hatchery Management

The Merced River Fish Hatchery has been operational since 1970 and is managed by California DFW. The initial construction of the hatchery was funded by California DFW, California DWR, and Merced ID, and its ongoing operation is cooperatively funded by California DFW in collaboration with state water contractors. The current population of Chinook salmon in the Merced River is supported by fish produced at the hatchery. Salmon produced at the hatchery are also routinely used for studies conducted within the San Joaquin River Watershed. The hatchery reports recent average annual hatchery production of Chinook salmon (2004 to 2009) to be 972,344 fish. The Merced River hatchery is located on the left bank of the river near Crocker-Huffman diversion dam and operates as a flow through facility that draws an average of 3 cfs from February through March and 7 cfs from April through January from the impoundment above the

dam and releases water into the Merced River downstream of the dam. Merced ID does not propose any measures relating to the management of the Merced River Fish Hatchery.

California DFW [10(j) recommendation 5] recommends that Merced ID prepare a hatchery master plan in consultation with California DFW, FWS, and NMFS. The plan would include provisions for an initial design study to determine site capabilities and costs associated with operating the hatchery. The recommended plan would also address 11 potential hatchery upgrades to be provided at the existing hatchery and provisions to assess the possible relocation of facilities to a site immediately below New Exchequer dam to meet the guidelines of the California Hatchery Scientific Review Group. California DFW states that Merced ID should be responsible for the annual hatchery release of 5 million fall-run Chinook salmon smolts with a single year maximum of 7.5 million juveniles, and the annual release of 250,000 steelhead juveniles with a single year maximum of 425,000 juveniles.

The Conservation Groups recommend that Merced ID develop and implement a Merced River fish management plan to design, construct, and operate a fish propagation facility for the production of native salmonids. The initial capacity would be a 5-year running average of 60,000 eyed eggs, fry, or fingerling Chinook salmon per year and multiple age class broodstock (capacity of 1,000 to 2,000 pounds). Initial capacity would also include up to a 5-year running total of 667,200 rainbow trout annual production, commensurate with the need to outplant fish in tributaries of the Merced River. The Conservation Groups identify a 22-acre site on Merced ID land immediately below New Exchequer dam as a potential location for this new facility.

Our Analysis

The current annual production goal of the Merced River Fish Hatchery is to take 2 million fall Chinook salmon eggs and release 1 million Chinook salmon smolts (California HSRG, 2012). California DFW states that the current goal is based on facility constraints. The continued operation of the Merced River Fish Hatchery would support the Chinook salmon population in the lower Merced River until such time as natural reproduction in the river channel is sufficient to sustain or enhance the existing population. However, no aspect of the hatchery is included in the current license and the Commission has previously determined that the hatchery is not related to the ancillary use of project water for hydropower generation. The Crocker-Huffman diversion dam, which blocks upstream anadromous fish passage, was constructed in 1910, well before the Merced River Project received its hydroelectric license from the Commission. We do not dispute the assertion that upgrading and expanding the existing hatchery and assessing the potential relocation of the hatchery to a more favorable site could benefit efforts to artificially sustain Chinook salmon populations in the lower Merced River by stocking Chinook salmon smolts. We also recognize that the project plays a part in cumulative effects in the lower Merced River. However, other factors, such as instream mining and irrigation diversions, have had a much greater proportional effect than those associated with hydropower operation. We prefer to focus our analysis of potential

measures that could benefit Central Valley fall-run Chinook salmon populations on factors that would enhance natural in-river production, such as an improved flow regime, reduced water temperatures to the extent controllable by the project, and spawning habitat enhancements.

Benthic Macroinvertebrate Monitoring

BMI assemblages are an important part of the aquatic ecosystem and provide a fundamental food source for many resident fish. The description and characterization of BMI can also be used to provide an indication of the general health and condition of a stream.

Previous study results showed at least two EPT taxa (intolerant of water quality impairment) included in the top five numerically dominant taxa at each monitoring site in the lower Merced River, with the majority of dominant taxa likely available as a food source for juvenile Chinook salmon (Stillwater Sciences 2008, 2006). Tolerance metrics indicated moderately tolerant BMI assemblages under existing conditions. Merced ID does not propose any measures relating to the development of a BMI monitoring plan.

FWS [10(j) recommendation 8] recommends that Merced ID develop a BMI monitoring plan describing sampling to be conducted in the project-affected bypass reaches to assess the effects on BMI under new flow regimes and other changes that may be included in a new license.

Our Analysis

The recent BMI studies on the lower Merced River provide an adequate baseline for evaluating effects under any potential change to the flow regime. The instream flow measures offered by various stakeholders would result in no decrease to the current flow schedule over all water year types and would, at a minimum, maintain existing conditions in the lower Merced River. Results of recent BMI studies indicate a moderately tolerant BMI assemblage that can be expected to be used as food by fish in the lower river. Additionally, if instream channel enhancements downstream of Crocker-Huffman diversion dam should be included in a new license, it should improve conditions for the BMI community. Although continued sampling of BMI in the lower Merced River would enable trends to be evaluated over time, we cannot envision a scenario where project hydroelectric operation with protection and enhancement measures included in a new license would result in a declining trend in BMI density and EPT taxa. Consequently, the benefits of this recommended monitoring are unclear.

Aquatic Invasive Species Management

New Zealand mud snails, quagga mussels, and zebra mussels are invasive aquatic mollusk species that have the potential to affect aquatic communities (e.g., New Zealand mud snails feed on the algae that is normally consumed by aquatic insects that make up a large portion of the diet of fish, and quagga mussels filter and remove plankton, which may also modify food webs). These species are not currently known to inhabit project

reservoirs although the New Zealand mud snail has been documented in the lower Merced River between Crocker-Huffman diversion dam (RM 52.0) and the Highway 59 bridge (RM 42.0). Non-native invasive plants including Eurasian milfoil, hydrilla, and didymo (*Didymosphenia geminata*) also have the potential to occur or to be introduced to project waters. Once introduced, populations of these species can rapidly expand, crowd out native aquatic plants, and become so dense that project operation and water-based recreational activities are adversely affected.

Merced ID proposes to implement the Amended Aquatic Invasive Species Management Plan (AQR4) as filed with the Commission on April 23, 2014, and supplemented on September 5, 2014. The plan is intended to address quagga and zebra mussels, New Zealand mud snails, Eurasian milfoil, and Asian clams, and includes provisions for public education regarding prevention actions; consultation with agencies regarding appropriate signage and access restrictions if aquatic invasive species are detected within any project reservoir located in whole or in part on federal land; and development of BMPs for specific activities that have the potential to introduce aquatic invasive species into a project reservoir. Merced ID would discuss aquatic invasive species activities on land administered by BLM within the project boundary at the proposed annual meeting with BLM and incorporate any new information into the plan. Merced ID states in the plan that it currently follows all regulations set forth by California Assembly Bill 2065 that pertain to prevention of infestation by invasive mussels, including an assessment of project reservoir vulnerability, and would follow any future legislation at all project reservoirs. Any updates to the plan would be developed in consultation with BLM prior to being filed with the Commission.

California DFW [10(j) recommendation 11] recommends that Merced ID implement its proposed Aquatic Invasive Species Management Plan. BLM [preliminary 4(e) condition 8] specifies that Merced ID develop an aquatic invasive species management and monitoring plan that meets applicable state and federal laws and regulations. The BLM specified plan is similar to the plan proposed by Merced ID, but also includes zebra and quagga mussel surface surveys, veliger sampling, and artificial substrate monitoring in Lake McClure. It would also include provisions for documenting incidental observations during other aquatic monitoring in project reservoirs and project-affected stream reaches of quagga and zebra mussels, New Zealand mudsnails, Eurasian milfoil, hydrilla; didymo, Asian clams, and American bullfrogs. BLM states that other aquatic invasive species may be identified through monitoring and incidental observations. Mapping and monitoring results would be provided to BLM, California DFW, and the Water Board. The Water Board comments that Merced ID's plan should also include managing for the invasive aquatic plan, Brazilian elodea (*Egeria densa*). Additionally, the Water Board [preliminary WQC condition 17] specifies that Merced ID develop an aquatic invasive species management plan that includes some of the elements in the existing plan, but also includes a description of proposed monitoring protocols and a detailed monitoring and reporting schedule.

Merced ID filed an alternative to the BLM 4(e) condition stating that its Aquatic Invasive Species Management Plan provides adequate protection; therefore, its alternative condition is to implement its existing amended plan. Merced ID objects to the BLM monitoring provision because it provides “considerably more than adequate protection,” among other issues. Merced ID states that BLM 4(e) condition would require a level of compliance that exceeds that of any reservoir in the state and would require monitoring for two species where survey protocols do not currently exist. Merced ID also contends that BLM 4(e) conditions would apply only to BLM-administered land, which covers 37 percent of Lake McClure’s total shoreline and includes one recreation area located at Horseshoe Bend. Merced ID also notes that the Project Mussel Vulnerability Assessment, included as an attachment to the amended plan, shows that the likelihood of infestation of project waters by these two species is remote, and concentrated monitoring for them is unwarranted.

Our Analysis

Although invasive species have not been documented in project reservoirs, taking a proactive approach by establishing an Aquatic Invasive Species Management Plan as proposed by Merced ID would ensure that reasonable measures are in place to prevent colonization in project reservoirs, and if colonization should occur, procedures are in place to control the spread of invasive species. Merced ID included a vulnerability assessment in its amended plan, as required by California regulations. The assessment found that the vulnerability of project reservoirs to the introduction of quagga and zebra mussels is low. Merced ID’s conclusions are based on water quality measurements from its Water Quality Study (Merced ID 2012c) that compared the concentrations provided in Claudi and Prescott (2011) to project waters. This comparison showed that multiple factors, primarily calcium concentration and pH, but also temperature, alkalinity, total hardness, and phosphorus concentration, were all outside the range necessary for successful mussel infestation. Based on the available information in Merced ID’s vulnerability assessment, we find no basis to include a rigorous monitoring program for quagga and zebra mussels in the plan, as specified by BLM.

Merced ID’s plan does not include any monitoring for aquatic invasive species other than to state that “any necessary monitoring for potential aquatic invasive species” would be included in activity-specific BMPs. Documenting incidental observations of aquatic invasive species (as well as the absence of target species), as BLM specifies, would provide a mechanism to detect if introductions have occurred in project waters and enable potential control strategies to be discussed with appropriate state and federal agencies. Merced ID’s proposed annual employee training, discussed further in section 3.3.2.2, *Terrestrial Resources*, would provide a convenient forum to train project operation and maintenance staff to identify invasive species. We conclude that requiring the staff conducting field monitoring and studies at project reservoirs to be able to recognize and identify aquatic invasive species and document the presence or absence of such species would not be particularly onerous. However, because there are no project facilities (recreation or otherwise) downstream of the McSwain impoundment, we do not

see how project operation or maintenance could influence the potential introduction of aquatic invasive species downstream of the McSwain impoundment.

BLM specifies that hydrilla and the American bullfrog be added to the list of aquatic species addressed in an aquatic invasive species management plan and the Water Board suggests adding Brazilian elodea to the list. Both hydrilla and Brazilian elodea have been documented in the San Joaquin River Watershed, and the popularity of Brazilian elodea as a tropical fish aquarium decoration makes it a candidate for introduction anywhere unwanted aquarium contents are released into lakes and rivers (California DFA, 2014). Introduced American bullfrogs are known to be pervasive throughout California and threaten many native aquatic species. Adding these three species to the species targeted in the plan would enable control strategies to be implemented, as appropriate, if these species should be detected in project reservoirs.

Merced ID's plan includes provisions for plan revisions that include consultation with BLM. Other agencies in addition to BLM, such as California DFW and the Water Board, have an interest in ensuring aquatic invasive species are not introduced to project waters and if introduced, deciding effective means to control the spread of such species. Developing plan revisions in consultation with all three agencies would provide a means to ensure current applicable state and federal policies and regulations are considered during plan revisions.

Merced Falls Project

Coordinated Operation between the Merced River and Merced Falls Projects

As previously discussed, flows released from the Merced River Project for environmental and irrigation purposes must pass through the Merced Falls Project before reaching the irrigation diversion point at Crocker-Huffman diversion dam. Although the Merced Falls Project operates in a run-of-river mode, where inflow to the project equals outflow, there are circumstances that could occur, such as routine maintenance events, that could have a bearing on the multi-purpose releases from the Crocker-Huffman diversion dam to the lower Merced River and irrigation flows into the Main Canal. Furthermore, due to the synergistic nature of the environmental effects of the two projects, the application of potential environmental measures could require the two applicants to communicate about the timing, access, or specific conduct of those measures.

PG&E proposes to continue operating the project run-of-river and proposes no specific mechanism for coordinating project activities, such as operation, maintenance, or the implementation of any potential protection, mitigation, and enhancement (PM&E) measures with the upstream Merced River Project.

California DFW [10(j) recommendation 2] recommends that PG&E develop a coordinated operation plan in consultation with Merced ID and file it with the

Commission, California DFW, the Water Board, FWS, and NMFS within 90 days of license issuance.

Our Analysis

By virtue of Merced Falls' close proximity downstream to the Merced River Project and its operational dependence on that project, the environmental effects of the PG&E project within the project area and downstream are often intertwined with that of the Merced River Project. Although PG&E must maintain some level of communication with Merced ID to maintain and operate the Merced Falls Project, no formal plan exists to coordinate operating conditions or potential PM&E measures. As indicated in the previous section, a coordinated operation plan for the Merced River and Merced Falls Projects would document the process by which flows released at McSwain dam would be available for intended purposes at Crocker-Hoffman diversion dam. Furthermore, given the intrinsic link between the two projects and their environmental effects, a plan to enable coordination between the licensees would be valuable to ensure the timeliness, efficacy, and consistency in the application of any operational and environmental measures in the Merced Falls Project area and downstream. Although developing this plan is likely to entail technical discussions about the fine points of project operation, inviting interested parties to provide input on the draft plan could provide valuable insights that enhance its effectiveness.

Coordination between Resource Agencies and Stakeholders

California DFW [10j recommendation 1] recommends that PG&E establish an ecological resource committee for the purpose of consulting annually with resource agencies and other interested stakeholders on the implementation of license measures, implementation of monitoring plans, review and evaluation of monitoring data, and review and evaluation of required facility modifications. NMFS [10(j) recommendation 6] recommends that Merced ID implement NMFS' Ecosystem Adaptive Management Process and actions related to habitat enhancements from Merced Falls dam to the Crocker-Huffman diversion dam. This process would entail collating the annual reports specified in applicable license conditions, and in consultation with a technical advisory committee, holistically assessing the information to determine if respective goals and objectives have been achieved; and, if goals and objectives are not achieved, determining adjustments needed to achieve habitat anadromous fish habitat restoration goals. NMFS [10j recommendation 7] recommends Merced ID establish an anadromous fish committee that includes a technical advisory plan that defines membership, meeting responsibilities, ground rules for consensus-based decision making, and a process for implementing the decisions. The Water Board specifies [preliminary WQC condition 8] that PG&E hold a pentennial meeting with the resource agencies to provide an update of all monitoring and data required by the new license and WQC and a map that depicts locations that pesticides were applied, California ESA and ESA listed species, and topography. PG&E indicates that participation in regular consultation is unnecessary, given the minimal environmental impact of the Merced Falls Project.

Our Analysis

As noted above, the Merced Falls Project area experiences many of the environmental effects of the upstream Merced River Project because of its proximity and operational dependence on the upstream Merced ID facilities. While Merced Falls' incremental contribution to environmental effects may be minor, compared to those upstream projects, PG&E's participation in a committee would require little effort and would be valuable to ensure the timeliness, efficacy, and consistency in the application of any operational and environmental measures required of Merced ID or PG&E in the Merced Falls Project area and downstream.

The NMFS recommendation that PG&E be responsible for implementing the Ecosystem Adaptive Management Process seems to reiterate the purposes of a technical advisory committee, previously discussed. Major functions of such a committee include review of information pertaining to environmental measures that may be included in a new license, including those that pertain to enhancement of anadromous fish habitat, and developing recommendations for future actions to be considered by other stakeholders. The Commission would ultimately determine if any conditions of a new license need to be adjusted based on recommendations from PG&E and other stakeholders to more effectively achieve the stated goals of environmental measures.

Instream Flows

PG&E proposes to continue operating the project run-of-river, where outflow equals inflow to the project.

California DFW [10j recommendation 3, parts A-D] recommends that PG&E calculate water year types annually and then implement and adaptively manage a flow schedule based on that water year type calculation. California DFW recommends that PG&E coordinate with Merced ID regarding implementation of its recommended instream flows. We note that the recommended flow schedule is identical to the flow schedule California DFW recommended for the Merced River Project. NMFS [10j recommendation 1] recommends that the Merced Falls Project pass through flows provided by Merced ID, such that the inflow equals outflow. NMFS further recommends that when diversions are occurring out of PG&E's reservoir, outflow should equal inflow minus the amount of flow being diverted.

PG&E states that it does not alter the quantity or timing of flow in the Merced River, nor does control or have the rights to gage the non-project diversions located at the Merced Falls impoundment. For these reasons, PG&E states that the recommended flow conditions are unnecessary and unwarranted.

Our Analysis

The Merced Falls Project does not alter the timing or quantity of flow. It is currently operated and proposed to continue to operate as a run-of-river facility, completely dependent on inflow from the upstream Merced River Project facilities. As

such, NMFS' minimum instream flow recommendation is identical to proposed operation, and therefore, redundant. California DFW recommends an identical flow schedule to the flow schedule it recommends for the Merced River Project. Because the Merced Falls Project does not propose to alter flows in the Merced River, any flow schedule prescribed to the upstream project would continue downstream, unmodified by the Merced Falls Project. For this reason, any flow prescription for the Merced Falls Project is unwarranted. However, we note that the intent of California DFW's recommendation was most likely to underscore the need for coordination between Merced ID and PG&E in the operation of both projects. We address that recommendation in the above sections, *Coordinated Operation between the Merced River and Merced Falls Projects*.

Water Temperature

Water temperature data collected from 1998 to 2008 in the Merced Falls Project impoundment ranged between 49°F and 60°F (9.4°C and 15.5°C). Downstream of Merced Falls dam, temperatures generally met or exceeded state standards, ranging from 57°F (13.8°C) to just over 60°F (15.5°C). The lower Merced River is listed under CWA section 303(d) as impaired for temperature. Under current conditions, warm water temperatures reduce habitat suitability for Chinook salmon and steelhead downstream of Crocker-Huffman diversion dam, particularly for spawning.

PG&E proposes to implement a long-term water quality monitoring program for periodic (10 year intervals) assessment of water temperature and DO downstream of the project dam.

Identical to its recommendation for the Merced River Project, California DFW [10(j) recommendation 4] recommends that PG&E prepare a long-term water temperature management plan in conjunction with Merced ID. The plan would include: (1) developing a long-term strategy for meeting seasonal temperature objectives for Chinook salmon and *O. mykiss* ranging from 13.0°C (55.4°F) to 18.0°C (64.4°F) during the time frames included in the recommendation; (2) a feasibility study on submerged pipes capable of delivering at least 200 cfs to a location downstream of Crocker-Huffman diversion dam; (3) measures to prolong and stabilize the irrigation delivery season; (4) measures to restore the natural channel morphology, floodplain habitats, and riparian forest in the approximately 10-mile reach downstream of the Crocker-Huffman diversion dam; (5) provisions to provide coldwater refugia when water temperatures exceed objectives for more than 14 days; and (6) evaluating the effects on instream flow releases of implementing alternatives, and the estimated funding and schedule needed for the alternatives. California DFW [10(j) recommendation 6(2)] also recommends that PG&E continuously monitor water temperatures between inflow into the Merced Falls impoundment and outflow into the Merced River downstream of the project.

FWS [10j recommendation 2] recommends that PG&E coordinate and cooperate with Merced ID for restoration of shaded riverine habitat and riparian floodplain in the

lower Merced River. FWS recommends that PG&E participate in temperature modeling to determine the thermal contribution of the Merced Falls Project to warming in the lower Merced River and bear a commensurate share of the costs of downstream restoration based on the results of that modeling.

Identical to its recommendation for the Merced River Project, NMFS [10(j) recommendation 8] recommends that water temperature and flows be measured at ten locations ranging from RM 62.0 to a location between Shaffer Bridge and the confluence with the San Joaquin River. NMFS states that measuring flow at temperature monitoring stations is important because temperature is related to flow and having information about both would better enable interpretation of the monitoring results given the many diversions that occur in the lower Merced River.

PG&E states that existing information indicates that the Merced Falls Project has an insignificant effect on warming in the project impoundment. Therefore, PG&E believes that measures related to water temperature management, monitoring, or mitigation are unwarranted.

Our Analysis

As previously discussed, the Merced River Project is the primary influence on water temperatures in the main channel of the Merced River downstream to Shaffer Bridge during the off-irrigation season (November through February) and exerts significant influence on temperatures during the irrigation season. Because of the low residence time of water in the Merced Falls impoundment, little warming occurs. Modeling studies estimated that the Merced Falls impoundment warmed only 0.54°F in the month of July—within the bounds of error reported by the study. Because existing information indicates that Merced Falls Project has a relatively insignificant thermal influence on the Merced River, PG&E should bear minimal responsibility for the implementation or funding of any potential temperature management, monitoring, or mitigation programs. PG&E's proposed long-term monitoring program would identify any potential unforeseen effects on water quality parameters (temperature and DO) important to aquatic biota. We analyze the effect of Merced ID's Merced River Project on water temperature in the lower Merced River above, in section 3.3.1.2.

Fish Population Monitoring

Recent surveys of resident fish species found in the project impoundment and in the Merced River, summarized in the affected environment section, provide baseline conditions of species diversity and relative abundance. Resident fish species found in project-affected waters are largely maintained by various stocking programs or natural reproduction in both reservoirs and riverine habitats. PG&E proposes to conduct annual semi-qualitative fish surveys in the reach between Merced Falls dam and Crocker-Huffman diversion dam (Merced Falls reach) during the fall for the purpose of monitoring fish populations.

California DFW [10j recommendation 6] recommends that PG&E develop an annual monitoring plan and conduct *O. mykiss* surveys in the Merced Falls reach during the spring and summer to determine abundance, size distribution, spawning distribution, and summer distribution. Specific methodology of the monitoring plan would be developed in consultation with a technical advisory committee. California DFW also recommends that PG&E continuously monitor water temperatures between inflow into the Merced Falls impoundment and outflow into the Merced River downstream.

NMFS [10j recommendation 4] recommends that PG&E should develop and implement an anadromous/resident fish monitoring plan in the Merced Falls reach in consultation with a technical advisory committee. The goals and timing of NMFS' recommended plan are similar to those recommended by California DFW. The primary differences include NMFS' recommendation to (1) conduct an annual pre-spawning mortality survey; (2) conduct carcass surveys, including data collection and analysis of scales, otoliths, length, sex, wire tags, and fecundity data; (3) conduct annual juvenile emergence and outmigration monitoring using two RSTs; (4) establish counting weirs to estimate Central Valley Chinook salmon and Central Valley steelhead escapement and provide data on the percentage of females and migration timing; and (5) conduct otolith analysis annually to estimate the contribution of naturally produced fry-, parr-, and smolt-sized migrants to the adult population. NMFS [10j recommendation 5] recommends that PG&E consult with the technical advisory committee annually regarding the presence of special-status species in the area, and if newly-listed species are determined to be affected by the project, providing the committee with a draft biological evaluation or biological assessment.

PG&E notes that the Merced Falls reach is characterized by high flows, typically in excess of 2,000 cfs, throughout the spring and summer. PG&E states that these high flows would greatly limit the efficacy of standard fish population sampling methods, such as snorkel surveys and backpack electrofishing, because of the deep, swift, and unwadeable conditions.

Our Analysis

Monitoring fish populations in the Merced Falls reach could form the basis for establishing immediate and long-term protection strategies. Given the seasonally high spring and early summer flows in the Merced Falls reach, certain sampling techniques would not only be limited in their efficacy, but also dangerous to those responsible for conducting the sampling. While fall sampling efforts would ensure safer and more effective sampling conditions, specific data needs, such as spawning distribution or summer distribution, may not be fulfilled, because the timing of discrete events in the life cycle of the species of interest may not coincide with fall sampling. Consultation with a technical advisory committee could resolve the necessity for specific data needs, such as spawning distribution, or summer distribution, with regard to local site conditions, and would assist in any potential adaptation of sampling techniques to address local site conditions. We note that NMFS' additional recommendations 1-5 listed above are

identical to recommendations for the Merced River Project, and are primarily intended to gather monitoring data on anadromous species. As previously discussed, Crocker-Huffman diversion dam (RM 52.0), located downstream of the Merced Falls Project, represents the upstream barrier to resident and anadromous fish in lower Merced River. Therefore, monitoring these species in the Merced Falls reach, using the recommended techniques, would be unnecessary at this time. Participation in a technical advisory committee, in conjunction with annual monitoring, would keep PG&E informed about the potential future introduction of special-status species in the project area and the adaptation of any management programs to avoid the potential for the project to contribute to take of a listed species. We discuss fish monitoring in the lower Merced River in the *Merced River—Fish Population Monitoring* section.

Spawning Habitat Enhancement

Availability and composition of river gravels influences suitability of spawning habitat for anadromous and resident fish. For example, salmonids deposit their eggs in redds created within gravel. Coarse gravel also provides substrate for growth of algae and invertebrates, both of which are important components of the aquatic food web.

PG&E proposes no specific measures to address enhancing spawning habitat through gravel augmentation. The Water Board [preliminary WQC condition 3] specifies that PG&E develop a gravel augmentation plan in consultation with California DFW, FWS, and NMES, and submit the plan to the Water Board's Deputy Director within 1 year of license issuance. The Water Board also specifies that the amount of gravel augmented should be consistent with the amount of gravel annually trapped behind Merced Falls dam. No further details were provided about the content of the plan.

NMFS [10(j) recommendation 2] recommends that Merced ID add 2,500 tons of coarse sediment to the Merced Falls reach. Following the initial large-scale gravel augmentations, an annual maintenance augmentation would be added to the river reach. Details of gravel-augmentation particle-size ranges, locations, and configurations in the river reaches would be developed in consultation with a technical advisory committee and coordinated with LWD enhancement actions.

The Conservation Groups recommends that PG&E provide a \$50,000 annual payment to Merced ID for gravel augmentation.

PG&E states that the New Exchequer and McSwain dams prevent the transmission of gravel through McClure and McSwain reservoirs to the Merced Falls impoundment, and that no tributaries entering the Merced Falls impoundment that would contribute gravel. Additionally, Merced ID noted a 100 acre-foot difference in bathymetry data from 1972 and 2008 in its study of sediment trapped by Merced Falls dam. PG&E suggests that this data limitation is significant enough to question the accuracy of the estimate of sediment trapped by Merced Falls. PG&E concludes that no measures related to gravel augmentation are warranted.

Our Analysis

As previously discussed, pre-application studies indicated that, in conjunction with Merced ID's New Exchequer and McSwain dams, the Merced Falls dam has cut-off access to historical spawning grounds in the upper reaches of the Merced River and captured sediment that would otherwise move downstream to the lower reaches where limited spawning habitat remains. Coarse-sediment entrapment behind the dams inhibits replenishment of riverine gravels considered vital for maintaining geomorphic features (i.e., gravel bars and riffles) and, therefore, suitable spawning opportunities in the lower reaches.

The two Merced ID project dams have collectively intercepted the majority of sediment that has contributed in part to bed coarsening, channel narrowing and simplification, and spawning-habitat loss in downstream reaches. Merced ID estimated annual sediment capture behind New Exchequer dam to be 727,000 tons per year, with an estimated bedload³³ fraction accounting for 36,000 to 73,000 tons per year. Merced ID estimated sediment deposited behind McSwain dam to be 29,000 tons per year, with an estimated bedload fraction amounting to 1,500 to 2,900 tons per year. Merced ID estimated that the Merced Falls dam traps an average of only approximately 0.65 to 13 tons of sediment per year. Taken together, the sediment supply delivered annually to the downstream reaches has been substantially reduced. However, the incremental effect of the Merced Falls project on sediment supply in the Merced Falls reach and lower Merced River appears to be several orders of magnitude less than that of the upstream Merced River project dams.

While the study conducted by Merced ID estimated that the Merced Falls dam traps an average of 0.31 acre-feet of sediment annually, the study authors noted that there was some amount of measurement error due to the differing precision of data collected in 1972 versus 2008. As such, the accuracy of this estimate is questionable. Regardless, we note that the banks of the Merced Falls impoundment are armored, the water level does not fluctuate dramatically, and there are no tributaries that enter the impoundment. Therefore, coarse sediment supply in the Merced Falls reach is likely very limited – further confirming the project's minor role in the sediment dynamics in the Merced Falls reach and the lower Merced River.

We analyze the benefits of coarse gravel augmentation above, in the *Merced River—Spawning Habitat Enhancement* section. We acknowledge the benefits of such a program to aquatic species in the lower Merced River; however, our analysis indicates that while the Merced Falls dam may trap some coarse sediment, the New Exchequer and

³³ Bedload is assumed to account for 5 to 10 percent of the total sediment load (Stillwater Sciences 2001), and is roughly equivalent to the fraction of sediment accounted for by gravel-sized materials.

McSwain dams are the primary sediment-trapping mechanisms responsible for the lack of coarse sediment in the Merced Falls reach and the lower Merced River. For these reasons, PG&E should bear minimal responsibility for the implementation or funding of any potential gravel augmentation program(s).

As described in the *Merced River—Environmental Effects* section above, a gravel augmentation plan, developed by Merced ID with input from a technical advisory committee, would consider the appropriate sources, quantities, composition, and augmentation sites of gravels to place in the lower Merced River reaches, in addition to the Merced Falls reach, to ultimately benefit spawning habitat in the Merced Falls project area and downstream.

Managing Large Woody Material

LWM provides habitat structure in streams and can influence sediment storage and channel morphology through its effects on flow, water velocity, and sediment transport. LWM provides cover and holding habitat for fish, serves as substrate for the growth of algae and invertebrates (which are important components of the aquatic food web), and affects patterns of sediment deposition and scouring. Loss of LWM can result in reduced complexity of aquatic habitat and reduced carrying capacity for aquatic biota.

PG&E proposes to continue performing periodic intake cleaning, wherein woody debris lodged against the intake is raked off, placed on a debris chute, and passed downstream. PG&E also notes that woody debris can continue downstream periodically when project gates are opened.

Identical to its recommendation for the Merced River Project, NMFS [10(j) recommendation 3] recommends that in conjunction with Merced ID, PG&E implement LWD³⁴ enhancements in the four river reaches between Crocker-Huffman diversion dam and Shaffer Bridge (RMs 52.0–32.8). Specifically, NMFS recommends that PG&E should be responsible for adding LWD to the Merced Falls reach, based on consultation with the technical advisory committee. PG&E and Merced ID would routinely count and acquire LWD from project reservoirs and roads, and from nearby dredge tailings where sediment harvesting would occur. Boat surveys of the upper reaches of Lake McClure would be conducted within weeks of any large peak flow (i.e., greater than 1.5-year return interval). Collection and storage of LWD would avoid reducing the size or structural complexity of individual pieces, and stockpiles would be secured to minimize illegal firewood cutting, theft, or other non-designated consumptive uses. A spatial inventory of existing LWD in these reaches would be created and housed within a GIS database. The inventory would be updated annually to account for manually placed

³⁴ NMFS defines LWD as structurally sound logs, with or without root wads, that are equal to or greater than 3-feet long and equal to or greater than 8-inches in diameter at 5 feet from the large end.

LWD pieces, and comprehensively throughout the reaches during water years with a high-flow event of at least 4,000 cfs. Annual reports on status of LWD management and monitoring would be provided to the Commission and used for adaptive management.

PG&E states that the primary issue regarding LWD is restricted movement through upstream Merced ID reservoirs. PG&E notes that the Merced Falls Project has a very limited potential to collect LWD that would otherwise move into the Lower Merced River.

Our Analysis

The Merced Falls project area consists primarily of annual grasses, with a relatively small percentage of woody vegetation that could contribute to the recruitment of LWM and LWD. Thus, the recruitment of LWM and LWD in the reach downstream of Merced Falls and the lower Merced River depends primarily on upstream sources. As previously discussed, pre-application studies indicated that LWM is uncommon at the New Exchequer dam, most likely because LWM transported into Lake McClure (most often during storm flows) sink or wash up on the reservoir shoreline before reaching the dam. Loss of LWM due to storage in Lake McClure is unavoidable. LWM input from the adjacent oak woodlands downstream of Lake McClure is also limited, and hardwood recruited to stream channels tends to be relatively small and short-lived in the channel. For these reasons, the breadth and scale of the LWM management activities recommended by NMFS are unwarranted, given the project's minimal effects.

However, PG&E's current LWD/LWM management practices do not effectively document the quantity or timing of LWD removal and therefore, it is difficult to determine the biological significance of its placement back into the Merced River channel. Furthermore, the success of any LWD/LWM management program implemented by the upstream Merced River Project for the benefit of the lower Merced River would depend on coordination and communication with the downstream Merced Falls Project. Therefore, development of a LWM and LWD management plan in consultation with the technical advisory committee would ensure that management and monitoring of collected and placed LWM satisfies biological needs and regulatory requirements and consistency with any upstream LWM/LWD management program.

Fish Passage and Canal Screening

The Merced Falls dam has a non-operational fish passage facility. The facility was decommissioned after construction of the upstream Merced River project dams eliminated suitable habitat for anadromous species upstream of the Merced Falls dam. PG&E does not propose any measures relating to fish passage. As previously discussed, Crocker-Huffman diversion dam (RM 52.0), located downstream of the Merced Falls project, represents the upstream barrier to resident and anadromous fish in lower Merced River. Crocker-Huffman diversion dam is equipped with a fish ladder that has been non-operational since 1971 and would require replacement or retrofit to meet current standards for fish passage.

The Water Board [preliminary WQC condition 4] specifies that if fish passage resumes at Crocker-Huffman diversion dam, PG&E consult with NMFS, CDFW, and FWS to determine if passage should resume at Merced Falls dam. In the event that passage is recommended after consultation, the preliminary condition specifies that PG&E develop a fish passage plan in consultation with the same parties.

FWS [10(j) recommendation 1] recommends PG&E, in coordination with Merced ID, develop a salmonid conservation, rescue, and passage plan to include: (1) planning, permitting, design, scheduling, costs, construction implementation, and monitoring of anadromous and resident salmonid passage at Crocker-Huffman diversion dam; (2) cooperating screening at any conveyance facilities out of the Merced Falls reservoir pool; (3) cooperating with California DFW in trapping and hauling local wild fish when temperatures in the lower Merced River are expected to be stressful; (4) planning for opening of the existing fish ladder on Merced Falls dam; conducting an analysis of the measures that would need to be taken to bring the existing fish ladders up to NMFS standards; and (5) providing annual progress reports.

The Conservation Groups recommend that PG&E reopen the fish ladder at Merced Falls, based upon the “reasonably foreseeable” future reoperation of the fish passage facility at the downstream Crocker-Huffman diversion dam.

PG&E states that it is willing to work on mutually agreeable solutions to fish passage; however, it does not provide details regarding a proposal for fish passage. Regarding canal screening, PG&E notes that a 1923 deed granted Merced ID a right-of-way easement for Merced ID’s northside canal, the only facility that conveys water out of the Merced Falls impoundment. PG&E states that given the terms of the deed, it cannot require such screens at the northside canal.

Our Analysis

As previously discussed, Crocker-Huffman diversion dam is considered a barrier to upstream anadromous fish movement in the Merced River. Therefore, at this time, reoperation of the fish ladder at Merced Falls dam would provide no benefit to anadromous species in the Merced River. As previously discussed, the Crocker-Huffman diversion dam and any associated features are not project features of either the Merced River or the Merced Falls Projects. We find that participation in a technical advisory committee, as described above, would facilitate the sharing of information regarding the status of anadromous fish passage at Crocker-Huffman, and therefore, the potential necessity of reevaluating passage scenarios at Merced Falls dam. Should fish passage be successfully restored upstream of the Crocker-Huffman diversion dam at some point in the future, the Commission’s standard reopener could be used to address any necessary changes to project facilities or environmental measures to accommodate anadromous species. Therefore, the Water Board’s specification of a plan to accommodate the passage of anadromous species in the project area is unnecessary.

PG&E's study of entrainment at the project estimated that 87 fish are entrained annually into northside canal. Therefore, entrainment of fish into the northside canal likely represents a negligible effect on the overall abundance of the fish assemblage. As such, FWS's recommendation to screen water conveyance facilities out of the Merced Falls reservoir pool would provide only minor enhancement to existing fish populations. Furthermore, we note that PG&E is not proposing any operational changes to the project that could increase canal entrainment. Therefore, canal screening would not mitigate for any potential project effect.

3.3.1.3 Cumulative Effects

Direct and indirect (cumulative) effects of the proposed hydroelectric project operation are intertwined. Consequently, some cumulative effects are previously discussed in section 3.3.1.2. In such cases, we summarize those effects here rather than repeating the entire effects analysis.

Water Quantity

Water diversions from the Merced River began well before operation of the Merced River Hydroelectric Project began in 1967. The Robla Canal Company first began diversions from the Merced River in 1870 and the Merced Falls diversion dam was constructed in 1901. Crocker-Huffman diversion dam was constructed in 1910 and the original Exchequer dam was constructed in 1926 for the purpose of facilitating water storage primarily for irrigation purposes. Merced ID is required to operate the project for flood control purposes in compliance with the rules and regulations of the Corps, which also enables the capture of high spring flows for water supply purposes. Therefore, during the spring, flows in the Merced River are substantially lower than they would be under unregulated conditions. During the irrigation season, which typically extends from March through October, diversions from the Merced River into irrigation canals can range from just under 200,000 acre-feet to nearly 700,000 acre-feet, but typically range from 400,000 to 500,000 acre-feet. Existing information reported in the Commission's April 1, 2011, study plan determination indicates that during the irrigation season, non-jurisdictional withdrawals account for up to 52 percent of the average annual unregulated discharge from the watershed, limiting the available water supply for instream flow needs. Our review of annual canal diversions from 1940 through 2010 shows no clear trend in diversions before and after New Exchequer dam was completed in 1967. Some water diverted for irrigation purposes may return to the Merced River via agricultural returns. We find no evidence that hydroelectric project operation has had a direct bearing on the amount of water that remains in the Merced River during the irrigation season. Flows in the lower Merced River outside of the irrigation season are more directly influenced by hydroelectric project operation.

A reasonably foreseeable future cumulative effect on water quantity in the Merced River and downstream reaches of the San Joaquin River is the outcome of the ongoing proceeding to enhance river flows in these reaches and the Sacramento-San Joaquin

Delta. In its comments and draft preliminary WQC conditions filed with the Commission on July 22, 2014, the Water Board states that its release of the 2012 *Draft Substitute Environmental Document in Support of Potential Changes to the Water Quality Control Plan for the Bay Delta: San Joaquin River Flows and Southern Delta Water Quality* may have an effect on how Merced ID manages water resources in Lake McClure. The draft Substitute Environmental Document recommends 35 percent of unregulated flow (i.e., inflow to Lake McClure) for the Merced River from February through June, and the final document may require instream flows that range from 25 to 60 percent of unregulated flows according to the Water Board.

Water Quality

The results of Merced ID's water temperature modeling indicate that during the March through October irrigation season, releases from the project can result in lower water temperatures downstream of Crocker-Huffman diversion dam, a beneficial cumulative effect. However, this cooling effect diminishes with distance downstream of the diversion dam primarily because of the increasing effect of ambient meteorology, and is negligible downstream of Shaffer Bridge. Larger early-season releases of water for environmental or irrigation purposes reduces the available cold water pool within Lake McClure, which directly affects the availability of cold water later in the season.

Merced ID monitored DO in the lower Merced River in 2011, 2012, and 2013. The 2011 monitoring results showed that downstream of the project to the confluence of the San Joaquin River, DO concentrations decreased between Shaffer Bridge and River Road, but generally met Basin Plan objectives in both the summer and the post-irrigation season. However, in 2012 and 2013, the Basin Plan objective for DO was not met during part of each day throughout each summer monitoring period. Basin Plan objectives were met during the fall post-irrigation season during 2012 and 2013. Merced ID water quality monitoring during 2010 shows that nutrient levels in water released from the project are low and not present in sufficient quantities to cause nuisance conditions related to algal blooms or decreased water clarity and therefore unlikely to contribute to downstream decreased DO. A likely contributor to instances of DO in water downstream of Crocker-Huffman diversion dam not meeting Basin Plan objectives is nutrient input from agricultural runoff and irrigation return flows. However, our review of the DO data from August 2004 through January 2009 presented in figures 3-18 and 3-19 indicates that water in McSwain reservoir at the powerhouse intake location often was below the Basin Plan objective of 8 mg/L. This was not the case for DO monitoring results from March 2010 through February 2011 shown in figure 3-20. Although the hydroelectric projects may play a role in the DO regime of the Merced River downstream of the Crocker-Huffman diversion dam, establishing a causal relationship to either the Merced River or Merced Falls project would be difficult because of the multiple factors that influence DO.

Water quality in the Merced River downstream of Crocker-Huffman diversion dam can also be affected by increases in total suspended solids associated with erosion, mining, and habitat restoration efforts. Recommended erosion and sedimentation control

measures at both the Merced River and Merced Falls Projects would minimize hydroelectric project effects on total suspended solids in the lower Merced River. Any continuation of gravel and aggregate mining in the lower Merced River would result in increased total suspended solid concentrations. Project-related instream habitat enhancement measures such as gravel augmentation have the potential to increase total suspended solid concentrations, but implementation of protective BMPs would minimize any such water quality affects. Non-project-related instream habitat enhancement measures also have the potential to increase total suspended solids concentrations. Requiring protective BMPs in such cases would be outside the Commission's jurisdiction, but within the jurisdiction of other agencies such as the Water Board.

Aquatic Habitat for Chinook Salmon and Central Valley Steelhead

Actual and potential spawning and rearing habitat for Chinook salmon and Central Valley steelhead exists in the lower Merced River, primarily between Crocker-Huffman diversion dam and Shaffer Bridge. A number of cumulative factors have contributed to the degradation of this habitat including: (1) numerous (estimates range from 170 to 240) non-project water withdrawals in the lower Merced River; (2) extensive aggregate mining both in the floodplain and the channel, which have created in-channel or captured mining pits that serve as habitat for introduced predators on rearing salmonids; (3) flow accretion and sedimentation from Dry Creek, a tributary to the Merced River; (4) extensive development of non-project levees; and (5) backwater effects of the San Joaquin River (Commission's April 1, 2011, study plan determination). Under existing conditions, dams at the two upstream hydroelectric projects contribute to the habitat degradation by interrupting the downstream transport of gravel that may be suitable for spawning, and LWM that may enhance rearing habitat in the lower Merced River. Some enhancement of the thermal regime for spawning and rearing habitat can be achieved by cold pool releases from Lake McClure, but the finite volume of available cold water limits the duration of the benefit during most water years.

Many factors influence the suitability of aquatic habitat in the lower Merced River. As discussed in detail in section 3.3.1.2, *Environmental Effects*, requiring hydroelectric project licensees to address factors that could enhance spawning and rearing habitat that have a nexus to the continued operation of the projects would be a fair approach to partially addressing project-related effects. Other cumulative non-project factors would need to be addressed by other entities for the available spawning and rearing habitat to reach its full potential given the competing demands for available water.

3.3.2 Terrestrial Resources

3.3.2.1 Affected Environment

Merced River Project

Vegetation

Cover Types—In 2010 and 2011, Merced ID characterized botanical communities using the CALVEG³⁵ systems in areas within the existing project boundary and an area of at least 300 feet from the NMWSE of project reservoirs—Lake McClure and McSwain reservoir—or to the project boundary, whichever was greater, and 0.25 mile around project facilities including recreation facilities (vegetation study area). The botanical communities are composed primarily of upland vegetation alliances with minimal areas of wetland, riparian, or littoral habitats.

Four botanical communities dominate upland areas in the vegetation study area: blue oak, chamise, annual grasses and forbs, and agriculture. There are also sub-dominate areas of gray pine and smaller inclusions of lower montane mixed chaparral, interior live oak, and riparian mixed hardwood.

The blue oak vegetation alliance consists of open blue oak woodlands within a grassland matrix. This alliance typically occurs on well-drained, gentle slopes and is one of the most common vegetation communities in the Central Valley ecological province. In addition to blue oak, other tree species include gray pine, ponderosa pine, valley oak, and California buckeye. Shrub species include wedgeleaf ceanothus and chamise. Annual grasses, including wild oats, cheatgrass, and needlegrass, dominate the ground layer (Forest Service, 2009).

The chamise vegetation alliance occupies drier sites on upper ridge locations. Dense, monotypic stands of chamise, a tall chaparral shrub species, dominate the vegetation community. Scrub oak also occurs in low density. Sparse trees, including blue oak, gray pine, and interior live oak may also be present along the fringe of chamise stands (Forest Service, 2009).

The annual grasses and forbs alliance is the most common vegetation community in the Central Valley ecological province. This alliance typically occurs between urban/agricultural developments and foothill woodlands. Dominant species include western needlegrass, cheatgrass, purple owl's clover, filaree, wild oats, and devil's

³⁵ The CALVEG system is the method Forest Service uses to classify existing vegetation in Region 5. More information about the CALVEG system can be found at <http://www.fs.fed.us/r5/rsl/projects/classification/system.shtml>.

lettuce. Vernal pools, depression areas that hold water in the spring but are dry in summer, also occur within this alliance. Vernal pools frequently support plant species that are rare in the surrounding area. Common species in these areas include sedges, rushes, bulrush, brome, fescue, bluegrass, reedgrass, false hellebore, and shooting star (Forest Service, 2009).

The gray pine alliance forms sparse to prominent open stands throughout the Central Valley at lower elevations up to about 5,200 feet. This community type is very common in the Ranges and Foothills sections and less so in the Valley section. In addition to gray pine, this community includes blue oak, interior live oak, and minor amounts of ponderosa pine. Shrubs, including chamise and wedgeleaf ceanothus are common low-elevation shrubs associated with the gray pine community (Forest Service, 2009).

The lower montane mixed chaparral alliance is a mixture of low-elevation chaparral species such as whiteleaf and common manzanitas, wedgeleaf and lemmon ceanothus, scrub oaks, chamise, silk-tassel, birchleaf mountain mahogany, California buckwheat, and other shrub species below productive coniferous and hardwood sites. No single species is dominant in the mixture (Forest Service, 2009).

The interior live oak alliance is often located above blue oak stands, generally below about elevation 4,400 feet. Other common species include Fremont cottonwood, white alder, and upland trees as canyon live oak, California buckeye, Douglas-fir, and gray pine (Forest Service, 2009).

Riparian areas in the Central Valley are a mixture of hardwoods with some shrubs rather than areas of monotypic species. Typical hardwoods species mixtures include willows, valley oak, Fremont cottonwood, California sycamore, and white alder. Blue oak is a closely associated upland hardwood that may occasionally be found in this mixture (Forest Service, 2009).

Agricultural lands in the Central Valley include vineyards, orchards, pastures, and field crops.

Vegetation along the shorelines of the lower half of Lake McClure predominantly consists of blue oak and annual grasses and forb communities. From Arnold Bay east to Bagby recreation area, the shoreline is dominated by chamise. The shorelines of the arm of Lake McClure east from Highway 49 to the upstream end of the project boundary are composed of a mixture of vegetation communities, including lower montane mixed chaparral, chamise, interior live oak, gray pine, annual grasses and forbs, and a few small areas of riparian mixed hardwoods. The vegetation communities around McSwain reservoir are almost exclusively blue oak and annual grasses and forbs, with a few small areas of gray pine and interior live oak.

Vegetation around Crocker-Huffman diversion dam and Merced ID's wildlife refuge water delivery facilities is generally limited to herbaceous weeds, annual grasses,

milk thistle, wild mustard, and water speedwell. These species are also present at the perimeter of most agricultural fields in the surrounding area and often occupy entire fields; they are ubiquitous throughout the vicinity and not unique to the area at or near project facilities. Based on our review of aerial photography in the license application and supporting reports, there also is riparian woodland in the vicinity of Crocker-Huffman diversion dam.

Currently, Merced ID's management of vegetation within the project boundary is limited to application of herbicides on the faces of project dams, along project roads, and in campgrounds.

Riparian Habitats and Wetlands—In 2010, Merced ID conducted proper functioning condition assessments of six riparian habitat sites and three wetlands sites collaboratively selected with relicensing participants to represent the range of riparian habitat and wetlands that the project has potential to affect. In addition to the proper functioning condition assessments, Merced ID performed a descriptive analysis of the named drainages occurring within the project boundary on USGS 7.5-minute quadrangle maps.

In preparation for fieldwork and analysis, Merced ID collected and reviewed available information pertinent to establishing an understanding of the capability³⁶ and potential³⁷ of the riparian habitat and wetland sites. Merced ID reviewed FWS National Wetland Inventory maps, which show the distribution, extent, and class of wetlands based on aerial photographs. Merced ID reviewed low elevation helicopter video imagery for each study site and performed ground-truthing reconnaissance. In addition, Merced ID collected historical aerial photographs of the sites to examine changes over time, such as variation in lateral movement or changes in vegetation coverage (e.g., forest development following disturbance), and for comparison with current field conditions.

Merced ID determined that all six riparian habitat study sites (Sherlock Creek, Lake McClure upstream of Bagby recreation area, Maxwell Creek, Piney Creek, Cotton Creek, and Merced Falls reach) and three wetland study sites (McSwain reservoir, Merced Falls reservoir and Crocker-Huffman diversion dam impoundment) exhibited conditions consistent with a rating of *Properly Functioning*. The sites had well-developed riparian and wetland plant communities relative to site capability and

³⁶ Capability is defined as “the highest ecological status an area can attain given political, social, or economic constraints, which are often referred to as limiting factors.”

³⁷ Potential is defined as “the highest ecological status a riparian-wetland area can attain given no political, social, or economic constraints, and is often referred to as the potential natural community.”

potential, and exhibited channel characteristics indicating resilience to high-flow events. Descriptive analysis indicated that riparian vegetation was present and vigorous at 9 of 12 of the major tributaries surveyed (Solomon Gulch, David Gulch, Flyaway Gulch, Hell's Hollow, Scotch Gulch, Whites Gulch, Wheeler Gulch, Willow Creek, and Picture Gallery Gulch). Riparian habitat was not present at Rocky Gulch, Rancho del Oro Gulch, or Temperance Creek.

Noxious and Invasive Weeds—Merced ID does not have a formal control program for noxious and invasive plants. However, at the request of the California Department of Transportation, Merced ID conducts some targeted spraying of yellow starthistle near the Bagby recreation area. Merced ID also conducts targeted spraying along McSwain reservoir. Additionally, vegetation management conducted as part of project operation and maintenance activities may indirectly target some occurrences of invasive weeds.

To identify invasive weeds with the potential to occur in the vegetation study area, Merced ID: (1) compiled a list of regionally known species from the Sierra-San Joaquin Noxious Weeds Alliance; (2) queried the BLM about invasive weeds of concern; and (3) queried the California Department of Food and Agriculture (California DFA) for invasive weed listings at state and federal levels. Based on these sources, Merced ID determined that 31 invasive weeds have a reasonable potential to occur within the vegetation study area.

In 2010, Merced ID performed surveys for these invasive weeds and others that may occur. Italian thistle and tocalote were the most common invasive weed species, ubiquitous in grasslands within the project boundary. Specific locations for these species were not recorded. For the other 10 invasive weed species located, a total of 323 invasive weed occurrences were found within the vegetation study area (table 3-16).

Table 3-16. Occurrences of noxious and invasive plants identified on the Merced River Project vegetation study area (Source: Merced ID, 2012a, as modified by staff).

Common Name	Scientific Name	2010 California DFA Rating ^a	Number of Occurrences
Tree of heaven	<i>Ailanthus altissima</i>	C	2
Giant reed	<i>Arundo donax</i>	B	2
Italian thistle	<i>Cardus tenuiflorus</i>	C	Too many to count
Iberian starthistle	<i>Centaurea iberica</i>	A	1
Tocalote	<i>Centaurea melitensis</i>	C	Too many to count
Yellow starthistle	<i>Centaurea solstitialis</i>	C	12
Bermudagrass	<i>Cynodon dactylon</i>	C	31

Common Name	Scientific Name	2010 California DFA Rating ^a	Number of Occurrences
Edible fig	<i>Ficus carica</i>	Not Rated	70
Klamath weed	<i>Hypericum perforatum</i>	C	170
Perennial pepperweed	<i>Lepidium latifolium</i>	B	1
Medusahead grass	<i>Taeniatherum caput-medusae</i>	C	32
Puncturevine	<i>Tribulus terrestris</i>	C	2

Note: California DFA – California Department of Food and Agriculture

^a California DFA rating:

A = Eradication, containment, rejection, or other holding action at the state-county level. Quarantine interceptions to be rejected or treated at any point in the state.

B = Eradication, containment, control, or other holding action at the discretion of the California DFA commissioner. State endorsed holding action and eradication only when found in a nursery.

C = Action to retard spread outside of nurseries at the discretion of the commissioner; reject only when found in a crop seed for planting or at the discretion of the commissioner.

Wildlife

The project and surrounding area supports a diversity of habitats and associated wildlife species that reflect wide variations in topography and soils and are typical of the western foothills of the central Sierra Nevada. Based on a review of California DFW's California Wildlife Habitat Relation system, Merced ID identified 23 reptile, 12 amphibian, 218 bird, and 85 mammal species that have a potential to occur in the vicinity of the project.

Reptiles in the project vicinity include western terrestrial (or mountain) garter snake, western aquatic (or Sierra) garter snake, common garter snake, western rattlesnake, western fence lizard, western sagebrush, and southern alligator lizard. These species occur in a variety of habitats ranging from riverine to woodlands, forests, and grasslands. Most are active during the summer and inactive during the winter.

Common bird species expected to occur in the project vicinity include raptors such as redtailed hawk and American kestrel; songbirds including dark-eyed junco and spotted towhee; woodpeckers such as downy woodpecker and northern flicker; and owls including great horned owl and barn owl. These birds are found in a variety of habitats ranging from streamside riparian habitats and wet meadows to hardwood dominated

woodlands common throughout the project. Seasonally, some birds are only present between March and July for breeding, while others may be year-round residents.

Common mammal species in the vicinity of the project, such as mule deer, bats, and squirrels like the California ground squirrel are most often associated with grassland habitats. Some of the common mammals like mule deer are migratory, and move from summer habitat at higher elevations to wintering habitat along the foothills.

Sensitive Plant Species

Following consultation with California DFW and BLM and a review of the California Native Plant Society's Inventory of Rare and Endangered Plants database, Merced ID identified 40 sensitive³⁸ plants with potential to occur in the vicinity of the project. In 2010 and 2011, Merced ID performed surveys for these special-status and California ESA-listed plants. Surveys were conducted following the botanical survey protocol section of California Department of Fish and Game's (now California DFW) *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities*. The study included the area surrounding all project facilities (e.g., powerhouses and switchyards, dams, reservoirs, access roads, and recreation facilities) within the existing project boundary and in the immediate area of the project's seven minor wildlife refuge water delivery facilities.

Merced ID recorded a total of 377 occurrences (i.e., either a single plant or a distinct geographic population of plants) of 10 different special-status plants: 165 occurrences on federal land administered by BLM, 168 occurrences on land owned by Merced ID, and 44 occurrences on owned by private entities. Table 3-17 summarizes the special-status plant occurrences by land ownership and describes the general habitat for each species. No California ESA-listed plants were encountered during Merced ID's survey.

³⁸ Sensitive plant species include California state-listed threatened and endangered species, BLM-listed sensitive species, and species included in the California Native Plant Society's Inventory of Rare and Endangered Plants database.

Table 3-17. Special-status plant species identified in the Merced River Hydroelectric Project study area (Source: Merced ID, 2012a, as modified by staff).

Common Name/ Scientific Name	Habitat Description and Location Within the Project	Status ^a	Number of Occurrences by Land Owner		
			Public (BLM)	Merced ID	Private
Mariposa clarkia <i>Clarkia biloba</i> ssp. <i>australis</i>	Oak woodlands and annual grasslands, recorded throughout the project area	BLM-S, CNPS 1B.2	62	31	15
Beaked clarkia <i>Clarkia rostrata</i>	Oak woodlands and annual grasslands, recorded throughout the project area	BLM-S, CNPS 1B.3	20	112	19
Mariposa cryptantha <i>mariposae</i>	Serpentine habitat in and around the Bagby recreation area	BLM-S, CNPS 1B.3	--	--	1
Tansy-flowered woolly sunflower <i>Eriophyllum confertiflorum</i> var. <i>tanacetiflorum</i>	Cismontane woodland and lower montane coniferous forests (CNPS, 2013a)	CNPS 4.3	6	1	--
Stinkbells <i>Fritillaria agrestis</i>	Clay and sometimes serpentine soils in chaparral, cismontane woodland, pinyon and juniper woodland, and valley/foothill grassland (CNPS, 2013b)	CNPS 4.2	1	--	--
Serpentine bluecup <i>Githopsis pulchella</i> ssp. <i>serpentinicola</i>	Serpentine habitat in and around the Bagby recreation area	CNPS 4.3	2	1	1
Peak rush-rose <i>Helianthemum scoparium</i>	Chaparral understories in and around the Horseshoe Bend recreational area	CNPS 3.2	65	1	2

Common Name/ Scientific Name	Habitat Description and Location Within the Project	Status ^a	Number of Occurrences by Land Owner		
			Public (BLM)	Merced ID	Private
Foothill jepsonia <i>heterandra</i>	Rocky, metamorphic soils in cismontane woodland and lower montane coniferous forest (CNPS, 2013c)	CNPS 4.3	5	8	3
Northern California black walnut <i>Juglans californica</i> var. <i>hindsii</i>	Riparian woodlands along rivers and streams, occasionally in somewhat drier slopes, valleys, and canyons; on rocky/gravelly, well-drained soil (NatureServe, 2013).	CNPS 1B.1	--	1	--
Shaggyhair lupine <i>Lupinus spectabilis</i>	Serpentine habitat in and around the Bagby recreation area	BLM-S, CNPS 1B.2	4	3	3

Notes: Special-status:

BLM-S = Bureau of Land Management Sensitive Plants

CNPS 1A = California Native Plant Society list presumed extinct in California

CNPS 1B = California Native Plant Society list endangered in California and elsewhere

CNPS 2 = California Native Plant Society list rare/threatened/endangered in California only

CNPS 3 = California Native Plant Society list plants requiring further information

CNPS 4 = California Native Plant Society limited distribution, watch list

^a A “.1” after the CNPS rating indicates that this species is seriously endangered in California, a “.2” after the CNPS rating indicates this species is fairly endangered in California, and a “.3” after the CNPS rating indicates that this species is not very endangered in California.

Sensitive Wildlife Species

Special-status wildlife species include those protected by the state of California as endangered or threatened, candidate for listing, California species of special concern, California fully protected species, and BLM sensitive species. Federally listed threatened or endangered species and any applicable designated critical habitat for a listed species are discussed in section 3.3.3, *Threatened and Endangered Species*.

Merced ID conducted a search of federal and state databases, including the California Natural Diversity Database and California Wildlife Habitat Relationship System, and consulted with California DFW, FWS, and BLM, to identify special-status species with potential to occur in the vicinity of the project. The search determined that 29 special-status species could potentially occur within 0.25 mile of the project boundary. This included 3 amphibians, 2 reptiles, 14 birds, and 10 mammal species. Merced ID reviewed habitat preferences and habitat types present within the project vicinity to identify species with potential habitat in vicinity of the project. Table 3-18 presents sensitive wildlife species known to occur in the project vicinity or with suitable habitat in the project vicinity.

Following consultation with stakeholders and Commission staff during the Integrated Licensing Process, Merced ID conducted surveys for special-status wildlife species known to occur in the project boundary or within 0.25 mile of the project boundary. Specifically, Merced ID conducted surveys for wintering and nesting bald eagles, limestone salamanders, sensitive bats, and western pond turtles.

Table 3-18. Sensitive wildlife species known to occur or with potential habitat that occurs in or within 0.25 mile of the Merced River Project boundary (Source: Merced ID, 2012a,d,e, as modified by staff).

Common Name (Scientific Name)	Status	Habitat	Known to Occur within 0.25 mile of the Project Boundary
Coast horned lizard (<i>Phrynosoma cronatum</i>)	BLM-S, SSC	Occurs in valley foothill hardwood woodlands, conifer forests, riparian areas, and annual grasslands.	No recorded occurrences within 5 miles of the project.
Western pond turtle	BLM-S, SSC	Occurs in permanent ponds, lakes, channels, backwaters, and pools of streams; aquatic habitats with warm, shallow water with cover for hatchlings; terrestrial sites for nesting; and sites with suitable basking substrates such as rocks, logs, banks, root masses, and emergent vegetation for both juveniles and adults.	Observed at 3 basking survey sites at Lake McClure and 1 site at McSwain reservoir; 12 incidental observations at Lake McClure; 3 at McSwain reservoir; and 1 in Merced River between PG&E's Merced Falls dam to the non-project Crocker-Huffman diversion dam.
Foothill yellow-legged frog (<i>Rana boylii</i>)	BLM-S SSC	Occurs on small to large streams and rivers with pools and low-gradient riffles (small streams are probably non-breeding habitat). Breeding sites usually in shallow, slow-flowing areas near the shore with coarse substrates (cobbles and boulders). Infrequent in habitats where introduced fish and American bullfrogs are present.	Tadpoles were observed at Sherlock Creek, which flows into Lake McClure.

Common Name (Scientific Name)	Status	Habitat	Known to Occur within 0.25 mile of the Project Boundary
Limestone salamander (<i>Hydromantes brunus</i>)	ST, FP	Occurs on moss-covered outcroppings of limestone and other types of rock, and talus rubble, generally in oak woodlands with scattered foothill pine, and less frequently in chaparral. Lives under ground for much of the year with surface activity most likely during cool, wet periods between November 1 and April 15.	Yes, surveys identified presence at 6 sites along the eastern arm of Lake McClure. Portions of BLM designated Limestone Salamander Area of Critical Environmental Concern exist in the project boundary.
Western spadefoot (<i>Spea hammondi</i>)	BLM-S, SSC	Occurs in grasslands, oak woodlands, and occasionally chaparral. Breeds in vernal pools and other ponds that dry seasonally (rarely in permanent ponds), and occasionally in intermittent streams.	Not observed during relicensing studies. No recorded occurrences within 2 miles of the project.
American white pelican (<i>Pelecanus erythrorhynchos</i>)	SSC	Habitat includes rivers, lakes, reservoirs, estuaries, bays, and open marshes. May occur in the project during migration.	No recorded occurrences within 5 miles of the project.
Bald eagle (<i>Haliaeetus leucocephalus</i>)	SE, FP	Often found near water bodies such as lakes, rivers with adequate fish populations.	Yes, known to nest and winter at the project. Over three winter survey periods, Merced ID's bald eagle surveys documented a total of 13 sightings at Lake McClure and 3 sightings at McSwain reservoir. Nesting surveys documented six nests at Lake McClure and one at McSwain reservoir.

Common Name (Scientific Name)	Status	Habitat	Known to Occur within 0.25 mile of the Project Boundary
Burrowing owl (<i>Athene cunicularia</i>)	BLM-S, SSC	Nest in abandoned burrows dug by small mammals such as ground squirrels, as well as larger mammals such as foxes and badgers. If burrows are unavailable, burrowing owls may dig their own burrow in soft soil, or use pipes, culverts, and/or nest boxes.	No recorded occurrences within 5 miles of the project.
Black-crowned night heron (<i>Nycticorax nycticorax</i>)	BLM-S	Nest in dense-foliaged trees, dense fresh or brackish emergent wetlands, dense shrubbery or vine tangles, and usually near aquatic or emergent feeding area.	No recorded occurrences within 5 miles of the project.
Golden eagle (<i>Aquila chrysaetos</i>)	BLM-S FP	Occurs in sparse woodlands, grasslands, savannas, lower successional forest stages, and shrubland. Cliffs, large trees, and man-made structures (e.g., electric transmission towers) with a commanding view are used for nesting.	No recorded occurrences within 5 miles of the project.
Loggerhead shrike (<i>Lanius ludovicianus</i>)	SSC	Preferred habitats include open-canopied valley foothill hardwood, valley foothill hardwood-conifer, valley foothill riparian, pinon-juniper, juniper, desert riparian and Joshua tree habitats.	No recorded occurrences within 5 miles of the project.
Long-eared owl (<i>Asio otus</i>)	SSC	Require dense riparian and live oak thickets with small densely canopied trees.	No recorded occurrences within 5 miles of the project.

Common Name (Scientific Name)	Status	Habitat	Known to Occur within 0.25 mile of the Project Boundary
Northern harrier (<i>Circus cyaneus</i>)	SSC	Occurs in meadows, grasslands, open rangelands, desert sinks, fresh and saltwater emergent wetlands.	No recorded occurrences within 5 miles of the project.
Purple martin (<i>Progne subis</i>)	SSC	Uncommon to rare local summer resident of various wooded, low-elevation habitats comprised of montane hardwood, valley foothill and montane hardwood-conifer, and riparian habitats.	No recorded occurrences within 5 miles of the project.
Short-eared owl (<i>Asio flammeus</i>)	SSC	Winters in the Central Valley and western Sierra Nevada foothills. Prefers open grasslands with no trees.	No recorded occurrences within 5 miles of the project.
Swainson's hawk (<i>Buteo swainsoni</i>)	SE	Typical breeding habitat consists of trees within mature riparian forest, lone trees and oak groves, and mature roadside trees. It forages in native grasslands, lightly-grazed dryland pasture, and suitable grain or alfalfa fields that are adjacent to nesting habitat.	No recorded occurrences within 5 miles of the project.
Tricolored blackbird (<i>Agelaius tricolor</i>)	BLM-S SSC	Occurs in herbaceous wetland areas as well as cropland and hedgerow habitats. Tricolored blackbirds have been found to breed in fresh-water marshes consisting of cattails, tule, bulrushes, and sedges.	No recorded occurrences within 5 miles of the project.
Yellow-breasted chat (<i>Icteria virens</i>)	SSC	Found in thickets of willow and other brushy vegetation in riparian areas near	No recorded occurrences within 5 miles of the project.

Common Name (Scientific Name)	Status	Habitat	Known to Occur within 0.25 mile of the Project Boundary
Yellow warbler (<i>Setophaga petechia</i>)	SSC	watercourses for cover. Occurs in riparian deciduous habitats with cottonwoods, willows, alders, and other small trees and shrubs found in low, open-canopy woodland.	No recorded occurrences within 5 miles of the project.
American badger (<i>Taxidea taxus</i>)	SSC	Found most abundantly in drier open stages of most shrub, forest, and herbaceous habitats, with friable soils. This species' diet consists mostly of rodents: rats, mice, chipmunks, pocket gophers, and ground squirrels.	No recorded occurrences within 5 miles of the project.
Fringed myotis (<i>Myotis thysanodes</i>)	BLM-S	Roosts in caves, mines, buildings, and crevices. Uses open habitats, early successional stages, streams, lakes, and ponds as foraging areas (California WHR, 2013a).	Yes, recorded acoustically during surveys.
Pallid bat (<i>Antrozous pallidus</i>)	BLM-S SSC	Arid deserts and grasslands, often near rocky outcrops and water. Less abundant in evergreen and mixed conifer woodland. Usually roosts in rock crevice or building, less often in caves, tree hollows, mines (California WHR, 2013b).	Yes, recorded acoustically and captured during surveys.

Common Name (Scientific Name)	Status	Habitat	Known to Occur within 0.25 mile of the Project Boundary
Spotted bat (<i>Euderma maculatum</i>)	BLM-S SSC	Prefers to roost in rock crevices. Occasionally found in caves and buildings. Prefers sites with adequate roosting habitat, such as cliffs. Feeds over water and along washes. May move from forests to lowlands in autumn (California WHR, 2013c).	Yes, recorded acoustically during surveys.
Townsend's big-eared bat (<i>Corynorhinus townsendii</i>)	BLM-S, SSC	Requires caves, mines, tunnels, buildings, or other human-made structures for roosting. Prefers mesic habitats. Gleans from brush or trees or feeds along habitat edges (California WHR, 2013d).	Yes, recorded acoustically during surveys.
Western long-eared myotis (<i>Myotis evotis</i>)	BLM-S	Roosts in buildings, crevices, spaces under bark, and snags. Caves are used primarily as night roosts. Feeds along habitat edges, in open habitats, and over water (California WHR, 2013e).	Yes, recorded acoustically during surveys.
Western mastiff bat (<i>Eumops perotis</i>)	BLM-S SSC	Suitable habitat consists of extensive open areas with abundant roost locations provided by crevices in rock outcrops and buildings (California WHR, 2013f).	Yes, recorded acoustically during surveys.

Common Name (Scientific Name)	Status	Habitat	Known to Occur within 0.25 mile of the Project Boundary
Western small-footed myotis (<i>Myotis ciliolabrum</i>)	BLM-S	Seeks cover in caves, buildings, mines, crevices, and occasionally under bridges and under bark. Prefers open forest and woodland stands in arid uplands as well as brushy habitats. Streams, ponds, springs, and stock tanks are used for drinking and feeding (California WHR, 2013g).	Yes, recorded acoustically and captured during surveys.
Western red bat (<i>Lasiurus blossevillii</i>)	SSC	Roosts primarily in trees, less often in shrubs. Roost sites often are in edge habitats adjacent to streams, fields, or urban areas. Prefers edges or habitat mosaics that have trees for roosting and open areas for foraging (California WHR, 2013h).	Yes, recorded acoustically during surveys.
Yuma myotis (<i>Myotis yumanensis</i>)	BLM-S	Roosts in buildings, mines, caves, or crevices. The species also has been seen roosting in abandoned swallow nests and under bridges. Distribution is closely tied to bodies of water, which it uses as foraging sites and sources of drinking water. Open forests and woodlands are optimal habitat (California WHR, 2013i).	Yes, recorded acoustically and captured during surveys.
Notes: BLM-S – BLM sensitive species; FP – California fully protected; SE – California endangered; ST – California threatened; SSC – California species of special concern			

Merced Falls Project

Vegetation

Cover Types—In 2010 and 2011, PG&E characterized the botanical communities within the existing project boundary, and an area of at least 200 feet from the NMWSE of the Merced Falls impoundment, including areas that could be affected by maintenance and operation. This vegetation study area includes upland, riparian, wetlands, and littoral habitats. Specific cover types identified and discussed below.

PG&E reviewed digital aerial photography, in conjunction with the USGS Merced Falls 7.5-minute quadrangle. Visible breaks and differences in the type of vegetation cover were identified and polygons were drawn around the visibly different areas. Vegetation series were assigned to these polygons and series from the *Manual of California Vegetation* were used to describe existing vegetation (Sawyer and Keller-Wolf, 1995). This initial vegetation map was then ground-truthed and refined during the 2010 field surveys.

Two botanical communities dominate upland areas in the vegetation study area: California annual grassland series and ruderal vegetation. Sub-dominate communities include valley oak, white alder, fremont cottonwood, blackberry thickets and blackberry thickets with sedges, black willows, blue oaks, interior live oak, Ailanthus, bulrush-cattail and bulrush, mosquito fern, and emergent aquatics.

The most dominant cover type in the vegetation study area is California annual grassland series, an extensive and variable series composed of non-native and native annual species. Common non-native species in the California annual grassland include slender wild oat, soft chess, and ripgut brome. The California annual grassland supports some non-dominant native species such as fiddleneck, yellow Mariposa lily, and purple clarkia.

The ruderal series is similar to the California annual grassland series and plants of this series often intergrade with plants of the California annual grassland. These habitats are dominated by short-statured, non-native grasses and forbs, and noxious weeds are mostly dominant with few to no native herbs, although some occasional late-blooming native bulbs do occur. The ruderal areas are disturbed areas around dwellings, heavily used roads and recreation areas, and also livestock pastures. Dominant species in the ruderal areas include ripgut brome, Jim-hill mustard, and prickly lettuce.

The valley oak series is a riparian forest series that occurs on the northwest to north shores of the impoundment. On the northwest shore, it intergrades with the Fremont cottonwood series. The overstory of the valley oak series is dominated by medium to large valley oaks. Other white alder, black walnut, interior live oak, Gooding's black willow, and Fremont cottonwood are common and tree of heaven also occurs in this series. The understory varies from dense to sparse, and is either dominated by herbs or woody shrubs and vines, depending on the amount of available water and

light. Annual grasses are common as are California pipevine, Pacific rush, and Himalayan blackberry.

The white alder series, a riparian forest series, presents along the northwest side of the immediate impoundment edge. Portions of white alder series are also present surrounding an inlet on the southeast side of the impoundment, and as inclusions around ponds within the mine tailings. These areas typically have a dense overstory dominated by white alder, as well as valley oak, interior live oak, or Fremont cottonwood. These habitats are often wetter than those dominated by valley oak. Sandbar willow, red willow, and stinging nettle occur in the understory. Common herbaceous species include western lady's fern, Santa Barbara sedge, and dense sedge.

Blackberry thickets, including blackberry thickets with sedges, are dominated by thick stands of Himalayan blackberry that often form monocultures but can also be mixed with other riparian forest understory species. This series occurs in areas on the south side of the impoundment. Stands are co-dominated by dog rose, with a cover of hydrophytic herbs and herbaceous emergent aquatics occur along the impoundment edge. Common species include tufted hairgrass, spike-rushes, and meadow fescue.

The Fremont cottonwood series of riparian forest has an overstory dominated by Fremont cottonwood with representations of other riparian trees such as white alder, black walnut, Valley oak, Gooding's black willow, and arroyo willow. These areas are generally somewhat moister than the valley oak series with which they intergrade. The understory is similar between these two series, often consisting of Pacific rush, and dense Himalayan blackberry and California grape.

Two areas dominated by Gooding's black willow occur in the vegetation study area and adjacent lands. These riparian forests are very similar to the valley oak and Fremont cottonwood series with the exception that Gooding's black willow is the dominant overstory tree.

The blue oak series is a riparian series that occurs in one small area north of the boat launch, on the northeast side of the impoundment. Blue oak trees are dominant and the understory consists of herbaceous species also common in the California annual grasslands.

The interior live oak series occurs at some rock outcrops on the southeast side of the impoundment. The herbaceous understory is similar to that of the California annual grassland, except different native species grow on the rocks than in other places in the vegetation study area. Canyon dudleya, lax woodsorrel, and glassy onion are present in this habitat.

A tree of heaven stand occurs in a small area on the north side of the impoundment, opposite the Hornitos Road turnoff. The understory consists of herbaceous species common in California annual grasslands and ruderal vegetation.

A few areas with shallow standing permanent water are dominated by perennial rooted emergent aquatics. The bulrush series is dominated by a near monoculture of

bulrush, otherwise known as hard-stemmed tule. The bulrush-cattail series is mixed bulrush and broad-leaved cattail.

The mosquito fern series occurs at two small ponds on the southwest side of the impoundment that have permanent standing water and little disturbance. These ponds are covered in a layer of mosquito fern mixed with duckweed. These ponds are surrounded by mine tailings, and may have been old mine ponds.

Emergent aquatics occur on the northernmost portion of the vegetation study area, where a small perennial or long-running intermittent stream runs into the Merced Falls impoundment. It flows through annual grasslands at the northern tip of the project area and supports a small area of emergent vegetation including barnyard grass, fringed willowherb, and clistogamous spike primrose.

In addition to the open water, other areas with little or no vegetation occur in the project area, including developed habitats, rock outcrops, and mine tailings.

Developed habitats, on the north side of the project area include substations, parking lots, and residential areas that have been largely modified by human activity and are generally managed for no vegetation or landscaped vegetation. The most common plant species occurring in the developed areas include bladderpod, oleander, and redwood.

Rock outcrops are present on the northeast side of the impoundment, along the access road to the McSwain powerhouse. These rock outcrops support a sparse covering of many species common to the California annual grassland. However, some native species were observed on these rock outcrops, including pink spineflower, white-whorled lupine, and phacelia.

There is a section of mine tailings on the southwest edge of the project area and immediate vicinity with numerous human-placed cobbles and similar rocks. The composition of the vegetation in the mine tailings area is similar to the California annual grassland and is composed of non-native and native forbs. However, vegetation cover in the mine tailings area is sparse.

Noxious and Invasive Weeds—PG&E does not have a formal program to control noxious and invasive plants at the Merced Falls Project. However, it conducts periodic weed control (usually twice per year) at the dam and River's Edge Fishing Access area to minimize the risk of spreading noxious weeds and invasive plants through accessing the project. In 2010, PG&E performed surveys for noxious and invasive weeds.

Prior to conducting field surveys, PG&E developed a candidate list species by reviewing the Federal Weed List, the California DFA list of A- and B-rated weeds, and the California Invasive Plant Council's Inventory of noxious weeds, and cross referenced the potentially occurring weeds with known plants within Merced and Mariposa Counties. A few species were added to the candidate list from the most-recent yearly agricultural treatment reports for Mariposa and Merced Counties, and the Sierra-San

Joaquin Noxious Weed Alliance's *Field Guide to Invasive Non-Native Weeds of Mariposa, Madera, and Fresno Counties*).

The 2010 botanical survey found 11 noxious weed species within the vegetative study area and surrounding lands a total of 303 invasive weed occurrences were found within the vegetation study area (table 3-19). The most abundant weeds were yellow star-thistle and tocalote; Italian thistle and Klamathweed were also widespread and abundant. A large stand of milk thistle occurs on the southeast shore, and several stands of Himalayan blackberry and a large stand of tree of heaven occurs on the north shore.

Table 3-19. Occurrences of noxious and invasive plants identified in the Merced Falls Project vegetation study area (Source: PG&E, 2012, as modified by staff).

Common Name	Scientific Name	Number of Occurrences (Points and Polygons)	Approximate Acreage ^a (polygons)	Estimated Number of Plants
Tree of heaven	<i>Ailanthus altissimus</i>	14	0.9	600
Italian thistle	<i>Carduus pycnocephalus</i>	24	2.2	200,000
Tocalote	<i>Centaurea melitensis</i>	22	8.7	790,000
Yellow star-thistle	<i>Centaurea solstitialis</i>	37	10.4	1,550,000
Bull thistle	<i>Cirsium vulgare</i>	21	small amounts	120
Fennel	<i>Foeniculum vulgare</i>	10	small amounts	140
Klamathweed	<i>Hypericum perforatum</i>	54	1.2	183,000
Himalayan blackberry	<i>Rubus armeniacus</i> (=R. discolor)	39	3.8	thickets – not available
Milk thistle	<i>Silybum marianum</i>	70	0.4	15,000
Medusahead	<i>Taeniatherum caput-medusae</i>	1	small amounts	500
Woolly mullein	<i>Verbascum thapsis</i>	11	small amounts	100

Wildlife

The project area, located in the Lower Merced Basin, supports habitats and associated wildlife species typical of the topography and soils and of the transition zone between the Central Valley and the foothills of the Sierra Nevada Mountains. The project area contains predominately open water habitat (i.e., the Merced Falls impoundment), providing habitat for a variety of aquatic species and waterfowl. Riparian and wetland habitat occurs along the shoreline. However, most wildlife species are associated with riparian and upland habitats located above the mean high water mark of the impoundment. The terrestrial habitats in the project area include primarily disturbed areas such as historic dredge tailings, roadways, and a mixture of annual grasslands and oak woodlands.

PG&E identified 2 reptiles, 3 amphibians, 15 birds, and 10 mammals potentially occurring in the project area by reviewing FWS' website for federally endangered and threatened species, California DFW's online California Natural Diversity Database, online records located at University of California, Berkeley, Museum of Vertebrate Zoology, and California Academy of Sciences' Herpetology Records. For special-status species, searches were generally focused on the USGS 7.5-minute quadrangle on which the project is located (Merced Falls), and four surrounding quadrangles including Hornitos, Yosemite Lake, Haystack Mountain, and Indian Gulch, although some searches were conducted by county (Merced and Mariposa).

Common resident bird species in the project area include American crow, western scrub-jay, American robin, and cliff swallows. Common waterfowl include the Canada goose, pied-billed grebe, and mallard and wading birds such as great blue heron. Common mammals include pocket gopher and gray fox, as well as bat species such as canyon bat, Townsend's big-eared bat, Western mastiff bat, pallid bat, and *Myotis* species.

Sensitive Plant Species

Following consultation and a review of the USGS quadrangle map in which the Merced Falls Project is located plus eight adjacent quadrangles; available information from California Native Plant Society's *Online Inventory of Rare and Endangered Vascular Plants of California*, FWS' website and the California Natural Diversity Database; FWS critical habitat maps; and herbarium specimens and photographs from Mariposa and Merced Counties, PG&E identified 11 sensitive³⁹ plants with potential to

³⁹ Sensitive plant species include federally-listed endangered and threatened species and candidate species proposed for federal listing, California state-listed threatened and endangered species, and species included in the California Native Plant Society's Inventory of Rare and Endangered Plants database.

occur in the project area. In 2010 and 2011, PG&E performed surveys for these special-status plants.

None of the 11 species identified as potentially occurring in the project area were observed during the 2010 and 2011 surveys; however, two special-status plant species, gypsum-loving larkspur and foothill jepsonia, were observed and mapped. Although not state- or federally-listed, both species are identified as uncommon in the state by the California Native Plant Society. PG&E documented 48 individuals of gypsum-loving larkspur on the southeast side of the impoundment in the California annual grassland series, adjacent to a rocky outcrop in the interior live oak woodland, and 86 individuals of foothill jepsonia on the southeast side of the impoundment in rocky outcrops within the interior live oak woodland. In addition, one blue elderberry shrub of suitable size to support the federally threatened valley elderberry longhorn beetle was observed and mapped on the northeast side of the impoundment during the 2010 survey.

Sensitive Wildlife Species

PG&E identified a list of sensitive wildlife species⁴⁰ potentially occurring in the project area, including 46 plants, 15 birds, 10 mammals, 3 amphibians, 2 reptiles, and 1 fish species. In 2010 and 2011, PG&E conducted surveys to document sensitive wildlife species and potential habitat for sensitive wildlife species, including unique features of habitats. PG&E documented nine state special-status species, including five classified as Species of Special Concern, two classified as Fully Protected, and two on the state's Watch List (table 3-20).

⁴⁰ Sensitive wildlife species include federally-listed endangered and threatened species and candidate species proposed for federal listing, California state-listed threatened and endangered species, and species included in the California Native Plant Society's Inventory of Rare and Endangered Plants database, and species designated as California Species of Special Concern by California Department of Fish and Game (now California DFW). Federally listed threatened or endangered species and any applicable designated critical habitat for a listed species are discussed in section 3.3.3, *Threatened and Endangered Species*.

Table 3-20. Sensitive wildlife species known to occur or with potential habitat occurring within the Merced Falls Hydroelectric Project area (Source: PG&E, 2012, as modified by staff).

Common Name (Scientific Name)	Status	Habitat	Occurrences in Project Area
Western pond turtle <i>Actinemys marmorata</i>	SSC	Permanent and seasonal aquatic habitats; basking habitats; females require terrestrial habitat for nesting	Observed basking in the Hornitos Bridge cove.
Bald eagle (<i>Haliaeetus leucocephalus</i>)	SE, FP	Open water such as lakes, rivers with adequate fish populations	Five sightings observed on protocol surveys in winter and spring. No nesting in 2011.
Osprey <i>Pandion haliaetus</i>	WL	Open water such as lakes and rivers with adequate fish populations	Three active nests on impoundment.
Yellow-breasted chat <i>Icteria virens</i>	SSC	Thickets of willow and other brushy vegetation in riparian areas near watercourses for cover	Adult male singing on southwest side of Hornitos Bridge, in riparian brush.
Double-crested comorant <i>Phalacrocorax auritus</i>	WL	Open water with ample fish populations	Observed foraging on impoundment.
Townsend's big-eared bat <i>Corynorhinus townsendii</i>	SSC	Caves, mines, tunnels, buildings, or other human-made structures for roosting; prefers mesic habitats; gleans from brush or trees or feeds along habitat edges (California WHR, 2013d)	Documented roosting in mill ruins. Visually detected.

Common Name (Scientific Name)	Status	Habitat	Occurrences in Project Area
Pallid bat <i>Antrozous pallidus</i>	SSC	Arid deserts and grasslands, often near rocky outcrops and water; less abundant in evergreen and mixed conifer woodland; usually roosts in rock crevice or building, less often in caves, tree hollows, mines (California WHR, 2013b)	Documented roosting in mill ruins. Visually detected.
Western mastiff bat <i>Eumops perotis</i>	SSC	Extensive open areas with abundant roost locations provided by crevices in rock outcrops and buildings (California WHR, 2013f)	Acoustically detected.
Ringtail <i>Bassariscus astutus</i>	FP	Various riparian habitats, and in brush stands of most forest and shrub habitats	Observed at night in switchyard.

Notes: FP – California fully protected; SE – California endangered; WL – California watch list;⁴¹ SSC – California species of special concern

3.3.2.2 Environmental Effects

Merced River Project

Vegetation Management

Under a new license, operation and maintenance of the project and construction of any new facilities could disturb vegetation resources from excavation, grading, topsoil stripping, or other similar activities. Such disturbances are expected to occur in association with improvements to recreation resources, facility maintenance, and treatment of invasive weeds. Vegetation and soil disturbance could alter composition of existing vegetation communities or increase the potential for invasive weed colonization. These changes could also affect wildlife habitat quality.

⁴¹ California DFW defines Watch List Species as taxa that were previously SSCs, which no longer merit SSC status or do not meet SSC criteria, but for which there is concern and a need for additional information to clarify status.

To minimize potential effects of project operation and maintenance on vegetation, Merced ID proposes to implement its Vegetation Management Plan, as filed with the final license application and amended on September 22, 2014. The plan includes specific measures for revegetation, general vegetation management, and reporting. The plan also includes measures to protect sensitive species and the valley elderberry longhorn beetle. These components of the plan are discussed below under in Section 3.3.3.1, *Threatened and Endangered Species*.

As described in the Vegetation Management Plan, Merced ID would consider the need for revegetation activities in areas including all sites where treatment of invasive weeds covers more than 0.25 acre, construction sites subject to ground disturbance, and erosion control sites. Merced ID would evaluate the need for revegetation at such sites based on three criteria: (1) native vegetation cover is less than 30 percent of the surface area (excluding areas where natural vegetation cover is below 30 percent); (2) erosion is evident or there is a height potential for erosion; or (3) the potential for natural revegetation is limited based on vegetation in the surrounding area. If any of these criteria are met, Merced ID would develop a revegetation plan for the site.

Once Merced ID determines whether revegetation of a site is necessary, it would develop a site-specific revegetation plan. The revegetation plan would include: (1) a site assessment to record existing soil, topography, water availability, and vegetation characteristics; (2) identification of suitable species and planting methods; and (3) an implementation schedule. For sites larger than 0.5 acre, the revegetation plan would also include a site design, soil treatments, and an invasive weed control strategy. Merced ID would submit all revegetation plans to BLM for approval.

The Vegetation Management Plan includes a description of proposed revegetation methods. Merced ID would determine planting and site preparation methods on a site-by-site basis. Proposed methods would include soil treatments at sites where compaction is a concern. In these areas, Merced ID would remove the top 6 to 12 inches of top soil and store this soil to be used for planting following completion of the disturbance activities. On BLM land, Merced ID proposes to use seed mixes that contain only native species and meet BLM standards. Merced ID would use custom seed mixes on larger sites and would cover all seed with mulch. Merced ID would typically plant larger sites with a mixture of native trees, shrubs, and forbs but would use salvaged plants from the site whenever feasible. Merced ID would handle all plant materials as little as possible and protective features would be installed where necessary. Merced ID would complete seeding, planting, and restoration of disturbed areas, including topsoil piles and berms, within 90 days following completion of construction or ground-disturbing activities, or as soon as feasibly possible.

Merced ID would annually monitor disturbed sites where revegetation is deemed unnecessary for a minimum of 3 years or until success criteria are met. Merced ID would annually monitor revegetated sites until success criteria are met and attained for 1 year. If revegetated sites do not meet success criteria after 3 years, Merced ID would

implement additional remedial measures, including additional seeding and planting. If after 2 years, the success criteria for these sites are still not met, Merced ID would consult with BLM to develop strategies to address the issues at the site. Success criteria for all sites would include:

1. native vegetation cover comprises more than 60 percent of the surface area of the site, compared to similar sites on the adjacent undisturbed area;⁴²
2. no List A invasive weeds are present;
3. List B and C invasive weeds and other undesirable plant species would meet the following standards for acceptable revegetation:
 - if the area adjacent to the project site contains less than a 25 percent cover of undesirable species, revegetation will be considered acceptable when the cover of undesirable species on the project site does not exceed 5 percent;
 - if the area adjacent to the project site contains a 25 to 50 percent cover of undesirable species, revegetation will be considered acceptable when the cover of undesirable species on the project site does not exceed 10 percent;
 - if the area adjacent to the project site contains more than a 50 percent cover of undesirable species, revegetation will be considered acceptable when the cover of undesirable species on the project site does not exceed 25 percent;
4. there is no evidence of significant erosion, rills are less than 3 inches deep and deeper, or excessive rilling is not observed;
5. desirable vegetation appears vigorous and self-sustaining and plants have the opportunity to complete their annual life cycles; Merced ID would evaluate this objective by observing the size, color, and vigor of the plants and noting the presence of new growth shoots, flowers, seeds, litter build-up, and seedlings;
6. adequate diverse vegetation is present; and
7. the site contains a mixture of native species similar to the adjacent undisturbed area.

Additionally, the Vegetation Management Plan includes descriptions of general vegetation maintenance activities, such as the routine clearing of vegetation around project facilities, removal of hazardous trees, and maintenance of recreation areas. The

⁴² For example, if the surrounding area has 30 percent native vegetative cover, the site needs to have 18 percent cover, which is 60 percent of 30 percent.

plan includes specific protocols for applying herbicides and requires prior approval from BLM before applying such herbicides on federal land. The plan also requires prior landowner approval for hazard tree removals. At recreation areas, the plan calls for maintenance to ensure the ground is bare around campfire sites and vegetation maintenance, such as native planting and tree trimming, to promote campground aesthetics.

The Vegetation Management Plan also includes provisions for reporting activities to document herbicide applications, revegetation efforts, and the results of revegetation monitoring. Merced ID would present these reports to BLM during its proposed annual meetings, which would also provide opportunities for Merced ID, BLM (and other invited agencies and stakeholders that chose to attend the meeting) to discuss the need for potential revisions to the Vegetation Management Plan over the term of a new license.

BLM [preliminary 4(e) condition 9] specifies that Merced ID develop a vegetation and non-native invasive plant management plan to protect terrestrial resources. Requirements relating to non-native invasive plant management are discussed below under *Noxious Weeds and Invasive Plants*. The general objectives of BLM's plan regarding vegetation management include:

- conserving and restoring habitats to support long-term viability of native species, sensitive species, and the associated natural diversity of these habitats;
- ensuring safe and effective operation of the facilities by maintaining safe access to facilities, protecting worker and public health and safety, and reducing fire hazards; and
- managing public lands in accordance with the Federal Land Policy and Management Act of 1976.

Our Analysis

Proposed enhancements at existing project recreation areas and construction of the proposed new Mack Island recreation site, treatment of invasive weeds, and maintenance of project facilities would entail removal of existing vegetation and soil disturbance. These activities have potential to alter existing vegetation community composition or structure within the project boundary. Implementation of Merced ID's proposed Vegetation Management Plan would identify areas where project operation and maintenance activities have the potential to affect existing vegetation and provide guidance for revegetation measures in these areas. Revegetation and subsequent proposed monitoring would help ensure existing native vegetation communities are restored following project-related disturbance and minimize the potential for erosion of exposed soils. Modifying the plan to include details about the specific BMPs to be implemented would provide the agencies with information to evaluate the effectiveness of the BMPs and would allow Merced ID to implement additional BMPs, if necessary, to

further protect terrestrial resources. We further discuss measures to control erosion in section 3.3.1.2, *Aquatic Resources*.

General vegetation management protocols identified in the plan include pre-approval for herbicide use on federal land and guidelines for vegetation management at recreation sites and would also minimize potential for adverse effects on native vegetation. Merced ID's proposed Vegetation Management Plan is consistent with the goals, objectives, and methodologies outlined in the components of BLM's management plan that are specific to vegetation management. Implementing Merced ID's plan for vegetation management would reduce project-related effects on terrestrial vegetation. Additionally, implementation of the proposed plan, which is consistent with BLM's plan, would ensure the project is compliant with federal laws and policies.

Invasive Weeds

Project operation and maintenance activities including road grading and vegetation control could result in the removal of existing vegetation and soil disturbance, thereby increasing the potential for the spread of invasive weeds. Additionally, project vehicles may transport invasive weed seeds from one area to another, and the rise and fall of the reservoir water levels can also carry seeds from invasive weeds along the shoreline and distribute them in other areas suitable for colonization.

To minimize the spread of invasive weeds, Merced ID proposes to implement its Invasive Species Management Plan, as filed with the final license application and amended on September 22, 2014. The plan presents protocols for annual employee training, provisions for reviewing weed lists, and measures to prevent the spread of weeds into and within the project boundary. Prevention measures include cleaning vehicles and equipment prior to entering the project, revegetating disturbed areas with native vegetation (as described in the Vegetation Management Plan), using weed-free materials for erosion control, and limiting travel through weed-infested areas. The plan also calls for conducting surveys for invasive weeds on all public land within the project boundary. These surveys would occur during the first year of a license and every 5 years thereafter. The plan also outlines weed control measures for all California DFA A- and B-listed weeds on public land. Merced ID would also treat new occurrences of five C-listed species (tree-of-heaven, Scotch broom, Russian thistle, Spanish broom, and puncturevine). Weed treatments would be consistent with BLM guidelines for invasive weed control. Following treatment, Merced ID would annually monitor treated populations and would implement additional control measures until three consecutive surveys show no sign of the treated species present. Finally, the plan includes provision for annual reporting to BLM to present results of surveys and weed treatments that occurred during the previous year.

In preliminary 4(e) condition 9, BLM specifies that Merced ID develop a vegetation and non-native invasive plant management plan to protect terrestrial resources. The objectives of BLM's invasive plant management plan are to:

- control invasive species using early detection, rapid response, and prevention measures;
- prevent, eliminate, and/or control undesired non-native vegetation or other invasive species using an integrated pest management approach that combines biological, cultural, physical, and chemical tools to minimize economic health and environmental risks; and
- implement federal acts and laws, BLM policies and strategies, and other efforts to meet the goals of eradicating and controlling invasive species on BLM lands.

California DFW's 10(j) recommendation 10 recommends that Merced ID develop a plan for integrated pest management and pesticide use notification to control undesirable woody and herbaceous vegetation in addition to aquatic plants, insects, and rodents to minimize the use of pesticides. California DFW recommends that the plan include the following specific details: locations of use, herbicides proposed for use, application rates, dose and exposure rates, and safety risk and time frames for application. The plan should include an exception for when unexpected outbreaks of pests require control measures that were not anticipated at the time the report was submitted. In that case, Merced ID would submit an emergency notification of use to the appropriate agencies.

BLM [preliminary 4(e) condition 40] specifies that Merced ID request approval prior to using pesticides to control undesirably woody and herbaceous vegetation, aquatic plants, and other pests on BLM lands. The plan allows for exceptions in the event of unexpected outbreaks.

Merced ID proposes to obtain written approval from BLM before using pesticides and herbicides on lands administered by BLM.

Our Analysis

Under a new license, continued operation and maintenance of the project would include vegetation management, road grading, and vehicle traffic. Construction associated with modified or new project facilities could also result in ground-disturbing activities. These activities would expose soils and remove existing vegetation, creating suitable sites for weed establishment. Operation of project vehicles has the potential to spread seeds from existing populations to new areas within the project.

Merced ID's proposed Invasive Species Management Plan includes appropriate measures (e.g., vehicle washing, use of weed-free materials, revegetation activities) to the limit potential for weed introduction and dispersal within the project boundary. The plan also stipulates that Merced ID would conduct surveys every 5 years to determine the location of invasive weeds and use BLM-approved treatment measures to treat existing weed populations. Proposed treatment and monitoring measures are likely to control or

eradicate these populations. However, with the exception of the Iberian starthistle population located on private land, Merced ID's proposed survey and treatment activities are limited to BLM-managed land within the project boundary. Existing populations on Merced ID land would be left untreated, and no surveys would be conducted to identify new populations on Merced ID and private land.

The majority (more than 70 percent) of the existing invasive weed populations identified during surveys were located on Merced ID land with a high frequency of the invasive weed populations occurring in the immediate vicinity of project recreation areas. Because the majority of these invasive weed populations are C-listed species, they may not require treatment. However, during its invasive weed survey, Merced ID identified a population of perennial pepperweed (a B-listed species) on its land, and there is no proposed treatment for this population. Since the majority of project activities with potential to introduce or spread invasive species would occur on Merced ID land, excluding these areas from survey and treatment measures would be counter-productive. Failing to monitor these areas would increase potential for establishment of A- and B-listed species. Untreated populations would increase the potential for invasive weeds to spread to surrounding areas, including BLM-managed land.

Merced ID's proposed Invasive Species Management Plan would reduce the potential for the introduction and spread of invasive weeds resulting from project activities. Proposed treatment and monitoring of A- and B-listed species on BLM land would reduce potential for these populations to spread and would reduce potential effects of these species on native plants that are not able to outcompete invasive weeds and avoid mono-cultures that are less suitable for wildlife habitat compared to diverse communities of native plants. Modifying the proposed Invasive Species Management Plan to stipulate that the measures in the plan apply to all land within the project boundary, including treatment measures for the existing population of perennial pepperweed on Merced ID land would further reduce invasive weeds and would more directly address project-related effects from invasive weeds. Modifying the plan to include specifics on the BMPs that Merced ID proposes to implement would keep the agencies apprised about the proposed BMPs and allow the BMPs to be evaluated and/or adjusted based on their effectiveness as necessary, thereby further reducing potential effects of invasive plant management on other terrestrial and aquatic resources.

Merced ID's Invasive Species Management Plan is consistent with the goals, objectives, and methodologies outlined in the components of BLM's recommended management plan that are specific to vegetation management.

Integrating a component for pest management and pesticide use notification into the Invasive Species Management Plan to address agency requirements of notification prior to use would further protect both terrestrial and aquatic resources from the effects of herbicides used to control undesirable vegetation and other pesticides. We recommend including a provision in the plan to describe incidents for which pesticide use without prior notification would be allowed. Implementing the plan and measures discussed

above would also ensure the project is compliant with laws and policies regarding pesticide use.

Protection of Sensitive Plants and Wildlife

Project operation and maintenance activities, such as road grading and vegetation control, modification of existing facilities, and construction of new project facilities could remove existing vegetation, disturb soils, and change microsite habitats. These activities have potential to disturb sensitive plants, disturb habitat for sensitive wildlife, or directly injury or disturb sensitive wildlife in the immediate vicinity of these activities. Specific effects on the bald eagle and limestone salamander are discussed in the following subsections.

Merced ID's proposed Vegetation Management Plan includes several measures to reduce potential effects on sensitive plants and wildlife. In areas with known sensitive resources, Merced ID would: (1) flag sensitive areas prior to conducting any vegetation management or ground-disturbing activities; (2) emphasize the use of manual weed control methods, where feasible; (3) use unspecified BMPs; and (4) provide annual employee training including identification of key special-status species and the locations of sensitive resources to be avoided. Merced ID's proposed Recreation Facilities Plan, as filed with the final license application and amended on September 22, 2014, also includes provisions for avoidance of known sensitive plant and wildlife populations in the planning of the future placement of major rehabilitation or capital improvement projects. For any future developments planned outside the project boundary, Merced ID would consult with BLM during the planning process and evaluate the need for additional surveys for sensitive plants and wildlife. Merced ID also proposes, as part of its Invasive Species Management Plan, to emphasize protection of sensitive plants when selecting control measures for invasive weeds in proximity to sensitive resources.

In preliminary 4(e) condition 9, BLM specifies that Merced ID conduct botanical surveys to provide baseline information on existing rare plants in the project area, identify potential adverse project effects on rare plants, and develop measures to reduce these effects. According to the condition, the plant surveys generally would be valid for 5 years or until new information is obtained via BLM guidance.

Our Analysis

Continued operation of the project under a new license would include some activities that, if conducted near sensitive plant species, could affect these resources. These activities include application of herbicides to invasive weeds, vegetation management in recreation areas or around project facilities, road grading, or any other activities with potential to disturb soil or vegetation. Implementation of Merced ID's proposed Vegetation Management Plan, Invasive Weed Management Plan, and Recreation Facilities Plan would reduce potential for adverse effects on sensitive plants and sensitive wildlife habitat. However, Merced ID's plans do not include any pre-disturbance surveys for areas where new disturbance could affect potential habitat. Over

the term of a new license, there is potential for sensitive species to colonize new areas and that species would be added to sensitive species lists. Therefore, we agree with BLM preliminary 4(e) condition 9 to conduct botanical surveys prior to disturbance.

Consultation with BLM, California DFW, and FWS during the planning phases for any new disturbance would identify the need for pre-disturbance surveys and determine which methodology should be employed. Implementing surveys, if needed, and developing protection measures for any sensitive species in the disturbance area, would further reduce potential effects.

Additionally, Merced ID's proposed Vegetation Management Plan and Invasive Weed Management Plan state that Merced ID would employ BMPs in sensitive areas to protect sensitive species; however, Merced ID does not provide any detail about what BMPs it would implement, making this measure unenforceable, and we are unable to analyze the benefits of these unspecified measures. By revising the proposed Vegetation Management Plan and Invasive Weed Management Plan to provide details about the specific BMPs it proposes to implement, Merced ID would improve these plans and would likely reduce potential effects on sensitive species. Providing these details informs the agencies of the proposed BMPs and allows for the effectiveness of the BMPs to be assessed and revised if necessary to further reduce potential project effects on sensitive species.

Protection of Bald Eagles

Operation and maintenance activities, such as invasive weed control, facility maintenance, road maintenance, and construction, could create noise near active bald eagle nests and winter roosting sites. Recreation users including hikers and boaters could cause similar disturbance. Vegetation management activities could also result in the removal of nest trees or roost trees. Bald eagles can be sensitive to increased noise during the nesting period, and such disturbance could result in nest abandonment or reduced nesting success. The National Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act prohibit such disturbances.

To minimize potential project effects on bald eagles, Merced ID proposes to implement its Bald Eagle Management Plan, as amended, filed on September 22, 2014. The plan includes provisions to conduct bald eagle surveys at 4-year intervals, starting the first year of any new license issued for the project. Survey areas would include all lands within 0.25 mile of the project boundary. During each survey, Merced ID would collect data related to early spring territory occupancy, late spring nesting behavior, and reproduction success in summer. Merced ID would use the survey results to delineate protection buffers around each bald eagle nest site. Protection buffers would include all land within the project boundary that is within 1,000 feet of the nest.

Within the protection buffers, Merced ID would prohibit operation and maintenance activities that could result in bald eagle disturbance, such as weed control, facility maintenance, and road maintenance and construction, from January 1 through

August 1. However, Merced ID may request an exception if a nest appears to be unoccupied, but the buffer is still in place. Merced ID would consider any emergency work conducted within nest buffers to be exempt from the timing restriction and would notify agencies of any emergency actions within a minimum of 48 hours, or as soon after the emergency as is reasonably possible. If a tree containing an eagle nest is identified as a hazard tree, because it is dead or dying and has potential to fall on or near project recreation facilities, powerhouses, switchyards, or other project features, it would be removed outside the nesting period and BLM and California DFW would be consulted.

To minimize the potential for bald eagle disturbance related to recreation activities, Merced ID would post public information notices at campgrounds and boat launch facilities. Notices would remain in place from January 1 through August 1 each year to: (1) inform the public about bald eagle nests occurring within the project vicinity; (2) describe the legal protections for bald eagles; (3) describe what recreationists can do to help protect nesting bald eagles (e.g., stay at least 1,000 feet from nests and observe birds from a distance); and (4) provide California DFW's contact information to report injured birds.

In preliminary WQC condition 5, the Water Board specifies that Merced ID prepare a monitoring plan for bald and golden eagles consistent with the most current National Bald Eagle Management Guidelines provided by FWS that includes goals and objectives, measurable criteria, a monitoring and reporting schedule, a plan for corrective measures if goals are not achieved, and minimum monitoring requirements. BLM preliminary 4(e) condition 10 specifies that Merced ID implement a bald eagle management plan and to consult with BLM, California DFW, FWS, and the Water Board before submitting the plan for Commission approval. FWS [10(j) recommendation 9] recommends that Merced ID consult with resource agencies within 1 year of license issuance, before implementing the revised Bald Eagle Management Plan, which would include the edits made to the plan by FWS and filed with its recommendation.

Our Analysis

Operation and maintenance activities (including invasive weed control, facility maintenance, road maintenance, and construction) and recreation activities (such as hiking and boating) would conflict with bald eagle protection laws if these activities adversely affect nesting bald eagles. Merced ID's proposed buffer distances and timing restrictions are consistent with the National Bald Eagle Management Guidelines (FWS, 2007). These measures would provide protection for nesting bald eagles and would reduce potential effects related to project operation and maintenance activities. Posting public notifications to inform recreationalists about the presence of bald eagle and protection measures would also reduce potential effects on nesting bald eagles.

However, Merced ID's proposed plan does not include any protection measures for winter roost sites. In addition to nest trees, winter roost trees are also important habitat. Roost trees are typically taller than the surrounding tree canopy, providing a

view over the landscape and foraging areas. Removal of these trees would degrade winter eagle habitat in the project boundary. The National Bald Eagle Management Guidelines (FWS, 2007) include the following recommendations to protect foraging areas and roost sites:

1. minimize potentially disruptive activities and development in the eagles' direct flight path between nests and roost sites and important foraging areas;
2. locate long-term and permanent water-dependent facilities, such as boat ramps and marinas, away from important eagle foraging areas; and
3. avoid recreational and commercial boating and fishing near critical eagle foraging areas during peak feeding times (usually early to mid-morning and late afternoon), except where eagles have demonstrated tolerance to such activity.

Revising Merced ID's proposed Bald Eagle Management Plan to protect winter roost trees from vegetation management and future construction activities would reduce potential for degrading these areas. Including information about roost sites on public information boards would also help reduce disturbance to roosting and foraging eagles.

Additionally, Merced ID's proposed Bald Eagle Management Plan states that emergency activities would be exempt from the timing restrictions. However, Merced ID does not provide any description of what would constitute an emergency activity. This omission leaves the statement open to interpretation and reduces enforceability. Revising the plan to clearly describe what kinds of activities would be considered emergencies, and why these activities would supersede bald eagle protection would add to the quality of the plan and better protect bald eagles.

In its amended proposal filed on September 22, 2014, Merced ID states that it revised the Bald Eagle Management Plan, based on FWS' 10(j) recommendation. However, we find inconsistencies between Merced ID's proposal and FWS' recommended plan. Merced ID's proposal to conduct nesting surveys within 0.25 mile of the reservoir shorelines every 4 years is inconsistent with FWS' recommendation to annually conduct nesting, wintering, and night roost surveys within 1 mile of the reservoir shorelines. Other inconsistencies include, but are not limited to, buffer distances around active nests and protective measures for wintering bald eagles. Increasing the frequency of surveys would result in data that are representative of the bald eagles nesting, wintering, and roosting in the project area, as opposed to data collected infrequently, which can cause difficulty in drawing conclusions if the data are collected during a year when eagle use of the habitat in the project area is atypical. Overall, implementing the plan with the specific measures required by FWS would result in an eagle protection plan that affords more protection to bald eagles, thereby minimizing project effects on bald eagles nesting, wintering, and roosting in the project area.

Protection of Limestone Salamanders

Project operation and maintenance activities including invasive weed control, vegetation management, road or trail maintenance, and recreation activities could disturb limestone salamander if these activities occur close to occupied habitat.

To minimize potential effects on the limestone salamander, Merced ID identified and mapped suitable habitat for this species in the project area (Merced ID, 2012d). Merced ID also proposes to implement its Limestone Salamanders Sensitive Areas Management Plan, filed with the final license application. The plan includes measures to: (1) flag sensitive areas prior to any vegetation management or ground-disturbing activities; (2) conduct any necessary treatment of invasive weeds near limestone salamander habitat between April 16 and October 31 and manually remove weeds, if possible; (3) use unspecified BMPs; and (4) provide annual employee training, including the identification of key special-status species and of locations of sensitive resources to be avoided. Additionally, Merced ID would not authorize any minerals mining or the use of explosives in areas with potential habitat for limestone salamander. Merced ID would avoid sensitive areas during any vegetation maintenance and road or trail construction and also avoid the use of toxic fire retardants within 500 feet of suitable habitat. If roads or trails are needed to meet recreation commitments or to access locations to combat wildfire under emergency circumstances, Merced ID would consult with BLM and California DFW and make every effort to minimize disturbance. Further, the plan includes provisions for annual reporting to BLM and California DFW on any activities conducted in limestone salamander habitat.

In preliminary 4(e) condition 15, BLM specifies that Merced ID obtain its approval before submitting and implementing the plan, conduct studies of limestone salamanders every 7 years beginning in year one of license issuance, and inventory all suitable but unconfirmed habitats on BLM lands for the presence of limestone salamanders. In addition, BLM disagreed with some of Merced ID's other proposed measures in its proposed plan. In response, Merced ID amended its proposal on September 22, 2014, to be consistent with BLM preliminary 4(e) condition 15. California DFW [10(j) recommendation 8] specifies that the Limestone Salamander Sensitive Areas Management Plan provide mapping of known occurrences of limestone salamanders and sensitive habitat, avoid sensitive areas, hold annual meetings with California DFW and BLM to review activities that may affect sensitive areas, and identify BMPs to be implemented as part of the plan.

Our Analysis

The majority of habitat within the project boundary suitable for limestone salamander occurs on the southern bank of the east arm of Lake McClure. This area contains limited roads and trails and project-related activities are expected to be infrequent. In most cases, known habitat areas are difficult to approach because of steep slopes, rocky terrain, and unstable rocky banks, making these areas unsuitable for most

project-related activities. Additionally, salamanders are likely to be deep below the surface during the summer, when most project maintenance is expected to occur. However, because of the rocky nature of the surface habitats, construction of roads or trails in these areas would cause substantial habitat degradation by disturbing or shifting loose rocks or causing rockslides that could injure salamanders occurring in the narrow spaces between rocks. A short recreation trail between Shepherd's Point and Sherlock Creek also traverses BLM-managed land designated as Limestone Salamander areas of critical environmental concern (ACECs). Hikers on this trail could create similar habitat disturbances. Additionally, there is potential that fluctuating reservoir levels would inundate occupied salamander habitat.

Implementation of Merced ID's proposed Limestone Salamanders Sensitive Areas Management Plan would limit project-related activities in proximity to mapped limestone salamander habitat, consistent with California DFW's recommendation. In the unlikely event project activities are necessary, Merced ID would conduct these actions between April 16 and October 31, the period during which salamanders are likely to be underground and unaffected by most surface activity. Merced ID would also protect mapped sensitive areas from future project-related development. Implementation of the Limestone Salamanders Sensitive Areas Management Plan would reduce project effects on limestone salamanders. Because the plan does not specify which BMPs would be implemented, this measure is unenforceable and impossible to analyze. We agree with California DFW's recommendation that Merced ID should identify the BMPs that would be implemented as part of the plan. By revising the proposed Limestone Salamanders Sensitive Areas Management Plan to provide details about the specific BMPs it proposes to implement, Merced ID would improve the plan and would likely reduce potential effects on sensitive species. Consulting with agencies would allow for agency comments on the BMPs, ensuring that only BMPs consistent with agency policies and requirements would be included in the plan. Consultation would also ensure consistency of the plan with laws protecting this species, which is state endangered, fully protected, and BLM sensitive.

Results of the limestone salamander survey (Merced ID, 2012d) indicate that while reservoir elevations occasionally inundate suitable habitat for limestone salamanders, these inundations rarely occur during periods when the salamanders are above ground. During rare periods when high water levels coincide with above-ground activity, it is likely that salamanders would be able to relocate upslope to avoid submersion. Therefore, project operation is expected to have minor effects on this species and no protection measures would be necessary.

The presence of hiking trails in limestone salamander habitat create potential for rock slides or trampling that could cause injury to limestone salamanders. We expect potential for injury to be small because hikers tend to stay on the trails in areas that are difficult to traverse. However, if a new license requires modifications to existing trails or construction of new trails in suitable habitat, potential for injury could increase, especially during trail construction. Siting these features outside of suitable habitat, if

possible, would further reduce potential effects on limestone salamander and be consistent with California DFW's recommendation to avoid sensitive habitat areas.

Protection of Western Pond Turtles

Project operation and maintenance, particularly those activities that cause water level fluctuations, could affect habitat for basking and nesting, as well as habitat for juvenile western pond turtles. Traffic associated with project maintenance and recreation, and maintenance activities such as pesticide applications, also may affect the species.

Merced ID amended its proposal to include measures for the western pond turtle, consistent with BLM preliminary 4(e) condition 16. Merced ID proposes to document western pond turtles incidentally observed on lands administered by BLM while conducting other environmental work, record relevant data including GPS locations, and develop written reports to be submitted annually to BLM [consistent with BLM preliminary 4(e) condition 1] and the Commission. Merced ID also proposes to train project staff to identify western pond turtles. BLM preliminary 4(e) condition 16 includes objectives for the conservation of special-status species, habitat maintenance or improvement, and proactive conservation measures to minimize the likelihood of and need for federal listing of the species.

Our Analysis

We agree with Merced ID's proposed measures and acknowledge that Merced ID's proposed measures accomplish BLM's objectives regarding conservation of the western pond turtle. Because a project nexus exists, we recommend revising the proposal to record incidental observations of western pond turtles in the entire project area, rather than limiting the data collection to just BLM lands. Under the proposal, Merced ID would submit reports to BLM and the Commission. Because the species is of special status to the state of California (i.e., as a species of special concern) and FWS (as a species of concern), we recommend including these agencies in the reporting requirements, and developing a protection plan that would include both the proposed measures and measures recommended by other agencies that would minimize project effects on western pond turtles.

Protection of Special-status Bats

Human presence and noise caused by human activity around project facilities could adversely affect bats roosting in project facilities. To protect bats from project-related effects, Merced ID amended its proposal to include measures for bat management. Under its amended proposal, Merced ID would document all known bat roosts in project facility structures within 1 year of license issuance and report relevant information to BLM and California DFW. Merced ID would put humane exclusion devices in place when bats are absent from roosts (i.e., November through February) to prevent bats from

occupying structures, and reevaluate the potential for bat roosts in project facilities every 3 years.

BLM [preliminary 4(e) condition 12] specifies that Merced ID inspect and document all known bat roosts occurring in any project structure that may be used as a roosting structure within 1 year of license issuance, and report results of structure inspections to BLM (for inspections of structures occurring on BLM lands) and California DFW (for all structure inspections). BLM also specifies that Merced ID place exclusion devices at locations where bats or signs of bats are present where staff would have a routine presence. The exclusion devices would be placed at the structures when bats are absent, from November 1 through February 28, after inspecting the structures to prevent trapping any overwintering bats. BLM also specifies that project facilities be reevaluated every 3 years.

Our Analysis

Merced ID's proposed measures to manage bats are consistent with the measures contained in BLM preliminary 4(e) condition. We agree that these measures would protect bats by excluding them from project facilities, and, as a result, roosting bats would not be disturbed by project staff entering the facility or visiting other project structures on a regular basis. However, the proposed measures lack specific details about the type and design of the exclusion devices, measures for success, and other details that are necessary to evaluate the effectiveness of the measures. While we agree with the reporting requirements that would have Merced ID report to BLM about structures used by bats on BLM lands, and to California DFW with all information obtained from inspections of bat roosts at all project facilities, we assert that the well-documented occurrence of nine special-status bat species in or near project facilities warrants involvement of other agencies as well, particularly since some of these species are identified by FWS as species of concern. We recommend that any report made to BLM and California DFW also be made to FWS and the Commission, and to the Water Board to the extent required by its policies and procedures for special-status species. We find that the proposed measures should be included in a protection plan that would also contain specific details about the exclusion devices, locations where the devices would be installed, how success of the exclusion devices would be defined, and mitigation measures to be implemented if exclusion devices are unsuccessful. The plan should also include a schedule for implementation and filing reports. By developing and implementing a protection plan for special-status bats, project effects on bats could be better qualified and quantified.

Merced Falls Project

Vegetation Management

PG&E proposes to continue to operate the project in a run-of-river mode, where flows are determined by releases made by the upstream Merced River Project. PG&E proposes no changes to its vegetation maintenance activities, which currently include

vegetation trimming and clearing and herbicide spraying along project access roads, near gages, around the dam, and around some areas of the impoundment. Because of the abundance of noxious weeds and invasive plants on private lands surrounding the project, and the infrequency of weed management activities, PG&E does not propose a formal management plan for the control of undesirable vegetation.

The Water Board comments that the Basin Plan pertains to all levels of pesticide use and includes herbicides. Preliminary WQC condition 2 specifies that PG&E develop a pesticide use plan within 6 months of license issuance, in consultation with the Water Board, BLM, California DFW, FWS, and NMFS. California DFW [10(j) recommendation 7] recommends an integrated pest management and pesticide use notification plan to control undesirable woody and herbaceous vegetation, aquatic plants, insects, and rodents. FWS' comments about the effects of rodenticide and pesticide use are discussed in section 3.3.3.2, *Threatened and Endangered Species* and section 3.3.3.3, *Cumulative Effects*.

Our Analysis

No changes in flows and no resulting effects on vegetation would occur because PG&E proposes no changes to project operation. Project operation and maintenance activities, including road grading and vegetation control could result in the removal of existing vegetation and soil disturbance, thereby increasing the potential for the spread of invasive weeds. Additionally, project vehicles may transport invasive weed seeds from one area to another, and the rise and fall of the reservoir water levels can also carry seeds for invasive weeds along the shoreline and distribute them in other areas suitable for colonization. Under a new license, visitors would continue to access the project at the dam, the River's Edge Fishing Access area, and the gages. Project access is a potential source for the introduction, establishment, and spread of noxious weeds and invasive plants.

PG&E's semi-annual treatment of noxious weeds and invasive plants would continue to control the spread of existing noxious weeds and invasive plants and would also reduce the establishment of additional species of noxious weeds and invasive plants from private lands adjacent to the project area.

A formal plan detailing the methods, locations, timing, frequency of control treatments, and target species would allow PG&E to manage undesirable vegetation more effectively. The potential effects on other species could be determined by reviewing details of a management plan for noxious weeds and invasive plants, which would reduce effects on sensitive species and state and federally listed species, as discussed below. Integrating the use of rodenticides and insecticides into the plan for the control of undesirable vegetation would be consistent with agency conditions and recommendations, and would further reduce potential effects on sensitive species and state and federally listed species.

Protection of Sensitive Plants and Wildlife

Project operation and maintenance activities, such as vegetation control, could remove existing vegetation, disturb soils, and change microsite habitats. These activities have the potential to disturb sensitive plants, disturb habitat for sensitive wildlife, or directly injure or disturb sensitive wildlife in the immediate vicinity of these activities. Specific effects on the bald eagle are discussed in the following subsection, and specific effects on the elderberry shrub and the valley elderberry longhorn beetle, California red-legged frog, and San Joaquin kit fox are discussed in section 3.3.3, *Threatened and Endangered Species*.

PG&E does not propose a formal vegetation management plan to reduce potential effects on sensitive plants and wildlife, nor does it propose changes to project operation or maintenance activities. Under a new license, PG&E would continue to control vegetation about twice a year around the powerhouse, gages, the River's Edge Fishing Access area, particular areas of the impoundment, and along access roads.

As noted above, the Water Board indicates that the Basin Plan pertains to all levels of pesticide use and includes herbicides. Preliminary WQC condition 2 specifies that PG&E develop a pesticide use plan within 6 months of license issuance, in consultation with the Water Board, BLM, California DFW, FWS, and NMFS. California DFW [10(j) recommendation 7] recommends an integrated pest management and pesticide use notification plan to control undesirable woody and herbaceous vegetation, aquatic plants, insects, and rodents.

FWS comments that the burrowing owl, a BLM sensitive species, has been known to occur in the project vicinity. FWS points out that because burrowing owls occur in ground squirrel burrows, they are vulnerable to rodent control methods such as burrow fumigation and burrow collapse. FWS' comments about the effects of rodenticide and pesticide use are also discussed in section 3.3.3.2, *Threatened and Endangered Species* and section 3.3.3.3, *Cumulative Effects*.

Our Analysis

Continued operation of the project under a new license would include some activities that, if conducted near sensitive plant species, could affect these resources. These activities include vegetation management activities such as application of herbicides to noxious weeds and invasive plants, vegetation trimming, recreation activities, or any other activities with potential to disturb soil or vegetation.

Although none of the eleven sensitive plant species identified as potentially occurring in the project area were observed during the surveys, two other special-status plant species identified as uncommon by the California Native Plant Society, gypsum-loving larkspur and foothill jepsonia, were observed and mapped on the southeast side of the impoundment. Although the abundance of these two species suggests that they are thriving under current project operation and maintenance activities, it is difficult to assess

effects on these species. Because PG&E does not propose changes to project operation and maintenance activities, the current status of these species is not expected to change.

Sensitive plants, as well as sensitive wildlife, could be adversely affected by the control of undesirable vegetation. The development of a formal plan for the control of noxious weeds and invasive plants would disclose the details of the locations, timing, and frequency of treatments so agencies could determine potential effects on sensitive plants and wildlife. Consultation with agencies during the development of the plan would ensure consistency with state and federal laws and compliance with laws protecting sensitive plants and wildlife that occur within the project area. Therefore, the development of a formal plan for the control of noxious weeds and invasive plants could reduce effects of the control measures on sensitive species.

Commonly used control measures for rodents and insects could directly or indirectly affect sensitive plants and wildlife. Integrating a component on rodenticides and insecticides into the control plan for noxious weeds and invasive plants would ensure that all pest management activities and methods are considered and evaluated by agencies for their potential effects on sensitive species, and that the plan is consistent with the Basin Plan and other comprehensive plans listed in section 5.4, *Consistency with Comprehensive Plans*.

Protection of Bald Eagles

Operation and maintenance activities, such as vegetation management activities and facility and road maintenance, could create noise near active bald eagle nests and winter roosting sites. Recreation users, including hikers and boaters could cause similar disturbance. Vegetation management activities could also result in the removal of nest trees or roost trees. Bald eagles can be sensitive to increased noise during the nesting period, and such disturbance could result in nest abandonment or reduced nesting success. The National Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act prohibit such disturbances.

A bald eagle nest and bald eagles were documented within the project area during 2010 and 2011. PG&E does not propose any measures to minimize potential project effects on bald eagles or their roost trees within the project area. PG&E does not propose construction activities within the project area, nor does PG&E propose any changes to project operation and maintenance activities.

Preliminary WQC condition 5 specifies that PG&E develop a monitoring and conservation plan for bald eagles, consistent with the most current guidelines provided by FWS. FWS [10(j) recommendation 5] recommends a bald eagle management plan, either to be implemented in concert with Merced ID or to be developed and implemented by PG&E. In its reply comments, PG&E opposes some aspects of FWS' recommended survey protocols and protection and mitigation measures, such as the implementation of buffer zones, and argues that buffer zones should be site- and project-specific.

Our Analysis

Without proposed measures for the protection of bald eagles from project operation, maintenance, and recreation activities, the project could conflict with bald eagle protection laws if these activities adversely affect nesting bald eagles. The National Bald Eagle Management Guidelines (FWS, 2007) include recommendations to protect bald eagle nests during breeding season from ORV use, motorized watercraft, and non-motorized recreation and human activities such as fishing and hiking within 330 feet from the nest.

The removal of overstory trees within 330 feet of a nest is prohibited during any season. Similarly, bald eagles could be adversely affected without proposed measures to protect winter roost trees, which are necessary components of bald eagle habitat. Roost trees are typically taller than the surrounding tree canopy, providing a view over the landscape and foraging areas. Removal of these trees would degrade winter eagle habitat in the project boundary. The National Bald Eagle Management Guidelines (FWS, 2007) include the following recommendations to protect foraging areas and roost sites:

1. minimize potentially disruptive activities and development in the eagles' direct flight path between nests and roost sites and important foraging areas;
2. locate long-term and permanent water-dependent facilities, such as boat ramps and marinas, away from important eagle foraging areas; and
3. avoid recreational and commercial boating and fishing near critical eagle foraging areas during peak feeding times (usually early to mid-morning and late afternoon), except where eagles have demonstrated tolerance to such activity.

Requiring a plan to protect bald eagle nests from operation and maintenance activities and recreation activities would reduce project-related effects on nesting bald eagles. Also requiring protection of winter roost trees from vegetation management and future construction activities would reduce potential habitat degradation.

All survey protocols and protection and mitigation measures should be consistent with the guidelines provided in the National Bald Eagle Management Guidelines, rather than site- or project-specific. Implementing survey protocols and protection and mitigation measures inconsistently could conflict with the National Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. Therefore, requiring consultation with FWS, California DFW, and BLM prior to developing the plan would ensure that appropriate survey protocols and protection and mitigation measures are proposed to reduce project-related effects on bald eagles during and outside the nesting season. Consultation would ensure consistency with FWS' most current guidelines and compliance with the National Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act.

3.3.3 Threatened and Endangered Species

3.3.3.1 Affected Environment

Merced River

Aquatic Species

Central Valley Steelhead—Steelhead (*O. mykiss*), the anadromous life history form of rainbow trout, historically migrated up the Merced River well past the site of present-day Lake McClure and are believed to have spawned and reared in the Sierra Nevada as far upstream as Yosemite National Park based on water temperature, known barriers to upstream passage, and other factors (Lindley et al., 2006). *O. mykiss* currently found in and upstream of project reservoirs and in the Merced River between Merced Falls dam and Crocker-Huffman diversion dam are considered resident rainbow trout because they are not the progeny of anadromous parents.

O. mykiss found in the Merced River downstream of Crocker-Huffman diversion dam have the potential to be anadromous and are therefore considered by NMFS to belong to the California Central Valley steelhead DPS. This DPS is federally listed as threatened (71 FR 834; January 5, 2006) and critical habitat includes the Merced River downstream from Crocker-Huffman diversion dam, the San Joaquin River, and the Sacramento-San Joaquin Delta (70 FR 52488; September 2, 2005). Steelhead⁴³ in the lower Merced River belong to the Southern Sierra Nevada Diversity Group of the Central Valley steelhead DPS. Populations of naturally reproducing Central Valley steelhead have been experiencing a long-term decline in abundance throughout their range with populations in the Central Valley and southward experiencing the most severe declines.

Adult steelhead enter the San Joaquin River Basin as early as late September and spawn primarily from December through March. Egg incubation can extend through May, and juvenile rearing and outmigration occur year-round. Spawning occurs in riffles and pool tails with abundant gravel ranging in size from 0.4 to 1.8 inches (median particle size, or D₅₀) and low fine sediment concentrations. Recommended water temperatures⁴⁴ are < 18°C for adult immigration and < 13°C for spawning, incubation, and emergence. Steelhead fry and juveniles rear in a wide range of hydraulic conditions, generally occupying areas with rocky substrates and overhead cover. Water temperatures

⁴³ Throughout the remainder of this section, we refer to *O. mykiss* that occur downstream of Crocker-Huffman diversion dam as steelhead, even though some may be resident rainbow trout.

⁴⁴ Water temperature thresholds referenced in this section are based on recommendations found in EPA (2003), and criteria are given as the 7-day average of the daily maximum temperatures.

of $< 16^{\circ}\text{C}$ are recommended for rearing, and temperatures of $< 14^{\circ}\text{C}$ are recommended for smolting.

Modeled spawning habitat suitability for steelhead in the lower Merced River downstream of Crocker-Huffman diversion dam varies with flow (see figures 3-28, 3-31, and 3-34). The greatest amount of suitable habitat is predicted to occur between RM 42.0 and 52.0, which corresponds with the reach containing most of the suitable spawning gravel. Downstream of this 10-mile reach, substrate in the lower Merced River is predominantly cobble embedded in sand, which is not suitable for steelhead spawning and provides poor steelhead rearing habitat.

Water temperature has been identified as a primary limiting factor for steelhead production in many Central Valley streams. Merced ID compared water temperature monitoring data collected from 1991 through 2010 at seven locations between RM 52.0 and RM 13.0 with EPA's (2003) recommended 7-day average daily maximum water temperature criteria for salmonids to evaluate the frequency with which the criteria were exceeded for each steelhead life stage. Merced ID's conclusions regarding existing conditions were:

- During the upstream migration period, the 18°C criterion for adult steelhead migration was exceeded 58 to 100 percent of the time in September and 12 to 68 percent of the time in October between RM 46.3 and RM 13.0. From November through February, water temperatures were below the 18°C criterion at all times and locations, except during November at RM 52.0 ($>18^{\circ}\text{C}$ 2 percent of the time) and RM 46.3 ($>18^{\circ}\text{C}$ 1 percent of the time).
- During the December through March spawning and incubation period, the 13°C criterion to protect spawning, incubation, and fry emergence life stages was evaluated at locations from RM 52.0 downstream to RM 41.9. In December, the 13°C criterion was exceeded 1 to 14 percent of the time from RM 52.0 to RM 41.9. In January the criterion was exceeded only at RM 41.9 (12 percent of the time). In February and March, the 13°C criterion was exceeded at all locations 5 to 97 percent of the time.
- During the year-round steelhead juvenile rearing period, the 16°C rearing criterion was exceeded about 20 percent of the time at RM 52.0, 37 to 53 percent of the time between RM 46.3 and RM 33.0, and 61 percent of the time at RM 13.0.
- During the March through May steelhead smoltification period, the 14°C smoltification criterion was exceeded 20 percent of the time at RM 52.0, 57 to 82 percent of the time between RM 46.3 and RM 41.9, 77 percent of the time at RM 33.0, and 94 percent of the time at RM 13.0.

Population data for steelhead in the lower Merced River are lacking. Good et al., (2005) report incidental captures of juvenile steelhead during RST monitoring in 2002,

but none were captured during outmigration monitoring using RSTs in 2007 (S.P. Cramer and Associates, 2007). The 110 *O. mykiss* observed in the lower Merced River during seasonal fish monitoring in 2006 through 2008 ranged in size from the 0 to 1 inch (0 to 25 mm) size class to the 15.8 to 16.7 inch (401 to 425 mm) size class, and likely ranged up to age 4+. Only 37 of these 110 fish were observed downstream of Crocker-Huffman diversion dam and therefore were possibly anadromous steelhead (Stillwater Sciences, 2008).

Steelhead populations in the Merced, Tuolumne, Stanislaus, and Calaveras Rivers are the only remaining representatives of the Southern Sierra Nevada diversity group, but currently none of these populations are considered to be viable (i.e., at low risk of extinction). NMFS' recovery plan for the DPS of Central Valley steelhead characterizes the Merced River as a Core 2 watershed, in which steelhead populations have a moderate risk of extinction (NMFS, 2014). Core 2 watersheds have lower potential to support viable populations of steelhead because of lower abundance or amount and quality of habitat. NMFS lists the risk of extinction in the Merced River as uncertain.

Priority 1 Merced River recovery actions for steelhead presented in NMFS (2014) are as follows:

- Develop a program to reestablish steelhead in historic habitat upstream of Crocker Huffman, Merced Falls, McSwain, and New Exchequer dams. The program should include feasibility studies, habitat evaluations, fish passage design studies, and a pilot reintroduction phase prior to implementation of the long-term program.
- Supplement flows provided pursuant to the Davis-Grunsky Agreement and the Merced River Project license with water acquired from willing land owners and water districts to provide additional instream flow.
- Develop a Merced River steelhead team to help guide collection and evaluation of baseline data to address hypotheses for why resident *O. mykiss* are more abundant than anadromous *O. mykiss* in the Merced River.
- Evaluate whether pulse flows in the Merced River are beneficial to adult steelhead immigration and juvenile steelhead emigration; if pulse flows are determined to be effective, implement the most beneficial pulse flow regime.
- Identify floodplain and side channel projects to improve river function and increase habitat diversity in the Merced River.
- Develop a long-term gravel management plan to increase and maintain steelhead spawning habitat downstream of Crocker-Huffman, Merced Falls, and New Exchequer dams.

Priority 2 Merced River recovery actions for steelhead presented in NMFS (2014) are as follows:

- Manage release from Lake McClure to provide the most beneficial flow and water temperatures for all steelhead life stages.
- Prioritize Merced River diversions based on their level of entrainment and screen those with the highest benefit to cost ratio.
- Work with water rights holders in the Merced River Watershed to provide flows that protect steelhead.
- Develop ramping rate criteria for the Merced River that protect anadromous fishes.
- Continue to supply spawning-sized gravel to landowners for construction and maintenance of wing dam diversion structures in the Merced River.
- Evaluate the potential benefits and feasibility of installing a water temperature control device on New Exchequer dam to most efficiently use the volume of cold water in the reservoir.
- Federal, state, and local agencies should use their authorities to develop programs and projects that focus on retaining, restoring, and creating riparian corridors within their jurisdiction in the Merced River Watershed.
- Permanently protect Merced River riparian habitat through easements and/or land acquisition.
- Increase monitoring and enforcement of illegal rip rap applications in the Merced River.
- Implement studies designed to quantify the impact of predation on steelhead in the Merced River. If the studies identify predator species and/or locations contributing to low steelhead survival, then evaluate whether predator control actions can be effective in minimizing predation on steelhead in the Merced River; continue implementation if effective.
- Implement programs and measures designed to control predation in the Merced River, including actions to isolate “ponded” sections in the river.

Vernal Pool and Conservancy Fairy Shrimp—Fairy shrimp are generally restricted to seasonal aquatic habitats where predatory fish do not occur. Female fairy shrimp of all species carry their eggs in a ventral brood sac. The eggs either are dropped to the pool bottom or remain in the brood sac until the mother dies and sinks. When the pool dries, the eggs dry and remain dormant in the dry pool bed until rains and other environmental stimuli cause them to hatch. Resting fairy shrimp eggs are commonly referred to as cysts and are capable of withstanding heat, cold, and prolonged desiccation.

When the pools refill, some, but not all, of the cysts may hatch. The cyst bank in the soil may contain cysts from several years of breeding.

The vernal pool fairy shrimp occupies a variety of different vernal pool habitats—from small, clear, sandstone rock pools to large, turbid, alkaline, grassland valley floor pools. Although the vernal pool fairy shrimp has been collected from large vernal pools, including one exceeding 25 acres in area, it tends to occur primarily in smaller pools, and is most frequently found in pools measuring less than 0.05 acre in area in grass or mud-bottomed swales or basalt depression pools in unmowed grasslands. The vernal pool fairy shrimp typically occurs at elevations from 30 feet to 4,000 feet, although two sites in the Los Padres National Forest have been found to contain the species at an elevation of 5,600 feet. The species is typically found in pools with low to moderate amounts of salinity or total dissolved solids.

The Conservancy fairy shrimp (*Branchinecta conservatio*) is active from early November to early April. This species primarily inhabits relatively large (1 acre to 7.5 acres), cool-water, sparsely vegetated, vernal pools with moderately turbid water. In addition to vernal pools, Conservancy fairy shrimp may be found in alkaline pools or vernal lakes. The Conservancy fairy shrimp occurs on basin rim, high terrace, and volcanic mud flow landforms. Conservancy fairy shrimp and vernal pool fairy shrimp may co-occur; however, they have rarely been collected from the same pool at the same time.

Vernal pool fairy shrimp and Conservancy fairy shrimp are federally listed as threatened and endangered, respectively. Neither species is state-listed in California. In 2006, FWS designated critical habitat for four vernal pool crustaceans and eleven vernal pool plants, including these two species of fairy shrimp. In its designation, FWS created 35 critical habitat units. Primary constituent elements of critical habitat include: (1) vernal pools with underlying restrictive soil layers that hold water for a minimum of 18 days but do not promote development of obligate wetland vegetation; (2) continuous or intermittent flowing surface water that connects pools to other pools; (3) sources of detritus within the pools for foraging; and (4) living and dead plant material in the pools that provide shelter for fairy shrimp (71 FR 7118–7316). Critical habitat unit 21B for vernal pool fairy shrimp overlaps about 1 acre of land in the project study area.⁴⁵ This area is a 656-foot by 79-foot section of the existing Lake McClure Road, which is adjacent to PG&E's Merced Falls reservoir. The road does not contain any of the primary constituent elements of vernal pool fairy shrimp critical habitat. The nearest critical habitat for Conservancy fairy shrimp is critical habitat unit 6, which is

⁴⁵ The fairy shrimp study area consisted of project-affected areas with potentially suitable habitat, such as vernal pools or other appropriate seasonally flooded habitats, within the project boundary, and the section of the Merced River from PG&E's Merced Falls dam to Crocker-Huffman diversion dam.

approximately 0.25 mile southwest of the project boundary surrounding McSwain reservoir, and overlaps critical habitat unit 22 for vernal pool fairy shrimp.

In 2010, Merced ID reviewed aerial imagery, national wetland inventory maps, and conducted field reconnaissance to identify areas in the project study area with potential to support fairy shrimp. Based on the review, Merced ID conducted site assessments at 44 sites. Merced ID assessed the suitability of sites as potential vernal pool fairy shrimp habitat based on the following components: (1) seasonal standing water (i.e., continuous for at least 19 days), (2) water depth of 0.1 feet or greater for more than 45 days under optimal conditions, and (3) location within the known range or vicinity of documented vernal pool fairy shrimp occurrences. Because the Conservancy fairy shrimp is typically associated with very large vernal pools (or playa pools⁴⁶) and not known to occur in anthropogenic habitats, such as ditches and toe-drains, sites that differed from this habitat profile were considered unlikely to support Conservancy fairy shrimp. Merced ID also related the potential of sites to support vernal pool fairy shrimp and Conservancy fairy shrimp to the absence of frequent and/or excessive disturbance (e.g., plowing or grading). This study identified potential vernal pool fairy shrimp habitat at 33 of the 44 sites. None of the sites were suitable for Conservancy fairy shrimp.

Of the 33 sites identified as potentially suitable for vernal pool fairy shrimp, 9 sites occur in areas where vegetation maintenance or recreation activities are likely to occur (six sites at Lake McClure and three sites at McSwain reservoir). Information describing these sites is presented in table 3-21. Fairy shrimp habitat surveys did not identify suitable habitat for Conservancy fairy shrimp. Continued operation of the project would have no effect on Conservancy fairy shrimp and this species is not discussed further.

⁴⁶ Playa pools are large, flat, bottoms of undrained desert basins that become shallow lakes during wet periods.

Table 3-21. Summary of sites assessed for federally threatened and endangered fairy shrimp in areas of project-related activities (Merced ID, 2011e).

Site Name, Location	Maximum Area/ Maximum Depth	Pool Substrate	Pool Description
Site 7, Barrett Cove recreation area	538 square feet (50 square meters)/1 inch (3 cm)	Organic matter, gravel	Small seasonal pool fed by hillside drainage and road runoff (site adjoins access road into Barret Cove recreation area and is within the project boundary); no invertebrates observed; potential disturbance from vehicular traffic and roadside maintenance. • Potential vernal pool fairy shrimp habitat • Little or no potential to support Conservancy fairy shrimp habitat
Site 8, McClure Point recreation area	20 pools ranging from 11 square feet (1 square meter) to 215 square feet (20 square meters) in size and 0.4 inch (1 cm) to 1 inch (3 cm) deep	Cement, sand, and cobble	Approximately 20 small seasonal depressions formed in tire ruts on a gravel pad; ostracods observed in some of the depressions; vehicular disturbance likely infrequent. • Potential vernal pool fairy shrimp habitat • Not potential Conservancy fairy shrimp habitat
Site 9, McClure Point recreation area	5 square feet (0.5 square meter)/8.7inches (22 cm)	Cobbles	Seasonal ditch fed by runoff from surrounding campgrounds (site adjoins road); no invertebrates observed; human disturbance likely is uncommon. • Potential vernal pool fairy shrimp habitat • Little or no potential to support Conservancy fairy shrimp habitat

Site Name, Location	Maximum Area/ Maximum Depth	Pool Substrate	Pool Description
Site 11, South of McClure Point recreation area	16 square feet (1.5 square meters)/5 inches (13 cm)	Organic matter, gravel	Anthropogenic pool formed out of tire ruts in an unpaved parking area; mosquito larvae observed; vehicular disturbance observed in pool. • Potential vernal pool fairy shrimp habitat • Little or no potential to support Conservancy fairy shrimp habitat
Site 15, South of McClure Point recreation area	592 square feet (55 square meters)/12 inches (30 cm)	No data	Site inaccessible; remote observations only; seasonally ponded emergent wetland formed in a drainage fed by road runoff and hillside drainage (site adjoins road); human disturbance likely is uncommon. • Potential vernal pool fairy shrimp habitat • Little or no potential to support Conservancy fairy shrimp habitat
Site 16, South of McClure Point recreation area	242 square feet (22.5 square meters)/2 inches (4 cm)	Organic matter, gravel	Seasonal ditch fed by runoff from adjoining road; no invertebrates observed; use of herbicides in pool. • Potential vernal pool fairy shrimp habitat • Little or no potential to support Conservancy fairy shrimp habitat
Site 21, Lake McSwain recreation area	39 square feet (3.6 square meters)/7 inches (18 cm)	Clay soil, organic matter	Swale fed by surface water discharge from upslope culverts and ephemeral drainage; mosquito larvae observed; site adjoins campground, but human disturbance likely is uncommon. • Potential vernal pool fairy shrimp habitat • Little or no potential to support Conservancy fairy shrimp habitat

Site Name, Location	Maximum Area/ Maximum Depth	Pool Substrate	Pool Description
Site 24, Lake McSwain recreation area	80 square feet (7.5 square meters)/2 inches (6 cm)	Organic matter over clay loam	Seasonal pool formed from a seasonal surface drainage that discharges to McSwain reservoir; no invertebrates observed; human disturbance likely is uncommon. • Potential vernal pool fairy shrimp habitat • Little or no potential to support Conservancy fairy shrimp habitat
Site 32, Lake McSwain recreation area	46 square feet (4.3 square meters)/4 inches (9 cm)	Organic matter	Shallow, seasonal ditch that adjoins a paved pedestrian trail and is fed by hillside drainage; mosquito larvae and ostracods observed; site adjoins a trail but likely not frequently disturbed. • Potential vernal pool fairy shrimp habitat • Little or no potential to support Conservancy fairy shrimp habitat

Terrestrial Species

In consultation with FWS, NMFS, and other relicensing participants, Merced ID developed a list of threatened and endangered species that potentially occur in the project area. Merced ID used a three-step screening process to identify threatened and endangered species that could be affected by the project.

In 2010 and 2011, Merced ID performed surveys for federal and state-listed plants. Surveys were conducted following the botanical survey protocol section of California Department of Fish and Game's (now California DFW) *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities*. The study included the area surrounding all project facilities (e.g., powerhouses and switchyards, dams, reservoirs, access roads, and recreation facilities) within the existing project boundary and in the immediate area of the project's seven minor wildlife refuge water delivery facilities. Individual species are discussed below.

Layne's Butterweed—Layne's butterweed (*Senecio layneae*), also known as Layne's ragwort, is a perennial herb that blooms April to August (CNPS, 2014). It grows in open rocky areas of gabbro and serpentine soils within chaparral plant communities at elevations ranging from 650 to 3,300 feet msl. Most plants do not grow well on gabbro or serpentine soils because they are unusually low in nutrients and high in heavy metals, giving those plants adapted to such soils, such as Layne's butterweed, a competitive advantage over other species. Most known sites are scattered within a 40,000-acre area in western El Dorado County that includes the Pine Hill intrusion and adjacent serpentine soils (located about 80 miles northwest of the project area).

Layne's butterweed is federally listed as threatened, state listed as rare, and is a California Native Plant Society 1B.2 species (CNPS, 2014). FWS published a recovery plan for this species in 2002 but did not designate critical habitat (FWS, 2014a).

Layne's butterweed was not found during Merced ID's surveys. All project features except those at the New Exchequer development are below the known elevation of this species. The closest known population exists in the Red Hills in Tuolumne County (Chinese Camp and Moccasin quadrangles) about 10 to 15 miles northwest of suitable habitat in the project boundary. No occurrences of Layne's butterweed have been documented in Mariposa and Merced Counties. However, suitable habitat is present within the project boundary.

Keck's Checkerbloom—Keck's checkerbloom (*Sidalcea keckii*), also called Keck's checker-mallow, is an annual herb that blooms April to June (CNPS, 2014). It grows in relatively open areas on grassy slopes of the Sierra foothills in Fresno and Tulare Counties. The species is associated with serpentine soils at elevations ranging from 250 to 2,150 feet msl. Serpentine soils are fairly rare, limiting the range of plants such as Keck's checkerbloom that are adapted to grow on them. The species' low population numbers leave it vulnerable to random environmental events including bad weather, disease, and damaging insect infestations. The isolation of remaining

populations exacerbates these vulnerabilities by precluding re-colonization of extirpated populations. Limited cross-pollination between populations and loss of genetic variability may also be causes for concern in such small isolated populations.

Keck's checkerbloom is federally listed as endangered and is designated by the California Native Plant Society as 1B.1 (CNPS, 2014). FWS designated critical habitat for this species in 2003, but no critical habitat exists within the project area (FWS, 2014b). The closest critical habitat unit is in Fresno County, about 70 miles southeast from the project. Merced ID did not find this species during its rare plant surveys conducted in 2010 and 2011, although suitable habitat is present within the project boundary.

Chinese Camp brodiaea—*Chinese Camp brodiaea* (*Brodiaea pallida*) is a perennial bulbiferous herb that blooms May to June (CNPS, 2014). It grows in overflow channels, seeps, and springs in clays derived from serpentine soils of the foothills of the Sierra. This species grows in association and hybridizes with two other brodiaeas, but can be differentiated by the shape, color, and position of the flower parts (FWS, 1998). The species is known from only two occurrences near Chinese Camp in Calaveras and Tuolumne Counties and occurs in areas located on only four quadrangles, including Sonora, Chinese Camp, New Melones dam, and Copperopolis, although it could be found in other areas where suitable habitat exists (CNPS, 2014).

Chinese Camp brodiaea is federally listed as threatened, state listed as endangered, and is designated by the California Native Plant Society as 1B.1 (CNPS, 2014). No critical habitat rules have been published for the *Chinese Camp brodiaea*.

Mariposa pussypaws—*Mariposa pussypaws* (*Calyptridium pulchellum*) is an annual herb that blooms April to August (CNPS, 2014). It grows in small, barren areas on decomposed granitic sands in annual grasslands and woodlands in the southwestern foothills of the Sierra Nevada (FWS, 1998) at elevations between 1,500 and 3,600 feet (Merced ID, 2012a). Its adaptation to a harsh, exposed setting makes it unusual as little else grows on these shallow, bare substrates (Merced ID, 2012a). Seven small populations are patchily distributed over a 750-square mile area in Fresno, Madera, and Mariposa Counties, collectively occupying only 14 gross acres (FWS, 1998).

Mariposa pussypaws is federally listed as threatened and is designated by the California Native Plant Society as 1B.1. No critical habitat rules have been published for this species. This species is vulnerable to extirpations from random events because of the limited number and small size of population and small range of the species (FWS, 1998). Merced ID did not find this species during its rare plant surveys conducted in 2010 and 2011, although it has been found in surrounding areas located on the Mariposa quadrangle.

California vervain—*California vervain* (*Verbena californica*) is a perennial herb that blooms May to September (CNPS, 2014). It occurs at elevations between 850 to 1,150 feet in the Red Hills and nearby Rawhide Hill in western Tuolumne County

(Merced ID, 2012a). California vervain is restricted to intermittent and perennial streams within areas of serpentine soils (FWS, 1998). The populations are distributed over about 90 acres within an area of 24-square miles (Merced ID, 2012a).

California vervain is federally listed as threatened, state listed as threatened, and designated by the California Native Plant Society as 1B.1 (CNPS, 2014). No critical habitat rules have been published for this species. This species is vulnerable to extirpation because few populations with low numbers exist (FWS, 1998). Merced ID did not find this species during its rare plant surveys conducted in 2010 and 2011 (Merced ID, 2012a), although it has been found in surrounding areas located on Chinese Camp quad (CNPS, 2014).

San Joaquin Kit Fox—The San Joaquin kit fox is federally listed as endangered and state listed as threatened (FWS, 2014c; California DFW, 2014c). No critical habitat rules have been published for the San Joaquin kit fox.

Dens are an important habitat component for the San Joaquin kit fox. The kit fox may use numerous dens throughout the year for shelter, reproduction, and temperature regulation. Kit foxes may dig the den sites; modify den sites constructed by ground squirrels, badgers, and coyotes; or use human-made structures such as culverts and abandoned structures. This species historically occupied several native plant communities in the San Joaquin Valley, but presently occur in areas where native habitats only occur as remnants and are surrounded by habitat extensively modified by anthropogenic activities, including agriculture, oil fields, and wind energy projects (California DFW, 2014b; FWS, 2014d). Any habitat occupied by kit fox must support a suitable prey base, including nocturnal rodents, as well as diurnal rodents and insects. Kit fox also consume some vegetation (FWS, 2014d). Population declines are attributed to habitat loss and degradation caused by agriculture and urban uses of lands. Mortality from predation, shooting, habitat loss, and poisoning through the consumption of poisoned rodents contributes to population decline (California DFW, 2014b; FWS, 2014d).

In its license application, Merced ID notes that it eliminated the San Joaquin kit fox from further analysis because it does not occur in the vicinity of the project. Merced ID therefore did not conduct surveys for the San Joaquin kit fox.

Valley Elderberry Longhorn Beetle—The valley elderberry longhorn beetle is listed as threatened. The valley elderberry longhorn beetle is associated with various species of elderberry (*Sambucus* spp.) throughout the California Central Valley and foothills below 3,000 feet msl. Mariposa County is within the valley elderberry longhorn beetle range, although no critical habitat is designated within the county. The valley elderberry longhorn beetle occurs within riparian vegetation communities where it feeds exclusively on elderberry in both adult and larval stages. Adult valley elderberry longhorn beetles appear to feed externally on the flowers and foliage of the elderberry. Adult females lay eggs in crevices in the bark of the host elderberry plant. After

hatching, larvae spend 1 to 2 years feeding inside the plant. Prior to pupating, valley elderberry longhorn beetle larvae chew an exit hole in the elderberry trunk for the emerging adult, leaving boreholes in the elderberry stems.

Merced ID's botanical surveys documented boreholes at 9 out of 101 elderberry populations identified in the project study area. These 9 populations occurred on the north shore of Lake McClure, on the Piney Creek arm of Lake McClure, in the Barrett Cove recreation area, and along McSwain reservoir. No valley elderberry longhorn beetles were observed during the elderberry surveys.

California Red-legged Frog—The California red-legged frog is federally listed threatened. There is no state status for this species. FWS published a Recovery Plan for the California Red-legged Frog (*Rana aurora draytonii*) (2002). The project occurs in the vicinity of one of the recovery units.

FWS revised critical habitat for this species in 2010. The criteria for the California red-legged frog critical habitat are: (1) suitable aquatic habitat, (2) associated uplands, and (3) suitable dispersal habitat connecting suitable aquatic habitat. At a minimum, critical habitat includes two or more suitable breeding locations, one of which must be a permanent water source, associated uplands surrounding these water bodies (extending to 500 feet from the water's edge), all within 1.25 miles of one another and connected by barrier-free dispersal habitat of at least 500 feet in width. No critical habitat occurs within the project boundary. The closest critical habitat unit to the project is about 50 miles northwest in Calaveras County.

California red-legged frog breeding occurs from late November to late April in ponds, backwater pools, or creeks. Egg masses are attached to emergent vegetation such as cattails and bulrushes. Tadpoles remain in these aquatic habitats until metamorphosis. Increased siltation during the breeding season can cause asphyxiation of eggs and small tadpoles. Tadpoles typically metamorphose between July and September, and most likely feed on algae.

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

The California red-legged frog is primarily associated with perennial ponds or pools and slow-moving perennial or seasonal streams where water remains continuously for a minimum of 20 weeks beginning in the spring (i.e., sufficiently long for breeding to occur and tadpoles to complete development). The California red-legged frog is not expected to breed successfully at sites holding water less than 15 weeks. The minimum depth of breeding habitat is 20 inches; however, deep water pools, ponds, and lake areas

are not suitable. Dense, shrubby riparian vegetation (e.g., willow, bullrush, and tule species), and bank overhangs are important features of California red-legged frog breeding habitat, although they sometimes use sites that lack these features. Locations with the highest densities of California red-legged frogs exhibit dense emergent or shoreline riparian vegetation closely associated with moderately deep (greater than 2.3 feet), still, or slow-moving water.

Another correlate to California red-legged frog occurrence is the absence or near-absence of introduced predators such as American bullfrog and predatory fish, particularly Centrarchids (i.e., freshwater bass and sunfishes), which feed on the tadpoles at higher rates than native predatory species. Hiding cover from predators may be provided by emergent vegetation, undercut banks, and semi-submerged root wads. Some habitats that are not suitable for breeding (e.g., vernal pools, pools in intermittent streams, seeps, and springs) may constitute habitats for aestivation, shelter, foraging, predator avoidance, and juvenile dispersal.

Suitable upland habitat consists of all upland areas (riparian or otherwise) within 500 feet of the water's edge but not farther than the watershed boundary. This upland habitat is important in maintaining the integrity of California red-legged frog aquatic/breeding habitat, as land use activities adjacent to and upstream of suitable aquatic habitat greatly affect the quality of aquatic/breeding habitat downstream.

Suitable dispersal habitat consists of all upland and wetland habitat that connect two or more patches of suitable aquatic habitat within 1.25 miles of one another. Dispersal habitat must be at least 500 feet wide and free of barriers such as, heavily traveled roads (roads with more than 30 cars per hour), moderate to high-density urban or industrial developments, and large reservoirs. The healthiest California red-legged frog populations persist and flourish where suitable breeding and non-breeding habitats are interspersed throughout the landscape and are interconnected by un-fragmented dispersal habitat.

Merced ID conducted site assessments to characterize suitability of aquatic habitat sites for California red-legged frog breeding habitat using FWS guidelines. Assessments were based on the following components: (1) deep, still or slow-moving water that persists for a sufficient portion of the breeding season in order for larvae to reach metamorphosis, and (2) closely associated dense, shrubby, or emergent vegetation. The presence of introduced predatory fish was considered a negative site attribute that decreases the likelihood of California red-legged frog occurrence. Merced ID assessed habitat locations which were accessible on-site or viewable from an adjacent public road in the field. Locations not accessible or viewable in the field were evaluated from aerial imagery.

Neither Lake McClure nor McSwain reservoir has suitable habitat because of the prevalence of deep, open water, limited suitable associated vegetation, pronounced seasonal changes in water level (Lake McClure), and the presence of abundant predatory fish. The essential components of California red-legged frog breeding habitat were

present or presumed to be present (based on available information from aerial photo interpretation) at 61 of the 336 assessment sites within 1 mile of the project boundary. There were no incidental observations of California red-legged frog during the licensing studies.

California Tiger Salamander—The California tiger salamander (*Ambystoma californiense*) is federally listed as endangered in Santa Barbara and Sonoma Counties and listed as threatened elsewhere. California lists this species as threatened. FWS designated critical habitat for the central population in 2005, encompassing 199,109 acres in 19 counties, including Mariposa and Merced. The nearest designated critical habitat units are situated about 7 miles west of Lake McClure (Central Valley unit 8) and about 6 miles southwest of the McSwain reservoir (Central Valley unit 9).

The California tiger salamander is a terrestrial salamander that typically resides in existing mammal burrows in uplands until it emerges for nocturnal breeding migrations that mainly occur from December through February after rains fill pools and ponds. Eggs are laid singly or in small clusters, often attached to submerged stems and leaves, and hatch in 2 to 4 weeks. Larvae transform in about 4 months as pools dry in late spring or summer, but larvae may overwinter in permanent ponds. California tiger salamander may not breed at all in drought years when ponds fail to fill. Metamorphosed California tiger salamander disperse from natal sites to find suitable burrows and spend the majority of their time underground, emerging from burrows only occasionally, usually on rainy nights. Interpond dispersal may occur as well. California tiger salamanders have been observed on land as far as 1.24 miles from any potential breeding pool. California tiger salamander populations generally do not persist where fish, American bullfrogs, or predacious insects are well-established in breeding habitats. For this reason, neither Lake McClure nor McSwain reservoir constitutes suitable breeding habitat. Low relief areas surrounding the southern and western portions of Lake McClure contain areas that meet California tiger salamander upland habitat requirements; these primarily consist of annual grassland with additional areas of oak savanna along the southern shore. Suitable upland habitat is also present surrounding most of McSwain reservoir where low relief areas with annual grassland and oak savanna are prevalent. Merced ID reviewed aerial imagery and National Wetlands Inventory wetland maps to identify sites within 1.24 miles of the project boundary with potential aquatic habitat for California tiger salamander. This review identified 69 aquatic assessment sites surrounding Lake McClure and 39 sites surrounding McSwain reservoir. Field reviews confirmed that six sites at Lake McClure and nine sites at Lake McSwain meet criteria for breeding habitat. However, in many cases, habitat quality is low due to presence of predatory species or short periods of water availability.

There were no incidental observations of California tiger salamander during the licensing studies. Merced ID did not conduct protocol-level surveys for the California tiger salamander.

Merced Falls

Terrestrial Species

PG&E conducted reconnaissance-level field surveys in 2010 and 2011, focusing on identifying potential habitat. Field surveys documented existing conditions, including habitat types present, quality of these habitats, and the presence of unique habitat features. PG&E developed a target list of threatened and endangered species by reviewing FWS' list of threatened and endangered species available on its website, California DFW's online California Natural Diversity Data Base, the online herpetological records located at the Museum of Vertebrate Zoology, University of California at Berkeley, and California Academy of Sciences' online Herpetology Records. Searches were county-based and also based on a search of the USGS 7.5-minute quadrangle on the Merced Falls quadrangle and four adjacent quadrangles, including Hornitos, Yosemite Lake, Haystack Mountain, and Indian Gulch. PG&E checked habitat data and the closest known locations of species relative to the project area, and compared this information to information from its botanical surveys. Individual species below are discussed below.

San Joaquin Kit Fox—The San Joaquin kit fox is federally listed as endangered and state listed as threatened (FWS, 2014c; California DFW, 2014c). No critical habitat rules have been published for the San Joaquin kit fox.

Dens are an important habitat component for the San Joaquin kit fox. The kit fox may use numerous dens throughout the year for shelter, reproduction, and temperature regulation. Kit foxes may dig the den sites; modify den sites constructed by ground squirrels, badgers, and coyotes; or use human-made structures such as culverts and abandoned structures. This species historically occupied several native plant communities in the San Joaquin Valley, but presently occur in areas where native habitats only occur as remnants and are surrounded by habitat extensively modified by anthropogenic activities, including agriculture, oil fields, and wind energy projects (California DFW, 2014b; FWS, 2014d). Any habitat occupied by kit fox must support a suitable prey base, including nocturnal rodents, as well as diurnal rodents and insects. Kit fox also consume some vegetation (FWS, 2014d). Population declines are attributed to habitat loss and degradation caused by agriculture and urban uses of lands. Mortality from predation, shooting, habitat loss, and poisoning through the consumption of poisoned rodents contributes to population decline (California DFW, 2014b; FWS, 2014d).

PG&E did not conduct surveys for the San Joaquin kit fox.

California Red-legged Frog—California red-legged frog is federally listed as threatened. There is no state status for this species. FWS published a Recovery Plan for the California Red-Legged Frog (*Rana aurora draytonii*) (2002). The project occurs in the vicinity of one of the recovery units.

FWS revised critical habitat for this species in 2010. Criteria for California red-legged frog critical habitat include: (1) suitable aquatic habitat, (2) associated uplands, and (3) suitable dispersal habitat connecting suitable aquatic habitat. At a minimum, critical habitat includes two or more suitable breeding locations, one of which must be a permanent water source, associated uplands surrounding these water bodies (extending to 500 feet from the water's edge), all within 1.25 miles of one another and connected by barrier-free dispersal habitat at least 500 feet wide. No critical habitat occurs within the project boundary. The closest critical habitat unit to the project is about 50 miles northwest in Calaveras County.

California red-legged frog breeding occurs from late November to late April in ponds, backwater pools, or creeks. Egg masses are attached to emergent vegetation such as cattails and bulrushes. Tadpoles remain in these aquatic habitats until metamorphosis. Increased siltation during the breeding season can cause asphyxiation of eggs and small tadpoles. Tadpoles typically metamorphose between July and September, and most likely feed on algae. Outside of the breeding season, adults may disperse upstream, downstream, or upslope of breeding habitat to forage and seek sheltering habitat, which may consist of small-mammal burrows, leaf litter, and other moist sites in or near (up to 200 feet from) riparian areas. During wet periods, long distance dispersal of up to a mile may occur between aquatic habitats, including movement through upland habitats or ephemeral drainages. Seeps and springs in open grasslands can function as foraging habitat or refugia for wandering frogs.

The California red-legged frog is primarily associated with perennial ponds or pools and slow-moving perennial or seasonal streams where water remains continuously for a minimum of 20 weeks beginning in the spring (i.e., sufficiently long for breeding to occur and tadpoles to complete development). The California red-legged frog is not expected to breed successfully at sites holding water for fewer than 15 weeks. The minimum depth of breeding habitat is 20 inches; however, deep water pools, ponds, and lake areas are not suitable. Dense, shrubby riparian vegetation (e.g., willow, bullrush, and tule species), and bank overhangs are important features of California red-legged frog breeding habitat, although they sometimes use sites that lack these features. Locations with the highest densities of California red-legged frogs exhibit dense emergent or shoreline riparian vegetation closely associated with moderately deep (greater than 2.3 feet), still, or slow-moving water.

Another correlate to California red-legged frog occurrence is the absence or near-absence of introduced predators such as American bullfrog and predatory fish, particularly Centrarchids (i.e., freshwater bass and sunfishes), which feed on the tadpoles at higher rates than native predatory species. Hiding cover from predators may be provided by emergent vegetation, undercut banks, and semi-submerged root wads. Some habitats that are not suitable for breeding (e.g., vernal pools, pools in intermittent streams, seeps, and springs) may constitute habitats for aestivation, shelter, foraging, predator avoidance, and juvenile dispersal.

Suitable upland habitat consists of all upland areas (riparian or otherwise) within 500 feet of the water's edge but not farther than the watershed boundary. This upland habitat is important in maintaining the integrity of California red-legged frog aquatic/breeding habitat, as land use activities adjacent to and upstream of suitable aquatic habitat greatly affect the quality of aquatic/breeding habitat downstream. Suitable dispersal habitat consists of all upland and wetland habitat that connect two or more patches of suitable aquatic habitat within 1.25 miles of one another. Dispersal habitat must be at least 500 feet wide and free of barriers such as, heavily traveled roads (roads with more than 30 cars per hour), moderate to high-density urban or industrial developments, and large reservoirs. The healthiest California red-legged frog populations persist and flourish where suitable breeding and non-breeding habitats are interspersed throughout the landscape and are interconnected by unfragmented dispersal habitat.

The reservoir itself does not likely does not contain suitable habitat because of the prevalence of deep, open water, limited suitable associated vegetation, and the presence of predatory fish and bullfrogs, although other areas of suitable habitat exist in the project area.

PG&E conducted visual encounter surveys for amphibians, including California red-legged frogs, and four areas were sampled by dip nets for aquatic life stages of frogs. Frogs were identified to species using binoculars, and under a spotlight if the survey was conducted during dark. No California red-legged frogs were observed during the surveys.

Valley Elderberry Longhorn Beetle—The valley elderberry longhorn beetle is federally listed as threatened. The valley elderberry longhorn beetle is associated with various species of elderberry (*Sambucus* spp.) throughout the California Central Valley and foothills below 3,000 feet msl. Mariposa and Merced Counties are within the valley elderberry longhorn beetle range, although no critical habitat is designated within the counties. The valley elderberry longhorn beetle occurs within riparian vegetation communities where it feeds exclusively on the blue elderberry shrub in both adult and larval stages. Adult valley elderberry longhorn beetles appear to feed externally on the flowers and foliage of the blue elderberry. Adult females lay eggs in crevices in the bark of the host elderberry plant. After hatching, larvae spend 1 to 2 years feeding inside the plant. Prior to pupating, valley elderberry longhorn beetle larvae chew an exit hole in the elderberry trunk for the emerging adult, leaving boreholes in the elderberry stems.

During the 2010/2011 surveys, PG&E documented one blue elderberry shrub located on the northeast side of the impoundment. The shrub was of suitable size to support the valley elderberry longhorn beetle and showed signs of possible exit holes by the beetle. Although no beetles were observed, the presence of the valley elderberry longhorn beetle should be assumed, given the exit holes in the bark of the elderberry shrub.

3.3.3.2 Environmental Effects

Merced River Project

Aquatic Species

The environmental effects of the proposed project on Central Valley steelhead would be similar to those on fall run Chinook salmon and relate to physical habitat availability, temperature management, and a flow regime that attracts adults to enter the Merced River to spawn and facilitates outmigration of juveniles. We discuss these environmental factors as they relate to Central Valley steelhead in section 3.3.1.2, *Aquatic Resources*.

Terrestrial Threatened and Endangered Species

General Protection Measures—Merced ID proposes numerous measures that would protect terrestrial and aquatic resources, including threatened and endangered species, from effects of project operation and maintenance. Two of those measures focus on threatened and endangered species: annual review of special-status species and annual employee training.

Merced ID proposes to review special-status species lists annually, assess newly added species occurring on federal land, and if necessary consult with agencies to develop and implement protection measures. The Water Board [preliminary WQC condition 12] specifies annual consultation to review the project status and plans, results of studies, necessary modifications to plans, and protection measures for newly listed species. In addition, the Water Board [preliminary WQC condition 13] specifies that Merced ID review the lists of species protected by the ESA and special-status species within 3 months of license issuance and annually thereafter, and evaluate potential project effects on newly listed species. BLM [preliminary 4(e) condition 1] specifies annual consultation to discuss the project status and plans, results of studies, review of non-routine maintenance, changes to project facilities, necessary modifications to plans, and protection measures for newly listed species. BLM [preliminary 4(e) condition 11] specifies an annual review of special-status species list and an assessment of newly listed species on federal lands. It also specifies that Merced ID conduct surveys and develop protection measures for newly added species. FWS 10(j) recommendation 6(b) recommends annual consultation to review federally listed and special-status species lists. FWS also recommends that Merced ID develop and implement studies to assess project effects on newly added species and prepare a draft biological assessment.

Merced ID proposes to provide annual employee training regarding the identification of special-status, non-native species and sensitive areas. BLM [preliminary 4(e) condition 3] specifies that Merced ID conduct annual employee training and immediate training for newly hired employees to familiarize them with special-status, non-native invasive plants and sensitive areas and that Merced ID provide maps,

locations, and pictures of special-status species, non-native invasive plants and sensitive areas.

Our Analysis

Merced ID's proposal to conduct an annual review of federally listed and special-status species lists is consistent with the Water Board's preliminary WQC condition 13 and BLM preliminary 4(e) condition 11. Annual review would identify newly listed species that should be evaluated as potentially affected by the project. Both the Water Board [preliminary WQC condition 12] and BLM [preliminary 4(e) condition 1] specify annual consultation to further protect federally listed and special-status species by reducing the possibility that newly added species could be affected by non-routine maintenance activities and activities included in plans. The annual consultation would also provide an opportunity for plans to be modified in the event of delisting of species. Further, the process of annual consultation would allow agencies to provide input based on unpublished data, gray literature, and other sources of information that may not be available in public databases. Although we recognize the benefits of annual review and consultation, the Commission typically includes in its licenses a standard license article with a fish and wildlife reopener provision, as discussed in section 5.1.1.3, *Measures not Recommended by Staff*.

Implementing Merced ID's proposed measure to conduct annual training for employees would reduce effects of project maintenance on threatened and endangered species and their habitats. Including BLM's recommendation to provide employees with maps, locations, and pictures of special-status species, non-native invasive plants, and sensitive areas would increase the probability of employees successfully avoiding special-status species and sensitive areas and also identifying non-native invasive plants. Unintentional effects of project maintenance activities would be avoided. Implementing the measure for employee training would reduce project effects on threatened and endangered species.

Federally Listed Plant Species—Project operation and maintenance, new construction, and recreation activities could affect federally threatened and endangered plants occurring or potentially occurring in the project area. Construction of any new facilities would directly affect vegetation through excavation and grading. Project maintenance activities, including road grading, vegetation removal and trimming, and herbicide applications to treat invasive plants would directly affect threatened and endangered plants occurring in the areas where these maintenance activities would occur. Recreation activities, such as hiking, would affect threatened and endangered plants situated on or near hiking trails.

Merced ID did not document any federally threatened or endangered plants during its surveys. Although Merced ID does not propose a plan specifically for the protection of federally listed plants, it does propose other plans with components that would protect these plants. Merced ID proposes to implement its Vegetation Management Plan to

minimize potential effects of project operation and maintenance on vegetation, including sensitive plants. Merced ID's proposed Vegetation Management Plan includes several measures to reduce potential effects on sensitive plants. Specific to sensitive plants, Merced ID would: (1) flag sensitive areas prior to conducting any vegetation management or ground-disturbing activities; (2) emphasize the use of manual weed control methods, where feasible; (3) use BMPs; and (4) provide annual employee training including identification of key special-status species and the locations of sensitive resources to be avoided. Per Merced ID's proposed Recreation Facilities Plan, areas where sensitive plants occur would be avoided during improvement or new construction projects. As part of the Invasive Species Management Plan, Merced ID proposes to emphasize protection of sensitive plants when selecting control measures for invasive weeds in proximity to sensitive resources. Merced ID also proposes annual employee training to, in part, help protect sensitive plants, and annual consultation to determine, in part, if project activities would affect newly listed species and develop appropriate studies and mitigation measures.

FWS comments that suitable habitat exists within the project for the endangered Keck's checkerbloom, threatened Layne's butterweed, Chinese Camp brodiaea, mariposa pussypaws, and California vervain. FWS states that there are no historical records of federally listed plants occurring with the project area and acknowledges that no federally listed plants were observed during the surveys conducted by Merced ID. FWS further states that Merced ID did not conduct the surveys during the peak bloom period or in the habitat for each plant. FWS [10(j) recommendation 6(b)] recommends annual consultation to identify newly listed species that could be affected by the project, the development of studies, and preparation of a biological assessment including protection measures.

The Water Board [preliminary WQC conditions 12 and 13] specify annual consultation and reviews to protect newly listed federally listed and special-status species. BLM [preliminary 4(e) condition 1] specifies annual consultation to discuss, in part, necessary protection measures for federally listed species. BLM [preliminary 4(e) condition 3] specifies annual employee training to train employees to identify federally listed species. In addition, this condition specifies review of federally listed and special-status species and assessment of newly listed species.

Our Analysis

Continued operation of the project under a new license would include some activities that could affect federally listed plant species. Proposed enhancements at existing project recreation areas, proposed construction of the new recreation site, and road grading would result in the removal of existing vegetation. Project maintenance activities, such as herbicide applications to noxious weeds and invasive plants and vegetation management in recreation areas or around project facilities could affect federally listed plant species and their habitats.

Ideally, implementation of Merced ID's proposed Vegetation Management Plan would identify areas where project operation and maintenance activities have the potential to affect sensitive plants and their habitats. Similarly, implementation of Merced ID's proposed Weed Management Plan and Recreation Facilities Plan should reduce the potential for adverse effects on sensitive plants and their habitats. These plans have been developed and proposed based on the assumption that the respective resources have been identified through surveys conducted in accordance with accepted methodologies and protocols. Because Merced ID did not follow species-specific methodologies and protocols during the surveys and did not conduct the surveys at the appropriate times and places, the resulting data do not prove the absence of these species or their habitats. None of the aforementioned plans could protect federally listed plants and their habitats that have not yet been identified in the project area. Proceeding with project activities without knowing the status and location of federally listed plants in the project area could result in federally listed plants being adversely affected by the project.

We recommend developing a protection plan for federally listed plants in consultation with FWS, the Water Board, California DFW, and BLM. The plan would, at a minimum, include the following for each federally listed plant species potentially occurring in the project area: (1) study methodologies and protocols sufficient to produce adequate survey results; (2) a list of peak bloom times and identifying features; (3) the timing and frequency of the surveys; (4) maps and written descriptions of habitat areas to be surveyed; (5) references to measures contained in other plans that could protect federally listed plants; (6) protection and mitigation measures; and (7) reporting requirements.

With the development and implementation of the protection plan for the federally listed plants, the project is not likely to adversely affect federally threatened and endangered plants, including Keck's checkerbloom, Layne's butterweed, Chinese Camp brodiaea, Mariposa pussypaws, and California vervain.

Vernal Pool Fairy Shrimp—Seven of the 33 sites Merced ID identified as potential habitat for vernal pool fairy shrimp exist in areas where vegetation and road management activities could occur. Two additional sites are located near recreation areas where vehicle use may occur. The remainder of the 33 sites occurs outside of areas where project activities are expected to occur. Vegetation maintenance activities, including herbicide treatments in roadside ditches or swales, runoff from treated sites, and mechanical vegetation maintenance could affect water quality in these sites. Pesticide applications could also affect vernal pool fairy shrimp. Vehicle use could compact soils or alter runoff patterns, potentially changing hydrology of seasonal pools. Such activities could affect vernal pool fairy shrimp if they occupy these habitats.

Although Merced ID proposes measures (e.g., annual review and annual consultation) that could benefit fairy shrimp, it does not propose any species-specific measures to monitor or protect fairy shrimp in the project area. The Water Board

[preliminary WQC condition 6] specifies that Merced ID develop and implement a monitoring and conservation plan for vernal pool and Conservancy fairy shrimp. Per the Water Board, monitoring would be conducted annually 4 years, and thereafter every 3 years and prior to construction or ground-disturbing activities. FWS commented that although no documented occurrences of fairy shrimp are known in the project area, Merced ID did not conduct protocol level surveys. FWS notes that project area overlaps with about 1 acre of critical habitat for the vernal pool fairy shrimp. FWS states that levee breaches spill water into vernal pool critical habitat in the dry summer months, and the project road that transects the critical habitat is likely to cause long-term degradation of the habitat adjacent to the road, despite the fact that the road itself does not contain any primary constituent elements.

Our Analysis

Continued operation of the project would include vegetation maintenance, road maintenance, and recreation activities in proximity to vernal pools with potential to support vernal pool fairy shrimp. These activities could change water quality or site specific hydrology and runoff patterns, potentially affecting any fairy shrimp that occur in these pools. The identified pools are largely dependent on human-modified hydrology, relying on runoff from roads and culverts, or spills from levees as noted by FWS, as well as depressions created by vehicles parking areas. While these areas may meet the conditions for vernal pool fairy shrimp habitat, it is unlikely that the species occurs in the project area, as substantiated by the FWS' comment that no known occurrences of fairy shrimp are documented in the project area. However, because Merced ID did not conduct protocol level surveys and therefore cannot show the presence or absence of the species, the presence of vernal pool fairy shrimp should be assumed.

Merced ID proposes recreation facility rehabilitation and construction activities in the Barrett Cove, McClure Point, and Lake McSwain recreation areas in proximity to pools suitable for vernal pool fairy shrimp. If occupied, disturbance to these pools could adversely affect this species. Merced ID could treat pools associated with study sites 7, 8, 9, 11, 21, 24, and 32 as sensitive habitats occupied by vernal pool fairy shrimp. Where vernal pool fairy shrimp are either shown to be by protocol level surveys or assumed to be, Merced ID could implement protection measures such as flagging and avoiding disturbance during vegetation management and ground-disturbing activities to minimize project effects on the species. The Water Board's preliminary WQC condition to conduct surveys would definitely determine the presence of vernal pool fairy shrimp. With respect to critical habitat, we acknowledge FWS' concern that the project road transecting the critical habitat could cause long-term habitat degradation to adjacent habitat. We agree that potential degradation of adjacent habitat is an issue, and we recognize that the potential long-term effects would likely be realized over the term of the license. The fact that critical habitat for vernal pool species overlaps with the project area validates the need for surveys and protective measures for vernal pool fairy shrimp and its habitat. We recommend developing a protection plan for the vernal pool fairy shrimp and its habitat that would include the measures specified by the Water Board [preliminary

WQC condition 6], and other measures as determined during consultation with the Water Board, FWS, California DFW, and BLM.

With the development and implementation of the protection plan for vernal pool fairy shrimp and its habitat, the project is not likely to adversely affect the affect vernal pool fairy shrimp or modify its critical habitat.

San Joaquin Kit Fox—Project activities, such as maintenance activities and recreation, could result in noise that could disturb kit fox in the project vicinity. Pest control, particularly the control of undesirable rodents through the use of rodenticides and burrow fumigants, could adversely affect the San Joaquin kit fox by poisoning its prey.

Merced ID did not conduct surveys for or analyze project effects on the San Joaquin kit fox, citing a lack of occurrence in the project vicinity. FWS states that the San Joaquin kit fox is known to occur on the Merced NWR, which receives mitigation water from the project. FWS cites its unpublished documentations of San Joaquin kit fox vocalizations in Mariposa County, within 4 miles of the project boundary, and notes that more than 300 square miles of San Joaquin kit fox habitat occurs to the north, south, and east of the project.

Merced ID proposes to avoid the use of burrow fumigants and rodenticides in habitat of the San Joaquin kit fox as a protection measure for the species. FWS [10(j) recommendation 6(a)F] recommends prohibiting the unauthorized use of burrow fumigants or rodenticides on federal land and 10(j) recommendation 6(a)G recommends prohibiting the use of burrow fumigants or rodenticides in habitat of the San Joaquin kit fox until section 7 ESA consultation is completed or a permit is issued under section 10 of the ESA. FWS also comments that the burrowing owl, a BLM sensitive species, has been known to occur in the project vicinity. FWS points out that because burrowing owls occur in ground squirrel burrows, they are vulnerable to rodent control methods such as burrow fumigation and burrow collapse.

In preliminary WQC condition 18, the Water Board specifies that Merced ID develop a pesticide use plan to prevent pesticides from affecting federally and state listed species in the project area or downstream of the project area. BLM specifies in preliminary 4(e) condition 40 that the use of pesticides be restricted and requires written approval by BLM. California DFW [10(j) recommendation 10] recommends that Merced ID develop an integrated pest management and pesticide use notification plan, which includes a provision for Merced ID to obtain approval prior to using pesticides including rodenticides. The plan includes an exception for unexpected outbreaks of pests requiring control measures not anticipated at the time the report was submitted. In that case, Merced ID would submit an emergency notification of use to the appropriate agencies.

Our Analysis

Merced ID does not provide information about San Joaquin kit fox in the project vicinity, nor does it provide information about potential project-related effects on the San

Joaquin kit fox. Although Merced ID does not propose construction activities that would result in noise, project maintenance activities and recreation could cause noise that could disturb San Joaquin kit fox in the project vicinity. Because Merced ID does not provide information about its current or proposed use of rodenticides and burrow fumigants, we are unable to analyze any effects on the San Joaquin kit fox, or other animals that could be affected by rodent control methods such as the burrowing owl.

Merced ID proposes to avoid the use of rodenticides and burrow fumigants in San Joaquin kit fox habitat, but it does not propose a protection plan, nor has it conducted surveys for the San Joaquin kit fox in the project area. Surveys would be necessary to identify habitat areas used by the San Joaquin kit fox, provide information on where to avoid the use of rodenticides and burrow fumigants, and where other protective measures may be necessary. Including the surveys as a component of a protection plan would allow study results to be formally documented, such that Merced ID can sufficiently evaluate project effects on the San Joaquin kit fox to develop appropriate protection and mitigation measures.

Also, under the staff alternative, the Noxious Weeds and Invasive Plants Control Plan would include the staff-recommended component on pest management and pesticide use, which would protect the San Joaquin kit fox, and other animals potentially affected by pesticides.

We recommend developing a protection plan for the San Joaquin kit fox in consultation with FWS, the Water Board, California DFW, and BLM. The plan would include: (1) study methodologies and monitoring protocols to identify San Joaquin kit fox habitats within the project area; (2) an assessment of potential project effects on San Joaquin kit fox in the project area; (3) protection and mitigation measures; (4) references to measures contained in other plans that would protect San Joaquin kit fox; and (5) descriptions of any exceptions to the prohibited use of rodenticides that would be considered emergencies and allowed by agencies and an explanation of why the emergency situations would supersede protection measures for the San Joaquin kit fox.

With the development and implementation of the protection plan for the San Joaquin kit fox, the project is not likely to adversely affect the San Joaquin kit fox.

Valley Elderberry Longhorn Beetle—Merced ID uses a combination of manual, mechanical, and chemical methods to control vegetation in the project boundary. Merced ID also conducts regular road maintenance on project roads, including grading, graveling, and paving. These project management activities could result in adverse effects on the valley elderberry longhorn beetle by trimming or pruning elderberry bushes that provide potential habitat. Merced ID also proposes a variety of rehabilitation and construction activities at project recreation sites. Ground-disturbing activities related to these activities have potential to damage or remove elderberry plants and could affect habitat for the valley elderberry longhorn beetle.

To minimize potential effects on valley elderberry longhorn beetles, Merced ID's proposed Vegetation Management Plan and Invasive Species management Plan include several measures specific to protection of elderberry plants. These measures are: (1) flagging all elderberry plants with stems measuring 1 inch in diameter or larger at ground level prior to any project maintenance or ground-disturbing activities with potential to affect the plant; (2) prohibiting removal of any elderberry plants with stems measuring 1 inch in diameter or larger at ground level; (3) prohibiting trimming of any elderberry stems measuring 1 inch in diameter or larger at ground level; (4) training project personnel to recognize valley elderberry longhorn beetle habitat; and (5) prohibiting use of herbicides, insecticides, fertilizers, or other chemicals that might harm the beetle or its host plant within 100 feet of any elderberry plant with one or more stems measuring >1 inch in diameter at ground level.

The Water Board [preliminary WQC condition 11] specifics that Merced ID develop, in consultation with the Water Board, a conservation plan for the valley elderberry longhorn beetle. At a minimum, the plan would include goals and objectives, monitoring protocols, potential effects on the beetle, a monitoring and reporting schedule, mitigation measures to be implemented if the beetle is affected by the project, and protective measures. FWS [10(j) recommendation 6(a)] recommends that Merced ID develop a biological assessment to evaluate effects of proposed construction of new project facilities or non-routine maintenance activities before such construction or activities are implemented and conclude consultation on the valley elderberry longhorn beetle.

Our Analysis

Merced ID proposes, as part of its Invasive Species Management Plan, and Vegetation Management Plan to use manual and chemical methods to control vegetation in the project boundary. Merced ID also proposes to maintain project roads through surface grading and resurfacing, ditch clearing, erosion control, and culvert clearing and repair. These activities have the potential to disturb vegetation, and could adversely affect elderberry plants in the area if appropriate protection measures are not implemented. Merced ID's proposed measures would ensure elderberry plants are clearly marked prior to maintenance and ground-disturbing activities near existing elderberry populations that could provide valley elderberry longhorn beetle habitat. Ground-disturbing activities would include construction related to recreation enhancements and other facilities that may be included in a new license for this project. Annual training would educate maintenance workers to recognize elderberry plants and understand their importance for valley elderberry longhorn beetles. Together, proposed flagging and training measures would minimize potential for accidental damage to elderberry plants. Proposed measures that prohibit removal and trimming of elderberry plants large enough to support valley elderberry longhorn beetles, and prohibiting use of chemicals within 100 feet of these plants would also minimize potential for on effects valley elderberry longhorn beetles.

Over the term of the license, existing elderberry plants would increase in size and new elderberry plants would likely be found. Therefore, the number of elderberry plants of suitable size to support the valley elderberry longhorn beetle would increase and the distribution of the plants within the project area would likely change. It would then be necessary to update the proposed plan to identify elderberry plants that should be flagged for avoidance. Over the term of license, the Water Board's preliminary WQC condition specifying that monitoring occur every 3 years would address changes in habitat for the valley elderberry longhorn beetle and allow for updates to the components of the Vegetation Management Plan and Invasive Species Management Plan concerning elderberry plants. Revising section 3.0 of the Vegetation Management Plan to include maps showing the locations of elderberry plants, both with and without signs of occupancy by the valley elderberry longhorn beetle, would facilitate the implementation of the plan and keep the information current for employee education.

The Water Board also specifies monitoring prior to construction, and FWS [10(j) recommendation 6(a)A-C] recommends that Merced ID evaluate project effects on any federally listed and candidate species and their habitats prior to construction of new facilities or features and non-routine maintenance activities. We agree that monitoring before implementing new construction and maintenance activities would reduce project effects on the valley elderberry longhorn beetle and its habitat. However, as discussed in section 5.1.1.3, *Measures not Recommended by Staff*, the Commission typically includes a standard license article with a fish and wildlife reopener provision.

With implementation of these measures, the project is not likely to adversely affect valley elderberry longhorn beetles.

California Red-legged Frog—Of the 61 sites supporting potential habitat for California red-legged frog, 2 occur in areas of potential project effects. The first is on a stream below the New Exchequer dam spillway. The second is a pond connected to McSwain reservoir via culverts. No project-related maintenance or recreation activities are expected to occur in these areas. However, there is potential for project operation to affect water levels in these areas. Abrupt water increases in the spillway could flush California red-legged frog eggs, tadpoles, or sub-adults downstream to unsuitable habitat. Water-level fluctuations at the pond site have potential to leave eggs or tadpoles stranded above the water level.

FWS comments that the project overlaps with a recovery unit defined in the Recovery Plan for the California Red-Legged Frog (*Rana aurora adraytonii*) (FWS, 2002). More specifically, the project overlaps with the Piney Creek core area. FWS [10(j) recommendation 7] recommends that Merced ID, in consultation with FWS and BLM, develop and implement a watershed management and protection plan for the California red-legged frog in the Piney Creek core area of the recovery plan. The plan should include measures to control bullfrogs and reestablish populations of the California red-legged frog in the Piney Creek core area and reduce population-level impacts from the frog-killing *Batrachochytrium dendrobatidis* fungus.

BLM specifies in preliminary 4(e) condition 1 that Merced ID consult with BLM, FWS, the Water Board, and California DFW to develop a management plan for the California red-legged frog that includes identification of areas where non-native predators occur, control and eradication measures for non-native species and predators, and identification of a habitat mosaic containing both breeding and dispersal habitat. BLM, in preliminary 4(e) condition 14, also specifies that Merced ID develop a management plan for the foothill yellow-legged frog. The plan would include provisions to monitor water temperature at the confluence of Sherlock Creek and the Merced River once in each water year type for the first 10 years, then every 5 years thereafter. In preliminary 4(e) condition 40, BLM specifies that Merced ID avoid pesticide use within 500 feet of known locations of foothill yellow-legged frogs and other special-status animals and plants.

The Water Board [preliminary WQC condition 10] specifies that Merced ID develop a monitoring and conservation plan for the California red-legged frog, foothill yellow-legged frog, and western spadefoot.

Our Analysis

As determined by surveys and noted by FWS in its comments, suitable habitat for California red-legged frog is present within the project's affected area. Although Merced ID recorded no incidental observations of California red-legged frog in the project area, it did not conduct protocol-level surveys for the frogs in the project area.

There is limited potential for project operation to affect the California red-legged frog. The majority of releases from Lake McClure occur through the powerhouse into McSwain reservoir. Spills over the New Exchequer dam have only occurred once, shortly after construction of the dam. The majority of releases from Lake McClure occur through the powerhouse into McSwain reservoir. Spills over the New Exchequer spillway have only occurred once, shortly after construction of New Exchequer dam. The spillway is located about 0.9 mile north of the dam and the spillway channel enters McSwain reservoir about 0.7 mile downstream from the powerhouse. Consequently, there is little influence of project releases from Lake McClure to affect these areas. Merced ID does not propose any changes to existing maintenance or operation that would affect baseline conditions in these areas.

Conversely, hydropower projects generally support bullfrogs and predatory fish. Sites identified in areas of project maintenance or operation are known to either support American bullfrog, or are accessible to predatory fish—both of which can adversely affect California red-legged frog and other amphibian species in the project area. In addition to potential effects of flows on frog reproduction, hydropower projects may also affect water temperature, which could affect the development time and rate of tadpoles, which is BLM's concern for the foothill yellow-legged frog. Additionally, other project maintenance activities, such as the application of herbicides and pesticides, could adversely affect the California red-legged frog and other amphibians in the project area.

Some of the protection measures that would be implemented for the California red-legged frog may benefit other species in the project area. Broadening the protection plan to encompass other federally listed and special-status amphibians, such as the foothill yellow-legged frog and western spadefoot, would facilitate consultation with agencies and eliminate the need for duplicate measures. Therefore, we recommend that Merced ID develop and implement a protection plan for federally listed and special-status species, including but not limited to the California red-legged frog, foothill yellow-legged frog, and western spadefoot. The plan should be developed in consultation with FWS, BLM, the Water Board, and California DFW and include the following: (1) all measures recommended by FWS, BLM, and the Water Board in their respective 10(j) recommendations and 4(e) conditions; (2) details of survey and monitoring protocols for each federally listed and special-status amphibian species recommended for monitoring by the agencies; (3) maps showing locations of species and their habitats relative to locations of project activities that could affect amphibians; (4) descriptions of potential project effects on each species; (5) and protective measures sufficient to minimize project effects on each species.

With implementation of these measures, the project is not likely to adversely affect the California red-legged frog.

California Tiger Salamander—Project-related activities occurring in potential California tiger salamander habitat include vegetation management, road maintenance, construction or rehabilitation of recreation facilities, and recreation activities. Vegetation management could result in vegetation removal or trampling that could disturb existing burrows, and the application of rodenticides could adversely affect small mammals that create the burrows used by California tiger salamanders. Herbicide applications could also affect this species. Maintenance of recreation areas, road maintenance, and project-related traffic have the potential to injure or kill salamanders crossing roads or migrating across project lands. Several potential aquatic breeding sites are used as swimming lagoons and there may be potential for these activities to disturb or injure salamander larvae.

FWS notes that seven documented occurrences of California tiger salamanders occurred within 5 miles of the project area. Fifteen aquatic sites within the project area provide potentially suitable breeding habitat, surrounded by potentially suitable upland habitat. FWS also commented that ESA consultation has not been concluded because Merced ID did not conduct protocol-level surveys for this species. FWS [10(j) recommendation 6(a)G] recommends prohibiting the use of burrow fumigants or rodenticides in the habitat of California tiger salamanders.

The Water Board [preliminary WQC condition 7] specifies the development of a monitoring and conservation plan to protect the California tiger salamander from the effects of pesticide use and recreation and construction activities.

Although Merced ID does not propose a protection plan for the California tiger salamander, it does propose to avoid the use of burrow fumigants and rodenticides in California tiger salamander habitat.

Our Analysis

Proposed maintenance activities, including rodent control and vegetation maintenance, could affect the California tiger salamander. Merced ID's proposal to avoid the use of burrow fumigants and rodenticides in habitat of the California tiger salamander would certainly minimize project effects from rodent control and would be consistent with FWS' recommendation. Avoiding the use of herbicides in California tiger salamander habitat, per the staff-recommended measure for pest management and pesticide discussed in section 3.3.2, *Terrestrial Resources*, would further reduce project maintenance effects. In areas where vegetation trimming and removal are planned, foot traffic could cause burrows to collapse. Although recreational activities in these areas are expected to remain similar to existing conditions and there are no plans for development in these areas,⁴⁷ with the exception of recreation development on Mack Island, we consider that recreation could adversely affect this species' burrows and habitat for eggs and larvae in pools in areas used for recreational hiking and recreational swimming, respectively. Additionally, vehicle traffic could adversely affect California tiger salamanders that cross roads as they migrate to breeding pools or upland foraging sites, or disperse to other ponds.

Although the habitat quality was reported to be low to marginal, and no incidental observations of California tiger salamanders were recorded during the surveys, assumptions about the presence or absence of this species should not be based on habitat surveys and incidental observations. Even with protocol-level surveys, secretive and rare species are difficult to detect and quantify. Therefore, the presence of this species should be assumed, until protocol-level surveys prove otherwise and agencies concur with survey results.

Although Merced ID proposes measures and other plans that would reduce project effects on the California tiger salamander, we find that surveys and monitoring efforts would be necessary to identify the areas where protective measures would best be implemented, based on habitats where the salamanders occur and their migratory routes. Therefore, we recommend developing and implementing a protection plan for the California tiger salamander, including, at minimum, provisions to conduct protocol level surveys, identify habitats and migratory routes used, and avoid using burrow fumigants and rodenticides in habitat of the California tiger salamander.

⁴⁷ Although Merced ID proposes construction and rehabilitation at some recreation areas (i.e., McClure Point, Barrett Cove, Horseshoe Bend, Bagby, and McSwain), no potential California red-legged frog habitat occurs in the area of the proposed activities.

With implementation of these measures, the project is not likely to adversely affect the California tiger salamander.

Merced Falls Project

General Protection Measures

PG&E does not propose any general protective measures that would protect terrestrial and aquatic threatened and endangered species from effects of project operation and maintenance.

The Water Board [preliminary WQC condition 7] specifies that PG&E conduct a review of lists of endangered and special-status species within 6 months of license issuance, and every 5 years thereafter, to identify newly listed species that could be adversely affected by the project. The Water Board [preliminary WQC condition 7] also specifies that PG&E should consult with FWS, California DFW, the Water Board, and NMFS to develop a species -specific study plan for any newly added species in the project area that could be adversely affected by the project.

Our Analysis

The Water Board's preliminary WQC condition 7 specifying pentennial review of threatened, endangered, and other special-status species would identify newly listed species. We agree that any newly listed species should be evaluated for potential project effects. We also agree that the requiring input from agencies in the development of species-specific study plans is appropriate, particularly since much information is available through unpublished data and gray literature. Although we recognize the benefits of pentennial review and consultation to threatened, endangered, and special-status species and their habitats, the Commission typically includes in its licenses a standard license article with a fish and wildlife reopener provision, as discussed in section 5.1.2.3, *Measures not Recommended by Staff*.

Effects on individual species are discussed below.

San Joaquin Kit Fox—Noise caused by project maintenance activities and recreation could affect San Joaquin kit fox in the project vicinity. The use of rodenticides or other pesticides to control rodents would adversely affect kit foxes in the project vicinity.

In the discussion of wildlife surveys in Appendix E1, *Updated Study Report*, PG&E states that habitat for the San Joaquin kit fox occurs within the USGS 7.5-minute Merced Falls quadrangle. PG&E states that an evaluation of project impacts on the San Joaquin kit fox is likely unnecessary because of a lack of sightings, prey base, and burrows and friable soils in the project area. Thus, PG& E did not indicate in its license application whether it proposes to use rodenticides at project facilities or any other pesticides to control rodents, which could ultimately affect the San Joaquin kit fox.

FWS disagrees with PG&E's reasoning for excluding an evaluation of project effects on the San Joaquin kit fox. FWS' disagreement is based on detections of kit fox less than 6 miles from the project boundary with the presence of contiguous habitat from the detection sites to Merced Falls reservoir, and a lack of surveys for kit fox in the project area. FWS also comments that the lack of prey base is likely due to eradication efforts in the vicinity of the project and the resulting effects on burrows. FWS comments that the reservoir is likely a dispersal barrier for kit fox, and opening Merced Falls dam for fish passage may also affect kit fox dispersal. FWS comments that the use of rodenticides and insecticides should be addressed through ESA consultation.

The Water Board [preliminary WQC condition 2] specifies that PG&E develop a pesticide use plan to protect state and federally threatened and endangered species, where pesticide use includes rodenticides. California DFW [10(j) recommendation 7] recommends an integrated pest management and pesticide use notification plan for undesirable vegetation, insects, and rodents.

Our Analysis

Because PG&E did not provide information about the use of rodenticides or other pesticides in the project area or noise caused by project maintenance or recreation, we are unable to evaluate project effects on the San Joaquin kit fox.

Conducting surveys in the project area would be necessary to document the use of habitat in the project area by San Joaquin kit fox. Additionally, data collected during surveys may provide information on the effects of the project on the dispersal of kit fox. Including the surveys as a component of a protection plan would allow for study results to be formally documented so that project effects on kit fox can sufficiently be evaluated and appropriate protection and mitigation measures can be developed. Developing the plan in consultation with FWS, the Water Board, California DFW, and BLM would ensure that study protocols and protection and mitigation measures are consistent with agency guidelines.

The use of rodenticides and insecticides affects kit foxes by poisoning its prey base, thereby contributing to mortality of kit fox. Other species that are vulnerable to rodenticides, burrow fumigants, and ultimately burrow collapse could also be affected. Requiring a component for pest management and pesticide use to be integrated with the control plan for noxious weeds and invasive plants would reduce effects of pesticides on kit fox as well as other species affected by rodent control methods. Including this component in the control plan for noxious weeds and invasive plants, would be consistent with state and federal laws protecting threatened and endangered species, including the San Joaquin kit fox.

We recommend developing a protection plan for the San Joaquin kit fox in consultation with FWS, the Water Board, California DFW, and BLM. The plan would include: (1) study methodologies and monitoring protocols to identify San Joaquin kit fox habitats within the project area; (2) an assessment of potential project effects on San

Joaquin kit fox in the project area; (3) protection and mitigation measures; and (4) references to measures contained in other plans that would protect San Joaquin kit fox; and (5) descriptions of any exceptions to the prohibited use of rodenticides that would be considered emergencies and allowed by agencies and an explanation of why the emergency situations would supersede protection measures for the San Joaquin kit fox.

With the development and implementation of the protection plan for the San Joaquin kit fox, the project is not likely to adversely affect the San Joaquin kit fox.

California Red-legged Frog—PG&E does not propose changes to project operation or construction activities; thus no effects on the California red-legged frog would be caused by project operation or construction activities. However, PG&E does not address the potential for the project to support bullfrogs and predatory fish, which in turn affect California red-legged frogs, nor does PG&E address the potential effects of controlling noxious weeds and invasive plants or other pests, on the California red-legged frog.

PG&E does not propose any protective measures for the California red-legged frog because it asserts the frog does not occur in the project area. The Water Board [preliminary WQC condition 9] specifies a frog monitoring program for the California red-legged frog, foothill yellow-legged frog, and western spadefoot. FWS [10(j) recommendation 4] recommends a conservation plan for the California red-legged frog that would include control measures for bullfrogs to reduce their effects on mortality of California red-legged frogs. FWS commented that Merced Falls reservoir is situated between two areas of potential breeding habitat for the California red-legged frog and that ESA consultation has not been concluded for the frog. In its reply comments, PG&E stated that the Water Board and FWS improperly impose conditions for California red-legged frogs because, as PG&E asserts, California red-legged frogs do not occur at the project.

Our Analysis

PG&E conducted only reconnaissance level surveys and did not conduct protocol level surveys in areas of suitable habitat within the project area. FWS commented that Merced Falls reservoir has not been surveyed for California red-legged frogs, and that potential breeding habitat occurs 0.83 and 1.17 miles south of Merced Falls reservoir and also 1.13 and 1.25 miles north of the reservoir. The project area could therefore provide suitable habitat to frogs dispersing from the breeding areas to the north and south of the reservoir. California red-legged frogs would be exposed to mortality risks while dispersing to habitat within the project area, and also when bullfrogs disperse into California red-legged frog habitat during routine drawdowns. Controlling predators of California red-legged frogs, particularly bullfrogs, has shown to be effective, based on information provided by FWS in its filing on July 22, 2014.

Requiring control measures for bullfrogs to be detailed in a protection plan that includes surveys for California red-legged frogs, and in consultation with FWS, the

Water Board, California DFW, and BLM, would ensure that survey protocols and protection measures are consistent with FWS and the Water Board's recommendations, and that any mitigation measures are adequate. Requiring a conservation plan for the California red-legged frog would ensure that consultation has been completed and that the project would remain in compliance with the ESA. Including other federally listed and special-status amphibian species, such as the foothill yellow-legged frog and western spadefoot, in the plan per the Water Board's recommendation, would further protect terrestrial resources in the project area, particularly these two species that are currently under review by the FWS.

It is also possible that the application of herbicides to control noxious weeds and invasive plants could affect the California red-legged frog and other amphibians in the project area. Requiring a formal plan that documents locations and timing of herbicide applications, relative to that of any documented occurrences of California red-legged frogs in the project area, would reduce potential effects of herbicides on California red-legged frogs.

With the implementation of these measures, the project is not likely to adversely affect the California red-legged frog.

Valley Elderberry Longhorn Beetle—One blue elderberry shrub showing exit holes of the valley elderberry longhorn beetle on the bark occurs in the project area, on the northeast side of the impoundment. PG&E proposes no construction or maintenance activities that could affect habitat in the area where the blue elderberry shrub was located. Project maintenance activities such as vegetation maintenance, and recreation activities such as hiking, could affect the blue elderberry shrub. PG&E conducts weed control about twice yearly at the dam, at the River's Edge Fishing Access area, and around gages to minimize the spread of noxious weeds.

PG&E does not propose a protection plan for the valley elderberry longhorn beetle. FWS commented that it considers exit holes in the bark of elderberry bushes to be extremely rare and to be evidence of occupation by the valley elderberry longhorn beetle. FWS [10(j) recommendation 3] indicates ESA consultation has not been concluded for this species. The Water Board [preliminary WQC condition 6] specifies a monitoring and conservation plan for the valley elderberry longhorn beetle.

Our Analysis

PG&E states that it proposes no construction; therefore, no maintenance activities would have no effect on the blue elderberry shrub and the valley elderberry longhorn beetle. PG&E also states that no maintenance activities would affect the blue elderberry shrub, because the periodic weed control would not be implemented in the near the shrub. The presence of one blue elderberry shrub makes it reasonable to assume that other blue elderberry shrubs could occur in the project area over the term of a new license. It is also reasonable to assume that maintenance activities, such as the control of undesirable vegetation, and increases in recreation could occur over the term of the license. In these

cases, blue elderberry shrub(s) and valley elderberry longhorn beetles could be affected by the project.

Marking the existing blue elderberry shrub, and consulting before implementing any future activities that could affect valley elderberry longhorn beetle habitat would minimize project effects on the valley elderberry longhorn beetle. Developing a protection plan for the valley elderberry longhorn beetle and its habitat would prevent unforeseen damage or removal of the shrub in the future, which would reduce the effects of the project on the valley elderberry longhorn beetle and its habitat. Consulting with FWS, BLM, California DFW, and the Water Board to develop the plan would ensure consistency of protocols and complete consultation requirements with FWS.

Additionally, developing a formal plan for the control of noxious weeds and invasive plants would reduce the potential effects of vegetation management on blue elderberry shrubs, and integrating pest management into the plan would reduce potential effects of any pesticides on valley elderberry longhorn beetles.

With the implementation of these measures, the project is not likely to adversely affect the valley elderberry longhorn beetle.

3.3.3.3 Cumulative Effects

Based on our review of the license application and agency and public comments, we have identified the federally listed San Joaquin kit fox and California red-legged frog as resources that may be cumulatively affected by the proposed continued operation of the project in combination with other past, present, and foreseeable future activities.

San Joaquin Kit Fox

Project facilities and maintenance activities of the Merced River and Merced Falls Projects would result in direct and indirect effects on the San Joaquin kit fox that when considered in concert with other activities in the basin, would further contribute to the cumulative adverse effects on the San Joaquin kit fox.

The Merced Falls Project dam could directly affect the San Joaquin kit fox by acting as a dispersal barrier for kit fox, despite the fact that McSwain dam and the Hornitos Bridge provide dispersal corridors. Project activities, particularly those occurring at dusk and dawn, would directly affect kit fox through disturbance. The use of pesticides, including rodenticides, burrow fumigants, and insecticides would have both direct and indirect effects on the San Joaquin kit fox. Rodenticides and insecticides commonly used around businesses and homes in the basin directly affect the San Joaquin kit fox by poisoning its prey. Rodenticides and burrow fumigants have been widely used in ground squirrel eradication programs in the basin, directly and indirectly affecting the species by poisoning the prey and reducing the prey base of the San Joaquin kit fox, respectively. The magnitude of the effects of pesticides is difficult to discern because of the effects of unregulated pesticide use on private lands in the basin. As noted by FWS,

the San Joaquin kit fox populations in the project vicinity are likely suppressed as a result of the basin-wide ground-squirrel eradication programs and predation pressure.

Proposed measures for the Merced River Project and agency conditions and recommendations for both the Merced River and Merced Falls Projects impose limits and regulations on the use of any pesticides at the projects. These limits and regulations would protect San Joaquin kit fox and other species dependent on ground-squirrel burrows and potentially affected by the use of rodenticides and burrow fumigants. Other project effects would be mitigated by developing and implementing the staff-recommended protection plan for the San Joaquin kit fox and developed in consultation with FWS, California DFW, the Water Board, and BLM. The plan would include management goals and objectives and describe and assess project-related effects on San Joaquin kit fox. It would also identify methods to mitigate ongoing project-related effects. Based on the above, we conclude that implementation of the protection plan would reduce any project-related cumulative effects associated with operation and maintenance of the Merced River and Merced Falls Projects.

California Red-legged Frog

Hydropower projects and the associated operation and maintenance activities for the Merced River and Merced Falls Projects would result in direct and indirect effects on the California red-legged frog that would be further contribute to cumulative effects on California red-legged frogs in the basin. These adverse cumulative effects would be compounded by undocumented activities on private lands that cannot be quantified or analyzed in the scope of cumulative effects.

Reservoirs of hydropower projects typically support bullfrogs and predatory fishes, which directly affect California red-legged frogs through increased predation. Operation and maintenance activities of hydropower projects, particularly drawdowns, cause bullfrogs to disperse from the reservoir to habitat areas where California red-legged frogs occur. Therefore, drawdowns at one reservoir would adversely affect California red-legged frogs at the other project by possibly increasing predation pressure. This is of particular concern because the Merced River Project area overlaps with the Piney Creek core area of the Recovery Plan of the Red-legged Frog (*Rana aurora draytonii*). As such, bullfrog control measures implemented at the Merced Falls Project area would facilitate the objectives for controlling bullfrogs at the Piney Creek core area and the Merced River Project area. Moreover, bullfrog control at Merced Falls is important even though California red-legged frogs have not been observed in the Merced Falls Project area, because frogs dispersing from breeding habitats outside the project area would be adversely affected by bullfrogs once inside the project area. Herbicides would also affect California red-legged frogs, both directly at the time of application and indirectly as these pesticides could mobilize in water or break down to components that could also affect the species.

Agency conditions and recommendations to protect the California red-legged frog at both the Merced River and Merced Falls Projects would reduce project effects on the this species by identifying goals and objectives, assessing project-related effects on California red-legged frogs, and mitigating for ongoing project effects. Developing and implementing a protection plan in consultation with FWS, California DFW, the Water Board, and BLM, and including other potentially occurring federally listed and special-status species, such as the foothill yellow-legged frog and western spadefoot, would protect other amphibian species of concern to agencies. Based on the above, we conclude that implementation of the protection plan would reduce any project-related cumulative effects in the basin associated with operation and maintenance of the Merced River and Merced Falls Projects.

3.3.4 Recreation Resources

3.3.4.1 Affected Environment

The regional recreation resources in the vicinity of the two projects are primarily associated with the Merced River extending from the crest of the Sierra Nevada Mountain range to the San Joaquin Valley of central California. Approximately 30 miles upstream of the project, the Merced River flows through Yosemite National Park, which is the most important regional recreation resource. Yosemite National Park annually receives about 4 million visitors, who enjoy sight-seeing, camping, hiking, rock climbing, water sports (e.g., waterskiing), and other outdoor activities (Park Service, 2013). Public lands managed by the Forest Service and BLM extend to the west of Yosemite National Park and offer opportunities for developed camping and scenic viewing along the designated Wild and Scenic River portion of the Merced River. Upstream of the project the Merced River provides whitewater boating opportunities from Yosemite National Park to Lake McClure. Within the park, whitewater boating is not allowed, except at one small area in Yosemite Valley. Proceeding downstream beyond the park boundary, the river has class IV to V rapids⁴⁸ and it is not commonly boated until near the community of El Portal, at which point commercial and private whitewater boating takes place. Boaters typically take out about 11 miles downstream at Briceburg (see figure 3-1).

⁴⁸ The American Whitewater Scale of River Difficulty: Class I, Easy: fast moving water with riffles and small waves; Class II, Novice: straightforward rapids with wide, clear channels which are evident without scouting; Class III, Intermediate: rapids with moderate, irregular waves which may be difficult to avoid and which can swamp an open canoe; Class IV, Advanced: intense, powerful but predictable rapids requiring precise boat handling in turbulent water; Class V, Expert: extremely long, obstructed or very violent rapids which expose a boater to added risk; Class VI, Extreme and Exploratory: runs that have almost never been attempted and often exemplify the extremes of difficulty, unpredictability, and danger.

Downstream of Briceburg, the Merced River has class IV and one class VI rapids. This reach is about 13 miles long and boaters take out at the project reservoir near Shepherd's Point, Bagby campground, and Bagby boat launch (American Whitewater, 2013). Upslope of the river corridor, the road system provides general access to public lands for dispersed recreational uses (Forest Service, 2003).

Downstream of the project, the Merced River flows into the San Joaquin Valley where there are many cities, rural residences, and agricultural farms. Most land along the Merced River downstream of the project is privately owned but there are limited opportunities for fishing, walking, bicycling, swimming, and floating (University of California, Merced, 2013). Class I and II whitewater boating opportunities exist on the nearly 50-mile-long reach of the Merced River downstream of the public access point just below Crocker-Huffman diversion dam to the confluence with the San Joaquin River (American Whitewater, 2013).

Additional recreation resources in the vicinity include State Route 49 (known as the Golden Chain Highway) and Lake Don Pedro. State Route 49 is a 317-mile state highway that is eligible for state scenic highway designation. This route is popular for scenic driving through river canyons and the scattered small historic towns established during the gold rush era located in the foothills of the Sierra Nevada Mountains (Geotourism Mapguide, 2013). State Route 49 crosses the Merced River at the upstream end of Lake McClure.

Lake Don Pedro, which impounds the Tuolumne River, is about 5 miles northwest of Lake McClure (Turlock Irrigation District, 2013). This reservoir is owned and operated by Turlock and Modesto Irrigation Districts together with the city and county of San Francisco. The reservoir is similar in size and character to Lake McClure with many developed facilities for popular recreation activities including boating, fishing, camping, water sports, swimming, picnicking, bicycling, and hiking.

Merced River Project

Project Recreation Resources

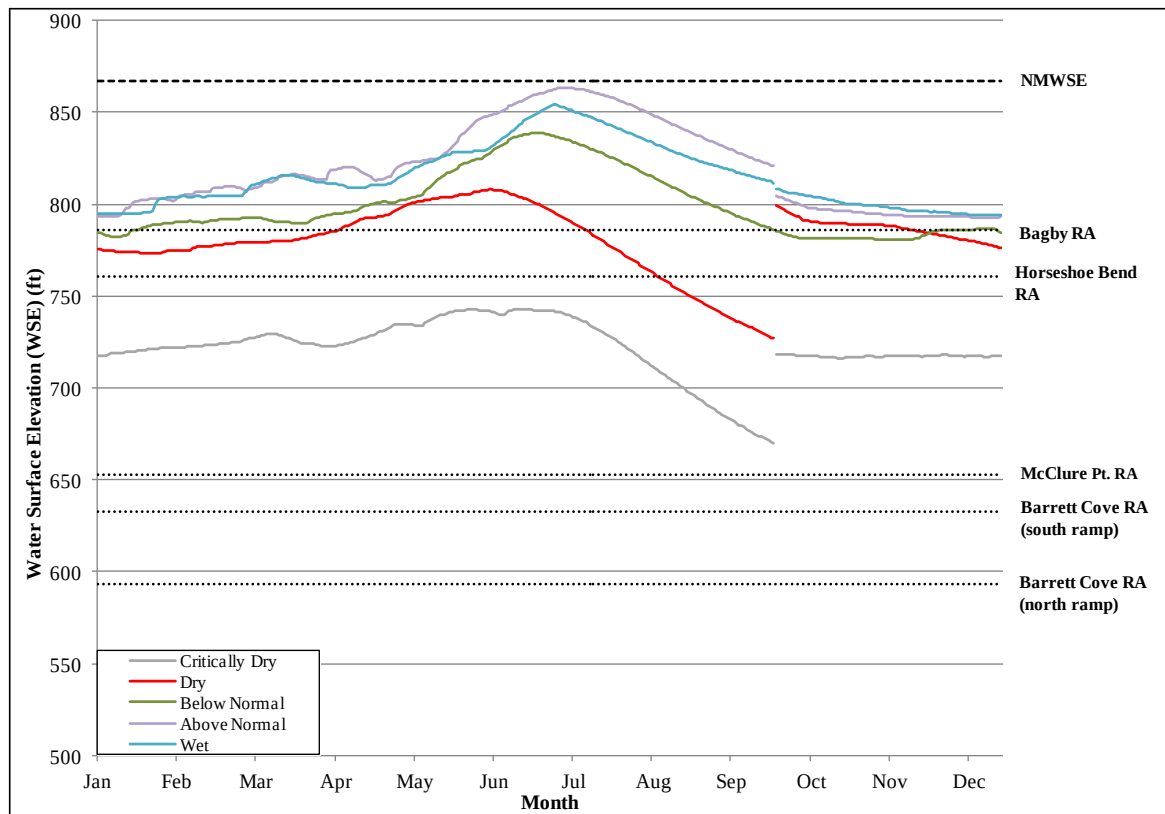
Lake McClure—At a NMWSE of 867 feet, Lake McClure extends 19 miles upstream from New Exchequer dam, has a surface area of 7,110 acres, and a shoreline length of approximately 82 miles. License article 44 requires that Merced ID make every reasonable effort to maintain the water surface elevation of Lake McClure as high as possible from April through October to be consistent with the primary purposes of the reservoir⁴⁹ and maintain a minimum pool of no less than 115,000 acre-feet (a reservoir

⁴⁹ MID operates the project for flood control, water supply, recreation, hydropower, and environmental purposes.

elevation of about 640 feet), except when a drawdown is necessary to maintain minimum streamflow as required by license article 40. Typically, the reservoir is at its highest level in June or July, recedes through the summer, and falls to its lowest elevation in October where it remains until the reservoir begins to fill again in the spring. Figure 3-38 shows typical reservoir elevations that occur in different water year types. In general, the reservoir only achieves the maximum elevation in above normal water year types. During critically dry water years, the reservoir can be more than 125 feet lower than the maximum water surface elevation during the summer months. Three of the five boat ramps at the reservoir, Barrett Cove (north and south) and McClure Point, are functional⁵⁰ year-round in all water year types. The boat ramp at Horseshoe Bend is functional year-round in below normal, above normal, and wet water year types. The boat ramp at Bagby is functional year-round in above normal and wet water year types.

The shoreline is steep and mainly undeveloped, except in the vicinity of the four recreation areas. Although there is public access along most of the shoreline, the steep shoreline is not very suitable for recreational use. The reservoir has four branch-like arms in the shape of a letter H (see figure 1-2). The widest arm of the reservoir is near the dam and the other three arms wind up narrow canyons. Merced ID reports extremely low boating density during peak recreation season with, on average, less than one watercraft per acre, regardless of water year type. Motorized boats (i.e., power boats, houseboats, personal watercraft) were the most common watercraft observed on Lake McClure; a few canoes and kayaks were occasionally observed. Boating regulations on Lake McClure include: (1) all boats must travel in a counterclockwise rotation on the reservoir; (2) waterskiing is prohibited in the reservoir arms adjacent to any of the four project recreation areas and in other marked, smaller arms of the reservoir; and (3) boaters must obey posted speed limits during the daytime and not exceed 10 miles per hour during the nighttime (Mariposa County Code Title 12, Chapter 16). In addition, as part of normal operation, Merced ID installs signs and buoys where water hazards exist along the reservoir throughout the year to ensure public boating safety and, as necessary, prohibits boats from accessing portions of the reservoir at lower water levels.

⁵⁰ Water surface is no less than 3 feet above the end of the constructed launch lane.



Notes: Break in water surface elevation line in this figure is because of the water year change (i.e., the water year runs from October 1 through September 30 of the following calendar year).

RA – recreation area

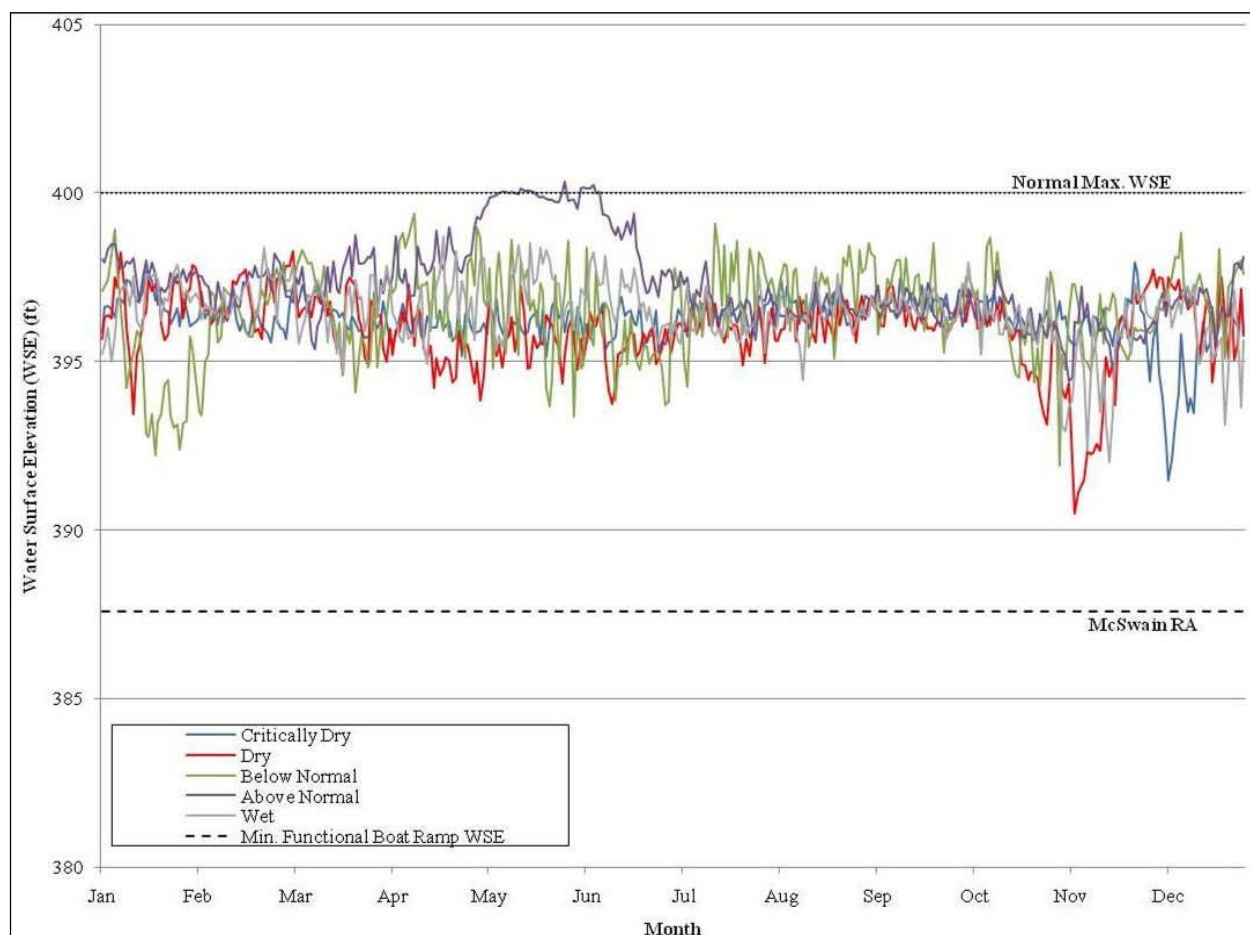
NMWSE – normal maximum water surface elevation

Figure 3-38. Water surface elevation of Lake McClure in different water year types (Source: Merced ID, 2013b).

Lake McClure supports a warmwater fishery, dominated by threadfin shad and black bass, and a coldwater fishery of rainbow trout, Chinook salmon, and kokanee. California DFW manages Lake McClure primarily as a put-and-take fishery for rainbow trout, although in 2004 and 2005, Chinook salmon and kokanee were stocked for managing as a put-and-grow fishery. Black bass is the most commonly caught species in the reservoir, and rainbow trout is the second most commonly caught species. May appears to be the most popular time of the year for fishing in the reservoir.

McSwain Reservoir—At a NMWSE of 399.0 feet, McSwain reservoir extends 6.3 miles upstream from McSwain dam, has a surface area of 310 acres, and a shoreline length of approximately 12.5 miles. Operated as a re-regulating afterbay for flows released from Lake McClure, the reservoir water surface elevation fluctuates throughout the year, but the water surface elevation remains fairly constant within about 7.5 feet (between elevation 391.5 and 399.0 feet). Unplanned outages or unexpected events

occasionally cause the water surface elevation to be lower than 391.5 feet. Figure 3-39 shows typical reservoir elevations that occur in different water year types. The boat ramp at McSwain recreation area is functional year-round in all water year types.



Note: RA – recreation area boat ramp elevation

WSE – water surface elevation

Figure 3-39. Water surface elevation of McSwain reservoir in different water year types (Source: Merced ID, 2012e).

The shoreline is steep and mainly undeveloped, except in the vicinity of one recreation area. Although the shoreline of the long and narrow reservoir is publically accessible, it is not very suitable for recreational use. Boating speed on the reservoir is restricted to 10 miles per hour on the entire reservoir (PaddlingCalifornia.com, 2013), and Merced ID reports extremely low boating density during the peak recreation season with, on average, 0.5 water craft per acre. About two-thirds of the boating use consists of motorized boats (power boats) and one-third of the boating use consists of non-motorized boats (i.e., canoes, row boats, and kayaks). California DFW stocks the reservoir with trout and manages the reservoir as a put-and-take fishery. Anglers most commonly catch

rainbow trout in the reservoir, and May appears to be the most popular time of the year for fishing in the reservoir.

Project Recreation Facilities

Exhibit R drawings (filed in 1963 and revised in 2007) depict the four project recreation areas at Lake McClure and one recreation area at McSwain reservoir. The recreation areas provide developed facilities for camping, picnicking, swimming, and launching boats. Figure 1-2 shows the location of the recreation areas, and table 3-22 lists the facilities provided at the recreation areas and their capacities. Campgrounds typically have flush restrooms, showers, trash receptacles, and potable water spigots distributed within the campground; each campsite typically has a picnic table, pedestal grill, food locker, and paved or gravel surfaced parking spur. Some campsites have water, septic, and power for recreational vehicles. Picnic areas typically have flush restrooms, potable water spigots, a parking area, and picnic sites with a table and pedestal grill. Some group picnic areas have shelters, sinks, and food preparation areas. Swimming beaches typically have a parking area, flush restrooms, showers, and picnic sites each with a table and pedestal grill. Marinas typically provide a parking area, flush restrooms, watercraft rentals, and slips. Boat launches typically have a parking area, concrete surfaced launch lane(s), courtesy docks, restrooms, watercraft rentals, and slips.

Merced ID owns and operates all of the project recreation facilities. Except Shepherd's Point, within the Bagby recreation area, the four recreation areas are open for public use year-round. When recreation use declines between Labor Day and Memorial Day, Merced ID closes some of the campground loops and other facilities. This strategy allows for operational efficiency yet maintains sufficient capacity for public use. Shepherd's Point is typically open for public use from Memorial Day through October; the opening and closing dates depend on weather and road conditions.

Based on Merced ID's condition and accessibility assessments, most of the campground loops are in poor or fair condition; very few are in fair to good condition. The boat launches are in fair to good condition and picnic areas are in fair condition. With a few exceptions (Barrett Cove [north and south], Horseshoe Bend, and Bagby boat launches), project recreation facilities do not comply with applicable accessibility guidelines.

Two recreation trails are located within the project boundary at Lake McClure (figure 3-40). The 6-mile-long segment of the Merced River trail on the north shoreline of Lake McClure follows an old railroad grade that was used for access to what is now Yosemite National Park. The trail crosses two drainages, David and Solomon gulches, and is located on both Merced ID and federal land. The trail is not maintained and is in poor condition (e.g., being debris-covered and eroded). The majority (approximately 59 percent) of the segment within the project boundary—from RM 85.2 downstream to RM 79.4—is located below the NMWSE and is inundated when the reservoir is full or nearly full (Merced ID, 2011f).

Table 3-22. Recreation facilities and capacities at project recreation areas (Source: Merced ID, 2012a).

Recreation Area	Facility	Camp Sites	Picnic Sites	Parking Spaces	Boat Ramps
Lake McClure					
McClure Point	Campground	101	--	14	--
	Picnic area	--	8	8	--
	Swimming beach	--	22	60	--
	Marina	--	--	50	--
	Boat launch	--	--	140	1 (3 lanes)
Barrett Cove	Campground	275	--	39	--
	Swimming beach	--	13	30	--
	Boat launch/marina	--	6	267	2 (5 lanes)
	Overflow parking	--	--	35	--
Horseshoe Bend	Campground	109	1	--	--
	Swimming beach	--	12	50	--
	Boat launch ^a	--	--	49	1 (2 lanes)
Bagby	Bagby campground	30	--	22	--
	Shepherd's Point ^b	15	--	--	--
	Boat launch	--	--	31	1 (2 lanes)
On-reservoir	Floating restrooms (3)	--	--	--	--
McSwain Reservoir					
McSwain	Campground	112	--	--	--
	Picnic area	--	56	--	--
	Swimming beach	--	--	--	--
	Boat launch/marina	--	--	89	1 (2 lanes)

^a Boat cleaning and fish cleaning stations also are provided.

^b One vault restroom is available, but potable water is not provided.

Figure 3-40. Trails located within the project boundary at Lake McClure (Source: Merced ID, 2012a).

A second trail, unnamed and approximately 3 miles long, is located mostly above the normal maximum reservoir elevation on the south shoreline to the east of Shepherd's Point and proceeds upstream to Sherlock Creek. The trail is located on Merced ID, private, and federal lands and provides non-motorized trail opportunities including hiking, mountain biking, and equestrian use. The trail is not maintained and varies in width from several feet to less than 1 foot due to overgrown vegetation. It is not known if the trail was formally constructed or informally developed over time by shoreline users.

Recreation Activities and Use

Most visitors using McClure Point, Barrett Cove, Horseshoe Bend, and McSwain recreation areas are residents of nearby Merced and Stanislaus Counties. Most of the visitors using the Bagby recreation area are Mariposa County residents.

Lake McClure provides a setting for many water-based recreational activities. Lake McClure supports year-round fishing, including bass tournaments. Houseboating and water sports (e.g., waterskiing and wakeboarding) are also popular activities at the reservoir, and commercial marinas provide boat rentals and slip rentals; boat launches provide access to the reservoir surface. Merced ID regulates houseboating using its permit system. Popular land-based activities at the project include camping, picnicking, swimming, hiking, and walking. Overall, the two most popular activities at the reservoir are camping and fishing.

The 10-mile per hour boating speed limit strongly influences water-based recreation on McSwain reservoir. Consequently, McSwain reservoir receives more non-motorized and low-speed watercraft use than Lake McClure. Recreation facilities at the reservoir provide opportunities for camping, picnicking, swimming, and boat launching.

The annual project recreation visitation in 2010 was nearly 1.9 million recreation-days.⁵¹ Visitation at Lake McClure—1.4 million recreation-days—was three times greater than visitation at McSwain reservoir—482,030 recreation-days. About half of the visitor use at Lake McClure occurs during the non-peak season (Labor Day to Memorial Day); however, about 70 percent of the visitor use at McSwain reservoir occurs during the non-peak season. By 2050, the annual recreation visitation is projected to increase to about 3 million recreation-days at Lake McClure and about 1.2 million recreation-days at McSwain reservoir, a 132 percent increase.

In 2010, weekend campground occupancy at Lake McClure (except Shepherd's Point) ranged from 28 to 33 percent. The occupancy of Shepherd's Point in 2010 was 15 percent on weekends. McSwain campground had the highest 2010 occupancy at 50 percent. The weekend occupancy in 2050 is projected to range from 26 to 57 percent at

⁵¹ A recreation-day is a visit by one person for recreational purposes during any 24-hour period.

Lake McClure, but the weekend occupancy at McSwain campground is projected to be 87 percent.

Weekend occupancies for day use facilities (e.g., swimming beaches and picnic areas) in 2010 ranged widely from 2 to 56 percent with the highest occupancy occurring at swimming beaches and picnic areas. Similar to overnight use, the McSwain reservoir day use facilities are projected to have occupancy rates higher than those at Lake McClure.

At Lake McClure, only three parking areas had moderate overall occupancies between 30 and 45 percent and moderate to high weekend occupancies between 57 and 81 percent in 2010. These included parking areas at the boat launches at McClure Point and Barrett Cove (north and south boat launches) recreation areas. The remaining parking areas had occupancies below 20 percent overall and 43 percent on weekends. By 2050, occupancy at these same boat launch parking areas is projected to reach 45 to 67 percent overall and 85 to 122 percent on weekends. Occupancy at the remaining parking areas is projected to be less than 30 and 65 percent overall and on weekends, respectively.

Recreation Needs

Recreation Survey Responses—Merced ID's recreation surveys investigated user satisfaction with, and needs related to, reservoir levels, recreation facilities, user conflicts and crowding, recreation information, access, and recreation activities. At Lake McClure, most visitors were satisfied with the recreation facilities, information, and access provided at the project. The few visitor needs identified in the survey responses included new or improved boating facilities (launches, parking, and docks), picnic areas, and restrooms. Some visitors also identified the need for trails, improvements to swimming areas to increase swimmer safety, higher reservoir levels to improve scenic quality, and more access for fishing along the shoreline.

At McSwain reservoir, most survey respondents said they had no opinion about making improvements to boating facilities. However, 40 percent of day use respondents identified the scenic quality of the shoreline and the ability to access the shoreline as large problems. About 30 to 40 percent of all respondents identified the need to improve picnic areas, restrooms, and trash receptacles, and about half of the visitors indicated the need to improve vehicle parking areas.

Most of the respondents to Merced ID's survey regarding the demand for trails were from Mariposa County, in particular, the towns of El Portal and Mariposa, and these visitors reported using trails a couple of times a year. Most visitors used the Merced River trail for hiking or walking, mountain biking, and nature viewing, and the trail is most often used from December through June. About half of the respondents indicated that barriers or conditions prevented or impaired their use of the Merced River trail between Bagby and Railroad Flat. Specific problems included trail condition, high water levels in tributaries, overgrown vegetation, downed trees, and eroded sections of the trail.

Visitors reported using alternative trails including the section of the Merced River trail from Briceburg to El Portal, the Burma Grade trail near Briceburg, and Hites Cove trail near the confluence of the South Fork Merced and Merced Rivers. Just fewer than half of the survey respondents indicated a need for additional non-motorized trails in the vicinity of the project. Specific recommendations included trails: (1) across New Exchequer dam; (2) that connect Merced River trail to McSwain reservoir; (3) downstream of Bagby recreation area in the vicinity of State Route 49 to the small arm immediately south of State Route 49 bridge (about 0.5 mile); (4) around McSwain reservoir; and (5) upstream from McSwain recreation area (approximately 1 mile).

Recreation Needs Identified by Agencies and Stakeholders—Agencies and stakeholders provided comments that included recommended measures during the relicensing proceeding. These recommendations reflect a need to reconstruct, relocate, and maintain the Merced River trail and an unnamed trail on the south side of the Merced River that is in the vicinity of Bagby near the upstream extent of the project boundary. Additional trail needs include constructing and maintaining a new trail extending from Bagby recreation area to McSwain reservoir. Other needs identified relate to existing and new recreation facilities, recreation and flow information, monitoring, and flow releases.

Merced Falls Project

Project Recreation Resources

The Merced Falls impoundment is approximately 1-mile long with a total surface area of approximately 65 acres at a normal impoundment elevation of 344 feet above msl. The shoreline is 2.7 miles long. The project is operated in a run-of-river mode, which keeps reservoir fluctuations negligible. The impoundment is open for boating and fishing year-round and does not require a user fee.

PG&E allows public access to all licensee-owned lands, with the exception of those lands that enclose project structures. According to the Recreation Resource Report (2010), approximately 50 percent of the 1-mile northern shoreline of the impoundment is available to the general public for recreational access. The southern shoreline is mostly private property and has only a single egress point (canoe portage trail).

The Merced Falls impoundment also supports a recreational cold-water fishery, which historically has been stocked by California DFW with catchable-sized trout.

Below Merced Falls dam to Crocker Huffman diversion dam, the Merced River offers approximately 3.4 miles of Class I whitewater boating. A recreational boating study suggested minimum flows are above 250 cfs, while the American Whitewater website reports that minimum flows are around 300 cfs and high boatable flows are around 5000 cfs (American Whitewater, 2014).

Project Recreation Facilities

There are several formal and informal recreation facilities located at the Merced Falls impoundment (see figure 3-41).

The River's Edge Fishing Access area is located near the dam on the northern shoreline of the impoundment. The site encompasses 0.5 acre, supports paved parking for up to eight vehicles, and includes waste receptacles and landscaping. Boat launching and swimming at this site are prohibited. The Merced Falls Fishing Access area is located on the northern shoreline at the upstream end of the impoundment and includes a sign, restroom, a car-top boat launch, and parking to accommodate 15 vehicles with boat trailers and 30 vehicles without trailers. PG&E maintains the car-top boat launch at the Merced Falls Fishing Access area; however, all facilities at Merced Falls Fishing Access area are owned by Merced ID.

Two informal, unpaved parking areas are located on either side of the Hornitos Bridge on the northern shoreline of the impoundment. The bridge features a pedestrian path that provides access to anglers. According to the Recreation Resource Report (PG&E, 2011b), these 2 parking areas can accommodate approximately 8 to 12 vehicles and serve as a location for informal car-top boat launching. However, many of these parking areas are located outside of the project boundary.

There is a 0.4-mile-long informal, partially-paved angler trail located along the northern shoreline of the impoundment, which accounts for most of the 0.5 mile of publically accessible shoreline. A user-created canoe portage trail is located on the south shoreline of the impoundment. The trails allows boaters to take their boats out above Merced Falls dam, portage around the south side of the dam, and put their boats back on the water directly below the dam. The canoe portage itself is between 150 and 200 yards depending on the exact location of take out, and portions of the trail may be located on private property.

Recreation Activities and Use

Total recreation days supported by the project in 2002, according the 2003 FERC Form 80, were 7,000 annually, with a peak weekend average of 84 recreation days. The more recent 2009 FERC Form 80 states that total recreation days supported by the project were 2,500 annually, with a peak weekend average of 120 recreation days. Results from the Recreation Resource Report (PG&E, 2011b) visitor counts conducted on 5 days between May 11, 2010, and July 14, 2010, (two weekend days and three weekdays) found a daily average of 20 recreation days.

Specifically, 80 percent of visitors surveyed at the project reported visiting the site before. These returning visitors visited the project an average of 16 times in the past year. The overwhelming majority of respondents reported zip codes that came from nearby communities in the Central Valley, with about 40 percent of respondents from the vicinity of the city of Merced.

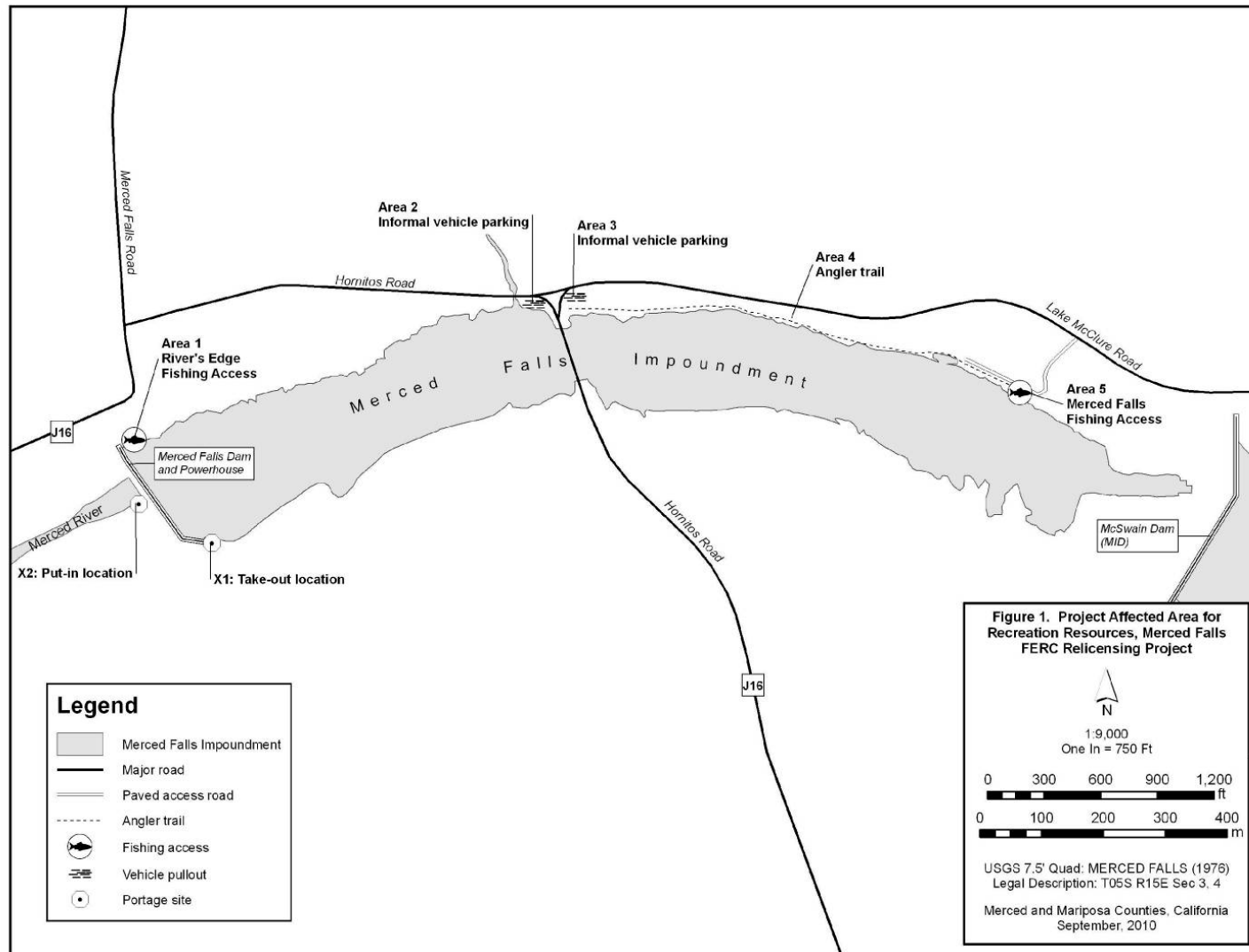


Figure 3-41. Map of recreation areas at Merced Falls Project (Source: PG&E, 2012).

Respondents also reported engaging in a small selection of recreation activities. Specifically, 92 percent of respondents reported fishing as their primary activity at the project, 5 percent reported visiting the project for multiple activities, and 3 percent reported their primary activity as kayaking. Other activities visitors reported engaging in at the project included resting/relaxing, picnicking, motor boating, and photography.

Recreation Needs

Use counts and capacity estimates from the Recreation Resource Report (PG&E, 2011b) included both formal and informal recreation areas at the project. Table 3-23 displays capacity estimates for parking, number of boats on the impoundment, and number of anglers on the shoreline for the project. The results presented in this table are based on average observed daily usage and peak observed daily usage during the Recreation Resource Study (PG&E, 2011b).

Table 3-23. Recreation capacity estimates for Merced Falls Project (Source: PG&E, 2011b as modified by staff).

Facility (Area)	Capacity		
	Vehicle Parking	Boats on the Reservoir	Anglers on Shoreline
Total site capacity	46 ^a	20 ^b	53 ^c
Average total daily observed use	9	2	20
Percent utilization based on average total daily observed use	20	10	38
Peak total daily observed use	14	3	34
Percent utilization based on peak total daily observed use	30	15	64

^a Estimates of physical capacity for parking at both formal and informal sites.

^b Estimates of recreational capacity for the reservoir assuming that each boat requires at least 3 acres of space.

^c Estimates of recreational capacity for the publically accessible shoreline assuming that each fishermen needs at least 50 feet of linear space.

Future use at the project is expected to increase primarily due to population increases in the area. Between 2000 and 2010, the population of Merced County increased by 21.5 percent, Mariposa County increased by 6.5 percent, and the state of California increased by 10 percent. Because the project provides few and fairly specific amenities, recreation activity participation may only increase moderately in proportion to the population growth.

The recreation facility condition assessment in the Recreation Resource Report (2010) states that River's Edge Fishing Access area is in "good" condition, while the informal angler trail and Merced Falls Fishing Access area "need repairs." Specifically, the report notes that the informal trail needs vegetation clearing and the Merced Falls Fishing Access area parking lot needs grading and the potholes need to be filled.

Merced ID conducted a recreational boating study on a 3-mile reach of the Merced River, from Merced Falls dam to Crocker Huffman diversion dam in 2010 and 2011. A focus group conducted as part of this study identified access to the riverine reach below Merced Falls dam as problematic. Vehicle and pedestrian access to the reach below Merced Falls dam does not exist because of private property restrictions. Currently, boaters launch in the Merced Falls impoundment and portage around the south side of Merced Falls dam. However, because the canoe portage trail may be located on private property, there is a potential for trespassing issues.

3.3.4.2 Environmental Effects

Merced River Project

To address project effects on recreation resources Merced ID proposes to (1) implement its Recreation Facilities Plan (measure RR1); (2) provide real-time information (flow and reservoir levels) and parking and signage for river access near Crocker-Huffman diversion dam (measure RR2); (3) make a good faith effort to maintain the water surface elevation of Lake McClure as high as possible from April through October and provide a minimum pool of no less than 115,000 acre-feet, except when necessary to maintain minimum streamflows (measure AQR2); (4) make a good faith effort to operate McSwain reservoir at an elevation no lower than elevation 388 feet, except when necessary to maintain minimum streamflows or make repairs (measure AQR2); (5) annually stock Lake McClure and McSwain reservoir for recreational fishing; and (6) implement ORV road closures at Piney Creek within the project boundary.

Recreation Facilities Plan

The project provides suitable settings for various recreational activities that, if unmanaged, could affect environmental and cultural resources. Merced ID filed a Recreation Facilities Plan with the license application (Merced ID, 2012a) to address this project effect and to provide visitors with a quality recreation experience. In its June 13, 2012, letter, the Commission identified several inadequacies in Merced ID's Recreation

Facilities Plan and requested Merced ID revise and refile the plan. Merced ID (2012e) provided some of the additional details the Commission requested, and further revised its Recreation Facilities Plan on August 23 and September 22, 2014. Merced ID's Recreation Facilities Plan is consistent with BLM preliminary 4(e) conditions 18, 19, 20, and 22 to designate a licensee contact person, annually coordinate with the BLM, implement a recreation facilities plan, and improve existing trails and provide additional trail access at the project. We analyzed the measures contained in the revised Recreation Facilities Plan provided by Merced ID (as filed with the August 21, 2014, alternative conditions).

Project Recreation Areas

Merced ID proposes to continue providing recreation facilities at the five project recreation areas (table 3-22). Merced ID also would be responsible for all annual maintenance, rehabilitation, and replacement of existing and proposed recreation facilities. The Recreation Facilities Plan defines and provides examples and frequency of actions that would be within the scope of operational maintenance.

Merced ID would rehabilitate and replace, as necessary, all existing project recreation facilities. All new, rehabilitated, and reconstructed facilities would be designed and constructed to meet accessibility guidelines for privately owned or federally owned facilities, as applicable. Merced ID would be responsible for all costs (e.g., design, contract, permits, and construction) associated with constructing and reconstructing facilities located on its lands.

On BLM-managed land, Merced ID would be responsible for survey, design, contract preparation, and administration; environmental analysis (including any required additional site-specific resource studies) and documentation (including permits) necessary for construction or reconstruction. Facilities on BLM-managed land would be designed to the agency's design standards, and BLM approval would be secured prior to constructing or reconstructing these recreation facilities. After construction, Merced ID would provide BLM with as-built drawings of facilities located on lands the agency manages.

Attachments to the Recreation Facilities Plan provide: (1) aerial photographs of the five existing recreation areas with labels showing site details, such as locations of loops, boat launches, project boundary, marinas, and swimming areas; (2) facility inventory and condition and accessibility assessments (relicensing study results); and (3) site plans for the five existing recreation areas.

Our Analysis

All recreation use at the five recreation areas identified in the Recreation Facilities Plan is directly related to project reservoir use. Accordingly, Merced ID appropriately proposes to be responsible for operating and maintaining these facilities to provide safe and adequate public recreation facilities. Most of the existing recreation facilities are in need of rehabilitation because of their condition and non-compliance with applicable

accessibility requirements. Implementing Merced ID's proposal to rehabilitate and replace facilities would correct public safety issues, provide recreation facilities that are accessible to persons with disabilities, and address an identified visitor need for improved recreation facilities. Securing BLM approval of facility designs, as proposed, would ensure these recreation facilities meet agency guidelines.

New Project Recreation Facilities

New technologies, recreational activities and trends create a need for new types of recreation facilities or increased capacity. Merced ID proposes to provide the following additional facilities at the project recreation areas:

- McClure Point recreation area:
 - concrete boat launch ramp, restroom, and paved parking area at the existing informal boat launch;
 - aerator in the swimming area;
 - up to 10 park model cabins with picnic tables and pedestal grills;
 - group day use area with shelter, picnic tables, pedestal grills, and restroom;
 - additional sand at the existing swimming area and up to 10 additional picnic tables and pedestal grills;
 - up to two floating swim platforms; and
 - potentially expanding the number of houseboat slips at the marina.
- Barrett Cove recreation area:
 - aerator in the swimming area;
 - additional sand at the existing swimming area and up to 15 additional picnic tables and pedestal grills;
 - sand lot volleyball court and playground at the swimming area;
 - up to 12 park model cabins with picnic tables and pedestal grills; and
 - potentially expanding the number of houseboat slips at the marina.
- Horseshoe Bend recreation area:
 - one-mile-long, non-motorized loop trail and information board;
 - aerator in the swimming area;
 - additional sand at the existing swimming area and up to 10 additional picnic tables and pedestal grills;
 - swim platform;

- sand lot volleyball court and playground at the swimming area;
- host site at the campground with septic system, power, and water; and
- up to 10 park model cabins with picnic tables and pedestal grills.
- Bagby recreation area:
 - interpretive and educational displays at the boat launch parking area and campground;
 - up to 12 park model cabins;
 - gravel parking area with 10 spaces, including at least 2 trailer spaces, two-unit vault restroom, and take-out trail from the reservoir/river to the parking area at Shepherd's Point primitive area;
 - an upstream take-out facility, gravel parking area with 10 spaces, two-unit vault restroom, and take-out trail from reservoir/river to the parking area at Sherlock Creek recreation area.⁵²
- McSwain recreation area:
 - non-motorized shoreline trail between the day use area and New Exchequer dam (about 4.1 miles, native surfaced);
 - information board at existing, native surfaced parking areas and directional signs on Lake McClure Road;
 - up to 12 park model cabins;
 - paved bicycle lane (about 5 miles) on Lake McClure Road from County Road J16 to near New Exchequer dam;
 - additional sand at the existing swimming area and extend beach to the east by up to 50 percent; and
 - up to two swim platforms.
- New Mack Island non-motorized recreation area:
 - non-motorized trails (paved and unpaved) for bicycle and pedestrian use;
 - trailhead parking area with restroom;
 - pedestrian bridge to Mack Island;

⁵² Merced ID proposes to develop an upstream take-out facility at Sherlock Creek only if BLM is able to secure public access to Mosher Road and ensures the road condition is suitable for vans/buses with trailers.

- up to 10 primitive campsites on Mack Island with shoreline trail access;
- up to two swim platforms; and
- watercraft restriction area between west shore of Mack Island and reservoir shoreline to the west.
- Maintain existing Merced River Trail (railroad grade trail along north shoreline) and provide:
 - interpretive and educational display at the trailhead;
 - pedestrian bridge over Merced river near Sherlock Creek recreation area; and
 - new trail segment on the south shoreline of Merced River to the Bagby recreation area.⁵³

Merced ID's explanation of the need for new facilities follows (Merced ID, 2012b):

- Aerators in swimming areas—No relicensing study results indicated a need for these improvements, but Merced ID believes these improvements would enhance the visitor experience.
- Designated swimming area with platforms—These facilities do not currently exist at McClure Point and Horseshoe Bend recreation areas where the steep shoreline limits suitability. These improvements would increase opportunities for swimming in safe locations (e.g., providing designated areas where boating is restricted).
- Park model cabins—These facilities do not exist at the project but are commonly offered at large recreation complexes. Merced ID believes these facilities would provide an upgraded camping opportunity that is not currently available at the project or other area reservoirs.
- Volleyball court and playground equipment—Providing these facilities would create consistency among the amenities provided at other project recreation areas and could more evenly distribute visitor use among the recreation areas.

⁵³ Merced ID proposes to construct and maintain the pedestrian bridge and trail segment along the south shoreline only if all necessary lands have legal access through ownership or easements to allow public access to Bagby recreation area and BLM agrees to construct a bridge across the North Fork of the Merced River to allow safe public crossing during spring snow melt off and storm events.

- Non-motorized trail construction and recreation area—Relicensing study results indicate there is an unmet demand for non-motorized trail use at the project. Trails in the vicinity of Horseshoe Bend recreation area, along the McSwain reservoir shoreline, and at the new Mack Island recreation area would meet this need in the area of the project closest to the existing vehicle access points. These areas are also ones where the topography would be suitable for non-motorized trail development.
- Bicycle lane on Lake McClure Road—Visitors currently bike along the road, and this activity is projected to increase in the future. Providing a bicycle lane would improve safety for bicyclists and meet the future, increased demand for this activity.
- Expanded houseboat slip capacity—Evaluating the need for and potentially providing additional houseboat slip capacity would respond to existing and future, increased demand for houseboating and the existing users' preference for slips rather than moorings.

Our Analysis

The demand for day use and group day use is predicted to increase, particularly for the recreation areas near Merced and surrounding communities. Merced ID's proposal for additional group day use areas and improvements at day use areas responds to this identified recreational need. Merced ID does not propose additional overnight capacity, which appears appropriate because according to occupancy data, existing and future demand for overnight use can be met with the existing number of campsites at the project.

Merced ID proposes to develop non-motorized trails near the lower elevation portions of the project; however, visitor responses to the unmet demand trail survey indicate a need for non-motorized trail opportunities near Bagby, specifically, the Merced River Trail. The current condition of the Merced River Trail and periodic reservoir inundation discourages visitors from using this trail. Additionally, the trail along the south side of Lake McClure near Bagby is in poor condition. As proposed, the project would continue to affect the Merced River Trail because reservoir inundation would prevent public access and erosion would continue to wash out portions of the trail. Merced ID's proposal to maintain the existing segment of the Merced River Trail along the north shoreline and construct a pedestrian bridge over Merced River to connect the trail segments would allow visitors to use the trail year-round without experiencing access issues due to inundation. In addition, developing a conceptual plan, in consultation with BLM, as specified in BLM preliminary 4(e) condition 20, for the Merced River Trail from McSwain dam to the Bagby recreation area would provide additional access to the reservoir shoreline and meet non-motorized trail demand at the project.

Merced ID also proposes new facilities for general recreational enjoyment. Merced ID believes aerators placed in swimming areas would enhance visitor use through improved aeration and circulation, but visitor survey responses did not indicate this need and relicensing studies did not indicate any water quality problems at the swimming areas. Providing aerators in swimming areas does not appear to address a project effect, but visitors may enjoy having water spraying in the swimming areas. Adding sand to the swimming beaches would improve beach suitability and address visitor needs for improved conditions at the swimming areas. Because playgrounds and volleyball courts are provided at some recreation areas, constructing these facilities at other recreation areas would offer consistent amenities among the recreation areas. This approach could better distribute recreational use across the recreation areas and reduce any effects of crowding on holidays or if use increases in the future.

Providing a paved bicycle lane would help meet an identified recreational need at the project and visitor safety would be improved along about 5 of the 7.8 miles of the project road between County Road J16 and the proposed parking area for the McSwain shoreline trailhead. However, it is not clear why the proposed route does not extend the length of the project road because the road extends almost another 3 miles to existing project recreation facilities and bicyclists would likely use this portion to the road.

Evaluating increased number of houseboat slips on Lake McClure, as Merced ID proposes, would be an appropriate and responsible approach to determining whether additional slips are necessary and, if so, determining the suitable locations. Existing boating densities indicate there is additional capacity for houseboating on Lake McClure. An evaluation that considers the number of additional houseboats that could be safely accommodated on the reservoir would provide a means to ensure that crowding on the reservoir does not become an issue. Providing these additional facilities, if feasible, would respond to a future increase in demand for houseboating.

Merced ID proposes to construct the new Mack Island recreation area with campsites accessible by boat or non-motorized trail and with recreation improvements along the shoreline. Although additional overnight capacity does not appear necessary, providing these campsites would provide an opportunity not currently available at this part of the project. Considering the trail access that would be developed to the island would encourage user-created sites, designating campsites would be a proactive approach to managing overnight use in order to minimize resource damage (e.g., sites too close to the water and sanitation). Designating the shoreline for non-motorized uses, such as swimming, water play, and non-motorized boating, would minimize user conflict and provide for public safety by providing a location for water contact recreation that is away from areas where boats are launched.

Implementation Schedule for Recreation Enhancements

The implementation schedule provided in Merced ID's revised Recreation Facilities Plan shows when it would rehabilitate and construct recreation facilities

(Merced ID, 2014g). Table 3-24 shows the general span of time when Merced ID would rehabilitate or construct new facilities at the recreation areas during the first 15 years of a new license. Modifications to existing facilities for accessibility would be completed when the facility is rehabilitated. Merced ID would make a good faith effort to complete construction and reconstruction activities at a facility within 1 year of commencement. Merced ID may complete major capital improvements sooner than scheduled. Based on annual consultation with BLM, Merced ID may also adjust the schedule, as needed, for facilities located on BLM-managed lands.

Table 3-24. Schedule for rehabilitating existing and constructing new recreation facilities (Source: Merced ID, 2012e, as modified by staff).

Project Recreation Area	Description	Implementation (within years of license issuance)
McClure Point	Boat launch (new) and marina	1 to 2
	Boat launch parking area, fish cleaning station, and restroom	3
	Swimming area improvements	1 to 4
	Campground loops	2 to 6
	Circulation roads	2 to 7
	Park model cabins (new)	3 to 7
	Group day use area (new)	4 to 5
Barrett Cove	Boat launch parking lots and overflow parking area	3
	Swimming area improvements	4 to 5
	Campground loops	8 to 13
	Circulation roads	6 to 10
	Park model cabins (new)	1 to 3
Horseshoe Bend	Boat launch parking lot and swimming area improvements	3 to 5
	Boat launch	12 to 13
	Campground loops	2 to 4
	Circulation roads	2 to 5
	Park model cabins (new)	6 to 7
	Pedestrian trail (new)	6

Project Recreation Area	Description	Implementation (within years of license issuance)
Bagby	Boat launch	5 to 6
	Campground	7
	Shepherd's Point	8
	Circulation roads	6 to 7
	Interpretive displays (new)	4
Mack Island (new)	Trail and parking area	13 to 15
	Swim area amenities and campsites	13 to 15
	Circulation roads	13 to 15
McSwain	Boat launch parking lot, marina and swimming area improvements	2 to 4
	Boat launch	8 to 10
	Picnic and day use areas	3 to 6
	Campground loops	4 to 7
	Circulation roads	3 to 7
	Shoreline trail (new)	5
	Park model cabins (new)	1 to 6
	Paved bicycle lane on Lake McClure Road	9

Our Analysis

The construction and rehabilitation schedule would span the first 15 years of a new license; however, a new license would likely be longer than 15 years. Because most of the improvements would be completed within the first 7 years of a new license term with no provision for subsequent rehabilitation, facility conditions could degrade over the license term (which could be 30 to 50 years in duration) and public safety issues could develop later in the license term. Although the plan states that water systems would typically be replaced once during the license term, the schedule does not include water systems. Including water system assessments in the schedule would ensure adequate water systems are provided at the recreation areas. Staggering rehabilitation of loops within each campground over several years would ensure sufficient overnight capacity during reconstruction periods; however, visitors would be exposed to construction traffic

and noise over a period of years. This effect could be reduced by planning activities after Labor Day and before Memorial Day.

The schedule indicates rehabilitating existing facilities, in general, before trails and new facilities are constructed. Although this approach properly prioritizes correcting existing problems, rehabilitation of some campground loops with poor and inaccessible facilities would not begin until 8 years after license issuance. Safety concerns for the public using these facilities would increase because they would continue deteriorating for 8 years before rehabilitation. In addition, these facilities would continue being inaccessible to persons with disabilities until rehabilitated. These effects would be more prominent at Bagby recreation area because alternative facilities are not available and the only accessible facilities are the boat launch parking area and restrooms at Bagby campground and boat launch.

Merced ID proposes to construct new facilities within 1 to 15 years of license issuance. In general, the park model cabins would be the first new facilities provided and the non-motorized trails would be the last facilities provided. This approach does not appear to prioritize the provisions of new facilities consistent with identified needs for recreation facilities and opportunities. For example, Merced ID states that visitors did not identify a need for park model cabins, yet these cabins would be provided as soon as 1 year after license issuance. Similarly, visitor responses, the Statewide Comprehensive Outdoor Recreation Plan or SCORP, and agency and stakeholder comments indicate an existing and increasing future demand for non-motorized trail opportunities, but trails are the last new facilities that would be constructed. Consequently, it does not appear that providing new facilities according to the schedule would meet identified needs in a timely manner.

Recreation Monitoring Program

Project recreation use over the license term will change in response to many factors such as population growth, new technologies and changes in activity participation. To ensure recreation needs are addressed through the license term Merced ID proposes to implement a recreation monitoring program to estimate recreation use levels, identify recreation use effects, assess visitor tolerances for effects (e.g., crowding, user conflicts, and facility conditions), and management actions that could be used to address identified issues. The program includes standards for quantifying recreation management objectives that would prompt review for determining a need for management action. The plan contains standards for monitoring facility occupancy, perceived crowding, and user conflicts. Every 6 years, Merced ID would collect and compile facility occupancy data and conduct direct counts of activity type, people, vehicles, and watercraft at the project recreation facilities during the peak recreation season; visitor surveys would be conducted every 12 years. Monitoring would be accomplished in the first year after license issuance and every 6 years to coincide with Form 80 reporting. Through its monitoring program, Merced ID would collect information for completing Form 80 as well as information about a much wider range of project recreation use and effects.

The Recreation Facility Plan explains Merced ID's approach for reporting monitoring results, consulting with BLM, and reviewing the plan for possible revision. As needed during the term of the license, Merced ID would meet annually with BLM to discuss measures needed to ensure public safety and provide for adequate protection and use of facilities located on BLM-managed lands. This annual meeting would provide the opportunity to identify upcoming recreation projects and to review, and possibly adjust, the schedule for completing recreation projects relative to logistics, permits, and other items requiring coordination. Merced ID would designate a liaison to coordinate with BLM as a single point of contact whenever planning, constructing or reconstructing recreation facilities, making major improvements, or performing major maintenance on BLM-managed land. Merced ID would report the recreation monitoring results to BLM and other unspecified agencies for a 60-day review period. Merced ID would review, update, and revise the Recreation Facilities Plan in consultation with BLM and other unspecified agencies. Merced ID would prepare plan updates affecting federal land in consultation with BLM. For plan revisions affecting other land, Merced ID would revise the plan in consultation with unspecified agencies. Merced ID would provide plan revisions to BLM and other unspecified agencies for a 30-day comment period prior to filing the plan with the Commission for approval.

Our Analysis

Monitoring recreation use would document whether or not project visitor needs are being met and would identify recreation use-related effects. The schedule and monitoring elements proposed are consistent with the Commission's regulations related to filing Form 80 recreation use reports at 6-year intervals (18 CFR §8.11) and would provide adequate information for reporting use, adjusting recreation management actions (e.g., implementation schedule for facility development), and determining whether a Recreation Facilities Plan revision is necessary. Consulting with BLM would ensure agency coordination to protect environmental and cultural resources on federal land when constructing, operating, and maintaining recreation facilities. Providing recreation monitoring results to the California Department of Parks and Recreation, California DFW, and FWS in addition to BLM, providing additional input opportunities regarding potential recreation needs, consulting with these agencies, and FWS regarding plan revisions affecting non-federal land would enable input from these agencies to be considered during the plan revision and approval process.

Reservoir Level, Flow Information, and River Access Signage at Crocker-Huffman Diversion Dam

Reservoir levels and quantity of flow influence access, visitor satisfaction, and recreational use (e.g., watersports). Enabling visitors to know current reservoir levels and flows would allow them to know whether conditions are suitable for their activities and, if necessary, make alternative plans. To address this need, Merced ID would continue to provide a link on its website to California DEC where the following real-time information is provided: (1) levels of Lake McClure and McSwain reservoir; (2) Merced

River downstream of Merced Falls; (3) Dry Creek near Snelling; (4) Merced River near Snelling; (5) Merced River at Cressey; and (6) Merced River near Stevinson. In addition, Merced ID would coordinate with California DWR to provide real-time flow for Merced River at Shaffer Bridge (USGS gage no. 11271290). If it is not possible to show the real-time flow at Shaffer Bridge, Merced ID would show this information on its website.

Merced ID would construct a parking area with an unspecified capacity and install river access directional signage at the existing gravel-surfaced parking area at Merced Falls Road near Crocker-Huffman diversion dam.

Our Analysis

Providing real-time, reservoir-level information would allow visitors to the project to know whether conditions are suitable for their planned activities. If necessary, visitors could adjust their destination or schedule to have more enjoyable trips that meet their expectations.

Providing flow information would allow visitors using the Merced River downstream of the project to determine whether flow conditions are suitable for their planned activities. Because Merced ID measures flow downstream of the project, it would likely be straightforward for Merced ID to provide this information to the public. However, because this reach of the Merced River is outside of the project, it would not enhance project recreation use. Similarly, providing a parking area near Crocker-Huffman diversion dam would improve access for non-project recreational use downstream of the project.

Lake McClure Water Surface Elevation

Reservoir water-surface elevations are a key factor in the functionality of boat ramps. As the reservoir level falls below the end of the surfaced ramp, boating access to the project reservoir can be limited when launching requires using the exposed shoreline that has unsuitable slope, rocks, and mud. Merced ID proposes to minimize this effect of reservoir drawdown by committing to make a good faith effort to maintain the water surface elevation of Lake McClure as high as possible from April through October and to provide a minimum pool of no less than 115,000 acre-feet, which equates to a lake level elevation of about 640 feet, except when necessary to maintain minimum streamflows.

Our Analysis

The content of the proposed measure is the same as license article 44 of the existing license. If the project were operated the same as it is currently operated, the effects on the boat ramps would be the same as those which currently exist—three of the five ramps function year-round in all water year types, one ramp functions year-round in below normal, above normal, and wet water year types, and one ramp functions year-round in only above normal and wet water year types. However, it is likely the “high as possible” elevation would be lower because more water would need to be released to meet generally higher proposed instream flow requirements. Similarly, the reservoir may

more frequently fall below the target minimum pool elevation. It is not possible to quantify the effect on boat ramp availability because the measure is not a compliance target. However, any decreased availability would be temporary and minor and would affect only some of the boat launches because several boat ramps are functional even at low reservoir elevations. Providing real-time reservoir elevation information, as Merced ID proposes, would let visitors know whether conditions are suitable for their trip, further minimizing any potential effect of reservoir drawdowns.

McSwain Reservoir Minimum Water Level

To address the effects of potential reservoir drawdown on boating access for McSwain reservoir, Merced ID proposes to make a good faith effort to operate the reservoir at an elevation no lower than 388 feet, except when necessary to maintain minimum streamflows or make repairs.

Our Analysis

It is not possible to quantify the effect on boat ramp availability because the measure is not a compliance target. The minimum reservoir elevation specified in the proposed measure should allow the boat ramp to remain functional, except when additional water may be needed to meet increased minimum flow requirements or make repairs. However, if the reservoir level declines below elevation 388 feet, the public could not use the only boat ramp at this reservoir, although it still may be possible to launch car-top boats. The cyclic reservoir fluctuations combined with possibly drawing down the reservoir below elevation 388 feet has the potential to strand boaters on the reservoir. Although this circumstance may only occur infrequently, the effect could be minimized by closely monitoring project operation and posting information at the boat ramp when circumstances exist that could potentially cause the boat ramp to be unavailable. Providing real-time reservoir elevation information, as Merced ID proposes, would also let visitors know whether conditions exist, or potentially exist, that could affect boat ramp availability.

Fish Stocking

Merced ID proposes to annually stock both Lake McClure and McSwain reservoir at historic levels. Specifically, Merced ID proposes to stock the following in Lake McClure: 32,000 to 70,000 catchable-size rainbow trout with a 5-year running average target number of 48,000 fish; 4,000 to 20,000 fingerling kokanee with a 5-year running average target number of 15,000 fish; and 35,000 to 75,000 fingerling Chinook salmon with a 5-year running average target number of 45,000 fish. In McSwain reservoir, Merced ID proposes to stock 1,000 to 2,000 catchable-sized rainbow trout with a 5-year running average target of 1,500 fish. Merced ID states it would consult with California DFW and use angler data from recreation monitoring to make decisions on stocking throughout the term of the license.

California DFW recommends Merced ID provide 55,000 pounds of hatchery salmonids to be stocked at the project reservoirs in the first two years of license issuance.

In addition, California DFW recommends Merced ID develop a fish stocking plan for Lake McClure and McSwain reservoir, in consultation with California DFW and BLM, to include the annual funding of stocking in project reservoirs and annual consultation on fish stocking targets, fish species, acquisition of fish, and verification of the previous year's stocking commitment.

The Water Board specifies in preliminary WQC condition 16 that Merced ID develop and submit a fish stocking plan in consultation with the anadromous fish committee that it specified in its preliminary WQC condition 1 within 3 months of license issuance. In addition, the Water Board specifies Merced ID stock 32,000 to 70,000 catchable-sized fish and 39,000 to 95,000 fingerlings in Lake McClure and 1,000 to 2,000 catchable-sized rainbow trout in McSwain reservoir starting the first year of the new license term. The fish used to stock should be only native cold water species and should come from facilities free of invasive species.

The Conservation Groups recommend Merced ID stock Lake McClure with 444,600 to 973,000 Southern Sierra Nevada DPS watershed genetically-compatible fingerling rainbow trout with a 5-year running average target number of 667,200 fish and 40,000 to 90,000 fingerling Central Valley spring-run Chinook salmon evolutionary significant unit with a 5-year running average target number of 60,000 fish. In addition, the Conservation Groups recommend Merced ID stock McSwain reservoir with 1,000 to 2,000 genetically catchable-sized rainbow trout with a 5-year average target number of 1,500 fish.

Our Analysis

Angling is one of the primary recreational activities associated with the project. Stocking fish in both Lake McClure and McSwain reservoir would ensure that the recreational fishery is maintained for the term of the new license. Although PG&E's proposal to stock both project reservoirs at historic levels would ensure the recreational fishery is maintained, the demand for angling at the project is projected to increase over the term of the new license. Both California DFW and the Water Board's proposals for stocking numbers in Lake McClure and McSwain reservoir are comparable to PG&E's proposed stocking numbers; the Conservation Groups proposed stocking numbers for Lake McClure seems excessive in comparison. It is difficult to determine if any of these stocking numbers would be adequate for the duration of the license. Developing a fish stocking plan would address fish stocking in Lake McClure and McSwain reservoir based on changes in recreational use, angling demand, availability of hatchery fish, and future California DFW fish stocking management targets. The plan would include annual consultation with California DFW, the Water Board, and other appropriate stakeholders to determine fish species, stocking numbers, and sizes and it would provide the flexibility to increase or decrease stocking numbers, change fish stocking sizes, and change the frequency of annual consultation. The plan would also include stipulations for the acquisition of fish (e.g., native, cold water species from facilities free of invasive species).

Although the responsibility of fish stocking is mandated to California DFW by California law, we note that Merced ID is ultimately responsible for the management of all project reservoirs and would be responsible for the stocking of fish if required under a new license.

Operation, Maintenance, and Administration

BLM preliminary 4(e) condition 21 specifies that within 90 days of license issuance, Merced ID enter into an operation and maintenance agreement to provide annual funding in a contributed funds account set up by BLM to be used to offset operation, maintenance, management, and administration costs incurred while managing public use of BLM-administered lands in and around the project.

Our Analysis

It is appropriate for Merced ID to be responsible for operating and maintaining the facilities that support project recreation to provide safe and adequate public recreation facilities. Although BLM specifies Merced ID enter into an operation and maintenance agreement to provide funding for the agency to operate and maintain BLM-administered lands in and around the project, this mechanism would not relieve Merced ID of its responsibility to maintain project facilities at the project. Further, it is unclear how these funds would accomplish a project purpose or improve a project effect. Although the proposed funding is meant to offset operation, maintenance, and management costs, the Commission has no way of ensuring these funds would be used for project operation or maintenance activities.

Off-road Vehicle Access at Piney Creek

BLM specifies in preliminary condition 23 that within 1 year of license issuance Merced ID identify and map where ORV roads are and where they enter public land, whether road closure is feasible, determine physical road closures and signage where closure is not feasible, and provide law enforcement assistance to enforce road closures.

Merced ID's proposal is consistent with BLM preliminary 4(e) condition 23, but limits ORV road closures at Piney Creek to ORV roads located on lands administered by BLM within the project boundary.

Our Analysis

BLM specifies the implementation of ORV road closures and signage at Piney Creek to prevent ORV access. Implementing road closures and installing signage would benefit project resources by preventing ORV use in undesignated areas, which can affect vegetation, habitats, and potentially, cultural resources. Although Merced ID proposes limiting ORV road closures to roads within BLM-administered lands, implementing these measures on all project lands at Piney Creek would stop further erosion and would ensure continued protection of the affected resources at the project in the area of Piney Creek.

Merced Falls Project

PG&E proposes no changes to the operation and maintenance of the Merced Falls' project recreation facilities, including River's Edge Fishing Access area and the car-top boat launch at Merced Falls Fishing Access area. PG&E would continue to allow free access to project waters. Monitoring recreation use and facility capacity levels would continue through the FERC Form 80 process every 6 years.

Our Analysis

A number of formal and informal recreation sites exist at the Merced Falls impoundment. PG&E maintains the River's Edge Fishing Access area and its associated sites, but there is also an informal angler trail along the northern shoreline and two informal parking areas on either side of the Hornitos Bridge. Although Merced ID maintains the majority of facilities at the Merced Falls Fishing Access area (restroom and parking area), recreationists depend on the other facilities at Merced Falls Fishing Access area to access the car-top boat launch.

The Recreation Resource Report (PG&E, 2011b) notes that the parking facilities at Merced Falls Fishing Access area need repair. Specifically, the parking area is gravel with some potholes and could be graded or resurfaced to provide an improved surface for physically challenged recreationists. PG&E proposes to continue to operate and maintain the car-top boat launch; however, there is no assurance that the rest of the facilities at the Merced River Fishing Access area, or any of the informal recreation sites at the Merced Falls impoundment, would be maintained or remain accessible to the public over the term of a new license. While overall use at the project is low compared to upstream projects, recreation use⁵⁴ is robust enough that access to both formal and informal recreation facilities at the project should be maintained. All the facilities are located within the project boundary and PG&E ultimately would be responsible to operate and maintain them for the term of a new license. Further, PG&E's proposal to continue to monitor visitor use and facility capacity levels through the FERC Form 80 process would help assess changes in recreational use and capacity at these facilities and ensure adequate recreation opportunities are provided over the term of a new license.

Canoe Portage Trail

PG&E proposes to work with stakeholders to develop signage at the canoe portage trail to enhance safety for boaters using the site.

The Conservation Groups propose that PG&E maintain the canoe portage trail around the south end of Merced Falls dam, including developing signage at the trail.

⁵⁴ Recreation use estimates from the Recreation Resource Report (PG&E, 2011b) visitor count suggest that with a recreation season lasting from May 1 to September 30 (152 days), the project supported approximately 3,040 days in 2010.

Our Analysis

The canoe portage trail around the south side of Merced Falls dam receives low to moderate use. PG&E maintains the relatively low quality of the boating experience at the project and the availability of other similar reaches in central California do not justify the cost to improve access below Merced Falls dam. PG&E believes that providing formal access to the downstream area below Merced Falls dam would likely require an easement across private property, which could entail a significant cost.

Currently, boaters are forced to portage around the south side of the dam on private property to access the stream reach below Merced Falls dam. PG&E notes that obtaining an easement would be a significant cost, however, it provides no evidence or cost estimates to formalize this undeveloped area (approximately 1,000 square feet) adjacent to the project. Formalizing the canoe portage trail and adding directional signage would ensure boaters have a clear and safe passageway around the dam and would decrease the chance of boaters unintentionally trespassing on private lands.

McSwain Tailrace

Merced ID's application for the McSwain Project notes that there is an existing recreational facility at the McSwain tailrace for the Merced Falls Project. Although it cannot find supporting documentation, Merced ID states that PG&E constructed a small car-top boat launch that provides access to the Merced Falls impoundment. To ensure this facility continues to be available for public use, Merced ID proposes to assume operation and maintenance responsibility under the terms of an off-license agreement (Merced ID, 2013b).

Our Analysis

Little is known about this recreation site's current use, facilities, and condition because it was not included in the Recreation Resource Report (PG&E, 2011b) nor was it included in PG&E's license application. An existing road, owned and maintained by Merced ID, located on the north side of the Merced Falls impoundment provides access to the tailrace water of McSwain powerhouse. However, Merced ID states that it does not currently use, and has not used, the road for project operation or project-related recreation for the McSwain Project.

The need for this area as a specific recreation site is also questionable. Considering current use levels and the location of this recreation site near the Merced Falls Fishing Access area, this area may best serve the project as an informal public access. However, more information is needed to determine if a car-top boat launch does exist and if it is located within the Merced Falls Project boundary.

Fish Stocking

California DFW recommends that PG&E provide 11,000 adult-sized rainbow trout to be stocked at the Merced Falls impoundment for the first 2 years after license issuance.

California DFW further recommends a fish stocking plan be developed for the Merced Falls impoundment for the rest of the license term. PG&E supports this recommendation.

Our Analysis

Angling is one of the most popular activities at the Merced Falls Project. According to the Recreation Resource Report (PG&E, 2011b), 92 percent of respondents reported fishing as their primary activity at the project. Stocking 11,000 adult-sized rainbow trout in the Merced Falls impoundment for the first 2 years after license issuance would allow PG&E to continue to provide angling opportunities at the project without disruption while PG&E develops a fish stocking plan with California DFW for the rest of the license term.

3.3.5 Land Use

3.3.5.1 Affected Environment

Merced River Project

Overview

Land ownership within the project boundary is composed of federal land administered by BLM and land owned by Merced ID, and other private entities (table 3-25).

Table 3-25. Land ownership in the project boundary (Source: Merced ID, 2012b).

Development	Merced ID (acres)	BLM (acres)	Private (acres)	Total (acres)
New Exchequer	7,577.5	3,134.7	13.2	10,725.4
McSwain	907.5	20.2	0	927.7
Total	8,450.0	3,154.9	13.2	11,653.1

BLM administers public land at two of the project recreation areas—McClure Point and Horseshoe Bend. The marina access road and parking area for McClure Point recreation area are located on public land, and nearly all of the land, including the land underlying the developed recreation facilities at the Horseshoe Bend recreation area, is administered by BLM.

Mariposa County

All land within the existing project boundary is located within Mariposa County. The project includes a few small facilities located in Merced County, such as conduits for delivering water to the Merced NWR, but these are not located within the project boundary.

Land use within Mariposa County is varied and classified for either public or private use. Three broad areas of land use characterize the existing land use pattern in Mariposa County. In the eastern part of the county, federal land associated with Yosemite National Park dominates the land use pattern. In the western part of the county, where the project is located, land is primarily used for agricultural purposes. The remainder of the county is home to rural residential areas and small communities with commercial and industrial uses and high-density housing. Of the county's approximate 931,200 acres of land, 57 percent of this land is public land that encompasses Yosemite National Park, the Sierra and Stanislaus National Forests, and BLM-managed lands. Private land use accounts for about 43 percent of the land within the county.

Public land in Mariposa County is not subject to county jurisdiction. Mariposa County manages private land use to comply with the Mariposa County General Plan and county zoning ordinances. The Mariposa County General Plan has five land use categories, four of which are applicable to the project (table 3-26).

Table 3-26. Mariposa County land use categories applicable to land located in the vicinity of the Project (Source: Merced ID, 2012a).

Land Use Category	Description
Agriculture/Working Landscape	Lands for production, extraction, or harvesting of food, fiber, timber, and minerals on large parcels of 160 acres or larger.
Natural Resources	Lands for open space, recreation, ecosystem conservation, watershed protection, environmental protection, conservation of natural resources and protection of health and safety.
Planning Area	Special planning areas for which area plans are adopted by the board of supervisors. These are mini-general plans adopted to meet the needs of each town, community, or uniquely identified special area of the county. The nearest such area to the project is the Lake Don Pedro Town Planning Area. ^a
Residential	Lands for single family dwellings outside the Planning Area land use classification.

^a A Lake Don Pedro Town Plan has been proposed for the Lake Don Pedro subdivision located south of the project. There is no current information pertaining to when the Lake Don Pedro Town Plan may be approved and implemented. All lands that would be included in this Town Plan are currently categorized as Planning Study Area.

To the southwest of Lake McClure and around McSwain reservoir, land is designated as agriculture/working landscape. On the north, east, and west of Lake McClure and upstream along the Merced River, land is designated as Natural Resources land. Land along the northern half of the west shore of Lake McClure is designated as a planning study area; the area includes part of the Lake Don Pedro Town Planning Area, a

planned residential area. The town of Coulterville just northeast of Lake McClure is also designated as a Town Planning Area, with residential land use and rural-scale development of “urban” center amenities to serve community needs. West of the project in the San Joaquin Valley lies an extensive network of irrigation canals, predominantly for agricultural and rural residential uses.

Public Land

A portion of the project is located on BLM-administered land and is managed as part of the Sierra Resource Management Area, which encompasses approximately 230,000 acres in 16 counties, primarily in the foothills of the Sierra Nevada mountain range between Yuba and Mariposa Counties. BLM manages the Sierra Resource Management Area in accordance with the Sierra Resource Management Plan (BLM, 2008). The Sierra Resource Management Plan identifies ACECs—areas of federal land where special management attention is required to protect relevant and important natural or cultural resource values. As shown in figure 3-42, three separate ACECs are located near the project: (1) Merced River, (2) Bagby Serpentine, and (3) Limestone Salamander, and were designated for the following purposes:

- Merced River ACEC—maintain consistency with Merced River’s designation as a Wild and Scenic River;
- Bagby Serpentine ACEC—protect the Henneke soil series and serpentine endemic species; and
- Limestone Salamander ACEC—promote the recovery of listed species and improve the status of candidate and special-status species to eliminate the need to officially list these species.

No special land use restrictions apply, at this time, to the Bagby Serpentine ACEC. BLM’s conservation strategy for the limestone salamander specifies the following guidance regarding activities in the Limestone Salamander ACEC: (1) prevent all surface-disturbing activities that would alter or degrade confirmed or potential limestone salamander habitat on BLM-managed lands; (2) maintain vegetative cover in the ACEC within specification outlined in the Management Plan for the Limestone Salamander Area of Critical Environmental Concern; and (3) identify additional limestone salamander occurrences and consolidate BLM holdings within the species’ range and adjust ACEC boundaries as necessary.

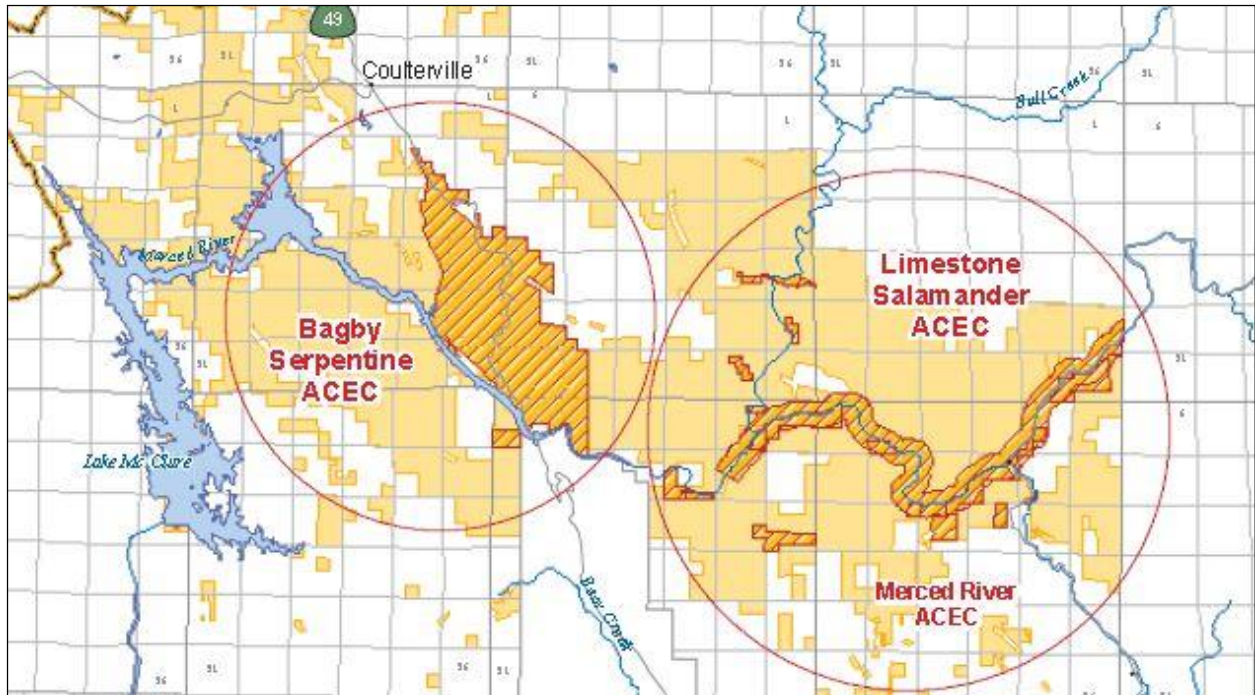


Figure 3-42. Areas of critical environmental concern identified in Sierra Resource Management Plan (Source: BLM, 2008).

Specially Designated Areas at and near the Project

The main stem of the Merced River is a designated Wild and Scenic River from its sources—Red Peak Fork, Merced Peak Fork, Triple Peak Fork, and Lyell Fork on the south side of Mount Lyell in Yosemite National Park—downstream to the NMWSE of Lake McClure (elevation 867 feet). The South Fork Merced River is a designated Wild and Scenic River from its source near Triple Divide Peak in Yosemite National Park to the confluence with the main stem. Section 3 of Public Law 102-432 provides that Merced River’s Wild and Scenic River designation shall not affect the continued operation and maintenance of the project, including flood control operation, or the Commission’s authority to issue a new license for the project within the existing project boundary. Individual segments of the main stem and South Fork Merced River are managed by the Park Service, the Forest Service, or BLM. BLM manages the segment immediately upstream of the project extending to about 4 miles upstream of Briceburg under its Merced Wild and Scenic River Management Plan (BLM, 1991). By agreement with the Park Service and the Forest Service, BLM manages all commercial whitewater use of the Merced River between El Portal and Bagby.

No wilderness areas or National Scenic trails are located in the vicinity of the project.

Shoreline and Water Surface Management

Merced ID does not have a formal shoreline buffer zone policy for project reservoirs. Merced ID-owned and privately owned lands on project reservoir shorelines are managed in accordance with the Mariposa County General Plan. Federally owned lands along project reservoir shorelines are managed in accordance with BLM policies. Similarly, Merced ID does not have a formal written shoreline policy for permitting shoreline facilities (e.g., docks, piers, and bulkheads) on the project reservoirs, except to allow such development when it is consistent with Merced ID's operational requirements, public safety, project recreation and other resource management plans, and compliance with all federal, state, and local regulations.

Merced ID regulates houseboating on Lake McClure using a permit system and guidance provided in its Lake McClure houseboat policies (Merced ID, 2010b). The houseboat policy requires that houseboat permit holders conduct self-inspections. In 2008, Merced ID reported 241 permits had been issued for houseboats on Lake McClure.

Wildland Fire Prevention and Suppression

Merced ID is unaware of any project-caused fires in the past 15 years, and it does not have a formal policy regarding fire prevention and suppression. If a fire were to occur at the project, Merced ID would notify appropriate emergency response agencies. Merced ID implements fire prevention measures (e.g., keeping available onsite shovels, water, and radios) when completing project work on BLM-administered land at the project. When burning project-related debris, Merced ID acquires permits and approvals from appropriate agencies and complies with any project-specific measures (e.g., burning during a certain time of day or year) that may be specified as part of a required permit.

Law Enforcement

Law enforcement at the project reservoirs and recreation facilities is shared between Mariposa County Sheriff's Department and Merced ID. Funding for the Mariposa County sheriff's deputies to patrol and enforce the laws and regulations on the water at Lake McClure and McSwain reservoir is provided by California Department of Boating and Waterways. Mariposa County Sheriff's Department deputized the Merced ID's Parks Department rangers to provide law enforcement at the project's land-based recreational facilities. However, rangers are not permitted to carry fire arms, and they rely on the Mariposa County Sheriff's Department to respond to more serious incidents and violations.

The response time of the Mariposa County Sheriff's Department to the project ranges from 30 to 60 minutes, depending on the location of the incident. Travel time from the lower elevation area of the project (McSwain reservoir) to the highest elevation area (Bagby recreation area on Lake McClure) is approximately 22 miles or 30 minutes by road. Law enforcement issues at the project reservoirs are frequently related to

alcohol use (e.g., fights or loud noise from parties during quiet hours) graffiti, and occasionally weapons.

Project Access

Merced ID uses federal, state, county, and private roads to access the project. Vehicular access to McSwain dam and powerhouse and New Exchequer dam and powerhouse is by way of several Merced ID-owned roads that intersect Lake McClure Road. Lake McClure Road is within the project boundary from its intersection with County Road J16 to its terminus inside McClure Point recreation area. Project access roads that intersect Lake McClure Road include McSwain powerhouse access road, Village Drive, and Exchequer dam road.

Merced Falls Project

The Merced Falls Project is located on the border of Merced and Mariposa Counties. The county line bisects the project about midway through the Merced Falls impoundment nearly adjacent to the Hornitos Bridge. The total area within the existing project boundary is 75.6 acres, including 1.0 acre of federal land (table 3-27).

Table 3-27. Land ownership in the project boundary (Source: PG&E, 2012).

Land Ownership	Acres
Federal (BLM) ^a	1.0
Patented privately owned lands	54.1
Licensee-owned lands	20.5
Total	75.6

^a Ownership of this land is uncertain due to an unresolved determination of navigability on the Merced River. See 45 FR 75214 (November 14, 1980). PG&E has been and intends to continue to assume these are federal lands, and to pay annual federal land charges thereon.

Within Mariposa County, the project is located on agricultural/working landscape designated lands. The goal of this land use designation is to maintain the economic use of the land, as well as the scenic and open space functions.

Within Merced County, the project is located on agricultural designated lands. The agricultural designation serves to support productive agricultural lands and promote the agricultural industry.

The nearest community to the project is Snelling, which is a small, unincorporated community in Merced County approximately 6 miles west of the project. The nearest incorporated community is the city of Merced, located approximately 24 miles southwest of the project.

3.3.5.2 Environmental Effects

Merced River Project

Project Boundary Adjustments

Merced ID proposes to adjust the project boundary to: (1) include land where the proposed Mack Island non-motorized recreation area would be located; (2) include the main access road to McSwain powerhouse; and (3) exclude land in the vicinity of McSwain dam.

Our Analysis

In accordance with regulation, the project boundary must enclose all principal project works and lands necessary for operation and maintenance of the project and other project purposes, such as recreation, shoreline control, or protection of environmental resources (18 CFR §4.51). Including land in the project boundary where the non-motorized recreation area would be located would ensure that the Commission would have the oversight necessary to require Merced ID to provide adequate public recreational access and use of these lands. Because the access road leading to McSwain powerhouse serves this sole purpose, it is, by definition, a project road and should be located within the project boundary to comply with Commission regulations. Merced ID's proposal would add 215.59 acres for the recreation area and 1.06 acre for the road to McSwain powerhouse.

Removing lands from the project boundary is appropriate in situations where the land is not necessary for project operation and maintenance, including recreational purposes. Merced ID's proposal would remove land in the vicinity of McSwain dam from the project boundary as shown in figure 3-43.

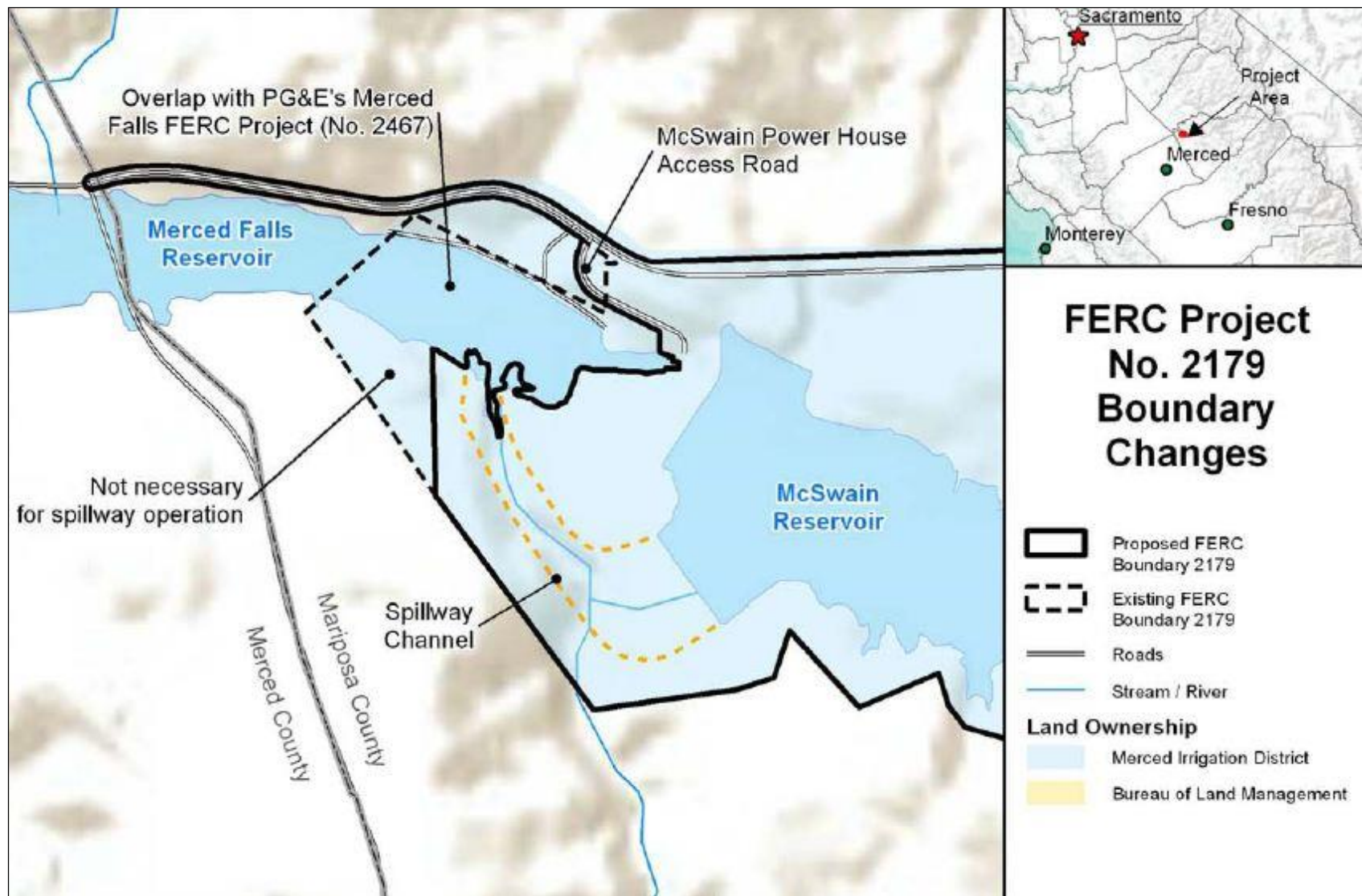


Figure 3-43. Land proposed for exclusion from the project boundary (Source: Merced ID, 2012a, Exhibit G)

Adjusting the boundary in the vicinity of McSwain powerhouse access road would remove about 30 acres of land that is also included in the Merced Falls Project boundary. An Merced ID-owned and maintained road, which is located on the north side of Merced Falls reservoir, provides access to the tailwater of McSwain powerhouse and one of several non-project related river access sites operated and maintained by Merced ID. Merced ID states that it does not currently use, and has not used, the road for project operation or project-related recreation, so Merced ID does not consider it to be a project road. Although it cannot find supporting documentation, Merced ID states that PG&E constructed a small car-top boat launch that provides access to Merced Falls reservoir. To ensure this facility continues to be available for public use if the land is removed from the Merced River Project boundary, Merced ID proposes to assume operation and maintenance responsibility under the terms of an off-license agreement (Merced ID, 2013b). Removing the road from the project boundary would remove the Commission's oversight of this area regarding recreational access to the project tailwater. However, because the road primarily provides access to Merced Falls reservoir (FERC Project No. 2467), public access to the project tailwater would continue to be the responsibility of the Merced Falls licensee.

Merced ID proposes to remove some of its land along the Merced Falls reservoir shoreline from the project boundary. Merced ID leases this land for grazing and there are no project uses or project access on this parcel of land. This land lies within the Merced Falls Project boundary. If this land were removed from the Merced River Project boundary, Merced ID would still have sufficient access to operate and maintain the project. Public access for recreational use at the project would not be diminished because it is not adjacent to the project reservoir or any project recreation facility.

Management of Project-related Roads

Merced ID proposes to implement its proposed Transportation Management Plan filed on September 22, 2014, to provide guidance for rehabilitating and maintaining project roads.⁵⁵ The plan identifies and includes a map of six asphalt-surfaced project roads for a total of 12.9 miles, all of which are located on Merced ID-owned land. The plan does not address roads within project recreation areas because these roads are addressed in the Recreation Facilities Plan. The plan provides a programmatic approach for inspecting and maintaining the six roads and states that unspecified BMPs for road maintenance would be used to guide treatments and protect environmental resources.

The Water Board specifies in preliminary WQC condition 21 that Merced ID develop a Transportation Management Plan within 1 year of license issuance to include:

⁵⁵ Roads within the project boundary that MID primarily uses to operate and maintain the project.

- a map identifying all roads associated with the project, appurtenant facilities, and locations of drainage structures, streams, surface water bodies, ephemeral and intermittent waters, wetlands, and equipment storage and service areas;
- a road inventory to address project use and non-project use of the roads, condition surveys, associated facilities, improvement needs, road closures, and safety, jurisdiction, and maintenance responsibilities; and
- an annual road monitoring and maintenance report to include conditions of roads, conditions of drainage structures and runoff patterns after major storm events, measures to improve performance in comparison to the Forest Service's National BMPs Road Management Activities, and a schedule for repair.

Our Analysis

In its letter to Merced ID dated June 13, 2012, Commission staff identified several inadequacies in the Transportation Management Plan filed with the final license application. Specifically, staff requested Merced ID to:

- revise table 2.2-1 in the plan to include all roads that provide access to project recreation facilities and identify each project facility accessed by all project road;
- revise table 2.2-1 to provide the number of lanes, road width, and buffer widths that extends to the project boundary, as appropriate, and indicate whether each road is open for public use and if there is any shared use;
- for any roads not open to the public, show gate locations on figure 2.2-1 of the plan; and
- revise the plan to include whether or not Merced ID proposes to add or remove any project roads from the existing project boundary and if Merced ID proposed to upgrade or change the level of public access for any existing project road.

Commission staff requested that Merced ID revise and refile the plan. In its response to the Commission dated October 10, 2012, Merced ID (2012e) stated it would revise and refile the plan to include the requested information and include an additional road segment. While Merced ID revised and refiled the plan on September 22, 2014, to include a list of roads within project recreation areas, the plan continues to lack adequate content for Commission approval.

The transportation plan adequately identifies the six project roads that provide primary routes of access for operating and maintaining the project, including access to the existing and proposed recreation areas. In addition to lacking sufficient content for Commission approval, it does not include any details regarding the road condition survey

frequency, describe any approach for monitoring use over the term of the license, or identify BMPs that would be implemented, also specified by the Water Board in preliminary WQC condition 21. Because the plan does not include sufficient information, it is uncertain whether project roads would continue to meet needs for public recreational access. Although the Water Board specifies that the plan should use the Forest Service BMPs for guidance, no project roads are located on Forest Service land. In its response to comments, Merced ID stated it would use Merced County, Mariposa County, and/or BLM's BMPs to identify road treatments to improve road performance. Including an inventory of current road conditions, measures to improve conditions according to relevant local, county and BLM BMPs, and an approach to monitor use over the term of the license would address the level of access that would be maintained through proper annual and long-term maintenance of project roads.

Fire Prevention and Response

Merced ID proposes to implement its Fire Prevention and Response Plan, as filed with the final license application and revised on September 22, 2014, to provide fire prevention measures, reporting, and safe fire practices for Merced ID and its contractors to follow when operating and maintaining the project. The plan identifies the various agency plans and regulations that Merced ID referenced to prepare the plan, provides the fire history on lands in the vicinity of the project, and identifies the state and federal laws and regulations with which it would comply when operating and maintaining the project. Elements of the plan include descriptions of Merced ID's actions, responsibilities, and access related to wildland fire preparedness and reporting, including:

- equipment and tools for Merced ID staff and job sites;
- fire index monitoring and activity curtailment, as appropriate;
- debris burning;
- vegetation clearance;
- communication systems;
- access routes to recreation areas and helicopter landing areas;
- fire investigation; and
- emergency contact information.

Based on Merced ID's ignition analysis, the plan also includes fire prevention education and signage at recreation facilities. The plan would be reviewed and potentially revised in consultation with BLM and the California Department of Forestry and Fire Protection during the license term on an unspecified schedule. Merced ID would provide the revised plan to the agencies for a minimum 60-day review period before filing it with the Commission for approval.

Merced ID's proposed Fire Prevention and Response Plan is consistent with BLM preliminary 4(e) condition 25; however, BLM specifies that Merced ID obtain BLM approval of the plan before filing it for Commission approval.

Our Analysis

By implementing its Fire Prevention and Response Management Plan, Merced ID would improve planning for and management of wildfires and improve the coordination of wildfire protection and prevention measures that could reduce wildfire occurrence in the vicinity of the project. Provisions in the plan and consultation with BLM and the California Department of Forestry and Fire Protection could also improve suppression efforts, thereby minimizing damage caused by wildfires that may occur in the project vicinity. Because fire-related circumstances would likely change over the term of a new license, it would be appropriate to periodically review the plan, as Merced ID proposes, to determine if the plan should be revised.

Merced Falls Project

There are no construction or land use changes proposed in the new license application. However PG&E does propose to modify the project boundary. The proposed modifications would change the current project boundary area from 75.6 acres to 70.8 acres (see figure 3-44). The changes would remove 4.8 acres of land from the project boundary on the northeastern shoreline of the Merced Falls impoundment. PG&E states these lands are not needed for project purposes.

Our Analysis

The project boundary must enclose all principal project works and lands necessary for operation and maintenance of the project and other project purposes, such as recreation. PG&E states that these lands are not needed for project purposes; however, in section 3.3.4, *Recreation Resources*, we note that recreation features that serve the Merced Falls Project are located on the lands proposed for removal. More specifically, portions of the Merced Falls Fishing Access area and the informal angler trail may be within the lands proposed for removal. If these lands are deemed necessary for project recreation, then the proposed project boundary changes would need to be modified to ensure adequate public access to these lands over the term of a new license.

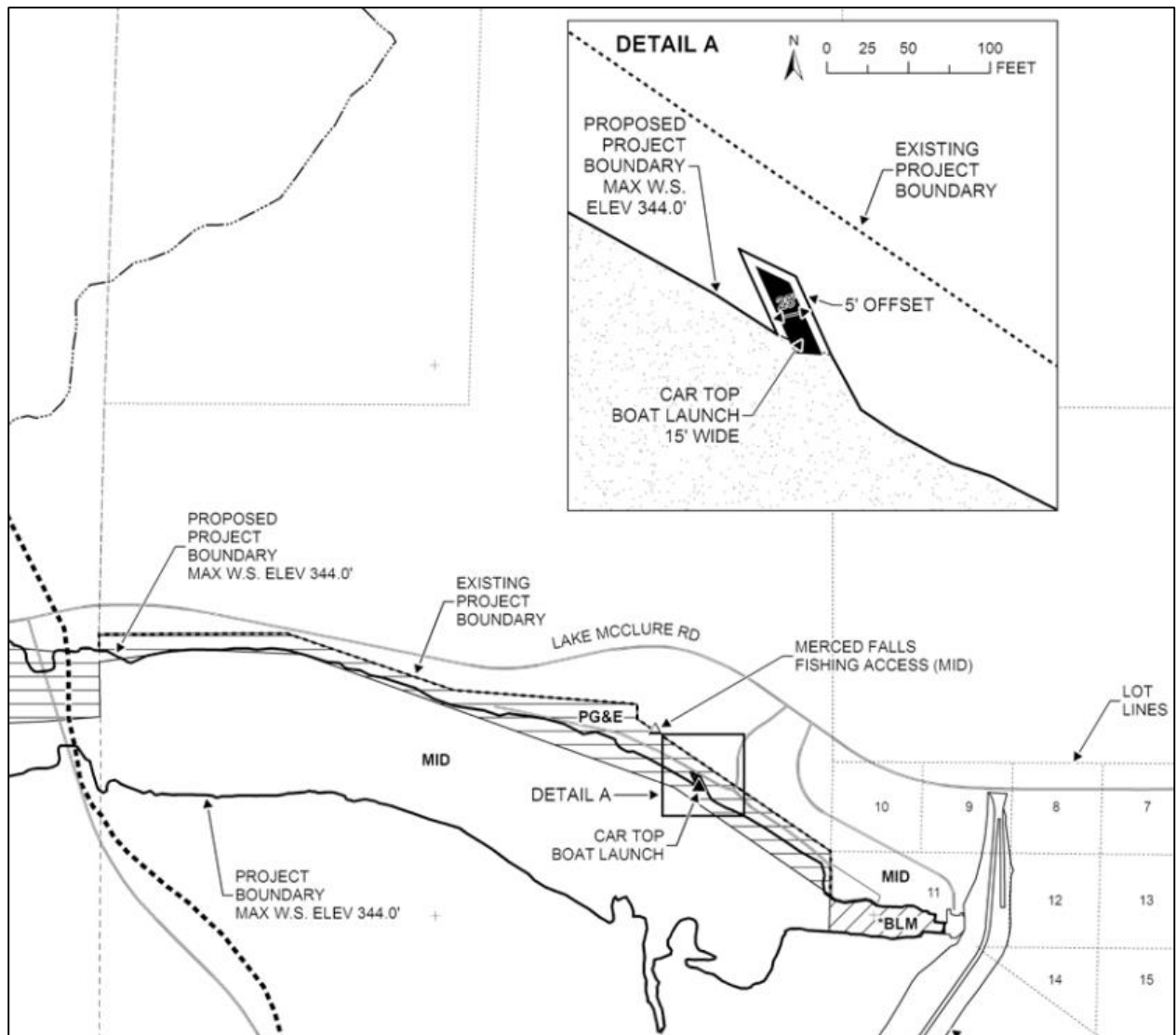


Figure 3-44. Map of proposed project boundary changes (Source: PG&E, 2012).

3.3.6 Cultural Resources

3.3.6.1 Affected Environment

Section 106 of the NHPA, as amended, requires the Commission to take into account the effects of licensing a hydropower project on properties listed or eligible for listing in the National Register and allow the Advisory Council on Historic Preservation (Advisory Council) a reasonable opportunity to comment if any adverse effects on historic properties are identified within the project's APE.

Historic properties are defined as any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. In this document, we also use the term "cultural resources" to include properties that have not been evaluated for eligibility for listing in the National Register. In most cases, cultural resources less than 50 years old are not considered eligible for the National Register. Cultural resources need enough internal contextual integrity to be considered historic properties. For example, dilapidated structures or heavily disturbed archaeological sites may not have enough contextual integrity to be considered eligible. TCPs are a type of historic property eligible for listing in the National Register because of their association with cultural practices or beliefs of a living community that: (1) are rooted in that community's history or (2) are important in maintaining the continuing cultural identity of the community (Parker and King, 1998). Section 106 also requires that the Commission seek concurrence with the California SHPO on any finding involving effects or no effects on historic properties. If TCPs have been identified, section 106 also requires that the Commission consult with interested Native American tribes that might attach religious or cultural significance to such properties.

If existing or potential adverse effects have been identified on historic properties, license applicants need to develop an HPMP to seek to avoid, reduce, or mitigate the effects. Potential effects that may be associated with a hydroelectric project include any project-related effects associated with the day-to-day operation and maintenance of the project after issuance of a new license. During development of an HPMP, the applicants should consult with the Commission, Advisory Council, California SHPO, Native American tribes, and BLM. In most cases, the HPMP would be implemented by execution of a PA that would be signed by the Commission, Advisory Council (if it chooses to participate), the California SHPO, and other consulting parties.

Cultural History Overview

Researchers have attempted to identify prehistoric temporal sequences for the vicinity of the Merced River and Merced Falls Projects based on differing artifact assemblages that indicate adaptations to environmental and other changes. Two primary sequences have been defined: the Yosemite Archaeological Sequence and the Chowchilla River Archaeological Sequence. These sequences are both associated with the Sierra Miwok, Central Miwok, and Foothill Yokuts people.

The Yosemite Archaeological Sequence has been divided into three primary complexes. During the period associated with the Crane Flat Complex (1,000 Before Christ [BC] to 500 Anno Domini [AD]), resident populations had not yet taken up bow and arrow technology and used the atlatl (i.e., a spear thrower) for hunting purposes. The atlatl used Elko-like projectile points typically manufactured from obsidian obtained from local sources. Groundstone tools included metates and handstones, but the use of mortars and pestles was not widespread. During the period associated with the Tamarack Complex (500–1200 AD), projectile point size decreased, indicating a possible change in technology from the atlatl to use of the bow and arrow. During this time, an increase in acorn processing is evidenced by the presence of more bedrock mortar features and cobble pestles. The trend toward smaller projectile points continued into the period identified as the Mariposa Complex (1,200–1800 AD). At this time, Cottonwood and Desert side-notched points are prevalent. Also at this time, the presence of large bedrock mortar sites containing hundreds of cupules indicates and even greater reliance on acorn processing. This change may indicate an increase in population.

The Chowchilla Archaeological Sequence also contains three temporal sequences during which populations were relatively high but with an intermittent period of decline. The earliest of these, the Chowchilla Phase (800 BC–550 AD) is characterized by projectile points that were similar to those found at Crane Flat Complex sites but include points with concave bases and contracting stems. However, unlike the Crane Flat Complex, pestles and cobble mortars have been recovered from sites dating to the Chowchilla Phase. Additionally, there is evidence of elaborate funerary practices with grave goods at this time as well as trade with populations in the adjacent Great Basin and southwestern California. Small projectile points with contracting stems are typically found in archaeological sites dating to the Raymond Phase (550–1500 AD). Pestles and cobble mortars continued to be used, but unlike the previous phase, fewer bedrock mortars are found and burials generally lack grave goods. This indicates a period of population decline. During the subsequent Madera Phase (1500–1859 AD), populations again increased. Smaller projectile points were more prevalent, and new technologies appeared. These included arrow shaft straighteners, pendants, and items manufactured from steatite. Burial practices varied to include cremation, and villages often contained sweatshops, housepit residential structures, and other features.

Ethnographically, the Merced River and Merced Falls Projects are located within the traditional territory of the Southern Sierra Miwok people. Subsistence activities focused on hunting large game, such as deer, antelope, and elk. Fishing and the collection of local plant resources supplemented the diet. Acorns, collected in the cooler months, were a particularly important staple. Acorns were processed using ground stone tools such as mortars and pestles. Other implements that the Sierra Miwok people used included flaked stone tools such as scrapers, choppers, projectile points, and knives. Willows and other plant materials were woven into baskets for storage purposes.

Spanish explorers were the first Europeans to contact the indigenous California populations in the late 1700s. Spanish missions and pueblos were established, and native

peoples who had not succumbed to introduced disease were often brought to these settlements against their will to serve as workers. In 1882, Spanish rule over California was replaced with Mexican governance. Mexican ranchos of thousands of acres were granted to individuals primarily for cattle ranching purposes. One such grant of greater than 44,000 acres was issued to General John C. Fremont. This property was located on Mariposa Creek between the mountains of the Sierra Nevada and the San Joaquin, Chowchilla, and Merced Rivers.

The gold rush of 1848 resulted in mining of many of the gravel deposits and streams of the Sierra Nevada. While gold was the main mining focus in the vicinity of the project, other materials such as silver, lead, zinc, copper, and tungsten were also found in the area. Several mining camps were located near the project area including Bagby, Barret City, Exchequer, and Horseshoe Bend. One of these camps, the Exchequer Camp, is inundated by the Merced River Project's Lake McClure.

Agriculture, cattle ranching, and tourism were also important to the growing economy of the area. While large operations, such as Miller & Lux established in 1881, ran thousands of head of cattle and sheep on open range, farmers also purchased land to grow crops such as wheat, barley, and cotton. In 1870, construction of the Central Pacific Railroad from Lathrop through the Central Valley began, and in 1871, the line reached Merced County. The line replaced unreliable river boats as a means of transporting good and also led to increased tourism in the area, including to Yosemite Valley.

Hydroelectric power essentially developed out of the use and conveyance of water from the Merced River during the California gold rush era, especially involving hydraulic mining. Dams such as the Merced Falls, Fremont, and Benton Mills dams were built on the river as early as the 1850s. Many of these dams were also used for hydro mechanical power associated with mills involved with hard rock mining and the grinding of grain. By the 1890s, hydroelectric power was implemented in higher elevations of California, first for mining operations, and then to power local towns and municipalities associated with the mines. By the turn of the 19th century, hydroelectric facilities were constructed on the Merced River, such as the Kittridge dam, flume, and powerhouse, that was used to power the Nameless Mine and associated rock crusher at Jasper Point. Out of an original grist mill dam built on the Merced Falls in 1854, a hydropower facility was built at the site in the 1890s, and Merced Falls and Utility Company (sold, reorganized, and later incorporated into PG&E) purchased the facility in 1900 for hydroelectricity, and in the following year, built a concrete dam in place of the older timber dam. Irrigation dams and conveyance systems were also developed as far back as the 1860s to provide a reliable source of water for agriculture in the often arid Merced River Valley and were later augmented with harnessing electricity from hydropower. As an irrigation district, Merced ID was developed between 1917 and 1919, and began construction on the original Exchequer concrete dam in 1922.

Merced River Project

Area of Potential Effects

Pursuant to section 106, the Commission must take into account whether any historic property could be affected by issuance of a new license within a project's APE. The APE is defined as the geographic area or areas that an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. Merced ID defined the APE as consisting of all lands, project facilities, and features located within the project boundary and any lands outside of the project boundary where cultural resources may be affected by project-related activities. There are 11,653.3 acres in the existing project boundary. By letter dated April 19, 2011, the California SHPO concurred with Merced ID's definition of the APE (letter from M.W. Donaldson, California SHPO, California Department of Parks and Recreation, Office of Historic Preservation, Sacramento, CA, to B. Kelly, Merced ID, Merced, CA, filed February 27, 2012). However, on February 14, 2013, Merced ID requested California SHPO concurrence with an expanded APE that includes two additional areas located outside of the project boundary where project activities could affect cultural resources (letter from B. Kelly, Merced ID, Merced, CA, to M.W. Donaldson, California SHPO, California Department of Parks and Recreation, Office of Historic Preservation, Sacramento, CA, filed April 8, 2013). These areas consist of approximately 221 acres located at the Horseshoe Bend recreation area and 29.5 acres located near New Exchequer dam.

Project-specific Cultural Resources

As summarized above, early mining endeavors resulted in the construction of water control systems in the Sierra Nevada. Some of these structures, including ditches and reservoirs, were later used to generate hydroelectric power. Irrigation canals were also constructed to provide water to ranches and farms. Several irrigation companies formed to convey mountain water to lower elevation lands. One such company was the Crocker Huffman Land and Water Company. Merced ID was established on December 8, 1919, and in 1922, it purchased the Crocker Huffman Land and Water Company irrigation system and selected the Exchequer Mining Company on the Merced River for the location of its first dam. By 1926, the Exchequer dam—Lake McClure—and associated canals and power system had been constructed. At the time, the dam was considered to be the largest dam of its kind.

In 1964, Merced ID sought to expand its storage and generation capabilities. The old powerhouse was removed, and the New Exchequer and McSwain dams were completed in 1967. The Old Exchequer dam became a footing of the New Exchequer dam.

Archaeological and Historic-Era Sites—Merced ID conducted a review of records and files housed at the Central California Information Center and BLM to determine the location and adequacy of any previous surveys and to identify previously recorded

archaeological sites, historic structures, and other resources within the proposed project boundary. The records search found that 14 previous cultural resource investigations had been undertaken within, or partially within, the project APE. These studies resulted in the identification of 15 sites within the APE—seven prehistoric sites (a village site, four milling stations, a milling station with a midden and lithic scatter, and a milling station with petroglyphs), seven historic-era sites (two mining sites, Yosemite Valley railroad, Bagby Benton mills, Bruschi Mine, Horseshoe Bend mining town, and Highway 49), and one site that contained both prehistoric and historic components (a milling station and lithic scatter in association with the Bondville mining camp). Another existing cultural resource within the APE was a historic stone building.

Merced ID conducted archaeological survey of all accessible lands within the project APE between 2008 and 2010, and again in 2013. Approximately 6,759 acres were surveyed, and a total of 186 archaeological sites and 90 isolated artifacts were documented. Of the 186 archaeological sites documented within the APE, 131 are historic-era sites, 29 are prehistoric, and 26 contain both prehistoric and historic-era components. Details pertaining to the 186 cultural resource sites identified in the project APE were provided in Merced ID's December 2013 amended HPMP (Merced ID, 2013c).

Of the 29 prehistoric sites, the majority (21) are milling station sites with no other archaeological materials or features. These sites contain at least one bedrock mortar cupule, milling slick, or milling basin. One site contains six separate features within the site boundary that contained a combined total of 63 milling surfaces. Of the remaining eight prehistoric sites, two sites were identified as lithic scatters. Two additional temporary camp sites that reflect limited seasonal occupation were also identified. These sites may or may not contain milling features, but they typically contain lithic scatters and midden or possible midden deposits. Three sites were identified as larger base camps that may contain evidence of house structures. These sites also typically contain bedrock milling features. Finally, one site was identified as a base camp or village site with more than 159 milling features, but the site also contains numerous zoomorphic and abstract petroglyph features. The site is also unique in that the bedrock mortars also contain numerous small cupules of the type frequently found in "pitted boulders" (Payen, 1966, as cited by Merced ID, 2013c).

Multi-component sites primarily consist of historic-era features or refuse deposits located with prehistoric milling stations. Several of the sites, however, also contain other prehistoric features or materials such as midden development, housepit depressions, lithic scatters, and/or groundstone artifacts.

Of the 131 historic period sites, 53 sites are mining or mining related. These sites include placer mining debris and features such as adits, tailings, walls, foundations, waste rock locations, and other features. Other sites include historic railroad features associated with the Yosemite Valley Railroad, roads and trails, retaining walls and fences, transmission lines, structural foundations, water control features, features and structures

associated with historic habitation sites, retaining walls, refuse deposits, land survey markers, and the historic town site of Bagby.

All but 2 of the 186 archaeological sites recorded in the APE remain unevaluated for their National Register eligibility. Of the two sites that have been evaluated, one has been determined eligible for the National Register. This particular site (P-22-0739) is an aboriginal village site with a possible place name associated with it. The other site is the Yosemite Valley railroad grade, and it has been determined ineligible for the National Register.

Historic Buildings, Structures, and Districts—The current Merced Hydroelectric System was constructed in the mid- to late 1960s and does not currently meet the 50-year age requirement for listing on the National Register eligibility. While most of the Old Exchequer dam (site MID-215), now a footing of the current dam, was inundated during relicensing surveys, the portion of the old dam that was visible appears to be intact. However, the remains of the old dam were evaluated as ineligible for listing on the National Register because dams of this type are not uncommon and the setting of the dam has been greatly compromised by construction of the new system and other modern developments. A gaging station (MID-111) located downstream from the dam was also documented. This station pre-dates the current system and may be associated with the original project. However, the gaging station was also evaluated as ineligible for listing on the National Register.

Other structures associated with the project include residential and maintenance buildings. These buildings, which were recorded as a single site (MID-12), include 15 historic-era structures. A total of eight of these structures are residential and date from the late 1920s to the early 1940s. Two garages date to 1947 and a third to 1950. The site includes a pool of unknown age, but a pool maintenance building dates to 1939. Finally, a water tower of unknown age is also present at the site. These 15 structures have been modified and maintained using modern materials, and Merced ID recommends that they no longer retain historic integrity. For this reason, Merced ID recommends that they are not eligible for listing in the National Register.

Traditional Cultural Properties—In October 2008, the Commission consulted with the Washoe Tribe of Nevada and California, the Tuolumne Band of Me-Wuk Indians, the Chicken Ranch Rancheria Tribal Council, and the California Valley Miwok Tribe. The intent of this consultation was to determine whether any of the tribes had interest in the proposed project and whether they would like to participate in the relicensing effort. The California Miwok Tribe and the Chicken Ranch Rancheria both responded with requests for including the Southern Sierra Miwuk Nation (also known as the American Indian Council of Mariposa County/Southern Sierra Miwuk Nation) in the tribal consultation process. The Southern Sierra Miwuk Nation are considered to be the most likely descendants who lived along the Merced River prior to European contact. On November 16, 2008, the Southern Sierra Miwuk Nation provided the Commission with a copy of a completed Pre-Application Document questionnaire issued by Merced ID. The

questionnaire identified the Southern Sierra Miwuk Nation's interest in the project, contact information, and other important information. In the questionnaire, the Southern Sierra Miwuk Nation requested formal consultation with Merced ID and the Commission regarding the project.

Merced ID consulted with the Southern Sierra Miwuk Nation between 2008 and 2012 to discuss the tribe's concerns regarding cultural resources and the potential need for a TCP study. A Memorandum of Agreement for a TCP study was executed between Merced ID and Southern Sierra Miwuk Nation on May 19, 2011. It provides protocols for completion of the TCP study. A TCP report was completed by Merced ID in November 2013. Archival research has been done on the TCP study, but no interviews with tribal members have been completed so far with MID's contracted ethnographer. Nevertheless, the TCP study shows that there is the potential to connect some of the recorded archaeological sites within the APE with ethnographic villages of the Miwuk. Merced ID states that to date, no potential TCPs of importance to the Southern Sierra Miwuk Nation have been identified within the project APE. However, Merced ID is continuing consultation with the tribe to identify and document National Register-eligible TCPs within the APE and assess the project's effects (if any) on these resources.

Merced Falls Project

Area of Potential Effects

PG&E defines the APE as encompassing all lands within the FERC project boundary, in addition to a 20-foot buffer above the Merced Falls impoundment high water line. The APE consists of a total of 74.4 acres; however, approximately 68 acres are inaccessible due to the impoundment, in addition to some private lands that cannot be accessed. As a result, 5.8 acres were inventoried for cultural resources. For TCPs, the buffer zone above the Merced Falls impoundment is expanded to 100 feet above the high water line.

Project-specific Cultural Resources

As summarized above, the project and associated APE were the result of hydroelectric development during and after 1916, resulting in the existing dam and impoundment, and other associated structures. Companies associated with hydroelectric development at Merced Falls began with the San Joaquin Light and Power Corporation, incorporated in the 1910, and where they acquired a deed for the Merced Falls and Gas Electric Company and put into service the Merced Falls substation (PG&E, 2014). As mentioned before, an earlier power house had been constructed at the falls in the 1890s, but was put out of service by floods in 1911. The powerhouse was then replaced and put back into operation in 1916. In 1930, the San Joaquin Light and Power Company purchased additional property around the falls and expanded the hydropower facility. The project facilities at Merced Falls were improved, resulting in a new concrete diversion dam, substation building, and additional structures. In 1938, San Joaquin Light

and Power Company was officially merged with PG&E. At that time, PG&E filed an application with Federal Power Commission for a license to operate the Merced Falls Power Plant. In 1969, PG&E was issued a major license to operate the project overall in place of its preceding minor license. Improvements, reconstructions, and modifications of the project continued into the 1980s and 1990s.

Archaeological and Historic-Era Sites—PG&E conducted a review of the existing records at the California Historical Resources Information System at the University of California, Stanislaus, along with records kept at the California State Library, Water Resources Collection Center, University of California Berkeley, Bancroft Library, University of California Berkeley, Merced County Library, Merced County Museum, and at the consultant's research library. A previously recorded historic period archaeological site was located within the project's APE consisting of the remains of the Merced Falls Yosemite Sugar Pine Lumber Mill that was built in 1912.

PG&E, through its cultural resource contractor, conducted an intensive survey of the accessible 5.8 acres of land within the APE. Remains of the Merced Falls Yosemite Sugar Pine Lumber Mill were located within the APE, consisting of a railroad spur grade, various historic concrete foundation features, and a crane foundation for transferring logs from the impoundment/pond area to a milling processing station, along with a scatter of various iron and glass artifacts. The majority of the Yosemite Sugar Pine Lumber Mill lies outside the APE, and could not be fully recorded since most of the site lies on private property and where access was denied by the landowner to do additional archaeological survey. As a result, this particular archaeological site could not be evaluated for National Register eligibility, however, for management purposes, PG&E considers to treat this particular resource as if it was eligible for the National Register, and the SHPO agreed with this particular approach (PG&E, 2014). Linear remnants of the Yosemite Valley Railroad (circa 1905) were also located along the north shore of the impoundment within the APE. Based on documentation dating to 2011, this particular portion of the railroad had been considered ineligible for the National Register by the SHPO involving a previous undertaking of another federal agency (PG&E, 2014).

No other historic or prehistoric archaeological sites were found within the APE.

Historic Buildings, Structures, and Districts—The Merced Falls Hydroelectric Project began in 1915 and work continued through 1916. The 1915–1916 project essentially consisted of the Merced Falls dam and powerhouse facility. Overall, the project includes the dam, powerhouse, generator, garage, control room and gauge house buildings, switch yard, fish ladder, flow-pipe for the Kesley and Snelling ditches, and related power generation structures. Among the various project features, the project dam consists of a concrete diversion dam 573-feet long, 34-feet high, and was reconstructed in 1930. Associated with the dam is a concrete fish ladder consisting of ten 7-foot square boxes. The garage, control room, and gauge house buildings were built in 1915. When the project was put into operation in 1916, the control house served as the original powerhouse. The existing powerhouse consists of a 1930 one-story metal outdoor

structure containing a single turbine and generator. Overall, the project facilities have been extensively modified over the years on up to the 1980s and 1990s, and as a result, PG&E considers them all ineligible for inclusion in the National Register (PG&E, 2014).

Traditional Cultural Properties—PG&E initially contacted Southern Sierra Miwuk Nation, Amash Musun Tribal Band, North Valley Yokuts Tribe, Choinumni Tribe, Chukchansi Tribe, and North Fork Mono Rancheria. The American Indian Council of Mariposa County/Southern Sierra Miwuk Nation (Southern Sierra Miwuk Nation⁵⁶) was the only Native American group who requested to be kept abreast of the Merced Falls relicensing process and participated with PG&E in ascertaining whether there were TCPs in or near the project's APE. Consultation with the Southern Sierra Miwuk Nation and PG&E began in January 9, 2009, and again in August and October of 2010. A Memorandum of Understanding was executed between PG&E and the Southern Sierra Miwuk Nation on July 23, 2010. It provides protocols for completion of the TCP study. PG&E finished a draft of the TCP study in January 2012. Background research for the possible presence of TCPs in and near the project area were gathered from a number of sources, from the Merced County Library, Merced County Museum and Archives, Mariposa County Museum, Yosemite National Park, and other research institutions. Earlier ethnographic interviews with Miwuk informants were also compiled and reviewed. Correlations with archaeological sites and ethnographic/historic villages were also made, and a particular Native American village and associated archaeological site was located on the north bank of the Merced River west of the Merced Falls APE. Discussion with contemporary tribal members involved with the TCP study did not yield any known village sites associated with distant Miwok ancestors or descendants. The TCP study itself involved work and data gathered by a contracted ethnographer, commissioned by PG&E.

The TCP investigations and study demonstrated that the overall project area along the Merced River was of considerable importance to Miwok peoples for ceremonial, traditional fishing and collecting activities, spanning thousands of years. A good case can be made, supported by ethnographic accounts and modern-day tribal informants, that long stretches of the Merced River corridor had direct generational ties with living peoples going back to at least 150 years and could be considered as a more extensive TCP. Within the project's APE, research and tribal interviews with members of the Southern Sierra Miwuk Nation demonstrated that there are locations where traditional collection of fish, aquatic resources, and botanical resources took place. As a result, a TCP, called the Merced Falls TCP, was established within the APE, and consists of the Merced Falls impoundment, shores, and adjacent lands up to 100 feet away. The TCP was considered eligible for the National Register, and to which the SHPO concurred with its eligibility on February 29, 2012 (PG&E, 2014).

⁵⁶ This group is the same group that MID consulted during its TCP study.

3.3.6.2 Environmental Effects

Merced River Project

Project-Related Effects on Cultural Resources

Project-related effects on cultural resources within the APE are likely to occur from project operation and maintenance, use and maintenance of project roads, recreation, vandalism, and modifications or repairs to project facilities. Project effects are considered to be adverse when an activity may alter, directly or indirectly, the characteristics of a historic property that qualify the property for inclusion in the National Register. If adverse effects are found, such effects would need to be resolved in consultation with the California SHPO, and with other parties. Merced ID has identified a number of different types of project-related effects on historic properties such as project maintenance, operation, reservoir fluctuations, recreation, artifact collection and vandalism (Merced ID, 2013c).

Routine maintenance and operation of the project system, vegetation management, road construction and use, and emergency repairs to system components can result in impacts to archaeological sites and historic structures in the project APE. In particular, both inundation and reservoir fluctuation, which can cause erosion, deflation, and/or artifact transport and deterioration, can adversely affect resources. When reservoir levels are low, sites that are typically inundated are also frequently susceptible to artifact collection and impacts from ORV traffic.

The project vicinity is also popular for recreational activities, including fishing, boating, camping, hiking, and picnicking. These activities can result in inadvertent damage to cultural resources. Erosion along footpaths can expose cultural materials and increase vandalism and looting. Furthermore, use of project recreation facilities in the vicinity of historic properties may increase their susceptibility to vandalism and looting. Finally, cattle grazing in the project area may disturb cultural sites, particularly in areas where soils are damp.

Historic Properties Management Plan

On December 31, 2013, Merced ID filed an amended HPMP to address project effects on historic properties with its final license application. The amended HPMP includes, but is not limited to, measures for:

- avoiding National Register-eligible sites;
- stabilizing and protecting sites from erosion, recreation, and other impacts;
- implementing anti-looting approaches that may include education, signage, and law enforcement;
- site testing and data recovery where impacts are unavoidable;
- monitoring procedures and site condition assessment protocols;

- dealing with inadvertent discoveries and emergency situations;
- unanticipated discoveries of human remains on both private and public lands;
- training personnel for better understanding of cultural resources and responsible management for them;
- continued consultation with agencies, including the California SHPO, and Native American tribes;
- completion of archaeological surveys, National Register evaluations, and TCP studies; and
- periodic reporting and review/revision of the HPMP.

The amended HPMP also includes a more detailed and site-specific National Register Evaluation Plan. Among other things, the National Register Evaluation Plan identifies and prioritizes unevaluated sites for National Register evaluation and treatment that are experiencing on-going project-related effects. Such sites also require additional in-depth cultural investigations to determine National Register eligibility. On other unevaluated sites that are not being affected by the project, these particular sites will be avoided and continued to be treated as if such sites were eligible for the National Register. The HPMP also provides a detailed schedule on when various aspects of the plan will be carried out during the term of the new license.

Agency Comments on Historic Properties Management Plan

In its comments on the initial draft HPMP filed with the Commission on January 26, 2012, BLM questioned the adequacy of Merced ID's cultural resources identification efforts and the measures to protect historic properties provided in Merced ID's draft HPMP. BLM stated that it would appreciate the opportunity to review the inventory report and HPMP once Merced ID has revised these documents to address BLM comments and concerns. On April 2, 2012, Merced ID requested that the Commission grant it an additional 15 months, until May 30, 2013, to complete any additional fieldwork and to file a revised HPMP. Merced ID continued to consult with BLM, and on May 29, 2013, Merced ID requested an additional extension, until December 30, 2013, to file the revised HPMP. The Commission granted this request on June 13, 2013, and Merced ID filed an amended HPMP with the Commission on December 31, 2013. The amended HPMP was revised again based on subsequent changes to the cultural resources inventory report, and was submitted to BLM and involved Indian tribes on March 20, 2014 (Merced ID, 2014). The amended HPMP was also submitted to the SHPO. Both the SHPO (filed August 5, 2014) and BLM have made additional comments on the amended HPMP, and Merced ID is in the process of addressing these comments and anticipates that a final revised HPMP will be filed with the Commission by the end of 2014 (see Merced ID response to BLM preliminary 4(e) conditions, August 21, 2014).

BLM specifies in preliminary condition 24 that Merced ID obtain BLM approval of its HPMP before submitting it to the Commission. Upon Commission approval, Merced ID would implement its HPMP. On August 21, 2014, in its alternative conditions, Merced ID indicated that the amended HPMP (filed with the Commission on December 31, 2013) would be revised again to (1) include the recent discovery of three new cultural resources; (2) assign state resource numbers to all sites; (3) incorporate SHPO and BLM comments on the Cultural Resources Inventory Report; and (4) incorporate SHPO, BLM, and comments from the involved tribes on the revised amended HPMP. After addressing these comments, Merced ID plans to file the revised amended HPMP with the Commission at the end of 2014.

Our Analysis

After Merced ID makes adequate revisions to the amended HPMP, we expect to see a final revised HPMP at the end of this year that would meet all of the Commission's requirements under section 106. Once we receive the final revised HPMP, we would attach it to a PA and execute it with the California SHPO (in anticipation that upon notification, the Advisory Council would choose not to participate in the PA). Once a decision to issue a new license for this project is made, Merced ID would implement its HPMP under the stipulations of the PA for the term of the new license. Merced ID, BLM, and the Southern Sierra Miwuk Nation would be invited to sign the PA as concurring parties. Execution of the PA would ensure that Merced ID adequately addresses any existing and potential adverse effects on historic properties identified within the project's APE through the implementation of the final HPMP.

Merced Falls Project

Project-related Effects on Cultural Resources

Similar to the Merced River Project, project-related effects on cultural resources within the Merced Falls APE would likely occur from project operation and maintenance, including vegetation management and recreation activities. Nevertheless, the APE around the Merced Falls Project is small (approximately 6 acres), and is restricted to the impoundment area of the project. Although there are no above-ground project facilities considered to be eligible for the National Register within the project's APE, there is one historic archaeological site (the Yosemite Sugar Pine Merced Falls Lumber Mill) that would be treated as National Register-eligible. Furthermore, the identified National Register-eligible Merced Falls TCP is also within the project's APE, and has sustained importance to the Southern Sierra Miwuk Nation over many generations as a location for gathering aquatic and botanical resources.

Historic Properties Management Plan

To resolve any potential project-related adverse effects on the Merced Falls TCP within the APE, PG&E crafted an HPMP that would preserve and protect this TCP for

the term of a new license. Among other things, the HPMP includes measures to preserve and protect the important aspects of this TCP and to monitor the TCP area within the APE at regular intervals over the term of a new license. Furthermore, the HPMP also recommends that the Yosemite Sugar Pine Merced Falls Lumber Mill be treated as if it is National Register-eligible, and details steps that would be taken in the event of project-related adverse. The HPMP includes, but is not limited to, the following measures:

- a plan and procedure for consultation with the SHPO and Southern Sierra Miwuk Nation when project activities might affect properties considered to be eligible for the National Register;
- a plan to deal with inadvertent discoveries and emergency situations if and when they arise;
- a plan to deal with unanticipated discoveries of human remains;
- monitoring and evaluating cultural resources below the present impoundment area when opportunities exist to survey these areas at low water levels;
- training of project personnel regarding the sensitivity of the Merced Falls TCP and for the day-to-day management and avoidance of this site;
- a process for the continued consultation with Southern Sierra Miwuk Nation and the SHPO; and
- periodic reporting and review/revision of the HPMP.

Agency Comments on the Historic Properties Management Plan

PG&E sent a draft HPMP to the SHPO on March 4, 2013, and the SHPO responded on September 9, 2013, that it did not concur with the draft document. Based on the SHPO's comments, PG&E resubmitted a revised HPMP on August 8, 2014, and on September 15, 2014, the SHPO responded that it concurred with PG&E's HPMP, dated June 2014, and that the HPMP would adequately address project-related effects on historic properties for the undertaking involving a new license for the project (PG&E, 2014, Appendix B).

Our Analysis

Commission staff concurs with PG&E's June 2014 HPMP and the associated steps to resolve project-related adverse effects on historic properties for the term of any new license. As a result, Commission staff intends to execute a PA with the SHPO (in anticipation that upon notification, the Advisory Council would decline to participate in the PA). The stipulations in the PA would, in turn, implement PG&E's HPMP upon issuance of a new license for the project. PG&E and the Southern Sierra Miwuk Nation would be concurring parties to the PA. Execution of the PA and implementation of the HPMP would ensure that PG&E appropriately protects and preserves the Merced Falls TCP, and that future encounters with other possible historic properties would be handled

in accordance with the HPMP and include consultation with the parties associated with the PA.

3.3.7 Aesthetic Resources

3.3.7.1 Affected Environment

Merced River Project

The Merced River Project is located in the Sierra Nevada foothills west of Yosemite National Park in oak woodland vegetation type (see section 3.3.2.1, *Terrestrial Resources*). The viewsheds at and near the project have few structures, so the natural vegetation and canyons dominate the views. The eastern extent of the project has steep, dramatic hills and the landscape in the western portion of the project consists of gently rolling hills. The project is located in Mariposa County on land owned by Merced ID and private entities, as well as on federal land administered by BLM (see section 3.3.5.1, *Land Use*).

The project reservoirs are visible from the reservoirs and adjacent land. New Exchequer dam, powerhouse, spillway, dike, and other buildings have light colors, uniform textures, and geometric shapes that, as seen in the foreground and near middle ground from Lake McClure Road, contrast with the surrounding landscape. McSwain dam and powerhouse have low to moderate visual contrast as viewed from locations near Lake McClure Road and Merced Falls Project. The foreground view of McSwain dam from the McSwain recreation area contrasts with the surrounding landscape. Contrasting elements include the industrial shapes and lines of the trash rack and intake facilities and linear appearance of the guardrail on the top of the dam. Brightly colored, orange floating safety booms on both reservoirs located near the dams contrast with views of the reservoir surface and surrounding landscape.

Merced ID characterized visual resources using BLM's visual assessment protocols and guidance in BLM's Sierra Resource Management Plan and the Mariposa County General Plan, as applicable. Objectives for visual resources in the Sierra Resource Management Plan include maintaining the existing visual quality of the: (1) Lake McClure/State Route 49 viewshed; and (2) Merced Wild and Scenic River. The appearance of project dams, powerhouses, appurtenant buildings and five recreation areas located on or near federal land is compliant with BLM land management guidance for all background views and for most middle ground views. New Exchequer dam begins to contrast with its surroundings at views less than 2 miles and highly contrasts when viewed from the foreground along Lake McClure Road and the reservoir when the water surface is low.

Three of the five project recreation areas (Bagby, Horseshoe Bend, and McClure Point) are located on federal land administered by BLM or have adjacent federal land. The housing unit and water tank at Horseshoe Bend are not consistent with BLM visual resource management objectives. The contrasting view of the unvegetated swath of soil

that appears as the level of McClure Lake recedes is also inconsistent with BLM visual resource management objectives; adjacent Merced ID-owned lands have a similar contrasting appearance.

Facilities on Merced ID-owned land were also evaluated for visual contrast. Near New Exchequer dam, the foreground and immediate middle ground views of geometric shapes and light colors of appurtenant buildings, spillway, and dike strongly contrast with the natural landscape. The gray colored, rough textured rock facing of New Exchequer dike moderately contrasts with the surrounding landscape. Viewed from downstream of McSwain dam, the dam has a moderately contrasting appearance. The powerhouses at each dam have muted colors and moderately contrasting appearances. Barrett Cove and McClure Point recreation areas foreground views of maintenance buildings and storage yards highly contrast with surrounding landscape, but the recreation area site design and road locations allow these facilities to blend well into the landscape. McSwain reservoir only fluctuates a few feet, so there is little, if any, change to the view of the shoreline caused by changes in water surface elevation.

Merced Falls Project

The Merced Falls Project is located in Merced and Mariposa Counties near the base of the western slope of the central Sierra Nevada Mountain Range. To the east and north, foothill terrain dominates the landscape, while to the south and west, flat agricultural land is prevalent. The land is mostly undeveloped with the exception of a few rural residences. The scenery along the southern shoreline includes rolling pastoral hills with scattered oaks, while Lake McClure Road runs along the northern shoreline. The banks are lined in some places with trees and other vegetation.

Project facilities include a 575-foot-long and 34-foot-high concrete gravity dam, and a powerhouse consisting of steel building housing the turbine generator unit adjacent to a single-story concrete control room structure. There is no transmission line associated with the project. The impoundment level is maintained at the same elevation year round, which avoids fluctuating water levels.

3.3.7.2 Environmental Effects

Merced River Project

Visual Resource Plan

Merced ID proposes to implement a Visual Resource Plan, filed on September 22, 2014, to provide guidance for the management of visual resources on lands administered by BLM within the project boundary. The plan includes identifying project facilities in need of visual resource mitigation, addressing project facility building materials (e.g., paint colors, landscaping, spoil piles), and implementing visual resource measures to bring existing and new project facilities into compliance with visual resource objectives

in BLM's Sierra Resource Management Plan. Merced ID included the following specific measures for Barrett Cove and Horseshoe Bend recreation areas:

- painting the Barrett Cove recreation area maintenance yard warehouse/storage building a gray-green color to blend the facilities with the surrounding landscape;
- planting vegetation to screen the warehouse area from the parking lot;
- painting the Horseshoe Bend recreation area maintenance yard warehouse and water tank a gray-green color to blend the facilities with the surrounding landscape;
- removing the existing ranger station house located below the water tank and constructing a new house near the maintenance yard; and
- planting shrubs to screen the maintenance yard warehouse from the main entry road.

Merced ID would secure BLM approval of the color used to paint any facilities located on BLM-managed land.

Merced ID's proposed Visual Resource Plan is consistent with BLM preliminary 4(e) condition 26; however, BLM specifies before implementing the plan, Merced ID obtain BLM approval of the plan and file it for Commission approval.

Our Analysis

The visual resource assessment did not identify many concerns or inconsistencies of project feature appearances relative to guidance contained in applicable plans. Merced ID's proposal to implement a Visual Resource Plan would identify project facilities in need of mitigation from visual resource impacts, improve the visual appearance at Barrett Cove and Horseshoe Bend recreation areas, and provide a mechanism to manage and monitor visual resources over the term of a new license. Over the license term, management actions and recreation use patterns could affect visual resources at the project. Monitoring visual resources and consulting with BLM on an annual basis, at a minimum, would provide necessary information to determine whether additional treatments would be necessary to achieve visual quality objectives. Because future project activities could affect views of not only BLM-managed lands but all project lands, it would be appropriate to include all project lands in the Visual Resource Plan.

Merced Falls Project

PG&E does not propose any new construction or changes to project operation that would affect aesthetic resources.

Our Analysis

Project operation targets stable impoundment levels and manage downstream flows in concert with Merced ID's upstream facilities. This results in negligible reservoir fluctuations, which reduces negative impacts on aesthetic resources at the project.

Future development of lands adjacent to the project could affect visual resources; however, PG&E owns only a small amount of property outside the project boundary and has little control over the development of lands outside the project boundary.

3.4 NO-ACTION ALTERNATIVE

Under the no-action alternative the Merced River project and the Merced Falls project would continue to operate as they have in the past. None of the licensee's proposed measures or the resource agencies' recommendations and mandatory conditions would be required.

Merced River Project

Under the no-action alternative: (1) anadromous fish habitat would not be enhanced as a result of a minimum instream flow and pulse flows, (2) spawning habitat for fish species would not be enhanced, (3) there would be no means to monitor the status of anadromous fish, (4) there would be no plan to protect federally listed species or survey for federally listed species not previously surveyed, and (5) recreation facilities would not be improved and new facilities would not be constructed.

Merced Falls Project

Under the no-action alternative: (1) there would be no formalized plan or setting for the coordination of project operation or environmental measures with the upstream Merced River Project, (2) there would be no plan to enhance LWD habitat in the Merced Falls reach, (3) there would be no protection plans for federally listed species, and (4) recreation facilities, including a canoe trail, would not be maintained.

4.0 DEVELOPMENTAL ANALYSIS

In this section, we look at the Merced River and Merced Falls Projects' use of the Merced River for hydropower purposes to see what effect various environmental measures would have on the projects' costs and power generation. Under the Commission's approach to evaluating the economics of hydropower projects, as articulated in *Mead Corp.*,⁵⁷ the Commission compares the current project cost to an estimate of the cost of obtaining the same amount of energy and capacity using the likely alternative source of power for the region (cost of alternative power). In keeping with Commission policy as described in *Mead Corp.*, our economic analysis is based on current electric power cost conditions and does not consider future escalation of fuel prices in valuing the hydropower project's power benefits.

For each of the licensing alternatives, our analysis includes an estimate of: (1) the cost of individual measures considered in the EIS for the protection, mitigation, and enhancement of environmental resources affected by the projects; (2) the cost of alternative power; (3) total project costs (including the operation and maintenance cost, and the cost of environmental measures); and (4) the difference between the cost of alternative power and total project costs. If the difference between the cost of alternative power and total project cost is positive, the projects produce power for less than the cost of alternative power. If the difference between the cost of alternative power and total project cost is negative, the projects produce power for more than the cost of alternative power.

4.1 POWER AND DEVELOPMENTAL BENEFITS OF THE PROJECT

As currently operated, the Merced River Project has an authorized installed capacity of 103.5 MW and generates an average of 387 GWh annually (based on operation model results); the Merced Falls Project has an authorized installed capacity of 3.4 MW and generates an average of 14.4 GWh annually.

Tables 4-1 and 4-2 summarize the assumptions and economic information we use in our analysis. This information was provided by Merced ID and PG&E in their respective license applications for the Merced River Project and the Merced Falls Project. We find that the values provided by Merced ID and PG&E are reasonable for the purposes of our analysis. Cost items common to all alternatives include: taxes and insurance costs; net investment (the total investment in power plant facilities remaining to be depreciated); estimated future capital investment required to maintain and extend the

⁵⁷ See *Mead Corporation, Publishing Paper Division*, 72 FERC ¶ 61,027 (July 13, 1995). In most cases, electricity from hydropower would displace some form of fossil-fueled generation, in which fuel cost is the largest component of the cost of electricity production.

life of plant equipment and facilities; relicensing costs; normal operation and maintenance cost; and Commission fees.

Table 4-1. Parameters for the economic analysis of the Merced River Hydroelectric Project (Source: Merced ID, 2012a).

Parameter		Value
Period of analysis (years)		30
Net investment, \$ ^a		\$26,991,500
Relicensing cost, \$ ^b		\$17,000,000
Operation and maintenance, \$/year ^c		\$14,784,530
Commission fees, \$/year ^d		\$163,180
Energy value – New Exchequer (\$/MWh) ^e	35.84 (peak)	24.56 (off-peak)
Energy value – McSwain (\$/MWh) ^f	60.84 (peak)	49.56 (off-peak)
Capacity value (\$/kW-year) ^g	162	
Short-term interest rate (percent) ^h	3.875	
Long-term interest rate(percent) ⁱ	6.375	
Discount rate (percent) ^j	6.375	

^a Net investment is the depreciated project investment allocated to power purposes.

^b Relicensing costs include the administrative, legal/study, and other expenses to date.

^c Existing plant operation and maintenance includes operation and maintenance related to environmental measures associated with the current license.

^d Commission fees are based on statements of annual charges received from the Commission for federal lands and administrative charges based on authorized capacity.

^e Source: Application for New License, exhibit D, table D-6.2.2.

^f Energy values for McSwain powerhouse are based on New Exchequer plus a \$25/MWh renewable energy credit added per California Renewable Portfolio Standards (Senate Bill X1-2, signed by Governor Brown in April 2011).

^g The capacity value is based on the amortization and fixed operation and maintenance cost for a combined-cycle combustion turbine.

^h Short-term interest rate provided in license application, Exhibit D, section 5.1.

ⁱ Long-term bond rate provided in license application, Exhibit D, section 5.1.

^j Assumed by staff to be same as long-term interest rate.

Table 4-2. Parameters for the economic analysis of the Merced Falls Hydroelectric Project (Source: PG&E, 2012).

Parameter	Value
Period of analysis (years)	30
Taxes State	8.84%
Federal income tax rate	31.91%
Net investment, \$ ^a	\$3,800,000
Future major capital cost, \$ ^b	\$201,000 per year
Relicensing cost, \$ ^c	\$4,400,000
Operation and maintenance, \$/year ^d	\$387,000
Commission fees, \$/year ^e	\$8,000
Energy value (\$/MWh)	9.1
Capacity value (\$/MW-year)	162
Interest rate	8.79%
Discount rate	8.79%

^a Net investment is the depreciated project investment allocated to power purposes.

^b Future major capital costs include major plant rehabilitation to maintain present-day capability.

^c Relicensing costs include the administrative, legal/study, and other expenses to date.

^d Existing plant operation and maintenance includes operation and maintenance related to environmental measures associated with the current license.

^e Commission fees are based on statements of annual charges received from the Commission for federal lands and administrative charges based on authorized capacity.

4.2 COMPARISON OF ALTERNATIVES

4.2.1 Merced River Project

Table 4-3 compares the installed capacity, annual generation, cost of alternative power, estimated total project cost, and difference between the cost of alternative power and total project cost for each of the alternatives considered in this draft EIS: no action, Merced ID's proposal, the staff alternative, and staff alternative with mandatory conditions.

Table 4-3. Summary of the annual cost of alternative power and annual project cost for the alternatives for the Merced River Hydroelectric Project (Source: staff).

	No Action	Merced ID's Proposal	Staff Alternative	Staff Alternative with Mandatory Conditions
Authorized installed capacity (MW)	103.5	103.5	103.5	103.5
Annual generation (GWh)	387	389	368	368
Dependable capacity (MW)	57.5	57.5	57.5	57.5
Annual cost of alternative power (\$/MWh)	77.6	77.4	78.8	78.8
Annual project cost (\$/MWh)	45.2	72.8	81.7	89.3
Difference between the cost of alternative power and project cost (\$/MWh)	32.4	4.6	(2.9) ^a	(10.5)

^a A number in parentheses denotes that the difference between the cost of alternative power and project cost is negative, thus the total project cost is greater than the cost of alternative power.

4.2.1.1 No-action Alternative

Under the no-action alternative, the project would continue to operate as it does now. The project has an authorized installed capacity of 103.5 MW, a dependable capacity of 57.5 MW, and generates an average of 387,000 MWh of electricity annually. The average annual project cost is about \$17,492,000, or \$45.2/MWh. When we multiply the on-peak and off-peak energy components by the corresponding alternative energy cost and add a value to account for the project's 57.5 MW of dependable capacity, we calculate a total value of the project's power of \$30,020,000, or \$77.6/MWh in 2014 dollars. To determine whether the proposed project is currently economically beneficial, we subtract the project's cost from the value of the project's power. Therefore, the

project costs \$12,527,000, or \$32.4/MWh, less to produce power than the likely alternative.

4.2.1.2 Merced ID's Proposal

Merced ID's proposed project environmental/recreational resources measures are listed in table 4-5.

As proposed by Merced ID, the annual cost of operating the project is \$28,331,000 or \$72.8/MWh. As proposed, the project would have an authorized installed capacity of 103.5 MW, a dependable capacity of 57.5 MW, and would generate an average of 389,000 MWh of energy annually. When we multiply the on-peak and off-peak energy components by corresponding alternative energy cost and add a value to account for the project's dependable capacity, the result is the total value of the project's power of \$30,127,000, or \$77.4/MWh. To determine whether the proposed project is economically beneficial, we subtract the project's cost from the total value of the project's power. The result is that in the first year of continued operation, the project would cost \$1,795,000 or \$4.6/MWh less than the likely alternative.

4.2.1.3 Staff Alternative

Table 4-5 also shows the staff-recommended measures, including additions, deletions, and modifications to Merced ID's proposed environmental protection and enhancement measures, and the estimated cost of each.

As proposed by staff, the annual cost of operating the project is \$30,090,000 or \$81.7/MWh. With staff's recommended measures, the project would have an authorized installed capacity of 103.5 MW, a dependable capacity of 57.5 MW, and would generate an average of 368,000 MWh of energy annually. When we multiply the on-peak and off-peak energy components by corresponding alternative energy cost and add a value to account for the project's dependable capacity, the result is the total value of the project's power of \$29,003,000, or \$78.8/MWh. To determine whether the proposed project is economically beneficial, we subtract the project's cost from the total value of the project's power. The result is that in the first year of continued operation, the project would cost \$1,077,000 or \$2.9/MWh **more** than the likely alternative.

4.2.1.4 Staff Alternative with Mandatory Conditions

The cost of the mandatory and other measures **not** recommended by staff are included in table 4-5. Staff's alternative with mandatory measures adds fish passage and requires the filing of annual operation plans. Any operation and maintenance cost BLM would require Merced ID to pay would also add to the costs for this alternative. With mandatory conditions added, the cost of operating the project is \$32,866,000 or \$89.3/MWh. This alternative would have an average annual generation of 368 GWh, and an average annual power value of 29,003,000, or about \$78.8/MWh. Overall, the project

would produce power at a cost that is \$3,863,000 or \$10.5/MWh **more** than the cost of alternative power.

4.2.2 Merced Falls Project

Table 4-4 compares the installed capacity, annual generation, cost of alternative power, estimated total project cost, and difference between the cost of alternative power and total project cost for each of the alternatives considered in this draft EIS: no action, Merced ID's proposal, the staff alternative, and staff alternative with mandatory conditions.

Table 4-4. Summary of the annual cost of alternative power and annual project cost for the alternatives for the Merced Falls Hydroelectric Project (Source: staff).

	No Action	Merced ID's Proposal	Staff Alternative
Installed capacity (MW)	3.4	3.4	3.4
Annual generation (GWh)	14.4	14.4	14.4
Dependable capacity (MW)	1.9	1.9	1.9
Annual cost of alternative power (\$/MWh)	112.4	112.4	112.4
Annual project cost (\$/MWh)	153.8	155.5	157.8
Difference between the cost of alternative power and project cost (\$/MWh)	(41.4)	(43.1)	(45.4)

^a A number in parentheses denotes that the difference between the cost of alternative power and project cost is negative, thus the total project cost is greater than the cost of alternative power.

4.2.2.1 No-action Alternative

Under the no-action alternative, the project would continue to operate as it does now. The project has an authorized installed capacity of 3.4 MW, a dependable capacity of 1.9 MW, and generates an average of 14,400 MWh of electricity annually. The average annual project cost is about \$2,215,000, or \$153.79/MWh. When we multiply the average annual energy by the alternative energy cost and add a value to account for the project's 1.9 MW of dependable capacity, we calculate a total value of the project's

power of \$1,618,000, or \$112.38/MWh in 2014 dollars. To determine whether the proposed project is currently economically beneficial, we subtract the project's cost from the value of the project's power. Therefore, the project costs \$596,000 or \$41.41/MWh more to produce power than the likely alternative.

4.2.2.2 Applicant's Proposal

PG&E's proposed project resource measures are listed in table 4-6.

As proposed by PG&E, the annual cost of operating the project is \$2,239,000 or \$155.5/MWh. As proposed, the project would have an authorized installed capacity of 3.4 MW, a dependable capacity of 1.9 MW, and would generate an average of 14,400 MWh of energy annually. When we multiply the average annual energy by the alternative energy cost and add a value to account for the project's dependable capacity, the result is the total value of the project's power of \$1,618,000 or \$112.4/MWh. To determine whether the proposed project is economically beneficial, we subtract the project's cost from the total value of the project's power. The result is that in the first year of continued operation, the project would cost \$621,000 or \$43.1/MWh **more** than the likely alternative.

4.2.2.3 Staff Alternative

The staff alternative would have the same capacity and energy attributes as PG&E's proposal. Table 4-6 shows the estimated cost of the additional staff-recommended environmental protection and enhancement measures, including the estimated cost of any changes to PG&E's proposed measures.

With staff's recommended measures, the annual cost of operating the project is \$2,273,000 or \$157.8/MWh. Staff's alternative would have an authorized installed capacity of 3.4 MW, a dependable capacity of 1.9 MW, and would generate an average of 14,400 MWh of energy annually. When we multiply the average annual energy by the alternative energy cost and add a value to account for the project's dependable capacity, the result is the total value of the project's power of \$1,618,000, or \$112.4/MWh. To determine whether the proposed project is economically beneficial, we subtract the project's cost from the total value of the project's power. The result is that in the first year of continued operation, the project would cost \$655,000 or \$45.4/MWh **more** than the likely alternative.

4.3 COST OF ENVIRONMENTAL MEASURES

Tables 4-5 and 4-6 give the cost of each of the environmental enhancement measures considered in our analysis. We convert all costs to equal annual (levelized) values over a 30-year period of analysis to give a uniform basis for comparing the benefits of a measure to its cost.

4.3.1 Merced River Project

Table 4-5. Cost of proposed and recommended measures for the Merced River Hydroelectric Project (Source: staff).

Enhancement/Mitigation Measures		Entity	Staff Recommended?	Capital Cost (2014\$)	Annual Cost (2014\$)	Levelized Annual Cost (2014\$)
General						
1.	Annual consultation with BLM.	Merced ID (GEN1); BLM (recommendation 1)	Do not adopt	\$0	\$10,580	\$10,580
2.	Annual employee training.	Merced ID (GEN2)	Adopt	\$0	\$12,000	\$12,000
3.	Annual review of special-status species.	Merced ID (GEN3)	Do not adopt	\$0	\$8,000	\$8,000
4.	Consultation regarding new ground-disturbing activities on federal lands.	Merced ID (GEN4)	Adopt	\$0	\$0	\$0
5.	Consultation regarding new facilities on federal lands.	Merced ID (GEN5)	Adopt	\$0	\$0	\$0
6.	Develop and implement a coordinated operation plan for the Merced River Project and the Merced Falls Project.	Merced ID (GEN6)	Adopt	\$0	\$5,880	\$5,880
7.	Pay BLM annual operation and maintenance costs.	BLM	Do not adopt			Cost not specified

Enhancement/Mitigation Measures		Entity	Staff Recommended?	Capital Cost (2014\$)	Annual Cost (2014\$)	Levelized Annual Cost (2014\$)
Geology and Soil Resources						
1.	Develop and implement a recreation facilities construction erosion control and reforestation plan.	Merced ID (G&S1)	Adopt	\$0	\$0	\$0
2.	Develop and implement a LWM management plan.	Merced ID (G&S2)	Adopt	\$0	\$12,460	\$12,460
Aquatic Resources						
1.	Develop and implement a recreation facilities construction hazardous material spill prevention.	Merced ID (WR1)	Adopt	\$0	\$0	\$0
2.	Deliver water to Merced NWR.	Merced ID (WR2)	Adopt	\$0	\$873,020	\$873,020
3.	Streamflows and ramping rates.	Merced ID (AQR1)	Adopt	\$0	\$187,000	\$187,000
4.	Maintain Lake McClure minimum pool.	Merced ID (AQR2)	Adopt	\$0	\$0	\$0
5.	Develop a general erosion control plan.	Water Board (condition 23)	Adopt	\$10,000	\$1,000	\$4,000
6.	Develop a hazardous spill prevention plan.	Merced ID (WR1); Water Board (condition 25–29)	Adopt as modified by Water Board	\$10,000		\$760

	Enhancement/Mitigation Measures	Entity	Staff Recommended?	Capital Cost (2014\$)	Annual Cost (2014\$)	Levelized Annual Cost (2014\$)
7.	Continue 25 cfs release at New Exchequer dam.	California DFW (recommendation 3B[a])	Adopt	Included in baseline operation cost		
8.	Develop water temperature monitoring plan.	Merced ID (T&E1); Water Board (condition 9); NMFS (recommendation 8); FWS (recommendation 5[j]); California DFW (recommendation 9[7])	Adopt (expanded Merced ID's plan)		\$35,000	\$35,000
9.	Develop a drought management plan.	Merced ID (AQR1); Water Board (condition 9);	Adopt (expanded Merced ID's plan)	\$10,000		\$760
10.	Develop a Merced NWR delivery plan.	Staff	Adopt	\$60,000		\$4,300
11.	Develop an anadromous fish monitoring plan.	Merced ID (T&E2); Water Board (condition 20); California DFW (recommendation 3F)	Adopt (expanded Merced ID's plan)	\$20,000		\$1,520
12.	Establish Merced river anadromous fish committee.	Merced ID (T&E3)	Adopt		\$24,000	\$24,000
13.	Develop a gravel augmentation plan.	Conservation Groups, NMFS, California DFW, FWS	Adopt	\$30,000	\$125,000	\$127,280
14.	Minimum instream flows.	Staff	Adopt		\$1,075,000	\$1,075,000

	Enhancement/Mitigation Measures	Entity	Staff Recommended?	Capital Cost (2014\$)	Annual Cost (2014\$)	Levelized Annual Cost (2014\$)
15.	Spring and fall pulse flows.	Staff	Adopt	Included with minimum flows		
16.	Minimum and pulse flows	FWS	Do not adopt		\$525,000	\$525,000
17.	Minimum and pulse flows	California DFW	Do not adopt		\$2,100,000	\$2,100,000
18.	Minimum and pulse flows	NMFS	Do not adopt		\$2,393,000	\$2,393,000
19.	Minimum and pulse flows	Conservation Groups	Do not adopt		\$1,667,000	\$1,667,000
20.	New minimum instream flow compliance gage.	NMFS; FWS; California DFW (recommendations 4, 5[A–F], and 9[1–6])	Do not adopt	\$150,000		\$11,400
21.	Develop fish passage upstream of Crocker-Huffman diversion dam.	Water Board, FWS, NMFS, Conservation Groups	Do not adopt	\$3,500,000	\$2,500,000	2,766,000
22.	Lower Merced River habitat restoration.	FWS, NMFS	Do not adopt	\$100,000,000 or more		\$7,600,000
23.	BMI monitoring.	FWS (recommendation 8)	Do not adopt	\$10,000	\$50,000	\$50,760
24.	Monitor adult anadromous fish.	Merced ID (T&E2)	Adopt	\$300,000	\$25,000	\$47,800
25.	Monitor juvenile anadromous fish.	Merced ID (T&E2)	Adopt	\$100,000	\$25,000	\$32,600
26.	Implement amended Aquatic Invasive Species Management Plan.	Merced ID (AQR4)	Adopt	\$30,000		\$2,280

Enhancement/Mitigation Measures		Entity	Staff Recommended?	Capital Cost (2014\$)	Annual Cost (2014\$)	Levelized Annual Cost (2014\$)
Terrestrial Resources						
1.	Monitor western pond turtles, as part of TR6 protection plan.		Adopt		\$2,000	\$2,000
2.	Implement the Invasive Weeds Management Plan on federal lands integrated with a component on pest management and pesticide use.	Merced ID (TR1)	Adopt as amended	\$0	\$55,030	\$55,030
3.	Implement the Vegetation Management Plan on federal lands.	Merced ID (TR2)	Adopt as amended	\$0	\$15,870	\$15,870
4.	Implement the pesticide and herbicide use restrictions on federal lands.	Merced ID (TR3)	Adopt as amended	\$0	\$0	\$0
5.	Implement bat management measures as part of a bat protection plan.	Merced ID (TR4)	Adopt as amended	\$0	\$3,610	\$3,610
6.	Implement the Bald Eagle Management Plan.	Merced ID (TR5)	Adopt as amended	\$0	\$3,220	\$3,220
7.	Implement the Limestone Salamander Habitat Management Plan.	Merced ID (TR6)	Adopt as amended	\$0	\$2,260	\$2,260

Enhancement/Mitigation Measures			Staff Recommended?	Capital Cost (2014\$)	Annual Cost (2014\$)	Levelized Annual Cost (2014\$)
Threatened and Endangered Species						
1.	Develop a protection plan for federally listed plants.	Water Board (condition 12 and 13); FWS (recommendation 6[b]); BLM (recommendations 1 and 3)	Adopt	\$0	\$2,500	\$2,500
2.	Develop a protection plan for vernal pool fairy shrimp and its habitat.	Water Board (condition 6)	Adopt	\$0	\$2,500	\$2,500
3.	Develop a protection plan for the San Joaquin kit fox.	Staff	Adopt	\$0	\$2,500	\$2,500
Recreational Resources						
1.	Implement the Recreation Facilities Plan for McClure Point recreation area on Lake McClure.	Merced ID (RR1a)	Adopt	\$12,649,000	\$453,500	\$1,415,000
2.	Implement the Recreation Facilities Plan for Barrett Cove recreation area on Lake McClure.	Merced ID (RR1b)	Adopt	\$16,270,000	\$1,254,200	\$2,491,000
3.	Implement the Recreation Facilities Plan for Horseshoe Bend recreation area on Lake McClure.	Merced ID (RR1c)	Adopt	\$7,529,000	\$477,100	\$1,049,000

	Enhancement/Mitigation Measures	Entity	Staff Recommended?	Capital Cost (2014\$)	Annual Cost (2014\$)	Levelized Annual Cost (2014\$)
4.	Implement the Recreation Facilities Plan for the Bagby recreation area on Lake McClure.	Merced ID (RR1d)	Adopt	\$4,547,000	\$2,2670,000	\$2,612,000
5.	Implement the Recreation Facilities Plan for the proposed Mack Island non-motorized recreation area on Lake McClure.	Merced ID (RR1e)	Adopt	\$3,479,000	\$170,800	\$435,200
6.	Implement the Recreation Facilities Plan for McSwain recreation area on McSwain reservoir.	Merced ID (RR1f)	Adopt	\$9,094,000	\$500,000	\$1,191,000
7.	Provide recreation flow information and river access signage.	Merced ID (RR2)	Adopt		\$2,000	\$2,000
8.	Develop a plan for stocking fish in Lake McClure and McSwain reservoir.	Merced ID (AQR3)	Adopt as amended	\$5,000	\$35,000	\$35,000
Land Use and Aesthetics						
1.	Implement the Transportation Management Plan.	Merced ID (LU1)	Adopt	\$0	\$97,000	\$97,000
2.	Implement the Fire Prevention and Response Plan on federal lands.	Merced ID (LU2)	Adopt	\$0	\$1,060	\$1,060

	Enhancement/Mitigation Measures	Entity	Staff Recommended?	Capital Cost (2014\$)	Annual Cost (2014\$)	Levelized Annual Cost (2014\$)
3.	Implement the Visual Resource Plan on federal lands.	Merced ID (AER1)	Adopt as amended		\$1,166	\$1,166
4.	Expand transportation plan to consult with agencies.		Adopt	\$0	\$1,200	\$1,200
Cultural Resources						
1.	Implement the HPMP.	Merced ID (CR1)	Adopt	\$0	\$170,000	\$170,000

4.3.2 Merced Falls Project

Table 4-6. Cost of proposed and recommended environmental mitigation and enhancement measures for the Merced Falls Hydroelectric Project (Source: staff).

	Enhancement/Mitigation Measures	Entity	Staff Recommended ?	Capital Cost (2014\$)	Annual Cost (2014\$)	Levelized Annual Cost (2014\$)
Aquatic Resources						
1.	Develop and implement a water quality plan.	PG&E	Adopt	\$19,600	\$6,000 every 10 years	\$6,300
2.	Develop an annual fish sampling plan.	PG&E	Adopt	\$0	\$16,000	\$16,000
3.	Continue LWD cleaning of intake.	PG&E	Adopt	\$0 (included)	\$0	\$0

	Enhancement/Mitigation Measures	Entity	Staff Recommended ?	Capital Cost (2014\$)	Annual Cost (2014\$)	Levelized Annual Cost (2014\$)
4.	Develop coordinated operation plan with Merced ID.	Staff	Adopt		\$1,000	\$1,000
5.	Consult with technical advisory committee.	California DFW (recommendation 1); NMFS (recommendation 7)	Adopt		\$2,200	\$2,200
6.	Expand current LWD management plan.	Staff	Adopt		\$13,800	\$13,800
7.	Expand PG&E's proposed annual fish sampling plan in the Merced Falls reach.	California DFW (recommendation 1)	Adopt		\$20,000	\$20,000
8.	Develop fish passage.	Conservation Groups; FWS (recommendation 1)	Do not adopt	\$65,000		\$13,000
9.	Water temperature monitoring and mitigation.	California DFW (recommendation 1); FWS (recommendation 4); NMFS (recommendation 8)	Do not adopt		\$45,000	\$45,000
10.	Expand fish monitoring.	NMFS (recommendation 4)	Do not adopt		\$35,000	\$35,000
11.	Gravel augmentation.	Water Board (condition 2); NMFS (recommendation 2); Conservation Groups	Do not adopt		\$80,000	\$80,000
Terrestrial Resources						
1.	Develop a bald eagle management plan.	FWS (recommendation 5); Water Board (condition 5)	Adopt	\$0	\$2,000	\$2,000

	Enhancement/Mitigation Measures	Entity	Staff Recommended ?	Capital Cost (2014\$)	Annual Cost (2014\$)	Levelized Annual Cost (2014\$)
2.	Develop a noxious weed and invasive plants control plan integrated with a component for pest management and pesticide use notification.	California DFW (recommendation 7); Water Board (condition 2)	Adopt	\$0	\$15,000	\$15,000
Threatened and Endangered Species						
1.	Develop a protection plan for the valley elderberry longhorn beetle.	FWS (recommendation 3); Water Board (condition 6)	Adopt	\$0	\$2,000	\$2,000
2.	Develop a protection plan for the San Joaquin kit fox.	California DFW (recommendation 7); Water Board (condition 2)	Adopt	\$0	\$2,000	\$2,000
Recreational Resources						
1.	Continue to operate and maintain recreation facilities at the project.	PG&E	Adopt	Included in existing operation cost	\$0	\$0
2.	Develop a fish stocking plan.	PG&E	Adopt	\$2,000	\$1,000	\$1,400
Cultural Resources						
1.	Implement the HPMP.		Adopt	\$6,000		\$1,200

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5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE

Sections 4(e) and 10(a)(1) of the FPA require the Commission to give equal consideration to the power development purposes and to the purposes of energy conservation; the protection of, mitigation of damage to, and enhancement of fish and wildlife; the protection of recreational opportunities; and the preservation of other aspects of environmental quality. Any license issued shall be such as in the Commission's judgment will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for all beneficial public uses.

5.1.1 Merced River Project

This section contains the basis for, and a summary of, our recommendations for relicensing the Merced River Project. We weigh the costs and benefits of our recommended alternative against other proposed measures.

Based on our independent review of agency and public comments filed on this project and our review of the environmental and economic effects of the proposed project and its alternatives, we select the staff alternative as the preferred alternative. This alternative includes elements of the applicant's proposal, section 4(e) conditions, section 401 water quality certification conditions, resource agency recommendations, alternative conditions under the Energy Policy Act of 2005, and some additional measures. We recommend this alternative because: (1) issuance of a new hydropower license by the Commission would allow Merced ID to operate the project as an economically beneficial and dependable source of electrical energy for its customers; (2) the 101.25 MW of electric energy generated capacity comes from a renewable resource that does not contribute to atmospheric pollution; (3) the public benefits of this alternative would exceed those of the no-action alternative; and (4) the recommended measures would protect and enhance fish and wildlife resources and would provide improved recreation opportunities at the project.

Finally, for the reasons outlined below, we recommend that certain conditions specified by the BLM and the Water Board not be included in the staff alternative. The conditions we are not recommending include: (1) funding to offset operation, maintenance, management, and administration costs incurred by BLM; (2) annual consultation to review project status and plans, results of studies, necessary modifications to plans, and protection measures for newly listed species; (3) a review of the lists of federally listed and special-status species and evaluation of potential project effects on newly listed species; and (4) a fish passage plan. We recognize, however, that the Commission must include these conditions in any license due to their mandatory nature.

In the following section, we make recommendations as to which environmental measures proposed by Merced ID or recommended by agencies and other entities should be included in any license issued for the project. In addition to Merced ID's proposed environmental measures, we recommend additional staff-recommended environmental measures to be included in any license issued for the project. We also discuss which measures we do not recommend including in the license.

5.1.1.1 Measures Proposed by Merced ID

Based on our environmental analysis of Merced ID's proposal discussed in section 3.0 and the costs discussed in section 4.0, we recommend including the following environmental measures proposed by Merced ID in any license issued for the project. Our recommended modifications to Merced ID's proposed measures are shown in *italic*.

Aquatic Resources

- Establish a Merced River technical advisory committee (T&E2) *that expands the scope beyond measures that pertain only to anadromous fish downstream of the Crocker-Huffman diversion dam (such as topics that pertain to resident fish, aquatic and terrestrial monitoring results, and actions that could affect BLM-managed land, including Lake McClure water level management); establish guidelines for conducting meetings that provide ground rules for decision making; and add BLM and the Park Service to the entities invited to participate on the committee because Lake McClure water management affects resources within the jurisdiction of these two agencies.*
- Develop a coordinated operation plan for the Merced River and Merced Falls Projects (GEN6) *in consultation with the Water Board, BLM, FWS, California DFW, NMFS, and the Park Service.*
- Develop a site-specific erosion control and restoration plan in consultation with *the Water Board, California DFW, FWS, and BLM* and file the plan with the Commission at least 90-days in advance of initiating construction of recreation or other project facilities (G&S1); *the plan would apply to construction on all land within the project boundary, not just on or affecting BLM-managed land.*
- Develop a site-specific construction *and non-routine maintenance* hazardous materials spill prevention, control, and countermeasure plan in consultation with *the Water Board, California DFW, FWS, and, if construction is proposed on BLM-managed land, BLM,* and file the plan with the Commission at least 90-days in advance of initiating construction

or non-routine maintenance; the plan would apply to all construction and non-routine maintenance within the project boundaries, not just recreation facilities.

- For all controllable flows above 200 cfs, restrict the rate of change of releases from McSwain dam during any 1-hour period to not more than double or less than one-half the amount of controlled release from the reservoir at the start of the change; to measure compliance, flows would be measured at 1-hour intervals at the ramping rate compliance gage (AQR1 Part 2) *at McSwain powerhouse; flows and stage at 1-hour intervals would also be monitored at the existing gage immediately downstream of Crocker-Huffman diversion dam and data from both gages annually reported to the Commission after review by the technical advisory committee.*
- Measure and document compliance with minimum instream flow at the existing USGS gage 11271290 at Shaffer Bridge. Make the monitoring data available to the public in readily accessible formats and provide the data to USGS for inclusion in its annual hydrology summary reports (AQR1 Part 4).
- Monitor water temperature at four *to eight* sites selected by the technical advisory committee (T&E1).
- Maintain a minimum pool of not less than 115,000 acre-feet in Lake McClure except for drawdowns necessary to maintain minimum streamflows. Measure compliance at the existing USGS gage 11269500 daily and convert the stage reading to acre-feet of storage (AQR2); *annually report these data to the Commission to document compliance with water management measures and, when applicable, drought management plans.*
- Notify the Water Board, BLM, FWS, NMFS, and California DFW by March 10 of the second or subsequent dry/critically dry water year if Merced ID has drought concerns. By May 1 of these same years, consult with these same agencies to discuss the project's operational plans to manage drought conditions and file a drought plan with the Commission with a request for expedited approval (AQR1 Part 5). Implement the drought plan *upon Commission approval.*
- Operate the project for flood control *as prescribed by the Corps and approved by the Commission (WR3).*

- Provide 15,000 acre-feet of water to the Merced NWR annually unless otherwise agreed in advance by FWS *and as approved by the Commission* (WR2).
- Develop, in consultation with the *technical advisory committee*, the Corps, *and the California Department of Transportation*, a LWM and debris management plan that describes existing locations of LWM collection in Lake McClure and McSwain reservoir, potential options for moving the LWM collected to the Merced River downstream of Crocker-Huffman diversion dam, and suitable locations where LWM *and debris* can be placed in the active channel and possibly mobilized by 2- to 5-year high flow events. No LWM or debris would be stockpiled on BLM-managed land.
- Annually monitor Chinook salmon and *O. mykiss*⁵⁸ abundance in the Merced River downstream of Crocker-Huffman diversion dam using one RST (from January 1 through May 31) and one adult counting weir (from October 1 through December 31). The location of the monitoring stations would be determined by the technical advisory committee *and approved by the Commission*. Monitoring results would be posted on a publicly available website on the Monday following the week of data collection. An annual report would be developed in consultation with the technical advisory committee and filed with the Commission (T&E2).
- Implement the Amended Aquatic Invasive Species Management Plan filed on April 23, 2014, and supplemented on September 5, 2014 (AQR4), *after revising it to include provisions to document incidental observations by Merced ID staff and consultants of quagga and zebra mussels, New Zealand mudsnails, Asian clams, American bullfrog, Eurasian milfoil, Brazilian elodea, and hydrilla and reporting of any incidental observations that rise to the level of needing follow-up management actions to the Commission*. Consult with BLM, California DFW, and the Water Board on the staff-recommended plan revision and should the need to update the plan be identified in the future.

⁵⁸ In this draft EIS, *O. mykiss* refers to both the anadromous (steelhead) and resident (rainbow trout) form of this species.

Terrestrial Resources

- Implement the Invasive Species Management Plan on federal land (as filed with the final license application) (TR1, as amended) *with the following modifications to:*
 - *stipulate that the measures in the plan apply to all land within the project boundary, including treatment measures for the existing population of perennial pepperweed on Merced ID land;*
 - *provide details about the specific BMPs;*
 - *integrate a component on pest management and pesticide use, requiring agencies to be notified each year, for the upcoming year, of pesticide use on Merced ID's land and on land administered by BLM such that Merced ID would not use pesticides and herbicides on land administered by BLM without the prior written approval of BLM (TR3, as amended); and*
 - *include descriptions and examples of the unexpected outbreaks that would not require notification of pesticide use to agencies.*
- Implement the Vegetation Management Plan on federal land (as filed with the final license application) (TR2, as amended) *with the following modifications:*
 - *provide details about the specific BMPs that would be implemented as part of the plan;*
 - *include maps in section 3.0 to show locations of elderberry plants and identify which plants show signs of occupancy by the valley elderberry longhorn beetle.*
 - *require consultation with BLM, California DFW, and FWS during the planning phases for any new disturbance to identify the need for pre-disturbance surveys and develop protection measures for Commission approval for any sensitive species in the disturbance area; and*
- Implement the Bald Eagle Management Plan (as filed with the final license application) (TR4, as amended) *with modifications to:*
 - *include information about roost sites on public information boards;*
 - *describe activities that would be considered emergencies, and why these activities would supersede bald eagle protection;*
 - *protect winter roost trees from vegetation management and future construction activities to reduce potential for degrading these areas; and*

- *revise protocols and methodologies to be consistent with those recommended by FWS.*
- *Develop a bat protection plan for Commission approval including measures to document all known bat roosts at project facilities, and if bats could be subject to human disturbance, install humane exclusion devices (TR5).*
- *Implement the Limestone Salamanders Sensitive Areas Management Plan (as filed with the final license application) (TR6, as amended) with modifications to:*
 - *provide details about the specific BMPs that would be implemented as part of the plan; and*
 - *site new hiking trails or modifications to existing hiking trails outside limestone salamander sensitive habitat.*
- *Develop a protection plan for western pond turtles for Commission approval including measures to record the incidental observations of western pond turtles.*

Threatened and Endangered Species

- *Provide annual employee training regarding the identification of the special-status, non-native species, and sensitive areas that are known to occur in the project area and their locations in the project boundary (GEN2).*
- *Review special-status species lists annually, assess new species, and if necessary, consult with agencies to develop and implement special-status species protection measures, after Commission approval (GEN3).*
- *To minimize project-related and cumulative effects on the California tiger salamander, develop a protection plan for California tiger salamanders for Commission approval that includes the measure to avoid use of pesticides in California tiger salamander habitat.*
- *Develop a protection plan for the San Joaquin kit fox for Commission approval, including provisions for surveys and protection and mitigation measures to minimize project-related and cumulative effects on the San Joaquin kit fox.*

Recreation Resources

- Implement the Recreation Facilities Plan, filed on September 22, 2014, with the following modifications to:
 - *extend the proposed paved bicycle lane along the entire length of Lake McClure Road (7.8 miles) between County Road J16 and the proposed parking area from the McSwain shoreline trailhead;*
 - *remove the provision for a host site at the project's Horseshoe Bend recreation area campground;*
 - *identify the location of the project's three floating restrooms provided on Lake McClure, and include an operation and maintenance schedule and construction and rehabilitation measures (if needed) for each restroom; and*
 - *revise the implementation schedule to: to begin construction no earlier than Labor Day and no later than Memorial Day to avoid the primary recreation season; begin construction at the project's Bagby recreation area within 2 years of license issuance; begin construction of the project's non-motorized trails at the project's Horseshoe Bend recreation area, McSwain reservoir shoreline, and the new Mack Island recreation area within 3 years of license issuance; begin rehabilitation planning at each project campground within 3 years of license issuance (to be completed within 6 years of license issuance); and include a mid-license term rehabilitation assessment in the implementation schedule that would identify any project facilities and or water systems in need of rehabilitation.*
- Provide real-time recreation information on the California DEC (RR2), including:
 - *flow information for the Merced River below Merced Falls, Dry Creek near the city of Snelling, the Merced River near the cities of Snelling, Cressey, and Stevinson (existing measure);*
 - *elevations for Lake McClure and McSwain reservoir (existing measure); and*
 - *flow information for the Merced River at Shaffer Bridge (USGS gage no. 11271290).*
- Construct a parking area and install river access directional signage at the project's existing gravel-surfaced parking area at Merced Falls Road near the Crocker-Huffman diversion dam (RR2).

- Develop a conceptual plan to align the project's existing Merced River Trail to a new trail segment that would follow along the shoreline of Lake McClure and McSwain reservoir, filed on September 22, 2014.
- Annually stock rainbow trout, fingerling kokanee, and Chinook salmon in Lake McClure and McSwain reservoir for recreational fishing (AQR3).

Land Use

- Implement the Transportation Management Plan, filed on September 22, 2014, to ensure project roads are adequately maintained, *with the following modification:*
 - *include an inventory of all project roads and current road conditions, a detailed schedule of maintenance based on that inventory, relevant BMPs that would be implemented, a schedule for monitoring project road use over the term of the license, and a schedule for consultation with BLM and the California Department of Forestry and Fire Protection.*
- Implement the Fire Prevention and Response Plan, filed on September 22, 2014, to provide for management, reporting, and the prevention of wildfires at the project.

Cultural Resources

- Implement the final HPMP upon license issuance.

Aesthetics

- Implement the Visual Resources Plan, filed on September 22, 2014, to ensure visual quality objectives are met at the project through monitoring and consultation *for all project lands.*

5.1.1.2 Additional Measures Recommended by Staff

In addition to Merced ID's proposed measures listed above, we recommend including the following staff-recommended measures in any license issued for the Merced River Project.

Aquatic Resources

- Details of elements to be included in site-specific erosion control and restoration plans to protect project waters from erosion and sedimentation.

- Details of elements to be included in hazardous material spill prevention, control, and countermeasure plans to protect project waters from contaminants.
- Use of the Hughes method to determine water year type.
- A staff minimum instream flow regime downstream of Crocker-Huffman diversion dam for the purpose of enhancing physical habitat, density-dependent conditions, and water temperature for Chinook salmon and *O. mykiss*.
- A 25-cfs minimum flow release from New Exchequer dam to ensure the channel is not dewatered.
- A water temperature monitoring plan in the Merced River between Crocker-Huffman diversion dam and Shaffer Bridge.
- A fall pulse flow to attract adult anadromous salmonids to the mouth of the Merced River and stimulate upstream migration.
- Spring pulse flows to stimulate outmigration of rearing anadromous salmonids and inundate riparian floodplains.
- A drought management plan.
- A Merced NWR water delivery plan.
- An anadromous fish monitoring plan.
- A gravel augmentation plan to enhance spawning habitat for anadromous salmonids.

Threatened and Endangered Species

- Develop a protection plan for vernal pool fairy shrimp and its habitat to reduce project effects on fairy shrimp and associated habitat.
- Develop a protection plan for federally listed plants potentially occurring at or near the project to minimize project effects on these plant species.
- Develop a protection plan for the California red-legged frog, foothills yellow-legged frog, and western spadefoot to reduce project effects on these species.

Recreation Resources

- Develop and implement a fish stocking plan that includes the species, size, and amount of fish to be stocked in Lake McClure and McSwain reservoir based on recreational use, angling demand, and state fish

stocking management targets, and an implementation schedule to ensure appropriate recreational fish stocking at the project for the license term.

Below, we discuss our rationale for our additional staff-recommended measures.

Erosion Control and Restoration Plans

Under the proposed project and staff alternative, the following activities would cause ground-disturbance at the project: construction of new recreation facilities, rehabilitation of existing recreation facilities, and non-routine maintenance such as replacement of existing project facilities. As discussed in section 3.3.1.2, Merced ID provides no details on what measures it would implement under its proposed erosion control and restoration plans to control erosion resulting from the ground-disturbing activities. Consequently, we have no basis to conclude whether or not erosion related to the ground-disturbing activities would be controlled by Merced ID. The Water Board [preliminary WQC condition 23] specifies that Merced ID should have measures in place to control excessive erosion, excessive sedimentation, and turbidity at the beginning of and throughout any ground-clearing activities, excavation, or any other project activities that could result in erosion or sediment discharges to surface waters. In addition, the Water Board specifies that erosion control blankets, liners with berms, and/or other erosion control measures should be used for any stockpile of excavated material to control runoff resulting from precipitation, and prevent material from contacting or entering surface waters. We find that the inclusion of a provision that Merced ID implement the protective elements specified by the Water Board under the proposed site-specific erosion control and restoration plans would protect environmental resources at and near the project from the effects of erosion. Therefore, we recommend that Merced ID develop, in consultation with the Water Board, California DFW, FWS, and BLM, specific elements of its proposed erosion control and restoration plans. The plans should include, at a minimum, the following: (1) a description of BMPs for erosion control that would be applied in specific circumstances; (2) provisions for inspecting erosion control measures while they are in place; (3) emergency protocols for erosion and sedimentation control (e.g., steps that would be taken if control measures fail during a storm event); (4) techniques that would be used to stabilize sites once construction is completed; and (5) a description of when and what type of water quality monitoring of surface waters would occur during and after ground-disturbing activities. Identifying such measures and protocols in the erosion control and restoration plans would assure that erosion does not unacceptably degrade water quality adjacent to construction and other ground-disturbance sites. For these reasons, we conclude that development of erosion control and restoration plans with our recommended components would be worth the estimated levelized annual cost of \$4,000.

Hazardous Material Spill Prevention, Control, and Countermeasure Plans

Under the proposed project and staff alternative, the following activities would or could entail the use of hazardous materials (e.g., fuels, coolants, lubricants, herbicides,

and pesticides) at the project: construction of new recreation facilities, rehabilitation of existing recreation facilities, and non-routine maintenance such as replacement of existing project facilities. Merced ID provides no details regarding the contents that would be included in its proposed construction hazardous materials spill prevention, control, and countermeasure plans for each activity that may involve use of contaminants. Consequently, as discussed in section 3.3.1.2, we have no basis to conclude whether or not the release of contaminants would be controlled by Merced ID. The Water Board specifies various measures to minimize the chances of contaminants reaching project waters (preliminary WQC conditions 25 [three measures], 26 [three measures], 27 [six measures], 28 [five measures], and 29 [one measure]; see section 3.3.1.2 for details of these measures). We find that including in the site-specific hazardous materials spill prevention, control, and countermeasure plans a provision that Merced ID implement the protective principles specified by the Water Board would protect surface water and groundwater at and near the project from contaminants. Therefore, we recommend that Merced ID develop, in consultation with the Water Board, California DFW, BLM, and FWS, specific elements of its proposed hazardous material spill prevention, control, and countermeasure plans. The plans should include, at a minimum, the following: (1) a description of the BMPs for contaminant control that could be applied in specific circumstances; (2) emergency protocols for spill containment and remediation; (3) the location of emergency cleanup equipment in the event of contaminant release; (4) identification of the entities to be contacted in the event of a spill; (5) designated equipment refueling and maintenance areas; (6) provisions requiring equipment to be cleaned and inspected prior to entering a construction site to ensure it is in proper functioning condition; (7) post-spill water quality monitoring protocols to ensure remediation measures are effective; and (8) a listing of applicable local, state, and federal regulations that pertain to prevention of spills and protection of water quality. Identifying such measures and protocols in the hazardous materials spill prevention, control, and countermeasure plans would assure that surface water and groundwater are protected from contaminants. Therefore, we conclude that development of hazardous material spill prevention, control, and countermeasure plans with our recommended components would be worth the estimated leveled annual cost of \$760.

Determination of Water Year Type

Precipitation and runoff patterns vary considerably in the San Joaquin River Basin, and aquatic communities have adapted to these variances. Water management in this region accounts for this variability by establishing water year types that guide water allocation decisions. A water year type determination at the Merced River Project would govern how instream flow releases are adjusted based on meteorological conditions. Several different approaches to establishing water year types have been developed.

Merced ID's proposed measure AQR1, Part 3, would calculate a water supply index for the Merced River based on unregulated (unimpaired) runoff below Merced Falls (i.e., inflow to Lake McClure) using the same methods currently used for the San Joaquin Valley Water Year Hydrologic Classification (San Joaquin Valley 60-20-20 Index), which was developed by the Water Board for the San Joaquin River Basin as part of its Bay-Delta regulatory activities (Water Board 2006b). Five water year types would be established within this index: wet, above normal, below normal, dry, and critically dry. The water year types would be calculated as 60 percent of the current year's April through July inflow plus 20 percent of the current year's October through March inflow plus 20 percent of the previous year's index. The numerical breakpoints (in thousands of acre-feet) for the five water year classifications for the San Joaquin Valley 60-20-20 Index and the Merced 60-20-20 Index methods are presented in table 5-1.

Table 5-1. Comparison of alternative water-year type classifications.

Water year type	San Joaquin Valley 60-20-20 Index Classification^a	Merced ID's Proposed Merced 60-20-20 Index Classification	California DFW's Recommended Classification (Hughes Method)
	(in thousands acre-feet)		
Wet	>3,800	>650	>1,307
Above Normal	>3,100 and <3,800	>530 and <650	>919 and <1,307
Below Normal	>2,500 and <3,100	>420 and <530	>546 and <919
Dry	>2,100 and <2,500	>360 and <420	>339 and <546
Critical	<2,100	<360	<339

^a Source: Water Board 2006b

Merced ID would begin using its proposed approach to determining water year type within 90 days of license issuance. For each year, water year type would initially be established in February and updated in March, April, and May. From May 15 to February 14 of the following year, Merced ID would base water year type on California DWR's forecast published in May. Merced ID states that the water-supply indices for February and March would be calculated using the 90 percent exceedance forecast for unregulated runoff and the April and May indices would be calculated using the 75 percent exceedance forecast for unregulated runoff. FWS amended 10(j) recommendation 3(A1) and the Conservation Groups also recommend Merced ID's proposed approach to determining water year types. Additional details on the Merced 60-20-20 Index are presented in sections 3.3.1.1 and 3.3.1.2.

NMFS [10(j) recommendation 1.1A(7)] and California DFW [10(j) recommendation 3A] recommend that Merced ID use the “Hughes method” to determine water year type for instream flow releases. NMFS and California DFW state that Merced ID’s approach to water year determination using a 90 percent exceedance forecast for February and March and 75 percent exceedance forecast for April and May creates overly conservative predictions of inflows. California DFW estimates that this would result in drier than actual water year operations being implemented for February and March 40 percent of the time and for April and May, 25 percent of the time. The Hughes method is based on the water year forecast of unregulated runoff of the Merced River below Merced Falls published near the beginning of each month from February through May in California DWR’s Bulletin 120. Unlike the Merced 60-20-20 Index that factors current and past-year conditions, the Hughes method does not rely on carry over storage within Lake McClure. NMFS and California DFW note that the Merced 60-20-20 Index provides a disincentive for water conservation by reducing environmental flows when carry-over storage is low. California DFW recommends that the water year types be defined as having numerical breakpoints (in thousands of acre-feet) based on unregulated inflow to Lake McClure reported for water years 1901 to 2012 (see table 5-1). California DFW also recommends that Merced ID perform an update to the water year type determination at the end of the water year using California DWR’s “October update,” which, if published, uses observed monthly unregulated runoff for the river rather than forecasted runoff.

Merced ID’s proposal and NMFS and California DFW’s recommendation to base water year type on California DWR’s forecast of unregulated runoff of the Merced River would both follow an accepted approach implemented in similar watersheds contributing to the San Joaquin and Sacramento Valleys. The agencies and the Conservation Groups agree that the Merced 60-20-20 Index as proposed by Merced ID would result in more conservative water-year type estimates than would the Hughes method. Specifically, calculation of the February and March indices and the April and May indices using California DWR’s 90 and 75 percent exceedance forecasts, respectively, instead of the median (50 percent exceedance; i.e., distinction between below and above normal conditions) forecast would produce lower runoff estimates that are biased towards ascribing below normal conditions. Additionally, incorporating updated, observed unregulated runoff volumes published by California DWR in October, when available, would improve water year type determination under either method throughout the water year and into the subsequent one compared with the forecast-based, Merced 60-20-20 Index determination.

Based on our analysis in section 3.3.1.2, adoption of the Hughes method recommended by NMFS and California DFW would accomplish the following: (1) continued adherence to the California DWR’s forecasts for annual unregulated runoff in the Merced River during February, March, April, and May, (2) incorporation of updated observed runoff (full natural flows), when available, rather than complete reliance on forecast-based water year type, and (3) use of type classifications (numerical

breakpoints) based on a quartile-based distribution of the full hydrologic record for the watershed. Therefore, we recommend that Merced ID use the Hughes method to determine water year type because it is more hydrologically comprehensive and does not discount for previous year storage in Lake McClure. The cost of establishing the water year type using the Hughes method would be similar to the cost associated with Merced ID's proposed method.

Minimum Instream Flows Downstream of Crocker-Huffman Diversion Dam

Merced ID's, the agencies', and the Conservation Groups' proposed and recommended minimum flow regimes are all substantially different (tables 3-9 and 3-10). Merced ID modeling results show variable habitat availability by flow regime and modeled life stage for Central Valley steelhead and fall run Chinook salmon. Balancing the different resource values associated with each flow regime represents a complex series of tradeoffs (e.g., enhancing temperature conditions for specific fish species and life stages with the limited amount of cold pool water in Lake McClure, enhancing physical habitat for specific life stages of anadromous fish, providing flows that encourage juvenile outmigration because the temperature regime is unlikely to be favorable, and conserving water for irrigation purposes) to derive a reasonable flow regime.

As discussed in section 3.3.1.2, we consider the approach to establishing an appropriate minimum flow regime presented in the California DFW rationale document for its 10(j) recommendations to be a reasonable framework upon which to build a minimum flow regime compared to the approaches provided by FWS, NMFS, and the Conservation Groups. California DFW provides significant details (12 pages) on its recommended flows for the entire year. FWS and NMFS' rationale does not cover the entire year, and the Conservation Groups embed irrigation restrictions into most of its flow recommendations. The California DFW flow regime seeks to: (1) enhance physical Chinook salmon spawning and incubation habit during late fall and early winter when water temperatures are not overly constraining; (2) consider density-dependent variables as fry emerge from spawning gravel in late January through February; (3) enhance water temperatures for smoltification during the spring; and (4) provide reasonable physical habitat for *O. mykiss* juveniles and adults during the summer.

The California DFW recommended flow regime from October 16 through January 15 is intended to enhance Chinook salmon spawning and incubation habitat. The California DFW recommended minimum flows during this time for wet, above normal, and below normal water years (225 to 275 cfs) would provide about 80 to 100 percent of the maximum WUA, depending on water year type and the specific reach between Crocker-Huffman diversion dam and Shaffer Bridge (Merced ID, 2013a). However, providing a minimum flow of 175 cfs during wet and above normal water years (which is the same as the FWS recommended target flow from October 16 through February 28 and comparable to Merced ID's proposed 180 and 160 cfs during

wet and above normal water years from October 16 through January 31) would provide about 73 to 96 percent of maximum WUA and conserve Lake McClure water for use later in the year compared to the higher minimum flows during comparable water years recommended by NMFS, California DFW, and the Conservation Groups. The California DFW recommended minimum flows of 150 and 140 cfs during dry and critically dry water years would provide about 67 to 85 percent and 65 to 80 percent of the maximum WUA, respectively. We consider this to be a reasonable enhancement when water is scarce. However, flows of 150 cfs in October of dry years and 140 cfs during critically dry years and 140 cfs in November of critically dry years are more than would occur in the Merced River if the project did not exist (i.e., unregulated flows). We therefore recommend minimum flows during October and November that correspond to the unregulated flows for dry and critically dry water years shown in table 3-12 to conserve Lake McClure storage (i.e., 100 and 120 cfs during dry and critically dry Octobers, respectively, and 130 cfs during critically dry Novembers). These flows are comparable to FWS' target flows of 100 cfs non-pulse flow releases during October and November. Applying the 150 cfs minimum flow to below normal water years, which we also consider to be representative of relatively scarce available water, would also represent a reasonable enhancement compared to existing conditions. Merced ID's proposed minimum flow from October 16 through January of 100 and 80 cfs during dry and critically dry water years would only provide about 48 to 55 percent and less than 37 percent of the maximum WUA, respectively. Although this would represent an enhancement compared to the existing 60 cfs minimum flow, it would be unlikely for such a minor increase in potential Chinook salmon spawning and incubation habitat to result in tangible biological benefits to the community in the Merced River. Table 5-2 shows our recommended minimum flows for the entire year.

California DFW presents data that indicates that upon emergence, Chinook salmon fry survival is density dependent, with lower survival rates associated with higher densities. Increasing flows reduce density and enhance survival. Predicted survival of newly emerged fry between January 16 and the end of February would be between 60 and 100 percent for initial fry densities of 1,000,000 to 100,000, respectively, with flows of 400 cfs. This is the basis for the California DFW recommended minimum flow of 400 cfs during this period, regardless of water year type. Considering that minimum flows that would support spawning and incubation would be scaled back by most proposed and recommended flow regimes during less than wet water year types, we consider it appropriate to scale back the initial recommended flow of 400 cfs accordingly to conserve Lake McClure water for later use. Flows of 350 and 300 cfs during above normal and below normal water years, respectively, would still provide from about 98 to 100 percent fry survival assuming a starting density of 100,000 fry (which we consider a reasonable assumption because of the low escapement of Chinook salmon of natural origin during recent years; see figure 3-22). These minimum flows are consistent with the recommended NMFS minimum flows for the first half of February in above normal and wet water years and exceed the

Merced ID proposed and FWS recommended minimum flows for January and February. Continuing the California DFW recommended late fall-early winter minimum flow of 150 and 140 cfs during dry and critically dry water years from mid-January to the end of February would provide about 92 and 91 percent fry survival, respectively, assuming a starting density of 100,000 fry. We consider this to represent a reasonable enhancement that would conserve water for later use when water is scarce.

During March and April, the California DFW minimum flow regime focuses on attempting to achieve the EPA temperature guideline of 16°C (60.8°F) for Chinook salmon and steelhead rearing and emigration. During wet and above normal water years, the California DFW minimum flow modeling results show the goal would be achieved down to RM 32.5 (Shaffer Bridge); in below normal water years to RM 38.0; in dry water years to RM 45.0; and critically dry water years to RM 46.5 (about 3.5 miles downstream of the diversion dam). The reach from Crocker-Huffman diversion dam to RM 45.0 currently includes some of the best salmonid spawning and rearing habitat in the lower Merced River. However, we find two flows recommended by California DFW to be unnecessary. During the April 1 through 15 time frame, a higher minimum flow of 620 cfs would not be necessary during below normal water years to achieve the EPA guideline of 16°C (60.8°F) at RM 38.0 considering that a minimum flow of 590 cfs would achieve the guideline downstream to Shaffer Bridge (RM 32.5). For other 2-week periods during March and April, California DFW modeling shows that decreasing minimum flows as water years become drier would achieve the temperature goal at the designated river locations. Similarly, during April 1 through 15, the California DFW recommended flow of 560 cfs during critically dry water years is not necessary to achieve the temperature goal at RM 46.5 considering that a minimum flow of 510 cfs would achieve the goal down to RM 45.0. We find that minimum flows of 560, 560, and 510 cfs during below normal, dry, and critically dry water years, respectively, from April 1 through April 15, would likely achieve appropriate water temperature enhancements comparable to the California DFW analogous flows of 620, 510, and 560 cfs, while conserving water during below normal and critically dry water years. Monitoring water temperature would confirm our findings. NMFS and the Conservation Groups' minimum flow regimes during March and April are generally higher than those recommended by California DFW, and although higher flows could further enhance the lower Merced River temperature regime, it would come at the cost of reduced water storage in Lake McClure, which means that there would be less water available during the irrigation season and reduced cold pool water for late spring temperature enhancement.

During May, most stakeholders recommend a pulse flow (in addition to recommended minimum flows) or high minimum flows that would inundate riparian floodplains and serve to stimulate young anadromous salmonid outmigration. The FWS target flow recommendation would inundate floodplains for 69 days from late March through early June in wet water years, 27 days in late March through mid-April in above normal water years, 12 days in late March through early April in below normal water

years, and 5 days in late March during dry water years. These high spring flows are discussed under *Spring Pulse Flows*; however, during any such pulse or high flow releases, there would likely be water temperature enhancements in the lower Merced River unless the cold pool storage in Lake McClure had been expended during previous flow releases. Extending the California DFW recommended minimum flows for the April 16 through April 30 time frame into May until the beginning of a spring pulse flow would maintain any enhanced temperature condition if there is sufficient cold pool storage available.

With the relatively high staff recommended spring minimum flows as described previously, we expect there to be little if any Lake McClure cold pool water available to provide temperature enhancements to the lower Merced River during the summer. Assuming most Chinook salmon juveniles and smolt emigrate from the lower Merced River with a spring pulse flow, we focus on flows that provide suitable physical habitat for *O. mykiss* juveniles and adults, some of which are likely to remain in the lower Merced River throughout the summer. A minimum flow of 200 cfs that begins at the conclusion of a spring pulse flow (which we assume would be on June 1) and continues until October 15 or the start of a fall adult Chinook salmon attraction pulse flow would provide 90 to 98 percent of the maximum WUA for juvenile and adult *O. mykiss* (Merced ID, 2013a). This summer minimum flow is recommended by California DFW and comparable to the minimum flows recommended by the Conservation Groups. However it is lower than most of the minimum flows recommended by NMFS and FWS. It is unclear to us what additional habitat value higher summer minimum or target flows would provide, and higher flows would further deplete water storage in Lake McClure. However, flows of 200 cfs in August and September of dry years are more than would occur in the Merced River if the project did not exist (i.e., unregulated flows). We therefore recommend minimum flows during August (70 cfs during dry and 60 cfs during critically dry) and September (60 cfs) that correspond to the unregulated flows for dry and critically dry water years shown in table 3-12 to conserve Lake McClure storage.

For the reasons discussed above, we recommend that Merced release the instantaneous minimum flows shown in table 5-2. Our recommended minimum flow regime includes elements of all agency-recommended flows and attempts to strike a balance between aquatic habitat enhancement and maintaining Lake McClure water storage for irrigation and water temperature enhancements. We recognize that our recommended minimum flow would reduce the average amount of water available for irrigators by an additional 20,000 acre-feet annually compared to existing conditions and would reduce the average annual generation by about 21 GWh at an estimated annual cost of \$1,075,000. We conclude that the habitat enhancements for anadromous salmonids, potentially including federally listed Central Valley steelhead, would be worth any such costs.

Table 5-2. Staff-recommended minimum flows (cfs) by water year type (Source: staff).

	Wet	Above Normal	Below Normal	Dry	Critically Dry
Jan 1-Jan 15	175	175	150	150	140
Jan 16-Feb	400	350	300	150	140
Mar 1-15	270	270	270	240	200
Mar 16-31	410	410	370	370	310
Apr 1-15	590	590	560	560	510
Apr 16-30	790	790	780	570	570
May 1-15	790 ^a	790 ^a	780 ^a	570 ^a	570 ^a
May 16-31	790 ^a	790 ^a	780 ^a	570 ^a	570 ^a
June-July	200 ^b	200 ^b	200 ^b	200 ^b	200 ^b
Aug	200	200	200	270	260
Sept	200	200	200	60	60
Oct	200 ^c	200 ^c	200 ^c	100 ^c	120 ^c
Nov	175 ^d	175 ^d	150 ^d	150 ^d	130 ^d
Dec	175	175	150	150	140

^a Minimum flow up to the onset of the spring pulse flow.

^b Minimum flow at the conclusion of the spring pulse flow.

^c Minimum flow up to the onset of the fall pulse flow.

^d Minimum flow at the conclusion of the fall pulse flow.

We summarize the expected effects and costs of proposed and recommended flow regimes based on Merced ID's and staff's modeling in table 5-3. The staff-recommended minimum flow regime would enhance salmonid spawning and incubation habitat; however, the degree of enhancement would be reduced during drier water years to conserve water for irrigation. The staff-recommended minimum flow would enhance temperature for salmonid fry rearing during the spring, but temperature objectives would only be achieved in 5.0 and 3.5 miles of river downstream of Crocker-Huffman diversion dam in an attempt to balance water for irrigation and generation with water for habitat enhancements. We recognize that the relatively high spring minimum flows that we recommend would still come at substantial costs to irrigators and power generation, but protecting the lower Merced River populations of Chinook salmon and *O. mykiss* by enhancing fry growth to the point where the probability of successful outmigration is increased prior to the summer would be worth the cost.

Minimum Instream Flow Downstream of New Exchequer Dam

California DFW [10(j) recommendation 3B(a)] recommends that Merced ID provide a minimum flow of 25 cfs below New Exchequer dam at all times. This is identical to what is required by article 40 of the current license. Merced ID contends that McSwain reservoir backs up to New Exchequer dam and there is no need for an instream flow requirement. However, although McSwain reservoir may back up to the base of New Exchequer dam when McSwain reservoir is at full pool, this is likely not the case when McSwain reservoir is drawn down. During drawdowns, a short riverine section exists and releasing a minimum flow of 25 cfs would ensure that this channel is not dewatered. We therefore recommend that Merced ID continue to release a minimum flow of 25 cfs from New Exchequer dam and document compliance with this measure as it does currently. Because this is a continuation of an existing measure, the cost of this measure is included in the existing operation and maintenance costs of the project.

Table 5-3. Comparison of estimated effects and costs of flow regimes associated with proposed and recommended flow regimes compared to existing conditions (Source: Merced ID, 2014c,d; staff)

	Potential Effects			Cost		
Proponent	Fall-Run Chinook Salmon	CV Steelhead	EPA Water Temperature Guidelines	Water Deliveries	Energy Generation	Value of Project Power
Merced ID	-Reduces effective spawning habitat by 4% -Increases effective habitat for fry and juvenile rearing by 1% -Nearly optimal physical spawning habitat in late October-January of wet and above normal water years, slight enhancement in other water years -Nearly optimizes in-channel fry and juvenile rearing physical habitat	-Reduces effective spawning habitat by 5% -No change in effective fry or juvenile rearing habitat -Increases effective adult rearing habitat by 1% -Physical juvenile over-summer in-channel rearing habitat optimized or nearly so in wet and above normal water year -Moderate enhancement in other water years	-Criteria for Chinook salmon juvenile rearing and emigration at RM 42.0^a exceeded 25% of the time -Criteria for steelhead smoltification at RM 42.0 exceeded 46% of the time	Significant shortages in 6 of 36 years and average annual shortage of 1,000 acre-feet more than under existing conditions	Average annual increase of 1 GWh	Average annual increase of \$66,000

	Potential Effects			Cost		
Proponent	Fall-Run Chinook Salmon	CV Steelhead	EPA Water Temperature Guidelines	Water Deliveries	Energy Generation	Value of Project Power
NMFS	-Reduces effective spawning habitat by 4% -Increases effective habitat for fry by 1% and juveniles by 4% -October-January physical spawning habitat nearly optimal -In-channel fry and juvenile physical habitat reduced	-Increases effective spawning habitat by 1% -Increases effective fry habitat by 2% and juvenile over-summer effective rearing habitat by 2% -Increases effective adult rearing habitat by 4% -Physical juvenile over-summer in-channel rearing habitat moderately enhanced in all water years	-Criteria for Chinook salmon juvenile rearing and emigration at RM 42.0^a exceeded 11% of the time -Criteria for steelhead smoltification at RM 42.0 exceeded 42% of the time	Significant shortages in 19 of 36 years and average annual shortage of 101,000 acre-feet	Average annual reduction of 41 GWh	Average annual reduction of \$2.393 million

	Potential Effects			Cost		
Proponent	Fall-Run Chinook Salmon	CV Steelhead	EPA Water Temperature Guidelines	Water Deliveries	Energy Generation	Value of Project Power
FWS (amended)	-Reduces effective spawning habitat by 5% -Increases effective habitat for fry by 3% and juveniles by 4% -November-February physical spawning habitat nearly optimal in wet and above normal water year types, slight enhancement in other water years -In-channel fry and juvenile physical habitat reduced	-Reduces effective spawning habitat by 5% -Increases effective fry habitat by 3% -No change in effective juvenile rearing habitat -1% increase in effective adult rearing habitat -Physical juvenile over-summer in-channel rearing habitat optimized or nearly so in wet and above normal water year -Moderate enhancement in other water years	-Criteria for Chinook salmon juvenile rearing and emigration at RM 42.0^a exceeded 21% of the time -Criteria for steelhead smoltification at RM 42.0 exceeded 43% of the time -Physical juvenile over-summer in-channel rearing habitat nearly optimized or nearly so in all water years	Significant shortages in 12 of 36 years and average annual shortage of 24,000 acre-feet more than under existing conditions.	Average annual reduction of 10 GWh	Average annual reduction of \$525,000

	Potential Effects			Cost		
Proponent	Fall-Run Chinook Salmon	CV Steelhead	EPA Water Temperature Guidelines	Water Deliveries	Energy Generation	Value of Project Power
California DFW	-Reduces effective spawning habitat by 2% -Increases effective habitat for fry and juveniles by 6% -Physical spawning habitat optimized or nearly so from mid-October to mid-January in all but critically dry water years -In-channel fry and juvenile physical habitat reduced	-Increases effective spawning habitat by 4% -Increases effective fry rearing habitat by 16% -No change in juvenile over-summering effective habitat -4% increase in effective adult rearing habitat	-Criteria for Chinook salmon juvenile rearing and emigration at RM 42.0^a exceeded 1% of the time -Criteria for steelhead smoltification at RM 42.0 exceeded 39% of the time -Physical juvenile over-summer in-channel rearing habitat optimized or nearly so in all water year types	Significant shortages in 22 of 36 years and average annual shortage of 138,000 acre-feet more than under existing conditions	Average annual reduction of 35 GWh	Average annual reduction of \$2.1 million

	Potential Effects			Cost		
Proponent	Fall-Run Chinook Salmon	CV Steelhead	EPA Water Temperature Guidelines	Water Deliveries	Energy Generation	Value of Project Power
Conservation Groups	-Decreases effective spawning habitat by 2% -Increases effective habitat for fry by 5% and juveniles by 6% -Physical spawning habitat optimized or nearly so in all water year types -Physical spawning habitat optimized or nearly so from mid-October to mid-January in all but critically dry water years -In-channel fry and juvenile physical habitat reduced	-No change in effective spawning habitat -Increases effective fry rearing habitat by 12% -Increases juvenile over-summering effective habitat by 3% -Increases effective adult rearing habitat by 1%	-Criteria for Chinook salmon juvenile rearing and emigration at RM 42.0^a exceeded 14% of the time -Criteria for steelhead smoltification at RM 42.0 exceeded 40% of the time -Physical juvenile over-summer in-channel rearing habitat decreased in June of wet water years, slightly enhanced in June of above normal water years, and optimized or nearly so in July-September of other water year types	Significant shortages in 36 of 36 years and average annual shortage of 144,000 acre-feet more than under existing conditions	Average annual reduction of 29 GWh	Average annual reduction of \$1.6 million

	Potential Effects			Cost		
Proponent	Fall-Run Chinook Salmon	CV Steelhead	EPA Water Temperature Guidelines	Water Deliveries	Energy Generation	Value of Project Power
Commission Staff	-Estimated to reduce effective spawning habitat by about 2% -Estimated to increase effective habitat for fry and juveniles by about 6%,^b physical spawning habitat optimized or nearly so from mid-October to mid-January in all but critically dry water years -In-channel fry and juvenile physical habitat reduced	-Estimated to increase effective spawning habitat by about 4% -Estimated to increase effective fry rearing habitat by 16% -No change in juvenile over-summering effective habitat -4% increase in effective adult rearing habitat^b	-Criteria for Chinook salmon juvenile rearing and emigration at RM 42.0^a estimated to be exceeded 1% of the time -Criteria for steelhead smoltification at RM 42.0 estimated to be exceeded 39% of the time^b -Physical juvenile over-summer in-channel rearing habitat optimized or nearly so in all water year types	Increase in water supply shortage of 20,000 acre-feet	Average annual reduction of 21 GWh	Average annual reduction of \$1.075 million

^a This reach includes the primary salmonid spawning and rearing habitat downstream of Crocker-Huffman diversion dam.

^b Staff did not model this scenario, but uses the modeled flow regime of California DFW, which is similar to the staff alternative.

Water Temperature Monitoring Plan

Although Merced ID proposes to monitor water temperature, it does not propose to develop a plan that would document the rationale for monitoring locations or other details of how this monitoring would be implemented.

The Water Board [preliminary WQC condition 19] specifies that Merced ID develop a water temperature monitoring plan in consultation with a technical advisory committee that includes provisions for the installation of four to eight water temperature monitoring devices. The plan would include: (1) a statement of goals and objectives; (2) a description of monitoring protocols; (3) a description of factors that may affect water temperature and identification of the ones that are project-related; (4) monitoring and reporting schedules; and (5) a plan for corrective actions if data indicate that project operation is increasing water temperature.

Agency recommendations regarding monitoring water temperatures vary. NMFS [10(j) recommendation 8] recommends that water temperature and flows be measured at 10 locations ranging from RM 62.0 to a location between Shaffer Bridge and the confluence with the San Joaquin River. NMFS states that measuring flow at temperature monitoring stations is important because temperature is related to flow and having both would better enable interpretation of the monitoring results given the many diversions that occur in the lower Merced River. FWS [10(j) recommendation 5(j)] recommends that Merced ID continuously monitor water temperature at about 5-mile intervals between New Exchequer dam (RM 62.0) and Shaffer Bridge (RM 32.8), which would include six locations. California DFW [10(j) recommendation 9(7)] recommends that Merced ID include in an overall monitoring plan (other parameters would also be included in this plan) provisions for continuously monitoring water temperature at RMs 62.0, 56.0, 52.0 (below Crocker-Huffman diversion dam), 46.5, 45.0, 42.0, 38.0, and 32.8 (Shaffer Bridge).

We conclude that water temperature monitoring would be appropriate to document conditions in the project-affected reach downstream of Crocker-Huffman diversion dam to Shaffer Bridge and its relationship to anadromous fish habitat. As discussed in section 3.3.1.2, monitoring water temperature immediately downstream of Crocker-Huffman diversion dam at the existing flow gage would document conditions at the upstream limit of anadromous fish habitat. Monitoring water temperature at the existing gage at Shaffer Bridge would document conditions at the downstream end of the project-affected reach. Placement of gages at the upstream and downstream end of the project-affected reach would enable temperature to be correlated with associated flows. The diversions that occur within this reach are not project-related, but monitoring water temperature at intermediate locations would help to interpret whether temperature measurements at Shaffer Bridge are related to non-project factors such as irrigation returns. Overall, monitoring water temperature at several locations would provide data on whether project-related flow releases from Lake McClure are achieving expected water temperature

enhancements within the limitations of the available cold water pool and enable such effects to be separated from non-project effects. Ultimately, when combined with flow and anadromous fish monitoring, this monitoring would provide a basis for evaluating the need for future adjustments to the project flow regime. However, monitoring flows at interim locations or downstream of Shaffer Bridge, as recommended by NMFS, would not have a relationship to hydroelectric project operation. Although monitoring water temperature upstream of Crocker-Huffman diversion dam would have some value for interpreting downstream results, releases from New Exchequer dam have a relatively short residence time in McSwain reservoir, Merced Falls reservoir, and the Crocker-Huffman impoundment.

Developing the water temperature monitoring plan specified in preliminary WQC condition 19 would allow temperature monitoring gages to be placed at locations agreed upon by a technical advisory committee. We therefore recommend that such a plan be developed. However, we conclude that the plan should also include the justification for the placement of each monitoring station as well as the coordinates of the selected stations. As we note in the previous paragraph, we find clear justification for placement of temperature monitors in the reach from Crocker-Huffman diversion dam to Shaffer Bridge, but we are not convinced that there would be need for more than eight stations. We find that the benefits of establishing a water temperature monitoring plan that relates to hydroelectric project operation in consultation with the technical advisory committee would be worth the estimated annualized cost of \$35,000.

Fall Pulse Flow

The primary purpose of fall pulse flows is to attract anadromous fish to upstream spawning areas of the Merced River. Merced ID does not propose to release a fall pulse flow. Pulse flows recommended by FWS, NMFS, California DFW, and the Conservation Groups are variable in terms of both volume and how they are defined. We converted all recommended pulse flows to acre-feet to enable an equal comparison of the recommendations. The recommendations for fall pulse flows range from 7,932 to 13,881 acre-feet in dry years and from 12,500 to 19,830 acre-feet in wet years. The recommendations of NMFS and the Conservation Groups represent a continuation of existing conditions under the Memorandum of Understanding with California DFW, with a constant fall attraction flow release of 12,500 acre-feet regardless of water year type. California DFW and FWS recommend providing 1,000 or 1,200 cfs, respectively, for varying numbers of days depending on water year types, which equates to 11,880 to 23,760 acre-feet, for California DFW's recommendation and 7,932 to 19,830 acre-feet for FWS' recommendation. California DFW notes its reason for its recommended maximum pulse flow of 1,000 cfs is to (1) avoid floodplain inundation, which would not be desirable during the spawning season, and (2) keep spawning Chinook salmon in the channel proper. Fall floodplain inundation is atypical during the Chinook salmon spawning period and if redds should be constructed in the inundated floodplain during a short-term attraction flow release, they would be dewatered when the flows recede. The

reduction in the fall pulse flow duration during dry and critically dry water years to 11,880 and 7,932 acre-feet in the California DFW and FWS recommendations, respectively, would preserve water and associated cold pool storage in Lake McClure while simultaneously provide the benefits of fall pulse flows to attract adult Chinook salmon to the mouth of the Merced River.

A fall pulse flow release would continue to attract adult Chinook salmon to the Merced River for spawning. Pulse flows should not be such that over bank flows occur to ensure that spawning occurs in the channel proper and therefore should be restricted to no more than 1,000 cfs. Releases of 1,000 cfs would need to occur for between approximately 6 and 7 days to reach the current, NMFS, and Conservation Groups' recommended fall block pulse flow of 12,500 acre-feet. Increasing the number of days that fall pulse flows are released to 10 or 12 days, as FWS and California DFW recommend during wet, above normal, and below normal water years, could result in enhanced salmon attraction. However, it would also result in an additional depletion in the volume of water in Lake McClure. We consider the value of carrying over as much water as possible for use for habitat enhancement in the lower Merced River and irrigation during a following year to outweigh the potential increased attraction of Chinook salmon that could be achieved with an additional 3 to 6 days of fall releases. We therefore recommend a fall pulse flow release of 1,000 cfs during October or November until a total volume of 12,500 acre-feet is released, including the volume of water associated with the staff-recommended minimum flow during this period. Not including the volume of required minimum flows in the fall pulse flow could enable pulse flow releases to occur for a longer period of time, but as we note above, it would further deplete Lake McClure storage. Monitoring salmonid upstream migration in the lower Merced River, as we recommend, would provide data to assess the effectiveness of any fall pulse flow that may be included in a new license and provide a basis for adjustments, if necessary. The exact timing of the release would be determined by the technical advisory committee. This would essentially be a continuation of an existing measure with the exception that the current pulse flow release does not include the minimum flows included in the existing license (which range from 15 to 100 cfs under the current license). Therefore, the cost of pulse flow release is included in the cost of the minimum flow proposals.

Spring Pulse Flows

Spring pulse flows from precipitation and melting snow pack in unregulated rivers can facilitate downstream migration of juvenile/smolt salmonids, transport bedload, remove fine sediments from spawning gravels and, when the floodplain is inundated, promote recruitment of riparian tree species such as cottonwoods. Lake McClure is operated for flood control and irrigation storage so that the high spring pulse flows are dampened (see figures 3-2 through 3-7). Releasing discrete Merced River pulse flows in the spring that to some degree mimic the pulse flows in unregulated rivers can provide some of these environmental benefits.

Merced ID does not propose to release a spring pulse flow. Discrete spring pulse flow volumes recommended by the agencies and Conservation Groups range from 7,920 to 10,000 acre-feet in dry years and from 15,840 to 60,000 acre-feet in wet years. In general, NMFS and California DFW recommend higher pulse flows during wetter water years with the objective of providing at least some floodplain inundation to enhance riparian floodplain vegetation development and increase food availability for rearing native salmonids. In contrast, FWS and the Conservation Groups only recommend discrete spring pulse flows during the driest water years, although an extended spring pulse flow is embedded in the FWS and California DFW minimum flow recommendations. The basis for the approach given by the Conservation Groups and California DFW is that a late spring pulse flow would facilitate successful outmigration of those salmonids that are able to survive through the spring, prior to encountering low flow and high temperature conditions during the summer. Similarly, FWS states that by providing relatively cold water (i.e., cooler than 15°C) to the lower Merced River during the spring, smoltification of juvenile salmon and steelhead would be expedited, and outmigration would occur prior to low flow, high temperature conditions that promote disease and predation by warmwater predators. We conclude that the stated reasons for these approaches are valid and selecting the most appropriate spring pulse flow approach necessitates balancing environmental benefits against the effects on available storage in Lake McClure for use during the primary irrigation season.

Our analysis in section 3.3.1.2 supports a gradual spring increase of flows to a 2 or 3-day maximum followed by a gradual decrease in flows to stimulate germination of cottonwood and other riparian vegetation with the goal of up to 9 days of floodplain inundation. This concept is recommended by NMFS and would apply to wet, above normal, and below normal water years. This spring pulse flow would also serve to stimulate salmonid outmigration prior to stressful summer flows and temperature conditions, if timed appropriately, provide some geomorphic functions, and enable salmonids to gain access to food sources and cover when flows exceed 1,000 cfs (the flow at which flows begin inundating the floodplain). We recognize that there is natural variability in the magnitude of spring pulse flows during different water years and mimicking this variability would be ideal. However, the lower Merced River is regulated and if the floodplain inundation and channel maintenance objectives can be achieved with a release of 30,000 acre-feet (the below normal water year NMFS recommendation), we are not convinced that the additional 20,000 to 30,000 acre-feet recommended by NMFS for above normal and wet water years, respectively, would warrant the additional loss of Lake McClure water storage.

We also agree with the agencies and Conservation Groups that during dry or critically dry water years, when spring floodplain inundation flows are not the goal of pulse flow releases, a short-term pulse flow would likely stimulate salmonid emigration from the lower Merced River prior to stressful summer conditions. The range of critically dry water year flows to achieve this objective offered by stakeholders is broad: 10,000 acre-feet by NMFS, 20,000 acre-feet by the Conservation Groups, and 30,942 by

California DFW. We expect that if a critically dry water year pulse flow is effective in stimulating salmonid outmigration, a similar release during dry water years would achieve the same outcome. We have no data to support which of these flows would result in a meaningful stimulation of salmonid outmigration. Monitoring outmigration, as we recommend (discussed in detail in a following subsection) would provide a measure of effectiveness and a basis for adjusting future dry and critically dry water year pulse releases.

For these reasons, we recommend that Merced ID release a spring pulse flow consisting of 30,000 acre-feet during wet, above normal, and below normal water years that would consist of flows equal to or above 1,000 cfs for 9 days, and peak flows that hold for 2 or 3 days, with a gradually ascending and descending hydrograph. To conserve Lake McClure storage, we recommend that this volume include the volume released in accordance with the minimum flow that may be included in a new license. Our recommended monitoring of spring salmonid outmigration, discussed later, would provide a basis for assessing the effectiveness of the spring pulse flow in stimulating outmigration and enable adjustments to be made, if necessary. During dry and critically dry water years, we recommend a spring pulse flow release of 10,000 acre-feet (which would equate to 1,040 cfs for about 5 days). After a minimum of two dry or critically dry water years, Merced ID, in consultation with the technical advisory committee, would make recommendations in a report to the Commission regarding whether anadromous fish outmigration data support increasing the volume of the spring pulse flow or continuing the 10,000 acre-feet spring pulse flow release to achieve outmigration stimulation. The specific timing of the beginning of the spring pulse flows and the configuration of the specific flow releases (as long as the recommended total volume is released) during all water year types would be determined by the technical advisory committee and approved by the Commission. The cost of the spring pulse flows are included in the cost of the minimum flow proposal. Although there would be some additional loss of generation capability and water for irrigation with our recommendation, we consider the benefits to juvenile Chinook salmon and potential benefits to federally listed Central Valley steelhead to be worth any such costs.

General Drought Management Plan

The Water Board [preliminary WQC condition 9] specifies that Merced ID submit a drought plan within 1 year of license issuance. The plan would provide overarching guidance for operation during an emergency drought and/or multiple critically dry years and would be created in consultation with the technical advisory committee. The plan would include Commission license or water quality certification variances that Merced ID may request.

Merced ID proposes and we recommend (in section 5.1.1.1) that during years in which drought conditions can be predicted, a drought management plan specific to that year should be developed, because it would ensure prompt notification of drought concerns to the resource agencies, and effective consultation and development of

appropriate emergency operational plans tailored to the specific circumstances of each drought. However, as we recommend below, some elements of drought management can be determined regardless of the specific circumstances associated with a particular year. As we note in section 3.3.1.2, we prefer this proactive approach rather than waiting until a drought is imminent or in progress to develop all of the details regarding how each drought would be managed. Consequently, we recommend that Merced ID, in consultation with the technical advisory committee, develop a general drought management plan. The plan would include, but not be limited to: (1) the measures that would be considered to address droughts when they occur; (2) decision paths regarding how management options for a specific drought would be decided; and (3) a listing of any Commission license conditions, BLM 4(e) conditions, and WQC conditions that would require variances with each of the potential drought management measures identified in item (1). We estimate that the levelized annual cost to develop this plan would be \$760 but the time saved and associated public benefit in developing, gaining approval, and implementing effective site-specific drought management plans would be worth this relatively minor cost.

Merced National Wildlife Refuge Water Delivery Plan

Merced ID proposes a continuation of the existing measure to annually provide 15,000 acre-feet of water to the Merced NWR. Both FWS and California DFW recommend specific monthly deliveries to the Merced NWR with maximum deliveries occurring from September through December to facilitate winter refuge flooding. Merced ID, in its letter filed on September 5, 2014, states that water is available for delivery to the Merced NWR only during the irrigation season (March 1 through October 31), and that providing water to the NWR from November through February is not possible because of the need for flood control (water levels in Yellowstone Lake, upstream of Lake McClure are kept low in the winter to capture spring high flows), dewatering the canals for maintenance, and health and safety considerations.

On May 22, 1992, the Commission ordered Merced ID to implement a plan for installing a water delivery system to provide 15,000 acre-feet to the entire refuge as required by article 45 of the current license.⁵⁹ Included in the order was a provision to construct a 0.5-mile-long canal from Deadman Creek to the northeast corner of the Merced NWR. According to FWS, this canal was only used for one season and was ineffective in providing water to the refuge. FWS installed lift pumps on Deadman Creek to address the shortfall of water to this portion of the refuge; however, during years when capital to operate the pumps is unavailable, the northeast portion of the refuge does not receive water. FWS reported that from 2006 through 2013, actual deliveries to the Merced NWR never reached the 15,000 acre-feet specified in the current license and

⁵⁹ 59 FERC 62,195

ranged from 9,130 to 12,271 acre-feet (average of 10,501 acre-feet). In addition, FWS reported that Merced ID sold an average of 4,929 acre-feet of water per year to the U.S. Bureau of Reclamation and FWS for delivery to the San Luis NWR during September through February. FWS states that at least some of this water originated from Yellowstone Lake and that some of it passed to the San Luis NWR through the Snobird Unit of the Merced NWR. FWS points to this as evidence that it is possible for Merced ID to provide water for Merced NWR's purposes during periods outside the irrigation season. We note that if the water delivery data provided by FWS is accurate, the amount of water sold to the San Luis NWR would have enabled full delivery to be achieved if it had been delivered to the Merced NWR.

The agencies and Merced ID also differ in how deliveries should be adjusted in drier water years. The agencies include a provision for a reduction in water provided to Merced NWR in critically dry water years but with Merced ID reimbursing FWS for the cost of pumping groundwater to make up for the shortfall. Merced ID makes no such provision in its proposed measure, but in its response to the agencies' 10(j) recommendations, states that if Merced ID reduces water deliveries to irrigators during dry and critically dry water years, deliveries to the Merced NWR should also be reduced in an equal proportion.

The groundwater resources in the Central Valley are under increasing demand because of the limited availability of surface water (California DWR, 2014). We consider it uncertain that groundwater would be available to compensate for reduced deliveries by Merced ID during dry or critically dry water years, or that groundwater use for compensation would be recommended in future years. We note that if irrigation water available for delivery by Merced ID to farmers is decreased because of increased flows to the Merced River downstream of Crocker-Huffman diversion dam, it would likely result in increased demand for groundwater by farmers to make up for this shortfall.

There is no disagreement between the agencies and Merced ID that Merced ID should continue to provide 15,000 acre-feet of water to the Merced NWR as required under the current license and we recommend this measure in section 5.1.1.1, because it would continue to mitigate for wildlife habitat inundated by Lake McClure. However, there remains disagreement regarding whether it is possible or feasible to deliver a portion of this total outside of the irrigation season. As indicated in section 3.3.1.2, we agree with the agencies' rationale that providing water to the refuge throughout the year would have environmental benefits. One of the factors that influences whether or not water can be delivered to the refuge outside of the irrigation season involves assessing a complex system of irrigation conduits that are currently outside of the Commission's jurisdiction. It is also unclear to us based on the available information whether the agency recommendation to provide "a device for delivering water to the Snobird Unit of Merced NWR along Bear Creek" would be necessary to achieve the goal of delivering 15,000 acre-feet of water to the refuge. We conclude that the most effective means to resolve this disagreement is for the entities most familiar with the system—Merced ID,

FWS, and California DFW—to further consult regarding the feasibility of providing water to the Merced NWR outside of the irrigation season. It is also evident that for license compliance purposes, there is a need to enhance documentation of how much water is delivered each year to the Merced NWR and the basis for the delivery estimates.

Consequently, we recommend that Merced ID develop a Merced NWR water delivery plan, in consultation with FWS and California DFW, to ensure to the extent reasonably practical, the delivery of 15,000 acre-feet to the refuge during times of the year when this water would provide the most benefit to wildlife. Elements in the plan would include the following:

- Provisions to conduct a feasibility study for providing the recommended monthly volumes of water to the Merced NWR on a year-round basis, including an assessment of adverse and beneficial effects, estimated costs for any needed infrastructure changes, and a report with a recommendation regarding proposed actions.
- An assessment of whether an enhancement of water delivery to the Snobird Unit of the Merced NWR is needed to achieve the overall annual or monthly water delivery objectives.
- A clear statement regarding where water delivery to the Merced NWR would be measured and the means for measuring and reporting monthly deliveries to the agencies and the Commission.
- An evaluation of the environmental effects on the refuge if monthly deliveries are curtailed during dry or critically dry water years and make-up water is obtained via groundwater, and the ramifications if there are future restrictions on the use of groundwater in the Central Valley.

Development of this plan and the associated feasibility report described in the first bullet would provide a basis for the Commission to approve a practical means of providing our recommended 15,000 acre-feet of water to the Merced NWR in a way that optimizes benefits to wildlife habitat. It would also provide the Commission with enhanced ability to maintain oversight over this important environmental measure. We estimate that the annual levelized cost of developing this plan and associated report would be \$4,300, but we conclude that the cost of providing clarity and documentation of issues that are now disputed is warranted.

Developing and gaining Commission approval for modifications to the water delivery process that would result from our recommended Merced NWR water delivery plan and feasibility study would take time, and we expect Merced ID to continue to provide 15,000 acre-feet of water to the Merced NWR until any such modifications are approved. Consequently, as an interim measure, we recommend that Merced ID implement its proposed measure to deliver water to the Merced NWR (WR2), which is essentially a continuation of the current process. We also recommend that Merced ID

report the amount of water delivered to the refuge on an annual basis. Any costs associated with this interim measure would be minimal.

Anadromous Fish Monitoring Plan

Merced ID proposes to, and we recommend that Merced ID monitor anadromous salmonids downstream of Crocker-Huffman diversion dam (measure T&E2). The Merced ID monitoring program would use one RST and one counting weir to be located based on recommendations from the technical advisory committee and contingent on land owner approval. The counting weir would operate annually from October 1 through December 31 to monitor adult Chinook salmon and *O. mykiss* migrating upstream into the Merced River and would acquire data on time, direction of migration, size, sex, and marks such as adipose fin clips. For all other fish species passing through the weir, Merced ID would collect data on time, direction of movement, number, species, and size. The RST would be operated annually from January 1 through May 31 to monitor juvenile Chinook salmon and *O. mykiss* migrating downstream from the spawning reaches in the lower Merced River and would acquire data on individual size, weight, and life stage from a representative sample of the catch.

The Water Board [preliminary WQC condition 20] specifies that Merced ID develop an anadromous fish monitoring plan that includes: (1) a statement of the goals and objectives; (2) a description of the proposed monitoring protocols; (3) a description of factors that could adversely affect California and federally listed species and whether the factors are related to project operation; (4) a monitoring and reporting schedule; (5) a plan for corrective actions if monitoring shows the project is adversely affecting anadromous fish or their habitat; and (6) protective measures. California DFW, as part of 10(j) recommendation 3F, recommends that Merced ID monitor salmonid habitat and populations and if stressful conditions are documented, implement fish rescue measures comparable to the emergency response that California DFW conducted in the spring and summer of 2014.

Although the proposed and staff-recommended measure provides reasonable monitoring for adult and juvenile anadromous salmonids, Merced ID does not specify the locations of the upstream or downstream monitoring stations because they would not be identified until after a license is issued and consultation with the technical advisory committee had occurred. Therefore, we have no basis to evaluate the reason for placement of the monitoring stations at specific locations and whether they would appropriately identify potential project-related direct and indirect effects. Developing an anadromous fish monitoring plan to include the first four elements specified by the Water Board, in consultation with the technical advisory committee, would provide documentation of specific monitoring, consultation, and reporting procedures that would be implemented.

We recognize that monitoring is an important component for protecting anadromous fish; however, it does not in and of itself provide for adequate protection

from project-related effects. Monitoring anadromous fish, combined with water temperature monitoring in the project-affected reach could form the basis for establishing immediate and long-term protection strategies for anadromous fish as developed by the technical advisory committee. Such strategies could include adjustments to project operation. We expect the need for adjustments to hydroelectric project operation or facilities would be identified within the first 10 years of a new license, unless substantial changes to project operation occur within that period. Protection strategies considered should also include a provision for fish rescue when water temperatures in the reach between Crocker-Huffman diversion dam and Shaffer Bridge become overly stressful. We conclude that not all stressful conditions are directly related or only partially related to hydroelectric project operation. Consequently, items (3), (5), and (6) of the Water Board specified plan link corrective actions to project effects. We agree that Merced ID should only be responsible for supporting fish rescue efforts if there is a linkage to project operation and that Merced ID should not bear the entire cost of any such fish rescue efforts. Therefore, we conclude that the entities responsible for each element of a fish rescue program should be identified.

Consistent with the Water Board condition, we recommend that Merced ID develop, in consultation with the technical advisory committee, an anadromous fish monitoring plan that includes the following: (1) a statement of the goals and objectives; (2) a description of the proposed monitoring locations, the rationale for selecting these locations, and the proposed monitoring protocols; (3) a description of factors that could adversely affect Chinook salmon and Central Valley steelhead in the lower Merced River from Crocker-Huffman diversion dam to Shaffer Bridge and whether these factors are related to project operation; (4) a monitoring and reporting schedule; (5) provisions for making recommendations for corrective actions if monitoring shows the project is adversely affecting anadromous fish or their habitat and reporting any such recommendations and associated costs to the Commission for approval; and (6) identification of the process that would be used for identifying Merced ID's responsibilities during any fish rescue effort that is linked to project operation. We estimate that the levelized annual cost of developing an anadromous fish monitoring plan would be \$1,500, but the value that such monitoring would have in interpreting other measures, such as the effectiveness of the instream flow measures, and the clarity that would be established regarding actions that could be taken based on the monitoring results, would be worth the cost.

Gravel Augmentation Plan

Gravel trapped behind project dams reduces the amount of gravel available for salmonid spawning in the lower Merced River. However, other factors such as gravel and placer mining have also contributed extensively to the current lower Merced River conditions. The agencies and Conservation Groups recommend various quantities of gravel to augment salmonid spawning habitat in the lower Merced River. NMFS recommends that Merced ID add 20,000 tons annually downstream of Crocker-Huffman

diversion dam over an approximate 30-year period, followed by 3,000 tons per year after the initial large-scale augmentation as an annual maintenance supply intended to balance out the transport capacity of the regulated flow regime. NMFS also recommends that PG&E add 2,500 tons of gravel to the reach between Merced Falls dam and Crocker-Huffman diversion dam. California DFW recommends initially adding 50,000 cubic yards (~42,000 tons) downstream of Crocker-Huffman diversion dam and then placing 2,600 cubic yards (~2,200 tons) per year thereafter for annual replenishment. FWS' recommendation includes annual augmentation of 2,600 cubic yards (~2,200 tons) downstream of Crocker-Huffman diversion dam but not a larger initial amount. The Conservation Groups' recommendation includes an initial placement of 20,000 cubic yards (~17,000 tons) downstream of Crocker-Huffman diversion dam followed by annual augmentation so that there is no net loss of spawning habitat thereafter (estimated to be from 2,600 to 10,400 cubic yards or ~2,200 to 8,800 tons).

Our analysis in sections 3.3.1.2 indicates that gravel augmentation amounts equal to at least the transport capacity of the supply-limited lower reaches, estimated to be 2,600 cubic yards (~2,200 tons) per year, would offset the ongoing coarse-sediment entrapment behind the Merced River Project dams that has a direct effect on spawning-habitat quantity. A larger initial placement of coarse sediments in the lower reaches would potentially benefit spawning habitat; however, doing so would address legacy effects not necessarily attributed wholly to past project effects and certainly not influenced by future project-related operation, construction, and maintenance activities. We also conclude that the contribution of the Merced Falls Project to the paucity of spawning gravel downstream of the Merced Falls is negligible.

Obtaining the gravel to be placed in the lower reaches from the existing dredger-tailing piles along the river, as recommended by California DFW and the Conservation Groups, would potentially make implementation relatively efficient, as opposed to importing gravels from outside of the project area, which could result in off-site environmental effects at the harvest site. Harvesting gravels on publicly owned land adjacent to the lower Merced River would also create an opportunity to develop a more natural floodplain that would facilitate the establishment of riparian vegetation and offer more valuable rearing habitat for anadromous and resident fish if grading following harvesting is properly implemented. We agree that monitoring and mapping existing and augmented spawning gravels, as recommended by FWS, California DFW, and the Conservation Groups, would provide an indication of the performance of the augmentations and inform the need for future augmentation projects.

To address project-related effects related to reduced spawning habitat availability for salmonids, we recommend that Merced ID develop, in consultation with the technical advisory committee, a gravel augmentation plan that provides for the annual placement of 2,600 cubic yards of gravel in the lower Merced River. The plan would address, at a minimum, the following: (1) the range of particle sizes to be used for augmentation; (2) identification and mapping of potential gravel harvest sites adjacent to the lower Merced River on Merced ID, state, or federally owned land and the expected sequence of

annual harvesting (i.e., which sites would be harvested first and why); (3) provisions for restoring land to what would be expected on natural riparian floodplains following gravel harvesting; (4) the protocol for selecting locations between Merced Falls dam and Shaffer Bridge for annual gravel augmentation based on consultation with the technical advisory committee; (5) provisions for monitoring and mapping augmented gravel after placement in the lower Merced River channel; and (6) provisions for annual reporting of the location of gravel harvesting and placement, and monitoring results. We estimate the levelized annual cost for this plan would be about \$127,280, but considering the known spawning of Chinook salmon and potential for the federally listed Central Valley steelhead to spawn in the lower Merced River, we consider the benefits of implementing this plan to be worth the cost.

Vegetation Management

Merced ID proposes to implement its Vegetation Management Plan to minimize effects of project operation and maintenance on vegetation. Project operation and maintenance activities, such as facility maintenance, treatment of invasive weeds, and construction of any new facilities, could disturb vegetation resources through excavation, grading, topsoil stripping, or other similar activities. The plan includes specific measures for revegetation, general vegetation management, reporting, and protection of sensitive plant species. BLM [preliminary 4(e) condition 9] specifies that Merced ID develop a vegetation and non-native invasive plant management plan to protect terrestrial resources.

In our analysis in section 3.3.2.1, *Terrestrial Resources*, we conclude that Merced ID could improve its plan by including details about the specific BMPs to be implemented. This modification would provide the agencies with information to evaluate the effectiveness of the BMPs and would allow Merced ID to implement additional BMPs, if necessary, to further protect terrestrial resources. We estimate the costs of this modification to provide detail that is pertinent to the management and protection of terrestrial species to be \$15,870.

Invasive Weeds

To minimize the spread of invasive weeds, Merced ID proposes to implement its Invasive Species Management Plan. In preliminary 4(e) condition 9, BLM specifies that Merced ID develop a vegetation and non-native invasive plant management plan to protect terrestrial resources. California DFW's 10(j) recommendation 10 recommends that Merced ID develop a plan for integrated pest management and pesticide use notification to control undesirable woody and herbaceous vegetation in addition to aquatic plants, insects, and rodents to minimize the use of pesticides. BLM [preliminary 4(e) condition 40] specifies that Merced ID request approval prior to using pesticides to control undesirably woody and herbaceous vegetation, aquatic plants, and other pests on BLM lands.

In section 3.3.2.1, *Terrestrial Resources*, we find that project construction of any new facilities and improvements to recreation resources requiring excavation, grading,

and topsoil stripping could contribute to the spread of invasive weeds. Facility and vegetation maintenance could cause disturbance to the soil, increasing the potential for weed colonization. We also find that an Invasive Species Management Plan would provide protocols for annual employee training, provisions for conducting surveys for invasive weeds, reviewing weed lists, and measures to prevent the spread of weeds into and within the project boundary. We also discuss the benefits of Merced ID's proposed plan as well as the consistency of the plan with agency recommendations. However, we conclude that Merced ID could improve its plan. Modifying the proposed Invasive Species Management Plan to stipulate that the measures in the plan apply to all lands within the project boundary and including specific details of the BMPs that Merced ID proposes to implement would more directly address project-related effects from invasive weeds and allow BMPs to be evaluated and/or adjusted based on their effectiveness as necessary, thereby further reducing potential effects of invasive plant management on other terrestrial and aquatic resources. Integrating a component for pest management and pesticide use notification to address agency requirements of notification prior to use would further protect both terrestrial and aquatic resources from the effects of herbicides. We recommend implementing the proposed Invasive Species Management Plan with the modifications above. We estimate the costs of the plan with the modifications to be a levelized annual cost \$55,030, and we consider the benefits of the plan to be worth the additional cost.

Bald Eagle Management Plan

Merced ID proposes to implement the Bald Eagle Protection Plan, as proposed in its license application and amended on September 22, 2014. In preliminary WQC condition 5, the Water Board specifies that Merced ID prepare a monitoring plan for bald and golden eagles consistent with the most current National Bald Eagle Management Guidelines provided by FWS that includes goals and objectives, measurable criteria, a monitoring and reporting schedule, a plan for corrective measures if goals are not achieved, and minimum monitoring requirements. BLM preliminary 4(e) condition 10 specifies that Merced ID implement a bald eagle management plan and consult with BLM, California DFW, FWS, and the Water Board before submitting the plan for Commission approval. FWS [10(j) recommendation 9] recommends that Merced ID consult with resource agencies within 1 year of license issuance before implementing the revised Bald Eagle Management Plan, which would include the edits made to the plan by FWS and filed with its recommendation.

In section 3.3.2.1, *Terrestrial Resources*, we discuss the inconsistencies between Merced ID's proposal and FWS' recommended plan, such as the frequency of shoreline surveys, distance of surveys from the shoreline, buffer distances around active nests, and protective measures for wintering bald eagles. In our discussion, we conclude that implementing the plan with the specific measures required by FWS would afford more protection to bald eagles and minimize project effects on bald eagles nesting, wintering, and roosting in the project area. These effects include noise caused by vegetation

management activities and facility and road maintenance, and disturbances caused by recreation users, including hikers and boaters. Vegetation management activities could also result in the removal of nest or roost trees.

In our analysis, we conclude that Merced ID's proposed plan would further protect bald eagles by including protective measures for wintering bald eagles and information on public information boards to reduce disturbance to roosting and foraging eagles. We also discuss the benefits of identifying and describing any emergency activities that would be exempt from the restrictions provided in the Bald Eagle Management Plan. We recommend implementing the Bald Eagle Management Plan with the above modifications. With these modifications, we estimate the costs of implementing the plan to be \$3,220, which is worth the cost of protecting bald eagles in the project area.

Limestone Salamander Sensitive Areas Management Plan

Merced ID proposes to implement its Limestone Salamander Sensitive Areas Management Plan, which provides protection measures for limestone salamanders and associated habitat areas. In preliminary 4(e) condition 15, BLM specifies that Merced ID obtain its approval before submitting and implementing the plan, conduct studies of limestone salamanders every 7 years beginning in year one of license issuance, and inventory all suitable but unconfirmed habitats on BLM lands for the presence of limestone salamanders. In addition, BLM disagreed with some of Merced ID's other proposed measures in its proposed plan. In response, Merced ID amended its proposal on September 22, 2014, to be consistent with BLM preliminary 4(e) condition 15. California DFW [10(j) recommendation 8] specifies that the Limestone Salamander Sensitive Areas Management Plan provide mapping of known occurrences of limestone salamanders and sensitive habitat, avoid sensitive areas, hold annual meetings with California DFW and BLM to review activities that may affect sensitive areas, and identify BMPs to be implemented as part of the plan.

In our analysis in section 3.3.2.1, *Terrestrial Resources*, we find that the project could affect limestone salamanders through mortality caused by the effects of recreational activities, such as hiking. The activities could cause rock slides or otherwise degrade habitat; therefore, we find that future development of hiking trails associated with the project could affect limestone salamander habitat. We also find that Merced ID should specify and provide details about the proposed BMPs to improve the plan and reduce project effects on limestone salamanders and their habitats as well as other sensitive species. We also analyze the potential for effects of recreation on limestone salamanders, and conclude that any new hiking trails or modifications to existing hiking trails should be sited outside limestone salamander sensitive habitat to protect these habitats from degradation. We recommend implementing the Limestone Salamander Sensitive Areas Management Plan with the above modifications. We estimate the costs of the plan with the modifications to be a levelized cost of \$2,260. We consider the plan worthwhile to protect limestone salamanders and their habitats within the project area.

Protection Plan for Western Pond Turtles

Merced ID does not propose a protection plan for western pond turtles though Merced ID amended its proposal to include measures for the western pond turtle, consistent with BLM preliminary 4(e) condition 16. Merced ID proposes to train staff to identify western pond turtles so that staff could document western pond turtles incidentally observed on lands administered by BLM while conducting other environmental work. Merced ID proposes to record relevant data, including GPS locations, and develop written reports to be submitted annually to BLM (consistent with BLM preliminary 4(e) condition 1) and the Commission. BLM preliminary 4(e) condition 16 includes objectives for the conservation of special-status species, habitat maintenance or improvement, and proactive conservation measures to minimize the likelihood of and need for federal listing of the species.

In our analysis in section 3.3.2, *Terrestrial Resources*, we find that project operation could affect western pond turtles by causing water level fluctuations, thereby affecting habitat for basking and nesting, as well as habitat for juvenile western pond turtles. We also find that traffic associated with project maintenance and recreation, and maintenance activities such as pesticide applications, also may affect the species. Because a project nexus exists, we recommend revising the proposal to record incidental observations of western pond turtles in the entire project area, rather than limiting data collection to just BLM lands. Under the proposal, Merced ID would submit reports to BLM and the Commission.

The western pond turtle is a special-status species, designated as a species of special concern by the state of California and as a species of concern by FWS. Thus, we recommend consulting with California DFW and FWS, in addition to BLM, to prepare a plan to protect western pond turtles to be implemented on all project lands. We estimate the plan would have a levelized annual cost of \$2,000. We consider the cost of the plan to be worthwhile, given the potential for the plan to reduce project-related effects on the western pond turtle.

Protection Plan for the California Red-legged frog, Foothill Yellow-legged Frog, and Western Spadefoot

Merced ID does not propose any measures to protect the federally listed California red-legged frog, nor does Merced ID propose measures to protect the foothill yellow-legged frog and western spadefoot, both of which are special-status species currently under review by FWS. FWS [10(j) recommendation 7] recommends that Merced ID, in consultation with FWS and BLM, develop and implement a watershed management and protection plan for the California red-legged frog in the Piney Creek core area of the recovery plan. BLM specifies in preliminary 4(e) condition 1 that Merced ID consult with BLM, FWS, the Water Board, and California DFW to develop a management plan for the California red-legged frog. BLM's preliminary 4(e) condition 14 also specifies that Merced ID develop a management plan for the foothill yellow-legged frog. In

preliminary 4(e) condition 40, BLM specifies that Merced ID avoid pesticide use within 500 feet of known locations of foothill yellow-legged frogs and other special-status animals and plants. The Water Board [preliminary WQC condition 10] specifies that Merced ID develop a monitoring and conservation plan for the California red-legged frog, foothill yellow-legged frog, and western spadefoot.

In section 3.3.3.2, *Threatened and Endangered Species*, we analyze project effects on the California red-legged frog, and find that project operation and maintenance activities could adversely affect the California red-legged frog. We concur with the agencies' recommendations for protective measures, such as including measures to control bullfrogs in the project reservoirs and adjacent areas, reducing population-level impacts from the frog-killing *Batrachochytrium dendrobatidis* fungus to reduce mortality of frogs within the project boundary and in the critical habitat area overlapping the project boundary, identifying areas where non-native predators occur within the project boundary, including control and eradication measures for non-native species and predators, identifying a habitat mosaic containing both breeding and dispersal habitat in the project area, monitoring water temperature at the confluence of Sherlock Creek and the Merced River to determine if project operation affects water temperature, and avoiding pesticide use within 500 feet of known locations of foothill yellow-legged frogs. These measures would reduce predation and mortality on the California red-legged frog. Because other species, including the foothill yellow-legged frog and western spadefoot, are also affected by changes in water temperature caused and pesticide use, broadening the measures to include other special-status species, such as the foothill yellow-legged frog and the western spadefoot, would bestow similar protective benefits to those species. Therefore, we recommend that Merced ID develop and implement a protection plan for federally listed and special-status amphibian species, including the California red-legged frog, foothill yellow-legged frog, and western spadefoot. We estimate the cost of the protection plan to be \$2,000. We consider the plan to be worth the cost, given the benefits to these federally listed and special-status species, while also ensuring the project's compliance with state and federal laws governing federally listed and special-status species.

Protection Plan for the California Tiger Salamander

Merced ID does not propose a protection plan for the California tiger salamander, though it does propose to avoid the use of burrow fumigants and rodenticides in California tiger salamander habitat. FWS [10(j) recommendation 6(a)G] recommends prohibiting the use of burrow fumigants or rodenticides in the habitat of California tiger salamanders. The Water Board [preliminary WQC condition 7] specifies the development of a monitoring and conservation plan to protect the California tiger salamander from the effects of pesticide use and recreation and construction activities.

In our analysis in section 3.3.2, *Terrestrial Resources*, we discuss potential project effects, including pesticide use on California tiger salamander. We agree with Merced

ID's proposed measure to avoid the use of pesticides in California salamander habitat and recognize that other plans could include measures that may protect California tiger salamanders. However, we find that protocol level surveys would be necessary to identify the habitats where California tiger salamanders occur and the migratory routes they use. Therefore, we recommend developing and implementing a protection plan for the California tiger salamander with provisions for protocol level surveys, identification of habitats and migratory routes used, and avoidance of burrow fumigants and rodenticides in habitat of the California tiger salamander. We estimate the plan would have a levelized annual cost of \$2,000 and would be worth the cost to ensure that the project would not affect the California tiger salamander.

Protection Plan for Vernal Pool Fairy Shrimp and its Habitat

Merced ID does not propose any species-specific measures to monitor or protect fairy shrimp in the project area, nor does it propose a protection plan for fairy shrimp or its associated habitat. The Water Board [preliminary WQC condition 6] specifies that Merced ID develop and implement a monitoring and conservation plan for vernal pool and Conservancy fairy shrimp. Per the Water Board, monitoring would be conducted annually for the first 4 years, and thereafter every 3 years and prior to construction or ground-disturbing activities. FWS commented that although no documented occurrences of fairy shrimp are known in the project area, Merced ID did not conduct protocol level surveys. FWS notes that the project area overlaps with about 1 acre of critical habitat for the vernal pool fairy shrimp. FWS states that levee breaches spill water into vernal pool critical habitat in the dry summer months, and the project road that transects the critical habitat is likely to cause long-term degradation of the habitat adjacent to the road, despite the fact that the road itself does not contain any primary constituent elements.

In our analysis in section 3.3.3.2, *Threatened and Endangered Species*, we note that the presence of vernal pool fairy shrimp should be assumed because protocol level surveys have not been conducted. We also discuss the fact that critical habitat for vernal pool species overlaps with the project area. Thus, we recommend developing a protection plan for the vernal pool fairy shrimp and its habitat. Merced ID would develop the plan in consultation with FWS, the Water Board, California DFW, and BLM. The plan would include any measures required by the agencies' conditions and recommendations, as well as those developed in consultation. We estimate the plan would have a levelized annual cost of about \$2,500 and would be worth the cost to ensure that the project would not affect vernal pool fairy shrimp or its habitat.

Protection Plan for Federally Listed Plants

Merced ID does not propose a protection plan for federally listed plants. FWS [10(j) recommendation 6(b)] recommends annual consultation to identify newly listed species that could be affected by the project, the development of studies, and preparation of a biological assessment that includes protection measures. The Water Board [preliminary WQC conditions 12 and 13] specifies annual consultation and reviews to

protect newly listed federally listed and special-status species. BLM [preliminary 4(e) condition 1] specifies annual consultation to discuss, in part, necessary protection measures for federally listed species. BLM [preliminary 4(e) condition 3] specifies review of federally listed and special-status species, assessment of newly listed species, and annual employee training to train employees to identify federally listed species.

In our analysis in section 3.3.3.2, *Threatened and Endangered Species*, we note that, given the lack of protocol level surveys for federally listed plants potentially occurring in the project area, the occurrence and locations of federally listed plants remain unknown and therefore these plants cannot be adequately protected by any other plans. Thus we recommend developing a protection plan for federally listed plants in consultation with FWS, the Water Board, California DFW, and BLM. The plan would, at a minimum, include the following for each federally listed plant species potentially occurring in the project area: (1) study methodologies and protocols sufficient to produce adequate survey results; (2) a list of peak bloom times and identifying features; (3) the timing and frequency of the surveys; (4) maps and written descriptions of habitat areas to be surveyed; (5) references to measures contained in other plans that could protect federally listed plants; (6) protection and mitigation measures; and (7) reporting requirements. We estimate the plan would have a levelized annual cost of \$2,500 and would be worth the cost to ensure that the project would not affect federally listed plants, including Keck's checkerbloom, Layne's butterweed, Chinese Camp brodiaea, Mariposa pussypaws, and California vervain, or their habitats.

Protection Plan for the San Joaquin Kit Fox

Merced ID proposes to avoid the use of rodenticides and burrow fumigants in San Joaquin kit fox habitat. FWS [10(j) recommendation 6(a)F] recommends prohibiting the unauthorized use of burrow fumigants or rodenticides on federal land and 10(j) recommendation 6(a)G recommends prohibiting the use of burrow fumigants or rodenticides in habitat of the San Joaquin kit fox until section 7 ESA consultation is completed or a permit is issued under section 10 of the ESA. In preliminary WQC condition 18, the Water Board specifies that Merced ID develop a pesticide use plan to prevent pesticides from affecting federally and state-listed species in the project area or downstream of the project area. BLM specifies in preliminary 4(e) condition 40 that the use of pesticides be restricted and require written approval by BLM. California DFW [10(j) recommendation 10] recommends that Merced ID develop an integrated pest management and pesticide use notification plan, which includes a provision for Merced ID to obtain approval prior to using pesticides, including rodenticides.

In our analysis in section 3.3.3.2, *Threatened and Endangered Species*, we discuss project effects on the San Joaquin kit fox, such as the use of pesticides, and maintenance activities and recreation resulting in noise that could disturb kit fox. We also explain that surveys would be necessary to identify habitats where the use of rodenticides and burrow fumigants would be avoided. In section 3.3.3.3, *Threatened and Endangered Species, Cumulative Effects*, we identify the San Joaquin kit fox as a species subject to cumulative

effects from the project combined with other activities in the basin. To protect San Joaquin kit fox from project effects, including any contribution that project effects would have to cumulative effects, we recommend that Merced ID develop a protection plan for the San Joaquin kit fox that would include the following: (1) study methodologies and monitoring protocols to identify San Joaquin kit fox habitats within the project boundary; (2) an assessment of potential project effects on San Joaquin kit fox in the project boundary; (3) protection and mitigation measures; and (4) descriptions of any exceptions to the prohibited use of rodenticides that would be considered emergencies and allowed by agencies and an explanation of why the emergency situations would supersede protection measures for the San Joaquin kit fox. We estimate the plan would have a levelized annual cost of \$2,500 and would be worth the cost to ensure that the project would not affect the San Joaquin kit fox.

Recreation Facilities Plan

The project provides numerous recreation opportunities, and Merced ID appropriately proposes extensive development, rehabilitation, and management of these facilities in its proposed Recreation Facilities Plan. However, the proposed plan lacks sufficient detail on some project facilities, including extending the proposed paved bike lane 2.8 miles short of the length of the project's Lake McClure Road, identifying the location and condition of the three floating restrooms on Lake McClure, and including an assessment of water systems at the project over the term of the license. Further, Merced ID's proposed implementation schedule for the rehabilitation and construction of recreation facilities included in the plan does not appear to prioritize those facilities with immediate rehabilitation needs (i.e., facilities within the Bagby recreation area) over the construction of new facilities where a need was not identified (i.e., park model cabins). Extending the bike lane along the entire length of Lake McClure Road, providing more detailed information on the location and future operation and maintenance of the three floating restrooms provided at Lake McClure and all project water systems, and revising the implementation schedule to prioritize those facilities in need of immediate rehabilitation would not only improve access to the project in the near future but would ensure all project facilities are maintained over the term of a new license.

Merced ID's plan also includes provisions for the management and protection of recreation areas, including providing a campground host site at the Horseshoe Bend recreation campground. While providing a campground host and host site at the Horseshoe Bend recreation area campground could potentially improve public safety and campground management, the Commission cannot ensure public safety would be improved as a result of providing a host site. The responsibility for recreation facility management is that of the licensee; therefore, we do not recommend a host site.

We recommend Merced ID implement the Recreation Facilities Plan with the above staff recommended modifications. Our recommended Recreation Facilities Plan would have an estimated levelized annual cost of about \$9,200,000, and we conclude the benefits of our recommended plan would be worth the cost.

Fish Stocking

Angling is one of the primary recreational activities associated with the project. Merced ID proposes to stock the following in Lake McClure: 32,000 to 70,000 catchable-size rainbow trout with a 5-year running average target number of 48,000 fish; 4,000 to 20,000 fingerling kokanee with a 5-year running average target number of 15,000 fish; and 35,000 to 75,000 fingerling Chinook salmon with a 5-year running average target number of 45,000 fish. In McSwain reservoir, Merced ID proposes to stock 1,000 to 2,000 catchable-sized rainbow trout with a 5-year running average target of 1,500 fish. Merced ID states it would consult with California DFW and use angler data from recreation monitoring to make decisions on stocking throughout the term of the license. California DFW recommends and the Water Board specifies similar stocking numbers for the first 2 years of license issuance, however they recommend Merced ID develop a fish stocking plan that would implement fish stocking at the project reservoirs for the remainder of the license term based on recreational use, angling demand, availability of hatchery fish, and future California DFW fish stocking management targets. The Conservation Groups propose similar stocking numbers to Merced ID and the agencies' proposals for McSwain reservoir; however, they propose stocking numbers that are significantly higher than what has historically been stocked in Lake McClure. Although Merced ID's proposal to stock both Lake McClure and McSwain reservoir would ensure that the recreational fishery is maintained at historic levels, it is unclear if these stocking numbers would be adequate to meet angling demand over the term of a new license. Alternatively, the Conservation Groups' proposed stocking numbers for Lake McClure seem excessive in comparison. Developing and implementing a fish stocking plan in consultation with the agencies and the Conservation Groups would provide the flexibility to stock project reservoirs at levels that meet both recreational demand and state fish stocking management targets over the term of a new license. We recommend Merced ID develop and implement a fish stocking plan in consultation with California DFW, the Water Board, NMFS, and the Conservation Groups and file the plan with the Commission for approval to include, at minimum, the species, size, and number of fish to be stocked in Lake McClure and McSwain reservoir for the first 3 years within license issuance, a consultation schedule to discuss fish stocking in Lake McClure and McSwain reservoir over the term of a new license, and stipulations for the acquisition of fish (e.g., native, cold water species from facilities free of invasive species). We estimate that the annualized cost of developing and implementing a fish stocking plan would be \$35,000, and conclude the benefits of this measure would be worth the cost.

Transportation Management Plan

Merced ID proposes to implement its proposed Transportation Management Plan to provide guidance to rehabilitate and maintain project roads over the term of a new license. However, Merced ID's plan does not include any details regarding road conditions and approaches for monitoring use over the term of the license, nor does it identify BMPs that would be implemented to improve road conditions. The Water Board

specifies in preliminary WQC condition 21 that Merced ID develop a transportation management plan that includes the aforementioned missing details as well as measures to improve maintenance and conditions of project roads, comparable to the most current Forest Service BMPs Road Management Activities. As discussed in section 3.3.5.2, *Management of Project-Related Roads*, the current conditions of roads are at the project are unclear. Further, it is uncertain whether those project roads would continue to be maintained to meet the need for safe public recreational access over the term of a new license. Implementing a Transportation Management Plan, as proposed by Merced ID, would provide the mechanism to address operation, maintenance, monitoring, and road use within the project boundary. It would also ensure safe public access to project lands and project waters over the license term. We agree that the Merced ID's proposed Transportation Management Plan needs to be revised to include more detail; however, because the Water Board did not provide specific information on the Forest Service's BMPs Road Management Activities, it is unclear how those BMPs would improve the plan. Further, there are no Forest Service roads or lands within the project boundary. We recommend Merced ID revise its Transportation Management Plan to include, at minimum, an inventory of all project roads and their current road conditions, a detailed schedule of maintenance based on the inventory of road conditions, relevant BMPs that would be implemented to improve and maintain road conditions, and a detailed approach for monitoring use over the term of the license. Our recommended Transportation Management Plan would have an estimated levelized annual cost of about \$97,000, and we conclude the benefits of our recommended plan would be worth the cost.

5.1.1.3 Measures Not Recommended by Staff

Staff finds that some of the measures recommended by other interested parties would not contribute to the best comprehensive use of the Merced River water resources, do not exhibit sufficient relationship to project environmental effects, or would not result in benefits to non-power resources that would be worth their cost. The following discusses the basis for staff's conclusion not to recommend such measures.

New Minimum Instream Flow Compliance Gage

NMFS recommends the Merced ID install a new gage capable of measuring up to 6,000 cfs at Shaffer Bridge to document compliance with the flow regime that may be specified in a new license. Although we consider Shaffer Bridge to be an appropriate compliance point for a minimum flow regime, NMFS does not elaborate on why a new compliance gage capable of measuring up to 6,000 cfs would be necessary to measure project-related flows. No entity has offered a flow-related measure with a maximum flow provision. The existing gage at Shaffer Bridge has served to document required minimum flows and would continue to be sufficient to monitor flows that may be included in a new license for this project. The maximum lower Merced River flow in any staff recommendation is 1,040 cfs. Therefore, installing a new gage with the capacity to

measure flows up to 6,000 cfs in place of the existing gage at this location would not be worth the estimated levelized annual cost of \$11,400.

Two-Day Spring Pulse Flow

California DFW [10(j) recommendation 3D] recommends a spring floodplain inundation flow in ranging from 2,000 to 4,000 cfs over a 2-day period between March 14 and March 28 in below normal, above normal, and wet water year types, with no requirement in dry and critically dry years. The stated purpose of this brief pulse flow is to provide young salmonids with at least some access to floodplain cover and food sources. The California DFW spring floodplain inundation flow volume (as converted from cfs) varies by water year type and includes: 15,840 acre-feet (4,000 cfs per day) in wet years, 11,880 acre-feet (3,000 cfs per day) in above normal years, and 7,920 acre-feet (2,000 cfs per day) in below normal years. In addition, California DFW's minimum flow recommendation, discussed in the previous section, includes an extended pulse flow of from 2 to 6 weeks, which we discussed previously under our recommended spring pulse flow.

Although California DFW's recommended 2-day pulse flow in March would provide young salmonids with access to floodplain cover and food sources, we conclude that a short-term pulse flow could also expose fish that occupy the floodplain to stranding as flows recede into the channel proper. We find that the benefit of providing limited floodplain access to young salmonids would not be worth the potential cost of stranding mortality following limited pulse flows. A more extended pulse flow later in the spring, which we recommend, would provide young salmonids with floodplain cover and food sources, and, because they would have better swimming ability, they would be better suited to avoid stranding.

Ramping Rates

Rapid changes in streamflow (both increases and decreases) can affect fish behavior, which in turn can reduce survival or growth. Limits governing the rate and timing of project-induced river stage changes (ramping rates) are often established to protect aquatic organisms from these project-related effects. For the Merced River Project, pulse flow releases and flood control releases are most likely to result in rapid changes in river flows that may warrant establishment of ramping rates.

NMFS [10(j) recommendation 1.1B(7)] recommends that minimum instream flow upramping and downramping rates occur evenly over a 24-hour period, with a maximum of 500 cfs per 24-hour period in all water years, with the exception of spring pulse flows in above normal and wet water years, when downramping rates are recommended to occur evenly over a 24-hour period at a maximum of 100 cfs per day (about 1 inch per day) to promote riparian seedling survival. The compliance point is not specified. FWS [10(j) recommendation 3A1] also recommends this gradual downramp of 100 cfs per day as measured at Shaffer Bridge in late May or early June during above normal and wet water years.

California DFW [10(j) recommendation 3G] recommends a ramping rate for increasing flows that restricts the rate of change to not more than double the amount of the release during any 1-hour period. This is the same as Merced ID's proposed upramping rate. For decreasing flows, California DFW recommends the rate of change be no more than 2 inches per hour as measured at the existing gage near Snelling Bridge, downstream of Crocker-Huffman diversion dam, and at flows above 200 cfs, the rate of change in any one 24-hour period, the flow rate should not drop by more than 500 cfs.

Flow releases for hydroelectric project operation occur at New Exchequer and McSwain dams. These releases flow directly into impoundments, which minimize adverse effects typically associated with upramping and downramping in riverine habitat. The rate of change in flows downstream of Crocker-Huffman diversion dam is influenced by both hydroelectric project flow releases from McSwain dam and diversions for irrigation into the Main Canal, a facility not related to hydroelectric operation. Therefore, California DFW and FWS' recommended downramping compliance point downstream of the diversion dam, and any other ramping rate compliance point downstream of the Crocker-Huffman diversion dam would measure both the rate of change of releases from McSwain dam, which would be related to hydropower operation, and gate operation at the Main Canal (and, in the case of FWS' compliance point, other diversions upstream of Shaffer Bridge) in response to changing flows, which would not be related to hydropower operation.

The benefits of the upramping rate recommended by NMFS (a maximum increase of 500 cfs evenly spread over a 24-hour period) are difficult to evaluate because as worded, it would only pertain to changes in minimum instream flows and the compliance point is not specified. Few increases in the minimum flows proposed or recommended by any entity change by more than 500 cfs between any designated release periods. We therefore have no basis to recommend NMFS' recommended upramping rate.

California DFW recommends a downramping rate of no more than 2-inches per hour as measured immediately downstream of Crocker-Huffman diversion dam. To support its recommended ramping rate, California DFW relies on Hunter (1992), which concludes that in unregulated river systems, aquatic biota are rarely exposed to drops in stage of more than 2-inches per hour and therefore are not adapted to more excessive stage changes. In addition, California DFW notes that a controlled downramping rate in late spring that approximates a natural recession rate promotes recruitment of willows and cottonwoods to riparian floodplains. Both California DFW and NMFS' recommended spring downramping rates would achieve this goal. California DFW states that under Merced ID's proposed downramping rate, using the maximum release of 6,000 cfs allowed by the current Corps' flood control rules, flows could be dropped by 3,000 cfs in 1 hour and by 1,500 cfs during the next hour with no ecological rationale.

Controlling downramping rates can reduce the potential for aquatic biota stranding and, in the spring, stimulate the growth of riparian trees and shrubs. However, the downramping rates that occur in Merced River downstream of Crocker-Huffman

diversion dam are a function of releases from McSwain powerhouse and operation of the gates for irrigation purposes at the Main Canal. Only releases from the McSwain powerhouse are within the Commission's ability to regulate. Our review of typical releases from McSwain powerhouse during a normal and dry water year indicates that the maximum range of decreases in flow during a relatively short period of time is from 650 to 1,000 cfs (see figures 3-5 and 3-7). Therefore, the scenario that California DFW presents is unlikely to occur except in emergency situations. Implementing Merced ID's proposed and staff recommended downramping rate, listed in section 5.1.1.1, would provide control over flows that reach Crocker-Huffman diversion dam. The ramping rates further downstream would be influenced by the rate of additional flow diversions and returns associated with non-project facilities and natural attenuation of flows, making it more difficult to establish a direct relationship with the downramping protocol when compared to using the existing gage near Snelling. However, we have no data to assess how this translates into downramping rates downstream of the diversion dam. We therefore have no basis to recommend the downramping rates recommended by NMFS, FWS, and California DFW given that both project and non-project flows cause downramping in the lower Merced River. Monitoring flows and the downramping rate at the existing gage near Snelling immediately downstream of the Crocker-Huffman diversion dam, as recommended by California DFW, would provide the Commission with data regarding how the downramping rate measured at McSwain dam translates to the downramping rates immediately downstream of Crocker-Huffman diversion dam, which are influenced by both hydroelectric operation and irrigation diversions. These data, along with input from the Merced ID proposed and staff-recommended technical advisory committee,⁶⁰ also listed in section 5.1.1.1, regarding the measured downramping rates, would serve to inform the Commission regarding the adequacy of the downramping protocol and whether adjustments to that protocol may be needed in the future to reduce stranding risk and stimulate floodplain revegetation.

Increased Lake McClure Minimum Pool Level

The volume of water required in Lake McClure affects Merced ID's ability to address water supply, carryover storage, and power generation needs associated with managing the project reservoirs. The volume of water in Lake McClure also affects Merced ID's ability to achieve minimum instream flows, pulse flows, and water temperature objectives. Establishing a minimum pool elevation sets the minimum volume of water available for downstream water uses.

⁶⁰ The staff recommended technical advisory committee would invite the following entities to participate: NMFS, FWS, California DFW, the Water Board, BLM, Park Service, and a representative from a non-governmental organization.

FWS [amended 10(j) recommendation 3(A1)] recommends Merced ID maintain a minimum pool of 130,000 acre-feet (an elevation of about 650 feet) in Lake McClure. Once the minimum pool storage drops below 130,000 acre-feet, all irrigation diversions would cease and the only flow releases from Lake McClure would be to maintain designated minimum instream flows. The Conservation Groups make a similar recommendation.

California DFW [10(j) recommendation 3F] recommends Merced ID maintain Lake McClure as high as possible from April through October, with a target minimum pool of no less than 200,000 acre-feet (an elevation of about 680 feet) on September 30 of each year, by maintaining a minimum pool of no less than 265,000 acre-feet (an elevation of about 710 feet) at all times by ceasing all irrigation diversions, except for drawdowns as necessary to maintain minimum instream flows. Additionally, California DFW recommends that Merced ID submit an annual draft plan to the Commission describing planned operation to maintain Lake McClure levels, including the estimated delivery pattern needed to achieve a 200,000 acre-feet minimum pool target by the end of September, with a final operation plan submitted annually to the Commission by May 15.

Merced ID provided model results that compare water supply, carryover storage, and power generation for its proposed measure and the stakeholder recommended flow regimes and minimum pool elevations to existing baseline conditions. The Merced ID model runs were developed without considering any additional flow measures that could be necessary to meet either NMFS, FWS, or California DFW water temperature objectives. Water supply shortages increase when Lake McClure is operated under California DFW's recommended minimum pool volume of 200,000–265,000 acre-feet compared with operation under the baseline volume of 115,000 acre-feet (which is also Merced ID's proposed and staff-recommended minimum pool). The Conservation Groups' flow regime builds into the measure irrigation delivery restrictions based on water year type and results in the greatest total water delivery shortage of any alternative proposed or recommended. Carryover storage in Lake McClure is substantially reduced under all recommended minimum pool and flow regime scenarios compared with baseline conditions.

Under baseline conditions and Merced ID's proposed measure, Lake McClure reaches maximum storage (the reservoir is filled) ten times over the 36-year period of record. Based on Merced ID's modeling results, this total is predicted to be reduced to six under FWS' flow and minimum pool recommendation, five under the NMFS flow recommendation, four under California DFW's flow and minimum pool recommendation, and Lake McClure would not fill in any of the 36 years under the Conservation Groups' flow and minimum pool recommendation.

Average annual power generation under existing conditions is about 387 GWh. With Merced ID's proposed flow and minimum pool levels, annual generation is predicted to increase to about 389 GWh. The flow and minimum pool recommendations of stakeholders would decrease predicted average generation to the following amounts:

FWS—377 GWh (a decrease of 3 percent from existing conditions); Conservation Groups—360 GWh (a decrease of 7 percent); California DFW—354 GWh (a decrease of 9 percent); and NMFS—347 GWh (a decrease of 10 percent).

Increasing the minimum pool as recommended by the agencies and Conservation Groups would serve to retain more coldwater pool in Lake McClure that would enable somewhat cooler temperatures to be maintained downstream of Crocker-Huffman diversion dam compared to existing conditions or Merced ID's proposed and staff-recommended measure. Predicted water temperatures immediately downstream of the diversion dam and at the Snelling Bridge are 3 to 5°F cooler from mid-July to mid-October compared to Merced ID's proposed measure. However, water temperatures during this time frame would still be well above the 18.0°C (64.4°F) 7DADM EPA guideline for adult steelhead rearing and juvenile rearing and emigration and the 16.0°C (60.8°F) guideline for juvenile over-summer rearing.

Maintaining the recommended higher Lake McClure storage level would have an effect on the water available for delivery to irrigators. To illustrate this effect, we reviewed Lake McClure storage volumes for summer 2014, a critically dry water year within a severe drought (letter from H. EITal, Deputy General Manager, Water Supply/Rights, Merced ID, to T.J. LoVullo, FERC, Chief, Aquatic Resources Branch, Division of Hydropower Administration and Compliance, filed on October 10, 2014). Our analysis only provides a general concept of the effect on irrigation diversions because in 2014, Merced ID released the minimum flow of 15 cfs required by the current license. Releases of higher minimum flows as recommended by the agencies would result in the storage meeting the trigger for cessation of irrigation flows sooner. The Conservation Groups' recommended minimum flow would have irrigation diversions equal to 30 to 40 percent of demand in 2014, and this would serve to preserve some storage in Lake McClure but at the expense of irrigators. Under California DFW's recommendation, irrigation diversions would have stopped after July 4, 2014, and under the FWS and Conservation Groups' recommendations, after September 23, 2014. Deliveries of irrigation water would have continued through September with Merced ID's proposed minimum pool trigger for curtailing irrigation diversions.

Dry, warm summers create stressful conditions for salmonids in the lower Merced River and for irrigators that depend on the water supply that had been provided by Merced ID long before the project was operated for hydroelectric power generation. We acknowledge that preserving the cold pool in Lake McClure could be used to create slightly less stressful water temperature conditions for salmonids in the lower Merced River. Irrigation diversions have the most value to irrigators during the driest years. Curtailing all irrigation diversions at the beginning of the summer would have a substantial effect on irrigated cropland and the associated agricultural community. Whether this adverse economic effect would be worth a marginally enhanced water temperature regime in the lower Merced River is questionable. Completely shutting down irrigation diversions when a target storage level is reached transfers all of the costs of any environmental benefits that such an approach would achieve to the irrigators. We

therefore conclude that the limited benefits of the higher minimum pool elevations recommended by the agencies and Conservation Groups would not warrant the substantial cost to irrigators of the lost irrigation water. The recommended approach of the Conservation Groups would entail a reduction in irrigation deliveries that escalates during dry years but is never reduced to less than 30 percent of demand. Consequently, the irrigators would not bear the entire cost of enhanced lower Merced River habitat enhancements that relate to available water storage in Lake McClure. However, we still conclude that the benefits of the Conservation Groups' approach to managing available water do not warrant the cost to irrigators.

California DFW recommends that Merced ID annually submit a draft operation plan to the Commission by March 1 and a final operation plan by May 15 that includes the estimated delivery pattern needed to achieve the 200,000 acre-feet end of September minimum pool target. If a minimum pool level should be specified in a new license, we would expect Merced ID to comply with any such condition. How Merced ID operates its project to comply with a minimum pool requirement would be up to them. However, if Merced ID is not able to meet a minimum pool requirement, the Commission would expect a report to be filed documenting the reasons for not meeting a specified minimum pool. Consequently, we find that there would be no need to file an annual operation plan with the Commission as California DFW recommends and we do not recommend that this measure be included in any new license that may be issued for this project. For the reasons described above, we do not recommend an increased Lake McClure minimum pool level.

Development of a Long-term Temperature Management Plan

NMFS [10(j) recommendation 1.1A(3c)] recommends developing a long-term water temperature improvement plan that includes a feasibility study of potential options for decreasing water temperature downstream of Crocker-Huffman diversion dam, including: (1) installing an underground pipe for New Exchequer dam that bypasses McSwain reservoir and/or Merced Falls reservoir; (2) modifying the Lake McClure outlet structure to allow water withdrawal from varying depths; and (3) developing engineering alternatives that do not require large volumes of water. The actual cost of this measure would not be known until a feasible option is identified. Merced ID conducted a feasibility study of engineering options and concludes that no feasible engineering options exist to decrease water temperature downstream of the Crocker-Huffman diversion dam (Merced ID, 2014e). The estimated cost for modifying the Lake McClure outlet structure ranged from \$60 to \$120 million.

California DFW [10(j) recommendation 4] also recommends that Merced ID prepare a long-term water temperature management plan. The plan would include: (1) developing a long term strategy for meeting seasonal temperature objectives for Chinook salmon and *O. mykiss* ranging from 13.0°C (55.4°F) to 18.0°C (64.4°F) during the time frames included in the recommendation; (2) a feasibility study on submerged pipes capable of delivering at least 200 cfs to a location downstream of Crocker-Huffman

diversion dam; (3) measures to prolong and stabilize the irrigation delivery season; (4) measures to restore the natural channel morphology, floodplain habitats, and riparian forest in the approximately 10-mile reach downstream of the Crocker-Huffman diversion dam; (5) provisions to provide coldwater refugia when water temperatures exceed objectives for more than 14 days; and (6) evaluating the effects on instream flow releases of implementing alternatives, and the estimated funding and schedule needed for the alternatives.

FWS [10(j) recommendations 3(A3) and 5 (G and H) recommends that Merced ID conduct a riparian microclimate study and collect data for calibrating a HEC-5Q water temperature model analysis to determine the optimum length and width of riparian forest in the 10 miles from Merced Falls dam to a point 1.2 miles downstream of the Snelling Road bridge needed to achieve temperature objectives downstream of Crocker-Huffman diversion dam. FWS states that until site-specific modeling and analysis is completed, the expected cost per acre of riparian forest restoration is unknown. However, FWS notes that other riparian and floodplain restorations in the Central Valley ranged from \$5,000 per acre for riparian plantings to \$530,000 per acre for a small highly engineered restoration that included removal of dredge tailings from the site and riparian plantings.

To develop a range of potential costs associated with restoring the riparian forest in the 10 miles downstream of Merced Falls dam, we assumed a 30-yard-wide restoration zone on each side of the river, which would result in the restoration of about 218 acres under the FWS and California DFW recommended measures. With these assumptions, the estimated costs for implementing 110 miles of floodplain restoration would range from \$1,090,900 to \$115,540,000. Merced ID states that the expected cost of riparian floodplain restoration would be well in excess of \$100,000,000, and this falls within the range of our estimated costs.

The Water Board [preliminary WQC condition 8] specifies that Merced ID develop a fish passage or habitat restoration plan in consultation with a technical advisory committee. We address fish passage in a separate subsection. The habitat restoration plan would be developed within 1 year of license issuance and designed to decrease water temperatures in and downstream of the project.

The long-term water temperature improvement plans recommended by NMFS and by California DFW contain some elements pertaining to engineering options to deliver colder water from Lake McClure to downstream of Crocker-Huffman diversion dam that have already been studied by Merced ID and presented in its reservoir water temperature management and feasibility study (Merced ID, 2014e). The options evaluated were found by Merced ID to be infeasible and we concur with this conclusion. Therefore, the benefit of repeating this analysis are unclear. As we note previously, the cost of implementing any engineering options would not be known until a feasible option is identified.

Although establishing a riparian forest canopy adjacent to the Merced River from Crocker-Huffman diversion dam to Shaffer Bridge, as embedded in the FWS and

California DFW recommendations, could help to decrease water temperatures compared to existing conditions, we conclude that the primary reason for the absence of a riparian forest is in-channel and floodplain dredger and aggregate mining, not operation of the hydroelectric project. Consequently, conducting modeling to determine the optimal configuration for a restored floodplain forest would be more like a research study not directly related to hydropower operation. The timing of our recommended spring pulse flow would create optimal conditions for germination of riparian cottonwood trees, which eventually would provide shading and some water temperature relief. Enhanced floodplain configuration could also result from implementation of our recommended gravel augmentation plan, which could also serve to foster establishment of riparian vegetation. Both of these measures would address project-related cumulative effects, whereas establishing the ideal riparian forest width may or may not lead to meaningful water temperature enhancements.

With regard to California DFW's recommendation that Merced ID evaluate the feasibility of prolonging and stabilizing the irrigation delivery season to provide the benefit of shorter residence times, we note that Merced ID did evaluate reducing the residence time downstream of Lake McClure by releasing larger volumes of water from New Exchequer dam (Merced ID, 2014e). California DFW does not provide sufficient detail for us to analyze how prolonging and stabilizing irrigation deliveries by using irrigation storage capacity downstream of the project would enhance the temperature regime of the lower Merced River. Therefore, we have no basis to recommend that Merced ID evaluate the feasibility of this measure.

Our recommended anadromous fish monitoring plan would include provisions for Merced ID to participate in fish rescue operations with other appropriate entities when water temperature monitoring indicates that stressful conditions exist when anadromous fish are present. This would partially address California DFW's recommendation that Merced ID provide coldwater refugia for salmonids. However, as noted in our discussion of our recommended anadromous fish monitoring plan, we do not conclude that Merced ID should be solely responsible for any fish rescue efforts.

The Water Board preliminary WQC condition 8 would have Merced ID develop a plan for decreasing water temperatures in the lower Merced River without necessarily establishing a relationship to project operation. As we note in our discussion of our the recommended water temperature monitoring plan, we find that the Water Board's approach specified in preliminary WQC condition 19 bases corrective actions on monitoring results and a linkage to project operation to be reasonable. We therefore recommend that preliminary WQC condition 19 be included in any new license that may be issued for this project, but not preliminary WQC condition 8. However, we recognize that the Water Board's preliminary WQC condition 8 would be included as a mandatory condition in any license issued for the project.

The costs of the agency recommended and specified plans and studies are difficult to estimate and would largely be dependent on which aspects of the plans and feasibility

study recommendations Merced ID would be expected to implement. However, we expect the implementation costs would be substantial (within \$1 million to more than \$100 million) and the incremental benefits over the staff alternative would not be worth the costs.

Fish Passage Upstream of Crocker-Huffman Diversion Dam

Crocker-Huffman diversion dam represents the upstream barrier to resident and anadromous fish in lower Merced River. Merced ID owns and operates Crocker-Huffman diversion dam and the Main Canal as part of its water supply system and both facilities are not related to hydropower operation. Crocker-Huffman diversion dam is equipped with a fish ladder that has been non-operational since 1971 and would require replacement or retrofit to meet current standards for fish passage.

The Water Board (preliminary WQC condition 8) specifies that Merced ID either develop a fish passage plan to allow for passage upstream of Crocker-Huffman, McSwain, and New Exchequer dams, or, develop a habitat restoration plan to decrease water temperatures in and downstream of the project.

FWS [10(j) recommendation 2] recommends Merced ID, in coordination with PG&E, develop a salmonid conservation, rescue, and passage plan to include: (1) planning, permitting, design, scheduling, costs, construction implementation, and monitoring of anadromous and resident salmonid passage at Crocker-Huffman diversion dam; (2) screening at the Merced ID Main Canal; (3) water filtration for the existing hatchery; (4) refrigeration facilities at the existing hatchery for protecting salmonids from sub-lethal and lethal water temperatures resulting from project operation; and (5) cooperating with California DFW in trapping and hauling local wild fish when temperatures in the lower Merced River are expected to be stressful.

NMFS [10(j) recommendation 1.1A(3c)] recommends that until a long-term water temperature improvement plan is developed, Merced ID should provide fish with access to the cold water habitat upstream of the Crocker-Huffman diversion dam. California DFW [10(j) recommendation 6] makes a similar recommendation but adds the option of using self-contained water temperature controlled holding units.

The Conservation Groups recommend that Merced ID: (1) open the Crocker-Huffman fish ladder on a temporary basis for seasonal use by *O. mykiss* when fall-run Chinook salmon are not present and develop monitoring and reporting protocols to quantify fish passage at this dam; (2) develop a plan for infrastructure needed for long-term upstream and downstream *O. mykiss* passage at Crocker-Huffman diversion dam including transporting adult anadromous fish upstream of Lake McClure and young anadromous fish from upstream of Lake McClure to downstream of the diversion dam; (3) evaluate the suitability of habitat in the upper Merced River Watershed for reintroducing spring-run Chinook salmon and steelhead, including a literature review, field studies to fill data gaps, and a habitat feasibility evaluation report; (4) conduct an engineering study to define capture and transport options for moving adult and juvenile

anadromous fish to and from habitat upstream of Lake McClure; and (5) develop a plan for reintroduction of anadromous fish to the upper Merced River Watershed, including project description, conceptual drawing of facilities, costs, known and potential funding sources, and a time line for implementation.

Anadromous fish do not pass upstream of the Merced Falls dam, which is downstream of the first project dam, McSwain dam, and therefore are not present in Lake McClure or the upper Merced River. The Crocker-Huffman diversion dam and any associated features, including the Main Canal, are not related to hydropower operation and are not included in the existing license.

The Conservation Groups made similar requests in 2009 and 2011 to study habitat in the upper Merced River for anadromous fish reintroduction suitability. In its April 1, 2011, study plan determination letter, Commission staff determined that there is no relationship of Merced River Hydroelectric Project operation on fish habitat upstream of Lake McClure. Commission staff further noted that the suitability of upstream habitat for anadromous salmonids, as it relates to recovery planning under NMFS guidelines, pertains to management decisions and actions that most appropriately fall under NMFS' jurisdiction. We agree with the previous staff findings and, consequently, do not recommend specific measures that would enable fish passage at Crocker-Huffman diversion dam to the Merced Falls reach or the Merced River water shed upstream of Lake McClure, or studies to evaluate the potential for such reintroduction. However, we recognize that the Water Board's preliminary WQC condition 8 would be included as a mandatory condition in any license issued for the project.

Measures Related to Lower Merced River Habitat Restoration

Habitat restoration and enhancement projects have the potential to benefit aquatic biota as well as terrestrial vegetation and improve geomorphic processes in the lower Merced River. Some of these measures are discussed previously under additional staff-recommended measures or in subsections pertaining to measures we do not recommend.

FWS [amended 10(j) recommendations 3(A2) and 3(A3)] recommends habitat restoration and enhancement measures for the lower Merced River. For the 10-mile reach between Merced Falls dam and RM 45.2 (1.2 miles downstream of Snelling Road), FWS recommends that Merced ID restore a dense, riparian tree canopy in at least a 30-meter-wide zone on each side of the river to reduce water temperature by planting root stock, cuttings, or nursery stock using native tree species from the riparian corridor; protecting the plantings from beaver depredation; and, for restoration on lands not federally or state-owned, obtaining conservation easements and conveying them to an FWS-approved entity. For the reach from Shaffer Bridge to the confluence with the San Joaquin River, FWS recommends that Merced ID enhance at least 10 miles of habitat based on recommendations of a technical advisory committee and where conservation easements can be acquired to protect the restored habitat. FWS gives examples of potential habitat restoration projects, including addition of LWM, floodplain and riparian

restoration, removal of riprap, and restoration of gravel mine pits. In 10(j) recommendations 5(I) and 9(9), FWS and California DFW recommend that Merced ID conduct long-term monitoring of riparian vegetation at floodplain restoration sites. The Conservation Groups make an identical recommendation.

NMFS [10(j) recommendation 6] recommends that Merced ID implement NMFS' Ecosystem Adaptive Management Process and actions related to habitat enhancements from Crocker-Huffman diversion dam to Shaffer Bridge. This process would entail collating the annual reports specified in applicable license conditions, and in consultation with a technical advisory committee, holistically assessing the information to determine if respective goals and objectives have been achieved; and, if goals and objectives are not achieved, determining adjustments needed to achieve anadromous fish habitat restoration goals. In addition, in 10(j) recommendation 7.1(C), NMFS recommends that Merced ID establish a restoration implementation fund and use an independent financial advisor to manage, track, and report on the fund's progress. Interest from the fund would be used to support habitat restoration projects recommended by a technical advisory committee.

We do not dispute the environmental benefit to aquatic and riparian habitat of restoring a dense riparian tree canopy along the Merced River. However, we conclude that existing information indicates that non-project-related dredger and aggregate mining has elevated the floodplain downstream of Crocker-Huffman diversion dam from its original position, indicating that non-project variables affect the establishment of over-floodplain flows, which serve an important function in maintaining floodplain vegetation. In addition, Commission staff noted that the extensive aggregate mining both in the floodplain and the channel have created in-channel or captured mining pits.

In its April 1, 2011, study plan determination, Commission staff also found that the effects of hydroelectric project operation are outweighed by other non-project factors downstream of Shaffer Bridge. We find no basis to recommend that Merced ID be responsible for any habitat enhancement measures downstream of Shaffer Bridge. Although FWS gives examples of the types of projects that could be considered in this downstream reach, it does not specify the activities that would actually take place. Therefore, we have no basis to evaluate the environmental benefits of this aspect of FWS' recommendation or the associated costs.

The NMFS recommendation that Merced ID be responsible for implementing the Ecosystem Adaptive Management Process seems to reiterate the purposes of the staff-recommended technical advisory committee. Major functions of such a committee include review of information pertaining to environmental measures that may be included in a new license, including those that pertain to enhancement of anadromous fish habitat, and developing recommendations for future actions to be considered by other stakeholders. The Commission would ultimately determine if any conditions of a new license need to be adjusted based on recommendations from Merced ID and other stakeholders to more effectively achieve the stated goals of environmental measures. We do not consider it appropriate to recommend this measure for inclusion in any new

license that may be issued for this project, because with our recommended technical advisory committee, listed in section 5.1.1.1, there is no need to recommend an Ecosystem Adaptive Management Process.

NMFS recommends that Merced ID establish a restoration implementation fund and use the interest from the fund for activities recommended by a technical advisory committee at a future date. This recommendation does not identify specific environmental measures for us to assess and consider pursuant to sections 4(e) and 10(a) of the FPA; therefore, we have no justification for adopting the recommendation under the staff alternative.

Supplemental Anadromous Fish Monitoring

Existing California DFW monitoring of fish populations in project-affected waters is currently focused on anadromous salmonids occurring in the lower Merced River downstream of the Crocker-Huffman diversion dam (RM 52.0). California DFW continues to monitor fall-run Chinook salmon escapement, including carcass surveys, spawning distribution, scale and otolith collection and analysis, length, sex, coded-wire-tag, and fecundity data and analysis, as it has been doing since 1970.

NMFS, FWS, and California DFW [10(j) recommendations 4, 5(A-F), and 9(1-6), respectively] and the Conservation Groups recommend similar measures pertaining to anadromous fish monitoring. Compared with our recommended anadromous fish monitoring measure, these measures would include an expanded set of monitoring activities. The primary differences include: (1) continuing existing California DFW carcass surveys, including data collection and analysis of scales, otoliths, length, sex, wire tags, and fecundity for fall-run Chinook salmon; (2) conducting RST sampling at both currently monitored upstream and downstream sites (although the Conservation Groups only recommend RST sampling at one location); and (3) conducting annual snorkel surveys of the *O. mykiss* population.

We recognize the additional value that conducting carcass surveys, scale and otolith analysis, and fecundity determinations of adult anadromous fish would provide for resource management purposes, but we do not see how this information relates to the hydroelectric project operation or how it could be used to inform any project modifications. Merced ID estimates the annual cost of conducting carcass and otolith surveys to be about \$350,000, and we consider this to be a reasonable estimate of expected costs. Therefore, we do not consider the benefits of gathering this additional information to warrant the likely substantial cost of doing so.

In our analysis of the need for anadromous fish monitoring, we conclude that one RST monitoring station would be sufficient to document the number of outmigrating salmonids from project-affected waters of the lower Merced River. Merced ID estimates that the annual cost of operating the agency-recommended second RST monitoring site would be about \$150,000, and we consider any benefits of this second monitoring site not to warrant the expected annual cost.

Similarly, conducting additional snorkel surveys to monitor the *O. mykiss* population would supplement the monitoring proposed by Merced ID and recommended by staff. However, during six seasonal fish sampling efforts conducted between summer 2006 to spring 2008 using snorkel surveys, seining, and backpack and boat-mounted electrofishing units, a total of 110 *O. mykiss* were observed. This included 73 *O. mykiss* observed in the Crocker-Huffman diversion dam impoundment, which were most likely resident because there are no upstream passage facilities at the diversion dam and 37 *O. mykiss* observed downstream of the diversion dam, which could have been either anadromous or resident (Stillwater Sciences, 2008). Of the 37 *O. mykiss* observed by all collection methods in the reach downstream of the diversion dam, 30 were observed during snorkel surveys (an average of 5 per survey). The anadromy of any observed *O. mykiss* during snorkel surveys could not be determined, and we expect that very few *O. mykiss* would be observed based on the results of previous studies. Therefore, it is unclear how snorkel surveys could further inform decisions regarding the status of lower Merced River steelhead beyond what would be achieved by Merced ID's proposed RST and counting weir monitoring, which would detect upstream and downstream migrating fish. We therefore conclude that the benefit of conducting snorkel surveys in the lower Merced River would not be justified by the estimated annual cost of \$150,000.

Merced River Fish Hatchery Management

The Merced River Fish Hatchery has been operational since 1970 and is managed by California DFW. The initial construction of the hatchery was funded by California DFW, California DWR, and Merced ID, and its ongoing operation is cooperatively funded by California DFW in collaboration with state water contractors. The current population of Chinook salmon in the Merced River is supported by fish produced at the hatchery. Salmon produced at the hatchery are also routinely used for studies conducted within the San Joaquin River Watershed. The hatchery reports recent average annual hatchery production of Chinook salmon (2004 to 2009) to be 972,344 fish.

California DFW [10(j) recommendation 5] recommends that Merced ID prepare a hatchery master plan in consultation with California DFW, FWS, and NMFS. The plan would include provisions for an initial design study to determine site capabilities and costs associated with operating the hatchery. The recommended plan would also address 11 potential hatchery upgrades to be provided at the existing hatchery and provisions to assess the possible relocation of facilities to a site immediately below New Exchequer dam to meet the guidelines of the California Hatchery Scientific Review Group. California DFW states that Merced ID should be responsible for the annual hatchery release of 5 million fall-run Chinook salmon smolts with a single year maximum of 7.5 million juveniles, and the annual release of 250,000 steelhead juveniles with a single year maximum of 425,000 juveniles.

The Conservation Groups recommend that Merced ID develop and implement a Merced River fish management plan to design, construct, and operate a fish propagation facility for the production of native salmonids. The initial capacity would be a 5-year

running average of 60,000 eyed eggs, fry, or fingerling Chinook salmon per year and multiple age class broodstock (capacity of 1,000 to 2,000 pounds). Initial capacity would also include up to a 5-year running total of 667,200 rainbow trout annual production, commensurate with the need to outplant fish in tributaries of the Merced River. The Conservation Groups identify a 22-acre site on Merced ID land immediately below New Exchequer dam as a potential location for this new facility.

The current annual production goal of the Merced River Fish Hatchery is to take 2 million fall Chinook salmon eggs and release 1 million Chinook salmon smolts (California HSRG, 2012). California DFW states that the current goal is based on facility constraints. The continued operation of the Merced River Fish Hatchery would support the Chinook salmon population in the lower Merced River until such time as natural reproduction in the river channel is sufficient to sustain or enhance the existing population. However, no aspect of the hatchery is included in the current license and the hatchery is not related to the ancillary use of project water for hydropower generation. The Crocker-Huffman diversion dam, which blocks upstream anadromous fish passage, was constructed in 1910, well before the Merced River Project received its hydroelectric license from the Commission. We do not dispute the assertion that upgrading and expanding the existing hatchery and assessing the potential relocation of the hatchery to a more favorable site could benefit efforts to artificially sustain Chinook salmon populations in the lower Merced River by stocking Chinook salmon smolts. We also recognize that the project plays a part in cumulative effects in the lower Merced River. However, other factors, such as instream mining and irrigation diversions, have had a much greater proportional effect than those associated with hydropower operation. To mitigate the effects of the project, we have recommended measures that could benefit Central Valley fall-run Chinook salmon populations by enhancing natural in-river production, such as an improved flow regime, reduced water temperatures to the extent controllable by the project, and spawning habitat enhancements.

The cost of California DFW recommended measures relating to a fish hatchery are difficult to quantify, because it is not clear how many of the elements Merced ID would be expected to implement. We estimate that implementing the recommended enhancements to the existing hatchery or constructing a new hatchery in proximity to New Exchequer dam would cost millions of dollars. Nevertheless, given the lack of a connection to hydroelectric project operation, we have no justification for adopting the recommended hatchery measures under the staff alternative.

Benthic Macroinvertebrate Monitoring

BMI assemblages are an important part of the aquatic ecosystem and provide a fundamental food source for many resident fish. The description and characterization of BMI can also be used to provide an indication of the general health and condition of a stream.

Previous study results showed at least two EPT taxa (intolerant of water quality impairment) included in the top five numerically dominant taxa at each monitoring site in the lower Merced River, with the majority of dominant taxa likely available as a food source for juvenile Chinook salmon (Stillwater Sciences 2008, 2006). Tolerance metrics indicated moderately tolerant BMI assemblages under existing conditions.

FWS [10(j) recommendation 8] recommends that Merced ID develop a BMI monitoring plan describing sampling to be conducted in the project-affected bypass reaches to assess the effects on BMI under new flow regimes and other changes that may be included in a new license.

The recent BMI studies on the lower Merced River provide an adequate baseline for evaluating effects under any potential change to the flow regime. The instream flow measures offered by various stakeholders and recommended by staff would result in no decrease to the current flow schedule over all water year types and would, at a minimum, maintain existing conditions in the lower Merced River. Results of recent BMI studies indicate a moderately tolerant BMI assemblage that can be expected to be used as food by fish in the lower river. Additionally, if instream channel enhancements downstream of Crocker-Huffman diversion dam should be included in a new license, it would improve conditions for the BMI community. Although continued sampling of BMI in the lower Merced River would enable trends to be evaluated over time, we cannot envision a scenario where project hydroelectric operation with our recommended protection and enhancement measures would result in a declining trend in BMI density and EPT taxa. Consequently, the benefits of this recommended monitoring are unclear and we do not recommend provisions for such monitoring be included in a new license for this project.

Operation, Maintenance, and Administration

BLM specifies in preliminary 4(e) condition 21 that Merced ID enter into an agreement to provide annual funding to BLM for the operation, maintenance, management, and administration costs of BLM-administered lands in and around the Merced River Project.

BLM did not disclose the amount of funding to be provided each year. Merced ID is ultimately responsible for operating and maintaining all project facilities and lands within the project boundary. Further, it is unclear how these funds would accomplish a project purpose. Therefore, we do not recommend Merced ID provide annual funding for the operation and management of lands and facilities at the project.

Annual Consultation and Review

Merced ID proposes to conduct an annual review of federally listed and special-status species lists, assess newly added species occurring on federal land, and if necessary consult with agencies to develop and implement protection measures. Preliminary WQC condition 12 and BLM preliminary 4(e) condition 1 both specify annual consultation to review the project status and plans, results of studies, necessary modifications to plans,

and protection measures for newly listed species. Preliminary WQC condition 13 and BLMs preliminary 4(e) condition 11 also both specify that Merced ID review the lists of federally listed and special-status species and evaluate potential project effects on newly listed species. In its 10(j) recommendation 6(a), FWS recommends under item A, consultation prior to construction of new project features or the implementation of non-routine maintenance activities that may affect federally listed and candidate species and their habitat, and directs the licensee to develop a draft biological assessment for potentially affected species. Under item B, FWS states the draft biological assessment should evaluate potential impacts of the proposed actions on species and their habitats, and the licensee should submit the plan to FWS and BLM for comments to be incorporated into a final biological assessment. Under item C, FWS recommends the contents of the draft biological assessment, and under items D and E, FWS recommends the licensee conclude consultation for a particular set of species and habitats, in the event of new construction or non-routine maintenance activities.

Our analysis in section 3.3.3.2, *Threatened and Endangered Species, Environmental Effects*, indicates that although we agree that consultation prior to new construction and non-routine maintenance would protect federally listed species and their habitats over the term of the license, the Commission typically includes in its licenses a standard license article providing such protection. This license article contains a fish and wildlife reopener provision that could be used to require changes to project facilities or maintenance plans upon Commission motion or as recommended by the appropriate state and federal fish and wildlife agencies after notice and opportunity for hearing. This standard reopener provision retains authority for the Commission to implement any measures that may be needed to protect threatened or endangered species or other fish and wildlife resources over the term of the license issued for the project. Although we have no objection to Merced ID conducting this agency consultation, the standard license article would provide a similar level of protection as the proposed measure. We recognize, however, that these annual review and consultation measures are included in the Water Board preliminary WQC conditions and BLM preliminary 4(e) conditions, so the measures would be included as mandatory conditions of any license issued for the project.

5.1.2 Merced Falls Project

This section contains the basis for, and a summary of, our recommendations for relicensing the Merced Falls Project. We weigh the costs and benefits of our recommended alternative against other proposed measures.

Based on our independent review of agency and public comments filed on this project and our review of the environmental and economic effects of the proposed project and its alternatives, we select the staff alternative as the preferred alternative. This alternative includes elements of the applicant's proposal, section 4(e) conditions, section 401 WQC conditions, resource agency recommendations, alternative conditions under the Energy Policy Act of 2005, and some additional measures. We recommend this

alternative because: (1) issuance of a new hydropower license by the Commission would allow PG&E to operate the project as an economically beneficial and dependable source of electrical energy for its customers; (2) the 3.4 MW of electric energy generated capacity comes from a renewable resource that does not contribute to atmospheric pollution; (3) the public benefits of this alternative would exceed those of the no-action alternative; and (4) the recommended measures would protect and enhance fish and wildlife resources and would provide improved recreation opportunities at the project.

Finally, for the reasons outlined below, we recommend that certain conditions specified by the Water Board not be included in the staff alternative. The conditions we are not recommending include a fish passage plan and a gravel augmentation plan. We recognize, however, that the Commission must include these conditions in any license due to their mandatory nature.

5.1.2.1 Measures Proposed by PG&E

Based on our environmental analysis of PG&E's proposal discussed in section 3 and the costs discussed in section 4, we recommend including the following environmental measures proposed by PG&E in any license issued for the project. Our recommended modifications to PG&E's proposed measure are shown in *italic*.

Aquatic Resources

- Develop and implement a water quality monitoring program.
- *Develop an annual fish sampling plan in the Merced Falls reach in consultation with the technical advisory committee.*
- Continue to perform intake cleaning of LWD. *Cleaning and subsequent downstream placement of LWD should be dictated by an LWD management plan, created in consultation with the technical advisory committee.*

Recreation

- Continue to operate and maintain existing recreation facilities at the Merced Falls impoundment area, including the River's Edge Fishing Access area and the car-top boat launch at Merced Falls Fishing Access area.
- Develop and post directional and safety signage at the informal canoe portage trail.
- Continue to monitor recreation use and recreation facility capacity through the FERC Form 80 every 6 years.

- Develop a fish stocking plan in consultation with California DFW that includes stocking 11,000 adult-sized rainbow trout at the Merced Falls impoundment for the first 2 years following license issuance and a plan for stocking (schedule and type and amount of fish) for the rest of the license term.

Cultural Resources

- Implement the final HPMP upon license issuance.

5.1.2.2 Additional Measures Recommended by Staff

In addition to PG&E's proposed measures listed above, we recommend including the following staff-recommended measure in any license issued for the Merced Falls Project:

Aquatic Resources

- Participate in a Merced River technical advisory committee in conjunction with Merced ID.
- In conjunction with Merced ID, develop a coordinated operation plan for the Merced River and Merced Falls Projects in consultation with the technical advisory committee.
- Develop a LWD management plan in consultation with the technical advisory committee.
- Develop an annual fish sampling plan in the Merced Falls reach in consultation with the technical advisory committee.

Terrestrial Resources

- Develop a control plan for noxious weeds and invasive plants, integrated with a component for pesticide use and notification.
- Develop and implement a management plan for the bald eagle in consultation with FWS, California DFW, and the Water Board.

Threatened and Endangered Species

- Develop a protection plan, in consultation with BLM, FWS, California DFW, and the Water Board for the valley elderberry longhorn beetle.
- Develop a protection plan in consultation with BLM, FWS, California DFW, and the Water Board for the San Joaquin kit fox.
- Develop a protection plan in consultation with BLM, FWS, California DFW, and the Water Board for the California red-legged frog, foothills yellow-legged frog, and western spadefoot.

Recreation

- Operate and maintain all recreation facilities at the Merced Falls Fishing Access area, including one sign, restroom, parking area, and car-top boat launch, the informal angler trail along the northern shoreline, the two informal parking areas on either side of Hornitos Bridge, and the informal canoe portage trail at the south end of Merced Falls dam.

Project Boundary

- Modify the project boundary to include the informal canoe trail on the south side of Merced Falls dam.

Below, we discuss our rationale for our additional staff-recommended measures.

Technical Advisory Committee

The Merced Falls Project area experiences many of the environmental effects of the upstream Merced River Project because of its proximity and operational dependence on the upstream Merced ID facilities. Downstream of Merced Falls dam, the environmental effects of both the Merced River and Merced Falls Projects are highly interrelated, although the incremental effects of the PG&E project are minor, as discussed in section 3.3.1.2.

California DFW [10(j) recommendation 1] recommends that PG&E establish an ecological resource committee in conjunction with Merced ID for the purpose of consulting annually with resource agencies and other interested stakeholders on the implementation of license measures, implementation of monitoring plans, review and evaluation of monitoring data, and review and evaluation of required facility modifications. Similarly, NMFS [10(j) recommendation 7] recommends Merced ID establish an anadromous fish committee in conjunction with Merced ID that includes a technical advisory plan that defines membership, meeting responsibilities, ground rules for consensus-based decision making, and a process for implementing the decisions. The Water Board [preliminary WQC condition 7] specifies that PG&E hold a pentennial meeting with resource agencies to provide an update of all monitoring and data required by the new license and WQC. PG&E indicates that participation in regular consultation is unnecessary, given the minimal environmental impact of the Merced Falls Project.

Establishing a committee to assess ongoing study results and project operation would provide an effective forum for making decisions regarding future project operation within the constraints of a new license. Due to the close proximity, operational dependence, and combined environmental effects of the Merced River and Merced Falls Projects, PG&E's participation in a technical advisory would be valuable to ensure the timeliness, efficacy, and consistency in the application of any operational and environmental measures required of Merced ID and/or PG&E in the Merced Falls Project area and downstream.

We note that Merced ID proposes to establish a Merced River technical advisory committee.⁶¹ Under the *Merced River Project* staff alternative, Merced ID would establish a technical advisory committee that is not constrained to measures that pertain only to anadromous fish downstream of Crocker-Huffman diversion dam; establish guidelines for conducting meetings; and add BLM and the Park Service to the entities invited to participate on the committee because Lake McClure water management affects resources within the jurisdiction of these two agencies. As such, PG&E's investment in a technical committee would be limited to participation—significantly reducing the cost and effort associated to the measure, and thus being commensurate with the Merced Falls Project's minor incremental environmental effects.

NMFS [10(j) recommendation 6] recommends that Merced ID implement NMFS' Ecosystem Adaptive Management Process and actions related to habitat enhancements from Merced Falls dam to the Crocker-Huffman diversion dam. We find that this recommendation seems to reiterate the purposes of a technical advisory committee, previously discussed. Major functions of such a committee include review of information pertaining to environmental measures that may be included in a new license, including those that pertain to enhancement of anadromous fish habitat, and developing recommendations for future actions to be considered by other stakeholders. The Commission would ultimately determine if any conditions of a new license need to be adjusted based on recommendations from PG&E and other stakeholders to more effectively achieve the stated goals of environmental measures.

The Water Board [preliminary WQC condition 7] also specifies that PG&E review lists of endangered and special-status species to identify newly listed species that could be adversely affected by the project. For any newly listed species identified as potentially affected by the project, the Water Board further specifies that PG&E should consult with FWS, California DFW, the Water Board, and NMFS to develop a species-specific study plan. The Commission typically includes a standard license article providing such protection in its licenses. This license article contains a fish and wildlife reopener provision that could be used to require changes to project facilities or maintenance plans upon Commission motion or as recommended by the appropriate state and federal fish and wildlife agencies after notice and opportunity for hearing. This standard reopener provision retains authority for the Commission to implement any measures that may be needed to protect threatened or endangered species or other fish and wildlife resources over the term of the license issued for the project.

We consider PG&E's participation in a technical advisory committee an effective approach to ensuring coordination between the licensees for the Merced River and Merced Falls Projects and adaptively managing resources during the term of the licenses. We estimate this measure would have an annualized cost of \$2,200. Given the benefits

⁶¹ See section 5.2.1.1 and section 3.3.1.2 for corresponding analysis.

of the staff's recommended alternative as described above, we consider this cost to be warranted.

Coordinated Operation Plan

PG&E proposes to continue operating the project run-of-river and proposes no specific mechanism for coordinating project activities, such as operations and maintenance activities with the upstream Merced River Project.

Merced ID proposes to develop a coordinated operations plan for the Merced River and Merced Falls Projects. Under the *Merced River Project* staff alternative, Merced ID would develop the plan in consultation with the Water Board, BLM, FWS, California DFW, NMFS, and the Park Service.

California DFW [10(j) recommendation 2] recommends that PG&E develop a coordinated operation plan in consultation with Merced ID and file it with the Commission, California DFW, the Water Board, FWS, and NMFS within 90 days of license issuance.

Under the staff alternative, PG&E would develop a coordinated operation plan in consultation with Merced ID and file it with the Commission, California DFW, the Water Board, FWS, and NMFS within 90 days of license issuance.

As discussed in section 3.3.1.2, flows released from the Merced River Project for environmental and irrigation purposes must pass through the Merced Falls Project before reaching the irrigation diversion point at Crocker-Huffman diversion dam. Although the Merced Falls Project operates in a run-of-river mode, where inflow to the project equals outflow, there are circumstances that could occur, such as routine maintenance events, that could have a bearing on the multi-purpose releases from the Crocker-Huffman diversion dam to the lower Merced River and irrigation flows into the Main Canal. Although developing this plan is likely to entail technical discussions about the fine points of project operations, inviting interested parties to provide input on the draft plan could provide valuable insights that enhance its effectiveness.

We estimate that developing a coordinated operations plan as recommended by staff would have an annualized cost of \$1,000. Because operational coordination between the licensees would be valuable to ensure the timeliness, efficacy, and consistency in the application of any operational measures in the Merced Falls Project area and downstream in the lower Merced River, we conclude the benefits of the program are worth the costs.

Large Woody Debris Management

LWM provides habitat structure in streams and can influence sediment storage and channel morphology through its effects on flow, water velocity, and sediment transport. LWM provides cover and holding habitat for fish, serves as substrate for the growth of algae and invertebrates (which are important components of the aquatic food web), and

affects patterns of sediment deposition and scouring. Loss of LWM can result in reduced complexity of aquatic habitat and reduced carrying capacity for aquatic biota.

PG&E proposes to continue periodically perform intake cleaning, wherein woody debris lodged against the intake is raked off, placed on a debris chute, and passed downstream. PG&E also notes that woody debris can continue downstream periodically when project gates are opened. PG&E does not provide details regarding the timing or quantity of LWD/LWM removal and therefore, it is difficult to evaluate the biological significance, if any, of PG&E's LWD/LWM intake cleaning procedures.

Identical to its recommendation for the Merced River Project, NMFS [10(j) recommendation 3] recommends that in conjunction with Merced ID, PG&E implement LWD enhancements in four river reaches between Crocker-Huffman diversion dam and Shaffer Bridge (RMs 52.0–32.8). The Merced Falls project area consists primarily of annual grasses, with a relatively small percentage of woody vegetation that could contribute to the recruitment of LWM and LWD. The recruitment of LWM and LWD in the reach downstream of Merced Falls and the lower Merced River depends primarily sources upstream of the project. As previously discussed, pre-application studies indicate that LWM is uncommon at upstream the New Exchequer dam, most likely because LWM transported into Lake McClure (most often during storm flows) sinks or washes up on the reservoir shoreline before reaching the dam. Loss of LWM due to storage in Lake McClure is unavoidable. LWM input from the adjacent oak woodlands downstream of Lake McClure is also limited, and hardwood recruited to stream channels tends to be relatively small and short-lived in the channel. Therefore, the Merced Falls Project's incremental effect on the lack of LWD in Merced Falls reach or the lower Merced River is negligible compared to the effect of the upstream dams. For these reasons, the breadth and scale of the LWM management activities recommended by NMFS are unwarranted. Development of an LWD plan specific to the Merced Falls Project, as described above would emphasize mitigation of the project's effects on LWD in the project area. However, we note that we recommend Merced ID develop a LWM and debris management plan that describes existing locations of LWM collection in Lake McClure and McSwain reservoir, potential options for moving the LWM collected to the Merced River downstream of Crocker-Huffman diversion dam, and suitable locations where LWM and debris can be placed in the active channel.⁶²

We estimate that PG&E's proposal would have an annualized cost of \$8,800. We estimate that developing a LWD management plan as recommended by staff would have an annualized cost of \$13,800. Because staff's recommended measure would provide a benefit to aquatic species in the Merced Falls reach, we conclude the benefits of the program are worth the additional costs.

⁶² See section 5.2.1.1 and section 3.3.1.2 for corresponding analysis.

Fish Population Monitoring

Fish population monitoring could form the basis for establishing immediate and long-term protection and enhancement strategies for fish in the project area. PG&E proposes to monitor *O. mykiss* populations in the reach of the Merced River downstream of the Merced Falls dam and upstream of Crocker-Huffman dam (Merced Falls reach) annually during the fall. California DFW [10(j) recommendation 6] recommends that PG&E develop an annual monitoring plan and conduct *O. mykiss* surveys in the Merced Falls reach during the spring and summer to determine abundance, size distribution, spawning distribution, and summer distribution. Specific methodology of the monitoring plan would be developed in consultation with a technical advisory committee. NMFS [10(j) recommendation 4] recommends that PG&E develop and implement an anadromous/resident fish monitoring plan in the Merced Falls reach in consultation with a technical advisory committee. The goals and timing of NMFS' recommended plan are similar to those recommended by California DFW. Given the seasonally high spring and early summer flows in the Merced Falls reach, certain sampling techniques would not only be limited in their efficacy, but also dangerous to those responsible for conducting the sampling. While fall sampling efforts would ensure safer and more effective sampling conditions, specific data needs, such as spawning distribution or summer distribution, may not be fulfilled because the timing of discrete events in the life cycle of the species of interest may not coincide with fall sampling. The development of a fish monitoring plan for the Merced Falls reach in consultation with a technical advisory committee could resolve the necessity for specific data needs, such as spawning distribution or summer distribution with regard to local site conditions, and would assist in any potential adaptation of sampling techniques to address local site conditions. We estimate that PG&E's proposed measure would have an annualized cost of \$16,000. We estimate that the development and implementation of a fish monitoring plan as recommended by staff would have an annualized cost of \$20,000. Because the staff-recommended measure would optimize the design and implementation of a fish monitoring program, we conclude the benefits of the plan are worth the costs.

NMFS [10(j) recommendation 4] also recommends PG&E: (1) conduct an annual pre-spawning mortality survey; (2) conduct carcass surveys, including data collection and analysis of scales, otoliths, length, sex, wire tags, and fecundity data; (3) conduct annual juvenile emergence and outmigration monitoring using two RSTs; (4) establish counting weirs to estimate Central Valley Chinook salmon and Central Valley steelhead escapement and provide data on the percentage of females and migration timing; and (5) conduct otolith analysis annually to estimate the contribution of naturally produced fry-, parr-, and smolt-sized migrants to the adult population. We note that NMFS' additional recommendations 1-5 listed above are identical to its recommendations for the Merced River Project, and are primarily intended to gather monitoring data on anadromous species. As previously discussed, Crocker-Huffman diversion dam, located downstream of the Merced Falls Project, represents the upstream barrier to resident and anadromous fish in lower Merced River. Therefore, monitoring these species in the

Merced Falls reach, using the recommended techniques, would represent a considerable expense, estimated to be as much as \$35,000 annually, but would likely result in data of little value. For these reasons, we find that the cost of the additional measures is not worth the potential benefits. As discussed in section 5.1.1.2, *Additional Measures Recommended by Staff*, we recommend that Merced ID conduct anadromous fish monitoring in the lower Merced River.

Integrated Management Plan for Noxious Weeds, Invasive Plants, Pest Management, and Pesticide Use

Under a new license, PG&E proposes to continue its semi-annual treatment of noxious weeds and invasive plants, but it does not propose a formal management plan. The Water Board comments that the Basin Plan pertains to all levels of pesticide use and includes herbicides. Preliminary WQC condition 2 specifies that PG&E develop a pesticide use plan within 6 months of license issuance, in consultation with the Water Board, BLM, California DFW, FWS, and NMFS. California DFW [10(j) recommendation 7] recommends an integrated pest management and pesticide use notification plan to control undesirable woody and herbaceous vegetation, aquatic plants, insects, and rodents. FWS' comments about the effects of rodenticide and pesticide use are discussed in section 3.3.3.2 and section 3.3.3.3.

A formal plan detailing the methods, locations, timing, frequency of control treatments, and target species would allow PG&E to manage undesirable vegetation more effectively, while also reducing effects on sensitive species and habitats. Integrating a component for pest management and pesticide use notification into the Invasive Species Management Plan to address agency requirements of notification prior to use would further protect both terrestrial and aquatic resources from the effects of herbicides used to control undesirable vegetation and other pesticides. We therefore recommend PG&E develop a plan for the control of noxious weeds and invasive plants integrated with a component on pest management and pesticide use. The plan would be developed in consultation with FWS, the Water Board, California DFW, and BLM and include the measures required by the conditions and recommendations made by agencies. We estimate the plan would have a levelized annual cost of about \$15,000. Such a cost outweighs the potential effects on sensitive species and habitats in the project vicinity.

Bald Eagle Management

PG&E proposes to protect bald eagles according to site-specific and project-specific management criteria, rather than developing a management plan consistent with the National Bald Eagle Management Guidelines. The Water Board specifies in preliminary WQC condition 5 that PG&E develop a monitoring and conservation plan for bald eagles, consistent with the most current guidelines provided by FWS. FWS [10(j) recommendation 5] recommends a bald eagle management plan either to be implemented in concert with Merced ID or to be developed and implemented by PG&E.

Requiring a plan to protect bald eagle nests from operation and maintenance activities and recreation activities would reduce project-related effects on nesting bald eagles. In addition, requiring protection of winter roost trees from vegetation management and future construction activities would reduce potential habitat degradation.

All survey protocols and protection and mitigation measures should be consistent with the guidelines provided in the National Bald Eagle Management Guidelines, rather than site- or project-specific. Implementing survey protocols and protection and mitigation measures inconsistently could conflict with the National Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. Thus, we recommend developing a plan in consultation with FWS, California DFW, and BLM to ensure survey protocols and protection and mitigation measures are consistent with those required by the National Bald Eagle Management Guidelines. We estimate the plan would have a levelized annual cost of about \$2,000.

Protection Plan for the Valley Elderberry Longhorn Beetle

PG&E does not propose a protection plan for the valley elderberry longhorn beetle. FWS comments that it considers exit holes in the bark of elderberry bushes to be extremely rare and to be evidence of occupation by the valley elderberry longhorn beetle. FWS [10(j) recommendation 3] indicates ESA consultation has not been concluded for this species. The Water Board [preliminary WQC condition 6] specifies a monitoring and conservation plan for the valley elderberry longhorn beetle.

In our analysis in section 3.3.3.2, we note that valley elderberry longhorn beetles could occur in the project area. Project-related activities, such as the control of undesirable vegetation and increases in recreation could negatively impact valley elderberry longhorn beetles and their habitat. To prevent unforeseen damage or removal of the existing elderberry shrub and any elderberry shrubs identified in the future, we recommend developing a protection plan for the valley elderberry longhorn beetle and its habitat in consultation with FWS, BLM, California DFW, and the Water Board. The plan would include measures required by agency conditions and recommendations, as well as other measures recommended by agencies during consultation. We estimate the plan would have a levelized annual cost of \$2,000 and would be worth the cost to ensure the protection of any elderberry shrubs and the valley elderberry longhorn beetle from project effects.

Protection Plan for the San Joaquin Kit Fox

PG&E does not propose any measures to protect the San Joaquin kit fox nor has it provided information about project effects on the species. The Water Board [preliminary WQC condition 2] specifies that PG&E develop a pesticide use plan to protect state and federally threatened and endangered species, where pesticide use includes rodenticides. California DFW [10(j) recommendation 7] recommends an integrated pest management and pesticide use notification plan for undesirable vegetation, insects, and rodents.

PG&E did not provide information about San Joaquin kit fox and potential project-related effects on San Joaquin kit fox to sufficiently assess potential effects on the species. Conducting surveys in the project area would be necessary to document San Joaquin kit fox use of habitat in the project area. Additionally, data collected during surveys may provide information on the effects of the project on the dispersal of kit fox. Including the surveys as a component of a protection plan would be formally document study results so that project effects on kit fox can sufficiently be evaluated and appropriate protection and mitigation measures can be developed. As such, we recommend PG&E develop a protection plan for the San Joaquin kit fox in consultation with FWS, the Water Board, California DFW, and BLM. The plan would include: (1) study methodologies and monitoring protocols to identify San Joaquin kit fox habitats within the project area; (2) an assessment of potential project effects on San Joaquin kit fox in the project area; (3) protection and mitigation measures; (4) references to measures contained in other plans that would protect San Joaquin kit fox; and (5) descriptions of any exceptions to the prohibited use of rodenticides that would be considered emergencies and allowed by agencies and an explanation of why the emergency situations would supersede protection measures for the San Joaquin kit fox. We estimate the plan would have a levelized annual cost of \$2,000 and would be worth the cost to ensure that the project would not adversely or cumulatively affect the San Joaquin kit fox.

Protection Plan for the California Red-legged frog, Foothill Yellow-legged Frog, and Western Spadefoot

PG&E does not propose any protective measures for the California red-legged frog, or any other federally listed or special-status amphibian species. FWS [10(j) recommendation 4] recommends a conservation plan for the California red-legged frog. The Water Board [preliminary WQC condition 9] specifies a frog monitoring program for the California red-legged frog, foothill yellow-legged frog, and western spadefoot.

In section 3.3.3.2, we discuss the potential for California red-legged frogs to occur in and near the project area and analyze project effects on the species. The protective measures recommended by FWS include: measures to control bullfrogs, reestablishing populations of the California red-legged frog in the Piney Creek core area, and reducing population-level impacts from the frog-killing *Batrachochytrium dendrobatidis* fungus. These measures would help reduce predation and mortality and enhance populations in the vicinity of the project. We also agree with Water Board's recommendation to include similar measures for the foothill yellow-legged frog and western spadefoot, both of which are special-status species currently under review by FWS. Broadening the measures to include other special-status species, such as the foothill yellow-legged frog and the western spadefoot, would bestow similar protective benefits to those species. Therefore, we recommend PG&E develop a plan to protect federally listed and special-status amphibian species, including but not limited to the California red-legged frog, foothill yellow-legged frog, and western spadefoot. We estimate the cost of the protection plan

to be \$2,000. We consider the plan to be worth the cost, given the benefits to these federally listed and special-status species, while also ensuring the project's compliance with state and federal laws governing federally listed and special-status species.

Recreation

A number of formal and informal recreation sites exist at the project. Although PG&E proposes to continue to operate and maintain the recreation facilities at River's Edge Fishing Access area and the car-top boat launch at Merced Falls, there is no assurance that the rest of the formal and informal recreation sites at the Merced Falls impoundment would be maintained or remain accessible to the public over the term of a new license. We find these facilities necessary for project purposes and therefore, recommend PG&E operate and maintain all formal and informal recreation facilities within the project boundary at the Merced Falls impoundment. The cost of this measure is included in the existing operation and maintenance costs.

Project Boundary

Currently, boaters are forced to portage around the south side of the dam on private property to access the stream reach below Merced Falls dam. Although the canoe portage trail receives low to moderate use, it is the only access to the Merced Falls impoundment on the south shoreline. Formalizing the canoe portage trail would ensure boaters have a clear and safe passageway around the dam and would decrease the chance of boaters unintentionally trespassing on private lands.

5.1.2.3 Measures Not Recommended by Staff

Staff finds that some of the measures recommended by other interested parties would not contribute to the best comprehensive use of the Merced River water resources, do not exhibit sufficient nexus to project environmental effects, or would not result in benefits to non-power resources that would be worth their cost. The following discusses the basis for staff's conclusion not to recommend such measures.

Fish Passage

The Merced Falls dam has a non-operational fish passage facility. The facility was decommissioned after construction of the upstream Merced River Project dams eliminated suitable habitat for anadromous species upstream of the Merced Falls dam. As previously discussed, Crocker-Huffman diversion dam (RM 52.0), located downstream of the Merced Falls Project, represents the upstream barrier to resident and anadromous fish in lower Merced River. Crocker-Huffman diversion dam is equipped with a fish ladder that has been non-operational since 1971 and would require replacement or retrofit to meet current standards for fish passage. PG&E does not propose any measures relating to fish passage.

The Conservation Groups recommend that PG&E reopen the fish ladder at Merced Falls, based on the "reasonably foreseeable" future reoperation of the fish passage facility

at the downstream Crocker-Huffman diversion dam. Because anadromous fish are unable to achieve passage over Crocker-Huffman diversion dam and access the Merced Falls Project area, reoperation of the fish ladder at Merced Falls dam would provide no benefit to anadromous species in the Merced River at this time.

FWS [10(j) recommendation 1(1-3)] recommends PG&E, in coordination with Merced ID, develop a salmonid conservation, rescue, and passage plan to include: (1) planning, permitting, design, scheduling, costs, construction implementation, and monitoring of anadromous and resident salmonid passage at Crocker-Huffman diversion dam; (2) cooperating screening at any conveyance facilities out of the Merced Falls reservoir pool; (3) cooperating with California DFW in trapping and hauling local wild fish when temperatures in the lower Merced River are expected to be stressful. The Crocker-Huffman diversion dam and any associated features, including the Main Canal, are not related to hydropower operation and are not included in the existing license.

Regarding canal entrainment, studies indicate that entrainment into the northside canal likely represents a negligible effect on the overall abundance of the fish assemblage. As such, FWS's recommendation to screen water conveyance facilities out of the Merced Falls reservoir pool would provide only minor enhancement to existing fish populations. Furthermore, we note that PG&E is not proposing any operational changes to the project that could increase canal entrainment. Therefore, canal screening would not be a valid mitigation measure for any potential project effect.

The Water Board [preliminary WQC condition 4] specifies that if fish passage resumes at Crocker-Huffman diversion dam, PG&E consult with NMFS, CDFW, and FWS to determine if passage should resume at Merced Falls dam. In the event that passage is recommended after consultation, the preliminary condition specifies that PG&E develop a fish passage plan in consultation with the same parties. Similarly, FWS [10(j) recommendation 1(4&5)] recommends that PG&E (4) plan for opening of the existing fish ladder on Merced Falls dam; conduct an analysis of the measures that would need to be taken to bring the existing fish ladders up to NMFS standards; and (5) provide annual progress reports. We find that participation in a technical advisory committee, as described above, would facilitate the sharing of information regarding the status of anadromous fish passage at Crocker-Huffman, and therefore, the potential necessity of reevaluating passage scenarios at Merced Falls dam. Should fish passage be successfully restored upstream of the Crocker-Huffman diversion dam at some point in the future, the Commission's standard reopener could be used to address any necessary changes to project facilities or environmental measures to accommodate anadromous species. We estimate screening the northside canal and developing a fish passage plan would have an annualized cost of \$13,000. Because these measures would not provide any significant enhancement to resident or anadromous fish species, we find that the costs of the measures are not worth the potential benefits.

Minimum Instream Flows

PG&E proposes to continue operating the project run-of-river, where outflow equals inflow to the project.

California DFW [10j recommendation 3, parts A-D] recommends that PG&E calculate water year types annually and then implement and adaptively manage a flow schedule based on that water year type calculation. California DFW recommends that PG&E coordinate with Merced ID regarding implementation of its recommended instream flows. We note that the recommended flow schedule is identical to the flow schedule California DFW recommended for the Merced River Project. The Merced Falls Project does not alter the timing or quantity of flow and has limited operational capacity to do so. PG&E proposes to continue to operate the project as a run-of-river facility, completely dependent on inflow from the upstream Merced River Project facilities. Therefore, California DFW's recommendation of a flow prescription for the Merced Falls project is unfounded. However, we note that the intent of California DFW's recommendation was most likely to underscore the need for coordination between Merced ID and PG&E in the operation of both projects. We address that recommendation in the above sections, *Coordinated Operations Plan and Technical Advisory Committee*.

Water Temperature Monitoring and Mitigation

Water temperature data collected from 1998 to 2008 in the Merced Falls Project impoundment ranged between 49°F and 60°F (9.4°C and 15.5°C). Downstream of Merced Falls dam, temperatures generally met or exceeded state standards, ranging from 57°F (13.8°C) to just over 60°F (15.5°C). The lower Merced River is listed under CWA section 303(d) as impaired for temperature. Under current conditions, warm water temperatures reduce habitat suitability for Chinook salmon and steelhead downstream of Crocker-Huffman diversion dam, particularly for spawning.

PG&E proposes to implement a long-term water quality monitoring program for periodic (10 year intervals) assessment of water temperature and DO downstream of the project dam. PG&E's proposed long-term monitoring program would help identify any potential unforeseen effects on water quality parameters (temperature and DO) important to aquatic biota.

Identical to its recommendation for the Merced River Project, California DFW [10(j) recommendation 4] recommends that PG&E prepare a long-term water temperature management plan in conjunction with Merced ID. The plan would include:

- (1) developing a long-term strategy for meeting seasonal temperature objectives for Chinook salmon and *O. mykiss*;
- (2) a feasibility study on submerged pipes capable of delivering water to a location downstream of Crocker-Huffman diversion dam;
- (3) measures to prolong and stabilize the irrigation delivery season;
- (4) measures to restore the natural channel morphology, floodplain habitats, and riparian forest downstream of the Crocker-Huffman diversion dam;
- (5) provisions to provide coldwater

refugia when water temperatures exceed objectives; and (6) evaluating the effects on instream flow releases of implementing alternatives, and the estimated funding and schedule needed for the alternatives. California DFW [10(j) recommendation 6(2)] also recommends that PG&E continuously monitor water temperatures between inflow into the Merced Falls impoundment and outflow into the Merced River downstream of the project.

FWS [10j recommendation 2] recommends that PG&E coordinate and cooperate with Merced ID for restoration of shaded riverine habitat and riparian floodplain in the lower Merced River. FWS recommends that PG&E participate in temperature modeling to determine the thermal contribution of the Merced Falls Project to warming in the lower Merced River and bear a commensurate share of the costs of downstream restoration based on the results of that modeling.

Identical to its recommendation for the Merced River Project, NMFS [10(j) recommendation 8] recommends that water temperature and flows be measured at ten locations ranging from RM 62.0 to a location between Shaffer Bridge and the confluence with the San Joaquin River.

As previously discussed, the Merced River Project is the primary influence on water temperatures in the main channel of the Merced River downstream to Shaffer Bridge during the off-irrigation season (November through February) and exerts significant influence on temperatures during the irrigation season. Water entering the Merced Falls impoundment from the upstream Merced River project moves quickly downstream – typically within a day, and therefore, little warming occurs. Modeling studies estimated that the Merced Falls impoundment warmed only 0.54°F in the month of July. For these reasons, we can conclude that, when compared to the Merced River project, Merced Falls Project has a relatively insignificant incremental thermal influence within the project area and downstream in the lower Merced River. We estimate that PG&E’s proposed monitoring program would have an annualized cost of \$500. We estimate that a water temperature and mitigation program consisting of the elements recommended by the agencies could cost as much as \$45,000 annually. For these reasons, we conclude that the potential costs of implementation or funding of any potential temperature management, monitoring, or mitigation programs are not commensurate with the incremental effects of the project. PG&E’s proposed long-term monitoring program would identify any potential unforeseen effects on water quality parameters (temperature and DO) important to aquatic biota and provide information useful for the adaptive management of the project. As discussed in section 5.1.1.2, we recommend Merced ID develop a water temperature monitoring plan, which would include sites within the Merced Falls project area. We also recommend that Merced ID implement a flow schedule that would improve water temperature conditions downstream of the Merced River project for coldwater aquatic species during certain periods and produce conditions more suitable for the establishment of riparian shade vegetation in the lower Merced River.

Gravel Augmentation

The availability and composition of river gravels influences suitability of spawning habitat for anadromous and resident fish. Studies suggest that the Merced River downstream of the Merced River Project is starved of coarse sediment, and as such, the availability of gravel suitable for fish habitat is limited.

The Water Board [preliminary WQC condition 3] specifies that PG&E develop a gravel augmentation plan in consultation with California DFW, FWS, and NMES, and submit the plan to the Water Board's Deputy Director within 1 year of license issuance. The Water Board also specifies that the amount of gravel augmented should be consistent with the amount of gravel annually trapped behind Merced Falls dam. No further details were provided about the content of the plan.

NMFS [10(j) recommendation 2] recommends that Merced ID add 2,500 tons of coarse sediment to the Merced Falls reach. Following the initial large-scale gravel augmentations, an annual maintenance augmentation would be added to the river reach. Details of gravel-augmentation particle-size ranges, locations, and configurations in the river reaches would be developed in consultation with a technical advisory committee and coordinated with LWD enhancement actions.

The Conservation Groups recommends that PG&E provide a \$50,000 annual payment to Merced ID for gravel augmentation.

As discussed in section 3.3.1.1, the two Merced River project dams have collectively intercepted the majority of sediment that has contributed in part to bed coarsening, channel narrowing and simplification, and spawning-habitat loss in downstream reaches. The banks of the Merced Falls impoundment are armored, the water level does not fluctuate dramatically, and there are no tributaries that enter the impoundment. Therefore, coarse sediment supply in the Merced Falls reach is likely very limited. Studies conducted by Merced ID estimated that the incremental effect of the Merced Falls project on sediment supply in the Merced Falls reach and lower Merced River are several orders of magnitude less than that of the upstream Merced River project dams.

We estimate that the development and implementation of a gravel augmentation plan could cost as much as \$80,000 annually. For these reasons, we conclude that the potential costs of implementation or funding of any potential gravel augmentation and/or monitoring, or mitigation programs are not commensurate with the minor incremental effects of the project. As discussed in section 5.1.1.2, we recommend Merced ID develop a gravel augmentation plan, with input from a technical advisory committee. The plan would consider the appropriate sources, quantities, composition, and augmentation sites of gravels to place in the lower reaches of the Merced River, including the Merced Falls reach, to ultimately benefit spawning habitat.

Proposed Project Boundary

PG&E proposes to remove 4.8 acres from the project boundary (75.6 to 70.8 acres) at the northeastern shoreline of the Merced Falls impoundment. In accordance with regulations, the project boundary must enclose all principal project works and lands necessary for operation and maintenance of the project and other project purposes, such as recreation (18 CFR §4.51). PG&E states that these lands are not needed for project purposes. However, in section 3.3.4, *Recreation Resources*, we find that recreation features that serve the Merced Falls Project are located on the lands proposed for removal. Specifically, portions of the Merced Falls Fishing Access area and the informal angler trail are within the lands proposed for removal. Therefore, we do not recommend these lands be removed from the project boundary because they are currently serving a project purpose.

5.2 UNAVOIDABLE ADVERSE EFFECTS

The continued operation of the Merced River and Merced Falls Projects would result in some minor unavoidable adverse effects on geologic, soil, geomorphic, and water quality resources, including some minor continued erosion associated with project operation and the renovation of recreational facilities, interruption of sediment transport at project reservoirs, and warming of water in the Merced River. Most of these effects would be reduced by recommended resource enhancement measures, including: (1) preparation and implementation of an erosion and sediment control plan, (2) preparation and implementation of LWD management plans; (3) preparation and implementation of a sediment management and gravel augmentation plan; and (4) the provision of a minimum instream flow, enhanced spring pulse flows, and a fall pulse flow.

Under the proposed action, the continued operation of the projects would continue to adversely affect some archaeological sites. The execution of PAs and implementation of the final HPMPs would ensure proper protection and management of significant cultural resources within the both project's APEs and also would provide satisfactory resolution of any project-related adverse effects.

We have identified no other unavoidable adverse effects on resources influenced by the projects' operations.

5.3 SUMMARY OF SECTION 10(j) RECOMMENDATIONS AND 4(e) CONDITIONS

5.3.1 Fish and Wildlife Agency Recommendations

Under the provisions of section 10(j) of the FPA, each hydroelectric license issued by the Commission shall include conditions based on recommendations provided federal and state fish and wildlife agencies for the protection, mitigation, and enhancement of fish and wildlife resources affected by the project.

Section 10(j) of the FPA states that whenever the Commission believes that any fish and wildlife agency recommendation is inconsistent with the purposes and the requirements of the FPA or other applicable law, the Commission and the agency will attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

5.3.1.1 Merced River Project

In response to our REA notice, the following fish and wildlife agencies submitted recommendations for the project: California DFW (letter filed July 21, 2014), FWS (letter filed July 22, 2014), and NMFS (letter filed July 22, 2014).

Table 5-4 lists the federal and state recommendations filed subject to section 10(j), and whether the recommendations are adopted under the staff alternative. Environmental recommendations that we consider outside the scope of section 10(j) have been considered under section 10(a) of the FPA and are addressed in the specific resource sections of this document and the previous section.

Of the 38 recommendations that we consider to be within the scope of section 10(j), we wholly include 14, include 11 in part, and do not include 13. We discuss the reasons for not including those recommendations in section 5.1, *Comprehensive Development and Recommended Alternative*. Table 5-4 indicates the basis for our preliminary determinations concerning measures that we consider inconsistent with section 10(j).

Table 5-4. Fish and wildlife agency recommendations for the Merced River Hydroelectric Project (Source: staff).

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
1.	Establish a Merced ecological resource committee to consult on implementation of license measures and monitoring plans, monitoring data and study plans, and facility modifications; the committee would meet quarterly for the first 5 years, after which it may meet less frequently, but not less than annually.	California DFW (recommendation 1)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$24,000	Yes
2.	Establish a technical advisory committee to help manage flow releases, research, and habitat restoration to benefit native fish species by providing study plan and fishery report oversight and approving entities conducting field work.	FWS (recommendation 5)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$24,000	Yes, would be included in the committee referenced in item 1
3.	Establish a Merced technical advisory committee to guide implementation of license terms that would protect anadromous and resident fish from Merced Falls dam to Shaffer Bridge. The committee would operate under a	NMFS (recommendation 7)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$24,000	Yes, would be included in the committee referenced in item 1

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
	technical advisory plan that defines membership, meeting responsibilities, ground rules for consensus-based decision making, and a process for implementing decisions.				
4.	Annually consult with FWS and BLM regarding special-status species that may have been added to state or federal lists and determine if any newly added species could be affected by the project and if so, determine actions needed to protect the species. NMFS restricts area to downstream of Crocker-Huffman diversion dam to Shaffer Bridge and expands consultation to include NMFS, California DFW, and the Water Board.	FWS (recommendation 6[b]); NMFS (recommendation 5[B])	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$8,000	No
5.	Implement NMFS' Ecosystem Adaptive Management Process for the reach from Crocker-Huffman diversion dam to Shaffer Bridge in consultation with the technical committee.	NMFS (recommendation 6)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	Not specific enough to estimate	No

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
6.	Develop a coordinated operations plan for the Merced River and Merced Falls Projects	California DFW (recommendation 2)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$5,880	Yes
7.	Annually deliver 15,000 acre-feet of water to the Merced NWR in accordance with a specified monthly schedule at a rate of up to 55 cfs.	California DFW (recommendation 12); FWS (recommendation 1)	Yes	\$873,000	Yes, for total annual; develop plan to address year-round monthly deliveries
8.	Install a device for delivering water to the Snobird Unit of the Merced NWR along Bear Creek, which would be used when the areas serviced by the lift pumps on Deadman Creek are at capacity.	California DFW (recommendation 12); FWS (recommendation 1)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	Cost included with #7	To be determined, would be addressed in the plan referenced in item 7

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
9.	Include facilities for delivering water to the Merced NWR in the project boundary.	California DFW (recommendation 12); FWS (recommendation 1)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$0	To be determined, depends on the plan contents
10.	Use the Hughes method to determine water year type.	California DFW (recommendation 3A); NMFS (recommendation 1.1A[7])	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$0	Yes
11.	Use the Merced ID method to determine water year type.	FWS (amended recommendation 3(A1))	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$0	No
12.	Maintain a minimum flow of 25 cfs at all times downstream of Exchequer dam.	California DFW (recommendation 3B[a])	Yes	Included in existing O&M	Yes

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
13.	Maintain minimum instantaneous flows of from 140 to 2,330 cfs at Shaffer Bridge depending on water year type and time frame (15-day intervals).	California DFW (recommendation 3B[b])	Yes	\$2,010,000	Partially, we recommend some but not all of the recommended minimum flows
14.	Maintain target flows of from 100 to 2,972 cfs at Shaffer Bridge depending on water year type and time frame (1 to 31 day intervals).	FWS (amended recommendation 3A1)	Yes	\$525,000	Partially, we recommend some but not all of the recommended minimum flows
15.	Maintain minimum flows of from 150 to 1,200 cfs at Shaffer Bridge depending on water year type and time frame (15-day intervals) if upstream fish passage at Crocker-Huffman diversion dam is not provided. If fish passage is provided, maintain minimum flows from 150 to 1,000 cfs depending on water year type and time frame.	NMFS (recommendation 1.1A[1])	Yes	\$2,393,000	Partially, we recommend some but not all of the recommended minimum flows

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
16.	Measure minimum flows at a new gage as mean daily flows based on instantaneous flows measured at 15-minute intervals. Allow instantaneous minimum flows to deviate below the specified flow by up to 10 percent or 3 cfs, whichever is less. The gage would be capable of measuring up to 6,000 cfs.	NMFS (recommendation 1.1B[1-4])	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$11,400	No, the existing gage at Shaffer Bridge should be sufficient to measure minimum flows
17.	Release a spring floodplain inundation flow for not less than 2 days between March 14 and March 28 of 2,000 cfs in below normal water years, 3,000 cfs in above normal water years, and 4,000 in wet water years as measured at Shaffer Bridge.	California DFW (recommendation 3D)	Yes	Included in minimum flow estimate	No, a short-term, high flow event could expose salmonids to stranding when the flow recedes

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
18.	Release a spring floodplain inundation flow of 10,000 acre-feet in dry and critically dry water years, 30,000 acre-feet in below normal water years, 50,000 acre-feet in above normal water years, and 60,000 acre-feet in wet water years.	NMFS (recommendation 1.1A[2])	Yes	Included in minimum flow estimate	Partially, we recommend 10,000 acre-feet in dry and critically dry water years and 30,000 acre-feet in above normal and wet water years instead of 50,000 and 60,000 acre-feet
19.	Release a fall attraction flow between October 16 and November 15 of 1,000 cfs as measured at Shaffer Bridge for 6 days in dry and critically dry water years, 9 days in below normal water years, and 12 days in wet and above normal water years.	California DFW (recommendation 3E)	Yes	Included in minimum flow estimate	Partially, we recommend a fall attraction flow of 1,000 cfs until a total of 12,500 acre-feet is reached; this would take just over 6 days to achieve
20.	Release a fall pulse flow of 12,500 acre-feet; timing determined by the committee.	NMFS (recommendation 1.1A[2])	Yes	Included in minimum flow estimate	Yes

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
21.	For all controllable flow rate changes above 200 cfs when releases are increasing, restrict the rate of change to not more than double the amount of release during any 1 hour period at the start of the change.	California DFW (recommendation 3G)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	Included in minimum flow estimate	Yes
22.	Allow incremental up-ramping steps to occur evenly over a 24-hour period, with a maximum of 500 cfs per 24-hour period.	NMFS (recommendation 1.1b[7])	Yes	Included in minimum flow estimate	No, but we recommend monitoring stage and flow in the lower Merced River, which would enable problematic ramping rates to be documented, and if needed, corrective action taken

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
23.	When controllable flows are decreasing, the rate of change should be no more than 2-inches per hour as measured at the existing gage near Snelling, and should not drop by more than 500 cfs in any one 24-hour period.	California DFW (recommendation 3G)	Yes	Included in minimum flow estimate	No, but we recommend monitoring stage and flow in the lower Merced River, which would enable problematic ramping rates to be documented, and if needed, corrective action taken
24.	Incremental down-ramping steps are to occur evenly over a 24-hour period, with a maximum of 500 cfs per 24-hour period. The exception is that at the cessation of spring pulse flows in above normal and wet water years, the steps would occur evenly over a 24-hour period at a maximum of 100 cfs per day to promote riparian seedling survival.	NMFS (recommendation 1.1B[7])	Yes	Included in minimum flow estimate	No, but we recommend monitoring stage and flow in the lower Merced River, which would enable problematic ramping rates to be documented, and if needed, corrective action taken

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
25.	Required releases at Crocker-Huffman diversion dam for Cowell diversions are in addition to all flow requirements.	NMFS (recommendation 1.1A[5])	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	Included in minimum flow estimate	Yes
26.	Maintain Lake McClure as high as possible from April through October to achieve a target minimum pool of no less than 200,000 acre-feet on September 30 of each year. To achieve this target, irrigation diversions should stop when the minimum pool is less than 265,000 acre-feet except for drawdowns needed to maintain minimum flows.	California DFW (recommendation 3F)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	Included in minimum flow estimate	No, we consider the loss of water for irrigation to be too much
27.	File a draft operations plan with the Commission by March 1 of each year describing planned operations to maintain the 200,000 acre-feet minimum pool. By May 15 of each year, file a final operations plan with the Commission.	California DFW (recommendation 3F)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$6,000	No

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
28.	When a dry or critically dry water year is immediately preceded by a dry or critically dry water year, notify the agencies by June 1 of any potential concerns related to meeting the required Lake McClure minimum pool, and implement revised operations upon Commission approval.	California DFW (recommendation 3F)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$4,000	Yes, would be encompassed by Merced ID's proposed measure
29.	If management of Lake McClure is modified in accordance with the previous measure, prepare, implement, and fund a fisheries protection management plan that includes provisions for monitoring flows, water temperature, and fish abundance, and a fish rescue component comparable to drought emergency plans implement by California DFW in the spring and summer of 2014.	California DFW (recommendation 3F)	Yes	\$1,520	Yes, if the need for fish rescue is tied to project operation

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
30.	By March 10 of the second or subsequent dry/critically dry water years, notify the agencies, and consult with the agencies by May 1 regarding operational plans to manage the drought. After this consultation, file a drought management plan with the Commission.	NMFS (recommendation 1.1A[8])	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$4,000	Yes
31.	California DFW reserves the right to adaptively manage its instream flow recommendations in response to future amendments to relevant comprehensive plans, such as the 2006 Bay-Delta Plan issued by the Water Board.	California DFW (recommendation 3H)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$0	Not applicable, the standard fish and wildlife reopener article allows for such requests to modify an existing license condition

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
32.	Maintain a 7DADM of 13°C (55.4°F) from January 1 to February 14 at Shaffer Bridge (RM 32.8) during wet and above normal water years, RM 38.0 in below normal water years, RM 45.0 in dry water years, and RM 46.5 (Snelling) in critically dry water years. Maintain a 7DADM of 16.0°C (60.8°F) from February 15 through June 15 at Shaffer Bridge in wet and above normal water years; from February 15 through May 31 at RM 38.0 in below normal water years; and RM 45.0 in dry water years; and from February 15 through May 15 at RM 46.5 in critically dry water years.	California DFW (recommendation 3C)	Yes	Included in minimum flow estimate	Yes, to the extent controllable by the project; location of temperature monitoring stations would be determined by a technical advisory committee
33.	Maintain the 7DADM below 18°C from April 1 through October 31 between Crocker-Huffman diversion dam and Snelling Road Bridge to the extent possible.	FWS (amended recommendation 3A1a)	Yes	Included in minimum flow estimate	Yes, temperature monitoring locations would be determined by a technical advisory committee

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
34.	Maintain 7DADM below 18°C year-round at the Highway 59 bridge (RM 42.0) if fish passage at Crocker-Huffman diversion dam is not provided and at the G Street bridge (RM 46.4) if fish passage is provided.	NMFS (recommendation 1.1A[3a])	Yes	Included in minimum flow estimate	Yes, to the extent controllable by the project; temperature monitoring locations would be determined by a technical advisory committee; however, it may not be possible to meet the objectives of this recommendation
35.	Include provisions in a monitoring plan for continuously monitoring water temperature at RMs 32.5, 38.0, 42.0 (Highway 59 bridge), 45.0, 46.5, 52.0 (below Crocker-Huffman diversion dam), 56.0 (below McSwain dam), and 62.0 (below Exchequer dam).	California DFW (recommendations 3C and 9[7])	Yes	\$5,000	No, we recommend water temperature monitoring at four to eight locations to be determined by a technical advisory committee

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
36.	Continuously monitor water temperature at about 5-mile intervals from Exchequer dam and Shaffer Bridge.	FWS (recommendation 5[J])	Yes	\$5,000	No, we recommend water temperature monitoring at four to eight locations to be determined by a technical advisory committee
37.	Develop a plan to continuously monitor water temperature and flows at the following RMs: 1.0; 32.8, 38.0; 42.0; 44.7; 46.4; 52.0; 55.0; 56.0; and 62.0.	NMFS (recommendation 8)	Yes	\$5,000	No, we recommend water temperature monitoring at four to eight locations to be determined by a technical advisory committee
38.	Develop a long-term water temperature management plan that includes: (1) a strategy for meeting identified temperature objectives and the compliance locations; (2) an evaluation of potential	California DFW (recommendation 4)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife	\$35,000	No

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
	effectiveness and engineering and biological feasibility of the following: (a) a sequence of submerged pipes from the outlet of the Exchequer dam to McSwain reservoir, the outlet of McSwain dam to Merced Falls impoundment, and the outlet at Merced Falls dam to Crocker-Huffman diversion dam with each pipe capable of delivering 200 cfs; (b) measures to prolong and stabilize the irrigation delivery season until at least September 30 of each year to minimize residence time in project reservoirs; (c) measures to restore a natural channel morphology, floodplain habitats, and a riparian forest in the 10-mile reach between Merced Falls dam and RM 45.2 to reduce water temperatures downstream of Crocker-Huffman diversion dam; and(d) access to native anadromous species to cold water refugia during periods when water temperature objectives at RM 46.5 are exceeded for more than 14		resources		

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
39.	consecutive days; (3) an evaluation of the effects of implementing long-term water temperature management alternative(s) on instream flow releases required to mitigate water temperature effects; (4) funding estimates necessary to implement the identified alternative(s); and (5) a schedule for achieving the temperature objectives at the identified locations. Collect microclimate data in areas with mature riparian forests and in degraded areas between Merced Falls dam and Shaffer Bridge to be used for calibration of a HEC-5Q analysis. This analysis would focus on the effects of restored channel morphology, floodplain width, and riparian tree canopies on water temperature.	FWS (recommendation 5[G&H])	No, this modeling study could have been done prior to license issuance	Not specific enough to estimate	No

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
40.	Develop a long-term water temperature improvement plan that includes a feasibility study of potential options for decreasing water temperature downstream of Crocker-Huffman diversion dam including: (1) installing an underground pipe from New Exchequer dam that bypasses McSwain reservoir and/or Merced Falls reservoir; (2) modifying the McClure outlet structure to allow water withdrawal from varying depths; and (3) developing engineering alternatives that do not require large volumes of water.	NMFS (recommendation 1.1A[3c])	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$45,000	No
41.	Provide fish access to cold water refugia upstream of Crocker-Huffman diversion dam.	NMFS (recommendation 1.1A[3c])	No, Crocker-Huffman diversion dam is not within the Commission's jurisdiction; therefore, there is no nexus to the hydroelectric project	\$2,766,000	No

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
42.	Develop a spawning gravel and floodplain habitat restoration plan that includes (1) initially adding 50,000 cubic yards of cleaned spawning gravel downstream of Crocker-Huffman diversion dam (the source would be from dredger tailings located on either public lands or lands owned by Merced ID), (2) replenishing spawning-size gravel at a mean annual rate of 2,600 cubic yards between Crocker-Huffman diversion dam and Shaffer Bridge following the initial augmentation; (3) harvesting aggregate in a manner that creates new floodplain areas and in-channel placement in a manner that increases local floodplain inundation; and (4) the schedule and sequence for habitat restoration actions.	California DFW (recommendation 6)	Yes	\$128,000	Yes, with modifications; we recommend development of a plan that provides for the annual placement of 2,600 cubic yards between Crocker-Huffman diversion dam and Shaffer Bridge

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
43.	Restore natural channel morphology, floodplain habitat, and a riparian forest in the 10-mile reach between Merced Falls dam and RM 45.2 by using dredger tailings and grading the floodplain to allow inundation at a 1.5-year interval.	FWS (amended recommendation 3A2f)	Yes	\$128,000 (with gravel augmentation)	No, however, we recommend gravel augmentation, which would help restore channel morphology, enable some floodplain grading at harvest sites, and a spring pulse flow release, which would inundate floodplains and facilitate riparian forest growth
44.	Add 20,000 tons of cleaned coarse sediment annually into four river reaches from Crocker-Huffman diversion dam to Shaffer Bridge; complete aggregate harvest to create new floodplain areas; and complete in-channel placement to increase local floodplain inundation by raising the channel bed.	NMFS (recommendation 2)	Yes	\$128,000	Yes with modifications; we recommend development of a plan that provides for the annual placement of 2,600 cubic yards (about 2,200 tons) between

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
					Crocker-Huffman diversion dam and Shaffer Bridge
45.	Add about 2,600 cubic yards of spawning-size gravel annually between Crocker-Huffman diversion dam and Shaffer Bridge.	FWS (recommendation 4)	Yes	\$128,000	Yes
46.	Include in a monitoring program provisions for monitoring sediment size between Crocker-Huffman diversion dam and Shaffer Bridge to help determine where future spawning gravel augmentation is needed; also include monitoring of spawner use of restoration sites and control sites for at least 5 years following completion of gravel augmentation projects. California DFW specifies development of a plan but FWS does not.	California DFW and FWS (recommendations 9[8] and 5[K])	Yes	Cost included in augmentation plan estimate	Yes, we recommend monitoring sediment size be addressed in the plan we recommend
47.	Restore floodplain forests and associated habitats by plantings of root stock, cuttings, or nursery stock from trees along the Merced River riparian corridor; protect	FWS (amended recommendations 3A2[a-e and i])	Yes	\$7,600,000	No, however our recommended spring pulse flow would inundate floodplain

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
	plantings for beaver depredation for 5 years; during above normal and, when possible in wet years, release flows that inundate floodplain surfaces for at least 5 days and then ramp down to base flows no faster than 100 cfs/day (1 inch/day of water surface in elevation) during late May or early June to promote recruitment of tree species; and, if the results of the HEC-5Q modeling suggest that only a portion of the dredger tailing reach needs to be restored to achieve the temperature objectives, restore riparian habitat in accordance with a prioritized list.				surfaces for up to 9 days
48.	Include in a monitoring program provisions for long-term monitoring of riparian vegetation at floodplain restoration sites. California DFW specifies development of a plan but FWS does not.	California DFW and FWS (recommendations 9[9] and 5[I])	Yes, related to temperature enhancements for salmonids	Not specific enough to estimate	No

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
49.	For floodplain restoration projects on land that is not federal or state-owned, obtain conservation easements and convey such easements to a FWS-approved entity.	FWS (amended recommendation 3A2g)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	Not specific enough to estimate	No
50.	Enhance at least 10 miles of habitat between Shaffer Bridge and the confluence of the San Joaquin River by implementing projects approved by the committee and based on whether conservation easements can be acquired, such as addition of LWM, floodplain and riparian restoration, removal of riprap, and restoration of gravel mine pits.	FWS (amended recommendation 3A3)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	Not specific enough to estimate	No
51.	Acquire LWD from project reservoirs, roads, and aggregate harvest sites downstream of Crocker-Huffman diversion dam; routinely survey Lake McClure by boat to corral and stabilize wood for future transport, removal, and stockpiling for later use at	NMFS (recommendation 3)	Yes	\$12,400	Yes with modifications; we recommend development of a plan that addresses the environmental effects of

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
	downstream augmentation projects. Consult with the committee regarding placement of LWD downstream of Crocker-Huffman diversion dam to Shaffer Bridge. Maintain a GIS database that is updated annually of all LWD between RM 32.8 and 55.0; report annually on status of LWD management and monitoring.				stockpiling large amounts of LWD
52.	Develop a salmonid monitoring plan that includes provisions for: annual snorkel surveys; annual pre-spawning mortality surveys; annual carcass surveys during which scales, otoliths (for age analysis and to determine contribution of naturally produced fry, parr, and smolts to the adult population), length, sex, wire tags, and fecundity data would be collected; annual juvenile emergence and outmigration monitoring using two RSTs; counting weirs for adult salmonids; and reporting mechanisms.	California DFW, FWS, NMFS (recommendations 9[1-6], 5[A-F], and NMFS 4.1[D])	Yes	\$1,520	Yes with modifications; we recommend Merced ID's proposed measure, which would monitor upstream and downstream migration, but not all of the additional parameters recommended

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
53.	Develop a hatchery master plan that establishes short- and long-term goals for the Merced River Hatchery; 11 needed upgrades to the existing hatchery are listed as elements of the plan as well as an evaluation of a new hatchery location immediately downstream of New Exchequer dam. The plan would also provide estimated needed operation and management funding, costs of upgrades, and provisions for periodic reviews of progress under the master plan. Provide for the annual release of 5 million fall-run Chinook salmon smolts with a single year maximum of 7.5 million juveniles, and 250,000 juvenile steelhead with a single year maximum of 425,000 juveniles.	California DFW (recommendation 5)	No, measure does not have a nexus to the hydroelectric project	Not specific enough to estimate	No
54.	Develop a salmonid conservation, rescue, and passage plan that includes provisions for planning, permitting, design, scheduling, costs, construction implementation, monitoring of fish passage,	FWS (recommendation 2)	Yes	\$2,766,000	No, we include measures for fish rescue if linked to project operations

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
	screening, water filtration, and refrigeration facilities for protecting salmonids from sub-lethal and lethal water temperatures resulting from project operation. Elements of the plan would include opening the fish ladder at Crocker-Huffman diversion dam, installing a fish screen at the entrance of the Main Canal, installing a filtration device at the hatchery intake to protect it from New Zealand mud snails, maintaining a refrigeration device at the hatchery, cooperating with California DFW in trapping and hauling wild fish in the lower Merced River when conditions could cause thermal stress or mortality.				

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
55.	Implement Merced ID's proposed Aquatic Invasive Species Management Plan.	California DFW (recommendation 11)	Yes	\$2,280	Yes, with modifications
56.	Develop a BMI monitoring plan.	FWS (recommendation 8)	Yes	\$50,760	No
57.	Develop a fish stocking plan for Lake McClure and McSwain reservoir that provides for stocking 55,000 pounds of hatchery salmonids.	California DFW (recommendation 7)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$35,000	Yes
58.	Establish a restoration implementation fund and use an independent third party financial advisor to manage, track, and report on the fund's progress; interest from the fund would provide funding for implementing the terms of a new license.	NMFS (recommendation 7.1[c])	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	Not specific enough to estimate	No

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
59.	California DFW reserves the authority to modify its 10(j) recommendations if needed to respond to any final biological opinion by NMFS or FWS or WQC conditions specified by the Water Board.	California DFW (recommendation 13)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$0	Not applicable, the standard fish and wildlife reopener article allows for such requests to modify an existing license condition
60.	Prior to construction of new project features or non-routine maintenance activities that affect federally listed and candidate species and their habitat, prepare a draft biological assessment or other required documents and obtain any necessary permits or approvals from FWS and BLM. Complete consultation with FWS for the San Joaquin kit fox, California red-legged frog, valley elderberry longhorn beetle, conservancy fairy shrimp, vernal pool fairy shrimp, California tiger salamander, Keck's checkerbloom, Layne's ragwort, and Chinese camp brodiaea, mariposa pussypaws, California	FWS recommendation 6(a)A-E	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	Not specific enough to estimate	No; the standard fish and wildlife reopener article requires consultation for new construction

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
	vervain and critical habitat for vernal pool fairy shrimp, conservancy fairy shrimp, succulent owl's-clover, Hoover's spurge, Colusa grass, and San Joaquin Valley orcutt grass.				
61.	Avoid the unauthorized use of burrow fumigants or rodenticides on federal land.	FWS recommendation 6(a)F	Yes	\$0	Yes
62.	Avoid use of burrow fumigants or rodenticides in habitat of the San Joaquin kit fox and the California tiger salamander until either section 7 consultation is completed or a section 10 permit is issued.	FWS recommendation 6(a)G	Yes	\$0	Yes
63.	Conduct annual consultation for newly added federally listed and special-status species that could be affected by the project.	FWS recommendation 6(b)	Yes	\$4,000	No, the standard fish and wildlife reopener article requires consultation for project effects on federally listed species

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
64.	Develop and implement a protection plan for the California red-legged frog, within 1 year of license issuance.	FWS recommendation 7	Yes	\$3,000	Yes
65.	Implement the Bald Eagle Management Plan.	FWS recommendation 9	Yes	\$3,220	Yes
66.	Develop and implement a management plan for limestone salamander sensitive areas.	California DFW recommendation 8	Yes	\$2,260	Yes
67.	Develop an integrated pest management pesticide use plan.	California DFW recommendation 10	Yes	Included with invasive weeds plan (\$55,030)	Yes, modified to be a component of the noxious weed and invasive plants control plan

5.3.1.2 Merced Falls Project

In response to our REA notice, the following fish and wildlife agencies submitted recommendations for the project: California DFW (letter filed July 21, 2014), FWS (letter filed July 22, 2014), and NMFS (letter filed July 22, 2014).

Table 5-5 lists the federal and state recommendations filed subject to section 10(j), and whether the recommendations are adopted under the staff alternative. Environmental recommendations that we consider outside the scope of section 10(j) have been considered under section 10(a) of the FPA and are addressed in the specific resource sections of this document and the previous section.

Of the 14 recommendations that we consider to be within the scope of section 10(j), we wholly include 5, include 3 in part, and do not include 6. We discuss the reasons for not including those recommendations in section 5.1, *Comprehensive Development and Recommended Alternative*. Table 5-5 indicates the basis for our preliminary determinations concerning measures that we consider inconsistent with section 10(j).

Table 5-5. Fish and wildlife agency recommendations for the Merced Falls Hydroelectric Project (Source: staff).

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
1.	Establish a Merced ecological resource committee to consult on implementation of license measures and monitoring plans, monitoring data and study plans, and facility modifications; the committee would meet quarterly for the first 5 years, after which it may meet less frequently, but not less than annually.	California DFW 1 recommendation	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$2,200	Yes
2.	Establish a Merced technical advisory committee to guide implementation of license terms that would protect anadromous and resident fish from Merced Falls dam to Shaffer Bridge. The committee would operate under a technical advisory plan that defines membership, meeting	NMFS 7 recommendation	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$2,200	Yes, would be included in the committee referenced in item 1

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
	responsibilities, ground rules for consensus-based decision making, and a process for implementing decisions.				
3.	Develop a coordinated operations plan with Merced ID within 90 days after issuance of license.	California DFW recommendation 2	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$1,000	Yes
4.	Implement instream flow schedule.	California DFW recommendation 3	Yes	NA	No, Merced Falls proposes to operate as a run-of-river facility. Flows are dependent upon upstream Merced ID project facilities
5.	Pass through flows provided by Merced ID, such that inflow equals outflow. When diversions are occurring out of PG&E's reservoir, outflow should equal inflow, minus the amount of flow being diverted.	NMFS recommendation 1	Yes	NA	No, recommendation is identical to PG&E's proposed run-of-river operation

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
6.	Develop and implement a long term water temperature management plan in consultation with Merced ID, resource agencies and conservation groups.	California DFW recommendation 4	Yes	\$20,000	No, Merced Falls' incremental effects on water temperature are negligible. We recommend PG&E perform long-term water temperature monitoring downstream of Merced Falls dam.
7.	Continuously monitor water temperatures between inflow into the Merced Falls impoundment and outflow into the Merced River downstream.	California DFW recommendation 6(2)	Yes	\$10,000	No
8.	Coordinate with Merced ID for restoration of shaded riverine habitat and riparian floodplain in the lower Merced River – PG&E should provide a commensurate share of costs of downstream restoration, based upon its effects on water temperature.	FWS recommendation 2	Yes	\$15,000	No

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
9.	Stock 11,000 adult-sized rainbow trout for the first 2 years after license issuance; develop a reservoir fish stocking plan in consultation with California DFW.	California DFW recommendation 5	No	\$1,400	Yes
10.	Develop an integrated pest management and pesticide use plan.	California DFW recommendation 7	Yes	\$15,000	Yes, modified to be a component of the Noxious Weeds and Invasive Plants Control Plan
11.	Develop a salmonid conservation, rescue, and passage plan in consultation with Merced ID, including an analysis of measures that would be required to reoperate existing fish passage facilities at Merced Falls dam.	FWS recommendation 1 (1&2, 4&5)	Yes	\$3,000	No, existing downstream anadromous fish barrier (Crocker-Huffman) renders fish passage at Merced Falls unnecessary at this time. The Commission's standard reopener could be used to address any necessary changes to project facilities or environmental measures to accommodate anadromous species should passage be restored in the future.

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
12.	In coordination with Merced ID, screen any conveyance facilities out of the Merced Falls reservoir pool.	FWS recommendation 1(3)	Yes	\$10,000	No, existing entrainment mortality is not significant. Proposed operations would not change baseline entrainment rates. Therefore, the cost of measure would not support potential minimal biological benefits.
13.	Conclude ESA consultation for the San Joaquin kit fox, California red-legged frog, and valley elderberry longhorn beetle.	FWS recommendation 3	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$3,000	Not applicable; discussed under ESA
14.	Implement conservation measures for the California red-legged frog.	FWS recommendation 4	Yes	\$3,000	Yes
15.	Coordinate with Merced ID to implement its Bald Eagle Management Plan with FWS' edits, or develop and implement a management plan specific to the Merced Falls Project.	FWS recommendation 5	Yes	\$2,000	Yes

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
16.	Augment Merced Falls reach with 2,500 tons of coarse sediment. Determine additional maintenance augmentations in consultation with technical advisory committee.	NMFS recommendation 2	Yes	\$80,000	No, we recommend Merced ID include the Merced Falls reach in its development of a gravel augmentation plan
17.	In conjunction with Merced ID, acquire LWD from project reservoirs, roads, and aggregate harvest sites downstream of Crocker-Huffman diversion dam; routinely survey Lake McClure by boat to corral and stabilize wood for future transport, removal, and stockpiling for later use at downstream augmentation projects. Consult with the committee regarding placement of LWD downstream of Merced Falls dam and Crocker-Huffman diversion dam to Shaffer Bridge.	NMFS recommendation 3	Yes	\$13,800	Yes with modifications; we recommend PG&E develop a project-specific LWD management plan for the Merced Falls reach, in consultation with a technical advisory committee

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
	Maintain a GIS database that is updated annually of all LWD between RM 32.8 and 55.0; report annually on status of LWD management and monitoring.				
18.	Conduct an annual monitoring program for <i>O. mykiss</i> in the Merced Falls reach.	California DFW recommendation 6(1)	Yes	\$10,000	Yes, with modifications; we recommend that PG&E consult with the technical advisory committee to determine sampling periodicity, techniques, and data to be collected
19.	Develop a salmonid monitoring plan, in conjunction with Merced ID, that includes provisions for: annual snorkel surveys; annual pre-spawning mortality surveys; annual carcass surveys during which scales, otoliths (for age analysis and to determine contribution of naturally produced fry, parr, and smolts to the adult population), length, sex, wire tags, and fecundity	NMFS recommendation 4	Yes	\$14,000	No, we recommend PG&E develop a project-specific annual monitoring plan for <i>O. mykiss</i> in the Merced Falls reach. We also recommend Merced ID conduct fish monitoring downstream of Crocker-Huffman diversion dam.

No.	Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
	data would be collected; annual juvenile emergence and outmigration monitoring using two RSTs; counting weirs for adult salmonids; and reporting mechanisms.				

5.3.2 Land Management Agencies' Section 4(e) Conditions

In sections 2.2.1.5 and 2.2.2.5, *Modifications to Applicant's Proposal—Mandatory Conditions*, we list the preliminary 4(e) conditions submitted by BLM, and note that section 4(e) of the FPA provides that any license issued by the Commission “for a project within a federal reservation shall be subject to and contain such conditions as the Secretary of the responsible federal land management agency deems necessary for the adequate protection and use of the reservation.” Thus, any 4(e) condition that meets the requirements of the law must be included in any license issued by the Commission, regardless of whether we include the condition in our staff alternative.

5.3.2.1 Merced River Project

Of BLM's 50 preliminary conditions, we consider 25 of the conditions (conditions 7 and 27 through 50) to be administrative or legal in nature and not specific environmental measures. We therefore, do not analyze these conditions in this EIS. Table 5-6 summarizes our conclusions with respect to the 25 preliminary 4(e) conditions that we consider to be environmental measures. We include in the staff alternative six conditions as specified by the agency, modify two condition to adjust the scope of the measure, and did not recommend two conditions; the measures not adopted in total are discussed in more detail in section 5.1, *Comprehensive Development and Recommended Alternative*.

Table 5-6. Bureau of Land Management preliminary section 4(e) conditions for the Merced River Hydroelectric Project (Source: staff).

Condition	Annualized Cost	Adopted?
No. 1: Annual consultation with BLM	\$10,500	No
No. 2: Consultation group specific to the Merced River Hydroelectric Project	\$8,000	Yes
No. 3: Annual employee training	\$10,580	Yes
No. 4: Coordinated operations plan	\$5,880	Yes
No. 5: Erosion control and restoration plan	\$2,000	Yes
No. 6: LWD material management plan	\$12,460	Yes
No. 8: Aquatic invasive species management and monitoring plan	\$2,280	Yes
No. 9: Terrestrial protection measures	\$55,000	Yes
No. 10: Bald eagle management plan	\$3,220	Yes

Condition	Annualized Cost	Adopted?
No. 11: Annual review of special-status species lists and assessment of new species on federal land	\$4,000	No
No. 12: Bat management	\$3,600	Yes, modified to require a protection plan
No. 13: Red-legged frog management plan for Piney Creek Core Area	\$3,000	Yes
No. 14: Foothill yellow-legged frog management plan	\$3,000	Yes
No. 15: Limestone salamander sensitive management areas plan and studies	\$2,260	Yes
No. 16: Western pond turtle incidental observations	\$2,000	Yes, modified to require a protection plan
No. 17: Riparian vegetation monitoring plan	\$15,870	Yes

5.4 CONSISTENCY WITH COMPREHENSIVE PLANS

5.4.1 Applicable to Both Projects

Section 10(a)(2)(A) of the FPA, 16 U.S.C. §803(a)(2)(A), requires the Commission to consider the extent to which a project is consistent with the federal or state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by the project. We reviewed 17 comprehensive plans that are applicable to both the Merced River and Merced Falls Projects, located in California and no inconsistencies were found.

California Department of Fish and Game, U.S. Fish and Wildlife Service, National Marine Fisheries Service and Bureau of Reclamation. 1988. Cooperative agreement to implement actions to benefit winter-run Chinook salmon in the Sacramento River Basin. Sacramento, California. May 20, 1988. 10 pp.

California Department of Fish and Game. 2003. Strategic Plan for Trout Management: A Plan for 2004 and Beyond. Sacramento, California. November 2003.

California Department of Fish and Game. 2007. California wildlife: Conservation Challenges, California's Wildlife Action Plan. Sacramento, California. 2007.

- California Department of Parks and Recreation. 1980. Recreation outlook in Planning District 2. Sacramento, California. April 1980. 88 pp. 8
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- California Department of Parks and Recreation. 1998. Public Opinions and Attitudes on Outdoor Recreation in California. Sacramento, California. March 1998.
- California Department of Parks and Recreation. 1994. California Outdoor Recreation Plan (SCORP). Sacramento, California. April 1994.
- California Department of Water Resources. 1983. The California Water Plan: Projected Use and Available Water Supplies to 2010. Bulletin 160–83. Sacramento, California. December 1983. 268 pp.
- California Department of Water Resources. 1994. California Water Plan Update. Bulletin 160–93. Sacramento, California. October 1994. Two volumes and Executive Summary.
- California State Water Resources Control Board. 1975. Water Quality Control Plan Report. Sacramento, California. Nine volumes.
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- National Marine Fisheries Service, Seattle, Washington. Pacific Fishery Management Council, Portland, Oregon. 1978. Fishery management plan for commercial and recreational salmon fisheries off the coasts of Washington, Oregon, and California commencing in 1978. Department of Commerce. March 1978. 157 pp.
- Pacific Fishery Management Council. 1988. Eighth amendment to the fishery management plan for commercial and recreational salmon fisheries off the coasts of Washington, Oregon, and California commencing in 1978. Portland, Oregon. January 1988.
- The Resources Agency. 1983. Department of Parks and Recreation. Recreation Needs in California. Sacramento, California. March 1983. 39 pp.
- State Water Resources Control Board. 1999. Water Quality Control Plans and Policies adopted as part of the State comprehensive plan. April 1999.
- U.S. Fish and Wildlife Service and Canadian Wildlife Service. 1986. North American waterfowl management plan. Department of the Interior. Environment Canada. May 1986.
- U.S. Fish and Wildlife Service. Undated. Fisheries USA: The Recreational Fisheries Policy of the U.S. Fish and Wildlife Service. Washington, D.C.

5.4.2 Applicable Only to Merced River Project

Section 10(a)(2)(A) of the FPA, 16 U.S.C. §803(a)(2)(A), requires the Commission to consider the extent to which a project is consistent with the federal or state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by the project. We reviewed 10 comprehensive plans that are applicable to the Merced River Project, located in California and. No inconsistencies were found.

California Advisory Committee on Salmon and Steelhead Trout. 1988. Restoring the Balance: 1988 Annual Report. Sausalito, California. 84 pp.

California Department of Fish and Game. 1990. Central Valley Salmon and Steelhead Restoration and Enhancement Plan. Sacramento, California. April 1990. 115 pp.

California Department of Fish and Game. 1993. Restoring Central Valley streams: A plan for action. Sacramento, California. November 1993. 129 pp.

California Department of Fish and Game. 1996. Steelhead Restoration and Management Plan for California. February 1996. 234 pp.

California Department of Fish and Game and U.S. Fish and Wildlife Service. 2010. Final Hatchery and Stocking Program Environmental Impact Report/Environmental Impact Statement. Sacramento, California. January 2010.

California State Water Resources Control Board. 2006. Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary. Sacramento, California. December 13, 2006.

California Department of Water Resources. 2000. Final Programmatic Environmental Impact Statement/Environmental Impact Report for the CALFED Bay-Delta Program. Sacramento, California. July 2000. CD Rom, including Associated Plans.

National Park Service. 1982. The Nationwide Rivers Inventory. Department of the Interior, Washington, D.C. January 1982.

U.S. Fish and Wildlife Service. 1990. Central Valley Habitat Joint Venture Implementation Plan: A Component of the North American Waterfowl Management Plan. February 1990.

U.S. Fish and Wildlife Service. 2001. Final Restoration Plan for the Anadromous Fish Restoration Program. Department of the Interior, Sacramento, California. January 9, 2001.

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APPENDIX A

Draft License Articles for the Merced River Hydroelectric Project

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DRAFT LICENSE ARTICLES

I. ADMINISTRATIVE ARTICLES

Article 2XX. *Administrative Annual Charges.* The licensee must pay the United States annual charges, effective the first day of the month in which the license is issued, and as determined in accordance with provisions of the Commission's regulations in effect from time to time, for the purposes of:

(a) reimbursing the United States for the cost of administration of Part I of the Federal Power Act. The authorized installed capacity for that purpose is 101.25 megawatts.

(b) recompensing the United States for the use, occupancy, and enjoyment of 3,154.9 acres of its lands (other than for transmission line right-of-way).

Article 2XX. *Exhibit Drawings.* Within 45 days of the date of issuance of this license, as directed below, the licensee must file two sets of the approved exhibit drawings, form FERC-587, and GIS data in electronic file format on compact disks with the Secretary of the Commission, ATTN: OEP/DHAC.

(1) Digital images of the approved exhibit drawings must be prepared in electronic format. Prior to preparing each digital image, the FERC Project-Drawing Number (i.e., P-2179-1001 through P-2179-####) must be shown in the margin below the title block of the approved drawing. Exhibit F drawings must be segregated from other project exhibits, and identified as **(CEII) material under 18 CFR §388.113(c)**. Each drawing must be a separate electronic file, and the file name must include: FERC Project-Drawing Number, FERC Exhibit, Drawing Title, date of this license, and file extension in the following format [P-2179-####, G-1, Project Boundary, MM-DD-YYYY.TIF].

Each Exhibit G drawing that includes the project boundary must contain a minimum of three known reference points (i.e., latitude and longitude coordinates, or state plane coordinates). The points must be arranged in a triangular format for GIS georeferencing the project boundary drawing to the polygon data, and must be based on a standard map coordinate system. The spatial reference for the drawing (i.e., map projection, map datum, and units of measurement) must be identified on the drawing and each reference point must be labeled. In addition, each project boundary drawing must be stamped by a registered land surveyor. All digital images of the exhibit drawings must meet the following format specification:

IMAGERY - black & white raster file
FILE TYPE – Tagged Image File Format (TIFF), CCITT Group 4
(also known as T.6 coding scheme)
RESOLUTION – 300 dpi desired, (200 dpi min)
DRAWING SIZE FORMAT – 22” x 34” (min), 24” x 36” (max)
FILE SIZE – less than 1 MB desired

A third set (Exhibit G only) and a copy of Form FERC-587 must be filed with the Bureau of Land Management office at the following address:

Bureau of Land Management
Branch of Adjudication and Records (CA-943.5)
2800 COTTAGE WAY SUITE W1623
SACRAMENTO CA 95825-1886
ATTN: FERC Withdrawal Recordation

Form FERC-587 is available through the Commission’s website at the following URL: <http://www.ferc.gov/docs-filing/forms/form-587/form-587.pdf>. Although instruction no. 3 requires microfilm copies of the project boundary maps in aperture card format, electronic copies that meet the digital specifications in this ordering paragraph should be substituted. If the FERC-587 cannot be downloaded from the Internet, a hard copy may be obtained by mailing a request to the Secretary of the Commission.

(2) Project boundary GIS data must be in a georeferenced electronic file format (such as ArcView shape files, GeoMedia files, MapInfo files, or a similar GIS format). The filing must include both polygon data and all reference points shown on the individual project boundary drawings. An electronic boundary polygon data file(s) is required for each project development. Depending on the electronic file format, the polygon and point data can be included in single files with multiple layers. The georeferenced electronic boundary data file must be positionally accurate to ± 40 feet in order to comply with National Map Accuracy Standards for maps at a 1:24,000 scale. The file name(s) must include: FERC Project Number, data description, date of this license, and file extension in the following format [P-2179 boundary polygon/or point data, MM-DD-YYYY.SHP]. The filing must be accompanied by a separate text file describing the spatial reference for the georeferenced data: map projection used (i.e., UTM, State Plane, Decimal Degrees, etc.), the map datum (i.e., North American 27, North American 83, etc.), and the units of measurement (i.e., feet, meters, miles, etc.). The text file name must include: FERC Project Number, data description, date of this license, and file extension in the following format [P-2179, project boundary metadata, MM-DD-YYYY.TXT].

In addition, for those projects that occupy federal lands, a separate georeferenced polygon file(s) is required that identifies transmission line acreage and non-transmission line acreage affecting federal lands for the purpose of meeting the requirements of 18

CFR §11.2. The file(s) must also identify each federal owner (e.g., Bureau of Land Management, Forest Service, U.S. Army Corps of Engineers, etc.), land identification (e.g., forest name, Section 24 lands, national park name, etc.), and federal acreage affected by the project boundary. Depending on the georeferenced electronic file format, the polygon, point, and federal lands data can be included in a single file with multiple layers.

Article 2XX. Headwater Benefits. If the licensee's project was directly benefited by the construction work of another licensee, a permittee, or the United States on a storage reservoir or other headwater improvement during the term of the original license (including extensions of that term by annual licenses), and if those headwater benefits were not previously assessed and reimbursed to the owner of the headwater improvement, the licensee must reimburse the owner of the headwater improvement for those benefits, at such time as they are assessed, in the same manner as for benefits received during the term of this new license. The benefits will be assessed in accordance with Part 11, Subpart B, of the Commission's regulations.

II. ENGINEERING ARTICLES

Article 3XX. Project Modification Resulting from Environmental Requirements. If environmental requirements under this license require modification that may affect the project works or operations, the licensee must consult with the Commission's Division of Dam Safety and Inspections—San Francisco Regional Engineer. Consultation must allow sufficient review time for the Commission to ensure that the proposed work does not adversely affect the project works, dam safety, or project operation.

III. MANDATORY CONDITIONS

On July 22, 2014, the U.S. Department of the Interior, Bureau of Land Management (BLM) filed 50 preliminary 4(e) conditions (appendix C). These conditions are described in section 2.2.1.5 of the environmental impact statement (EIS). We consider 25 (7 and 27 through 50) of the BLM preliminary conditions to be administrative or legal in nature and not specific environmental measures. Of the 25 conditions we consider to be environmental measures applicable to the Merced River Project, we include 21¹ of these conditions in the staff alternative as specified by BLM.

¹ As explained in section 5 of the draft EIS, we recommend modifying the following conditions specified by BLM: 8, 13, 14, 16, 22, 25, and 26. We do not recommend the following condition: provide annual funding in a contributed funds account to offset operation, maintenance, management, and administration costs incurred by BLM.

We recognize, however, that the Commission is required to include valid 4(e) conditions in any license issued for the project. As such, each of the measures that staff recommend be modified in the staff alternative (as discussed in section 5.1.2, Comprehensive Development and Recommended Alternative) would not be included in any license issued by the Commission. Instead, those conditions would be replaced with BLM's corresponding conditions, as filed with the Commission.

On July 22, 2014, the California State Water Resources Control Board (Water Board) filed 49 preliminary water quality certification conditions (appendix D). We consider 20 (22, and 30 through 49) of the Water Board preliminary conditions to be administrative or legal in nature and not specific environmental measures. Of the 29 conditions we consider to be environmental measures applicable to the Merced River Project, we include 27² of these conditions in the staff alternative as specified by the Water Board. We recognize, however, that the Commission is required to include valid 401 Water Quality Certification (WQC) conditions in any license issued for the project. As such, each of the measures that staff recommend be modified in the staff alternative (as discussed in section 5.1.2, Comprehensive Development and Recommended Alternative) would not be included in any license issued by the Commission. Instead, those conditions would be replaced with Water Board's corresponding conditions, as filed with the Commission.

IV. ADDITIONAL LICENSE ARTICLES RECOMMENDED BY COMMISSION STAFF

We recommend including the following license articles in any license issued for the project in addition to the mandatory conditions.

Article 4xx. Commission Approval, and Filing of Reports and Amendment Applications.

(a) Requirement to File Plans for Commission Approval

Various conditions of this license found in the Bureau of Land Management's (BLM's) section 4(e) conditions (appendix C) and the California State Water Resources

² As explained in section 5 of the draft EIS, we recommend modifying the following conditions specified by the Water Board: 8, 18, and 19. We do not recommend the following conditions: (1) annual consultation to review the project status and plans, results of studies, necessary modifications to plans, and protection measures for newly listed species; (2) a fish passage or habitat restoration plan that would result in fish passage over Crocker-Huffman, McSwain, and New Exchequer dams or decrease water temperature in and downstream of the project; and (3) review the lists of federally listed and special status species and evaluate potential project effects on newly listed species.

Control Board's (Water Board) section 401 water quality certification (WQC) conditions (appendix D) require the licensee to prepare plans in consultation with other entities; some of these measures do not specify that Commission approval is required prior to implementation. Each such plan must also be submitted to the Commission for approval. These plans are listed below.

WQC Condition	Plan Name	Due Date
4	Gravel augmentation plan	Within 15 months of license issuance
5	Bald and golden eagle plan	Within 15 months of license issuance
6	Vernal pool fairy shrimp plan	Within 15 months of license issuance
7	Tiger salamander monitoring and conservation plan	Within 15 months of license issuance
8	Fish passage or habitat restoration plan	Within 15 months of license issuance
9	Drought plan	Within 15 months of license issuance
10	California red-legged frog, Foothills yellow-legged frog, and western spadefoot monitoring and conservation plan	Within 15 months of license issuance
11	Valley elderberry longhorn beetle monitoring and conservation plan	Within 15 months of license issuance
14	Large woody material plan	Within 15 months of license issuance
16	Lake McClure and McSwain reservoir fish stocking	Within 6 months of license issuance
17	Aquatic invasive species management plan	Within 15 months of license issuance
18	Pesticide use plan	Within 15 months of license issuance
19	Water temperature monitoring plan	Within 9 months of license issuance

WQC Condition	Plan Name	Due Date
20	Anadromous fish monitoring plan	Within 15 months of license issuance
21	Transportation management plan	Within 15 months of license issuance

(b) *Requirement to File Reports*

Some BLM section 4(e) conditions and Water Board WQC conditions require Merced ID to file reports with other entities. These reports document compliance with requirements of this license and may have a bearing on future actions. Each such report must also be submitted to the Commission. These reports are listed in the following table.

BLM Condition	Description	Due Date
12	Bat inspection documentation	15 months after license issuance

WQC Condition	Description	Due Date
13	Annual review of Endangered Species Acts lists and special status lists and assessment of new species	Within 6 months of license issuance, annually thereafter

(c) *Requirement to File Amendment Applications*

Certain BLM 4(e) conditions and Water Board WQC conditions appear to contemplate these unspecified long-term changes to project operations or facilities based on new information or results of monitoring, but do not appear to require Commission approval for such changes (e.g., modification of minimum pool, anadromous fish introduction). Such changes may not be implemented without prior Commission authorization granted after the filing of an application to amend the license.

Article 4XX. *Reservation of Authority to Prescribe Fishways.* Authority is reserved to the Commission to require the licensee to construct, operate, and maintain, or to provide for the construction, operation, and maintenance of such fishways as may be

prescribed by the Secretaries of the Interior and/or Commerce pursuant to section 18 of the Federal Power Act.

Article 4XX. Site Specific Erosion Control and Restoration Plan. The licensee must develop site-specific erosion control and restoration plans required by Bureau of Land Management (BLM) condition no. 5. The plans must include, at a minimum, the following: (1) a description of best management practices for erosion control that would be applied in specific circumstances; (2) provisions for inspecting erosion control measures while they are in place; (3) emergency protocols for erosion and sedimentation control (e.g., steps that will be taken if control measures fail during a storm event); (4) techniques that will be used to stabilize sites once construction is completed; and (5) a description of when and what type of water quality monitoring of surface waters will occur during and after ground-disturbing activities. Such plans must pertain to all project-related ground-disturbing activities within the project boundary and be developed in consultation with the California State Water Resources Control Board, California Department of Fish and Wildlife, and U.S. Fish and Wildlife Service, in addition to BLM, and filed with the Commission for approval at least 90 days in advance of initiating construction of recreation or other project facilities that require ground-disturbing activities. The licensee must include with each plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by each plan. The licensee must allow a minimum of 30 days for the agencies to comment before filing each plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on site-specific information.

The Commission reserves the right to require changes to each plan. Upon Commission approval, the licensee must implement each plan, including any changes required by the Commission.

Article 4XX. Site Specific Construction and Non-Routine Maintenance Hazardous Materials Spill Prevention, Control, and Countermeasure Plan. The licensee must develop site-specific construction and non-routine maintenance hazardous material spill prevention, control, and countermeasure plans and file each plan with the Commission at least 90-days in advance of initiating construction or non-routine maintenance. The plans must include, at a minimum, the following: (1) a description of the best management practices for contaminant control that will be applied in specific circumstances; (2) emergency protocols for spill containment and remediation; (3) the location of emergency cleanup equipment in the event of contaminant release; (4) identification of the entities to be contacted in the event of a spill; (5) designated equipment refueling and maintenance areas; (6) provisions requiring equipment to be cleaned and inspected prior to entering a construction site to ensure it is in proper functioning condition; (7) post-spill water quality monitoring protocols to ensure

remediation measures are effective; and (8) a listing of applicable local, state, and federal regulations that pertain to prevention of spills and protection of water quality. Such plans must pertain to all project-related ground-disturbing activities within the project boundary and be developed in consultation with the California State Water Resources Control Board, California Department of Fish and Wildlife, U.S. Fish and Wildlife Service, and, if construction or non-routine maintenance is proposed on Bureau of Land Management (BLM)-managed land, BLM. The licensee must include with each filed plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by each plan. The licensee must allow a minimum of 30 days for the agencies to comment before filing each plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on site-specific information.

The Commission reserves the right to require changes to each plan. Upon Commission approval, the licensee must implement each plan, including any changes required by the Commission.

Article 4XX. Ramping Rates. For all controllable flows above 200 cubic feet per second, the licensee must restrict the rate of change of releases from McSwain dam during any 1-hour period to not more than double the release from the reservoir at the start of the 1-hour period for upramping and not less than one-half the amount of controlled release from the reservoir at the start of the 1-hour period for downramping.

Article 4XX. Water Year Determination. Within 90 days of license issuance, the licensee must implement the process for determining water year type for instream flow allocations described in this license article. Water year determinations must be based on the Hughes method, wherein the water year forecast of unregulated runoff in the Merced River below Merced Falls published near the beginning of each month from February through May in the California Department of Water Resources' (California DWR) Bulletin 120, *Report of Water Conditions in California*. The water year types are defined as having the following numerical breakpoints (in thousands of acre-feet):

- Wet: $\geq 1,307$ (75th percentile of record)
- Above normal: > 919 (median) and $< 1,307$
- Below normal: > 546 (25th percentile) and ≤ 919
- Dry: > 339 (5th percentile) and ≤ 546
- Critically dry: ≤ 339

California DWR's forecast published in February, March, and April must apply from the 15th day of that month through the 14th day of the next month. From May 15th through October 14th, the water year type must be based on California DWR's forecast published in May.

From October 15th through February 14th of the following year, the water year type must be based on the sum of California DWR's monthly unregulated flow for the full water year for the Merced River near Merced Falls as made available by California DWR on the California Data Exchange Center in the folder named *FNF Sum*, currently available at: <http://cdec.water.ca.gov/cgi-progs/stages/FNFSUM>. If the California Department of Fish and Wildlife (California DFW) does not make the unregulated flow for the full water year available until after October 14th, but prior to or on October 31st, from 3 days after the date the unregulated flow is made available until February 14th of the following year, the water year type must be based on the sum of California DWR's monthly unregulated flow for the full water year as made available. If California DWR does not make available the final unregulated flow by October 31st, the water year type from November 1st through February 14th of the following year must be based on California DWR's May Bulletin 120.

Article 4XX. *Minimum Flow Releases from New Exchequer Dam.* The licensee must maintain a minimum flow of 25 cubic feet per second at all times downstream of New Exchequer dam through the existing fixed orifice pipe used to deliver such flows in the past.

Article 4XX. *Minimum Flow Releases from Crocker-Huffman Diversion Dam.* The licensee must release flows from McSwain dam such that the minimum flows in the following table are maintained at the U.S. Geological Survey gage 11271290 at Shaffer Bridge.

Required minimum flows in cubic feet per second by water year type

	Wet	Above Normal	Below Normal	Dry	Critical Dry
January 1 through 15	175	175	150	150	140
January 16 through February	400	350	300	150	140
March 1 through 15	270	270	270	240	200
March 16 through 31	410	410	370	370	310
April 1 through 15	590	590	560	560	510
April 16 through 30	790	790	780	570	570
May 1 through 15	790 ^a	790 ^a	780 ^a	570 ^a	570 ^a
May 16 through 31	790 ^a	790 ^a	780 ^a	570 ^a	570 ^a
June through July	200 ^b	200 ^b	200 ^b	200 ^b	200 ^b
August	200	200	200	70	60
September	200	200	200	60	60
October	200 ^c	200 ^c	200 ^c	100 ^c	120 ^c
November	175 ^d	175 ^d	150 ^d	150 ^d	130 ^d
December	175	175	150	150	140

^a Minimum flow up to the onset of the spring pulse flow required by article 4XX.

^b Minimum flow at the conclusion of the spring pulse flow required by article 4XX.

^c Minimum flow up to the onset of the fall pulse flow required by article 4XX.

^d Minimum flow at the conclusion of the fall pulse flow required by article 4XX.

Article 4XX. Fall Pulse Flow Releases. The licensee must provide for a fall pulse flow release of 1,000 cubic feet per second during October or November until a total volume of 12,500 acre-feet is released. This total volume must include the volume of water associated with the minimum flow specified in Article 4XX. The exact timing of the beginning of the release must be determined by the technical advisory committee specified in California State Water Resources Control Board condition no. 1 and Bureau of Land Management condition no. 2.

Article 4XX. Spring Pulse Flow Releases. The licensee must provide a spring pulse flow release of a total volume of 30,000 acre-feet during wet, above normal, and below normal water years, as determined in accordance with Article 4XX, and 10,000 acre-feet during dry and critically dry water years. This total volume must include the volume of water associated with the minimum flow specified in Article 4XX. The releases during wet, above normal, and below normal water years must be configured to consist of flows above 1,000 cubic feet per second (cfs) for a total of 9 days, and peak flows holding for 2 or 3 days, with a gradually ascending and descending hydrograph. The time needed to reach the 1,000 cfs threshold at the beginning of the pulse flow and to downramp from 1,000 cfs to the required minimum flow must not be included in the 9 days over 1,000 cfs. The total volume attributed to the pulse flow must take into account flows from the onset of upramping to the return to the designated minimum flow and must include the volume attributed to minimum flows that would have been in place in the absence of the pulse flow. The configuration of all releases (i.e., the targeted flows to be released on each day) and the exact timing of the beginning of the release must be determined by the technical advisory committee specified in California State Water Resources Control Board condition no. 1 and Bureau of Land Management condition no. 2³. The magnitude of the peak flows is purposely not specified to enable the technical advisory committee flexibility in adjusting the configuration of the releases to reflect monitoring results from past spring pulse flow releases. Compliance with this measure must be based on the verification of the number of days flows exceed 1,000 cfs (i.e., no less than 9) and the total volume of the pulse flow release (no less than 30,000 acre-feet).

After a minimum of two dry and critically dry water years, the licensee must develop a report, in consultation with the technical advisory committee, that assesses whether the results of anadromous fish outmigration counts required by Article 4XX support a continuation or increase in the 10,000 acre-feet pulse flow to effectively trigger outmigration and makes specific recommendations to the Commission regarding future implementation of the dry and critically dry water year spring pulse flow release. The

³ The technical advisory committee includes: the Bureau of Land Management, the California State Water Resources Control Board, U.S. Fish and Wildlife Service, the National Park Service, the National Marine Fisheries Service, the California Department of Fish and Wildlife, and the Conservation Groups.

licensee must include with the report documentation of consultation, copies of comments and recommendations on the completed report after it has been prepared and provided to the committee, and specific descriptions of how the committee's comments are accommodated by the report. The licensee must allow a minimum of 30 days for the members of the committee to comment before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on site-specific information.

The Commission reserves the right to require changes to any recommendations that may be included in the report. The licensee must not implement any changes in the operating regime of the project not authorized by this license until authorized to do so by the Commission.

Article 4XX. Minimum Pool at Lake McClure. The licensee must maintain a minimum pool storage in Lake McClure of not less than 115,000 acre-feet, which corresponds to an elevation of 640 feet National Geodetic Vertical Datum of 1929, except for drawdowns necessary to maintain minimum streamflows specified in Article 4XX.

Article 4XX. Streamflow and Reservoir Elevation Monitoring and Reporting. The licensee must monitor the water surface elevation of Lake McClure on a daily basis at U.S. Geological Survey (USGS) gage 11269500 and convert the stage readings to acre-feet in its report to the Commission. The licensee must monitor McSwain powerhouse outflow on an hourly basis at USGS gage 11270610. The licensee must monitor hourly stage and flow at the gage described as "Merced River below Crocker-Huffman Diversion Dam" in table 4.5-1 of Exhibit B of the amended final license application, filed on April 23, 2014, and at USGS gage 11269500 at Shaffer Bridge.

The licensee must notify the Commission of the water year type of each year when it is initially determined in February and when any subsequent modifications of the water type are made pursuant to Article 4XX, *Water Year Determination*. The licensee must make monitoring results at the four specified gages available in publicly-available and readily accessible formats and provide the data to USGS for inclusion in its annual hydrology summary reports. Within 6 months of the end of the water year (September 30), the licensee must file a data report of the monitoring results with the Commission, allowing members of the technical advisory committee specified in California State Water Resources Control Board condition no. 1 and Bureau of Land Management condition no. 2 at least 30 days to comment on the draft data report. The report must also include in the report documentation of the water year type used for flow determinations in accordance with Article 4XX and the total volume and release configuration of fall and spring pulse flows required by Articles 4XX and 4XX. The licensee must include with the report documentation of consultation, copies of comments and recommendations on the completed report after it has been prepared and provided to the committee, and specific descriptions of how the committee's comments are accommodated by the report.

If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on site-specific information. In the first monitoring report filed with the Commission under the new license, the licensee must include a description of the discharge gage below Crocker-Huffman diversion dam, including the make and model of the gage, the effective discharge range of the gage, calibration procedures, and the stage/discharge relationship at the gage.

Article 4XX. *Water Temperature Monitoring Plan.* Within 6 months of license issuance, the licensee must develop the water temperature monitoring plan required by California State Water Resources Control Board (Water Board) condition no. 19. In addition to the plan components specified in condition no. 19, the plan submitted to the Commission for approval must include the justification for the placement of each monitoring station, including how each relates to project operations, and the coordinates and a map showing each station.

The licensee must prepare the plan in consultation with the technical advisory committee specified in Water Board condition no. 1 and Bureau of Land Management condition no. 2. The licensee must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the members of the technical advisory committee, and specific descriptions of how the technical advisory committee members' comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the technical advisory committee members to comment before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on site-specific information.

The Commission reserves the right to require changes to the plan. Upon Commission approval, the licensee must implement the provisions of the plan, including any changes required by the Commission.

Article 4XX. *General Drought Management Plan.* The licensee must include in the drought plan required by California State Water Resources Control Board (Water Board) condition no. 9 the following elements: (1) the measures that would be considered to address droughts when they occur; (2) decision paths regarding how management options for a specific drought would be decided; and (3) a listing of any Commission license conditions, Bureau of Land Management 4(e) conditions, and water quality certification conditions that would require variances with each of the potential drought management measures identified in item (1).

The licensee must prepare the plan in consultation with the technical advisory committee specified in Water Board condition no. 1 and Bureau of Land Management condition no. 2. The licensee must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been

prepared and provided to the members of the technical advisory committee, and specific descriptions of how the technical advisory committee members' comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the technical advisory committee members to comment before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on site-specific information.

The Commission reserves the right to require changes to the plan. Upon Commission approval, the licensee must include in any drought-specific project operational plans developed under Article 4XX the provisions of the approved general plan, including any changes required by the Commission.

Article 4XX. Drought Notifications and Modified Project Operational Plans. By March 10 of the second or subsequent dry and critically dry water year, the licensee must notify the Bureau of Land Management (BLM), U.S. Fish and Wildlife Service (FWS), National Marine Fisheries Service (NMFS), California Department of Fish and Wildlife (California DFW), and the California State Water Resources Control Board (Water Board) of licensee's drought concerns. By May 1 of these same years, the licensee must consult with BLM, FWS, NMFS, California DFW, and the Water Board to discuss the licensee's operational plans to manage the drought conditions. If the consulted parties agree on a drought management plan, the licensee must file the plan and documentation of the agreement with the Commission. If the consulted parties do not reach agreement on the plan, the licensee must file with the Commission for approval, a revised proposed operational drought plan that addresses as many of the consulted agencies concerns as possible, with any assenting and dissenting comments and the reasons why any dissenting comments cannot be accommodated by the plan.

The Commission reserves the right to require changes to the plan. Upon Commission approval, the licensee must implement the provisions of the plan, including any changes required by the Commission.

Article 4XX. Flood Control Coordination. The licensee must operate the project as prescribed by the U.S. Army Corps of Engineers and approved by the Commission.

Article 4XX. Merced National Wildlife Refuge Water Delivery Plan. Within 2 years of license issuance, the licensee must develop a Merced National Wildlife Refuge (Merced NWR) water delivery plan to ensure, to the extent reasonably practical, the delivery of 15,000 acre-feet to the refuge during times of the year when this would provide the most benefit to wildlife. Elements in the plan should include the following:

- Provisions to conduct a feasibility study for providing the recommended monthly volumes of water to the Merced NWR on a year-round basis, including an assessment of adverse and beneficial effects, estimated costs for

any needed infrastructure changes, a schedule for conducting the study, and a report with a recommendation regarding proposed actions.

- An assessment of whether an enhancement of water delivery to the Snobird Unit of the Merced NWR is needed to achieve the overall annual or monthly water delivery objectives.
- A clear statement regarding where water delivery to the Merced NWR would be measured and the means for measuring and reporting monthly deliveries to the agencies and the Commission.
- An evaluation of the environmental effects on the refuge if monthly deliveries are curtailed during dry or critically dry water years and make-up water is obtained via groundwater, and the ramifications if there are future restrictions on the use of groundwater in the Central Valley.

The licensee must prepare the plan in consultation with the U.S. Fish and Wildlife Service (FWS) and California Department of Fish and Wildlife (California DFW). The licensee must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the agencies to comment before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on site-specific information.

The Commission reserves the right to require changes to the plan. Upon Commission approval, the licensee must implement the provisions of the plan, including any changes required by the Commission.

The licensee must prepare the feasibility study report specified in the Commission-approved Merced NWR water delivery plan referenced in the first bullet above in consultation with FWS and California DFW. The licensee must include with the study report documentation of consultation, copies of comments and recommendations on the completed report after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the study report. The licensee must allow a minimum of 30 days for the agencies to comment before filing the study report with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on site-specific information.

The Commission reserves the right to require changes to the recommendations in the study report. Upon Commission approval, the licensee must implement the recommended actions in the study report, including any changes required by the Commission.

Article 4XX. *Interim Delivery of Water to the Merced National Wildlife Refuge.* Until the Commission approves any modifications to water deliveries that result from the plan and study report specified in Article 4XX, the licensee must, beginning the first full calendar year after license issuance, provide to the Merced National Wildlife Refuge 15,000 acre-feet of water annually unless otherwise agreed to in advance by the U.S. Fish and Wildlife Service (FWS) and approved by the Commission. The water must be delivered to the refuge at a single delivery point in the northeast quarter of the southeast quarter of Section 36, Township 8S, Range 12E. On or before March 1 of each year, the licensee must notify FWS of the start date of the licensee's irrigation season. Upon receiving such notification, FWS will provide the licensee with a preliminary schedule for delivery of 15,000 acre-feet of water, at a flow rate not to exceed 45 cubic feet per second, to the refuge during the irrigation season. The licensee must make deliveries in accordance with said preliminary schedule unless requested otherwise by FWS.

The licensee must file a report with the Commission by January 30 of each year that documents the actual volume of water delivered to the refuge during the previous calendar year, how that volume was estimated, and, if 15,000 acre-feet is not delivered, the reasons why.

Article 4XX. *Large Woody Debris and Material Management Plan.* The licensee must add the U.S. Army Corps of Engineers and California Department of Transportation to the consulted entities in the development of the large woody debris and material management plan required by Bureau of Land Management condition no. 6 and California State Water Resources Control Board condition no. 14. Implementation of this plan would benefit aquatic habitat in the lower Merced River.

The licensee must prepare the plan in consultation with the technical advisory committee specified in Water Board condition no. 1 and Bureau of Land Management condition no. 2 as well as the two agencies specified in the previous paragraph. The licensee must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the consulted entities, and specific descriptions of how the consulted entities' comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the consulted entities to comment before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on site-specific information.

The Commission reserves the right to require changes to the plan. Upon Commission approval, the licensee must implement the provisions of the plan, including any changes required by the Commission. No large woody debris or material must be placed in the active channel until appropriate federal and state approvals have been obtained.

Article 4XX. Anadromous Fish Monitoring Plan. The licensee must develop, within 1 year of license issuance, the anadromous fish monitoring plan required by California State Water Resources Control Board (Water Board) condition no. 20. The plan must include provisions for monitoring downstream anadromous fish migration using a rotary screw trap from January 1 through May 31 at one location downstream of Crocker-Huffman diversion dam and monitoring upstream anadromous fish migration using one adult counting weir from October 1 through December 31. Data on downstream migrating anadromous fish must include, at a minimum, total number, and size, weight, and life stage of a representative sample. Data on upstream migrating anadromous fish must include, at a minimum, time and direction of migration, size, sex, and marks, such as adipose fin clips. In addition to the plan components required by Water Board condition no. 20, the plan must include: (1) a description of the proposed monitoring locations and the rationale for selecting these locations; (2) provisions for making recommendations for corrective actions if monitoring (including water temperature monitoring required by Article 4XX) shows the project is adversely affecting anadromous fish or their habitat, and reporting any such recommendations and associated costs to the Commission for approval; (3) identification of the process that would be used for identifying the licensee's responsibilities during any anadromous fish rescue effort that is linked to project operations; and (4) provisions for posting monitoring results on a publicly available website on the Monday following the week of data collection.

The licensee must prepare the plan in consultation with the technical advisory committee specified in Water Board condition no. 1 and Bureau of Land Management condition no. 2. The licensee must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the members of the technical advisory committee, and specific descriptions of how the technical advisory committee members' comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the technical advisory committee members to comment before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on site-specific information.

The Commission reserves the right to require changes to the plan. Upon Commission approval, the licensee must implement the provisions of the plan, including any changes required by the Commission.

The licensee must prepare an annual report, in consultation with the technical advisory committee, summarizing the monitoring results and making any recommendations for protocol modifications or other actions related to the monitoring results. If any such recommendation requires changes to the Commission-approved anadromous fish monitoring plan, the licensee must file the proposed changes with its annual report to the Commission. The licensee must include with the report documentation of consultation, copies of comments and recommendations on the

completed report after it has been prepared and provided to the members of the technical advisory committee, and specific descriptions of how the technical advisory committee members' comments are accommodated by the report. The licensee must allow a minimum of 30 days for the technical advisory committee members to comment before filing the report with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on site-specific information.

The Commission reserves the right to require changes to any recommended actions in the report. Upon Commission approval, the licensee must implement any recommended actions in the report and, as appropriate, the revised anadromous fish monitoring plan, including any changes required by the Commission.

Article 4XX. Gravel Augmentation Plan. Within 1 year of license issuance, the licensee must file with the Commission a gravel augmentation plan as required by California State Water Resources Control Board (Water Board) condition no. 4. This plan would enhance aquatic and riparian habitat in the lower Merced River. The licensee must develop the plan in consultation with the technical advisory committee specified in Water Board condition no. 1 and Bureau of Land Management condition no. 2. The plan must provide for the annual placement of 2,600 cubic yards of gravel in the lower Merced River and address, at a minimum, the following: (1) the range of particle sizes to be used for augmentation; (2) identification and mapping of potential gravel harvest sites adjacent to the lower Merced River on Merced Irrigation District, state, or federally owned land, and the expected sequence of annual harvesting (i.e., which sites would be harvested first and why); (3) provisions for restoring riparian floodplains following gravel harvesting; (4) the protocol for selecting locations between Merced Falls dam and Shaffer Bridge for annual gravel augmentation based on consultation with the technical advisory committee; (5) provisions for monitoring and mapping augmented gravel after placement in the lower Merced River channel; and (6) provisions for annual reporting of the location of gravel harvesting and placement, and monitoring results.

The licensee must include with the plan documentation of consultation with the technical advisory committee, copies of comments and recommendations on the completed plan after it has been prepared and provided to the members of the technical advisory committee, and specific descriptions of how the technical advisory committee members' comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the technical advisory committee members to comment before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on site-specific information.

The Commission reserves the right to require changes to the plan. Upon Commission approval, the licensee must implement the provisions of the plan, including any changes required by the Commission.

The licensee must prepare the annual report in consultation with the technical advisory committee and include any recommendations for protocol modifications or other actions related to the monitoring results. If any such recommendation requires changes to the Commission-approved gravel augmentation plan, the licensee must file the proposed changes with its annual report to the Commission. The licensee must include with the report documentation of consultation, copies of comments and recommendations on the completed report after it has been prepared and provided to the members of the technical advisory committee, and specific descriptions of how the technical advisory committee members' comments are accommodated by the report. The licensee must allow a minimum of 30 days for the technical advisory committee members to comment before filing the report with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on site-specific information.

The Commission reserves the right to require changes to any recommended actions in the report. Upon Commission approval, the licensee must implement any recommended actions in the report, and, as appropriate, the revised gravel augmentation plan, including any changes required by the Commission.

Article 4XX. Aquatic Invasive Species Management Plan. The licensee must add to the Amended Aquatic Invasive Species Management Plan filed with the Commission on April 23, 2014, and supplemented on September 5, 2014, and required by Bureau of Land Management (BLM) condition no. 8 and California State Water Resources Control Board (Water Board) condition no. 17, provisions to monitor and document incidental observations of Brazilian elodea (*Egeria densa*) and, if found, consult with the California Department of Fish and Wildlife, the Water Board, U.S. Fish and Wildlife Service, and BLM regarding the need to take appropriate management actions. If monitoring results rise to the level of needing follow-up management actions, file a report with the Commission that documents the need for the actions and the specific management actions that are recommended and consulted agency comments on the proposed actions.

The Commission reserves the right to require changes to any recommended actions in the report. Upon Commission approval, the licensee must implement any recommended actions in the report and, as appropriate, any revisions to the Aquatic Invasive Species Management Plan, including any changes required by the Commission.

Article 4XX. Federally Listed Plants Protection Plan. Within 6 months of license issuance, the licensee must file with the Commission for approval, a federally listed plants protection plan. The plan must include, at a minimum: (1) provisions to conduct surveys for federally listed plants and habitat areas that could support federally listed plants; (2) detailed survey methods; (3) protection and mitigation measures; (4) an implementation schedule; (5) reporting requirements; and (6) a provision for filing survey results and reports.

The licensee must prepare the plan after consultation with the U.S. Fish and

Wildlife Service, the Bureau of Land Management, the National Park Service, the California State Water Resources Control Board, and the California Department of Fish and Wildlife. The licensee must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the agencies to comment and make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Land disturbing activities must not begin until the licensee is notified by the Commission that the plan is approved. Upon Commission approval, the licensee must implement the plan, including any changes required by the Commission.

Article 4XX. *Vernal Pool Fairy Shrimp Protection Plan.* Within 6 months of license issuance, the licensee must file with the Commission for approval, a vernal pool fairy shrimp protection plan. The plan must include, at a minimum: (1) provisions to conduct surveys for vernal pool fairy shrimp and habitat areas that could support vernal pool fairy shrimp; (2) detailed survey methods; (3) protection and mitigation measures; (4) an implementation schedule; (5) reporting requirements; and (6) a provision for filing survey results and reports.

The licensee must prepare the plan after consultation with the U.S. Fish and Wildlife Service, the Bureau of Land Management, the National Park Service, the California State Water Resources Control Board, and the California Department of Fish and Wildlife. The licensee must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the agencies to comment and make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Land disturbing activities must not begin until the licensee is notified by the Commission that the plan is approved. Upon Commission approval, the licensee must implement the plan, including any changes required by the Commission.

Article 4XX. San Joaquin Kit Fox Protection Plan. Within 6 months of license issuance, the licensee must file with the Commission for approval, a San Joaquin kit fox protection plan. The plan must include, at a minimum: (1) provisions to conduct surveys for San Joaquin kit fox; (2) detailed survey methods; (3) protection and mitigation measures; (4) an implementation schedule; (5) reporting requirements; and (6) a provision for filing survey results and reports.

The licensee must prepare the plan after consultation with the U.S. Fish and Wildlife Service, the Bureau of Land Management, the National Park Service, the California State Water Resources Control Board, and the California Department of Fish and Wildlife. The licensee must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the agencies to comment and make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Land-disturbing activities must not begin until the licensee is notified by the Commission that the plan is approved. Upon Commission approval, the licensee must implement the plan, including any changes required by the Commission.

Article 4XX. Western Pond Turtle Protection Plan. Within 6 months of license issuance, the licensee must file with the Commission for approval, a western pond turtle protection plan. The plan must include the following additional items, at minimum: (1) protocols to be followed when western pond turtles are observed; (2) detailed description of monitoring plans; and (3) reporting requirements.

The licensee must prepare the plan after consultation with the U.S. Fish and Wildlife Service, the Bureau of Land Management, the California State Water Resources Control Board, and the California Department of Fish and Wildlife. The licensee must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the agencies to comment and make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Land-disturbing activities must not begin until the licensee is notified by the Commission that the plan is approved. Upon Commission approval, the licensee must implement the plan, including any changes required by the Commission.

Article 4XX. Bat Protection Plan. Within 6 months of license issuance, the licensee must file with the Commission for approval, a bat protection plan. The plan must include the following additional items, at minimum: (1) a list of special-status bats that will be protected by the measures contained in the plan; (2) methods of identifying bat roosts at project facilities; (3) detailed descriptions of the exclusion devices that will be installed at project facilities; (3) protocols that will be implemented if an exclusion device fails; (4) an implementation schedule; (5) reporting requirements; and (5) a schedule for filing reports.

The licensee must prepare the plan after consultation with the U.S. Fish and Wildlife Service, the Bureau of Land Management, the California State Water Resources Control Board, and the California Department of Fish and Wildlife. The licensee must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the agencies to comment and make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Land-disturbing activities must not begin until the licensee is notified by the Commission that the plan is approved. Upon Commission approval, the licensee must implement the plan, including any changes required by the Commission.

Article 4XX. Revised Bald Eagle Management Plan. Within 6 months of license issuance, the licensee must revise its Bald Eagle Management Plan filed on February 26, 2012, and amended on September 22, 2014, and file the revised plan with the Commission for approval. The revised plan must include the following additional items: (1) Information about roost sites on public information boards; (2) descriptions of activities that would be considered emergencies with explanations of why these activities would supersede bald eagle protection; (3) measures to protect winter roost trees from vegetation management and future construction activities; (4) revised protocols and methodologies to be consistent with those recommended by the U.S. Fish and Wildlife Service (FWS); and (5) a schedule for filing reports.

The licensee must prepare the plan after consultation with FWS, the Bureau of Land Management, the California State Water Resources Control Board, and the California Department of Fish and Wildlife. The licensee must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the agencies to comment and make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Land-disturbing activities must not begin until the licensee is notified by the Commission that the plan is approved. Upon Commission approval, the licensee must implement the plan, including any changes required by the Commission.

Article 4XX. *Revised Invasive Species Management Plan.* Within 6 months of license issuance, the licensee must revise its Invasive Species Management Plan on federal land, as filed with the final license application February 26, 2012, and amended on September 22, 2014, and file the revised plan with the Commission for approval. The revised plan must include the following additional items: (1) stipulations to apply the plan to all land within the project boundary, including treatment measures for the existing population of perennial pepperweed on Merced Irrigation District's land; (2) details about specific best management practices to be implemented as part of the plan; (3) a component on pest management and pesticide use notification that requires prior notification to agencies of pesticide use; (4) descriptions of unexpected outbreaks that would not require notification prior to use; and (5) a schedule for filing reports.

The licensee must prepare the plan after consultation with the U.S. Fish and Wildlife Service, the Bureau of Land Management, the California State Water Resources Control Board, and the California Department of Fish and Wildlife. The licensee must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the agencies to comment and make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Land-disturbing activities must not begin until the licensee is notified by the Commission that the plan is approved. Upon Commission approval, the licensee must implement the plan, including any changes required by the Commission.

Article 4XX. Revised Vegetation Management Plan. Within 6 months of license issuance, the licensee must revise its Vegetation Management Plan on federal land, as filed with the final license application on February 26, 2012, and amended on September 22, 2014, and file the revised plan with the Commission for approval. The revised plan must include the following additional items: (1) provide details about specific best management practices that would be implemented as part of the plan; (2) include maps in section 3.0 to show locations of elderberry plants and identify which plants show signs of occupancy by the valley elderberry longhorn beetle; (3) include provisions for consultation with the Bureau of Land Management (BLM), the California Department of Fish and Wildlife (California DFW), the California State Water Resources Control Board (Water Board), and the U.S. Fish and Wildlife Service (FWS) during the planning phases for any new disturbance to identify the need for pre-disturbance surveys; and (4) develop protection measures for any sensitive species in the disturbance area.

The licensee must prepare the plan after consultation with FWS, BLM, the Water Board, and California DFW. The licensee must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the agencies to comment and make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Land-disturbing activities must not begin until the licensee is notified by the Commission that the plan is approved. Upon Commission approval, the licensee must implement the plan, including any changes required by the Commission.

Article 4XX. Revised Limestone Salamanders Sensitive Areas Management Plan. Within 6 months of license issuance, the licensee must revise its Limestone Salamanders Sensitive Areas Management Plan, as filed with the final license application on February 26, 2012, and amended on September 22, 2014, and file the revised plan with the Commission for approval. The revised plan must include the following additional items: (1) details about the specific best management practices that would be implemented as part of the plan; (2) provisions to site new hiking trails or modifications to existing hiking trails outside limestone salamander sensitive habitat; and (3) a schedule for filing reports.

The licensee must prepare the plan after consultation with the U.S. Fish and Wildlife Service, the Bureau of Land Management, the California State Water Resources Control Board, and the California Department of Fish and Wildlife. The licensee must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the agencies to comment

and make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Land-disturbing activities must not begin until the licensee is notified by the Commission that the plan is approved. Upon Commission approval, the licensee must implement the plan, including any changes required by the Commission.

Article 4XX. Recreation Facilities Plan. Within 1 year of license issuance, the licensee must file, for Commission approval, a revised Recreation Facilities Plan. The plan, filed August 21, 2014, and required by Bureau of Land Management condition no. 22, must include the following modifications to:

- (1) extend the paved bicycle lane along the entire length of Lake McClure Road (7.8 miles) between County Road J16 and the proposed parking area from the McSwain shoreline trailhead;
- (2) identify the location of the project's three floating restrooms provided on Lake McClure, and include an operation and maintenance schedule and construction and rehabilitation measures (if needed) for each restroom; and
- (3) revise the implementation schedule to: to begin construction no earlier than Labor Day and no later than Memorial Day to avoid the primary recreation season; begin construction at the project's Bagby recreation area within 2 years of license issuance; begin construction of the project's non-motorized trails at the project's Horseshoe Bend recreation area, McSwain reservoir shoreline, and the new Mack Island recreation area within 3 years of license issuance; begin rehabilitation planning at each project campground within 3 years of license issuance (to be completed within 6 years of license issuance); and include a mid-license term rehabilitation assessment in the implementation schedule that would identify any project facilities and/or water systems in need of rehabilitation.

The Commission reserves the right to require changes to the revised plan. Implementation of the revised plan must not begin until the licensee is notified by the Commission that the plan is approved. Upon Commission approval, the licensee must implement the revised plan, including any changes required by the Commission.

Article 4XX. Recreation Streamflow Information. Within 1 year of license issuance, the licensee must provide real-time recreation streamflow information to the public via its webpage or on the California Data Exchange Center's webpage for: (1) Merced River below Merced Falls, Dry Creek near the city of Snelling, Merced River near the cities of Snelling, Cressy, and Stevinson, and Merced River at Shaffer Bridge

(U.S. Geological Survey gage no. 11271290); and (2) elevations for Lake McClure and McSwain reservoir.

Article 4XX. Fish Stocking Plan. Within 1 year of license issuance, the licensee must file, for Commission approval, a fish stocking plan. The plan must include, consistent with California State Water Resources Control Board condition no. 16, at minimum, the species, size, and number of fish to be stocked in Lake McClure and McSwain reservoir for the first 3 years following license issuance and a consultation schedule to address fish stocking over the term of the license.

The Commission reserves the right to require changes to the revised plan. Implementation of the revised plan must not begin until the licensee is notified by the Commission that the plan is approved. Upon Commission approval, the licensee must implement the revised plan, including any changes required by the Commission.

Article 4XX. Visual Resources Plan. The licensee must implement the Visual Resources Plan, filed September 22, 2014, and required by Bureau of Land Management condition no. 26, for all project lands.

The Commission reserves the right to require changes to the revised plan. Implementation of the revised plan must not begin until the licensee is notified by the Commission that the plan is approved. Upon Commission approval, the licensee must implement the revised plan, including any changes required by the Commission.

Article 4XX. Programmatic Agreement and Historic Properties Management Plan. The licensee must implement the "Programmatic Agreement Between the Federal Energy Regulatory Commission and the California State Historic Preservation Officer for Managing Historic Properties that may be Affected by a License to Merced Irrigation District for the Continued Operation of the Merced River Hydroelectric Project, in Merced and Mariposa County, California (FERC No. 2179-043)," executed on ____, including but not limited to the Historic Properties Management Plan (HPMP) for the project. In the event that the Programmatic Agreement is terminated, the licensee must continue to implement the provisions of its approved HPMP. The Commission reserves the authority to require changes to the HPMP at any time during the term of the license.

APPENDIX B

Draft License Articles for the Merced Falls Hydroelectric Project

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DRAFT LICENSE ARTICLES

I. ADMINISTRATIVE ARTICLES

Article 2XX. Administrative Annual Charges. The licensee must pay the United States annual charges, effective the first day of the month in which the license is issued, and as determined in accordance with provisions of the Commission's regulations in effect from time to time, for the purposes of:

- (a) reimbursing the United States for the cost of administration of Part I of the Federal Power Act. The authorized installed capacity for that purpose is 3.4 megawatts.
- (b) recompensing the United States for the use, occupancy, and enjoyment of 1.0 acre of its lands (other than for transmission line right-of-way).

Article 2XX. Exhibit Drawings. Within 45 days of the date of issuance of this license, as directed below, the licensee must file two sets of the approved exhibit drawings, form FERC-587, and GIS data in electronic file format on compact disks with the Secretary of the Commission, ATTN: OEP/DHAC.

(1) Digital images of the approved exhibit drawings must be prepared in electronic format. Prior to preparing each digital image, the FERC Project-Drawing Number (i.e., P-2467-1001 through P-2467-####) must be shown in the margin below the title block of the approved drawing. Exhibit F drawings must be segregated from other project exhibits, and identified as **(CEII) material under 18 CFR §388.113(c)**. Each drawing must be a separate electronic file, and the file name must include: FERC Project-Drawing Number, FERC Exhibit, Drawing Title, date of this license, and file extension in the following format [P-2467-####, G-1, Project Boundary, MM-DD-YYYY.TIF].

Each Exhibit G drawing that includes the project boundary must contain a minimum of three known reference points (i.e., latitude and longitude coordinates, or state plane coordinates). The points must be arranged in a triangular format for GIS georeferencing the project boundary drawing to the polygon data, and must be based on a standard map coordinate system. The spatial reference for the drawing (i.e., map projection, map datum, and units of measurement) must be identified on the drawing and each reference point must be labeled. In addition, each project boundary drawing must be stamped by a registered land surveyor. All digital images of the exhibit drawings must meet the following format specification:

IMAGERY - black & white raster file
FILE TYPE – Tagged Image File Format (TIFF), CCITT Group 4
(also known as T.6 coding scheme)
RESOLUTION – 300 dpi desired, (200 dpi min)
DRAWING SIZE FORMAT – 22” x 34” (min), 24” x 36” (max)
FILE SIZE – less than 1 MB desired

A third set (Exhibit G only) and a copy of Form FERC-587 must be filed with the Bureau of Land Management office at the following address:

Bureau of Land Management
Branch of Adjudication and Records (CA-943.5)
2800 COTTAGE WAY SUITE W1623
SACRAMENTO CA 95825-1886
ATTN: FERC Withdrawal Recordation

Form FERC-587 is available through the Commission’s website at the following URL: <http://www.ferc.gov/docs-filing/forms/form-587/form-587.pdf>. Although instruction no. 3 requires microfilm copies of the project boundary maps in aperture card format, electronic copies that meet the digital specifications in this ordering paragraph should be substituted.

If the FERC-587 cannot be downloaded from the Internet, a hard copy may be obtained by mailing a request to the Secretary of the Commission.

(2) Project boundary GIS data must be in a georeferenced electronic file format (such as ArcView shape files, GeoMedia files, MapInfo files, or a similar GIS format). The filing must include both polygon data and all reference points shown on the individual project boundary drawings. An electronic boundary polygon data file(s) is required for each project development. Depending on the electronic file format, the polygon and point data can be included in single files with multiple layers. The georeferenced electronic boundary data file must be positionally accurate to ± 40 feet in order to comply with National Map Accuracy Standards for maps at a 1:24,000 scale. The file name(s) must include: FERC Project Number, data description, date of this license, and file extension in the following format [P-2467 boundary polygon/or point data, MM-DD-YYYY.SHP]. The filing must be accompanied by a separate text file describing the spatial reference for the georeferenced data: map projection used (i.e., UTM, State Plane, Decimal Degrees, etc.), the map datum (i.e., North American 27, North American 83, etc.), and the units of measurement (i.e., feet, meters, miles, etc.). The text file name must include: FERC Project Number, data description, date of this license, and file extension in the following format [P-2467, project boundary metadata, MM-DD-YYYY.TXT].

In addition, for those projects that occupy federal lands, a separate georeferenced polygon file(s) is required that identifies transmission line acreage and non-transmission line acreage affecting federal lands for the purpose of meeting the requirements of 18 CFR §11.2. The file(s) must also identify each federal owner (e.g., Bureau of Land Management, Forest Service, U.S. Army Corps of Engineers, etc.), land identification (e.g., forest name, Section 24 lands, national park name, etc.), and federal acreage affected by the project boundary. Depending on the georeferenced electronic file format, the polygon, point, and federal lands data can be included in a single file with multiple layers.

Article 2XX. Amortization Reserve. Pursuant to section 10(d) of the Federal Power Act, a specified reasonable rate of return upon the net investment in the project must be used for determining surplus earnings of the project for the establishment and maintenance of amortization reserves. The licensee must set aside in a project amortization reserve account at the end of each fiscal year one half of the project surplus earnings, if any, in excess of the specified rate of return per annum on the net investment. To the extent that there is a deficiency of project earnings below the specified rate of return per annum for any fiscal year, the licensee must deduct the amount of that deficiency from the amount of any surplus earnings subsequently accumulated, until absorbed. The licensee must set aside one-half of the remaining surplus earnings, if any, cumulatively computed, in the project amortization reserve account. The licensee must maintain the amounts established in the project amortization reserve account until further order of the Commission.

The specified reasonable rate of return used in computing amortization reserves must be calculated annually based on current capital ratios developed from an average of 13 monthly balances of amounts properly included in the licensee's long-term debt and proprietary capital accounts as listed in the Commission's Uniform System of Accounts. The cost rate for such ratios must be the weighted average cost of long-term debt and preferred stock for the year, and the cost of common equity must be the interest rate on 10-year government bonds (reported as the Treasury Department's 10-year constant maturity series) computed on the monthly average for the year in question plus four percentage points (400 basis points).

Article 2XX. Headwater Benefits. If the licensee's project was directly benefited by the construction work of another licensee, a permittee, or the United States on a storage reservoir or other headwater improvement during the term of the original license (including extensions of that term by annual licenses), and if those headwater benefits were not previously assessed and reimbursed to the owner of the headwater improvement, the licensee must reimburse the owner of the headwater improvement for those benefits, at such time as they are assessed, in the same manner as for benefits received during the term of this new license. The benefits will be assessed in accordance with Part 11, Subpart B, of the Commission's regulations.

II. ENGINEERING ARTICLES

Article 3XX. *Project Modification Resulting from Environmental Requirements.* If environmental requirements under this license require modification that may affect the project works or operations, the licensee must consult with the Commission's Division of Dam Safety and Inspections—San Francisco Regional Engineer. Consultation must allow sufficient review time for the Commission to ensure that the proposed work does not adversely affect the project works, dam safety, or project operation.

III. MANDATORY CONDITIONS

On July 22, 2014, the California State Water Resources Control Board (Water Board) filed 36 preliminary water quality certification conditions (appendix E). These conditions are described in section 2.2.2.5 of the environmental impact statement (EIS). We consider 27 (1, and 10 through 36) of the Water Board preliminary conditions to be administrative or legal in nature and not specific environmental measures. Of the 8 conditions we consider to be environmental measures applicable to the Merced River Project, we include 5¹ of these conditions in the staff alternative as specified by the Water Board.

We recognize, however, that the Commission is required to include water quality certification conditions in any license issued for the project. As such, each of the measures that staff recommend be modified in the staff alternative (as discussed in section 5.1.2, Comprehensive Development and Recommended Alternative) would not be included in any license issued by the Commission. Instead, those conditions would be replaced with the Water Board's corresponding conditions, as filed with the Commission.

IV. ADDITIONAL LICENSE ARTICLES RECOMMENDED BY COMMISSION STAFF

We recommend including the following license articles in any license issued for the project in addition to the mandatory conditions.

¹ As explained in section 5 of the draft EIS, we recommend modifying the following condition specified by the Water Board: condition no. 8. We do not recommend the following conditions: (1) gravel augmentation in the Merced Falls reach; (2) a fish passage plan; and (3) annual consultation to review the project status and plans, results of studies, necessary modifications to plans, and protection measures for newly listed species.

Article 4xx. *Requirement to File Amendment Applications*

Certain California State Water Resources Control Board preliminary water quality certification conditions appear to contemplate requiring unspecified long-term changes to project operations or facilities based on new information or results of monitoring but do not appear to require Commission approval for such changes (e.g., water quality monitoring, climate change). Such changes may not be implemented without prior Commission authorization granted after the filing of an application to amend the license.

Article 4XX. *Reservation of Authority to Prescribe Fishways.* Authority is reserved to the Commission to require the licensee to construct, operate, and maintain, or to provide for the construction, operation, and maintenance of such fishways as may be prescribed by the Secretaries of the Interior and/or Commerce pursuant to section 18 of the Federal Power Act.

Article 4XX. *Coordinated Operations Plan.* Within 120 days of license issuance, the licensee must file the plan in conjunction with Merced Irrigation District and in consultation with the California State Water Resources Control Board, the Bureau of Land Management, the U.S. Fish and Wildlife Service, the California Department of Fish and Wildlife, the National Marine Fisheries Service, and the National Park Service. The licensee must include with the plan filed with the Commission documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the consulted entities, and specific descriptions of how the consulted entities' comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the consulted entities to comment before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on site-specific information.

The Commission reserves the right to require changes to the plan. Upon Commission approval, the licensee must implement the plan, including any changes required by the Commission.

Article 4XX. *Water Quality Monitoring Plan.* Within 120 days of license issuance, the licensee must file, in consultation with the technical advisory committee specified in Merced Irrigation District's Merced River Project California State Water Resources Control Board condition no. 1, a long-term water quality monitoring program for periodic (10-year intervals) assessment of water temperature and dissolved oxygen in the reach of the Merced River downstream of the project dam and upstream of Crocker-Huffman diversion dam. The licensee must include with the plan filed with the Commission documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the consulted entities, and specific descriptions of how the consulted entities' comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the consulted entities to comment before filing the plan with the Commission. If the licensee does not adopt a

recommendation, the filing must include the licensee's reasons, based on site-specific information.

The Commission reserves the right to require changes to the plan. Upon Commission approval, the licensee must implement the plan, including any changes required by the Commission.

Article 4XX. Fish Monitoring Plan. Within 90 days of license issuance, the licensee must prepare a plan to monitor *Oncorhynchus mykiss* abundance and distribution in the reach of the Merced River downstream of the project dam and upstream of Crocker-Huffman diversion dam. The licensee should prepare the plan, including the necessity of monitoring additional species or metrics, in consultation with the technical advisory committee specified in Merced Irrigation District's Merced River Project California State Water Resources Control Board condition no. 1. The licensee must include with the plan filed with the Commission documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the consulted entities, and specific descriptions of how the consulted entities' comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the consulted entities to comment before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on site-specific information

The Commission reserves the right to require changes to the plan. Upon Commission approval, the licensee must implement the provisions of the plan, including any changes required by the Commission.

Article 4XX. Large Woody Debris and Material Management Plan. Within 1 year of license issuance, the licensee must prepare the plan in consultation with the technical advisory committee specified in Merced Irrigation District's Merced River Project California State Water Resources Control Board condition no. 1. The licensee must include with the plan filed with the Commission documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the consulted entities, and specific descriptions of how the consulted entities' comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the consulted entities to comment before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on site-specific information.

The Commission reserves the right to require changes to the plan. Upon Commission approval, the licensee must implement the provisions of the plan, including any changes required by the Commission. No large woody debris or material must be placed in the active channel until appropriate federal and state approvals have been obtained.

Article 4XX. Bald Eagle Management Plan. Within 6 months of license issuance, the licensee must file with the Commission for approval, a bald eagle management plan. The plan must include the following items, at a minimum: (1) educational information about roost sites on public information boards; (2) descriptions of activities that would be considered emergencies with explanations of why these activities would supersede bald eagle protection; (3) protocols and methodologies to be consistent with those recommended by the U.S. Fish and Wildlife Service (FWS); and (4) a schedule for filing reports.

The licensee must prepare the plan after consultation with FWS, the Bureau of Land Management, the California State Water Resources Control Board, and the California Department of Fish and Wildlife. The licensee must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Land-disturbing activities, including use of construction staging areas, must not begin until the licensee is notified by the Commission that the plan is approved. Upon Commission approval, the licensee must implement the plan, including any changes required by the Commission.

Article 4XX. Noxious Weeds and Invasive Plants and Pesticide Use and Notification Plan. Within 6 months of license issuance, the licensee must file with the Commission for approval, a noxious weeds and invasive plants and pesticide use and notification plan. The plan must include, at a minimum: (1) details about methods to control noxious weeds and invasive plants; (2) a map showing locations of noxious weeds and invasive plants that would be controlled; (3) an implementation schedule, including the frequency and timing of the control methods; (4) any best management practices that would be implemented as part of the plan; (5) specifications for pesticide use on project lands to be consistent with state and federal laws; (6) provisions requiring notification of pesticide use on project lands; and (7) reporting requirements.

The licensee must prepare the plan after consultation with the U.S. Fish and Wildlife Service, the Bureau of Land Management, the California State Water Resources Control Board, and the California Department of Fish and Wildlife. The licensee must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the agencies to comment

and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Land-disturbing activities must not begin until the licensee is notified by the Commission that the plan is approved. Upon Commission approval, the licensee must implement the plan, including any changes required by the Commission.

Article 4XX. Valley Elderberry Longhorn Beetle Protection Plan. Within 6 months of license issuance, the licensee must file with the Commission for approval, a valley elderberry longhorn beetle protection plan. The plan must include, at a minimum: (1) maps showing locations of any elderberry plants in the project area; (2) identification of any elderberry plants showing signs of occupancy by the valley elderberry longhorn beetle; (3) the development of protection measures; (4) implementation schedule; and (5) reporting requirements.

The licensee must prepare the plan after consultation with the U.S. Fish and Wildlife Service, the Bureau of Land Management, the California State Water Resources Control Board, and the California Department of Fish and Wildlife. The licensee must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Land-disturbing activities, including use of construction staging areas, must not begin until the licensee is notified by the Commission that the plan is approved. Upon Commission approval, the licensee must implement the plan, including any changes required by the Commission.

Article 4XX. San Joaquin Kit Fox Protection Plan. Within 6 months of license issuance, the licensee must file with the Commission for approval, a San Joaquin kit fox protection plan. The plan must include, at a minimum: (1) provisions to conduct surveys for San Joaquin kit fox; (2) detailed survey methods; (3) protection and mitigation measures; (4) an implementation schedule; (5) reporting requirements; and (6) a provision for filing survey results and reports.

The licensee must prepare the plan after consultation with the U.S. Fish and Wildlife Service, the Bureau of Land Management, the National Park Service, the California State Water Resources Control Board, and the California Department of Fish

and Wildlife. The licensee must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Land-disturbing activities must not begin until the licensee is notified by the Commission that the plan is approved. Upon Commission approval, the licensee must implement the plan, including any changes required by the Commission.

Article 4XX. Fish Stocking Plan. Within 1 year of license issuance, the license must file, for Commission approval, a plan to stock 11,000 adult-sized rainbow trout in the Merced Falls impoundment for the first two years following license issuance and a plan for stocking (species, number, and stocking schedule) for the remainder of the license term.

The fish stocking plan must be developed after consultation with the California Department of Fish and Wildlife (California DFW). The licensee must include with the plan an implementation schedule, documentation of consultation, copies of recommendations on the complete plan after it has been prepared and provided to California DFW, and specific descriptions of how California DFW's comments are accommodated by the plan. The licensee must allow a minimum of 30 days for California DFW to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the revised plan. Implementation of the revised plan must not begin until the licensee is notified by the Commission that the plan is approved. Upon Commission approval, the licensee must implement the revised plan, including any changes required by the Commission.

Article 4XX. Recreation Operations. The licensee must operate and maintain all project recreation facilities, which includes all facilities at the Merced Falls Fishing Access area (signage, restroom, parking area, and car-top boat launch), the informal angler trail located along the northern shoreline, the two informal parking areas on either side of Hornitos County Bridge, and the informal canoe portage trail located at the south end of Merced Falls dam.

Article 4XX. Programmatic Agreement and Historic Properties Management Plan. The licensee must implement the "Programmatic Agreement Between the Federal Energy Regulatory Commission and the California State Historic Preservation Officer for

Managing Historic Properties that may be Affected by a License to Pacific Gas and Electric Company for the Continued Operation of the Merced Falls Hydroelectric Project, in Merced and Mariposa counties, California (FERC No. 2467-020),” executed on _____, including but not limited to the Historic Properties Management Plan (HPMP) for the project. In the event that the Programmatic Agreement is terminated, the licensee must continue to implement the provisions of its approved HPMP. The Commission reserves the authority to require changes to the HPMP at any time during the term of the license.

APPENDIX C

**Entities that filed Letters
in Response to the
Notice of Application Accepted for Filing, Soliciting Motions to Intervene and
Protests, Ready for Environmental Analysis, and Soliciting Comments,
Recommendations, Preliminary Terms and Conditions, and Preliminary Fishway
Prescriptions for the Merced River Hydroelectric Project**

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The following entities filed letters in response to the notice of application accepted for filing, soliciting motions to intervene and protests, ready for environmental analysis, and soliciting comments, recommendations, preliminary terms and conditions, and preliminary fishway prescriptions for the Merced River Hydroelectric Project issued on March 28, 2014.

Commenting Entity	Filing Date
Daniel Chavez	July 21, 2014
Judie Arthur	July 21, 2014
Micheal Ohki	July 21, 2014
Thomas McHatton	July 21, 2014
Irene M. Roberts	July 21, 2014
Suzanne Hultgren	July 21, 2014
Ezio A. Samsoni	July 21, 2014
Rory Randol	July 21, 2014
Stan Callan	July 21, 2014
Individual	July 21, 2014
Martin DeJaquer	July 21, 2014
Antonio Rednger	July 21, 2014
Ray Thomas	July 21, 2014
Thomas F. Valenito	July 21, 2014
Arlene Engel	July 21, 2014
Chelley Dallara	July 21, 2014
Judie Arthur	July 21, 2014
Willie Raheed	July 21, 2014
Individual	July 21, 2014
Joe Zester	July 21, 2014
Individual	July 21, 2014
Bill and Pam Ferrari	July 21, 2014
Douglas Guesling	July 21, 2014
Conde Burnett	July 21, 2014
Individual	July 21, 2014
Pamela Brewer	July 21, 2014
Thomas G. Innerbichler	July 21, 2014
Individual	July 21, 2014
Ray Marino	July 21, 2014
Individual	July 21, 2014
Individual	July 21, 2014
James Cepalinario	July 21, 2014
James Packso	July 21, 2014
Joseph Brown	July 21, 2014
Bruce Edwards	July 21, 2014

Commenting Entity	Filing Date
Chris Sumpter	July 21, 2014
Gary Tessin	July 21, 2014
Patrick Spielman	July 21, 2014
Charles D.	July 21, 2014
Leo and Eva Andrews	July 21, 2014
Anne Cooper	July 21, 2014
Individual	July 21, 2014
Yuki Nishihama	July 21, 2014
Francisco J. Gonzalez	July 21, 2014
Chris Sehler	July 21, 2014
Individual	July 21, 2014
Vicki and Henry Spencer	July 21, 2014
Viani Farms	July 21, 2014
Shirley Granes	July 21, 2014
Alice Souza	July 21, 2014
Stu and Nancy McElwain	July 21, 2014
Doris Crafts	July 21, 2014
John Gun	July 21, 2014
Mary and Micthell Reynolds	July 21, 2014
Joe Baker	July 21, 2014
Mike Mackinzie	July 21, 2014
Individual	July 21, 2014
Scott Wickstrom	July 21, 2014
Pat Murphy	July 21, 2014
Bob Majors	July 21, 2014
Tom and Diane Gannon	July 21, 2014
Emanuel and Sonia Belo	July 21, 2014
Augif Scond	July 21, 2014
Robert and Geraldine Hiser	July 21, 2014
Sanford Wickum	July 21, 2014
Ray and Loretta Fernandes	July 21, 2014
Jean, Philippe, and Kathryn Favier	July 21, 2014
Joseph M. Fagundes	July 21, 2014
Henry Soares	July 21, 2014
Braden Farms	July 21, 2014
Manuel E. Vieira	July 21, 2014
Mark F. Dent	July 21, 2014
Joe Zester	July 21, 2014
Shirley Young	July 21, 2014
Michael Hoyt	July 21, 2014

Commenting Entity	Filing Date
Daryl Hofman	July 21, 2014
June A. Tonery	July 21, 2014
Georgia Johnson	July 21, 2014
Mark Dent	July 21, 2014
Michael Vander Dussen	July 21, 2014
Diulinda Daley	July 21, 2014
Randy Lafollette	July 21, 2014
Suzanne Langley Sabatino	July 21, 2014
John P. Lourenco	July 21, 2014
John Ferrari	July 21, 2014
Randy Pimental	July 21, 2014
John and Edyne Hultgren	July 21, 2014
Joe Scoto	July 21, 2014
Pete Bandoni	July 21, 2014
David Silveira	July 21, 2014
Karen Miller	July 21, 2014
Hulbert E. Edrington	July 21, 2014
Robert Crawford	July 22, 2014
Individual	July 22, 2014
Irene Schmidt	July 22, 2014
Aron Schmidt	July 22, 2014
Joe Connelly	July 22, 2014
Lea Van Domever	July 22, 2014
Thomas G. Innerbichler	July 22, 2014
Wilder M. Thornhulk	July 22, 2014
Individual	July 22, 2014
Lang H. Montgomery	July 22, 2014
Individual	July 22, 2014
John Larson	July 22, 2014
Larry Jones	July 22, 2014
Bob Giampaoli	July 22, 2014
Vann M. and Lynne J. Smith	July 22, 2014
Ken Braden	July 22, 2014
Carol Boesch	July 22, 2014
Henry Soares	July 22, 2014
Joseph M. Fagundes	July 22, 2014
Ray and Loretta Fernandes	July 22, 2014
Hulbert Edington	July 22, 2014
Frank V Mumatore	July 22, 2014
Betty Mooney Raw	July 22, 2014

Commenting Entity	Filing Date
Joel Vicker	July 22, 2014
Bromley A. Null	July 22, 2014
Individual	July 22, 2014
M. and M. Bairos	July 22, 2014
Robert and Patricia Gamble	July 22, 2014
Lola F. Sutra	July 22, 2014
Barry and Helen Daughdrill	July 23, 2014
Baltazar and Maurilia Cabellero	July 23, 2014
Maria and Jose Duran	July 23, 2014
Mitsue Jakahaski	July 23, 2014
Lloyd an Etta Weaver	July 23, 2014
Donald and Edna Mason	July 23, 2014
Individual	July 23, 2014
Individual	July 23, 2014
Grove and Norma May	July 23, 2014
Alice Zeran	July 23, 2014
Farm Management, Inc.	July 23, 2014
Karen Miller	July 23, 2014
Gerald L. and Marcia J. Mincer	July 23, 2014
Douglas Beames	July 23, 2014
Clay Harmon	July 23, 2014
Mike Brown	July 23, 2014
Ray and Maria Glampaoli	July 23, 2014
Vernon Boyd	July 23, 2014
Individual	July 23, 2014
Individual	July 23, 2014
Donald H. Rogers	July 23, 2014
Victor Mormles	July 23, 2014
Individual	July 23, 2014
Bill Adams	July 24, 2014
Meridan O'Bara	July 24, 2014
G. Weststeyz	July 24, 2014
Daryl W. Wood	July 24, 2014
Ezio A. Samisoni	July 24, 2014
Charlene R. Dew	July 24, 2014
F. D. Thompson	July 24, 2014
Dennis Wittchow	July 24, 2014
Glenn Arnold	July 24, 2014
Bob Giampaoli	July 24, 2014
Merton G. Dodge	July 24, 2014

Commenting Entity	Filing Date
Gilbert M. Limera	July 24, 2014
Bartica and Baxter Johnston	July 24, 2014
Wesley N. Jantz	July 24, 2014
Anna Kuniyski	July 24, 2014
Gerardo Money	July 24, 2014
John M. Mackermen	July 24, 2014
Henry G. Kelsey	July 24, 2014
Miguel Vega	July 25, 2014
Randy Fritus	July 28, 2014
Mike Pellicano	July 28, 2014
Steve Whitaker	July 28, 2014
James L. Glams	July 28, 2014
Individual	July 28, 2014
Individual	July 28, 2014
Russell Peason and Custon Haying	July 28, 2014
Individual	July 28, 2014
Bonnie Nuemann-Bramell	July 28, 2014
Robin Koda	July 28, 2014
Ross Koda	July 28, 2014
Linda Jordan	July 28, 2014
Bruce Barnes	July 28, 2014
Michelle Clark	July 28, 2014
Betty Walker	July 28, 2014
Individual	July 28, 2014
Takako T. Endo	July 28, 2014
Jeff Chance	July 28, 2014
E. King	July 28, 2014
Individual	July 28, 2014
K Chevalier	July 28, 2014
Tabir Yasub	July 28, 2014
Individual	July 28, 2014
Julie Ferrario	July 28, 2014
David Long	July 28, 2014
Robert Chad	July 29, 2014
Thomas R. Barnell	July 29, 2014
Penny D. Gatch	July 29, 2014
Gino Pedretti, III	July 29, 2014
Diulinda Daley	July 29, 2014
Individual	July 29, 2014
Gino Pedretti	July 29, 2014

Commenting Entity	Filing Date
S. Jackson	July 29, 2014
Roger Wood	July 29, 2014
Philip Crites	July 30, 2014
Gina Crites	July 30, 2014
Nancy Deavours	July 30, 2014
Nathan McDowell	July 30, 2014
Ethan McDowell	July 30, 2014
Individual	July 30, 2014
Robert Alvernaz	July 30, 2014
William Vander Helen	July 30, 2014
Bettencourt Family Property	July 30, 2014
Bettencourt Family Property	July 30, 2014
Mike Dragovich	July 30, 2014
Travis Costa	July 30, 2014
Sharon B. Dragovich	July 30, 2014
Bettencourt Family Property	July 30, 2014
Bettencourt Family Property	July 30, 2014
Molly Bettencourt Mullen	July 30, 2014
Leanne Lopez	July 30, 2014
Richard Lopez	July 30, 2014
Pat Ferrigno	July 30, 2014
Seth McDowell	July 30, 2014
Lorrie McDowell	July 30, 2014
Marilyn Landlino	July 30, 2014
Lisa Mari Tsuchiya	July 30, 2014
Jack Deavours	July 30, 2014
Merced Union High School District	July 30, 2014
Gina D. Bettencourt	July 30, 2014
Mandy Ballenger	July 30, 2014
Steven Mullen	July 30, 2014
Gene Beach	July 30, 2014
Alice Moschitto	July 30, 2014
Aldo Assali	July 30, 2014
Marchini and Marchini LP	July 31, 2014
Bella Verde LLC	July 31, 2014
Bona Vista Orchards	July 31, 2014
Pieretti and Eyraud LLC	July 31, 2014
J and J Marchini Enterprise	July 31, 2014
Big Crops LLC	July 31, 2014
JJ and R Ranches	July 31, 2014

Commenting Entity	Filing Date
Kevin L. Malone	August 5, 2014
Jimmy Frazier	August 5, 2014
Individual	August 5, 2014
Individual	August 6, 2014
Individual	August 6, 2014
Individual	August 6, 2014
City of Merced, CA	September 3, 2014
Individual	September 30, 2014

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APPENDIX D

Bureau of Land Management Preliminary Conditions

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PRELIMINARY RECOMMENDATIONS, TERMS AND CONDITIONS FOR THE MERCED RIVER HYDROELECTRIC PROJECT

The BLM through its preliminary recommendations, terms and conditions and prescriptions seeks to ensure appropriate levels of resource protection are incorporated in any new license. The BLM recommends that the FERC include in any new license issued for the Merced River Hydroelectric Project the following BLM preliminary recommendations, terms and conditions. The BLM believes that the resource measures presented in this section adequately address impacts to the ecological and cultural resources impacted by the Merced River Hydroelectric Project.

PRELIMINARY LICENSE ARTICLES FOR THE MERCED RIVER HYDROELECTRIC PROJECT, FERC NO. 2179

These Preliminary License Articles are submitted to FERC as 4(e) Conditions (both specific and general/administrative) and 10(a) Recommendations.

Preliminary 4(e) Conditions

Condition No. 1 – Consultation

Licensee shall annually consult with BLM regarding license implementation. The date of the consultation meeting will be mutually agreed to by Licensee and BLM, but in general should be held by April 15. At least 30 days in advance of the meeting, Licensee shall notify BLM and other interested stakeholders (interested stakeholders are defined as anyone who sends a letter to the licensee requesting to be a part of the consultation group. Any organized group will select an individual to represent them and will notify the licensee who their representative will be when they are attending these meetings), confirming the meeting location, time and agenda. At the same time, Licensee shall also provide notice to the: United States Fish and Wildlife Service (USFWS); National Park Service (NPS); National Oceanic and Atmospheric Administration's National Marine Fishery Service (NMFS); California State Department of Fish and Wildlife (CDFW); and the State Water Resources Control Board (SWRCB) who may choose to participate in the meeting.

Two weeks prior to the meeting, the Licensee shall make available to BLM, interested stakeholders, and the agencies listed above an operations and maintenance plan for the forthcoming year in which the meeting occurs. The goals of the meetings are to: discuss the past and current year implementation of the license conditions affecting BLM lands.

Discussions about forthcoming year's operations and maintenance plan; to have the Licensee present results from the past/current year monitoring of noxious weeds and special status species, as well as any additional information that has been compiled for the Project area including progress reports on any other issues related to preserving and protecting ecological values affected by the Project; to share information on mutually agreed upon planned maintenance activities; identify concerns that BLM may have regarding project operations/activities and their potential effects on sensitive resources,

any measures required to avoid or mitigate those potential effects; and review and discuss the results of implementing the streamflow and reservoir-related conditions.

Consultation shall include, but is not be limited to:

- A status report regarding implementation of license conditions.
- Discussion on any conditions that were not implemented.
- Results of any monitoring studies performed over the previous year in formats agreed to by BLM and the Licensee during development of implementation plans.
- Review of any non-routine maintenance.
- Discussion of any foreseeable changes to Project facilities or features.
- Discussion of any necessary revisions or modifications to resource implementation plans approved as part of this license.
- Discussion of needed protection measures for species newly listed as threatened, endangered, or sensitive, or changes to existing management plans that may no longer be warranted due to de-listing of species or, to incorporate new knowledge about a species requiring protection.
- Discussion of needed protection measures for newly discovered cultural resource sites.
- Discussion of elements of current year maintenance plans, e.g. road and trail maintenance.
- Discussion of any planned pesticide use.
- Discussion of BLM identified concerns regarding project operations/activities and their potential effects on sensitive resources, and any measures required to avoid or mitigate those potential effects.
- Discussion of information on mutually agreed upon planned maintenance activities.

A record of the meeting shall be kept by the Licensee and shall include any recommendations made by BLM for the protection of BLM land and resources. The Licensee shall file the meeting record, if requested, with FERC no later than 60 days following the meeting.

A copy of the reports/records for the previous water year regarding streamflow, study reports, and other pertinent records shall be provided to BLM, CDFW, USFWS, NPS, NMFS, and SWRCB by Licensee at least 60 days prior to the meeting date, unless otherwise agreed.

Copies of other reports including, but not limited to, monitoring reports, non-compliance reports filed by Licensee, geologic or seismic reports, and structural safety reports for facilities affecting to BLM land shall be submitted to BLM concurrently with submittal to the FERC, with the goal of providing the material to BLM no later than 90 days in advance of the annual meeting.

During the first several years of license implementation, it is likely that more consultation than just one annual meeting will be required, given the complexity of the project.

Condition No. 2 - Consultation Group Specific to the Merced Hydroelectric Project

The Licensee shall, within 3 months of license issuance, establish a Consultation Group under the following contexts:

Purpose:

The primary purpose of Consultation Group is to provide a forum for the Licensee to consult with resource agencies and other interested parties on the following:

- To the extent topics covered in Condition No. 1 affect project-affected areas outside BLM jurisdiction, consultation with appropriate resource agencies on those same topics will occur at the Annual Meeting, other Consultation Group meetings, or as otherwise agreed with the Licensee and appropriate resource agencies. Licensee shall provide copies of the meeting materials to those who request it.
- Plans that are developed as required by the new license and plans that require specific consultation processes during implementation.
- Proposed temporary or permanent modifications to license conditions.

Licensee shall also provide notification of license compliance deviations to the current members of the Consultation Group.

Decision Making:

The Consultation Group will make recommendations to BLM. The BLM shall be responsible for final decisions within BLM jurisdiction. Licensee shall also ensure that consultation, permitting, and any necessary approvals within the jurisdiction of other agencies are completed. Licensee shall implement license conditions as approved and directed by FERC.

Participation:

In addition to the Licensee, BLM, SWRCB, USFWS, NPS, NMFS, and CDFW, Consultation Group meetings shall be open to any organization or individual that notifies the Licensee in writing of interest in participating in the Annual Meeting or Consultation

Group meetings. The Consultation Group should establish mutually agreeable process guidelines for conducting effective and efficient meetings no later than 1 year after license issuance. Each organization or individual shall be responsible for providing notification information to the Licensee and shall be responsible for keeping current a single point of contact for purposes of notification related to the Consultation Group. If a participant is interested in a particular meeting or topic, the participant is responsible for ensuring they are represented.

Meetings:

Separate from the Annual Meeting, the Licensee shall organize four Consultation Group meetings per year. Additional meetings may be scheduled if the Consultation Group decides additional meetings are necessary. Fewer meetings shall also be scheduled if the Consultation Group decides that four meetings per year are not necessary.

Condition No. 3 – Annual Employee Training

Licensee shall, beginning in the first full calendar year after license issuance, annually perform employee awareness training, and shall also perform such training when a staff member is first assigned to the Project. The goal of the training shall be to familiarize Licensee's operations and maintenance (O&M) staff with special-status species, non-native invasive plants, and sensitive areas (e.g. special-status plant populations and non-native invasive plant locations) that are known to occur within or adjacent to the FERC Project Boundary. Licensee shall provide to each O&M staff a confidential map showing these sensitive areas including GPS coordinates, as well as pictures and other guides to assist staff in recognizing special-status species, non-native invasive plants, and sensitive areas. It is not the intent of this measure that Licensee's O&M staff performs surveys or become specialists in the identification of special-status species or noxious weeds. Licensee shall direct its O&M staff to avoid disturbance to sensitive areas, and to advise all Licensee contractors to avoid sensitive areas. If Licensee determines that disturbance of a sensitive area is unavoidable, Licensee shall consult with BLM to minimize adverse effects to sensitive resources. This measure applies to employee training that is not otherwise covered by a specific plan.

Condition No. 4 - Coordinated Operations Plan

Licensee shall, within 90 days after issuance of new licenses for the Merced River Hydroelectric Project (2179) or Merced Falls Hydroelectric Project (2467), whichever is later, file with FERC for approval a Coordinated Operations Plan. Licensee shall develop the Plan in consultation with the licensee for the Merced Falls Hydroelectric Project No. 2467 to assure implementation of flow-related measures in the two project licenses, and with, BLM, F&WS, CDFW, NPS, NMFS, and SWRCB as interested parties of the Project flow-related measures. The purpose of the Plan shall be to provide for

coordination between the Merced River Hydroelectric Project and Merced Falls Hydroelectric Project to assure implementation of flow-related measures in the two project licenses. Licensee shall file the Plan with the Commission, with copies provided to the above listed state and federal agencies. Licensee shall implement those portions of the Plan approved by the Commission.

Condition No. 5 – Erosion Control and Restoration Plan

Licensee shall develop an Erosion Control and Restoration Plan with BLM approval for erosion and/or restoration actions to be carried out by Licensee on or affecting BLM lands that are within or adjacent to the Project boundary. Licensee must acquire BLM approval before submitting this plan for Commission approval. Licensee shall file the approved plan with the Commission at least 90-days in advance of initiating construction of recreation or other Project facilities.

Condition No. 6 – Large Woody Debris Material Management Plan

Licensee shall, within one year after license issuance prepares a large Woody Material Management Plan after consultation with, and approval from, CDFW, BLM, USFWS, SWRCB, and NFMS. The plan shall: (1) address the location of LWM collection in Lakes McClure and McSwain; (2) describe potential options for moving the LWM collected in Lake McClure and Lake McSwain and depositing it downstream of Crocker-Huffman Diversion Dam; and (3) identify suitable locations in the Merced River downstream of Crocker-Huffman Diversion Dam where LWM can be placed within the active channel and be passively mobilized by 2-5 year high flow events, or where it would be appropriate to anchor LWM in the active channel and floodplain. BLM will not allow LWM to be stock piled on BLM land, especially in the Piney Creek Red legged Frog Core Area. BLM prefers the Licensee to pass through LWM past the dams over any other approach. Licensee must acquire CDFW, BLM, USFWS, SWRCB, and NFMS approval before submitting this plan for Commission approval. Licensee shall file the approved plan with the Commission. Licensee will implement the plan within 90 days of its approval by the Commission.

Condition No. 7 – Modifications of 4(e) Conditions in the Event of Anadromous Fish Re-introduction

BLM exercises its 4(e) authority by reserving that authority to modify these conditions to respond to any reintroduction of Chinook salmon or steelhead trout, listed under the Endangered Species Act, to stream reaches through BLM lands where the flow is controlled by the Merced River Hydroelectric Project.

Condition No. 8 –Aquatic Invasive Species Management and Monitoring Plan

Within one year of license issuance, Licensee shall develop an Aquatic Invasive Species (AIS) Plan that meets applicable State and Federal laws and regulations. The plan shall be subject to review and approval by BLM after Licensee consultation with CDFW, USFWS, and SWRCB. The applicable State and Federal resource agencies shall be responsible for making the determination as to whether the AIS Plan complies with the State and/or Federal regulations under the purview of the respective agencies. Once approved, Licensee will file the plan with FERC.

The AIS Plan shall initially address the following AIS: dreissenid mussels (*Dreissena bugensis* and *Dreissena polymorpha*); New Zealand mudsnail (*Potamopyrgus antipodarum*); Eurasian milfoil (*Myriophyllum spicatum*); Hydrilla (*Hydrilla verticillata*); didymo (*Didymosphenia reinata*), and Asian clam (*Corbicula fluminea*). However, other AIS may be identified through monitoring.

The AIS Plan shall include the following elements:

Public Education Program

The AIS Plan shall include a public education program, including appropriate signage and information pamphlets at designated public boat access sites on Lake McClure which include information about:

- Draining water from boat, motor, bilge, live well and bait containers before leaving a water access site. • Removing visible plants, animals and mud from boat before leaving water body.
- Cleaning and drying boats and fishing equipment using California Department of Fish and Wildlife (CDFW) accepted protocols for the prevention of all AIS before entering any water body area.
- Disposing of unwanted bait in trash, including earthworms.
- Avoiding the release of plants and animals into a water body unless they originally came from that water body.

AIS information shall be included on Project websites that provide public information on Project facilities. The public information website will also include information on the amphibian chytrid fungus.

Best Management Practices

The AIS Plan shall specify that Licensee is responsible for developing BMPs for individual Project O&M activities, performed by MERCED-ID and/or its contractors which have the potential to introduce AIS into a Project reservoir, that prevent the spread of AIS. Licensee shall submit them to BLM, SWRCB, USFWS, and CDFW for review at the Annual Consultation Meeting (Condition 1) required in the FERC license.

Development of BMPs for Project activities shall include, but are not be limited to, the following:

- List of AIS with potential to be introduced.
- Control or preventive measures for AIS.
- Identification of critical control points in the Project activity sequence at which to prevent the introduction of AIS.
- Any necessary implementation monitoring for potential AIS to ensure BMPs are followed.
- Actions that will be taken if an introduction of AIS is found.

If invasive aquatic species are detected within any reservoir, Licensee will consult with the appropriate agencies and institute an appropriate plan of action.

Monitoring and Reporting

The AIS Plan shall include a specific monitoring program that addresses Lake McClure reservoir and that follows State and/or Federal laws, regulations, and policies. The following initial monitoring methods shall be discussed in the monitoring section of the AIS Plan:

- Zebra and Quagga Mussel Surface Surveys
- Zebra and Quagga Mussel Veliger Sampling
- Zebra and Quagga Mussel Artificial Substrate Monitoring

Incidental Observations Monitoring

The AIS plan shall include Incidental Observations Monitoring requirements as follows: During AIS and other license-related aquatic monitoring in project reservoirs and project affected stream reaches (e.g., monitoring for fish, foothill yellow-legged frogs (*Rana boylei*), riparian habitat, and geomorphology), Licensee shall record incidental observations of the following species: Quagga or Zebra Mussel, New Zealand Mudsnail, Asian clam, Eurasian milfoil, Hydrilla, *Didymosphenia geminata*, and American bullfrog (*Lithobates catesbeianus*). This initial list may be revised if other potential AIS are identified in project-affected reservoirs and stream reaches. The following practices will be implemented:

- Field personnel performing the license-related aquatic monitoring will be trained in the identification of the species listed above.
- Field crews working in aquatic environments (reservoirs, creeks, or rivers) conducting other biological monitoring will complete a checklist data form at the end of each day indicating the presence/absence (detect/non-detect) and location of the species listed above. It is recommended that at least one

field crew member make a full pass of the survey area each day focusing exclusively on the species on the checklist.

Mapping and monitoring results shall be provided to BLM, CDFW, and SWRCB.

Plan Revisions

Licensee, in consultation with BLM, CDFW, USFWS, and SWRCB shall review, update, and/or revise the AIS Plan, as determined necessary by BLM in consultation with CDFW, USFWS, and SWRCB, when substantial changes in the existing conditions occur. Additional monitoring may be part of any plan revisions. Changes or revisions to the Plan would be expected if AIS conditions change as a result of unforeseen circumstances, either from new or existing Project-related activities, the potential for new AIS to occur, from natural events, or if other regulatory or legal requirements are established. Changes in the existing conditions could include such things as new methods for the treatment of *Didymosphenia geminiata*. Licensee shall file with FERC any revised plan and include all relevant documentation of coordination/consultation with the BLM, CDFW, and SWRCB.

Condition No. 9 – Terrestrial Protection Measures

Vegetation and Non-Native Invasive Plant Management Plan

Upon the Commission approval, Licensee shall implement the Integrated Vegetation Management Plan.

Resource Objectives:

The following resource objectives are drawn from the BLM Sierra Resource Management Plan (RMP) and other relevant BLM regulations and documents (see References section).

Invasive Plant Objectives:

- Control invasive species using early detection, rapid response and prevention measures (USDI BLM 2008, Sierra RMP and ROD).
- Prevent, eliminate, and/or control undesired non-native vegetation or other invasive species using an Integrated Pest Management approach that combines biological, cultural, physical and chemical tools to minimize economic, health and environmental risks (USDI BLM 2008, Sierra RMP and ROD).
- Implement and meet national BLM policies consistent with the Partners against Weeds Initiative and Executive Order 13112 (USDI BLM 2008, Sierra RMP and ROD).

- The *Carlson-Foley Act of 1968* and the *Plant Protection Act of 2000* authorize and direct the BLM to manage noxious weeds and to coordinate with other Federal and state agencies in activities to eradicate, suppress, control, prevent, or retard the spread of any noxious weeds on Federal lands.
- The *Federal Noxious Weed Act of 1974* established and funded an undesirable plant management program, implemented cooperative agreements with state agencies, and established integrated management systems to control undesirable plant species.
- Executive Order 13112, *Invasive Species*, directs Federal agencies to prevent the introduction of invasive species and provide for their control, and to minimize the economic, ecological, and human health impacts that invasive species cause.
- The BLM has also produced national-level strategies for invasive species prevention and management. These include *Partners Against Weeds* (USDI BLM 1996), which outlines the actions BLM will take to develop and implement a comprehensive integrated weed management program; and *Pulling Together: National Strategy for Invasive Plant Management* (USDI BLM 1998), which illustrates the goals and objectives of a National invasive plant management plan (prevention, control and eradication).
- The Federal Interagency Committee for the Management of Noxious and Exotic Weeds is leading a national effort to develop and implement a *National Early Detection and Rapid Response System for Invasive Plants in the United States* (FICMNEW 2003). The primary long-term goals of the proposed system are to detect, report, and identify suspected new species of invasive plants in the United States.

General Vegetation Management Objectives:

- Conserve and restore oak woodland, conifer forest, chaparral, riparian, meadow, Central Valley wetland and grassland habitats to support long-term viability of native species, sensitive species and the associated natural diversity of these habitats (USDI BLM 2008, Sierra RMP and ROD).
- Vegetation management is implemented to ensure safe and effective operation of the Licensee's facilities by maintaining safe access to Project facilities including recreation facilities, protecting worker and public health and safety, and reducing fire hazards. It is BLM policy to reduce hazardous fuels to prevent catastrophic wildlife (USDI BLM 2008, Sierra RMP and ROD).

- The *Federal Land Policy and Management Act of 1976* (FLPMA) directs the BLM to manage public lands “in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resources, and archeological values.”

Condition No. 10 – Bald Eagle Management Plan

Licensee must acquire CDFW, BLM, USFWS, and SWRCB, approval before submitting this plan for Commission approval. Upon Commission approval, Licensee shall implement the Bald Eagle Management Plan, filed separately with the Commission.

Condition No. 11– Annual Review of Special-Status Species Lists and Assessment of New Species on Federal Land

Licensee shall consult with BLM within 3 months, after license issuance, and annually thereafter during the annual consultation meeting, to review the current list of special-status plant and wildlife species (species that are Federally Endangered or Threatened, Proposed Threatened or Endangered, BLM Sensitive, State Threatened or Endangered, State Species of Special Concern, and CDFW Fully Protected) that might occur on public land administered by BLM in the Project area that may be directly or indirectly affected by Project operations. When a species is added to one or more of the lists, BLM shall determine if the species, or un-surveyed suitable habitat for the species, is likely to occur on public land administered by BLM in or around the Project area. For any such newly added species, if BLM determines that the species is likely present on public land administered by BLM that may be directly or indirectly affected by the Project, Licensee shall develop and implement a study plan in consultation with BLM, and other appropriate agencies, to reasonably assess the effects of the Project on the species. Licensee shall prepare a report on the study, including objectives, methods, results, recommended resource measures where appropriate, and a schedule of implementation, and shall provide a draft of the final report to BLM and other appropriate agencies for review and approval. Licensee shall file the report, including evidence of consultation, with the Commission and shall implement those resource management measures required by the Commission.

If new occurrences of BLM special status plant or wildlife species as defined above are detected prior to or during ongoing construction, operation, or maintenance of the Project, Licensee shall immediately notify BLM. If BLM determines that the Project-related activities are adversely affecting BLM sensitive or watch list species, Licensee shall, in consultation with BLM, develop and implement appropriate protection measures.

If new occurrences of state or federally listed or proposed threatened or endangered species are detected prior to or during ongoing construction, operation, or maintenance of the Project, Licensee shall immediately notify BLM, FERC, and the relevant agency

(United States Fish and Wildlife Service or National Marine Fisheries Service) for consultation or conference in accordance with the Endangered Species Act. If state listed or fully protected species are affected, CDFW shall be notified.

The following resource objectives are drawn from the BLM Sierra Resource Management Plan (RMP) and other relevant BLM regulations and documents (see References section).

Threatened, Endangered, and Sensitive Plant Species Objectives:

- Ensure that proposed license conditions and recommended measures provide for well distributed, viable populations of special status species including threatened, endangered and BLM sensitive species, and are consistent with any applicable biological opinion issued under the federal or state Endangered Species Act (ESA). Ensure that proposed license conditions and recommended measures comply with BLM plans and policy.
- Ensure that actions authorized on BLM administered lands do not contribute to the need to list any sensitive plant species under the provisions of the ESA and to initiate proactive conservation measures that reduce or eliminate threats to BLM sensitive plant species to minimize their need for listing under ESA (USDI BLM 2012, Special Status Plant Management Manual).
- Conserve ESA-listed species and the ecosystems on which they depend and to the extent possible recover these species so that ESA protection is no longer needed (USDI BLM 2012, Special Status Plant Management Manual).
- Ensure that BLM activities affecting the habitat of federally listed plant species and BLM sensitive plant species are carried out in a manner consistent with the objectives for managing those species (USDI BLM 2012, Special Status Plant Management Manual).
- Monitor populations and habitats of federally listed and BLM sensitive plant species to determine whether management objectives are being met (USDI BLM 2012, Special Status Plant Management Manual).
- Develop site-specific management objectives for each occurrence of listed threatened and endangered plant species and BLM sensitive plant species on BLM lands that will be affected by BLM actions (USDI BLM 2012, Special Status Plant Management Manual).

- Modify proposed actions, to the extent possible, to avoid adverse impacts to special status plant species; where avoidance is not possible, develop measures to mitigate impacts to these species (USDI BLM 2012, Special Status Plant Management Manual).
- Conduct inventories to determine the occurrence and status of all special status plant species on lands managed by BLM or affected by BLM actions to ensure compliance with NEPA and the ESA by having sufficient information to adequately assess the effects of proposed actions on special status plants. Inventories are to be conducted at the time of year when such plant species can be found and positively identified (USDI BLM 2012, Special Status Plant Management Manual).

Condition No. 12 – Bat Management

In the first full calendar year after license issuance, Licensee shall inspect and document all known bat roosts within Project buildings (e.g., powerhouses, storage buildings, valve houses), dams, or other structures that may be used as a roosting structure. The results of the inspection will be provided to CDFW and BLM if the facility is located on BLM lands, at least 90 days prior to the Annual Consultation Meeting (described in Condition No. 1) that follows collection of the information. If bats or signs of roosting are present where staff have a routine presence (i.e., at least daily or weekly), Licensee will attempt, where feasible, and in the calendar year following the Annual Consultation Meeting described above, to place humane exclusion devices to prevent occupation of the structure by bats. Humane exclusion devices will be placed when bats are absent from the facility, generally between November 1 and February 28. Prior to installation of the exclusion devices, Licensee shall perform an inspection of the facility to ensure that overwintering bats are not trapped. If overwintering bats are present during the inspection, installation of exclusion devices shall be delayed. Licensee shall notify CDFW and BLM of the overwintering bats. Licensee shall consult with the CDFW and BLM during the Annual Consultation Meeting to identify future dates that would be suitable for installation of humane exclusion devices. All exclusion devices will be inspected on an annual basis and the facility will be reevaluated for roosting bats every 3 years after the initial exclusion devices are installed to insure that no new roosts or entry points have been established.

Bat Objectives:

- Ensure all management activities and BLM authorizations are consistent with the conservation needs for special status species (USDI BLM 2008, Sierra RMP and ROD).
- Maintain or improve habitat for special status species (USDI BLM 2008, Sierra RMP and ROD).

- Maintain, improve, or enhance native fish and wildlife populations and the ecosystems upon which they depend (USDI BLM 2008, Sierra RMP and ROD).
- Ensure all management activities and BLM authorizations are consistent with the conservation needs for special status species (USDI BLM 2008, Sierra RMP and ROD).
- Promote the recovery of listed species and improve the status of candidate and special status species to eliminate the need to officially list these species (USDI BLM 2008, Sierra RMP and ROD).
- During FERC relicensing maintain and improve meadow and wetland habitat, riparian, and aquatic habitat for all life stages of native fish, macroinvertebrates, other aquatic species, and special status species (USDI BLM 2008, Sierra RMP and ROD).
- To initiate proactive conservation measures that reduces or eliminates threats to Bureau sensitive species to minimize the likelihood of and need for listing of these species under the ESA (USDI BLM 2008, Special Status Species Management Manual).
- Because of the wide-spread decrease in bat numbers and increasing loss of habitat, BLM Folsom management approach will be an effort to protect all species of bats and their habitats. Conservation of bat roosting and foraging habitats is important to consider when conserving bats on BLM land. Habitats include specific roost and foraging requirements which vary by species, as well as by season and reproductive status.
- To sustain and manage viable populations of these bat species by managing factors affecting the distribution, abundance and quality of habitat for these species, and by minimizing adverse impacts to these species.

Condition No. 13 - Red Legged Frog Management Plan for Piney Creek Core Area.

Licensee must acquire CDFW, BLM, USFWS, and SWRCB, approval before submitting this plan for Commission approval. Upon Commission approval, Licensee shall implement the Red Legged Frog Management Plan for Piney Creek Core Area.

California Red-legged Frog Objectives:

- Ensure all management activities and BLM authorizations are consistent with the conservation needs for special status species (USDI BLM 2008, Sierra RMP and ROD).
- Maintain or improve habitat for special status species (USDI BLM 2008, Sierra RMP and ROD).

- Maintain, improve, or enhance native fish and wildlife populations and the ecosystems upon which they depend (USDI BLM 2008, Sierra RMP and ROD).
- Maintain or improve numbers of native fish, macroinvertebrates and other aquatic species (USDI BLM 2008, Sierra RMP and ROD).
- Prevent and control infestations of non-native species that negatively impact native and game species (USDI BLM 2008, Sierra RMP and ROD).
- Ensure all management activities and BLM authorizations are consistent with the conservation needs for special status species (USDI BLM 2008, Sierra RMP and ROD).
- Manage special status species habitat to assist in the recovery of listed species (USDI BLM 2008, Sierra RMP and ROD).
- Restore and maintain the ecological health of watersheds and aquatic ecosystems on BLM lands and, to the extent possible, partner with other landowners and stakeholders to coordinate restoration efforts across watersheds (USDI BLM 2008, Sierra RMP and ROD).
- Promote the recovery of listed species and improve the status of candidate and special status species to eliminate the need to officially list these species (USDI BLM 2008, Sierra RMP and ROD).
- Restore disturbed or altered habitat for all life stages of native wildlife species, aquatic species, macroinvertebrates, special status species, and native fish species, including spawning fish passage habitat (USDI BLM 2008, Sierra RMP and ROD).
- During FERC relicensing maintain and improve meadow and wetland habitat, riparian, and aquatic habitat for all life stages of native fish, macroinvertebrates, other aquatic species, and special status species (USDI BLM 2008, Sierra RMP and ROD).
- To conserve listed species and the ecosystems on which they depend (USDI BLM 2008, Special Status Species Management Manual).
- Determine, to the extent practicable, the occurrence, distribution, population dynamics and habitat condition of all listed species on lands administered by BLM, and evaluate the significance of lands administered by BLM in the conservation of those species (USDI BLM 2008, Special Status Species Management Manual).
- Develop and implement management plans and programs that will conserve listed species and their habitats (USDI BLM 2008, Special Status Species Management Manual).

- Ensure that all activities affecting the populations and habitats of listed species are designed to be consistent with recovery needs and objectives (USDI BLM 2008, Special Status Species Management Manual).
- To sustain and manage viable populations of the California red-legged frog and foothill yellow-legged frog in the planning area. Stabilize and manage the California redlegged frog population at Spivey Pond. Repatriate the California red-legged frog to suitable habitat on BLM lands (USDI BLM 2008, Sierra RMP and ROD).

Prioritized Goal(s) for above objective (Partial list as related to California red-legged frog and potentially applicable to this relicensing) (USDI BLM 2008, Sierra RMP and ROD).

- Identify sites where deleterious non-native predators are present. Prioritize where control efforts should take place.
- For all known occurrences of the California red-legged frog on BLM land, control/eliminate deleterious non-native species/predators (plants, vertebrates) using methods that are determined to be the most effective.
- Within watersheds, identify suitable habitat that includes a mosaic of breeding habitat interspersed with a matrix of barrier free dispersal habitat. For the California red-legged frog, this is optimally in the form of pond complexes.

Condition No.14 - Foothill Yellow-Legged Frog Management Plan

Licensee must acquire CDFW, BLM, USFWS, and SWRCB, approval before submitting this plan for Commission approval. Upon Commission approval, Licensee shall implement the Foothill Yellow-legged Frog Management Plan within 3 years of license issuance. At a minimum, the temperature plan shall include the following locations: Located at the confluence of Sherlock Creek and the Merced River Frequency: Once in each water year type for first 10 years. Once every 5 years after the first ten years.

Foothill Yellow-Legged Frog Objectives:

- Ensure all management activities and BLM authorizations are consistent with the conservation needs for special status species (USDI BLM 2008, Sierra RMP and ROD).
- Maintain or improve habitat for special status species (USDI BLM 2008, Sierra RMP and ROD).
- Maintain, improve, or enhance native fish and wildlife populations and the ecosystems upon which they depend (USDI BLM 2008, Sierra RMP and ROD).

- Restore disturbed or altered habitat for all life stages of native wildlife species, aquatic species, macroinvertebrates, special status species, and native fish species, including spawning fish passage habitat (USDI BLM 2008, Sierra RMP and ROD).
- Maintain or improve numbers of native fish, macroinvertebrates and other aquatic species (USDI BLM 2008, Sierra RMP and ROD).
- Restore and maintain the ecological health of watersheds and aquatic ecosystems on BLM lands and, to the extent possible, partner with other landowners and stakeholders to coordinate restoration efforts across watersheds (USDI BLM 2008, Sierra RMP and ROD).
- Ensure all management activities and BLM authorizations are consistent with the conservation needs for special status species (USDI BLM 2008, Sierra RMP and ROD).
- Promote the recovery of listed species and improve the status of candidate and special status species to eliminate the need to officially list these species (USDI BLM 2008, Sierra RMP and ROD).
- During FERC relicensing maintain and improve meadow and wetland habitat, riparian, and aquatic habitat for all life stages of native fish, macroinvertebrates, other aquatic species, and special status species (USDI BLM 2008, Sierra RMP and ROD).
- To initiate proactive conservation measures that reduces or eliminates threats to Bureau sensitive species to minimize the likelihood of and need for listing of these species under the ESA (USDI BLM 2008, Special Status Species Management Manual).
- To sustain and manage viable populations of the California red-legged frog and foothill yellow-legged frog in the planning area. Stabilize and manage the California redlegged frog population at Spivey Pond. Repatriate the California red-legged frog to suitable habitat on BLM lands (USDI BLM 2008, Sierra RMP and ROD).

Condition No. 15 - Limestone Salamander Sensitive Areas Management Plan and Studies:

Licensee must acquire BLM approval before submitting this plan for Commission approval. Upon Commission approval, Licensee shall implement the Limestone Salamander Sensitive Areas Management Plan and studies. Licensee shall perform limestone salamander studies to determine if the population is on the increase or in decline once every seven years beginning in year one of license issuance will conduct this study once every 7 years beginning in year one of license issuance.

Limestone Salamander Sensitive Areas Management Plan and Studies Objectives:

- Ensure all management activities and BLM authorizations are consistent with the conservation needs for special status species (USDI BLM 2008, Sierra RMP and ROD).
- Maintain or improve habitat for special status species (USDI BLM 2008, Sierra RMP and ROD). • Maintain, improve, or enhance native fish and wildlife populations and the ecosystems upon which they depend (USDI BLM 2008, Sierra RMP and ROD).
- Provide opportunities for research and education (USDI BLM 2008, Sierra RMP and ROD).
- Maintain or improve habitat for special status species (USDI BLM 2008, Sierra RMP and ROD).
- Promote the recovery of listed species and improve the status of candidate and special status species to eliminate the need to officially list these species (USDI BLM 2008, Sierra RMP and ROD).
- To initiate proactive conservation measures that reduces or eliminates threats to Bureau sensitive species to minimize the likelihood of and need for listing of these species under the ESA (USDI BLM 2008, Special Status Species Management Manual).
- Prevent all surface-disturbing activities which would alter or degrade confirmed or potential limestone salamander habitat on BLM lands (USDI BLM 2008, Sierra RMP and ROD).
- Maintain vegetative cover in the Area of Critical Environmental Concern (ACEC) within specification outlined in the *Management Plan for the Limestone Salamander Area of Critical Environmental Concern* (ACEC Management Plan) (Lehman 1989). (USDI BLM 2008, Sierra RMP and ROD).
- Identify additional limestone salamander occurrences and consolidate BLM holdings within the species' range. Adjust ACEC boundaries as necessary to increase habitat protection (USDI BLM 2008, Sierra RMP and ROD).
- Promote public use of the Limestone Salamander ACEC which is compatible with general wildland management goals and which does not conflict with the limestone salamander's habitat needs. Integrate management of the ACEC with other BLM programs in the Merced River corridor to meet this objective (USDI BLM 2008, Sierra RMP and ROD).

Prioritized Goal(s) for above objective (Partial list as related to limestone salamander and potentially applicable to this relicensing) (USDI BLM 2008, Sierra RMP and ROD).

Inventory all suitable but unconfirmed habitats on BLM lands for the presence of limestone salamanders.

Condition No.16-Western Pond Turtle Incidental Observations Monitoring

Licensee shall perform incidental observations for Western Pond Turtle as follows:

- Crews need to be trained on identification of Western Pond Turtle.
- Record any incidental sightings of Western Pond Turtles during all monitoring field work in rivers and lakes/reservoirs.
- Data shall include location, GPS if available, or location shown on USGS map.
- A written report (including location data) shall be compiled annually and provided at Annual Consultation meeting.
- The report shall be filed with FERC.

Western Pond Turtle Objectives:

- Ensure all management activities and BLM authorizations are consistent with the conservation needs for special status species (USDI BLM 2008, Sierra RMP and ROD).
- Maintain or improve habitat for special status species (USDI BLM 2008, Sierra RMP and ROD).
- To initiate proactive conservation measures that reduces or eliminates threats to Bureau sensitive species to minimize the likelihood of and need for listing of these species under the ESA (USDI BLM 2001, Special Status Species Management Manual).

Condition No. 17 - Riparian Vegetation Monitoring Plan

Licensee must acquire BLM, CDFW, USFWS, and SWRCB, approval before submitting this plan for Commission approval. Upon Commission approval, Licensee shall implement the Riparian Vegetation Monitoring Plan.

Riparian Vegetation Objectives:

- Conserve and restore oak woodland, conifer forest, chaparral, riparian, meadow, Central Valley wetland, and grassland habitats to support long-term viability of native bird species, sensitive species, and the associated natural diversity of these habitats.
- BLM's objectives during FERC relicensing include maintenance or improvement of the following (relevant RMP sections containing greater detail are in parentheses): Meadow and wetland habitat (2.4); riparian and

aquatic habitat for all life stages of native fish, macroinvertebrates, other aquatic species, and special status species (2.5).

- Ensure riparian/wetland vegetation and structure and associated stream channels and floodplains are functioning properly, achieving an advanced ecological status, or making significant progress toward these conditions.

Condition No. 18 – Licensee Contacts

The Licensee shall designate an individual as its liaison with BLM, whenever planning or construction of recreation facilities, other major Project improvements, or Project-related maintenance activities are taking place on BLM lands. The Licensee agrees to coordinate with BLM through this individual in contract review and work inspection.

Condition No. 19 – Annual Recreation Coordination Meeting

Each year during the term of the license, Licensee will arrange to meet with interested resource agencies – BLM at a minimum) for an Annual Recreation Coordination Meeting to discuss the measures needed to ensure use and management, public safety, and protection and utilization of the recreation facilities and resources. The date of the meeting will be mutually agreed to by Licensee and the resource agencies but in general will be held within the first 90 days of each calendar year. A detailed agenda will be provided to the resource agencies when the meeting date is proposed to assure that the appropriate parties are present.

The following will be discussed, at a minimum:

- Need for garbage collection based on the results of visitor surveys, evidence that wildlife is becoming habituated, and the status of garbage and litter left on site by users.
- Need for toilet facilities where dispersed camping is occurring will be discussed at least every 6 years (following submittal of Monitoring Report from the Recreation Facilities plan), and more frequently if warranted.
- Report on significant changes in sanitation issues and number and size of user created dispersed camping areas.
- Other O&M issues identified by BLM or Licensee.
- Schedule and invite BLM to the recreation resource impact field evaluations and facility condition assessment to be conducted on BLM lands.
- Significant issues raised by the public.

- Any Licensee proposal for new or increases in recreation fees on BLM lands to help cover the costs of recreation facility construction, operation, and maintenance, as allowed by FERC regulations, will be discussed for consideration and approval by BLM.
- Recreation use data that is available from Licensee or the BLM, which includes summary data, at a minimum; and, upon request, raw data.
- Licensee will provide BLM a copy of all documentation associated with FERC inspections of Project recreation facilities and use on BLM lands, including follow-up action taken by the Licensee.
- Status of recreation projects from the previous year, including rehabilitation of existing recreation facilities, the establishment of new recreation facilities, and any other recreation measures or programs that were implemented.
- Recreational use data that is available.
- List of the recreation facilities scheduled for rehabilitation and any other Plan measures or programs to be implemented, including
 - ☐ Logistical and coordination planning.
 - ☐ Implementation schedule
 - ☐ Coordination needs.
 - ☐ Permitting requirement.
 - ☐ Key resources that will need to be protected from potential impacts associated with the implementation of the scheduled recreation projects.
 - ☐ Potential adjustments in schedule.
- Licensee and the agencies will identify any coordination needed with other projects being implemented in the area. Permitting requirements, additional required environmental documentation and key resources that will need to be protected from potential impacts associated with the implementation of the scheduled recreation projects will be addressed. BLM must approve any revisions to the Project's Recreation Facilities Plan schedule when BLM land is involved, and the revised schedule will be submitted to FERC. Within 60 days following the meeting, Licensee will file with FERC evidence of the meeting, which will summarize comments made by the agencies, and Plan revisions or other agreements that were reached by Licensee and the agencies. The Annual Recreation Coordination Meeting is a minimum requirement and it is anticipated that meetings may occur throughout each year as needed to implement the Recreation Facilities Plans.

Any adjustments in specific actions or schedules shall be approved by BLM and filed with FERC.

Condition No. 20 – Merced River Trail Conceptual Plans and Implementation

Licensee shall, within 18 months of license issuance and in conjunction with BLM, develop and file with the Commission an agreed upon Conceptual Plan for the Merced River Trail from McSwain Dam to Bagby Recreation Area. The overall planning goal will be to align the Merced River Trail to follow the shoreline of Lake McClure and McSwain Reservoirs where it is possible to do so. The Merced River Trail Conceptual Plan shall include the following:

- Introduction
- Table of Contents
- Table of Tables/Figures (Photos and maps)
- Executive Summary
- Vision Statement
- Purpose and Need
- Setting
- Discussion By Trail Alternative
- Implementation - The Merced River Trail Conceptual Plan will contain three levels of recommendations for trail segments – ‘priority,’ ‘potential,’ and ‘conceptual.’ Priority trail segments are those that have primary importance and a great deal of support and are relatively ‘ready’ to implement. Potential trail segments need a little more work before they could be taken to the implementation level. Conceptual trail segments are mostly placeholders – ideas that need further research before they are considered in planning processes.

Conclusion:

- The plan shall identify on Geographic Information System (GIS) maps using BLM approved GIS protocols at least three corridors, each approximately 100 feet wide, in which a pedestrian trail may be sited. Topographic mapping, satellite imagery and other planning tools that are available will be used in showing the locations of the three trail alternative routes and any features or issues relating to these proposed segments.

- For the purpose of the plan, Licensee shall assume the trail is 4-8 feet wide, made up of natural-surface material, has a maximum grade of 10%, with an understanding that in most areas the standard threshold of 5% or less will be the goal that Licensee will try to adhere to in designing the trail route alternatives. The Merced River Trail alignment does not need to be located within the existing FERC Project Boundary.
- The GIS maps shall show for each corridor: land ownership, elevation along the corridor centerline to approximately 2 foot horizontal resolution, streams, roads, key results from Licensee's relicensing studies (e.g., sensitive areas due to special-status plants and wildlife resources), and other pertinent features and information. Known cultural and ESA-listed resources will be included in the evaluation but will not be specifically identified on the GIS maps.
- Licensee shall include in the plan, for each alternative trail corridor, concept-level drawings for trailhead access points, typical trail sections, and any associated trail facilities (e.g., campsites, picnic areas, foot bridges, causeways and signs). The plan shall include, for each alternative trail corridor, a discussion of agency permitting/approval requirements and a conceptual level cost by major cost areas for completion of the entire trail. The plan will also evaluate soils, erosion issues, brush removal, trail clearing by machines, hand crews, etc...for each alternative.
- Licensee shall develop an operations and maintenance section for each proposed alternative trail corridor. Included in this section will be projected costs to maintain the trails, and facilities.
- Licensee will hold a public meeting annually for the first five years after the Plan is Approved by FERC, and again as needed to discuss trail related issues with stakeholders, BLM, and other agencies.

Licensee will develop an MOU with BLM to address issues related to the Merced River Trail that are outside the Project Boundary, including how to proceed in producing a Final Merced River Conceptual Trail Plan and producing a NEPA//CEQA document, funding and implementation.

Following the Merced Trail Conceptual Plan, Licensee shall provide a trail implementation proposal, which shall include Licensee's and BLM's agreed upon proposed alternative trail corridor, to BLM and interested parties for 90-day review and comment. BLM will allow Licensee 60 days to respond to its review. Licensee will file the agreed upon Final Merced Trail Conceptual Plan with the Commission. If agreement has not been reached by the licensee and BLM on a preferred route, Licensee will keep the Commission informed biannually of the current status. Once agreement has been reached, Licensee will file the agreed upon plan with the Commission.

- Funding for implementing the Merced River Trail Conceptual Plan will be the responsibility of both parties, the Licensee for their lands and federal lands within the FERC project boundary and for BLM on their lands outside of the FERC project boundary. Responsibilities for each party include the cost of permitting, design, construction, and maintenance for their respective lands and land management responsibilities. It is expected that most if not all of the funding will come from outside sources where both agencies and their partners are able to secure grant funding sources.

Condition No. 21 – Operation, Maintenance, and Administration Agreement

Beginning 90 days after license issuance, the licensee shall enter into an Operation and Maintenance Agreement to provide annual funding in a contributed funds account set up by BLM. The cost basis for these payments shall originate from the first year of payment. The cost shall be escalated annually based on the U.S. Gross Domestic Product – Implicit Price Deflator (GDP-IDP).

Condition No. 22 – Recreation Facilities Plan

Licensee must acquire BLM approval before submitting this plan for Commission approval. Upon Commission approval, Licensee shall implement the Recreation Facilities Plan.

Condition No. 23 – Close Off Illegal Off Road Vehicle Access at Piney Creek

Within one year of license issuance Licensee will:

- Identify and map where ORV roads are and where they enter public land.
- Determine if physical closure of these access roads is feasible
- Require physical closure of ORV roads where it is determined to be feasible
- If physical closure is not a viable solution, post signage that indicates that the area is closed to ORV use
- Provide law enforcement assistance in enforcing the closure Rationale for Closing off illegal Off Road Vehicle Access at Piney Creek is to prevent illegal ORV use on the project lands.

Condition No. 24– Historic Properties Management Plan

Licensee must acquire BLM approval before submitting this plan for Commission approval. Upon Commission approval, Licensee shall implement the Historic Properties Management Plan.

Condition No. 25 – Fire Prevention and Response Plan

Licensee must acquire approval before submitting this plan for Commission approval. Upon Commission approval, Licensee shall implement the Fire Management and Response Plan.

Condition No. 26 – Visual Resource Plan

Licensee must acquire BLM approval before submitting this plan for Commission approval. Upon Commission approval, Licensee shall implement the Visual Resource Plan. Although the Merced ID did address visual resource mitigation issues, Merced ID did not write a plan for this measure. BLM expects that a visual resource plan will need to be written to address the procedures Merced ID will go through when they are addressing visual resource impacts, from project proposals. In numerous other relicensing's Licensees are required to develop a Visual Resource Plan. In order to meet the Visual Resource Management (VRM) goals outlined in BLM's Sierra Resource Management Plan BLM will require a plan be developed that discusses the process and protocols and mitigating measures to be implemented to reduce visual resource impacts. BLM will work with Merced ID to complete this plan.

Preliminary 4(e) Administrative Conditions

The following Section 4(e) Conditions include requirements that serve to address the statutory and administrative rights and responsibilities of the BLM pursuant to Federal, State, and local laws.

Condition No. 27 – Approval of Changes

Notwithstanding any license authorization to make changes to the Project, when such changes directly affect BLM lands the Licensee shall obtain written approval from BLM prior to making any changes in any constructed Project features or facilities, or in the uses of Project lands and waters or any departure from the requirements of any approved exhibits filed with the Commission. Following receipt of such approval from BLM, and a minimum of 60 days prior to initiating any such changes, the Licensee shall file a report with the Commission describing the changes, the reasons for the changes, and showing the approval of BLM for such changes. The Licensee shall file an exact copy of this report with BLM at the same time it is filed with the Commission. This condition does not relieve the Licensee from the amendment or other requirements of Article 2 or Article 3 of this license.

Condition No. 28 – Maintenance of Improvements on or Affecting Bureau of Land Management Lands

The Licensee shall maintain all its improvements and premises on BLM lands to standards of repair, orderliness, neatness, sanitation, and safety acceptable to BLM. Disposal of all materials will be at an approved existing location, except as otherwise agreed to by BLM.

Condition No. 29 – Existing Claims

The license shall be subject to all valid claims and existing rights of third parties. The United States is not liable to the Licensee for the exercise of any such right or claim.

Condition No. 30 – Compliance with Regulations

The Licensee shall comply with the regulations of the Department of the Interior on BLM lands for activities on BLM lands, and all applicable Federal, State, county, and municipal laws, ordinances, or regulations in regards to the area or operations on or directly affecting BLM lands, to the extent those laws, ordinances or regulations are not preempted by federal law.

Condition No. 31– Surrender of License or Transfer of Ownership

Prior to any surrender of this license, the Licensee shall provide assurance acceptable to BLM that Licensee shall restore any Project area directly affecting BLM lands to a condition satisfactory to BLM upon or after surrender of the license, as appropriate. To the extent restoration is required, Licensee shall prepare a restoration plan which shall identify the measures to be taken to restore such BLM lands and shall include or identify adequate financial mechanisms to ensure performance of the restoration measures. In the event of any transfer of the license or sale of the Project, the Licensee shall assure that, in a manner satisfactory to BLM, the Licensee or transferee will provide for the costs of surrender and restoration. If deemed necessary by BLM to assist it in evaluating the Licensee's proposal, the Licensee shall conduct an analysis, using experts approved by BLM, to estimate the potential costs associated with surrender and restoration of any Project area directly affecting BLM lands to BLM specifications. In addition, BLM may require the Licensee to pay for an independent audit of the transferee to assist BLM in determining whether the transferee has the financial ability to fund the surrender and restoration work specified in the analysis.

Condition No. 32 – Protection of United States Property

The Licensee, including any agents or employees of the Licensee acting within the scope of their employment, shall exercise diligence in protecting from damage the land and property of the United States covered by and used in connection with this license.

Condition No. 33 - Indemnification

The Licensee shall indemnify, defend, and hold the United States harmless for:

- any violations incurred under any laws and regulations applicable to, or
- judgments, claims, penalties, fees, or demands assessed against the United States caused by, or
- costs, damages, and expenses incurred by the United States caused by, or
- the releases or threatened release of any solid waste, hazardous substances, pollutant, contaminant, or oil in any form in the environment related to the construction, maintenance, or operation of the Project works or of the works appurtenant or accessory thereto under the license.

The Licensee's indemnification of the United States shall include any loss by personal injury, loss of life or damage to property caused by the construction, maintenance, or operation of the Project works or of the works appurtenant or accessory thereto under the license. Indemnification shall include, but is not limited to, the value of resources damaged or destroyed; the costs of restoration, cleanup, or other mitigation; fire suppression or other types of abatement costs; third party claims and judgments; and all administrative, interest, and other legal costs. Upon surrender, transfer, or termination of the license, the Licensee's obligation to indemnify and hold harmless the United States shall survive for all valid claims for actions that occurred prior to such surrender, transfer or termination.

Condition No. 34 – Damage to Land, Property, and Interests of the United States

The Licensee has an affirmative duty to protect the land, property, and interests of the United States from damage arising from the Licensee's construction, maintenance, or operation of the Project works or the works appurtenant or accessory thereto under the license. The Licensee's liability for fire and other damages to BLM lands shall be determined in accordance with the Federal Power Act and standard Form L-1 Articles 22 and 24.

Condition No. 35 – Risks and Hazards on Bureau of Land Management Lands

As part of the occupancy and use of the Project area, the Licensee has a continuing responsibility to reasonably identify and report all known or observed hazardous conditions on or directly affecting BLM lands within the Project boundary that would affect the improvements, resources, or pose a risk of injury to individuals. Licensee will abate those conditions, except those caused by third parties or not related to the occupancy and use authorized by the License. Any non-emergency actions to abate such

hazards on BLM lands shall be performed after consultation with BLM. In emergency situations, the Licensee shall notify BLM of its actions as soon as possible, but not more than 48 hours, after such actions have been taken. Whether or not BLM is notified or provides consultation, the Licensee shall remain solely responsible for all abatement measures performed. Other hazards should be reported to the appropriate agency as soon as possible.

Condition No. 36 – Protection of Bureau of Land Management Special Status Species

Before taking actions to construct new Project features on BLM lands that was not addressed in the Commission’s NEPA processes for relicensing that may affect BLM threatened and endangered species or BLM special status species or their critical habitat, the Licensee shall prepare and submit a biological evaluation (BE) for BLM approval. The BE shall evaluate the potential impact of the action on the species or its habitat. In coordination with the Commission, BLM may require mitigation measures for the protection of the affected species. The biological evaluation shall:

- Include procedures to minimize adverse effects to threatened and endangered species and special status species and their critical habitat.
- Include information on the current status of the special-status species within the project area, a full description of the Project and potential effects, if BLM determines that existing information is out of date.
- Ensure project-related activities shall meet restrictions included in site management plans for threatened and endangered species and special-status species and their habitat.
- Develop implementation and effectiveness monitoring of measures taken or employed to reduce effects to special status species.

Condition No. 37 – Access

Subject to the limitations set forth under the heading of “Access By The United States” in Condition No.44 hereof, BLM reserves the right to use or permit others to use any part of the licensed area on BLM lands for any purpose, provided such use does not interfere with the rights and privileges authorized by this license or the Federal Power Act

Condition No. 38 – Crossings

The Licensee shall maintain suitable crossings as required by BLM for all roads and trails that intersect the right-of-way occupied by linear Project facilities (powerline, penstock, ditch, and pipeline).

Condition No. 39 – Surveys, Land Corners

The Licensee shall avoid disturbance to all public land survey monuments, private property corners, and forest boundary markers. In the event that any such land markers or monuments on BLM lands are destroyed by an act or omission of the Licensee, in connection with the use and/or occupancy authorized by this license, depending on the type of monument destroyed, the Licensee shall reestablish or reference same in accordance with (1) the procedures outlined in the "Manual of Instructions for the Survey of the Public Land of the United States," (2) the specifications of the County Surveyor, or (3) the specifications of BLM. Further, the Licensee shall ensure that any such official survey records affected are amended as provided by law.

Condition No. 40 – Pesticide-Use Restrictions on Bureau of Land Management Lands

Pesticides may not be used on BLM lands or in areas affecting BLM lands to control undesirable woody and herbaceous vegetation, aquatic plants, insects, rodents, non-native fish, etc., without the prior written approval of BLM. During the Annual Consultation Meeting described in Condition No. 1, the Licensee shall submit a request for approval of planned uses of pesticides for the upcoming year. The Licensee shall provide at a minimum the following information essential for review:

- whether pesticide applications are essential for use on BLM lands;
- specific locations of use;
- specific herbicides proposed for use;
- application rates;
- dose and exposure rates; and
- safety risk and timeframes for application.

Exceptions to this schedule may be allowed only when unexpected outbreaks of pests require control measures that were not anticipated at the time the report was submitted. In such an instance, an emergency request and approval may be made. Any pesticide use that is deemed necessary to use on BLM lands within 500 feet of known locations of Western Pond Turtles, Sierra Nevada Yellow-Legged Frog, Foothill Yellow Legged Frog, or known locations of BLM Special Status or culturally significant plant populations will be designed to avoid adverse effects to individuals and their habitats. Application of pesticides must be consistent with BLM riparian conservation objectives. On BLM lands, the Licensee shall only use those materials registered by the U.S. Environmental Protection Agency and consistent with those applied by BLM and approved through BLM review for the specific purpose planned. The Licensee must

strictly follow label instructions in the preparation and application of pesticides and disposal of excess materials and containers. The Licensee may also submit Pesticide Use Proposal(s) with accompanying risk assessment and other BLM required documents to use pesticides on a regular basis for the term of the license as addressed further in Condition No.10 – Terrestrial Protection Measures. Submission of this plan will not relieve the Licensee of the responsibility of annual notification and review.

Condition No. 41 – Modifications of 4(e) Conditions after Biological Opinion or Water Quality Certification

BLM exercises its 4(e) authority by reserving that authority to modify these conditions, if necessary, to respond to any Final Biological Opinion issued for this Project by the National Marine Fisheries Service, United States Fish and Wildlife Service; or any Certification issued for this Project by the State Water Resources Control Board.

Condition No. 42– Signs

The Licensee shall consult with BLM prior to erecting signs related to safety issues on BLM lands covered by the license. Prior to the Licensee erecting any other signs or advertising devices on BLM lands covered by the license, the Licensee must obtain the approval of BLM as to location, design, size, color, and message. The Licensee shall be responsible for maintaining all Licensee-erected signs to neat and presentable standards.

Condition No. 43 – Ground Disturbing Activities

If the Licensee proposes ground-disturbing activities on or directly affecting BLM lands that were not specifically addressed in the Commission’s NEPA processes, the Licensee, in consultation with BLM, shall determine the scope of work and potential for Project-related effects, and whether additional information is required to proceed with the planned activity. Upon BLM request, the Licensee shall enter into an agreement with BLM under which the Licensee shall fund a reasonable portion of BLM staff time and expenses for staff activities related to the proposed activities time and expenses for staff activities related to the proposed activities.

Condition No. 44 – Use of Bureau of Land Management Roads for Project Access

The Licensee shall obtain suitable authorization for all project access roads and BLM roads needed for Project access. The term of the permit shall be the same as the term of the license. The authorization shall require road maintenance and cost sharing in reconstruction commensurate with the Licensee’s use and project-related use. The authorization shall specify road maintenance and management standards that provide for traffic safety, minimize erosion, and damage to natural resources and that are acceptable

to BLM as appropriate. The Licensee shall pay BLM for its share of maintenance cost or perform maintenance or other agreed to services, as determined by BLM for all use of roads related to project operations, project-related public recreation, or related activities. The maintenance obligation of the Licensee shall be proportionate to total use and commensurate with its use. Any maintenance to be performed by the Licensee shall be authorized by and shall be performed in accordance with an approved maintenance plan and applicable BMPs. In the event a road requires maintenance, restoration, or reconstruction work to accommodate the Licensee's needs, the Licensee shall perform such work at its own expense after securing BLM authorization. The Licensee shall complete a condition survey and a proposed maintenance plan subject to BLM review and approval as appropriate once each year. The plan may take the format of a road maintenance agreement provided all the above conditions are met as well as the conditions set forth in the proposed agreement. In addition, all BLM roads used as Project Access roads (PAR) and Right-of-Way access roads (ROW) shall have:

- Current condition survey.
- Be mapped at a scale to allow identification of specific routes or segments.
- BLM assigned road numbers are used for reference on the maps, tables, and in the field.
- GIS compatible files of GPS alignments of all roads used for Project access are provided to BLM.
- Adequate signage is installed and maintained by the Licensee at each road or route, identifying the road by BLM road number.

Condition No. 45 – Access by the United States

The United States shall have unrestricted use of any road over which the Licensee has control within the project area for all purposes deemed necessary and desirable in connection with the protection, administration, management, and utilization of Federal lands or resources. When needed for the protection, administration, and management of Federal lands or resources the United States shall have the right to extend rights and privileges for use of the right-of-way and road thereon to States and local subdivisions thereof, as well as to other users. The United States shall control such use so as not to unreasonably interfere with the safety or security uses, or cause the Licensee to bear a share of costs disproportionate to the Licensee's use in comparison to the use of the road by others.

Condition No. 46 – Road Use

The Licensee shall confine all vehicles being used for project purposes, including but not limited to administrative and transportation vehicles and construction and inspection

equipment, to roads or specifically designed access routes, as identified in the Transportation System Management Plan (Condition No.23). BLM, as appropriate, reserves the right to close any and all such routes where damage is occurring to the soil or vegetation, or, if requested by Licensee, to require construction/construction by the Licensee to the extent needed to accommodate the Licensee's use. BLM agrees to provide notice to the Licensee and the Commission prior to road closures, except in an emergency, in which case notice will be provided as soon as practicable.

Condition No. 47 – Bureau of Land Management Approval of Final Design

Before any new construction of the Project occurs on Bureau of Land Management lands, the Licensee shall obtain prior written approval of BLM for all final design plans for Project components, which BLM deems as affecting or potentially affecting Bureau of Land Management lands within the Project boundary. The Licensee shall follow the schedules and procedures for design review and approval specified in the conditions herein. As part of such written approval, BLM may require adjustments to the final plans and facility locations to preclude or mitigate impacts and to insure that the Project is either compatible with on-the-ground conditions or approved by BLM based on agreed upon compensation or mitigation measures to address compatibility issues. Should such necessary adjustments be deemed by BLM, FERC, or the Licensee to be a substantial change, the Licensee shall follow the procedures of FERC Standard Article 2 of the license. Any changes to the license made for any reason pursuant to FERC Standard Article 2 or Article 3 shall be made subject to any new terms and conditions of the Secretary of Interior made pursuant to Section 4(e) of the Federal Power Act to address Project effects within the Project boundary.

Condition No. 48 – Unattended Construction Equipment

The Licensee shall not place construction equipment on BLM lands prior to actual use or allow it to remain on BLM lands subsequent to actual use, except for a reasonable mobilization and demobilization period agreed to by BLM.

Condition No. 49 – Maintenance of Improvements

The Licensee shall maintain the improvements and premises on BLM lands within the Project boundary and Licensee adjoining property to standards of repair, orderliness, neatness, sanitation, and safety. For example, trash, debris, and unusable machinery will be disposed of separately; other materials will be stacked, stored neatly, or placed within buildings. Disposal will be at an approved existing location, except as otherwise agreed to by BLM.

Condition No. 50 - Construction Inspections

Within 60 days of planned ground-disturbing activity on or affecting BLM lands, Licensee shall file with the Commission a Safety during Construction Plan that identifies potential hazard areas and measures necessary to address public safety. Areas to consider include construction activities near public roads, trails, and recreation areas and facilities. Licensee shall perform daily (or on a schedule otherwise agreed to by BLM in writing) inspections of Licensee's construction operations on BLM lands and Licensee adjoining property while construction is in progress. Licensee shall document these inspections (informal writing sufficient) and shall deliver such documentation to BLM on a schedule agreed to by BLM. The inspections must specifically include fire plan compliance, public safety, and environmental protection. Licensee shall act immediately to correct any items found to need correction. A registered professional engineer or other qualified employee of the appropriate specialty shall regularly conduct construction inspections of structural improvements on a schedule approved by BLM.

APPENDIX E

Preliminary Water Quality Certification Conditions for the Merced River Hydroelectric Project

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1. Merced River Anadromous Fish Committee:

Within 3 months of license issuance, Merced Irrigation District (MID or Licensee) shall organize and host a meeting and all future meetings with the Merced River Anadromous Fish Committee (Committee). The Committee shall be comprised of one representative from MID, Pacific Gas and Electric Company (PG&E), National Marine Fisheries Service (NMFS), US Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife (CDRN), State Water Board, and a non-governmental organization. Committee members shall be selected by the organizations represented.

2. Minimum Instream Flow

State Water Board staff reserve the right to condition the Project with minimum instream flows in light of the whole record. The whole record includes but is not limited to the FERC record (i.e., recommendation by the resource agencies) the final NEPA document, and the final CEQA document.

3. Consultation Regarding New Ground Disturbing Activities

For any activity not addressed in the National Environmental Policy Act (NEPA) or California Environmental Quality Act (CEQA) or water quality certification documents, that may adversely affect water quality, the Licensee shall consult with the relevant resource agencies to determine if supplemental NEPA or CEQA documents are required and/or a water quality certification amendment.

4. Gravel Augmentation Plan

Within one year of license issuance, MID shall submit the Gravel Augmentation Plan to the Deputy Director. MID shall create the Gravel Augmentation Plan in consultation with the Committee. The amount of gravel augmented shall be consistent with annual gravel amount trapped behind New Exchequer and McSwain.

5. Bald and Golden Eagle Plan

Within one year of license issuance MID shall submit the Bald and Golden Eagle Monitoring Plan (Eagle Plan) to the Deputy Director. The Eagle Plans shall that include protective measures when nesting is identified. MID shall create the Eagle Plan in consultation with USFWS, and CDFW.

The Eagle Plan shall:

- A. Be consistent with the most current USFWS National Bald Eagle Management Guidelines;
- B. Include a statement of the goals and objectives;
- C. Include a description of the proposed monitoring protocol(s);
- D. Include specific, measureable criteria that will be used in combination with monitoring data and the comprehensive list of factors to objectively evaluate if

the goals and objectives of the Eagle Plan are being met or the Project may be adversely affecting eagles and/or eagle nests;

- E. Include a detailed monitoring and reporting schedule;
- F. Include a plan for the development of corrective measures and a timetable for action in cases when the Eagle Plan's goals and objectives are not being achieved or data indicate the Project may be impacting eagles and/or eagle nests;

and

At a minimum monitoring shall include:

- G. One breeding and one wintering survey every three years beginning within three years of license issuance;
- H. Monitoring surveys within 30 days prior to any activity in the Project area listed or similar to the listed activities in the USFWS National Bald Eagle Management Guidelines; and
- I. Include documentation of any eagle or eagle nest discovered during monitoring as well as any incidental eagle or eagle nest observations.

Within 60 days of the conclusion of the monitoring, MID shall submit the results of the monitoring data with a description of location of eagle(s) or nest(s), date(s) of discovery, timeframe(s) of monitoring and protective measure implementation. Monitoring reports shall also include recommendations for more frequent monitoring based on increased use of the Project area by eagles, changes in Project operation and management activities, information derived from other resource studies or the state or federal resource agencies, and updates to be consistent with updates to the USFWS National Bald Eagle Management Guidelines.

If monitoring or incidental (other) reports confirm the presence of an eagle(s) or eagle nest(s) in the Project area, protective measures must be implement prior to any Project-associated activity.

6. Vernal Pool Fairy Shrimp and Conservation Fairy Shrimp Monitoring and Conservation Plan (Shrimp Plan)

Within one year of license issuance, MID shall submit a Shrimp Monitoring and Conservation Plan (Shrimp Plan) to the Deputy Director. MID shall create the Shrimp Plan in consultation with the Committee. The Shrimp Plan shall include monitoring Vernal Pool Fairy Shrimp and Conservation fairy Shrimp and their habitat on the Merced River, Deadman Slough, and associated tributaries. Monitoring shall be conducted for the first four consecutive years.

After the fourth year, MID shall monitor every three years and prior to construction, or any ground disturbing maintenance or exploration activity. The Shrimp Plan shall include monitoring so that pesticides (pesticides, as defined by

the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins (Basin Plan)) will not be applied where the pesticide may reach shrimp or their habitat.

The Shrimp Plan shall include, at a minimum:

- A. A statement of goals and objectives;
- B. A description of proposed monitoring protocols;
- C. A comprehensive description of factors that may adversely affect Vernal Pool or Conservation Fairy Shrimp. This description shall also identify whether the factors are associated with the Project's operation;
- D. A detailed monitoring and reporting schedule;
- E. Protective measures; and
- F. A Plan for corrective measures and a timetable for implementation if data indicate that the Project may be impacting Vernal Pool and/or Conservation Fairy Shrimp or their habitat.

7. Tiger Salamander Monitoring and Conservation Plan

Pesticide use and recreation construction may adversely impact Tiger Salamander. Monitoring, documentation, and avoidance of Tiger Salamanders and their habitat are crucial to avoid adversely impacting Tiger Salamanders. Within one year after license issuance, MID shall submit the Tiger Salamander Monitoring and Conservation Plan (Tiger Plan) to the Deputy Director. MID shall create the Tiger Plan in consultation with the Committee.

The Tiger Plan shall include, at a minimum:

- A. A statement of goals and objectives;
- B. A description of proposed monitoring protocols;
- C. A comprehensive description of factors that may adversely affect Tiger Salamanders. This description shall also identify whether the factors are associated with the Project's operation;
- D. A detailed monitoring and reporting schedule;
- E. Protective measures; and
- F. A Plan for corrective measures and a timetable for implementation if data indicate that the Project may be impacting Tiger Salamanders or their habitat.

8. Fish Passage or Habitat Restoration Plan

Within one year after license issuance, MID shall submit the Fish Passage or Habitat Restoration Plan to the Deputy Director. MID shall evaluate, develop, and implement a fish passage or habitat restoration plan that will result in passage over Crocker-Huffman, McSwain Dam, and New Exchequer or decreasing

temperatures in and downstream of the Project. The Fish Passage or Habitat Restoration Plan shall be created in consultation with the Committee. MID shall submit the Fish Passage or Habitat Restoration Plan to the Deputy Director within one year of License issuance. Within three years of license issuance, MID shall implement Fish passage or Habitat Restoration Plan.

9. Drought Plan

Within one year after license issuance, MID shall submit the Drought Plan to the Deputy Director. Drought Plan shall provide overarching guidance for operations during an emergency drought and/or multiple critically dry years and shall be created in consultation with the Committee. The Drought Plan shall include FERC License or water quality certification (WQC) variances that MID may request.

10. California Red-legged Frog (CRLF), Foothill Yellow-legged Frog (FYLF), and Western Spadefoot Monitoring and Conservation Plan (Frog Plan)

Within one year of license issuance, MID shall file a Frog Plan with the Deputy Director. MID shall create the Frog Plan in consultation with the Committee. The Frog Plan shall include monitoring CRLF, FYLF, and Western Spadefoot egg masses, tadpoles and adults on the Merced River, Deadman Slough (if appropriate), and associated tributaries. Monitoring shall be conducted no later than the first spring following approval of the Frog plan by the Deputy Director. Monitoring egg masses, tadpoles, and adults will be required for the first three consecutive years. After the fourth year, MID shall monitor every three years:

The Frog Plan shall include, at a minimum:

- A. A statement of goals and objectives;
- B. A description of proposed monitoring protocols;
- C. A comprehensive description of factors that may adversely affect CRLF, FYLF, and Western Spadefoot. This description shall also identify whether the factors are associated with the Project's operation;
- D. Monitoring water temperature where eggs and tad poles are found;
- E. A detailed monitoring and reporting schedule;
- F. Protective measures; and
- G. A Plan for corrective measures and a timetable for implementation if data indicate that the Project may be impacting CRLF, FYLF, or Western Spadefoot.

11. Valley Elderberry Longhorn Beetle Monitoring and Conservation Plan

Within one year of license issuance, MID shall submit the Shrimp Plan with the Deputy Director. MID shall create the Valley Elderberry Longhorn Beetle (VELB) Plan in consultation with the Committee. The VELB Plan shall include monitoring

of VELB and their habitat on the Merced River, Deadman Slough (if appropriate), and associated tributaries. Monitoring shall be conducted prior to construction and every three years.

The VELB Plan, shall at a minimum include:

- A. A statement of goals and objectives;
- B. A description of proposed monitoring protocols;
- C. A comprehensive description of factors that may adversely affect VELB. This description shall also identify whether the factors are associated with the Project's operation.
- D. A detailed monitoring and reporting schedule;
- E. A Plan for corrective measures and a timetable for implementation if data indicate that the Project may be impacting VELB or their habitat; and
- F. Protective measures.

12. Annual Consultation

MID shall annually consult with BLM, the Committee, and the Park Service, regarding measures needed to ensure protections. The date of the Annual Consultation shall be mutually agreed to by BLM, Park Service, and the Committee. MID shall still provide notice to tribes and interested parties.

At the Annual consult meeting, MID shall at a minimum present the following:

- A. A status report regarding implementation of license conditions;
- B. Results of any studies performed over the previous year in formats agreed to by MID and agencies consulted with during the development of the study plan;
- C. Review of any non-routine maintenance;
- D. Discussion of any necessary revisions or modifications to resource plans included in the license;
- E. Discussion of needed protection measures for species newly listed as threatened, endangered, or special-status or, changes to existing management plans that may no longer be warranted due to de-listing of species or, to incorporate new knowledge about a species requiring protections; and
- F. Discussion of elements of current year operations and maintenance plans in the Project Area.

A record of the meeting shall be kept by MID and shall include any recommendations made by BLM and the Committee.

13. Annual Review of Endangered Species Act Lists and Special Status Species Lists, and Assessment of New Species

MID shall consult with BLM, the Park Service, and the Committee within 3 months after license issuance, and annually every for the term of the license and any annual extension. At the annual meeting, participants will review the current list of threatened and endangered species and special status plant and wildlife species that may be adversely impacted by the Project. When a species is added to one or more of the lists, MID, in consultation with BLM, Park Service, and the Committee shall determine if the species may be adversely affected by the Project. If it is determined that the species may be adversely affected by the Project, MID shall develop and implement a new species specific study plan. The study plan shall be created in consultation with BLM and other appropriate agencies to assess the effects of the Project on the species.

Each species specific study plans, shall at a minimum include:

- A. A statement of goals and objectives;
- B. A description of proposed monitoring protocols;
- C. A comprehensive description of factors that may adversely affect VELB. This description shall also identify whether the factors are associated with the Project's operation.
- D. A detailed monitoring and reporting schedule;
- E. A Plan for corrective measures and a timetable for implementation if data indicate that the Project may be impacting the newly listed specific species or their habitat; and
- F. Protective measures.

MID shall implement and prepare a report on the study including objectives, methods, results, recommended measures where appropriate, and a schedule of implementation.

14. Large Woody Materials Plan

Within one year after license issuance, shall submit the Large Woody Materials Management Plan (LWM Plan) to the Deputy Director. MID shall create the LWM Plan in consultation with the Committee.

15. Lake McClure Minimum Pool

Minimum instream flow increases will correspond to decreased water temperatures downstream of Lake McClure; as such an increase to the minimum pool requirement of Lake McClure may also be needed to achieve decreased water temperatures. State Water Board staff reserves the right to require a new value for the minimum pool requirement in Lake McClure in light of the whole record. The whole record includes but is not limited to the FERC record (i.e., recommendation by the resource agencies), the final NEPA document, and the final CEQA document.

16. Lake McClure and McSwain Reservoir Fish Stocking

Within 3 months of license issuance MID shall submit the Lake McClure and McSwain Reservoir Fish Stocking Plan (Fish Stocking Plan). MID shall create the Fish Stocking Plan in consultation with the Committee. Beginning the first year after license issuance MID shall annually stock fish in Lake McClure and McSwain Reservoir with a minimum of:

Lake McClure

1) 32,000 to 70,000 of catchable sized fish; and 2) 39,000 to 95,000 fingerings.

McSwain Reservoir

1) 1,000 to 2,000 catchable-sized rainbow trout

Fish stocked shall only be native cold water species. MID shall only stock fish from facilities free of invasive species and that provide documentation of monitoring and testing that fish source facility and equipment is free of invasive species.

17. Aquatic Invasive Species Management Plan

Within one year of license issuance, MID shall submit the Aquatic Invasive Species Management Plan to the Deputy Director. MID shall create the Aquatic Invasive Species Plan in consultation with CDFW. MID shall include monitoring and corrective action steps as part of the Aquatic Invasive Species Management Plan.

The Aquatic Invasive Species Management Plan shall at a minimum include:

- A. A statement of goals and objectives;
- B. A description of proposed monitoring protocols;
- C. A detailed monitoring and reporting schedule;
- D. A Plan for corrective measures and a timetable for implementation if data indicate presence of aquatic invasive species; and
- E. Protective measures that will prevent introduction of aquatic invasive species in the project area.

18. Pesticide Use Plan

Within six months of license issuance, MID shall submit the Pesticide Use Plan to the Deputy Director. MID shall create the Pesticide Use Plan in consultation with BLM and the Committee. The Pesticide Use Plan shall include provisions that restrict application of pesticides (pesticides, as defined by the Basin Plan) so pesticides will not reach ESA, CSA species or their habitat in or downstream of the Project area. Pesticides shall only be applied by an individual with a current and valid Qualified Applicator License issued by the California Department of

Pesticide Regulation or under the direct visual supervision of an individual with a current and valid Qualified Applicator License issued by the California Department of Pesticide Regulation. MID shall include dates or timeframes when pesticides will be applied and a map that includes: topography, waterways, scale, areas that pesticides will be applied, roads, locations of ESA and CESA listed species. In case of an emergency, MID shall seek approval from BLM and the Committee.

19. Water Temperature Monitoring Plan

Within six months of license issuance, MID shall submit the Water Temperature Monitoring Plan to the Deputy Director. MID shall create the Water Temperature Monitoring Plan in consultation with the Committee. MID shall install and operate 4 to 8 water temperature monitoring devices within 1.5 years of license issuance.

The Water Temperature Monitoring Plan shall at a minimum include:

- A. A statement of goals and objectives;
- B. A description of proposed monitoring protocols;
- C. A comprehensive description of factors that may affect water temperature. This description shall also identify whether the factors are associated with the Project's operation.
- D. A detailed monitoring and reporting schedule; and
- E. A Plan for corrective measures and a timetable for implementation if data indicate that the Project may be increasing water temperature and/or adversely effecting water quality.

Locations shall be suitable to the Committee. Monitoring stations shall be real-time or downloaded weekly and publically available within 1 week from download.

20. Anadromous Fish Monitoring Plan

Within one year of license issuance, MID shall submit Anadromous Fish Monitoring Plan (Anadromous Fish Plan) to the Deputy Director. The Anadromous Fish Plan shall include monitoring of CESA and ESA listed Anadromous Fish. MID shall create the Anadromous Fish Plan in consultation with the Committee.

The Anadromous Fish Plan shall at a minimum include:

- A. A statement of goals and objectives;
- B. A description of proposed monitoring protocols;
- C. A comprehensive description of factors that may adversely affect CESA and ESA listed anadromous fish. This description shall also identify whether the factors are associated with the Project's operation;

- D. A detailed monitoring and reporting schedule;
- E. A Plan for corrective measures and a timetable for implementation if data indicate that the Project may be impacting anadromous fish or their habitat; and
- F. Protective measures.

If passage at Crocker-Huffman is scheduled to resume, one year prior to passage, MID shall submit a revised Anadromous Fish Plan to the Deputy Director. MID shall create the revised Anadromous Fish Plan in consultation with the Committee. The revised Anadromous Fish Plan shall contain provisions that geographically expand anadromous fish monitoring locations.

21. Transportation Management Plan

Within one year of license issuance, MID shall submit the Transportation Management Plan to the Deputy. Director.

The Transportation Management Plans shall include:

- A. Map/Inventory. MID shall map and inventory roads associated with the Project, as follows:
 - I. Develop a clear and legible map with a scale and topography using a geographic information system (GIS) that includes all roads associated with the project, appurtenant facilities (e.g., gates, closures, associated infrastructure, etc.), and locations of drainage structures, locations of streams, surface water bodies, ephemeral and intermittent waters, wetlands, and equipment storage and service areas for equipment; and
 - II. Develop a road inventory that includes: addressing uses (e.g., recreation, facility access, etc.) or non-use of the roads; condition surveys; associated facilities (e.g., culverts, gates, etc.); improvement needs; road closures; and safety, jurisdiction, and maintenance responsibilities.
- B. Road Monitoring and Maintenance. MID shall perform at least annual monitoring and inspection of Project road conditions, as well as inspection of drainage structures and runoff patterns after major storm events. Annual monitoring and maintenance reports shall be submitted to the Deputy Director and shall identify any roads or drainage structures not meeting stipulated maintenance levels. Proposed measures to improve performance comparable to the most current United States Department of Agriculture, Forest Service National BMP's Road Management Activities shall be identified and a schedule for repair.

22. General Preliminary Condition

This condition applies to draft Conditions 1 through 21, as well as all plans or changes to plans required by the water quality certification or related to water

quality shall be developed in consultation with relevant state and federal agencies. MID shall provide the relevant state and federal agencies with a minimum 30-day comment period on the plans and draft report, if applicable. The final plans and final reports shall include documentation of consultation with the relevant state and federal agencies, all comments made by the relevant state and federal agencies, and a description of how the final plan and/or final report incorporates or addresses the comments made by the relevant state and federal agencies. The Licensee shall implement the plans and draft the report(s). Licensee shall file the final report and final plan with the Deputy Director for revision or approval. Upon Deputy Director approval, the Licensee shall file the approved final plan and approved final report with FERC.

The following conditions also apply to this Project in order to protect water quality and beneficial uses over the term of the Project's license and any annual extensions.

23. Control measures for erosion, excessive sedimentation and turbidity shall be implemented and in place at the commencement of and throughout any ground clearing activities, excavation, or any other Project activities that could result in erosion or sediment discharges to surface waters. Erosion control blankets, liners with berms, and/or other erosion control measures shall be used for any stockpile of excavated material to control runoff resulting from precipitation, and prevent material from contacting or entering surface water.

24. Waters shall be free of changes in turbidity (due to Project activities) that cause nuisance or adversely affect beneficial uses. Increases in turbidity attributable to Project controllable water quality factors shall not exceed the following limits as defined in the Central Valley Basin Plan:

- a. Where natural turbidity is less than 1 nephelometric turbidity unit (NTU), controllable factors shall not cause downstream turbidity to exceed 2 NTUs.
- b. Where natural turbidity is between 1 and 5 NTUs, increases in turbidity shall not exceed 1 NTU.
- c. Where natural turbidity is between 5 and 50 NTUs, increases in turbidity shall not exceed 20 percent.
- d. where natural turbidity is between 50 and 100 NTUs, increases in turbidity shall not exceed 10 NTUs.
- e. Where natural turbidity is greater than 100 NTUs, increases in turbidity shall not exceed 10 percent.

25. All imported riprap, rocks, and gravels used for construction within or adjacent to any watercourses shall be pre-washed. Wash water generated on-site shall not contact or enter surface waters. Wash water shall be contained and disposed of in compliance with state and local laws, ordinances, and regulations.

26. Construction material, debris, spoils, soil, silt, sand, bark, slash, sawdust, rubbish, steel, or other inorganic, organic, or earthen material, and any other substances from any Project related activity shall be prevented from entering: surface waters. All construction debris and trash shall be contained and regularly removed from the work area to the staging area during construction activities. Upon completion, all Project-generated debris, building materials, excess material, waste, and trash shall be removed from all the Project sites for disposal at an authorized landfill or other disposal site in compliance with State and local laws, ordinances, and regulations.

27. No unset cement, concrete, grout, damaged concrete, concrete spills, or wash water used to clean concrete surfaces shall contact or enter surface waters. Any area containing wet concrete shall be completely bermed and isolated. The berm shall be constructed of sandbags or soil and shall be lined with plastic to prevent seepage. No leachate from truck or grout mixer cleaning stations shall percolate into Project area soils. Cleaning of concrete trucks or grout mixers shall be performed in such a manner that wash water and associated debris is captured, contained and disposed of in compliance with State and local laws, ordinances and regulations. Washout areas shall be of sufficient size to completely contain all liquid and waste concrete or grout generated during washout procedures. Hardened concrete or grout shall be disposed at an authorized landfill, in compliance with State and local laws, ordinances and regulations.

28. All equipment must be washed prior to transport to the Project site and must be free of sediment, debris, and foreign matter. Any equipment used in direct contact with surface water shall be steam cleaned prior to use. All equipment using gas, oil, hydraulic fluid, or other petroleum products shall be inspected for leaks prior to use and shall be monitored for leakage. Stationary equipment (e.g., motors, pumps, generator, etc.) shall be positioned over drip pans or other types of containment. Spill and containment equipment (e.g., oil spill booms, sorbent pads, etc.) shall be maintained onsite at all locations where such equipment is used or staged.

29. Onsite containment for storage of chemicals classified as hazardous shall be away from watercourses and include secondary containment and appropriate management as specified in California Code of Regulations, title 27, section 20320.

30. Unless otherwise specified in this WQC or, at the request of the Deputy Director, data and/or reports must be submitted electronically in a format accepted by the State Water Board to facilitate the incorporation of this information into public reports and the State Water Board's water quality database systems in compliance with California Water Code section 13167.

31. The State Water Board's approval authority includes the authority to withhold approval or to require modification of a proposal or plan prior to approval. The

State Water Board may take enforcement action if the Licensee fails to provide or implement a required plan in a timely manner.

32. The State Water Board reserves the authority to add to or modify the conditions of this WQC to incorporate load allocations developed in a total maximum daily load developed by the State Water Board or the Central Valley Water Board.

33. The State Water Board reserves the authority to add to or modify the conditions of this WQC: (1) if monitoring results indicate that continued operation of the project could violate water quality objectives or impair the beneficial uses of the Merced River or Deadman Slough or tributaries to either waterway; (2) to coordinate the operations of this Project and other hydrologically connected water development projects, where coordination of operations is reasonably necessary to achieve water quality standards or protect beneficial uses of water; or (3) to implement any new or revised water quality standards and implementation plans adopted or approved pursuant to section 303 of the CWA.

34. Future changes in climate projected to occur during the license term may significantly alter the baseline assumptions used to develop the conditions of this certification. The State Water Board reserves authority to add to or modify the conditions in this certification to require additional monitoring and/or other measures, as needed, to verify that Project operations meet water quality objectives and protect the beneficial uses assigned to the Project-affected stream reaches.

35. The Licensee shall comply with all applicable requirements of the SR/SJR Basin Plan. Licensee must notify the Deputy Director and Executive Office within 24 hours of any unauthorized discharge to surface waters.

36. Notwithstanding any more specific conditions in this WQC, the Project shall be operated in a manner consistent with all water quality standards and implementation plans adopted or approved pursuant to section 303 of the CWA. The Licensee must take all reasonable measures to protect the beneficial uses of waters of the Merced River and Deadman Slough as well as tributaries to both waterways.

37. This WQC does not authorize any act which results in the taking of a threatened, endangered or candidate species or any act, which is now prohibited, or becomes prohibited in the future, under either the California ESA (Fish & Game Code 5 §§ 2050 2097) or the federal ESA (16 U.S.C. §§ 1531 - 1544). If a “take” will result from any act authorized under this WQC or water rights held by the Licensee, the Licensee must obtain authorization for the take prior to any construction or operation of the portion of the Project that may result in a take. The Licensee is responsible for meeting all requirements of the applicable ESAs for the Project authorized under this WQC.

38. In the event of any violation or threatened violation of the conditions of this WQC, the violation or threatened violation is subject to all remedies, penalties, processes, or sanctions as provided for under applicable state or federal law. For the purposes of section 401(d) of the CWA, the applicability of any state law authorizing remedies, penalties, process, or sanctions for the violation or threatened violation constitutes a limitation necessary to ensure compliance with the water quality standards and other pertinent requirements incorporated into this WQC.

39. In response to a suspected violation of any condition of this WQC, the Deputy Director or the Executive Officer may require the holder of any federal permit or license subject to this WQC to furnish, under penalty of perjury, any technical or monitoring reports the Deputy Director or the Executive Officer deems appropriate, provided that the burden, including costs, of the reports shall bear a reasonable relationship to the need for the reports and the benefits to be obtained from the reports. (Wat. Code, §§ 1051, 13185, 13267 & 13383). The State Water Board may add to or modify the conditions of this WQC as appropriate to ensure compliance.

40. No construction shall commence until all necessary federal, state, and local approvals are obtained.

41. Any requirement in this WQC that refers to an agency whose authorities and responsibilities are transferred to or subsumed by another state or federal agency will apply equally to the successor agency.

42. The Licensee must submit any change to the Project, including changes in Project operation, technology, upgrades, or monitoring, that could have a significant or material effect on the findings, conclusions, or conditions of this WQC, to the State Water Board for prior review and written approval. The State Water Board shall determine significance and may require consultation with state or federal agencies. If the State Water Board is not notified of a potentially significant change to the Project, it will be considered a violation of this WQC. If such a change would also require submission to FERC, the change must first be submitted and approved by the State Water Board, unless otherwise noted in this certification.

43. The Deputy Director and the Executive Officer shall be notified one week prior to the commencement of ground disturbing activities. Upon request, a construction schedule shall be provided to agency staff in order for staff to be present onsite to answer any public inquiries during construction and to document compliance with this WQC. The Licensee must provide State Water Board and Central Valley Water Board staff reasonable access to Project sites to document compliance with this WQC.

44. This WQC is subject to modification or revocation upon administrative or judicial review, including review and amendment pursuant to California Water Code section 13330 and California Code of Regulations, title 23, division 3, chapter 28, article 6 (commencing with section 3867).
45. The State Water Board shall provide notice and an opportunity to be heard in exercising its authority to add to or modify the conditions of this WQC.
46. Activities associated with operation and maintenance of the Project that threaten or potentially threaten water quality shall be subject to further review by the Deputy Director and Executive Officer.
47. Nothing in this certification shall be construed as State Water Board approval of the validity of any water rights, including pre-1914 claims. The State Water Board has separate authority under the Water Code to investigate and take enforcement action if necessary to prevent any unauthorized or threatened unauthorized diversions of water.
48. This WQC is not intended and shall not be construed to apply to any activity involving a hydroelectric facility and requiring a FERC license or an amendment to a FERC license unless the pertinent certification application was filed pursuant to California Code of Regulations, title 23, section 3855, subdivision (b) and that application specifically identified that a FERC license or amendment to a FERC license for a hydroelectric facility was being sought.
49. This WQC is conditioned upon total payment of any fee required under California Code of Regulations, title 26, division 3 chapter 28.

APPENDIX F

Preliminary Water Quality Certification Conditions for the Merced Falls Hydroelectric Project

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PRELIMINARY CONDITIONS FOR THE MERCED FALLS HYDROELECTRIC PROJECT

In accordance with Item 2 under the Post-Application Filing Activities under the Integrated Licensing Process section of the memorandum of understanding executed between the Federal Energy Regulatory Commission (FERC) and the State Water Resources Control Board (State Water Board) on November 19, 2013, and to the extent that information is available, State Water Board staff is providing preliminary terms and conditions in response to the notice of Ready for Environmental Analysis (REA) by FERC for the Merced Falls Hydroelectric Project (Project), FERC Project No. 2467.

1. General Preliminary Condition

This condition applies to draft Conditions 2-9 below, as well as all plans or changes to plans required by the water quality certification or related to water quality shall be developed in consultation with relevant state and federal agencies. Pacific Gas and Electric Company (Licensee) shall provide the relevant state and federal agencies with a minimum 30-day comment period on the plans and final report, if applicable. The plans and final reports shall include documentation of consultation with the relevant state and federal agencies, all comments made by the relevant state and federal agencies, and a description of how the final plan and/or final report incorporates or addresses the comments made by the relevant state and federal agencies. Licensee shall file the final report and final plan with the Deputy

Director for the Division of Water Rights (Deputy Director) for revision or approval. Upon Deputy Director approval, the Licensee shall file the approved final plan and approved final report with the FERC.

2. Pesticide Use Plan

Within six months of license issuance, the licensee shall submit the Pesticide Use Plan to the Deputy Director. The Licensee shall create the Pesticide Use Plan in consultation with the Bureau of Land Management, California Department of Fish and Wildlife (CDFW), US Fish and Wildlife Service (USFWS), National Marine Fisheries Agency (NMFS), and the State Water Board. The Pesticide Use Plan shall include provisions that restrict application of pesticides (as defined by the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins (Basin Plan)) so pesticides will not reach Endangered Species Act (ESA), California Endangered Species Act (CESA) listed species or their habitat in or downstream of the Project area. Pesticides shall only be applied by an individual with a current and valid Qualified Applicator License issued by the California Department of Pesticide Regulation or under the direct visual supervision of an individual with a current and valid Qualified Applicator License issued by the California Department of Pesticide Regulation.

3. Gravel Augmentation Plan

Within one year of license issuance, the Licensee shall submit the Gravel Augmentation Plan to the Deputy Director. The Licensee shall create the Gravel Augmentation Plan in consultation with CDFW, USFWS, and NMFS. The amount of gravel augmented shall be consistent with annual gravel amount trapped behind Merced Falls Dam.

4. Fish Passage Plan

If fish passage resumes at Crocker-Huffman Diversion Dam, the Licensee shall consult with NMFS, CDFW, and USFWS. If during the consultation it is recommended that passage resume at Merced Falls the licensee shall submit a Fish Passage Plan to the Deputy Director. The Licensee shall create the Fish Passage Plan in consultation with the NMFS, CDFW, and USFWS.

5. Eagle Monitoring and Conservation Plan

Within one year of license issuance, the Licensee shall submit the Bald and Golden Eagle Monitoring Plan (Eagle Plan) to the Deputy Director. The Licensee shall create the Eagle Plan in consultation with USFWS, CDFW, and BLM. The Eagle Plan shall include monitoring and protective measures when nesting is identified. This is necessary to protect the wildlife beneficial use.

The Eagle Plan shall:

- A. Be consistent with the most current USFWS National Bald Eagle Management Guidelines;
- B. Include a statement of the goals and objectives;
- C. Include a description of the proposed monitoring protocol(s);
- D. Include specific, measureable criteria that will be used in combination with monitoring data and the comprehensive list of drivers to objectively evaluate if the goals and objectives of the Eagle Plan are being met or the Project may be adversely affecting eagles and/or eagle nests;
- E. Include a detailed monitoring and reporting schedule;
- F. Include a plan for the development of corrective measures and a timetable for action in cases when the Eagle Plan's goals and objectives are not being achieved or data indicate the Project may be impacting eagles and/or eagle nests; and

At a minimum monitoring shall include:

- G. One breeding and one wintering survey every five years after license issuance;
- H. Monitoring surveys within 30 days prior to any activity in the Project area listed or similar to the listed activities in the USFWS National Bald Eagle Management Guidelines; and

- I. Include documentation of any eagle or eagle nests discovered during monitoring as well as any incidental eagle or eagle nest observations.

Within 60 days of the conclusion of the monitoring cycle, the Licensee shall submit the results of the monitoring data with a description of location of eagle(s) or nest(s), date(s) of discovery, timeframe(s) of monitoring and protective measure implementation. Monitoring reports shall also include recommendations for more frequent monitoring based on increased use of the Project area by eagles, changes in Project operation and management activities, information derived from other resource studies or the state or federal resource agencies, and updates to be consistent with updates to the USFWS National Bald Eagle Management Guidelines.

If monitoring or incidental (other) reports confirm the presence of eagle(s) or eagle nest(s) in the Project area, protective measures must be implemented prior to any Project-associated activity.

6. Valley Elderberry Longhorn Beetle Monitoring and Conservation Plan

Within 6 months of license issuance, the Licensee shall submit the Valley Elderberry Longhorn Beetle Monitoring and Conservation Plan (VELB Plan) to the Deputy Director. The Licensee shall create the VELB Plan in consultation with USFWS, CDFW, and BLM. The VELB Plan shall include monitoring of Valley Elderberry Longhorn Beetles and their habitat in the Project area, and associated tributaries. Monitoring shall be conducted prior to construction and every 5 years after license issuance.

The VELB Plan, shall at a minimum include:

- A. A statement of goals and objectives;
- B. A description of proposed monitoring protocols;
- C. A comprehensive description of factors that may adversely affect VELB. This description shall also identify whether the factors are associated with the Project's operation.
- D. A detailed monitoring and reporting schedule;
- E. Plan for corrective measures and a timetable for implementation if data indicate that the Project may be impacting VELB or their habitat; and
- F. Protective measures.

7. Review of Endangered Species Act Lists and Special-Status Species Lists, and Assessment of New Species in the Project Area

The Licensee shall consult with the USFWS, CDFG, and NMFS within 6 months of license issuance and at the Pentennial Meeting (see below) for the term of the license and any extension. At the meetings, participants will review the current list of threatened and endangered species and special-status plant and wildlife species

that may be adversely impacted by the Project. When a species is added to one or more of the lists, the Licensee, in consultation with the CDFW, USFWS, NMFS, and the State Water Board shall determine if the species may be adversely affected by the Project. If it is determined that the species may be adversely affected by the Project, the Licensee shall develop and implement a new species specific study plan. The study plan shall be created in consultation with the appropriate state or federal resource agencies to assess the effects of the Project on the species.

Each species specific study plans, shall at a minimum include:

- A. A statement of goals and objectives;
- B. A description of proposed monitoring protocols;
- C. A comprehensive description of factors that may adversely affect VELB. This description shall also identify whether the factors are associated with the Project's operation.
- D. A detailed monitoring and reporting schedule;
- E. A Plan for corrective measures and a timetable for implementation if data indicate that the Project may be impacting the newly listed specific species or their habitat; and
- F. Protective measures.

The Licensee shall implement and prepare a report on the study including objectives, methods, results, recommended measures where appropriate, and a schedule of implementation.

8. Pentennial Meeting with Resource Agencies

Beginning one year after license issuance, the Licensee shall hold a Pentennial Meeting with the resource agencies. Resource agencies include but are not limited to State Water Board, USFWS, CDFG, and NMFS. The date of the Annual Consultation shall be mutually agreed to by the Licensee, State Water Board, USFWS, CDFG, and NMFS. The meeting shall be open to the public and the Licensee shall also provide notice to tribes and interested parties.

The Licensee shall provide 1) an update of all a monitoring and data required by the new license and water quality certification; and 2) a map that clearly depicts locations that pesticides were applied in the previous five year cycle, CESA and ESA listed species, and topography.

A record of the meeting shall be kept by Licensee and shall include any recommendations made by State Water Board, USFWS, CDFG, and NMFS for the protection of resources effected by the Project. Licensee shall include a description of how the Licensee incorporated recommendations made by State Water Board, USFWS, CDFG, and NMFS at the meeting.

9. Frog Monitoring Plan

The Licensee shall monitor and identify the locations of California Red-legged Frog (CRLF), Foothill Yellow-legged Frog (FYLF), and Western Spadefoot. Within one year of license issuance, the Licensee shall file a Frog Monitoring Plan (Frog Plan) with the Deputy Director for approval. The Licensee shall create the Frog Plan in consultation with BLM, USFWS, and CDFW. The Frog Plan shall include monitoring CRLF, YLF, and Western Spadefoot egg masses, tadpoles and adults in the Project area and associated tributaries influenced by the Project. Monitoring of egg masses, tadpoles, and adults shall be required every five years from license issuance.

The Frog Plan shall include, at a minimum:

- A. A statement of goals and objectives;
- B. A description of proposed monitoring protocols;
- C. A comprehensive description of factors that may adversely affect CRLF, FYLF and Western Spadefoot. This description shall also identify whether the factors are associated with the Project's operation.
- D. Monitoring water temperature where eggs and tadpoles are found;
- E. A detailed monitoring and reporting schedule;
- F. Protective measures; and
- G. A Plan for corrective measures and a timetable for implementation if data indicate that the Project may be impacting CRLF, FYLF, or Western Spadefoot.

The following conditions also apply to this Project in order to protect water quality and beneficial uses over the term of the Project's license and any annual extensions.

10. Control measures for erosion, excessive sedimentation and turbidity shall be implemented and in place at the commencement of and throughout any ground clearing activities, excavation, or any other Project activities that could result in erosion or sediment discharges to surface waters. Erosion control blankets, liners with berms, and/or other erosion control measures shall be used for any stockpile of excavated material to control runoff resulting from precipitation, and prevent material from contacting or entering surface waters.

11. Waters shall be free of changes in turbidity (due to Project activities) that cause nuisance or adversely affect beneficial uses. Increases in turbidity attributable to Project controllable water quality factors shall not exceed the following limits as defined in the Central Valley Basin Plan:

- a. Where natural turbidity is less than 1 nephelometric turbidity unit (NTU), controllable factors shall not cause downstream turbidity to exceed 2 NTUs.

- b. Where natural turbidity is between 1 and 5 NTUs, increases in turbidity shall not exceed 1 NTU.
- c. Where natural turbidity is between 5 and 50 NTUs, increases in turbidity shall not exceed 20 percent.
- d. Where natural turbidity is between 50 and 100 NTUs, increases in turbidity shall not exceed 10 NTUs.
- e. Where natural turbidity is greater than 100 NTUs, increases in turbidity shall not exceed 10 percent.

12. All imported riprap, rocks, and gravels used for construction within or adjacent to any watercourses shall be pre-washed. Wash water generated on-site shall not contact or enter surface waters. Wash water shall be contained and disposed of in compliance with state and local laws, ordinances, and regulations.

13. Construction material, debris, spoils, soil, silt, sand, bark, slash, sawdust, rubbish, steel, or other inorganic, organic, or earthen material, and any other substances from any Project- related activity shall be prevented from entering surface waters. All construction debris and trash shall be contained and regularly removed from the work area to the staging area during construction activities. Upon completion, all Project-generated debris, building materials, excess material, waste, and trash shall be removed from all the Project sites for disposal at an authorized landfill or other disposal site in compliance with State and local laws, ordinances, and regulations.

14. No unset cement, concrete, grout, damaged concrete, concrete spoils, or wash water used to clean concrete surfaces shall contact or enter surface waters. Any area containing wet concrete shall be completely bermed and isolated. The berm shall be constructed of sandbags or soil and shall be lined with plastic to prevent seepage. No leachate from truck or grout mixer cleaning stations shall percolate into Project area soils. Cleaning of concrete trucks or grout mixers shall be performed in such a manner that wash water and associated debris is captured, contained and disposed of in compliance with State and local laws, ordinances and regulations. Washout areas shall be of sufficient size to completely contain all liquid and waste concrete or grout generated during washout procedures. Hardened concrete or grout shall be disposed at an authorized landfill, in compliance with State and local laws, ordinances and regulations.

15. All equipment must be washed prior to transport to the Project site and must be free of sediment, debris, and foreign matter. Any equipment used in direct contact with surface water shall be steam cleaned prior to use. All equipment using gas, oil, hydraulic fluid, or other petroleum products shall be inspected for leaks prior to use and shall be monitored for leakage. Stationary equipment (e.g., motors, pumps, generator, etc.) shall be positioned over drip pans or other types of containment. Spill and containment equipment (e.g., oil spill booms, sorbent pads,

etc.) shall be maintained onsite at all locations where such equipment is used or staged.

16. Onsite containment for storage of chemicals classified as hazardous shall be away from watercourses and include secondary containment and appropriate management as specified in California Code of Regulations, title 27, section 20320.

17. Unless otherwise specified in this WQC or at the request of the Deputy Director, data and/or reports must be submitted electronically in a format accepted by the State Water Board to facilitate the incorporation of this information into public reports and the State Water Board's water quality database systems in compliance with California Water Code section 13167.

18. The State Water Board's approval authority includes the authority to withhold approval or to require modification of a proposal or plan prior to approval. The State Water Board may take enforcement action if the Licensee fails to provide or implement a required plan in a timely manner.

19. The State Water Board reserves the authority to add to or modify the conditions of this WQC to incorporate load allocations developed in a total maximum daily load developed by the State Water Board or the Central Valley Water Board.

20. The State Water Board reserves the authority to add to or modify the conditions of this WQC: (1) if monitoring results indicate that continued operation of the Project could violate water quality objectives or impair the beneficial uses of the Merced River or tributaries to the Merced River; (2) to coordinate the operations of this Project and other hydrologically connected water development projects, where coordination of operations is reasonably necessary to achieve water quality standards or protect beneficial uses of water; or (3) to implement any new or revised water quality standards and implementation plans adopted or approved pursuant to section 303 of the CWA

21. Future changes in climate projected to occur during the license term may significantly alter the baseline assumptions used to develop the conditions of this certification. The State Water Board reserves authority to add to or modify the conditions in this certification to require additional monitoring and/or other measures, as needed, to verify that Project operations meet water quality objectives and protect the beneficial uses assigned to the Project-affected stream reaches.

22. The Licensee shall comply with all applicable requirements of the SR/SJR Basin Plan. Licensee must notify the Deputy Director and Executive Officer within 24 hours of any unauthorized discharge to surface waters.

23. Notwithstanding any more specific conditions in this WQC, the Project shall be operated in a manner consistent with all water quality standards and

implementation plans adopted or approved pursuant to section 303 of the CWA. The Licensee must take all reasonable measures to protect the beneficial uses of waters of the Merced River and tributaries to the Merced River.

24. This WQC does not authorize any act which results in the taking of a threatened, endangered or candidate species or any act, which is now prohibited, or becomes prohibited in the future, under either the California ESA (Fish & Game Code §§ 2050 2097) or the federal ESA (16 U.S.C. §§ 1531 - 1544). If a "take" will result from any act authorized under this WQC or water rights held by the Licensee, the Licensee must obtain authorization for the take prior to any construction or operation of the portion of the Project that may result in a take. The Licensee is responsible for meeting all requirements of the applicable ESAs for the Project authorized under this WQC.

25. In the event of any violation or threatened violation of the conditions of this WQC, the violation or threatened violation is subject to all remedies, penalties, processes, or sanctions as provided for under applicable state or federal law. For the purposes of section 401(d) of the CWA, the applicability of any state law authorizing remedies, penalties, process, or sanctions for the violation or threatened violation constitutes a limitation necessary to ensure compliance with the water quality standards and other pertinent requirements incorporated into this WQC.

26. In response to a suspected violation of any condition of this WQC, the Deputy Director or the Executive Officer may require the holder of any federal permit or license subject to this WQC to furnish, under penalty of perjury, any technical or monitoring reports the Deputy Director or the Executive Officer deems appropriate, provided that the burden, including costs, of the reports shall bear a reasonable relationship to the need for the reports and the benefits to be obtained from the reports. (Wat. Code, §§ 1051, 13165, 13267 & 13383). The State Water Board may add to or modify the conditions of this WQC as appropriate to ensure compliance.

27. No construction shall commence until all necessary federal, state, and local approvals are obtained.

28. Any requirement in this WQC that refers to an agency whose authorities and responsibilities are transferred to or subsumed by another state or federal agency will apply equally to the successor agency.

29. The Licensee must submit any change to the Project, including changes in Project operation, technology, upgrades, or monitoring, that could have a significant or material effect on the findings, conclusions, or conditions of this WQC, to the State Water Board for prior review and written approval. The State Water Board shall determine significance and may require consultation with state or federal agencies. If the State Water Board is not notified of a potentially

significant change to the Project, it will be considered a violation of this WQC. If such a change would also require submission to FERC, the change must first be submitted and approved by the State Water Board, unless otherwise noted in this certification.

30. The Deputy Director and the Executive Officer shall be notified one week prior to the commencement of ground disturbing activities. Upon request, a construction schedule shall be provided to agency staff in order for staff to be present onsite to answer any public inquiries during construction and to document compliance with this WQC. The Licensee must provide State Water Board and Central Valley Water Board staff reasonable access to Project sites to document compliance with this WQC.

31. This WQC is subject to modification or revocation upon administrative or judicial review, including review and amendment pursuant to California Water Code section 13330 and California Code of Regulations, title 23, division 3, chapter 28, article 6 (commencing with section 3867).

32. The State Water Board shall provide notice and an opportunity to be heard in exercising its authority to add to or modify the conditions of this WQC.

33. Activities associated with operation and maintenance of the Project that threaten or potentially threaten water quality shall be subject to further review by the Deputy Director and Executive Officer.

34. Nothing in this certification shall be construed as State Water Board approval of the validity of any water rights, including pre-1914 claims. The State Water Board has separate authority under the Water Code to investigate and take enforcement action if necessary to prevent any unauthorized or threatened unauthorized diversions of water.

35. This WQC is not intended and shall not be construed to apply to any activity involving a hydroelectric facility and requiring a FERC license or an amendment to a FERC license unless the pertinent certification application was filed pursuant to California Code of Regulations, title 23, section 3855, subdivision (b) and that application specifically identified that a FERC license or amendment to a FERC license for a hydroelectric facility was being sought.

36. This WQC is conditioned upon total payment of any fee required under California Code of Regulations, title 23, division 3, chapter 28.

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