UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Klamath River Renewal Corporation
PacifiCorp **Project No. 14803**

AMENDED APPLICATION FOR SURRENDER OF LICENSE FOR MAJOR PROJECT AND REMOVAL OF PROJECT WORKS AND REQUEST FOR EXPEDITED REVIEW

EXHIBIT E
ENVIRONMENTAL REPORT

The Renewal Corporation submits this amended Exhibit E - Environmental Report for the Proposed Action, attached hereto at **Exhibit E-1**. This Exhibit E updates and supersedes the Exhibit E filed with the Initial Surrender Application. Sub-exhibit E-1 incorporates new studies and analyses of the Proposed Action, most recently studies and analyses undertaken in connection with the Oregon and California state environmental review process in support of the issuance of § 401 water quality certifications. This includes the 60% Design Report and 60% Design Drawings, the 2018 Definite Plan Report (KRRC 2018), the State of California Water Resources Control Board's Draft and Final Environmental Impact Report and CEQA Findings and Statements (SWRCB 2020a, 2020b), and the State of Oregon Department of Environmental Quality's Evaluation and Findings Report (ODEQ 2018b). These studies and analyses update relevant portions of two prior NEPA environmental impact statements and a prior CEQA environmental report.[35] Sub-exhibit E-1 also includes all information required by 18 C.F.R. § 4.51(f). Sub-exhibit E-1 provides an extensive environmental record sufficient for the Commission to commence environmental review of this application. The appropriate level of further environmental review should be limited to issues that have not been covered by Exhibit E and the prior environmental impact statements and environmental reports.[36]

[35] FERC *Final Environmental Impact Statement for Relicensing of the Klamath Hydroelectric Project FERC Project No. 2082-027* (2007); U.S. Department of Interior and California Department of Fish and Wildlife *Klamath Facilities Removal Environmental Impact Statement /Environmental Report* (2012).

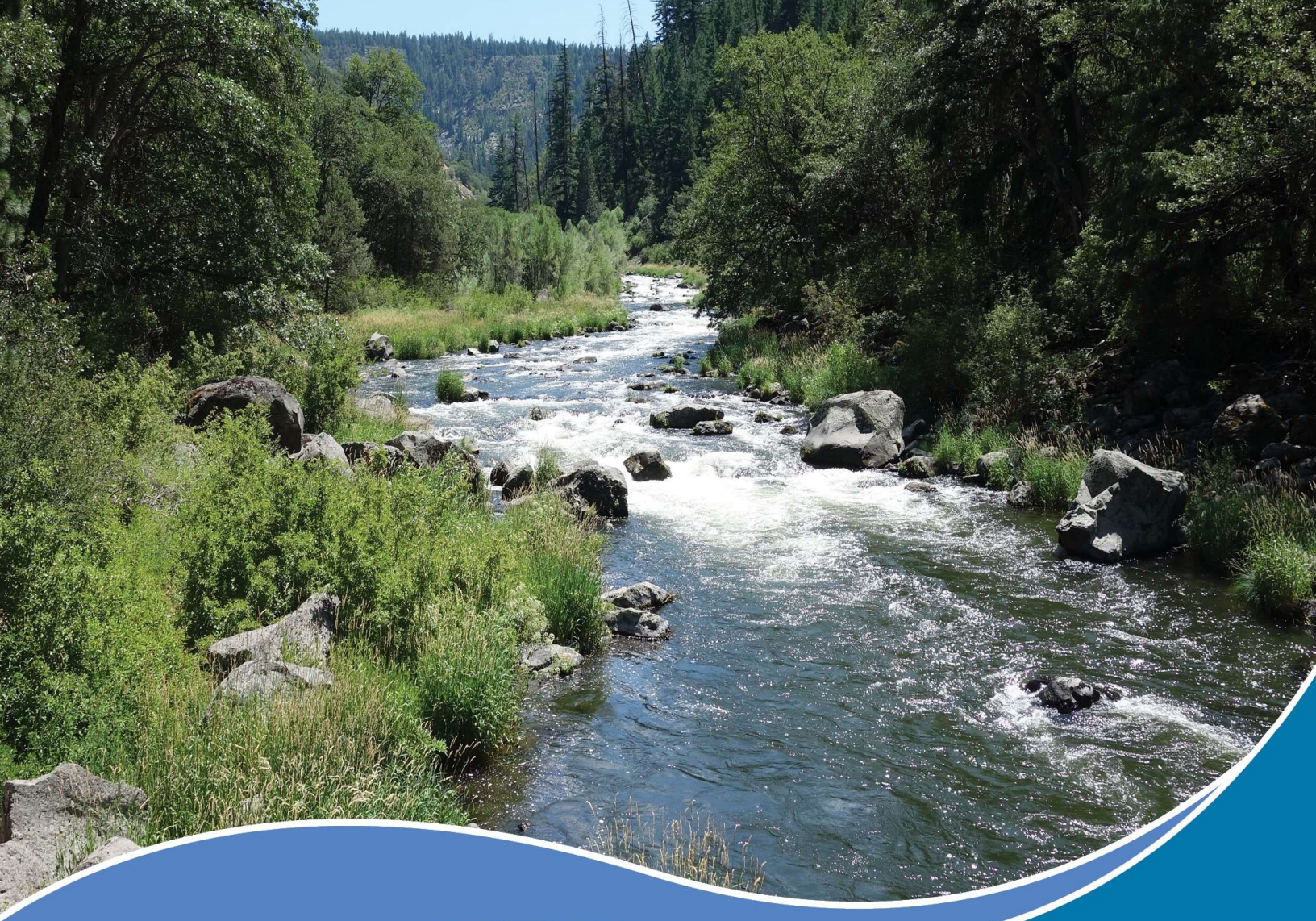
[36] NEPA does not require duplicative review of prior environmental analysis. A finding of no significant impact may be based on the environmental assessment and other environmental documents. 40 C.F.R § 1501.6(b). CEQ regulations require agencies to "reduce excessive paperwork" and authorize the incorporation of prior environmental documents by reference. 40 C.F.R § 1501.4(l). Indeed, agencies "*shall incorporate* material, such as planning studies, analyses, or other relevant information, into environmental documents by reference when the effect will be to cut down on bulk without impeding agency and public review of the action." 40 C.F.R § 1501.12 (emphasis added).

Exhibit E-1

(1 of 2)

Environmental Report for the Proposed Action

November 2020



Lower Klamath Project

Exhibit E Environmental Report

Amended Surrender Application

FERC No. 14803

November 2020

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A: Oregon Department of Environmental Quality's (ODEQ) Evaluation and Findings Report
B: Consultation Record
C: Geological and Soil Resources
D: KRRC Technical Reports (Aquatics, Wildlife, & Terrestrial Report)
E: Wildlife Resources

Acronyms and Abbreviations

yd^3	cubic yard
ADA	American Disabilities Act
Amended Surrender Application	2020 Amended License Surrender Application
APE	Area of Potential Effect
BLM	Bureau of Land Management
BMP	best management practice
BOR	United States Bureau of Reclamation
^oC	degrees Celsius
CDFG	California Department of Fish and Game (now CDFW)
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CPUC	California Public Utility Commission
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DDP	Definite Decommissioning Plan
DOI	United States Department of the Interior
EFH	Essential Fish Habitat
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
EWA	Environmental Water Account
^oF	degrees Fahrenheit
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FPA	Federal Power Act
HPMP	Historic Properties Management Plan
IMPLAN	Impact Analysis for Planning
KFMC	Klamath Fishery Management Council
KHSA	Klamath Hydroelectric Settlement Agreement
KIP	Klamath Irrigation Project
KOP	Key Observation Point
KRRC	Klamath River Renewal Corporation
mg/L	milligrams per liter
mm	millimeters
MMRP	Mitigation Monitoring and Reporting Plan
MOA	Memorandum of Agreement (per 36 C.F.R § 800.6(c))
MOU	Memorandum of Understanding

NAGPRA	Native American Graves Protection and Repatriation Act
NCRWQCB	North Coast Regional Water Quality Control Board
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NSO	Northern Spotted Owl
NRHP	National Register of Historic Places
O&M	Operations and Maintenance
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
OPCU	Oregon Public Utility Commission
OPR	(California) Office of Planning and Research
ORBIC	Oregon Biodiversity Information Center
PFMC	Pacific Fisheries Management Council
Project	Lower Klamath Project
Renewal Corporation	Klamath River Renewal Corporation
RM	River Mile
RTE	Rare, Threatened, and Endangered
RV	Recreational Vehicle
SSC	Suspended-Sediment Concentration
SHPO	State Historic Preservation Office
SONC	Southern Oregon/Northern California
SPCCP	Spill Prevention, Control, and Countermeasure Plan
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	California State Water Resources Control Board
TCP	Traditional Cultural Properties
TIPU	Transportation, Information, and Public Utilities
TMDL	total maximum daily load
USACE	United States Army Corps of Engineers
USC	United States Code
USEPA	United States Environmental Protection Agency
USDOI	United States Department of Interior
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VRM	Visual Resource Management
WQC	Water Quality Certification
WQMP	Water Quality Management Plan
WSR	Wild and Scenic River
WSRA	Wild and Scenic Rivers Act
WY	water year

Chapter 1: Introduction

1 INTRODUCTION

1.1 Background

The Lower Klamath Project (Project) Federal Energy Regulatory Commission (FERC) No. 14803 is located on the Klamath River in Klamath County in south-central Oregon, and Siskiyou County in north-central California. The Lower Klamath Project consists primarily of four dams and associated facilities, listed from upstream to downstream: (1) J.C. Boyle (Oregon); (2) Copco No. 1 (California); (3) Copco No. 2 (California); and (4) Iron Gate (California) (Figure 1-1). These facilities and their project features (Figure 1-2, Figure 1-3, Figure 1-4, Figure 1-5) are outlined in Exhibit A in the 2020 Amended License Surrender Application (Amended Surrender Application). The nearest principal cities are Klamath Falls, Oregon, located at the northern end of the Lower Klamath Project area; Medford, Oregon, 45 miles northwest of the downstream end of the Lower Klamath Project; and Yreka, California, 20 miles southwest of the downstream end (Figure 1-1).

Since the late 1990s, the Lower Klamath Project has been subjected to environmental studies leading to multiple federal and state agency regulatory analysis under National Environmental Policy Act (NEPA), the Clean Water Act Section 401, and California Environmental Policy Act to consider and disclose the effects FERC relicensing and then the decommissioning of the PacifiCorp Klamath Hydro Project (FERC No. 2082). This environmental analysis through the 2000s contributed to the agreement between the state and federal agencies, PacifiCorp, and stakeholders to remove the four dams in the Lower Klamath Project. This agreement is the Klamath Hydroelectric Settlement Agreement (KHSA) (2010, as amended 2016). The KHSA signatories recognized that the process for state and federal approval for dam removal will take many years through the incorporation of over 20 Interim Measures. The Interim Measures implemented by PacifiCorp are to benefit the environmental baseline and eventual post dam removal condition of a free-flowing river. These previous federal and state analyses along with the interim measures implemented provide the environmental basis for this Exhibit E.

For purposes of this Amended Surrender Application and Exhibit E, the No-Action Alternative is the continuation of the license operations consistent with the existing license, as FERC described in their 2007 Final Environmental Impact Statement (EIS) (FERC 2007). The Renewal Corporation is not pursuing this alternative; therefore, it is not discussed further, and this Exhibit E only analyzes the Proposed Action.

1.2 Relationship to Exhibit A

This Exhibit E analyzes the Proposed Action in this Amended Surrender Application, and specifically, the Definite Decommissioning Plan (DDP), as stated in Exhibit A. The DDP is a comprehensive

statement of construction, habitat restoration, and other environmental measures. The DDP supersedes prior descriptions, including the 2018 Definite Plan Report. The DDP also summarizes measures that are included in management plans to be implemented as part of the Proposed Action.

The Proposed Action being analyzed in this Amended Surrender Application is the removal and associated restoration work of the Lower Klamath Project. A complete history of the Project and Proposed Action, including reference documents filed on this docket, is included in the Explanatory Statement, which appears at the front of the Amended Surrender Application.

1.3 Incorporated Record

This 2020 Exhibit E replaces the Exhibit E filed with the Initial Surrender Application in September 2016. Among other things, this Exhibit E incorporates the contents of the environmental documentation developed since the PacifiCorp Application (2004) by reference (relying on the full project record to support this incorporation) [1]. The primary source document for baseline conditions is FERC's Final EIS for relicensing (FERC 2007). As noted in Section 1.1, the Proposed Action (dam removal pursuant to the KHSA) has been the source of many federal and state analyses, most recently through Oregon and California's state environmental review processes, as referenced to the issuance of the Section 401 Water Quality Certifications (WQC). The source documents for this Exhibit E and the DDP include the 60% Design Report and 60% Design Drawings (Exhibit A-2), the 2018 Definite Plan Report (KRRC 2018), the State of California Water Resources Control Board's (SWRCB) Draft and Final Environmental Impact Report and California Environmental Quality Act Findings and Statements (SWRCB 2020a, 2020b), and the State of Oregon Department of Environmental Quality's (ODEQ) Evaluation and Findings Report (ODEQ 2018b) (Appendix A) (Table 2-1).

(SWRCB 2020a, 2020b) and (ODEQ 2018b) are noteworthy and significant source documents for this Environmental Report. These studies and analyses of the Proposed Action update relevant portions of two prior National Environmental Policy Act (NEPA) environmental impact statements and a prior CEQA environmental report, collectively describing the Proposed Action at this level of specificity that is unique, if not unprecedented, for a surrender application. (SWRCB 2020a, 2020b) includes extensive environmental analysis compiled by SWRCB in support of its Section 401 Water Quality Certification, and (ODEQ 2018b) includes extensive environmental analysis compiled by ODEQ in support of its Section 401 Water Quality Certification. These documents are the current

[1] FERC Accession No. 20160923-5370

analyses of the states as successor regulators and landowners once license surrender is effective. The appropriate level of further environmental review in this proceeding should be focused on issues that have not been covered by Exhibit E and the prior environmental impact statements and environmental reports.[1] The Renewal Corporation urges Commission Staff to carefully review and consider (SWRCB 2020a, 2020b) and (ODEQ 2018b) as it makes this determination.

This Exhibit E provides summary level effects analyses on environmental, social, cultural, and recreational resources, along with a summary of environmental measures and management plans associated with the Proposed Action. This Exhibit E presents the summary of current information required in FERC Regulations at 18 Code of Federal Regulations (CFR) Section 4.51(f) (Major Existing Project), and Section 6.2 (Surrender of License) and the format conforms with FERC Guidance for Preparing Environmental Documents (September 2008). This information is necessary to assist FERC's evaluation and decision on the Klamath River Renewal Corporation's (Renewal Corporation) Amended Surrender Application. The FERC record has been summarized with a "cross-walk" table at the beginning of each resource section (Chapter 4) to identify where additional information may be found regarding the resource area and the Proposed Action.

[1] NEPA does not require duplicative review of prior environmental analysis. A finding of no significant impact may be based on the environmental assessment and other environmental documents. 40 C.F.R § 1501.6(b). CEQ regulations require agencies to Agencies to "reduce excessive paperwork" and authorize the incorporation of prior environmental documents by reference. 40 C.F.R § 1501.4(l). Indeed, agencies "*shall incorporate* material, such as planning studies, analyses, or other relevant information, into environmental documents by reference when the effect will be to cut down on bulk without impeding agency and public review of the action." 40 C.F.R § 1501.12 (emphasis added).

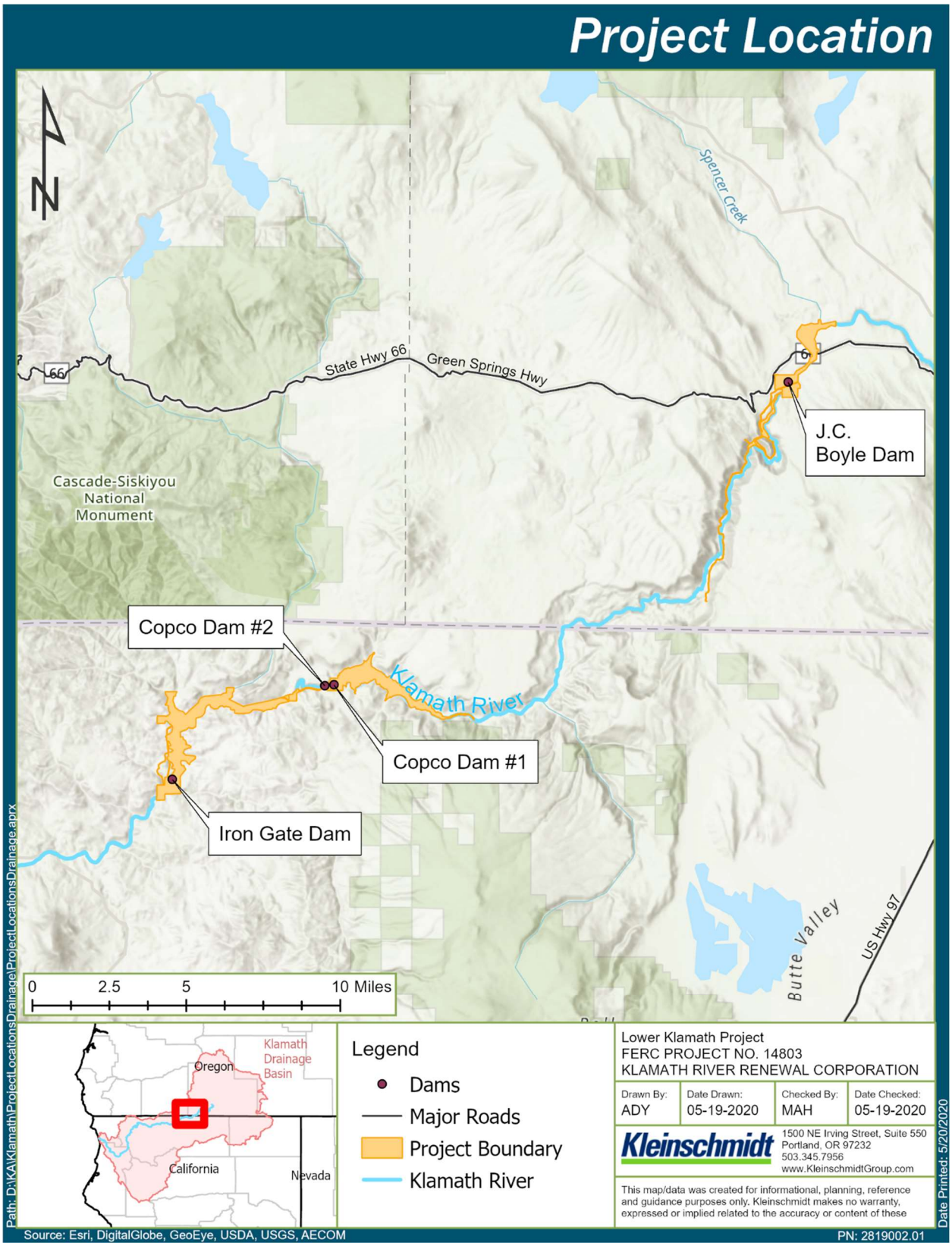

Figure 1-1 Lower Klamath Project Location

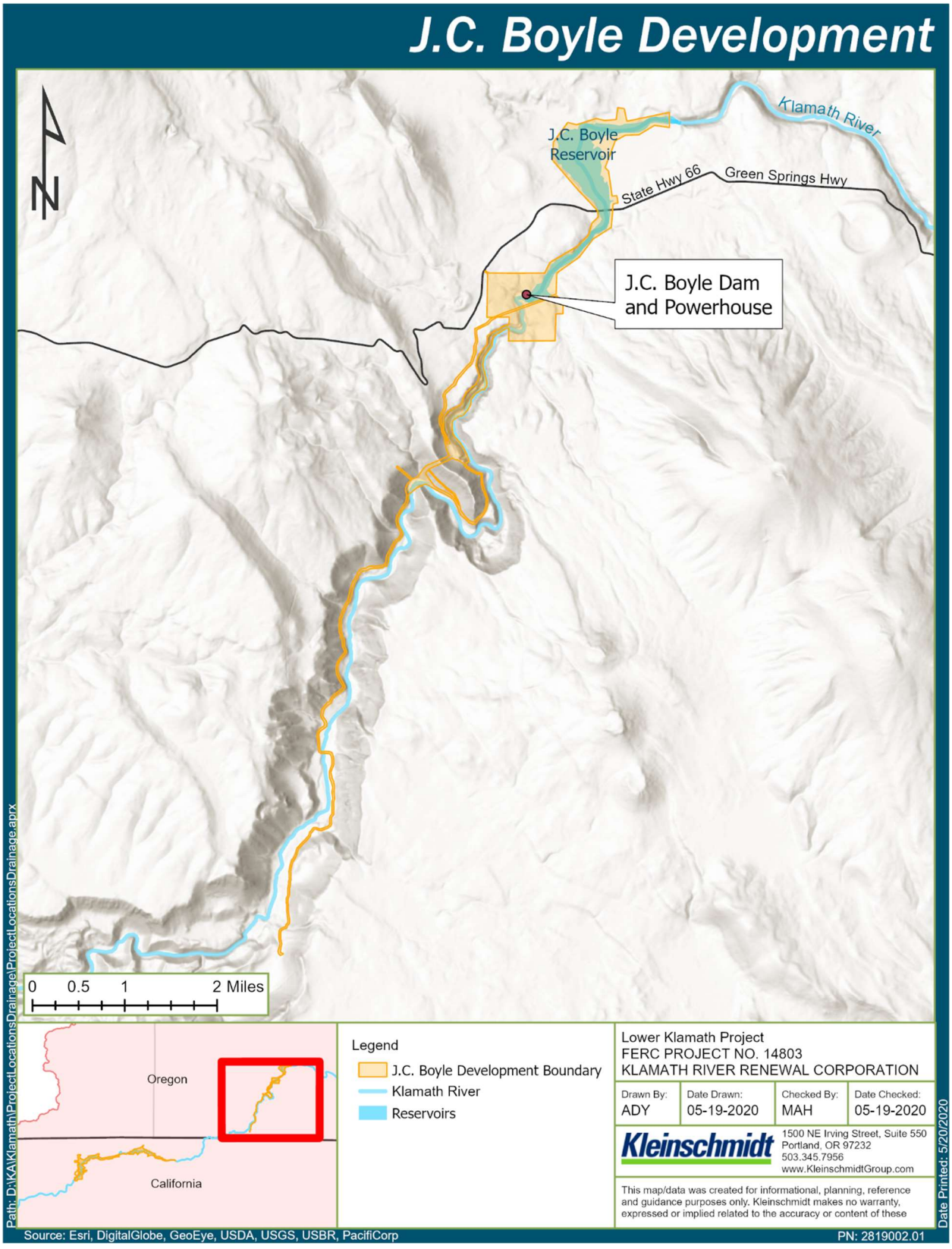

Figure 1-2 J.C. Boyle Development Facility Details

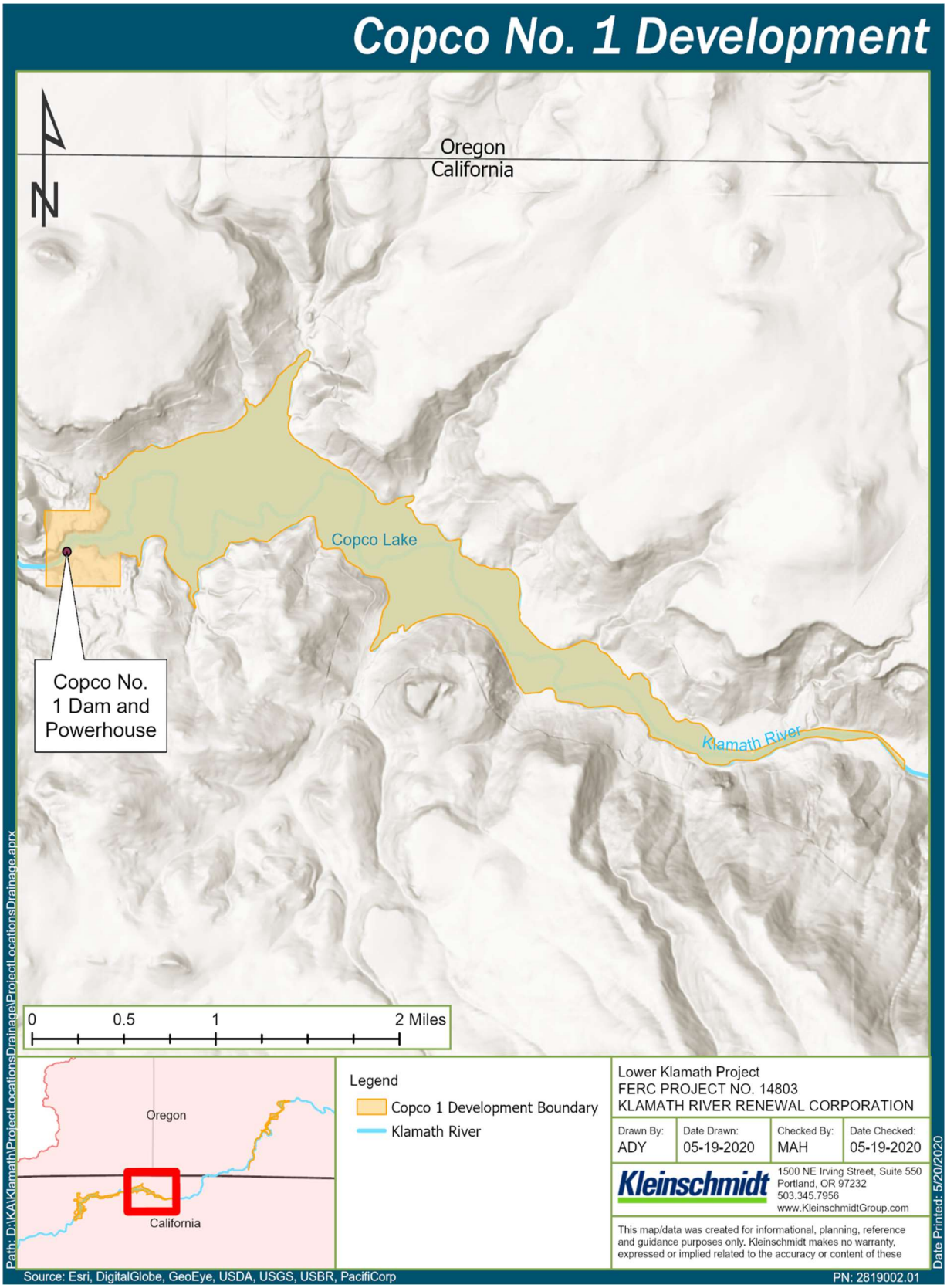

Figure 1-3 Copco No.1 Development Facility Details

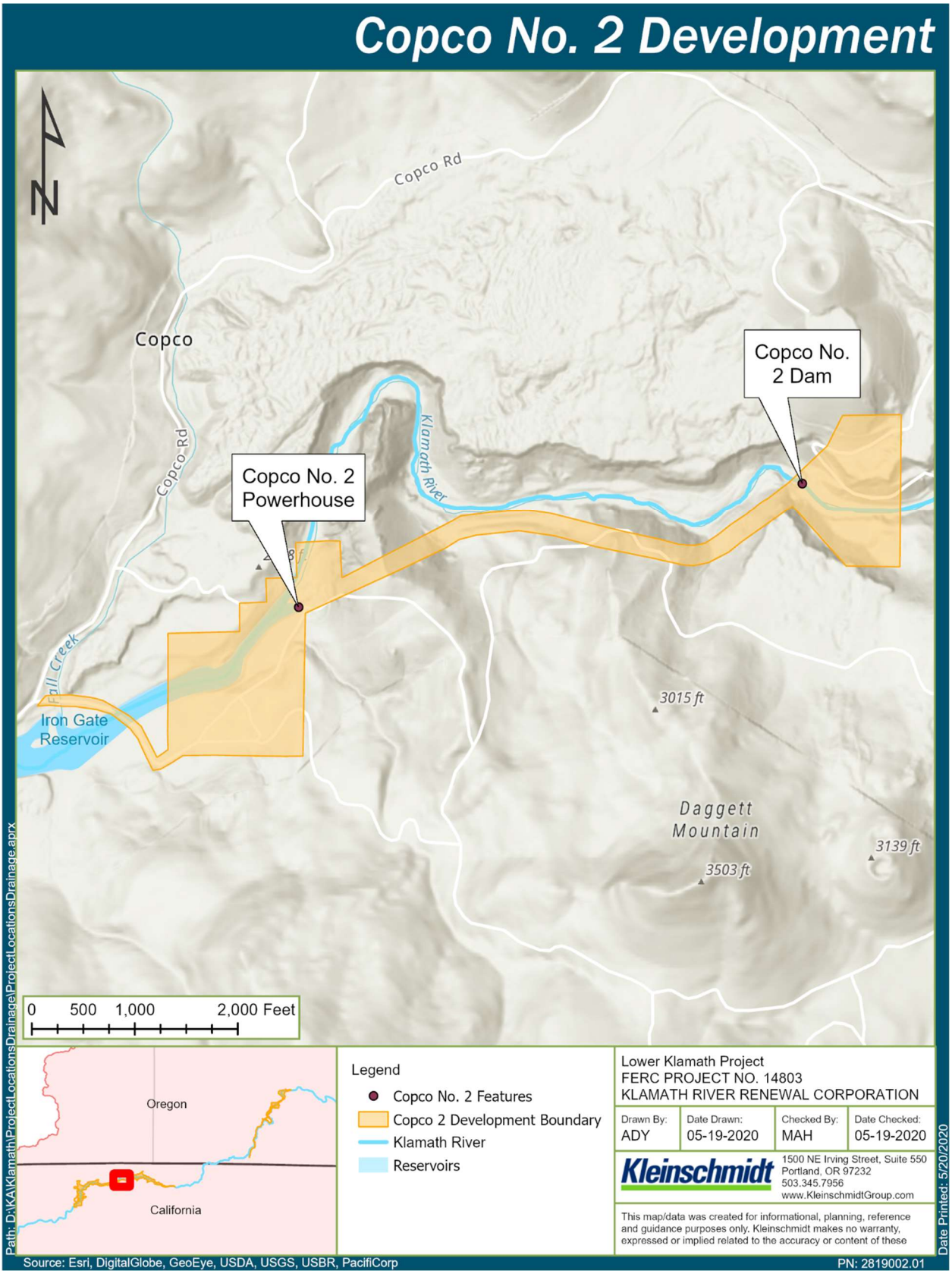

Figure 1-4 Copco No.2 Development Facility Details

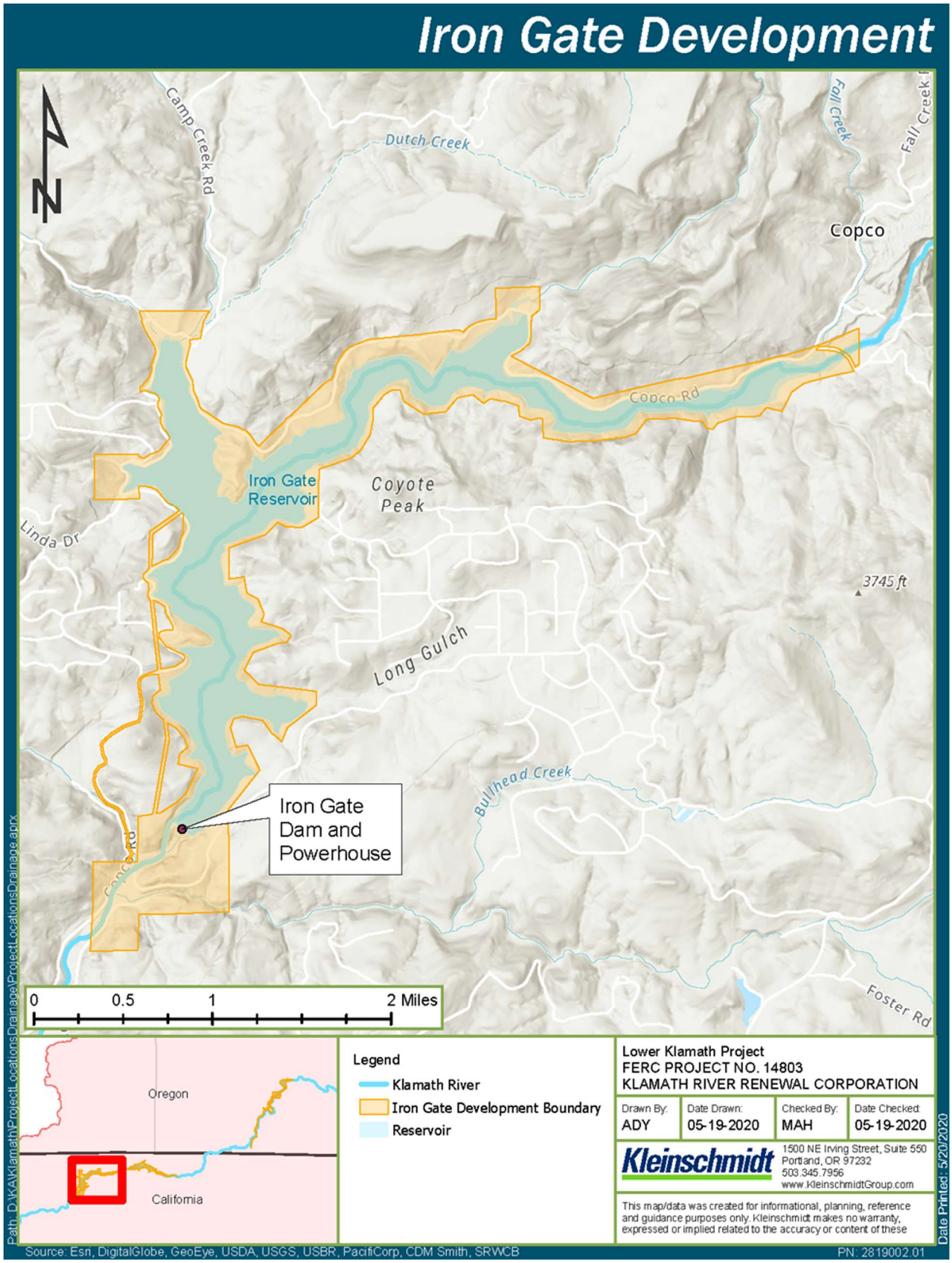

Figure 1-5 Iron Gate Development Facility Details

1.4 References

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State Water Resources Control Board (SWRCB). 2020b. Final Water Quality Certification prepared by the SWRCB (2020b), including Attachment 4 (CEQA Findings and Statements of Overriding Considerations).

U.S. Department of the Interior. 2012. Klamath Dam Removal Overview Report for the Secretary of the Interior: An Assessment of Science and Technical Information (2013); the Detailed Plan for Dam Removal – Klamath River Dams, Klamath Hydroelectric Project, FERC License No. 2082, Oregon – California.

U.S. Department of the Interior and California Department of Fish and Wildlife (BOR and CDFG). 2012. Klamath Facilities Removal Environmental Impact Statement (EIS) /Report.

Chapter 2: Statutory and Regulatory Requirements

2 STATUTORY AND REGULATORY REQUIREMENTS

2.1 Federal Requirements

2.1.1 Federal Power Act

Consistent with the Federal Power Act (FPA), FERC will determine whether to approve license surrender for the Lower Klamath Project consistent with the DPP (Proposed Action). In considering this Amended Surrender Application, FERC will evaluate and determine whether license surrender is in the public interest. Any surrender application must include a decommissioning plan (Exhibit A) describing the planned disposition of Lower Klamath Project facilities, an environmental report that describes the existing environment in the Proposed Action Area (Exhibit E), environmental effects that could potentially occur upon surrender, and any measures that would be taken to mitigate those effects, a schedule for implementing any proposed measures, and copies of consultation with relevant federal and state agencies (Appendix B).

FERC has the authority to impose conditions necessary to protect the public interest in connection with Lower Klamath Project decommissioning and, in this case, dam removal. It is generally not in the public interest to have a decommissioned project under federal (FERC) jurisdiction for an extended period of time. Surrender is not effective upon FERC's issuance of a surrender order; rather, it becomes effective when the FERC Regional Office affirms, in writing, that the licensee has fulfilled the conditions of the surrender order. Implementing the DDP is in the public interest and the Renewal Corporation anticipates that FERC will use the DDP as the basis for their license surrender order.[2]

As noted in the Explanatory Statement of this Amended Surrender Application, the Renewal Corporation (as FERC's designated non-federal representative) initiated informal consultation with: (1) the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) under Section 7 of the Endangered Species Act (ESA) and the joint agency implementing regulations of 50 CFR Part 402; (2) NMFS under Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations at 50 CFR § 600.920; and (3) the California and Oregon State Historic Preservation Officers (SHPO), as required by Section 106 of the National Historic Preservation Act (NHPA), and the implementing regulations of the Advisory Council on Historic Preservation at 36 CFR Part 800.

[2] Per FERC Order 133 FERC ¶ 61232, 62300 (2010), "Once surrender of a license is approved, a project ceases generation, and a project dam and other works are removed, there is no public interest in keeping that project under the Commission's jurisdiction for an extended time."

2.2 National Environmental Policy Act

FERC is the lead agency for purposes of complying with the National Environmental Policy Act (NEPA). To provide FERC sufficient information to undertake an environmental review, this Exhibit E incorporates information from the documents listed in Table 2-1.

Table 2-1 Exhibit E Reference Documents

Date	Author	Title
2004	PacifiCorp	Final License Application, Volume 2, Exhibit E. Klamath Hydroelectric Project (FERC Project No. 2082)
2007	FERC	Final Environmental Impact Statement for Hydropower License: Klamath Hydroelectric Project FERC Project No. 2082-027
2012	BOR	Klamath Dam Removal Overview Report for the Secretary of the Interior: An Assessment of Science and Technical Information (2013); the Detailed Plan for Dam Removal – Klamath River Dams, Klamath Hydroelectric Project, FERC License No. 2082, Oregon – California
2012	U.S. Department of Interior and California Department of Fish and Wildlife	Klamath Facilities Removal Environmental Impact Statement (EIS)/Report
2017	Renewal Corporation	Responses to FERC's July 14, 2017 Request for Additional Information
2018	Renewal Corporation	Definite Plan Report (updated, replaced, and superseded the 2012 Detailed Plan[3]
2018	ODEQ	Final Oregon Water Quality Certification prepared by the Oregon Department of Environmental Quality (ODEQ), including the Evaluations and Findings Report
2020	Kiewit	Klamath River Renewal Project 60% Design Report
2020	SWRCB	Final Water Quality Certification prepared by the SWRCB, including Attachment 4 (CEQA Findings and Statements of Overriding Considerations)
2020	SWRCB	Final Environmental Impact Report (Final EIR) prepared by the California State Water Resources Control Board (SWRCB) in compliance with the California Environmental Quality Act (CEQA)
2011-2020	PacifiCorp	KHSA Interim Measures Implementation Annual Reports

[3] Note that Renewal Corporation is filing, concurrent with this Amended Surrender Application, a DDP that updates, replaces, and supersedes the 2018 Definite Plan Report.

2.3 Section 303 of the Clean Water Act

Section 303(d) of the Clean Water Act (CWA) requires states to identify water bodies that do not attain water quality standards or that do not support their designated beneficial uses; these water bodies are then classified as impaired with respect to water quality. The Klamath River in the Lower Klamath Project area is listed as impaired on the States of Oregon and California Section 303(d) lists of water bodies with water quality impairments (SWRCB 2020b; ODEQ 2018) (see Section 4.4.1 for discussion).

2.4 Section 401 of Clean Water Act

Activities that may result in any discharge into navigable waters require certification from the state in which the discharge will originate. This is to ensure that any such discharge will comply with the applicable provisions of the CWA (i.e., effluent limitations, turbidity, and appropriate state law requirements). No federal license or permit shall be granted until the water quality certification required by Section 401 of the CWA has been obtained from the state agency authorized to administer the CWA, or that the state agency waives the requirement for a certification. If a certification is issued, the conditions set forth in a water quality certification by a state agency are binding upon FERC, and FERC must include them in their final order.

2.4.1 Oregon

The Renewal Corporation submitted a 401 WQC application to ODEQ on September 11, 2017. ODEQ approved that application and issued the water quality certification on September 7, 2018. The conditions of the ODEQ WQC are included in the Amended Surrender Application as proposed measures and are as discussed below in applicable resource areas.

2.4.2 California

On September 23, 2017, the Renewal Corporation filed an application to the SWRCB for the 401 WQC. On June 7, 2018, the SWRCB issued a draft WQC outlining the state and federal law requirements that are applicable to the certification. The Renewal Corporation received the 401 WQC on April 7, 2020 from the SWRCB.

Concurrent with issuance of the 401 WQC, the SWRCB issued its Final EIR in compliance with the CEQA. The requirements of these decisions are included in the Amended Surrender Application as proposed measures, which are discussed below in applicable resource areas.

2.5 Section 402 of Clean Water Act

Implementation of the DDP (Exhibit A) will require coverage under National Pollutant Discharge Elimination System (NPDES) Construction Stormwater General Permits for construction-related stormwater discharges to surface waters in California and Oregon. Information on NPDES and other permits needed for construction activities related to the proposed dam removal are discussed in the DDP. The Renewal Corporation is preparing to apply for and secure these permits.

2.6 Section 404 of the Clean Water Act

Section 404 of the CWA requires authorization from the U.S. Army Corps of Engineers (USACE) for the discharge of dredged or fill material into all waters of the United States, including wetlands. Implementation of the proposed dam removal (as described in Section 3.2) will include such activities within and adjacent to the Klamath River during construction.

The Renewal Corporation will secure and comply with the terms and conditions of an Individual Permit under Section 404 of the CWA. The USACE has the opportunity to become a cooperating agency upon FERC's Notice of the Amended Surrender Application.

2.7 Section 10 of the Rivers and Harbors Act

Section 10 of the Rivers and Harbors Act prohibits the obstruction or alteration of navigable waters without an USACE permit. This permit may be required as part of the 404 CWA permitting process.

2.8 Endangered Species Act

The ESA of 1973, as amended (16 United States Code [USC] § 1531 et seq.) provides a program for the conservation of threatened and endangered plants and animals and their habitats. The ESA defines an "endangered" species in part as a "species which is in danger of extinction throughout all or a significant portion of its range" and a "threatened" species as one "which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" 16 USC § 1532(6)(20). The ESA is administered by the Secretary of the Interior through the U.S. Department of the Interior (DOI), USFWS for most terrestrial species, and by the Secretary of the U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), NMFS for marine and anadromous species.

Consultation is required under Section 7 of the ESA as part of the FERC process. Federal agencies must consult with the USFWS and NMFS to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any threatened or endangered species, or result in the destruction or

adverse modification of critical habitat for these listed species. Jeopardy exists when an action would "reduce appreciably the likelihood of both the survival and recovery of a listed species…" (50 CFR § 402.02).

The Renewal Corporation (as FERC's designated non-federal representative) initiated informal consultation under Section 7 (Appendix B). with the USFWS and NMFS under Section 7 of the ESA on November 10, 2016. Since 2017, the Renewal Corporation has held workshops and conference calls with agencies responsible for implementing ESA consultation and is currently preparing a draft Biological Assessment to better evaluate potential impacts to those species potentially impacted by the Proposed Action. All consultation conducted by PacifiCorp prior to 2016 was focused on interim hydropower operations.

Discussion of the Proposed Action's effects on rare, threatened, and endangered species can be found in Section 4.8, Rare, Threatened and Endangered Species of this Exhibit E. The presence and potential occurrence of ESA-listed aquatic species in the project area is discussed in more detail in Section 4.5 (Fish and Aquatic Resources), for terrestrial wildlife species in Section 4.6 (Wildlife Resources), and for plant species in Section 4.7 (Botanical Resources) of this Exhibit E.

2.9 Magnuson-Stevens Fishery Conservation and Management Act

In 1996, the U.S. Congress recognized the increasing pressure on marine resources in the country and addressed these concerns in its reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act, now known as the Magnuson-Stevens Act. This Act required the eight Regional Fishery Management Councils, in collaboration with NOAA to consider Essential Fish Habitat (EFH) in resource management decisions. Congress defined EFH as "those waters and substrates necessary to fish for spawning, breeding, feeding or growth to maturity." The designation and conservation of EFH seeks to minimize adverse effects on habitat caused by fishing and non-fishing activities.

Before a federal agency proceeds with an activity that may adversely affect a designated EFH, the agency must: (1) consult with NOAA NMFS and, if requested, the appropriate Council for the recommended measures to conserve EFH; and (2) reply within 30 days of receiving EFH recommendations. The agency response must include proposed measures to avoid or minimize adverse impacts on the habitat, or alternatively an explanation if the agency cannot adhere to the recommendation from NOAA NMFS.

The Renewal Corporation (as FERC's designated non-federal representative) initiated informal consultation under Section 305(b) of the Magnusson-Stevens Act on November 10, 2016. Since 2017, the Renewal Corporation has held workshops and conference calls with agencies supporting EFH consultation (Appendix B).

Chinook salmon (*Oncorhynchus tshawytscha*) and chou salmon (*Oncorhynchus kisutch*) are both present in the Proposed Action area and are managed under the Magnuson-Stevens Act. Freshwater EFH also exists for

coho and Chinook salmon in the mainstem Klamath River and its tributaries from the mouth at the Pacific Ocean to Iron Gate Dam, as well as upstream to Lewiston Dam on the Trinity River (BOR 2019).

2.10 Coastal Zone Management Act

The Coastal Zone Management Program is a voluntary program that is national in scope and authorized by the CZMA. This program currently consists of 34 coastal state members, including both Oregon and California.

In Oregon, the Klamath River is not included in the state's coastal watersheds (Oregon.gov 2020).

In California, the Klamath River flows into the Pacific Ocean where the delta and estuary are designated as a Critical Coastal Area within the coastal zone. During scoping for the SWRCB's CEQA EIR, the California Coastal Commission indicated that it may issue a determination of consistency with the CZMA, if the Renewal Corporation prepares and submits a consistency certification and if the NOAA's Office for Coastal Management grants such authority (SWRCB 2020a). The Renewal Corporation will obtain a consistency determination with the CZMA if it is determined necessary.

2.11 National Historic Preservation Act

The NHPA (Public Law 89-665, 54 USC 300101 et seq.) establishes the federal government's policy on historic preservation and the programs, including the National Register of Historic Places (NRHP), through which that policy is implemented. The NRHP is maintained by the Secretary of the Interior of "districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, engineering and culture" (36 CFR § 60.1(a)). The NHPA established a federal policy of cooperation with other nations, tribes, states, and local governments to protect historic sites and values.

Under 54 USC 306108 of the NHPA, hereinafter, "Section 106" and its implementing regulations, "Protection of Historic Properties" (36 CFR Part 800), require that federal agencies take into account the effects of their undertakings (such as issuing a permit or license) on historic properties (cultural resources listed in or determined eligible for inclusion on the NRHP (6 CFR § 800.1(a)). Criteria applied in the NHPA Section 106 process to determine whether a property is eligible for nomination to the NRHP are provided in 36 CFR § 60.4.

The Renewal Corporation (as FERC's designated non-federal representative) initiated informal consultation with the California and Oregon SHPOs on November 10, 2016 (Appendix B). Following that designation, the Renewal Corporation extended invitations to coordinate with other federal and state agencies, tribes, local jurisdictions, and other interested parties and formed a Cultural Resources Working Group in August 2017. The Renewal Corporation continues to meet with this working group and has drafted a MOA (per 36 C.F.R. § 800.6(c)) and a HPMP.

2.12 Native American Graves Protection and Repatriation Act

The Native American Graves Protection and Repatriation Act (NAGPRA), 32 USC.§ 3001, et seq. establishes the ownership of cultural items excavated or discovered on federal or tribal land lies with the lineal descendants and culturally affiliated Indian tribes and Native Hawaiian organizations and, among other things, establishes procedures for the inadvertent discovery or planned excavation of Native American cultural items on federal or tribal lands. Information on compliance with NAGPRA is included in the HPMP.

2.13 Wild and Scenic Rivers and Wilderness Act

The National Wild and Scenic Rivers System was created by Congress in 1968 (Public Law 90-542; 16 USC 1271 et seq.) to preserve certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations. Rivers are classified as wild, scenic, or recreational.

In Oregon, 11-miles of the Klamath River from the J.C. Boyle Powerhouse to the California-Oregon border are designated as a scenic river under Section 2(a)(ii) of the federal Wild and Scenic Rivers Act (WSRA). In California, beginning 3,600 feet below Iron Gate Dam to its mouth, a reach extending approximately 190 miles, the Klamath River is designated as a wild and scenic river under Section2(a)(ii) of WSRA. These designations are based on the outstanding remarkable values of fisheries, recreation, scenic quality, prehistory, history, American Indian traditional uses, and wildlife.

Because the Renewal Corporation is proposing to remove an existing project, FERC will not be licensing the construction of any project works. Per FERC's decision respecting the Condit Project (FERC No. 2342), section 7 of the Wild and Scenic Rivers Act does not apply. *PacifiCorp,* 133 FERC ¶ 61232 (2010).

2.14 State and Local Regulations

The Renewal Corporation is actively working with state and local agencies to enter into Memoranda of Understandings (MOUs), pursuant to FERC's good neighbor approach.[4] These MOUs address the state and local regulations relevant to implementation of the DDP and are discussed in greater detail below. The DDP incorporates the MOU requirements to be implemented by the Renewal Corporation as part of the Proposed Action.

[4] Per FERC Order 115 FERC P 61194 (2006), "Federal preemption does not necessarily mean that the Commission will not elect to require [the licensee] to comply with those of the Counties' requirements that the Commission concludes will not interfere with the company's ability to carry out the Commission's orders. [The Commission prefers] for our licensees to be good citizens of the communities in which projects are located, and thus to comply with state and local requirements, where possible."

- **State of Oregon**: The Renewal Corporation is in final negotiations for an MOU with the above referenced Oregon Agencies. The proposed Oregon MOU establishes the procedures to be followed by the Oregon Agencies and the Renewal Corporation to address matters that fall under the statutory requirements of the respective state agencies. The DDP has incorporated the requirements of the proposed Oregon MOU and these requirements will be implemented by the Proposed Action.

  Klamath County issued a Land Use Compatibility Statement (LUCS) for the Proposed Action on April 13, 2018. The LUCS and supporting findings were provided to ODEQ on May 10, 2018. The LUCS and supporting findings provide an analysis, pursuant to OAR 340-048-0020(2)(i), that demonstrates that the Proposed Action is compatible with the applicable comprehensive plan and land use regulations of Klamath County.
- **CDFW**: The Renewal Corporation and CDFW entered into executed an MOU on September 18, 2020. The DDP incorporates the requirements of this CDFW MOU and these requirements will be implemented by the Proposed Action. The CDFW MOU is appended as Attachment F to the Amended Initial Statement.
- **Siskiyou County, California:** The Renewal Corporation is finalizing the terms of an MOU with Siskiyou County, California. The proposed Siskiyou County MOU addresses matters, such as roads, bridges, and traffic, that fall under the purview of Siskiyou County Code Title 7–Public Works Chapter 3 (Department of Public Works). The DDP incorporates the requirements of this proposed Siskiyou County MOU and these requirements will be implemented by the Proposed Action.
- **Del Norte County, California:** The Renewal Corporation is finalizing the terms of an MOU with Del Norte County, California. The proposed Del Norte County MOU establishes sediment monitoring measures and related minimization proposals for any sediment impacts to Crescent City Harbor as a result of the Proposed Action. The DDP incorporates the requirements of the proposed Del Norte County MOU and these requirements will be implemented by the Proposed Action.
- **Klamath County, Oregon:** The Renewal Corporation and Klamath County Oregon entered into an MOU on March 26, 2019. The Klamath County MOU establishes the procedures to be followed by the parties to implement the Proposed Action in compliance with Klamath County Code Chapter 70, Article 71 (vehicular access). The DDP incorporates the requirements of the Klamath County MOU and these requirements will be implemented by the Proposed Action. The Klamath County MOU is appended as Attachment E to the Amended Initial Statement.

2.14.1 California Environmental Quality Act

CEQA applies to all discretionary projects proposed to be conducted or approved by a California public agency, including private projects requiring discretionary government approval. For the Proposed Action, the SWRCB is the Lead Agency for CEQA compliance and has prepared CEQA findings and statements of overriding considerations to accompany the certified Final EIR for the Project License Surrender (SWRCB 2020a). With the publication of the CEQA findings and the SWRCB Final EIR, CEQA is satisfied with regard to the Proposed Action.

2.15 References

Kiewit Infrastructure West Co. (Kiewit). 2020a. Klamath River Renewal Project 60% Design Report. 2020.

Oregon Department of Environmental Quality (ODEQ). 2020. Maintenance Areas in Oregon. Available online: https://www.oregon.gov/deq/aq/Pages/Maintenance-Areas.aspx. Accessed: May 18, 2020.

Oregon.gov 2020. Accessed April 2020. https://www.oregon.gov/lcd/OCMP/Pages/Coastal-Zone.aspx

State Water Resources Control Board (SWRCB). 2020a. Final Environmental Impact Report for the Lower Klamath Project License Surrender. Available online: https://www.waterboards.ca.gov/waterrights/water_issues/programs/water_quality_cert/lower_klamath_ferc14803_eir.html.

U.S. Department of the Interior Bureau of Reclamation (BOR). 2019. Addendum 2 to the Bureau of Reclamation's December 21, 2018 Final Biological Assessment on the Effects of the Proposed Action to Operate the Klamath Project from April 1, 2019 through March 31, 2029 on Federally-Listed Threatened and Endangered Species, as modified on February 15, 2019: Inclusion of and Request for Essential Fish Habitat Consultation Associated with Klamath Project Operations under the Magnuson-Stevens Fishery Conservation and Management Act. March 8, 2019.

Chapter 3: Proposed Action and Alternatives

3 PROPOSED ACTION

3.1 No-Action Alternative

The No-Action Alternative is the continuation of the operations of the Lower Klamath Project consistent with the existing license. The Renewal Corporation is pursuing the Proposed Action to implement the KHSA. This Exhibit E does not analyze the No-Action Alternative, which was already analyzed in the Final EIS for relicensing (FERC 2007).

3.2 Proposed Action

To create a free-flowing river to allow volitional fish passage, the Proposed Action includes the deconstruction of the J.C. Boyle Dam and Powerhouse, Copco No. 1 Dam and Powerhouse, Copco No. 2 Dam and Powerhouse, and Iron Gate Dam and Powerhouse, and their associated features. Associated features vary by development, but generally include the powerhouse intake structures, embankments, and sidewalls, penstocks and supports, decks, piers, gatehouses, fish ladders and holding facilities, pipes and pipe cradles, spillway gates and structures, diversion control structures, aprons, sills, tailrace channels, footbridges, powerhouse equipment, distribution lines, transmission lines, switchyards, original cofferdam, portions of the Iron Gate Fish Hatchery, residential facilities, and warehouses. The complete removal will be completed within an approximately 20-month period. The removal schedule includes a 9-month period of site preparation and partial drawdown at Copco No. 1 Reservoir. To access the dams for deconstruction, the Renewal Corporation will perform a controlled reservoir drawdown using both existing and modified infrastructure for approximately four to six months depending on water year type. Dam demolition will occur over approximately six to eight months using multiple techniques, including blasting and hydraulic excavators.

The Proposed Action has evolved from the Initial Surrender Application and the 2018 Definite Plan Report. This Exhibit E presents the Proposed Action consistent with the DDP of the Amended Surrender Application, and describes how the Renewal Corporation will implement, upon FERC approval, the activities associated with the Proposed Action.

Road maintenance, improvements, and rehabilitation, culvert replacements, and bridge protection, strengthening, or replacement will occur at locations within the Lower Klamath Project Limits of Work to support construction activities. The Proposed Action involves the relocation of the City of Yreka water conveyance pipeline, Fall Creek Hatchery improvements, and the removal of recreation facilities adjacent to the reservoirs.

To meet the project objective for volitional fish passage, a restoration program will be implemented in the previously inundated areas in the former reservoir footprints, on the mainstem of the Klamath River, and on high-priority tributaries within the original Project reservoirs. Such restoration will involve assisted sediment evacuation and residual sediment stabilization; tributary reconnection, selective post-drawdown grading to provide volitional fish passage, revegetating through native plantings; and enhancing aquatic habitat.

Table 3-1 lists the proposed measures to be implemented to ensure that the Klamath River obtains both the objective of volitional fish passage and restoration, but also addresses all impacts related to the removal of the four dams and their ancillary facilities. The development of these proposed measures was the result of consultation with state and federal agencies, tribes, and technical studies as part of the necessary regulatory approval processes with these stakeholders (Appendix B). These proposed measures were adapted and derived from the SWRCB 2020 Final EIR, Mitigation Monitoring and Reporting Plan (MMRP) (contained in the Final EIR), the 2020 SWRCB 401 WQC, the 2018 ODEQ 401 WQC and the MOUs. Both the SWRCB and ODEQ found that the Proposed Action will have long-term beneficial impacts to water quality and habitat, in part due to implementation of the proposed measures outlined in Table 3-1 (SWRCB 2020b; ODEQ 2018b).

In Table 3-1, a reference to the appropriate resource area in Exhibit E, as applicable is included to assist in locating additional information on the measure. The details of the measures are included in multiple documents, permits, and management plans (as identified in the table) and are, therefore, not restated in their entirety in this document. Applicable measures are addressed in the appropriate resource sections throughout this Exhibit E.

The Renewal Corporation proposes to implement the measures outlined in Table 3-1 to address impacts to each resource area. To ensure those measures are successfully implemented and meet the interests of stakeholders, management plans are being developed. These management plans are outlined in Table 3-2 as well as in the DDP. The Renewal Corporation anticipates that all management plans will be completed and filed with FERC on or before February 26, 2021.

Table 3-1 Proposed Measures

Resource Area (s)	Measure Number	Proposed Measure[1,2,3]	Applicable Management Plan	References
Geology and Soils Water Resources	GSM-1	The Renewal Corporation will develop and implement a **Reservoir Drawdown and Diversion Plan** to include drawdown procedures, drawdown scenarios, reservoir levels, and monitoring and drawdown schedules. This plan will include Slope Stability Analysis and Monitoring to identify areas prone to instability, monitor for instability, and measures to prevent or address instability throughout the term of the Project to ensure soil instability does not result in discharges that violate water quality standards. This plan will protect private property, structures, and cultural sites that could similarly be impacted by slope instability.	Reservoir Drawdown and Diversion Plan	CA WQC Condition 3, 18 OR WQC Condition 5; Final EIR GEO-1
Geology and Soils	GSM-2	The Renewal Corporation will develop and implement **a Sediment Deposit Remediation Plan** that assesses and remediates (if appropriate) visibly obvious sediment deposits on private property adjacent to the Klamath River below Iron Gate Dam to the mouth of the Klamath Estuary that may have been deposited as a result of the Proposed Action. Sediment assessment, testing and remediation procedures are included in this plan.	Sediment Deposit and Remediation Plan	CA WQC Condition 4; Del Norte MOU
Geology and Soils Water Resources	GSM-3	The Renewal Corporation will develop and implement an **Erosion and Sediment Control Plan** based on best management practices to minimize sediment runoff during construction activities, as shown in Exhibit A. This plan will address erosion and sediment runoff at all dam and powerhouse removal sites, spoil disposal areas, recreation site removal, J.C. Boyle scour hole and restoration activities.	Erosion and Sediment Control Plan	CA WQC Condition 10 OR WQC Condition 8 CDFW MOU, Oregon MOU
Water Quality	WQM-1	The Renewal Corporation will develop and implement a **Water Quality Management Plan.** The plan will specify water quality parameters, monitoring methods, locations, and procedures for analysis for the duration of the Proposed Action. This plan will identify all other water quality related monitoring efforts undertaken as part of the Surrender Order, including but not limited to monitoring at recreation facilities, hatcheries, groundwater wells, and sediment deposits.	Water Quality Management Plan	CA WQC Condition 1, 2; 22 OR WQC Condition 2
Water Quality	WQM-2	The Renewal Corporation will develop and implement a **Waste Disposal and Hazardous Materials Management Plan** to dispose of both hazardous and non-hazardous waste materials and implement erosion control measures to preclude runoff from acquiring waste materials and conveying those materials to surface waters. The plan will include procedures for proper storage, containment, and response to spills caused by the Proposed Action and the proper removal and disposal of septic tanks.	Waste Disposal and Hazardous Materials Management Plan	CA WQC Condition 11, 12 Final EIR HZ-1 OR WQC Condition 4d, 9, CDFW MOU and Oregon MOU

Resource Area (s)	Measure Number	Proposed Measure[1,2,3]	Applicable Management Plan	References
Water Quality	WQM-3	The Renewal Corporation will develop and implement a **Construction Management Plan** addressing the requirements for all construction-related resource protection measures. This includes but is not limited to: CA and OR NPDES best management practices, revegetation of construction disturbance areas, construction work camp elements, Spill Prevention, Control and Countermeasure Plan, invasive weed removal on Bureau of Land Management land in construction disturbance zones.	Construction Management Plan	CA WQC Condition 10 OR WQC Condition 4e; 10, CDFW MOU and Oregon MOU
Water Quality	WQM-4	The Renewal Corporation will develop and implement a **Remaining Facilities Plan**. This Plan will describe all structures and ensure that any remaining facilities do not impair water quality.	Remaining Facilities Plan	CA WQC Condition 7 OR WQC Condition 7
Water Resources Terrestrial Resources Aquatic Resources	WRM-1	The Renewal Corporation will develop and implement a **Reservoir Area Management Plan**. This Plan will Include a detailed description of proposed restoration activities and a preliminary map identifying proposed locations for restoration activities. A list of best management practices or other measures addressing invasive weed management, floodplain connectivity and procedures to stabilize and restore the former reservoir area(s) after dam removal will also be included. Wetland restoration and overall revegetation success criteria will be identified. This plan will describe large woody material installation; exclusive use of native plants and the post-drawdown monitoring.	Reservoir Area Management Plan	CA WQC Condition 14 OR WQC Condition 6, CDFW MOU, Oregon MOU
Water Resources	WRM-2	The Renewal Corporation will develop and implement a **Water Supply Management Plan**. This Plan will identify measures to reduce impacts on communities who rely on the Klamath River for their drinking water supply and irrigation water. It will include addressing potential impacts on groundwater wells, irrigation intakes, drinking water diversions from the Klamath River, and City of Yreka water line replacement. The Plan will describe the disposition of all water rights associated with the Proposed Action. The Plan will address fire access through a subplan of Fire Management Plan.	Water Supply Management Plan	CA WQC Condition 8, 15, 21 OR WQC Condition 11g; Final EIR WQ-2, WSWR-1, WSWR-2
Water Resources	WRM-3	The Renewal Corporation will develop and implement an **Interim Hydropower Operations Plan** if drawdown is not initiated within 24 months of the Surrender Order. This Plan limits continued operation of Project facilities to an incidental, short-term timeframe prior to removal, and implements additional conditions should such interim operation exceed 24 months after issuance of the license surrender order.	Hydropower Operations Plan	CA WQC Condition 20
Water Resources	WRM-4	The Renewal Corporation will develop and implement a Fire Management subplan as part of the **Water Supply Management Plan** that includes locations where fire trucks and/or helicopters can access water for residential fire protection after re-establishment of the riverine system. The plan provides new locations for fire truck access that the Renewal Corporation will design and install.	Water Supply Management Plan	Final EIR PS-1, CA WQC Condition 15

Resource Area (s)	Measure Number	Proposed Measure[1,2,3]	Applicable Management Plan	References
Aquatic Resources	ARM-1	The Renewal Corporation will develop and implement an **Aquatic Resources Management Plan**. The Plan will include: (1) an assessment of tributary confluences with the Klamath River for connectivity that provides passage for coho salmon, Chinook salmon, steelhead, and Pacific lamprey; (2) Tributary-Mainstem Connectivity Monitoring; spawning gravel surveys and develop a report and to summarize newly accessible anadromous fish habitat and actions to augment the habitats; mainstem salvage of overwintering juvenile salmonids and relocation efforts; Rescue and Relocation of juvenile salmonids and Pacific lamprey from Tributary Confluence Areas; consideration of a delayed Iron Gate Hatchery smolt release during the drawdown year; Suckers Aquatic Resource Measures and the This plan will include maintaining fish passage at all artificial obstructions and the removal or modification of those artificial fish barriers created or affected by the Proposed Action; and a Fish Presence Plan to monitor and survey.	Aquatic Resources Management Plan	CA WQC Condition 5, 6 OR WQC Condition 4a, 3b
Aquatic Resources Water Quality	ARM-2	The Renewal Corporation will develop and implement a **Hatcheries Management and Operations Plan** which will include plans to construct, modify, operate and maintain Fall Creek hatchery; a description of hatchery operations; target production numbers for each species; water supply details; practices to be implemented to minimize impacts to water quality; and reporting requirements. Production requirements will be determined by NMFS in the final ESA Section 7 Biological Opinion.	Hatcheries Management and Operations Plan	Final EIR AQR-3 CA WQC Condition 13, CDFW MOU
Terrestrial Resources Aquatic Resources	TRM-1	The Renewal Corporation will develop and implement a **Terrestrial and Wildlife Management Plan** identifying the avoidance, minimization measures for amphibians, reptiles (western pond turtles), avian species for willow flycatcher, bald and golden eagles, Gray wolf, and special status plants. Measures will include protection of wetlands riparian with a 20-foot buffer around all delineated wetlands potentially affected by construction. The Plan will include biological monitoring, worker awareness training, herbicide use guidelines, and best management practices for construction crews to not attract and avoid wildlife.	Terrestrial and Wildlife Management Plan	CA WQC Conditions 9, 14,16, 17 OR WQC Condition 4c; Final EIR TER-1, 2, 3, 4, 5 6, 7; RTM 3, 4, 5, 6, 9, 10, CDFW MOU, Oregon MOU
Recreation Water Quality	REM-1	The Renewal Corporation will develop and implement a **Recreation Facilities Plan**. The Plan will identify recreation facilities that will be removed and schedule for removal; identify recreation sites to be added, modified, or maintained following dam removal, and proposed schedule; plans for facilitating transfer of ownership and/or operation of Project recreation facilities; and measures to protect water quality at recreation facilities during construction, removal, maintenance, or other activities associated with the Project recreation facilities.	Recreation Facilities Plan	CA WQC Condition 19

Resource Area (s)	Measure Number	Proposed Measure[1,2,3]	Applicable Management Plan	References
Historic, Cultural and Tribal Resources	HCTM-1	The Renewal Corporation will develop and implement a **Historic Properties Management Plan** to include the Looting and Vandalism Prevention Plan, Inadvertent Discovery Plan, and Monitoring Plan in addition to the Tribal Cultural Resources Management Program (TCRMP). The TCRMP will include a description of post-project implementation. This Plan include process for submitting compliance activity reports to the Yurok Tribe, a description and implementation of the Land Easement and Transfer Measures.	Historic Properties Management Plan	Final EIR TCR 1, 2, 3, 4, 5, 6, 7 CA WQC Condition 22
Air Quality	AQM-1	The Renewal Corporation will implement the best management practices for air quality as they relate to construction, both on-road and off, heavy-duty truck model year engine requirements (2010 or newer unless specified) and dust control measures.	Construction Management Plan	Final EIR AQ 1,2,3,4,5
General	TPM-1	The Renewal Corporation will develop and implement a Traffic Management sublan, as part of the **Construction Management Plan** inclusive of an Emergency Response Plan to address short-term construction-related impacts, prevent incidents, ensure preparedness and maintain consistency with all applicable traffic, highway and roadway regulations in Siskiyou County, California and Klamath County, Oregon.	Construction Management Plan	Final EIR TR-1, Siskiyou County MOU, Klamath County MOU
General	GRM-1	The Renewal Corporation will develop and implement a Camp Management subplan as part of the **Construction Management Plan** for temporary worker housing to identify the location and plans for security and safe temporary housing within the Project Boundary.	Construction Management Plan[5]	None
General	GRM-2	The Renewal Corporation will develop and implement a **Health and Safety Plan** to address site-specific risks, contractor coordination, site security, traffic, and pedestrian management, monitoring of health and safety, training requirements, and accident and incident reporting.	Health and Safety Plan[6]	Final EIR, OSHA
General	GRM-3	The Renewal Corporation will develop and implement a Public Safety Plan as part of the **Health and Safety Plan** to address worker and general public safety procedures for dam breaches or failures during construction activities related to facility removal, specifically the Project dams.	Health and Safety Plan[7]	FERC Surrender Policy

[1] Measures marked as "General" were identified as part of the CEQA process; however, do not fit within specific resource area in conformance with 18 CFR 4.51. These measures are identified as GRM (General Resource Measure).
[2] The proposed measures contained within meet the interest of the California Fish and Game Code through the executed MOU.

[5] This plan is described in the DDP but is not analyzed in Exhibit E.
[6] This plan is described in the DDP but is not analyzed in Exhibit E.
[7] This plan is described in the DDP but is not analyzed in Exhibit E.

[3] The proposed measures contained within meet Oregon Administrative Rules and Oregon Revised Statutes for the protection of environmental resources. The applicable measures from this table will be included in a final Memorandum of Understanding with the State of Oregon in Exhibit B, Proposed Conditions. The executed MOU will be filed with FERC.

Table 3-2 Renewal Corporation Proposed Management Plans[8]

Resource Area (s) Primary & *(Secondary)*	Management Plan	Included Measures	References
Geology and Soils *(Water Resources)*	Reservoir Drawdown and Diversion Plan *-CA Reservoir Drawdown and Diversion Plan* *-CA Slope Stability Plan* *-OR Reservoir Drawdown and Diversion Plan*	GSM-1	CA WQC Condition 3, 18 OR WQC Condition 5; Final EIR GEO-1
Geology and Soils *(Water Resources)*	Sediment Deposit and Remediation Plan	GSM-2	CA 401 Condition 4 Del Norte County MOU
Geology and Soils *(Water Resources)*	Erosion and Sediment Control Plan *-CA Erosion and Sediment Control Plan* *-OR Erosion and Sediment Control Plan*	GSM-3	CA 401 Condition 10 OR 401 Condition 8
Water Resources *(Terrestrial Resources)* *(Aquatic Resources)*	Reservoir Area Management Plan	WRM-1 TRM-2	CA WAC Condition 9, 14 OR WQC Condition 6 Final EIR TER-5
Water Quality	Water Quality Management Plan	WQM-1 WQM-2	CA WQC Condition 1 OR WQC Condition 2
Water Quality	Waste Disposal and Hazardous Materials Management Plan	WQM-3	Condition 11, 12 Final EIR HZ-1 OR WQC Condition 4d, 9
Water Quality *(Air Quality)*	Construction Management Plan	WQM-4 AQM-1 AQM-2 TPM-1 GRM-1	CA WQC Condition 10 OR WQC Condition 4e; 10 Final EIR AQ 1,2,3,4,5 Final EIR ENR-1 Final EIR TR-1

[8] The Management Plans listed may also include subplans that make up the plan entire plan indicated. These subplans are either direct requirements from the Oregon or California CWA 401s, state or county MOU's, or a necessary construction element for successful implementation. The subplans are shown in *italic*. Dividing the "parent" management into specific subplans allows for the Renewal Corporation to consult with the respective agencies identified as a reviewer/approver only in regards to their specific interest.

Resource Area (s) Primary & *(Secondary)*	Management Plan	Included Measures	References
Water Quality	Remaining Facilities and Operations Plan	WQM-5	CA WQC Condition 7 OR WQC Condition 7
Water Resources	Water Supply Management Plan	WRM-6 WRM-7	CA WQC Condition 8, 15, 21 OR WQC Condition 11g Final EIR WQ-2, WSWR-1, WSWR-2
Water Resources	Hydropower Operations Plan	WRM-8	CA WQC Condition 20
Aquatic Resources	Aquatic Resources Management Plan	ARM-1	CA WQC Condition 5, 6 OR WQC 4a, b
Aquatic Resources	Hatcheries Management and Operations Plan	ARM –2	Final EIR AQR-3 CA WQC Condition 13
Terrestrial Resources	Terrestrial and Wildlife Management Plan	TRM-1	CA WQC Conditions 9, 14,16, 17 OR WQC Condition 4c; Final EIR TER-1, 2, 3, 4, 5 6, 7; RTM 3, 4, 5, 6, 9, 10, CDFW MOU, Oregon MOU
Recreation *(Water Quality)*	Recreation Facilities Plan	REM-1	CA WQC Condition 19
Historic, Cultural and Tribal	Historic Properties Management Plan	HCTM-1	Final EIR TCR 1, 2, 3, 4, 5, 6, 7 CA WQC Condition 22
General	Health and Safety Plan	GRM-2	Final EIR; OSHA
General	Public Safety Plan	GRM-3	FERC Surrender Policy

3.3 References

Federal Energy Regulatory Commission (FERC). 2007. Final Environmental Impact Statement for Hydropower License: Klamath Hydroelectric Project FERC Project No. 2082-027. FERC/EIS-0201F. Washington, DC, Federal Energy Regulatory Commission, Office of Energy Projects, Division of Hydropower Licensing.

Oregon Department of Environmental Quality. 2018a. Final Oregon Water Quality Certification prepared by the Oregon Department of Environmental Quality (ODEQ).

Oregon Department of Environmental Quality (ODEQ). 2018b. Evaluations and Findings Report. Section 401 Water Quality Certification for the Removal of the lower Klamath Project (FERC Project Number 14803). September 2018. Available online: https://www.oregon.gov/deq/FilterDocs/ferc14803report.pdf. Accessed May 15, 2020.

State Water Resources Control Board (SWRCB). 2020a. Final Environmental Impact Report for the Lower Klamath Project License Surrender. Available online: https://www.waterboards.ca.gov/waterrights/water_issues/programs/water_quality_cert/lower_klamath_ferc14803_eir.html.

State Water Resources Control Board (SWRCB). 2020b. Final Water Quality Certification prepared by the State Water Resources Control Board, including Attachment 4 (CEQA Findings and Statements of Overriding Considerations).

Chapter 4: Environmental Analysis Report

4 ENVIRONMENTAL ANALYSIS REPORT

4.1 Overview of Environmental Analysis

This Exhibit E uses existing information to describe the environmental setting (i.e., existing condition) and to summarize the anticipated effects of the Proposed Action. A robust record has been developed since PacifiCorp's Application for New License in 2004 which is incorporated by reference in this section. For convenience, this record has been summarized with a "cross-walk" table in each resource section to identify where additional information may be found regarding the resource area and the Proposed Action. The table includes the following documents, citations for which are provided throughout document:

- PacifiCorp's 2004 Application for New License, Exhibit E
- FERC's November 2007 Final Environmental Impact Statement for Hydropower License: Klamath Hydroelectric Project FERC Project No. 2082-027
- U.S. Department of the Interior's 2012 Klamath Facilities Removal Final Environmental Impact Statement/Environmental Impact Report
- The Klamath River Renewal Corporation's 2018 Definite Plan Report
- State Water Resource Control Board's 2020 Final Environmental Impact Report for Lower Klamath Project
- State Water Resource Control Board's 2020 Water Quality Certification for Lower Klamath Project License Surrender
- Oregon Department of Environmental Quality's 2018 Water Quality Certification for Lower Klamath Project License Surrender.
- State Water Resource Control Board's 2020 Water Quality Certification for Lower Klamath Project License Surrender – Attachment 4 – CEQA Findings and Statements of Overriding Considerations
- Oregon Department of Environmental Quality's 2018 Evaluation and Findings Report. September 2018
- PacifiCorp Klamath Hydro Settlement Agreement, Interim Measures Implementation Annual Reports 2011-2020

Each resource section relies on the Project description in Exhibit A and Section 1 of Exhibit E, the Klamath River Basin description in Section 4.2, and the Proposed Action stated in Section 3.2. Some resources discussed herein may contain information that further describes the Lower Klamath Project and/or Klamath River Basin.[9] Finally, proposed measures that may alleviate specific effects on resources as a result of Proposed Action are presented in the appropriate resource sections.

[9] In accordance with FERC regulations at 18 CFR Section 4.51, major constructed project and Section 6.2, License Surrender.

Exhibit E requirements concerning wetlands, vegetative cover, land development population size and density, presence of any floodplain, and occurrence of flood events in the vicinity of the Lower Klamath Project are discussed in the applicable resource sections under the "Affected Environment."

4.2 General Description of the Klamath River Basin

As described in Section 4.1, this Exhibit E incorporates by reference the extensive environmental documentation developed since the 2004 PacifiCorp Application as described in Table 4-1.

Table 4-1 Cross-walk for General Description of River Basin Reference Documents

Date	Author	Reference Document	Section Number	Page Number(s)
2004	PacifiCorp	Application for New License	E2.0	2-1 – 2.20
2007	FERC	Final EIS	3.1	3-1 – 3.2
2012	U.S. BOR	EIS/EIR	3.1	3.1-1 – 3.1-10
2018	KRRC	Definite Plan Report	1.2	29
2020	SWRCB	Final EIR	2.3 – 2.7	AT1-111 – AT1-133
2020	State of California	401 WQ Certificate	2.0	6 – 15
2018	State of Oregon	401 WQ Certificate	N/A	N/A
2020	SWRCB	Attachment 4: CEQA Findings	N/A	N/A
2018	ODEQ	Evaluation and Findings Report	1.0 3.7.1	1 – 2 8
2011-2020	PacifiCorp	KHSA Interim Measures Implementation Annual Report (2020)	1.0	1-5

The Klamath River originates at the outlet of Upper Klamath Lake in south-central Oregon and flows approximately 30 miles to the Oregon-California border. The river continues southwest for an additional 230 miles through Northern California, draining directly into the Pacific Ocean south of Crescent City. In total, the Klamath River is approximately 260-miles-long. Major tributaries of the Klamath River include Butte Creek and the Shasta, Scott, Salmon, and Trinity rivers sub-basin (Figure 4-1). These flows contribute to the Klamath River being the second highest discharging river in California (FERC 2007). The Klamath River is the main river channel of the 15,700-square-mile Klamath River Basin and is categorized into the Upper and Lower Klamath River sub-basin geographic areas (USDA 2019).

The Upper Klamath River sub-basin is 8,100 square miles and spans seven Oregon counties and one California county (Figure 4-1) (USDA 2019). Marshes, such as Klamath Marsh, are common within the Upper Klamath sub-basin (FERC 2007). The Upper Klamath River sub-basin includes five major lakes: Crater, Upper Klamath, Lower Klamath, Clear, and Tule. Inflow to the upper basin is mostly comprised of the Sprague, Williamson, and Wood rivers; the latter of which drains directly into Upper Klamath Lake (FERC 2007). The shallow Upper Klamath Lake, the headwaters of the Klamath River, is a regulated natural lake, and is the largest lake by surface area in Oregon, measuring approximately 25-miles-long and 8-miles-wide. All four Lower Klamath Project dams are located within the Upper Klamath River sub-basin (Figure 4-1).

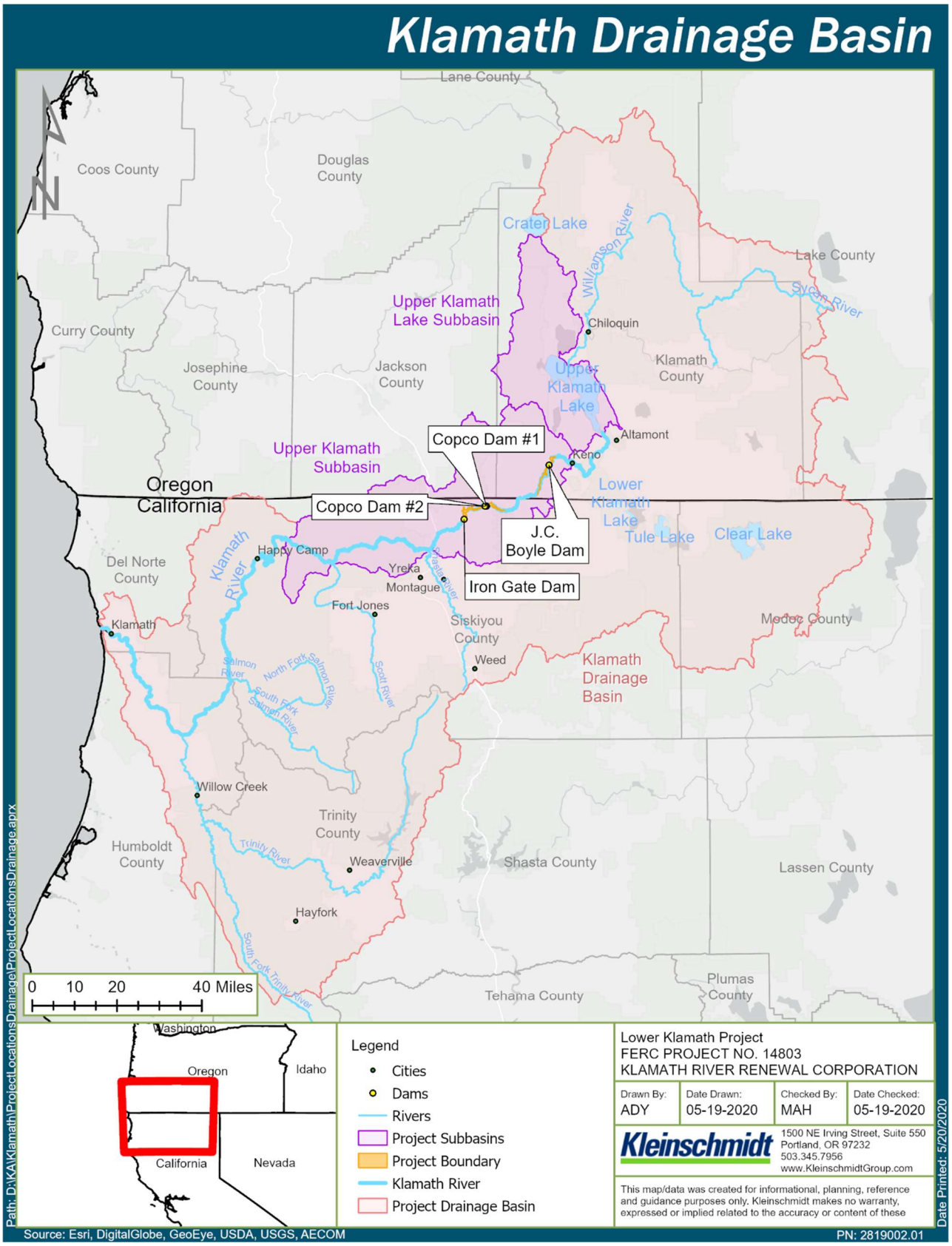


Figure 4-1 Klamath River Drainage Basin

The J.C. Boyle Dam is the furthest upstream dam, located in Klamath County, Oregon. Its reservoir is the smallest of the three reservoirs created by the Lower Klamath Project dams, measuring 0.60-square-miles. Located 28.4 miles downstream of J.C. Boyle is the Copco No. 1 Dam, followed directly by Copco No. 2 Dam less than 1.0 river mile (RM) downstream in Siskiyou County, California. Together, these two dams are responsible for the containment of Copco Lake. Downstream the Iron Gate Dam forms the 1.59-square-mile Iron Gate Reservoir. Iron Gate Dam is the furthest downstream dam and lies on the border of the Upper and Lower Klamath River sub-basins.

The Lower Klamath River sub-basin spans seven California counties (Figure 4-2) and encompasses approximately 7,600-square-miles of land (USDA 2019). Although smaller in land coverage, the Lower Klamath River sub-basin contains more tributaries than the Upper Klamath River sub-basin. The largest tributary to the Lower Klamath River sub-basin is the Shasta River. Other major tributaries to the Lower Klamath River sub-basin include the Scott, Trinity, and Salmon rivers (USDA 2019).

4.2.1 Topography

The Klamath River originates in a low gradient arid region and flows toward a temperate rainforest region (NOAA 2019). The Upper Klamath River sub-basin is located within the Modoc Plateau province and is bordered to the west and the east by the eastern edge of the Cascade Range and fault-block mountains, respectively (FERC 2007). The headwaters of the Klamath River are located at high elevations (4,139 feet at Upper Klamath Lake) with moderate topography, semi-arid weather conditions, and few streams compared to downstream provinces (FERC 2007). Due to these characteristics, sediment yield is low compared to downstream provinces (FERC 2007).

The Modoc Plateau province gradually begins to transition into the Cascade Range province as the Klamath River continues downstream into the Lower Klamath River sub-basin and into the Klamath Mountains province. Tributaries to the Klamath River in this region include the Scott, Salmon, and Trinity rivers. Steep slopes are characteristic to the Klamath Mountains province, where the highest elevation exceeds 9,000 feet in the Trinity Alps (FERC 2007). Due to the steep slopes and deep soils in the region, the middle to lower portions of the Klamath mid-river experience higher sediment loads compared to upstream regions (FERC 2007).

The Klamath Mountains province transitions into the Coast Range province. The Coast Range province houses an array of rocks, largely comprised of sandstone with small amounts of shale, chert, limestone, conglomerate, serpentine, and blueschist. The combination of these rock types along with faulting results in steep hillside slopes and a high rate of erosion, resulting in high sentiment loads (FERC 2007).

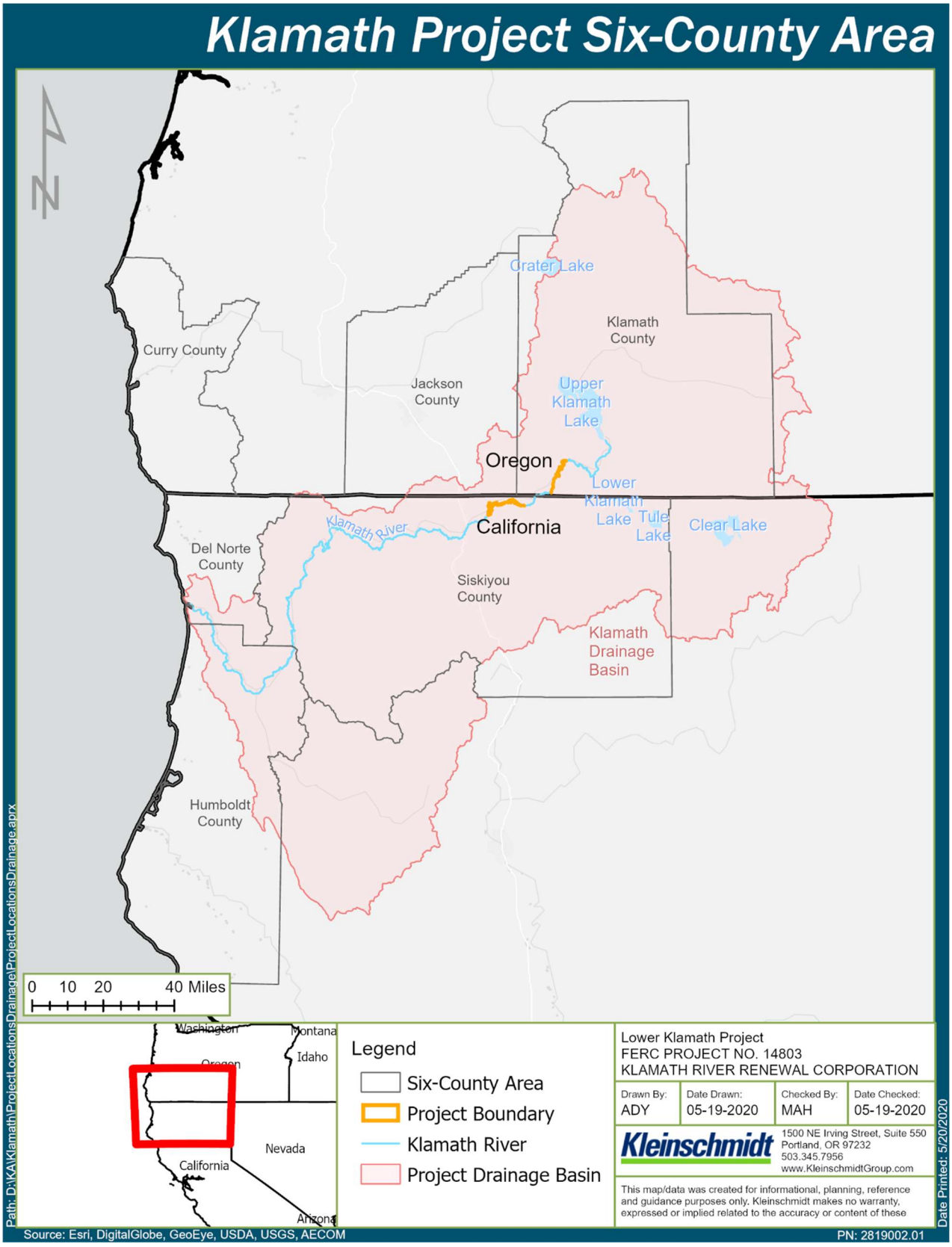


Figure 4-2 Lower Klamath Project Six-County Area

4.2.2 Climate

Due to the span of topography and geographic location, the Klamath River Basin has a wide range of climatic conditions, specifically temperature and precipitation. Temperatures within the project area tend to increase from upstream to downstream, in part as a result of a higher elevation at J.C. Boyle Dam and lower elevations at the three dams downstream. Temperatures can range from below freezing to above 100 degrees Fahrenheit (°F) in extreme conditions. Average annual precipitation is 13.5 inches in Klamath Falls and 18.2 inches at Copco Reservoir, both occurring mostly as rainfall. Higher elevations surrounding the project area can receive more than 50 inches of precipitation annually, where snow is more common. The project area experiences distinct dry and wet cycles, historically lasting approximately 20 to 30 years per cycle. Historical data support a positive correlation between runoff and the amount of precipitation, with a general decrease over the last 20 years in runoff and discharge with a decrease in precipitation amount (Barr et al., 2010).

4.2.3 Land Uses and Economic Activities

J.C. Boyle Dam is located in Klamath County, Oregon with the remaining three dams, Copco No. 1, Copco No. 2, and Iron Gate, located in Siskiyou County, California. Klamath County is the fourth largest county in Oregon by geographic area, ranking 4th of 36 counties, consisting of approximately 5,941 square miles (USCB 2020). Siskiyou County is the fifth largest county in California by geographic area, ranking 5th of 58 counties, consisting of 6,278 square miles (USCB 2020).

Additional demographic characteristics, and employment and income information can be found in Section 4.10, Socioeconomics.

Land use in the vicinity of the Lower Klamath Project is typical of rural areas in Oregon and California, and includes agriculture, open space, forestry, recreation, and rural communities (FERC 2007). Most of the area is composed of agriculture and grazing pastures or open space for conservation, with very little geographic space used by the hydroelectric operations and recreation sites (FERC 2007). Urban areas include Klamath Falls, the city of Yreka, near Keno, and areas of Copco Lake (FERC 2007).

4.2.4 References

Barr, Brian., Koopman, M., Williams, C., Vynne, S., Hamilton, R., and Doppelt, B. 2010. Preparing for Climate Change in the Klamath River Basin. National Center for Conservation Science and Policy. March 2010. Retrieved from: http://www.theresourceinnovationgroup.org/storage/KlamCFFRep_5-26-10finalLR.pdf. Accessed April 14, 2020.

Federal Energy Regulatory Commission (FERC). 2007. Final Environmental Impact Statement for Hydropower License: Klamath Hydroelectric Project FERC Project No. 2082-027. FERC/EIS-0201F. Washington, DC, Federal Energy Regulatory Commission, Office of Energy Projects, Division of Hydropower Licensing.

National Oceanic and Atmospheric Administration (NOAA). 2019. Klamath River Basin: Water Management, Hydroelectric Management and Dam Removal Activities, Restoration Activities, Conservation Partnerships, Salmon Management. Retrieved from: https://www.fisheries.noaa.gov/west-coast/habitat-conservation/klamath-river-basin. Accessed April 2020.

U.S. Census Bureau (USCB). 2020. State and County Quick Facts. U.S. Department of Commerce. Available online at: https://www.census.gov/quickfacts/fact/table/klamathcountyoregon/PST045219#. Accessed on April 7, 2020.

U.S. Department of Agriculture (USDA). 2019. Klamath River Basin. Natural Resource Conservation Service. Retrieved from: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/?cid=nrcs143_023523. Accessed April 2020.

4.3 Geological and Soil Resources

As described in Section 4.1, this Exhibit E incorporates by reference the extensive environmental documentation developed since the 2004 PacifiCorp Application as described in Table 4-2.

Table 4-2 Cross-walk of Geology and Soils Reference Documents

Date	Author	Reference Document	Section Number	Page Number(s)
2004	PacifiCorp	Application for New License	E2.4	2-3 – 2-4
2007	FERC	Final EIS	3.3.1	3-5 – 3-62
2012	U.S. BOR	EIS/EIR	3.11	3.11-1 – 3.11-30
2018	KRRC	Definite Plan Report	4.8 – 4.9	144 – 146
2020	SWRCB	Final EIR	2.2.12 3.11	2-115 – 2-126 AT1-732 – AT1-759
2020	State of California	401 WQ Certificate	Condition 4 Condition 18	35 and 56-58 41 and 80
2018	State of Oregon	401 WQ Certificate	7 – 8	6 – 9
2020	SWRCB	Attachment 4: CEQA Findings	N/A	81 - 85
2018	ODEQ	Evaluation and Findings Report	3.7.2	9
2011-2020	PacifiCorp	KHSA Interim Measures Implementation Annual Report (2020)	N/A	N/A

4.3.1 Affected Environment

4.3.1.1 Geology

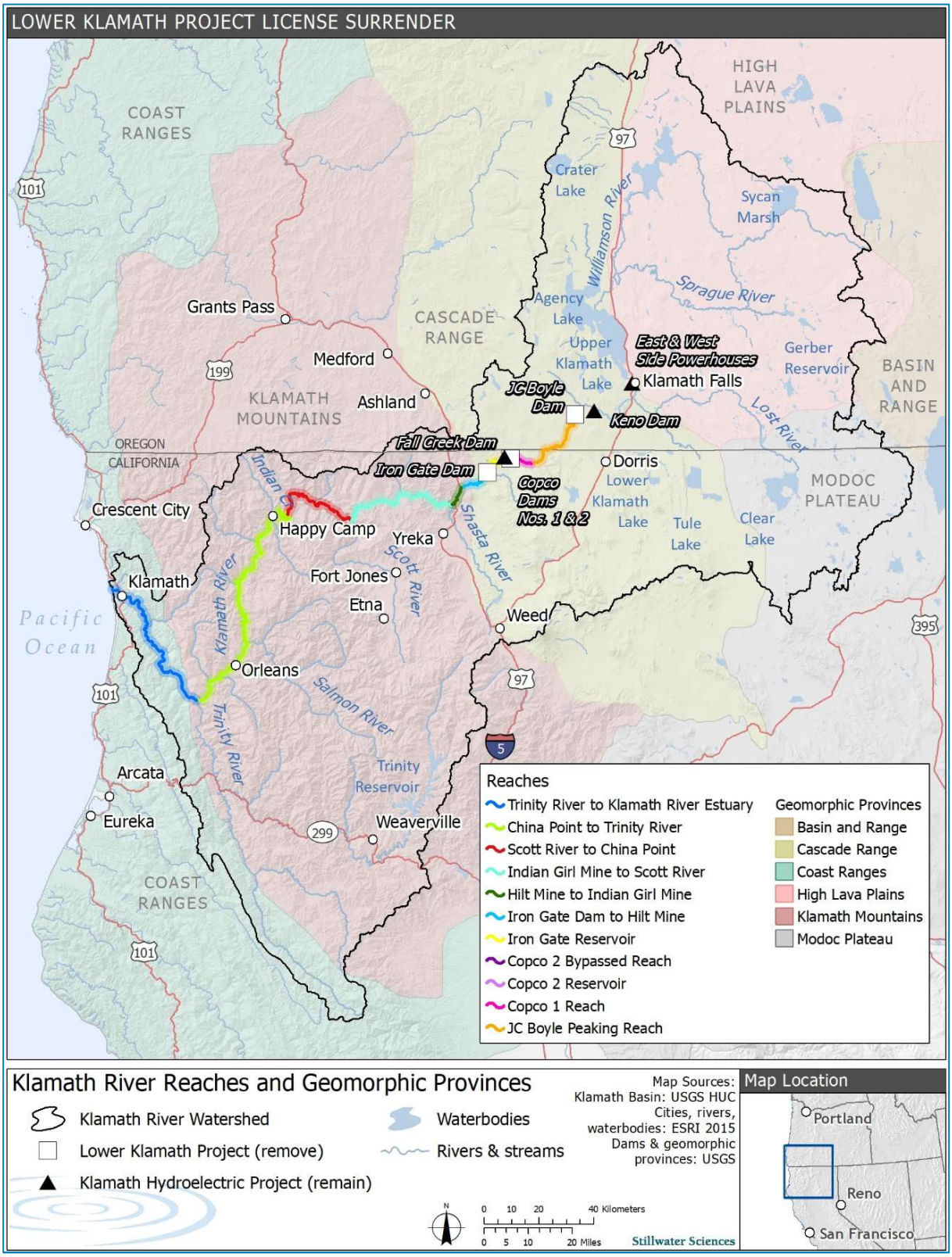
The Klamath River Basin lies at or near the convergence of the Pacific, Juan de Fuca, and North American tectonic plates. As such, the river's channel morphology and that of its tributaries vary the supply of inputs such as water, sediment, nutrients, and wood (FERC 2007). The Upper Klamath River Basin lies in the transition zone between the Modoc Plateau and Cascade Range physiographic provinces, with the Klamath River flowing west through the Klamath Mountain province and then the Coast Range province where it reaches the Pacific Ocean near Requa, California (Figure 4-3) (BOR and CDFG 2012).

The portion of the basin above Upper Klamath Lake drains portions of the High Lava Plains and Modoc Plateau physiographic provinces. The High Lava Plains and the Modoc Plateau primarily consist of Tertiary period volcanic rock (BOR and CDFG 2012). The provinces are the result of crustal thinning and non-explosive volcanism and lava flows. These provinces are characterized by low gradient streams and internally drained areas that fill with volcaniclastic sediments, alluvial fan deposits, and lacustrine sediments. Proximity to the Klamath and Cascade mountain ranges' rain shadows result in streamflow primarily charged by groundwater flow through the region's permeable volcanic rocks. Low channel gradients, limited surface runoff, and internal drainage contribute to a muted hydrologic response to storm events and low sediment yield to the Klamath River (SWRCB 2020a).

The Lower Klamath Project dams are within the Cascade Range Physiographic Province, still within the Upper Klamath River Basin. The Cascade Range is characterized by Cenozoic age andesitic volcanic rocks. The Cascade Province is subdivided into the Western Cascade and High Cascade sub-provinces based on the age and style of volcanism experienced (Mertzman and Hazlett 1997, Taylor 1990, as cited in SWRCB 2020a). The Western Cascade Sub-Province is dominated by calc-alkaline continental margin andesites extruded approximately 40 million years ago (Mertzman and Hazlett 1997, as cited in SWRCB 2020a). The High Cascades Sub-Province is younger (Quaternary age) and is distinguished by lava flows, lava shields, pyroclastic flows, tuffs, cinder cones, and classic cone shaped stratovolcanoes (SWRCB 2020a).

The Mid Klamath River Basin describes the area between Iron Gate Dam and the Klamath River's confluence with the Trinity River. This area falls predominantly within the Klamath Mountains Physiographic Province. It is characterized by Cretaceous to Paleozoic age metamorphosed marine igneous and sedimentary rocks (BOR and CDFG 2012). Widespread metamorphism and tectonic activity resulted in faulting and folding that has been exposed by riverine erosion. These more weather-resistant rocks result in high-relief terrain with prominent peaks and ridges (SWRCB 2020a).

The Lower Klamath River Basin describes the area between the Trinity River confluence and the Pacific Ocean. It is located within the Coast Range Physiographic Province. This area is underlain by the Eastern Belt of the Franciscan Complex and a narrow band below of the Central Belt at the coastline (BOR and CDFG 2012). The combination of tectonic deformation and shear, compositionally weak bedrock, and high precipitation rates in the Coast Ranges result in high erosion rates and sediment yields compared to other parts of the Klamath River Basin (FERC 2007 as cited in SWRCB 2020a).



Source: SWRCB 2020a

Figure 4-3 Klamath River Basin Physiographic Provinces

4.3.1.1.1 Faults and Seismicity

Volcanic Activity and Associated Strata

The Cascades Physiographic Province consists of a narrow band of shield volcanoes built on top of the eastern portion of the Western Cascades strata. The High Cascades are represented in the vicinity of the Lower Klamath Project by the extinct cones of Eagle Rock Mountain to the south of the Klamath River valley, the Secret Spring Mountain and McGavin Peak to the southeast, and Mount Shasta to the Northwest. In addition to the large shield volcanoes with their multiple eruptive events, numerous smaller vents and volcanoes are present in the area. Most of the volcanism in the Upper Klamath River Basin consists of single events from a given vent and most of the smaller explosive cones are formed from the interaction of flow material intersecting ground water (hydrovolcanic events). High Cascades volcanism continues to the present day (PanGeo 2008 as cited in BOR and CDFG 2012). Copco and Iron Gate dams are in the Western Cascades where volcanic activity is thought to have begun between 42 and 45 million years ago (Eocene) continuing until approximately 10 and 5 million years ago (PanGeo 2008 as cited in BOR and CDFG 2012). Near Copco Reservoir, up to half of the Western Cascade strata are exposed in the Klamath River Canyon as a result of river down cutting. In this exposure, the Western Cascade strata are comprised of inter-bedded tuffs, ash, and lava flows (Hammond 1983 as cited in BOR and CDFG 2012).

4.3.1.1.2 Mineral Resources

Numerous mining locations have been located in and along the Klamath River historically below J.C. Boyle Dam. Economically, the most important minerals that are extracted along the Klamath River are sand, gravel, and crushed rock (CGS/USGS 2004, as cited in SWRCB 2020a) (Figure 4-4). These mines are predominantly located below Iron Gate Dam within the Klamath Mountain Physiographic Province. These resources are more prominent here due to the geologic make-up of the Klamath Mountain Province and tributary sediment input.

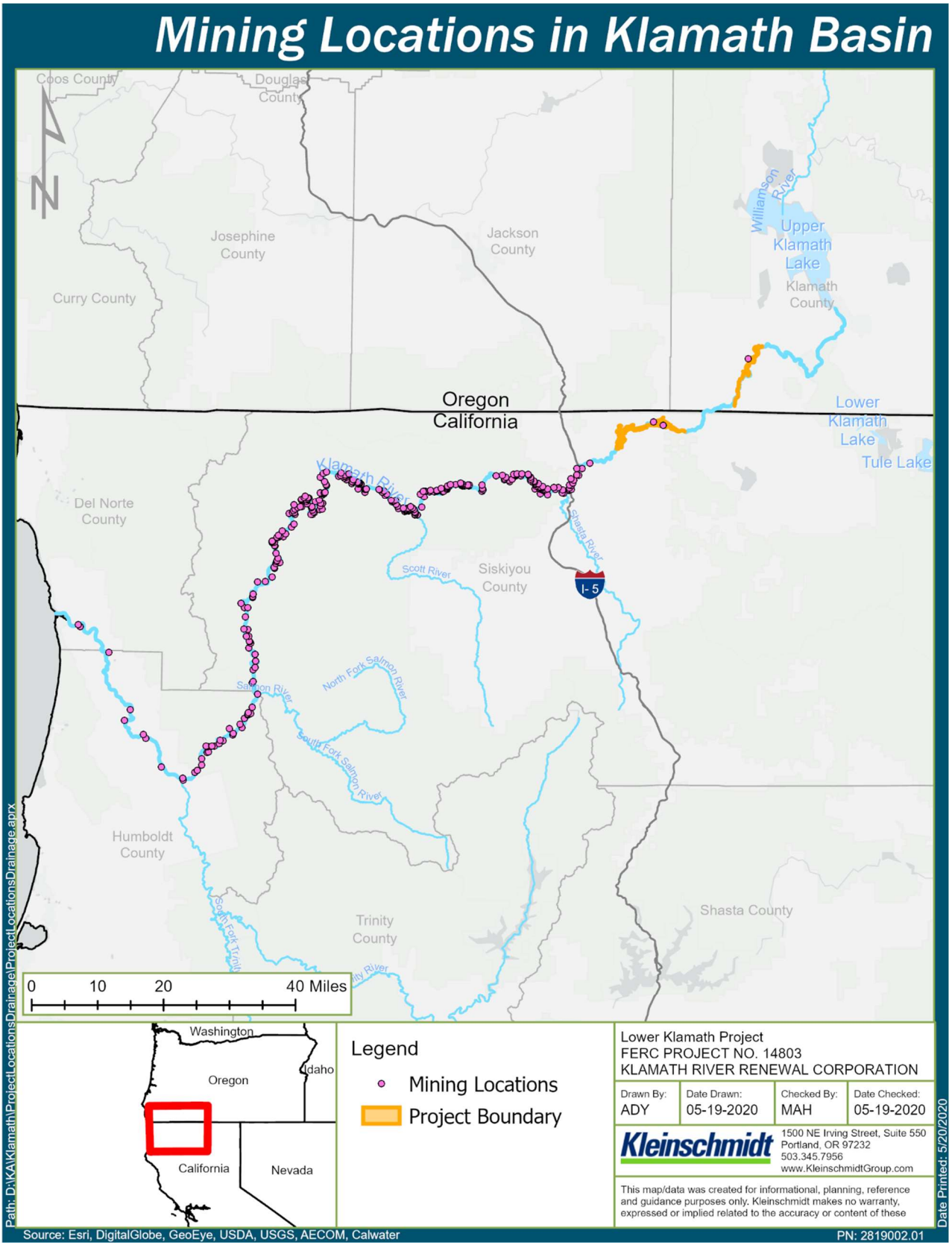


Figure 4-4 Mining Locations in Klamath Basin

Other minerals that may be mined include asbestos, chromium, clay, copper, diatomite, gold, graphite, and mercury. Diatomite deposits surround much of the shoreline of Copco No. 1 Reservoir (PanGeo 2008, as cited in SWRCB 2020a). It is a very fine-grained sedimentary rock most often used as a filter aid in commercial applications (SWRCB 2020a). Wave action on Copco No.1 Reservoir has resulted in undercutting and erosion of weaker material has resulted in near vertical bluffs in the diatomaceous deposits along the reservoir. These deposits are currently inaccessible due to their location within the reservoir and existing erosion (SWRCB 2020a).

4.3.1.2 Soils

Soils in the vicinity of the Upper Klamath River, surrounding J.C. Boyle Reservoir, and along the river south to the Oregon-California border generally consist of lacustrine and alluvial clay, silt, fine-grained sand, and peat (Priest et al 2008 as cited in BOR and CDFG 2012). The primary soil association along both sides of the river is Skookum-rock outcrop-Rubble land complex with 35 to 70 percent slopes. Immediately surrounding Keno Impoundment, soils consist of the Bly-Royst complex (NRCS 2005 as cited in BOR and CDFG 2012).

Soils along the Klamath River and on reaches between the Lower Klamath Project reservoirs are less homogenous in California than in Oregon. However, the various soil formations can be grouped generally into those on steeper slopes, flood plain or terrace surfaces, or directly along the river itself. The soils on steeper slopes are shallow to moderately deep and comprise a 7- to 8-inch surface horizon of gravelly loam, and an underlying horizon of gravelly, clayey loam. Floodplain and terrace soils are comprised of deep, well-drained alluvium and colluvium. Directly along the river, soils are comprised of unconsolidated alluvium, colluvium, and fluvial deposits. These geologically recent deposits consist of unconsolidated sand, silt, and gravels deposited by water or erosion (FERC 2007 as cited in BOR and CDFG 2012).

Soils along the Klamath River below Iron Gate Dam are generally composed of associations consisting of gravelly clay loam and gravelly sandy loam (Holland-Clallam, Skalan, Weitchpec, and Lithic Mollic Dubakella associations). Soils on steeper slopes are deeper (22- to 60-inches) than those on less steep slopes and along the floodplain. These soil associations are all classified as well-drained, with low to no flooding frequency or ability for ponding water. Soils directly along the river in floodplain areas are comprised of alluvial deposits consisting of sand and gravels (NRCS 2007 and 2008 as cited in BOR and CDFG 2012).

4.3.1.3 Slope Stability/Landslides

Observations of the Lower Klamath Project reservoirs identified no areas of unstable slopes or existing landslides adjacent to J.C. Boyle Reservoir or Copco 2 Reservoir (BOR and CDFG 2012). Land surrounding J.C. Boyle Reservoir is generally low gradient and underlain by competent materials (SWRCB 2020a). No large-scale landslides have been identified in either the terrestrial or subaqueous slopes around Copco No. 1 Reservoir, although a large alluvial fan or colluvial deposit on the north side of Copco No. 1 Reservoir may be related to an ancient inactive landslide (PanGeo 2008 as cited in SWRCB 2020a). Wave action at the Copco No. 1 Reservoir shoreline has eroded sand and volcaniclastic tuff beneath diatomite beds, creating up to 10-

to 20-feet-high vertical exposures (SWRCB 2020a). Within Iron Gate Reservoir, the adjacent hillside slopes are generally considered stable with no active landslide areas. However, geomorphic features suggestive of old, inactive landslides were identified on the south rim slopes above the reservoir and may have contributed to past sediment input into the reservoir (BOR and CDFG 2012). In addition, a low level of wave-induced shoreline erosion at the margin of the reservoir was observed and reported in the PanGeo (2008, as cited in BOR and CDFG 2012) study. The erosion has not substantially undercut or disturbed the hillside slopes; the exposed material along the shoreline comprises relatively competent volcanic or volcaniclastic rock.

4.3.1.4 Geomorphology

The Klamath River's headwaters flow through relatively flat, open country of the Modoc Plateau before flowing through mountainous areas with input of cold water from the major tributaries of the Cascade Range, Klamath Mountain, and Coast Range Provinces. Accordingly, the river is warmer and flatter in the upper basin, while mid and lower basin reaches tend to be colder and steeper. The Klamath River from the Oregon-California state line to downstream from Iron Gate Dam is a predominantly non-alluvial, sediment supply-limited river flowing through mountainous terrain. Downstream and for most of the river's length to the Pacific Ocean, the river maintains a relatively steep, high-energy, coarse-grained channel frequently confined by bedrock. Much of the course of the river in the project area is bedrock controlled, interspersed with relatively short alluvial reaches; thus, the influence of the Lower Klamath Project on river geomorphology within the Lower Klamath Project area and downstream is limited. Floodplain development is minimal, and wider valleys allowing alluvial channel migration processes are rare. A more detailed description of the geology and geomorphology of each of the subject reservoirs and associated river reaches, beginning with J.C. Boyle Reservoir and continuing downstream to the river estuary (BOR and CDFG 2012) is provided in Appendix C.

4.3.1.4.1 River Sediment Supply

The Klamath River is supply limited for fine material (sands and small gravels), but capacity limited for large material (cobbles and boulders) (BOR and CDFG 2012). Practically no substantial sediment is supplied to the Klamath River from the watershed above Keno Dam; however, because of its large surface area, Upper Klamath Lake traps practically all sediment entering it from its tributaries (BOR and CDFG 2012).

Existing information on sediment loads delivered to the Klamath River was combined with extrapolated estimates of sediment delivery from data-deficient source areas to derive estimates of the cumulative average of annual sediment delivery in the Klamath River from Keno Dam to the Pacific Ocean and the proportion of coarse material and fine material within the load (Stillwater Sciences 2010, as cited in SWRCB 2020a) (Table 4-3). The average annual sediment delivery from Keno Dam to Iron Gate Dam was estimated to be approximately 150,000 tons per year. The Scott River supplies approximately 607,000 tons per year, the Salmon River 320,000 tons per year, and the Trinity River 3,300,000 tons per year. The cumulative average annual sediment delivery from the Klamath River to the ocean is estimated to be 6,237,500 tons

per year. The cumulative average annual delivery of sediment with a particle size greater than 0.063 millimeters (mm) (coarse sediment) is estimated to be 1,970,200 tons per year. This estimate is within approximately 20 percent of Willis and Griggs (2003 as cited in SWRCB 2020a) estimate of average annual coarse sediment flux from the Klamath River to the Pacific Ocean (2,502,200 tons per year). These estimates are based on various data sources encompassing different time periods and do not account for transfer of sediment to and from storage nor attrition (SWRCB 2020a).

The sediment load supplied from the watershed in any given year will vary from the long-term annual average load based on annual hydrologic conditions and other environmental factors (e.g., mass wasting, wildfire, land use) that control sediment supply and transport. Quantifying the potential annual variations around the estimated average annual sediment supply in the entire Klamath River Basin is difficult without long-term data sets describing suspended or total sediment load. However, analyzing historical sediment discharge data from nearby locations provides a reasonable indication of the potential variation and trends The sediment load supplied from the watershed in any given year may vary from the long-term annual average load based on annual hydrologic conditions and other environmental factors (e.g., mass wasting, wildfire, land use) that control sediment supply and transport. Quantifying the potential annual variations around the estimated average annual sediment supply in the entire Klamath River Basin is difficult without long-term data sets describing suspended or total sediment load. However, analyzing historical sediment discharge data from nearby locations provides a reasonable indication of the potential variation and trends in annual sediment supply. Janda and Nolan (1979, as cited in SWRCB 2020a) summarize sediment discharge data from a variety of U.S. Geological Survey (USGS) gaging stations in Northern California, including the Klamath River watershed. The highest annual sediment yield (Water Year [WY] 1974) in the Klamath River at Orleans was three times greater than the period average (WY 1968–1977). The highest annual sediment yield (WY 1964) in the Trinity River at Hoopa was a factor of seven greater than the period average (WY 1957–1977) and a factor of 14 greater than the estimated long-term annual average (Janda and Nolan 1979, as cited in SWRCB 2020a). The period of record for the Trinity River at Hoopa includes the large flood of 1964, whereas the period of record for the Klamath River at Orleans does not.

Table 4-3 Cumulative Annual Sediment Delivery to the Klamath River

Source Area	River Mile	Cumulative Delivery (tons/year)		
		Total	≥0.063 mm[1]	≤0.063 mm
Keno Dam to Iron Gate Dam	193.1	151,000	24,160	126,840
Iron Gate Dam to Cottonwood Creek	185.1	160,961	25,754	135,207
Cottonwood Creek	185.1	175,560	30,426	145,135
Cottonwood Creek to Shasta River	179.5	177,715	31,115	146,600
Shasta River	180	199,259	38,009	161,250
Shasta River to Beaver Creek	163.4	231,710	48,393	183,316
Beaver Creek	163.4	279,869	63,804	216,065
Beaver Creek to Scott River	145.1	373,073	93,630	279,443
Scott River	145.1	980,393	287,972	692,421
Scott River to Grider Creek	132.1	1,048,860	309,881	738,978
Grider Creek to Indian Creek	108.3	1,099,934	326,225	773,709
Indian Creek	108.3	1,173,246	349,685	823,561
Elk Creek	107.1	1,211,930	362,064	849,866
Clear Creek	100.1	1,253,972	375,517	878,454
Dillon Creek	85.4	1,282,389	384,611	897,778
Indian Creek to Dillon Creek	85.4	1,354,759	407,769	946,990
Dillon Creek to Salmon River	66.3	1,440,282	435,137	1,005,146
Salmon River	66.3	1,760,904	537,736	1,223,169
Salmon River to Camp Creek	57.3	1,785,769	545,693	1,240,077
Camp Creek	57.3	1,923,108	589,641	1,333,467
Camp Creek to Red Cap Creek	52.9	1,946,606	597,160	1,349,446
Red Cap Creek	52.9	2,063,374	634,526	1,428,848
Red Cap Creek to Bluff Creek	49.7	2,079,504	639,687	1,439,816
Bluff Creek	49.7	2,417,974	747,998	1,669,976
Bluff Creek to Trinity River	43.3	2,439,210	754,793	1,684,416
Trinity River	43.3	5,756,544	1,816,340	3,940,204
Blue Creek	16.2	5,859,351	1,849,239	4,010,112
Trinity River to Mouth	0	6,237,471	1,970,237	4,267,234

Cumulative sediment delivery is reported for the downstream endpoint of the corresponding source area identified in the first column. Mass is reported in US short tons and assumes a density of 1.5 tons/yd3. Above Cottonwood Creek, assumes 16 percent of total load is ≥0.063 mm based on grain size distribution of reservoir sediment (Gathard Engineering Consulting 2006). Below Cottonwood Creek, assumes 10 percent of total load is bedload and 24 percent of suspended load is sand ≥0.063 mm.

Source: Adapted from Stillwater Sciences 2010, as cited in SWRCB 2020a

[1] Note: mm millimeter

4.3.1.4.2 Reservoir Substrates

The four Lower Klamath Project reservoirs currently store approximately 15.13 million cubic yards (yd^3) of sediment (SWRCB 2020a). The volume and weight of sediment stored in each reservoir is provided in Table 4-4. The distribution of sediment deposits varies within each of the reservoirs. In J.C. Boyle Reservoir, sediment primarily resides in the area nearest to the dam, with thicknesses up to 20 feet. Both Copco No. 1 and Iron Gate reservoirs have generally even distributions of sediment with thicknesses increasing towards the dams. The maximum thickness of the Copco No. 1 Reservoir sediment is approximately 10 feet. The maximum deposition within the thalweg of Iron Gate Reservoir is approximately 5 feet, with approximately 10 feet of deposition in the Jenny Creek arm of the reservoir. Copco No. 2 Reservoir inundates a small area extending to the base of Copco No. 1 Dam but has no sediment sources and does not retain appreciable amounts of sediment (SWRCB 2020a).

Table 4-4 Volume and Weight of Sediment Stored by Reservoir

Reservoir	Estimated 2020 Total			
	Total Volume (cubic yd)	Total Sediment (tons)[1]	Fine Sediment[2] (tons)	Sand[3] (tons)
J.C. Boyle	1,190,000	340,000	220,000	120,000
Copco No. 1	8,250,000	2,090,000	1,800,000	290,000
Iron Gate	5,690,000	1,730,000	1,460,000	280,000
Total[4]	15,130,000	4,160,000	3,480,000	680,000
Total Copco No. 1 and Iron Gate	13,940,000	3,820,000	3,260,000	560,000

Source: SWRCB 2020a

[1] Ton is defined as equal to 2,000 pounds (dry weight).
[2] Fine sediment is sediment with a diameter less than 0.063 millimeters.
[3] Sand is sediment with a diameter between 0.063 and 2 millimeters.
[4] Sediment volumes and weights from individual reservoirs from BOR (2012) were rounded to the nearest 10,000th unit. Copco No. 2 Reservoir does not retain measurable amounts of sediment and therefore is not included in the estimates of total stored sediment.

J.C. Boyle Reservoir

As shown in Table 4-5, the upper portion of the J.C. Boyle Reservoir primarily has coarse-grained sediment, both as pre-reservoir alluvium and reservoir sediment. The reservoir has an abundance of gravel/sand bars and cobbles exposed above the reservoir water surface, with sub-surface sand and gravel found by stab-sampling. The reservoir likely has small, local accumulations of fine-grained reservoir sediment within the upper 5,000 feet of the reservoir, but most of the reservoir sediment in this section is coarse grained. The reservoir sediment becomes finer grained with distance downstream. Sediment sampling conducted by the BOR indicates that approximately 5,000-feet downstream, reservoir sediment is 3- to 5-feet-thick and

composed of silty sand to poorly graded sand with silt with less than approximately 15 percent fine grained material (BOR and CDFG 2012).

Only thin deposits of reservoir sediment were present at the sample sites in the middle section of the reservoir. The reservoir sediment consisted of fine-grained elastic silt with substantial accumulations of organic material. Pre-reservoir material consisted of coarse-grained alluvium (silty gravel and sand), and bedrock consisted of volcaniclastic rock intensely weathered/decomposed to lean clay. Reservoir sediment was thickest in the lower section of the reservoir (ranging from 14- to 22-feet-thick). Sediment in the lower section was uniformly elastic silt with greater than 90 percent fine-grained material. The sediment overlaid coarse grained pre-reservoir alluvium consisting mostly of silty gravel with sand (BOR and CDFG 2012).

Copco No. 1 Reservoir

The upper portion of Copco No. 1 Reservoir has a sediment thickness ranging from 3.5 to 8.0 feet consisting of elastic silt with sand. Sediments in the rest of the reservoir are relatively uniform and composed of elastic silt, containing between 88 and 99 percent fine-grained material. Sediment thickness in the main reservoir ranges from 1.3- to 9.7-feet-deep (BOR and CDFG 2012).

Copco No. 2 Reservoir

The upper 500 feet of the Copco No. 2 Reservoir contained deposits primarily composed of cobble boulders. Similarly, the channel invert appeared to be covered mostly with angular gravel to boulder size talus and minor interstitial sand. Flow velocities in the reservoir channel at the time of sampling were relatively fast, therefore, it is likely that sediment composed of silt and clay did not deposit or had been previously eroded. Results of core drilling attempts revealed that cobbles, boulders, gravel, and sand formed the deposits in the bottom of the reservoir and there is a lack of fine-grained sediment (BOR and CDFG 2012).

Iron Gate Reservoir

Iron Gate Reservoir has relatively steep sided-slopes and a narrow channel with numerous side drainages. Three of these side drainages are large, and two likely contribute substantial amounts of sediment to the reservoir. Except for the three principal side drainages, Iron Gate Reservoir has a relatively similar depositional environment throughout its length. Only the upper 6,000 feet of the reservoir has a substantial percentage of sand within the reservoir sediment. Sediment thicknesses ranged from 1.4 to 9.2 feet, with most samples having a thickness of less than 5 feet. Reservoir sediment was relatively uniform throughout the reservoir and consisted of elastic silt with 85 to 98 percent fine-grained material (BOR and CDFG 2012).

Table 4-5 Physical Properties of Reservoir Sediment by Facility

Reservoir	Location	Volume yd³	Clay%	Silt%	Sand%	Gravel%	Liquid Limit (%)	Plasticity Index (%)	Moisture Content (%)	Porosity (%)	Dry Bulk Density (lb/ft)
J.C. Boyle	Upper Reservoir	380,000	17.3	26.2	56.5	0	45.5	14.7	173	0.82	29.5
	Lower Reservoir	620,000	38.2	49.7	12.1	0	173	60.6	345	0.9	16.3
	Pre-Reservoir		3.7	9.5	28.4	58.5	44.9	12.7	23.4	0.38	101
Copco 1	Upper Reservoir	810,000	27.9	46.8	25.1	0.2	109.3	49.3	287	0.88	19.2
	Lower Reservoir	6,630,000	55.8	34.2	10	0	154.3	59.1	295	0.88	18.7
	Pre-Reservoir		35.6	42.2	22.2	0	105	41.5	153	0.8	32.6
Iron Gate	Upper Reservoir	830,000	35.4	43.1	21.6	0	70.9	29.9	192	0.83	27
	Lower Reservoir	2,780,000	60.7	25.5	13.5	0.4	118.7	51.4	276	0.88	19.8
	Pre-Reservoir		33.6	16.9	20.4	29.1	60.6	32.5	37.9	0.5	81.8
	Upper Tributary	300,000	31.8	42.7	25.5	0	60.7	22.7	102	0.73	44.4
	Lower Tributary	800,000	61.8	32	6.1	0	112.2	49.6	284	0.88	19.3

Source: DOI 2010, BOR and CDFG 2012, as cited in SWRCB 2020a

4.3.2 Environmental Analysis

As stated in Section 3.1, the Proposed Action consists of the physical removal of the Lower Klamath Project to achieve a free-flowing condition and volitional fish passage, site remediation and restoration, and measures to avoid or minimize adverse downstream impacts.

4.3.2.1 Faults and Seismicity

The Lower Klamath Project is located in a region that historically has been seismically active. The active fault nearest the Lower Klamath Project dams is located approximately 5 miles away. Despite their proximity, these faults have not moved in 1.5-millions years and are not considered at risk to trigger a seismic event. Reservoir drawdown is not expected to trigger seismicity. Because the Proposed Action consists of facility removal, there will be no new structures built that would result in future hazards to people or infrastructure. No significant impact is expected.

4.3.2.2 Volcanic Activity

The Lower Klamath Project is located in a region that historically had volcanic activity. Active volcanoes with proximity to the Lower Klamath Project, such as Mt. Shasta, are not expected to be affected by reservoir drawdown. Because the Project consists of facility removal, there will be no new structures built that would result in future hazards to people or infrastructure. No significant impact is expected to this resource area.

4.3.2.3 Mineral Resources

Mineral resources most important in the Lower Klamath Project include sand/gravel deposits in the Klamath River downstream of Iron Gate Dam and diatomite deposits within Copco No. 1 Reservoir. Sand/gravel deposits area unlikely to be affected by dam removal. Renewed natural sediment transport processes by the removal of project dams will likely add to deposits in existing mining areas. Diatomite deposits within Copco No. 1 Reservoir are currently inaccessible due to their location and existing bank conditions with the reservoir. While removal of the reservoir could result in the deposits becoming more accessible for extraction, existing bank stability conditions within the deposit area could also continue to be inaccessible in the future. Accessibility of these diatomite deposits are not considered a beneficial effect, but rather a continuation of existing conditions (SWRCB 2020a). No significant impact is expected to this resource area.

4.3.2.4 Soils

Disturbance of soil is expected as a result of Proposed Action construction activities. The Renewal Corporation will obtain all required erosion permits. Construction will be regulated under Construction General permits and NPDES permits issued in Oregon and California. The NPDES permit will require the

development of best management practices (BMPs) prior to drawdown activities and will include the Construction Management Plan. These measures will prevent significant impact for soils in the project area. In addition to the NPDES permits, the Oregon 401 WQC requires a Sediment and Erosion Control Plan which will provide protection measures consistent with the Oregon NPDES.

4.3.2.5 Slope Stability/Landslides

Lower Klamath Project Reservoir drawdowns are expected to be between 2- and 5-feet per day. The Renewal Corporation analyzed reservoir rim stability at J.C. Boyle, Copco No. 1, and Iron Gate reservoirs to assess potential ramifications of reservoir drawdowns.

The area surrounding J.C. Boyle Reservoir is generally low gradient and underlain by competent materials. Review of topographic data and reconnaissance of the reservoir slopes indicate that no landslides occur adjacent to the reservoir. For these reasons, the stability of the J.C. Boyle Reservoir slopes would be unaffected by the reservoir drawdown and there would be no impact due to reservoir drawdown (SWRCB 2020a).

No large-scale landslides have been identified in the terrestrial or subaqueous slopes around Copco No. 1 Reservoir. Diatomaceous deposits and associated fluvio-lacustrine terrace deposits along the rim and below the reservoir water level present the greatest potential for slope instability during drawdown (KRRC 2018). Where the toe of the diatomite deposit lies above the current high lake level, slope response to rapid drawdown is determined by the properties and geometry of the underlying volcanic and volcaniclastic strata. Where the toe of the diatomite deposit lies below the current high lake level, slope response to rapid reservoir drawdown is determined by the properties and thickness of the diatomite deposits and the underlying material. Based on the low diatomite permeability, the proposed drawdown rate (2- to 5-feet per day) would have minimal effect on its stability. The Renewal Corporation is therefore not proposing to limit the drawdown rate of Copco No. 1 Reservoir beyond that proposed (SWRCB 2020a).

The slope stability analysis conducted by the Renewal Corporation (KRRC 2018) indicated that certain segments around Copco No. 1 Reservoir rim have the potential for slope failure that could impact existing roads and/or private property. These areas include approximately 1,780-linear-feet of shore parallel length with the potential for failure to impact existing structures outside the reservoir rim, including approximately 430-linear-feet of slopes along Copco Road and approximately 1,350-linear-feet of slope adjacent to private property. Twelve parcels and four habitable structures in these potentially unstable areas could potentially be impacted by slope failure. An additional five parcels and four habitable structures may experience damage and/or deformation due to nearby slope failure (SWRCB 2020a). Proposed slope stability management measures will prevent significant impacts and are described below in Section 4.3.4.

The extent and morphology of bedrock outcrops and general lack of surficial deposits around Iron Gate Reservoir suggest stable reservoir slopes under rapid drawdown conditions (KRRC 2018). There may be potential for drawdown to induce block sliding where hard, strong volcanic flow rocks are underlain by saturated tuffaceous beds and bedding dips into the valley (PanGEO 2008, as cited in SWRCB 2020a).

Hammond (1983, as cited in SWRCB 2020a) reports several low to moderate dip angles of volcaniclastic beds into the valley, but there is no evidence of previous slope instability at these locations. Historical aerial photographs indicate that the three possible old landslide-related features that occur on the south rim of Iron Gate Reservoir have been stable and unaffected by historical reservoir drawdowns and have a low risk of instability during future drawdown (KRRC 2018). Shallower slides are likely to occur in the shallow surficial deposits around the reservoir rim and on the reservoir slopes that are currently below the reservoir surface (KRRC 2018). Small, shallow soil failures in the more deeply weathered volcaniclastic beds and in colluvial deposits present a minor hazard to Copco Road where the road is immediately adjacent to the shore (KRRC 2018). These slope failures are likely to be shallow and local and therefore, if a slope failure were to occur, it will constitute a less than significant impact (SWRCB 2020a). No slope stability management measures are proposed for this area.

4.3.3 Geomorphology

4.3.3.1 River Sediment Supply

The analysis of potential changes in channel bed elevations and grain size distribution in response to increased bedload supply and transport as a result of dam removal relied upon output from the SRH-1D model (Huang and Greimann 2010, as cited in SWRCB 2020). The changes were evaluated for a range of hydrologic conditions for short-term changes (using a 2-year timeframe) and long-term changes (including analysis of 5, 10, 25, 50 years in the future) using a range of flows taken from historical hydrology.

Hydroelectric Reach (J.C. Boyle Dam to Iron Gate Dam)

SRH-1D modeling results indicated channel bed elevations could decrease and median channel substrate size could increase within the reservoir reaches during drawdown. The proportion of fine sediment should decrease to near 0 within 2 months after drawdown; the proportion of sand could initially increase 30 to 50 percent then decrease to 10 to 25 percent; the proportion of gravel could change (mostly increase) to 20 to 35 percent; and the proportion of cobble could increase to 50 to 70 percent. The estimated changes depend on the reservoir and simulation water year type (i.e., wet, median, or dry). These changes would stabilize within 6 months as the bed within the historical river channel reaches pre-dam elevations (BOR and CDFG 2012, as cited in SWRCB 2020a). After dam removal, channels currently inundated by reservoirs would likely vary from narrow, single-threaded to wide and sinuous with the potential to form complex features, such as meander cut-offs and vegetated islands (BOR and CDFG 2012, as cited in SWRCB 2020a).

The river reaches upstream of J.C. Boyle Reservoir and from Copco No. 1 Reservoir to J.C. Boyle Dam could experience little change in bed composition or median substrate size during drawdown (BOR and CDFG 2012). Currently, these reaches are predominantly cobble (90 percent) with small fractions of gravel and sand. Modeling of the Copco No. 2 Dam to Iron Gate Reservoir reach indicates decreases in the combined proportion of sand and fines, with the dry simulations indicating decreases to approximately 35 percent of sand and fines 2 years after drawdown (SWRCB 2020a).

Long-term modeling was not conducted for this reach as conditions are expected to stabilize within the window of the short-term affects (2 years) (BOR and CDFG 2012, as cited in SWRCB 2020a). Short-term impacts from Iron Gate Dam to Cottonwood Creek are expected to be significant and unavoidable due to sedimentation in the reach that could affect fish habitat. Long-term, dam removal will be beneficial to the reach as natural sediment transport processes run their course and conditions stabilize.

Klamath River Downstream of Iron Gate Dam

The short-term (i.e., 2 years following dam removal) effects of the dam removal released sediment and sediment resupply would likely extend from Iron Gate Dam to approximately Cottonwood Creek (BOR and CDFG 2012 as cited in SWRCB 2020a). Because approximately 85 percent of the sediment stored within the reservoirs is fine (silt and clay), most sediment eroded from the reservoirs would be fine. Fine sediment transport rates could increase downstream of Iron Gate Dam during the short-term, but a large portion of this fine sediment would be transported to the ocean as suspended sediment shortly after being eroded (Stillwater Sciences 2010, as cited in SWRCB 2020). Coarse sediment (i.e., sand and larger) transport would occur more slowly depending on the frequency and magnitude of mobilization flows and attenuation by channel storage. Model simulations indicate that up to approximately 0.9 feet of reach-averaged sediment deposition could be between Bogus Creek and Willow Creek (RM 188.0), and up to approximately 0.4 feet of sediment deposition could be from Willow Creek to Cottonwood Creek (BOR and CDFG 2012, as cited in SWRCB 2020a).

Short-term sediment transport and depositional patterns are expected to be consistent with other reaches of the Klamath River and other similar river channels. Dam-released sediments are expected to deposit in slack water areas such as pools, eddies, backwater channels, and tributary confluences in the reach down to Cottonwood Creek. These sediment deposits are highly erodible and likely have a short residence time and would be flushed very quickly (within a year). However, these deposits could have adverse effects on fish habitat in the reach in the short term.

Dam removal would have the beneficial long-term (i.e., 50 years) effects of increasing sediment supply and transport and creating a more dynamic and mobile bed downstream of Iron Gate Dam. During the 50 years following the initial release of sediment by the Project, bed elevations could adjust to a new equilibrium in response to sediment supplied by upstream tributaries within the Hydroelectric Reach. While 0.8 to 1.7 feet of aggradation could result from the Project between Iron Gate Dam and Cottonwood Creek (i.e., simulations based on a median start year), no long-term sediment deposition is expected downstream of Cottonwood Creek (BOR and CDFG 2012, as cited in SWRCB 2020a).

Klamath River Estuary

The majority of the fine sediment (silts, clays, and organics) released by dam removal could be transported to the ocean. The fine material is unlikely to deposit in significant quantities in the estuary, evidenced by the lack of a large sandbar within the mouth of the Klamath River under existing conditions. There are currently high concentrations of silt and clay transported through the estuary, and sediment sampling by DOI (2010) documented the absence of fine material in the estuary except in the backwater and vegetated areas. If dam

removal occurs during a low-flow year, there may be relatively small volumes of sediment deposited in these areas (SWRCB 2020a).

4.3.3.2 Reservoir Substrates

Reservoir drawdown will have varying affects to downstream reaches of the Klamath River as sediment deposition patterns change as riverine conditions return to the hydroelectric reach and previously trapped sediments are released back into the system. Reservoir sediments consist primarily of silts and clays that are more susceptible to erosion as they require less energy to mobilize. Modeling of expected erosion during drawdown suggests that 36 to 57 percent of the total sediment within the Lower Klamath Project reservoirs could be eroded and transported downstream during the reservoir drawdown period (Table 4-6). This equates to an estimated 5.4 to 8.6 million cubic yards released into the system during and immediately following the dam removal process. These estimates are affected by reservoir drawdown rate, faster drawdown rates could result in less sediment eroded during the reservoir drawdown. Methods such as sediment jetting could help mobilize sediments that could not otherwise be eroded during reservoir drawdown (SWRCB 2020a).

Large quantities of sediment could remain in place after dam removal in each of the former reservoirs, primarily in areas above the active channel. The remaining sediments could consolidate (dry out and decrease in thickness). Studies of the existing sediments in J.C. Boyle Reservoir reveal an anticipated change in sediment depth of up to 61 percent of original depth (BOR and CDFG 2012, as cited in SWRCB 2020a). A higher degree of shrinkage of the sediment layers is expected in Copco No. 1 and Iron Gate reservoirs due to the increased organic matter content in these sediment deposits (SWRCB 2020a).

Estimated volume of sediment erosion is further influenced by hydrologic conditions within the basin during the drawdown period. Primary erosion could occur during the reservoir drawdown process. Sediment erosion could be caused by several different factors including direct erosion of sediment by moving water, slumping of the fine sediment along the reservoir sides toward the river, and sediment jetting of some areas of reservoir-deposited sediments during drawdown. In a dry hydrologic year, reservoir pool levels can be drawn down steadily and relatively quickly, resulting in a shorter period of interaction between the flow and sediment deposits, and thus less overall sediment erosion. In a wet hydrologic year, the reservoir pool may experience cycles of drawdown followed by periods of refilling during high flow events, resulting in longer period of interaction between the flow and the sediment deposits, and thus more overall sediment erosion (SWRCB 2020a).

Table 4-6 Estimated Erodible Sediment with Dam Removal

Reservoir	Percent Erosion		Fine Sediment Erosion		Sand Erosion	
	Minimum Erosion (percent)	Maximum Erosion (percent)	Minimum (tons)	Maximum (tons)	Minimum (tons)	Maximum (tons)
J.C. Boyle	27	51	60,000	110,000	30,000	60,000
Copco No. 1	45	76	820,000	1,370,000	130,000	220,000
Iron Gate	24	32	350,000	460,000	70,000	90,000
Total	36	57	1,230,000	1,950,000	230,000	370,000
Total Copco No. 1 and Iron Gate	36	56	1,170,000	1,830,000	200,000	300,000

Source: BOR and CDFG 2012

Models indicate that the remaining 43 to 64 percent of sediment stored in the reservoirs could remain in place following dam removal, primarily in areas above the active channel. These sediments are expected to consolidate as they dry, resulting in decreased thickness of remaining sediment deposits (BOR and CDFG 2012). Sediments in J.C. Boyle Reservoir are expected to consolidate up to 61 percent of their existing thickness. Increased organic matter of deposits in Copco No. 1 and Iron Gate reservoirs will result in even higher degrees of sediment consolidation (BOR and CDFG 2012). As these sediments above the new river footprint consolidate, they will be subject to secondary erosion as they are left exposed. Remaining deposited sediments on steeper slopes, such as those at Copco No. 1 and Iron Gate, could likely develop gullies as runoff from rain events drain toward the river. Flatter areas such as those in the upstream section of J.C. Boyle are less likely to experience these same long-term erosion processes. Long term, sediment input from these areas would be indistinguishable from background sediment input rates within the basin (SWRCB 2020a).

Anticipated erosion volume due to dam removal in the context of annual basin-wide sediment discharge are estimated to average an annual total sediment supply from the Klamath River to the Pacific Ocean of approximately 5.8 million tons (4 million tons per year of fine sediment and 1.8 million tons per year of sand and larger sediment) (Stillwater Sciences 2010, as cited in SWRCB 2020a). Farnsworth and Warrick (2007, as cited in SWRCB 2020a) estimate that the average annual silt and clay discharge is 1.2 million tons per year. The difference in the annual average sediment load estimates is related to the different approaches to estimation, the large variation in the measurement of suspended-sediment concentrations (SSCs), the lack of a unique relationship between flow and SSC, and the large annual variation in sediment loads. In dry years, the supply of sediment to the ocean could be less than 1 million tons per year. Given these estimates, it is expected that the amount of sediment released during the year of drawdown and dam removal would be similar to that transported by the Klamath River to the Pacific Ocean in a year with average flow, much less

than that transported by the Klamath River in a wet year, and greater than that transported by the Klamath River in a dry year (SWRCB 2020a).

4.3.4 Proposed Measures

The Renewal Corporation proposes to implement the measures stated in the DDP, and outlined in Table 3-1 above, to address impacts to each resource area. A summary description and analysis of each measure is outlined in the "References" column of Table 3-1.

To ensure those measures are successfully implemented and meet the interests of stakeholders, management plans are being developed. These management plans are outlined in Table 3-2 as well as in the DDP. Below are the specific proposed measures and management plans related to geology and soils resources.

There are no proposed environmental measures for faults, seismicity, volcanic activity, or mineral resources. It is anticipated that implementation of these measures will reduce the potential impacts associated to geology and soils.

4.3.4.1 Slope Stability/Landslides

The Renewal Corporation proposes to identify reservoir slopes and other Project-related areas prone to instability and implement site-specific measures to avoid potential slope erosion and associated increases in sedimentation to surface waters throughout implementation of the Proposed Action. These measures include, but are not limited to:

- Monitor and address slope instability. The Copco No. 1 Reservoir rim will be monitored actively throughout the drawdown, and for two (2) weeks following the drawdown (or longer), as site conditions dictate instability (GSM-1)
- Stabilization activities may include establishing exclusion zones, re-aligning affected road segment, implementing engineered slope improvements, and revegetating affected areas. (GSM-1)
- Implement the Reservoir Drawdown and Diversion Plan. The plan establishes a drawdown rate designed to minimize any potential slope instability issues. (GSM-1)
- Implement a slope stability monitoring program to identify and monitor areas prone to instability to ensure soil instability does not result in discharges that violate water quality standards. (GSM-1)

4.3.4.2 Soils

The Renewal Corporation anticipates short-term soil disturbance resulting from construction activities is expected at Lower Klamath Project facilities during the pre-drawdown and drawdown phases (SWRCB 2020b). Measures to manage and minimize these effects include, but are not limited to:

- Acquire coverage under the NPDES Permit for all construction activities in Oregon and California (WQM-4).

- Implement an Erosion and Sediment Control Plan prior to drawdown activities that will describe BMPs to limit soil disturbance and erosion in affected areas (GSM-2).
- Implement a Construction Management Plan to include the Storm Water Pollution Prevention Plan (SWPPP) and BMPs to minimize stormwater discharges during construction activities (WQM-4).
- Implement a Reservoir Area Management Plan to include procedures to stabilize and restore the former reservoir area(s) during the post-drawdown phase (WRM-1).

4.3.4.3 Geomorphology

Within the Lower Klamath Project reservoirs, the Renewal Corporation has identified priority restoration areas that will involve grading and active sediment removal that will maximize erosion of reservoir sediment deposits in the historical floodplain areas (especially the historical 2-year floodplain) during drawdown and will minimize future erosion of reservoir sediment deposits after the drawdown period. This will promote riparian bank and floodplain connectivity by increasing river inundation on the historical floodplain during high flow events and minimize manual excavation and grading of sediments from restoration sites after completing drawdown. The Reservoir Area Management Plan will prescribe restoration efforts. Restoration areas are identified in Kiewit 2020a.

Below Iron Gate to the mouth of the Klamath River estuary the Renewal Corporation will assess and remediate (if appropriate) visibly obvious sediment deposits that may have been deposited during reservoir drawdown activities. The assessment is limited to sediment deposits on parcels with a current or potential residential or agricultural (e.g., row crop) land use, for which the property owner has notified the Renewal Corporation of a potential sediment deposit that may be associated with reservoir drawdown activities. (SWRCB 2020b). These measures include, but are not limited to:

- If notified by a landowner, the Renewal Corporation will assess visibly obvious sediment deposits to determine if the deposits are consistent with physical sediment properties associated with Lower Klamath Project reservoir sediments. (GSM-2).
- If the deposits appear to have the properties of the Project reservoirs, test sediment deposits for arsenic or remediate without testing. Test surrounding area to determine if arsenic is naturally occurring. (GSM-2).
- If the tested sediments require further action, the Renewal Corporation will implement the Sediment Deposit Remediation Plan in accordance with the CA WQC Condition 4 (a subplan of the Erosion and Sediment Control Plan) outlining measures to address the deposits (GSM-2).
- If the tested sediments do not require further action, the Renewal Corporation will notify the property owner (GSM-2).

4.3.5 Unavoidable Adverse Impacts

Short-term sediment deposition could impact channel substrates and habitat between Iron Gate Dam and Cottonwood Creek. These deposits could have adverse short-term effects on fish habitat and water quality as pools and other low flow areas are filled with released sediment. The reach below Iron Gate to Cottonwood Creek will be monitored during initial drawdown activities to identify if tributaries are being

blocked by sediment. If observed, manual (shovels) removal of the sediment will occur to allow for connectivity of species and flow. The long-term improvements in sediment transport outweigh the significant and unmitigable short-term impact of deposition, and that the impact is therefore acceptable with these measures in place (SWRCB 2020a).

4.3.6 References

Federal Energy Regulatory Commission (FERC). 2007. Final Environmental Impact Statement for Hydropower License, Klamath Hydroelectric Project, FERC Project No. 2082-027, FERC/EIS-0201F. Washington, DC, Federal Energy Regulatory Commission, Office of Energy Projects, Division of Hydropower Licensing.

Kiewit Infrastructure West Co. (Kiewit). 2020a. Klamath River Renewal Project 60% Design Report. 2020.

Klamath River Renewal Corporation (KRRC). 2018. Definite Plan Report.

State Water Resources Control Board (SWRCB). 2020a. Final Environmental Impact Report for the Lower Klamath Project License Surrender. Available online: https://www.waterboards.ca.gov/waterrights/water_issues/programs/water_quality_cert/lower_klamath_ferc14803_eir.html.

State Water Resources Control Board (SWRCB). 2020b. Final Water Quality Certification prepared by the SWRCB (2020b), including Attachment 4 (CEQA Findings and Statements of Overriding Considerations).

U.S. Department of the Interior (BOR). 2010. Klamath River Sediment Sampling Program, Phase I – Geologic Investigations. September 2010.

U.S. Department of the Interior and California Department of Fish and Wildlife (BOR and CDFG). 2012. Klamath Facilities Removal Environmental Impact Statement (EIS)/Report.

4.4 Water Resources

As described in Section 4.1, this Exhibit E incorporates by reference the extensive environmental documentation developed since the 2004 PacifiCorp Application as described in Table 4-7.

Table 4-7 Cross-walk of Water Resources Reference Documents

Date	Author	Reference Document	Section Number	Page Number(s)
2004	PacifiCorp	Application for New License	E3.0	2-1 – 2.20
2007	FERC	Final EIS	3.3.2	3-1 – 3.2
2012	U.S. BOR	EIS/EIR	3.2 3.6 – 3.8	3.1-1 – 3.1-10
2018	KRRC	Definite Plan Report	Appendix M Appendix N	29
2020	SWRCB	Final EIR	3.2	AT1-111 – AT1-133
2020	State of California	401 WQ Certificate	Condition 1 Condition 2 Condition 8 Condition 10 Condition 15	6 – 15
2018	State of Oregon	401 WQ Certificate	2 3 7 10 12	N/A
2020	SWRCB	Attachment 4: CEQA Findings	N/A	3 – 18 64 – 70 167 – 170
2018	ODEQ	Evaluation and Findings Report	3.7.3 5 – 6	10 21 – 34
2011-2020	PacifiCorp	KHSA Interim Measures Implementation Annual Report (2020)	5.10-5.16	36-42

4.4.1 Affected Environment

4.4.1.1 Water Quantity, Storage, and Use

4.4.1.1.1 Upper Klamath River Basin

The management of water levels and flows in the Upper Klamath River Basin is coordinated among the United States Bureau of Reclamation (BOR), NMFS, and PacifiCorp to meet requirements for the Klamath Irrigation Project (KIP), the Klamath River Basin National Wildlife Refuge, the 2019 Biological Opinion for the Klamath River (NMFS 2019), the KHP, and the Lower Klamath Project. Operations of the KIP are largely

dependent upon annual precipitation. Some water storage is provided by Upper Klamath Lake and Clear Lake; however, only small amounts of water are carried over between years (BOR and CDFG 2012).

The KIP supplies irrigation and agricultural water from the Klamath and Lost rivers to users in southern Oregon and northern California. The KIP is an extensive system of dams, canals, diversion structures, and reservoirs between Upper Klamath Lake, Clear Lake, Lower Klamath Lake, Keno Reservoir, Tule Lake, the Klamath River, and the Lost River. Water for the KIP is diverted from Upper Klamath Lake during the irrigation season (May-October); some of the diverted water is returned to the Klamath River at Keno Reservoir. The KIP provides water for approximately 240,000 acres of irrigable lands (PacifiCorp 2004).

Daily target flows in the Klamath River at the Iron Gate development are managed to reflect the natural hydrograph and to maintain daily average minimum flows at Iron Gate Dam (Table 4-8). Flow management criteria are specified for the fall/winter (October-February) and spring/summer (March-September) periods (NMFS 2019; NOAA 2019). Flow management in the fall/winter period is focused on meeting the needs of ESA listed species in the Klamath River, providing habitat for suckers in Upper Klamath Lake, and increasing storage in Upper Klamath Lake (KRRC 2020a). Flow management in the spring/summer period is based on the Environmental Water Account (EWA) which is calculated monthly. The EWA is the volume of water needed to meet the daily average minimum flow targets at Iron Gate Dam while also meeting the needs of the KIP, fishery resources, and the Klamath River National Wildlife Refuge (NMFS 2019; NOAA 2019). The minimum EWA account is 400,000 acre-feet (KRRC 2020a).

Table 4-8 Target Daily Average Minimum Flows Downstream of Iron Gate Dam

Month	Daily Average Minimum Flow (cfs)
October	1,000
November	1,000
December	950
January	950
February	950
March	1,000
April	1,325
May	1,175
June	1,025
July	900
August	900
September	1,000

Source: BOR 2018; NMFS 2019

4.4.1.1.2 Lower Klamath Project Developments

Exhibit B describes existing Lower Klamath Project operations and how the Lower Klamath Project will be operated until FERC issues an order on the license surrender. Table 4-9 provides a summary of the project reservoir characteristics.

Table 4-9 Lower Klamath River Project Reservoir Characteristics

Parameter	J.C. Boyle	Copco 1	Copco 2	Iron Gate
Surface Area (acres)	350	972	NA	942
Impoundment Length (miles)	3.3	5.4	0.25	6.8
Average (maximum) depth (feet)	8.3 (40)	47 (108)	NA	62 (167)
Normal full pool elevation (feet)	3,793.5	2,607.5	NA	2,328.0
Normal annual operating fluctuation (feet)	5.5	6.5	NA	4.0
Average daily operation fluctuation (feet)	1-2	0.5	NA	0.5
Active Storage capacity (acre-feet)	1,724	6,235	0	3,790
Total storage capacity (acre-feet)	2,267	33,724	70	50,941
Normal Retention Times (days)	0.5-2.5	1-12	0	1-16

Source: PacifiCorp 2004; FERC 2007; KRRC 2020a; SWRCB 2020a

River Flow

Three USGS gauges are located within the Lower Klamath Project area (Table 4-10) (Figure 4-5). USGS Gauge No. 11509500 Klamath River at Keno, Oregon, is approximately 7 RMs upstream of the J.C. Boyle Dam. USGS Gauge No. 11519799 Klamath River below J.C. Boyle Powerhouse near Keno, is approximately 0.7 RM downstream of the J.C. Boyle Powerhouse and 21 RMs upstream of Copco Reservoir. USGS Gauge No. 11516530 Klamath River below Iron Gate Dam, California, is approximately 0.5 RM downstream of the Iron Gate Powerhouse. These gauges provide information on the range of inflow to the Lower Klamath Project area and range of outflow from the project area. Monthly average inflows to the project area range from 609 cubic feet per second (cfs) in July to 2,002 cfs in April with an annual average of 1,181 cfs (Table 4-10). Monthly average outflows range from 912 cfs in July to 2,684 cfs in March with an annual average of 1,658 cfs.

Table 4-10 Annual and Monthly River Flow Statistics in the Lower Klamath Project Area (1990-2019)

USGS Gage	Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
USGS Gauge 11509500 Klamath River at Keno, OR (drainage area 3,920 square miles)	Average	1,430	1,521	1,946	2,002	1,596	1,078	609	641	713	813	878	977	1,181
	Median	874	842	1,285	1,495	1,120	895	621	669	709	813	896	832	816
	Minimum	248	184	200	203	201	147	131	144	145	253	292	215	131
	Maximum	9,310	9,250	8,580	8,380	6,640	6,640	2,710	1,590	1,450	1,650	2,750	4,950	9,310
USGS Gauge 11510700 Klamath River below J.C. Boyle Powerhouse (drainage area 4,080 square miles)	Average	1,679	1,784	2,234	2,304	1,893	1,333	843	878	955	1,072	1,128	1,242	1,443
	Median	1,135	1,110	1,525	1,810	1,455	1,140	848	910	954	1,080	1,130	1,070	1,070
	Minimum	318	316	313	306	317	321	309	302	309	320	346	360	302
	Maximum	9,860	10,200	9,120	8,650	6,790	6,740	3,070	1,660	1,720	2,250	3,150	5,400	10,200
USGS Gauge 11516530 Klamath River below Iron Gate Dam (drainage area 4,630 square miles)	Average	2,025	2,166	2,684	2,646	2,133	1,461	912	949	1,068	1,191	1,253	1,448	1,658
	Median	1,320	1,320	1,940	2,020	1,660	1,220	920	1,000	1,030	1,285	1,320	1,320	1,280
	Minimum	598	508	495	508	484	402	406	389	408	865	870	865	389
	Maximum	18,500	12,000	10,800	10,300	6,950	7,710	3,010	1,900	1,820	1,820	3,930	11,100	18,500

Source: USGS 2020a,b,c

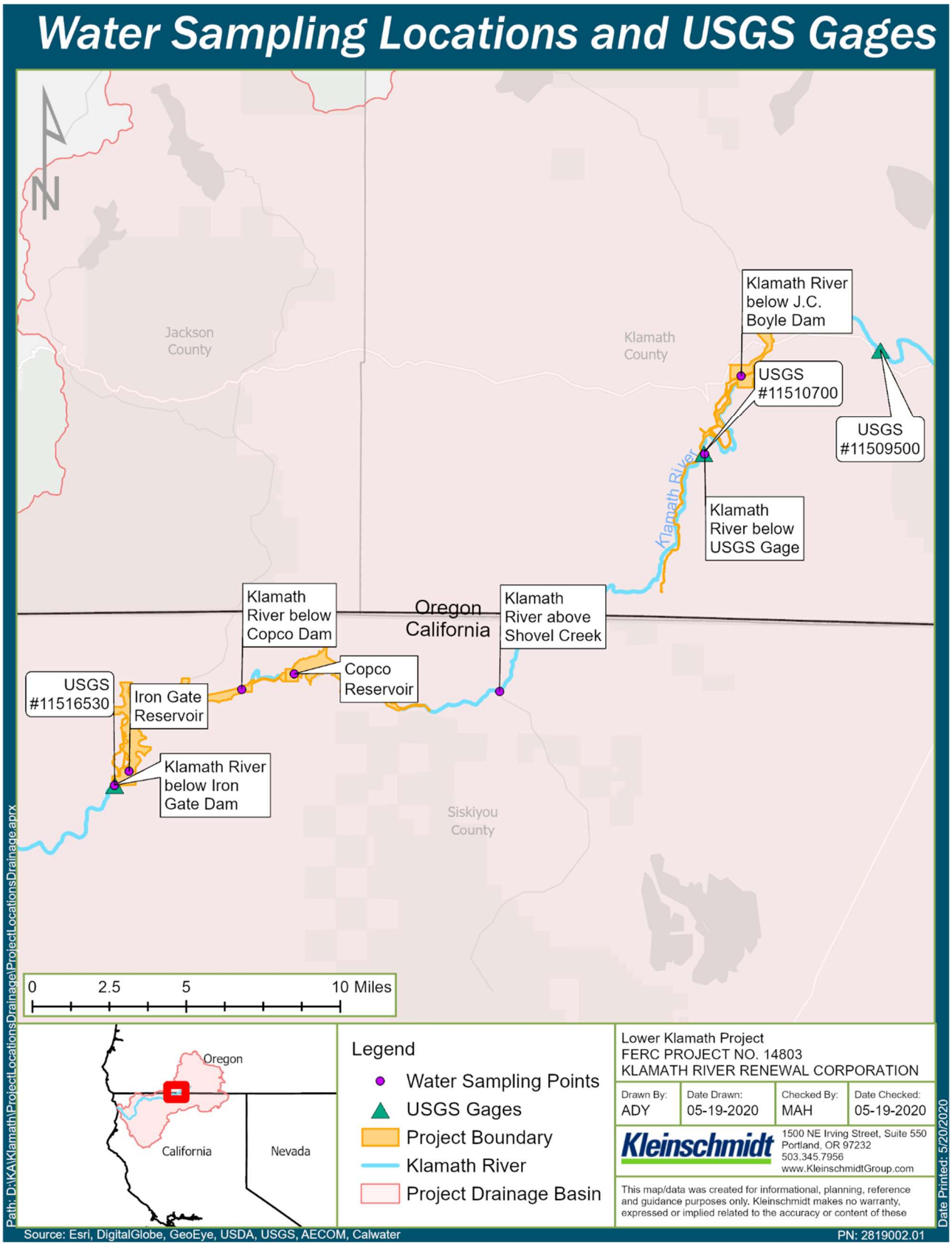


Figure 4-5 Location of USGS Gauges and Water Quality Monitoring Sites

Water Use

Water use in the Lower Klamath Project area includes aquatic and terrestrial wildlife, hydroelectric power generation, recreation, and irrigation. Multiple users rely on water supplied by the operation and management of the KIP. The main purpose of the Lower Klamath Project is hydroelectric generation. J.C. Boyle, Copco No. 1, and Copco No. 2 are hydroelectric peaking facilities; Iron Gate is a re-regulating facility operated to provide roughly as much water downstream as enters the Lower Klamath Project reach on a daily basis. The dams were not designed for flood control or water storage. The facilities provide whitewater boating flows on the Hells Corner whitewater boating reach of the Klamath River (refer to *Section 4.9 Recreation Resources* for more information) (BOR and CDFG 2012).

The city of Yreka, California, obtains its public water supply from a diversion on Fall Creek. Yreka is permitted to withdraw up to 15 cfs a day (FERC 2007). Fall Creek is a tributary that joins the Klamath River at the upper end of the Iron Gate Reservoir. Currently, the 24-inch water supply pipeline crosses the Klamath River at the upstream end of the Iron Gate Reservoir and is minimally buried in the reservoir bed (KRRC 2020a; BOR and CDFG 2012). The drawdown of Iron Gate Reservoir and removal of the dam would expose the pipeline, thus, making it susceptible to damage (e.g., from high flows, debris). The Renewal Corporation will relocate the pipeline prior to reservoir drawdown. (KRRC 2018, 2020a).

4.4.1.2 Water Quality

4.4.1.2.1 Beneficial Uses

Beneficial uses of water and water quality standards in the Klamath River Basin are designated by the North Coast Regional Water Quality Control Board (NCRWQCB), ODEQ, and the Hoopa Valley Tribe (BOR and CDFG 2012). Beneficial uses within the Klamath River in Oregon include public and private domestic water supply (with adequate pretreatment), industrial water supply, irrigation, livestock watering, wildlife and hunting, fish and aquatic life, water contact recreation, fishing, boating, aesthetic quality, hydroelectric power, and commercial navigation and transportation (ODEQ 2005; FERC 2007). The fish and aquatic designated use for the Klamath River within the Lower Klamath Project area in Oregon is Redband trout (*Oncorhynchus mykiss newberrii)* or Lahontan cutthroat (*Oncorhynchus clarki henshawi*) trout (OAR 340-041-0180). The beneficial uses of the Klamath River in California include municipal and domestic water supply; agriculture; industrial service and process supply; groundwater recharge; freshwater replenishment; navigation; hydropower generation; contact and non-contact water recreation; commercial and sport fishing; aquaculture; warm and cold water fish habitat; wildlife habitat; rare, threatened, and endangered (RTE) species; migration of aquatic organisms; spawning, reproduction and/or early development of fish; and American Indian culture (NCRWQCB 2018).

4.4.1.2.2 Clean Water Act Section 303(d) List

Section 303(d) of the CWA requires states to identify water bodies that do not attain water quality standards or that do not support their designated beneficial uses; these water bodies are then classified as impaired with respect to water quality. The Klamath River in the Lower Klamath Project area is listed as impaired on the states of Oregon and California Section 303(d) lists of water bodies with water quality impairments (SWRCB 2017; ODEQ 2020) (Table 4-11) total maximum daily loads (TMDLs) must be developed for impaired water bodies to restore the beneficial uses. TMDLs are designed to set limits on the amount of pollutants that can enter a water body and estimate the capacity of a water body to assimilate the pollutants while still maintaining water quality standards (SWRCB 2017; ODEQ 2020). The Upper Klamath and Lost River Sub-basins TMDL was developed in 2010 for dissolved oxygen, chlorophyll-a, ammonia toxicity, pH, and temperature; all of the TMDLs were approved by U.S. Environmental Protection Agency (USEPA) except for temperature (ODEQ 2010). In 2019, the Upper Klamath and Lost River sub-basins TMDL was modified to the Upper Klamath and Lost Sub-basins Nutrient TMDL (ODEQ 2019a). The temperature TMDL was finalized and approved in 2019 (ODEQ 2019b).

Table 4-11 List of Waterbodies on the States of Oregon and California Section 303(d) Lists

Length (miles) or Area (acres)	Status	Impaired uses	Cause of Impairment	Active TMDLs
Upper Klamath River Oregon-California State line to Keno Dam (including J.C. Boyle Reservoir)				
183.9 acres	Category 5: Impaired (Requires TMDL)	Fish and Aquatic Life	Dissolved Oxygen Year-Round	Upper Klamath River and Lost River Sub-basins
Klamath River from J.C. Boyle Reservoir to Oregon-California State Line				
16.3 miles	Category 5: Impaired (Requires TMDL)	Fish and Aquatic Life, Fishing, Public and Private Domestic Water Supply	Dissolved Oxygen- Spawning; Dissolved Oxygen Year-Round; Temperature; Year-Round; Arsenic, Inorganic	Upper Klamath River and Lost River Sub-basins
Middle Klamath River Oregon-California State line to Iron Gate Dam				
426 miles	Category 4a (being addressed by USEPA TMDL)	Water contact recreation; Cold Freshwater Habitat; Municipal and Domestic Supply	Microcystins; Nutrients; Organic Enrichment/Low Dissolved Oxygen; Water Temperature	Klamath River Nutrients, Temperature, DO, and Microcystin TMDL
Copco 1 Reservoir				
977 acres	Category 5: Impaired (Requires TMDL)	Commercial and Recreational Fishing; Water Contact Recreation; Cold Freshwater Habitat	Microcystin, Mercury, Water Temperature	Klamath River Nutrients, Temperature, DO, and Microcystin TMDL
Iron Gate Reservoir				
916 acres	Category 5: Impaired (Requires TMDL)	Commercial and Recreational Fishing; Water Contact Recreation; Cold Freshwater Habitat	Microcystin, Mercury, Water Temperature	Klamath River Nutrients, Temperature, DO, and Microcystin TMDL
Iron Gate Dam to Scott River				
1,639 miles	Category 5: Impaired (Requires TMDL)	Municipal and Domestic Supply; Commercial and Recreational Fishing; Water Contact Recreation; Fish Spawning; Preservation of Rare & Endangered Species; Wildlife Habitat	Aluminum; Microcystin; Nutrients; Organic Enrichment/Low DO; Sediment; Water Temperature	Klamath River Nutrients, Temperature, DO, and Microcystin TMDL

Source: NCRWQCB 2018; ODEQ 2020; SWRCB 2017

4.4.1.3 Water Quality Standards

Water quality standards for fresh surface waters in the Klamath River Basin have been developed by ODEQ and NCRWQCB Measures required to comply with these standards were included in the WQCs issued by the States of Oregon and California. These measures are described in Table 3-1 and Section 4.4.3. The complete water quality standards are available at ODEQ 2019a and NCRWQCB 2018.

4.4.1.3.1 Background Water Quality Information and Data

The water quality of the Lower Klamath Project reach is influenced by current and historical land and water uses (e.g., mining, logging, agriculture, hydropower development, wetland draining), geology and topography of the basin, and meteorological conditions (BOR and CDFG 2012). Multiple entities have completed water quality monitoring throughout the Klamath River Basin since the 1980s. Results from monitoring completed by the city of Klamath Falls between 1984 and 1990 are described in PacifiCorp (2004). The results of monitoring completed by PacifiCorp between 2001 and 2004 are presented in FERC (2007). Water quality monitoring completed through 2010 in the Klamath River Basin is summarized in BOR and CDFG (2012). More recent data and results are discussed in SWRCB (2020a). A brief summary of general findings for several water quality parameters measured throughout the Lower Klamath Project are provided in the following sections.

4.4.1.3.2 Water Temperature

The J.C. Boyle Reservoir typically does not thermally stratify because of its shallow depth and short residence time; the reservoir may briefly stratify in summer during annual maintenance. Peaking operations and cold-water springs downstream of the J.C. Boyle Dam cool the water in the bypass and peaking reaches. The deeper Copco No. 1 and Iron Gate reservoirs do thermally stratify in April/May through October/November. Maximum temperatures of approximately 25 degrees Celsius (ºC) occur in the epilimnion in late July (BOR and CDFG 2012; FERC 2007). When the reservoirs are stratified, the water temperature in the powerhouse discharges reflect temperatures in the epilimnions.

Stored water in the reservoirs delays the natural warming and cooling patterns resulting in cooler spring temperatures and warmer summer/fall temperatures than would naturally be expected (SWRCB 2020a). Annual maximum temperatures typically occur in late July to early August and often exceed temperature thresholds for salmonids (13-20 ºC).

4.4.1.3.3 Dissolved Oxygen

Natural seasonal and diurnal patterns control dissolved oxygen in the Lower Klamath Project area. Vertical profiles of dissolved oxygen in the Copco No. 1 and Iron Gate reservoirs generally reflect the degree of thermal stratification (FERC 2007; SWRCB 2020a). In the summer, epilimnetic waters may exhibit varying

degrees of super-saturation (greater than 100 percent saturation) with oxygen depleted waters in the hypolimnion; reservoir waters are often not in attainment with water quality standards. Dissolved oxygen is generally near saturation in free-flowing reaches of the Klamath River because of re-aeration (FERC 2007).

4.4.1.3.4 Nutrients

Sediments in the Klamath River system are naturally high in phosphorus. The volcanic rocks and soils in the Upper Klamath River Basin contribute to high total phosphorus levels in Upper Klamath Lake and are a major source of phosphorus in the Lower Klamath Project area (BOR and CDFG 2012). Land use activities (e.g., water diversion, agriculture) contribute to high nutrient (e.g., nitrogen, phosphorus) levels. Nutrient concentrations generally decrease with distance downstream from Upper Klamath Lake because of dilution from springs downstream of the J.C. Boyle Reservoir, uptake by vegetation, and particulate settling in reservoirs (FERC 2007; SWRCB 2020a). Occasional increases in total nitrogen or total phosphorus may occur due to release of dissolved nutrients from sediments under anoxic conditions. The Copco No.1 and Iron Gate reservoirs are characteristic of productive, stratified lakes (FERC 2007).

4.4.1.3.5 pH

Seasonal and is variations in pH occur; pH is near neutral in winter followed by higher levels in spring and summer. pH levels vary between approximately 8.0 and 9.2 in May and September with lower levels in June-August (7.5 to 8.0) (BOR and CDFG 2012). The lowest pH values were observed downstream of the J.C. Boyle Reservoir. The highest pH values were recorded in the Copco No.1 and Iron Gate reservoirs; the high levels were attributed to algal photosynthesis and high nutrient levels (SWRCB 2020a).

4.4.1.3.6 Chlorophyll-a and Algal Toxins

Chlorophyll-a concentrations generally decrease with distance downstream from the J.C. Boyle Development (FERC 2007). High chlorophyll-a and seasonal algal blooms occur in the Copco No.1 and Iron Gate reservoirs. Levels of the algal toxin microcystin (produced by cyanobacteria) above public health standards have been measured during summer algal blooms in the Copco No.1 and Iron Gate reservoirs since 2005 (BOR and CDFG 2012).

4.4.1.3.7 2017 – 2019 Water Quality Data

Interim Measure 15 – Water Quality Monitoring of the KHSA required PacifiCorp to fund long-term baseline water quality monitoring throughout the Klamath River Basin; monitoring has been conducted by multiple entities (BOR, PacifiCorp, Karuk Tribe, and Yurok Tribe) since 2008. There are 24 monitoring stations distributed between Upper Klamath Lake and the Pacific Ocean; monitoring is also conducted in four tributaries to the Klamath River (Shasta, Scott, Salmon, and Trinity rivers). The results from water quality

monitoring completed once or twice a month from March to December 2017 and 2018 at seven sites within the Lower Klamath Project area are presented in

Table 4-12. In addition, a continuous data sonde is installed below the Iron Gate Dam (Table 4-13) and collects water temperature, dissolved oxygen, specific conductivity, and pH all year. This data provides an overview of the water quality as it exits the Lower Klamath Project. Annual water quality parameter statistics from the data sonde downstream of Iron Gate Dam are presented Table 4-13.

In 2017 and 2018, water temperatures throughout the project area ranged from 2.5 °C to 26.8 °C; the maximum temperatures were observed in the Copco No. 1 and Iron Gate reservoirs. The pH ranged from 6.0 to 9.7. The lowest dissolved oxygen concentrations (near 0 milligrams per liter [mg/L]) occurred below approximately 18-feet-deep in the Copco No. 1 Reservoir and below approximately 16-feet-deep in Iron Gate Reservoir (Table 4-13). Downstream of Iron Gate Dam, dissolved oxygen was generally near saturation (Table 4-13). The highest chlorophyll-a concentrations were measured in the Copco No. 1 Reservoir, at the site downstream of Copco Dam, and in the Iron Gate Reservoir.

Table 4-12 Average (Range) of Water Quality Parameters Collected in the Project Area in 2017 and 2018

Monitoring Site	Water Temperature (°C)	pH	Specific Conductivity (µS/cm)	DO (mg/L)	Chlorophyll-a (µg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)
2017							
Klamath River below J.C. Boyle Dam	13.0 (2.5-22.7)	7.7 (7.5-7.9)	133 (90-215)	9.7 (7.4-12.6)	12.2 (5.0-25.3)	1.4 (0.6-2.4)	0.2 (0.1-0.4)
Klamath River below USGS Gauge	11.3 (4.4-17.9)	7.8 (7.0-8.2)	132 (92-193)	9.9 (8.2-12.2)	9.2 (3.4-18.0)	1.1 (0.7-1.7)	0.2 (0.1-0.2)
Klamath River above Shovel Creek	14.0 (4.2-23.9)	8.2 (8.0-8.5)	132 (93-193)	10.0 (8.2-12.3)	9.2 (3.0-23.3)	1.1 (0.7-1.9)	0.2 (0.1-0.3)
Copco Reservoir	13.8 (5.6-25.1)	7.9 (7.0-9.5)	134 (100-197)	8.2 (0-16.2)	97 (1.3-2,058)	1.9 (0.5-26.8)	0.3 (0.1-2.3)
Klamath River below Copco Dam	14.5 (5.4-22.6)	8.0 (7.6-8.9)	136 (100-180)	8.9 (5.9-12.6)	23.7 (1.6-149.5)	1.0 (0.6-2.4)	0.2 (0.1-0.3)
Iron Gate Reservoir	13.2 (4.8-26.8)	7.6 (6.1-9.7)	139 (105-173)	6.1 (0-16.1)	17.3 (1.3-111)	0.9 (0.5-1.7)	0.2 (0.1-0.4)
Klamath River below Iron Gate Dam	16.7 (6.1-23.3)	8.1 (7.4-8.9)	133 (101-172)	8.8 (6.0-11.4)	9.4 (1.4-25.7)	0.9 (0.5-1.5)	0.2 (0.1-0.3)
2018							
Klamath River below J.C. Boyle Dam	12.4 (3.1-23.2)	7.7 (6.5-9.3)	149 (0.1-322)	10.5 (7.2-12.0)	17.7 (1.4-72.6)	1.6 (0.7-2.7)	0.2 (0.1-0.3)
Klamath River below USGS Gauge	11.6 (4.3-17.1)	7.7 (6.6-9.4)	162 (129-298)	10.4 (9.1-11.6)	18.9 (1.3-70.2)	1.0 (0.7-2.3)	0.1 (0.1-0.3)
Klamath River above Shovel Creek	15.9 (4.1-25.2)	8.4 (7.4-10.0)	145 (0.1-303)	9.9 (7.5-12.5)	19.1 (2.0-68.7)	1.4 (0.6-2.5)	0.1 (0.1-0.3)
Copco Reservoir	14.8 (5.3-25.7)	7.9 (6.7-9.7)	172 (137-246)	9.0 (0-19.6)	33.1 (0.8-289)	1.3 (0.6-3.4)	0.2 (0.1-0.8)
Klamath River below Copco Dam	14.5 (6.1-22.4)	7.9 (6.5-9.0)	159 (138-214)	10.7 (6.7-18.7)	44.7 (1.3-232)	2.0 (0.6-8.7)	0.2 (0.1-0.6)
Iron Gate Reservoir	13.6 (5.5-26.2)	7.4 (6.0-9.4)	179 (142-227)	7.9 (0-18.6)	51 (0.7-819)	1.5 (0.5-12.6)	0.2 (0.05-1.2)
Klamath River below Iron Gate Dam	17.5 (6.1-26.2)	8.1 (6.6-9.5)	155 (124-224)	9.1 (8.0-11.2)	10.0 (1.2-53.6)	1.0 (0.6-1.9)	0.1 (0.1-0.2)

Source: Watercourse Engineering, Inc 2018, 2019

Table 4-13 Annual Average Water Quality Results from Iron Gate Dam Downstream Monitor

	2014	2015	2016	2017	2018
Water Temperature (°C)					
Minimum	3.7	5.1	3.7	2.0	4.7
Maximum	24.5	26.1	23.0	24.1	23.7
Average	14.0	15.3	13.1	12.9	14.0
Specific Conductivity (µS/cm)					
Min	64.5	72.3	140.8	105.0	135.3
Max	167.4	171.7	196.2	178.8	171.4
Avg	114.8	148.9	155.9	142.1	156.3
pH					
Min	7.1	6.6	7.2	7.0	7.1
Max	9.7	9.4	9.4	9.6	9.5
Avg	8.3	8.0	7.8	7.8	7.7
DO (mg/L)					
Min	6.2	6.5	5.5	5.2	4.6
Max	12.8	12.4	13.7	14.0	11.8
Avg	9.8	8.9	9.5	9.5	9.0
DO (percent saturation)					
Min	61.6	69.5	67.0	55.7	51.9
Max	142.0	114.3	127.0	119.0	119.4
Avg	97.5	87.9	95.0	88.9	86.3

Source: PacifiCorp 2020

4.4.2 Environmental Analysis

4.4.2.1 Analysis in California State Water Resources Control Board Environmental Impact Report

The Proposed Action may result in short-term and long-term changes to water quantity, storage, and water quality in the Klamath River Basin. Short-term impacts refer to 1 to 3 years before dam removal to 3 years

after dam removal. Long-term refers to effects occurring more than 3 years after dam removal (SWRCB 2020a).

The Proposed Action may alter the amount of water available for diversion under existing water rights and for diversion to the KIP (SWRCB 2020a). The release of sediments could change the geomorphology of the Klamath River and impact water intake pumps located downstream of the Iron Gate Dam. These impacts are not anticipated to have a short-term or long-term significant impact. The relocation of the Yreka water supply pipeline could have a short-term effect on water supply; the impact will not be significant with the proposed management measures that will provide uninterrupted water supply during replacement of the pipeline.

The Proposed Action may result in short-term increases in water flows and may expose people or structures to flooding (SWRCB 2020a). No significant impact is anticipated from potential flooding. The flow rates in the hydroelectric reach and downstream of Iron Gate Dam could be less than historical peak flows. The Proposed Action may change the Federal Emergency Management Agency (FEMA) 100-year floodplain between the California-Oregon state line and the Copco No.1 Reservoir; no significant impact is anticipated. The Proposed Action may have a significant impact on the FEMA 100-year floodplain downstream of Iron Gate Dam.

The Proposed Action may impact several water quality parameters including water temperature, dissolved oxygen, nutrients, pH, suspended sediments, alkalinity, chlorophyll-a, algal toxin, inorganic contaminants, and organic contaminants (SWRCB 2020a). There may be short-term impacts to water quality from various construction and restoration activities. Anticipated short-term impacts to water quality are largely related to the mobilization of sediments that are currently stored behind the dams to downstream reaches of the Klamath River (SWRCB 2020a). The release of reservoir sediments is expected to be most intense during the reservoir drawdowns and during the year following dam removal. The release of stored sediments in the reservoirs may have short-term impacts on oxygen demand and cause reduced dissolved oxygen levels, may cause short-term increases in nutrients, and may have short- and long-term impacts through the exposure of humans and aquatic organisms to inorganic and organic contaminants (SWRCB 2020a).

The Proposed Action resulting in free-flowing river reaches will have short- and long-term impacts on water temperature, with beneficial long-term impacts (SWRCB 2020a). Model results indicate that the Proposed Action will return the Klamath River to a more natural thermal regime by eliminating the seasonal temperature shift caused by the reservoirs (i.e., daily maximum temperatures in spring could increase and late summer/fall daily maximum temperatures could decrease) (SWRCB 2020a). The conversion of the reservoirs to free-flowing reaches will have short- term and long-term beneficial impacts on pH and daily pH fluctuations, short- and long-term impacts on chlorophyll-a and algal toxins, long-term impacts on nutrient levels because of the lack of interception and retention by the dams, and long-term impacts on dissolved oxygen concentrations and daily variability (SWRCB 2020a).

4.4.2.2 California Water Quality Certification

The California SWRCB issued a Section 401 WQC for the Proposed Action in April 2020 (SWRCB 2020b). The SWRCB determined that the Proposed Action will comply with state water quality standards if conducted under the WQC conditions. The SWRCB determined that the Proposed Action will result in long-term benefits to water quality conditions in the Klamath River; the short-term impacts are necessary to achieve the long-term benefits of improving the health of the Klamath River. The primary short-term water quality exceedances are related to the release of sediments stored in the reservoirs. These exceedances are permissible because they are limited in duration, occur during the time of year least harmful to the various salmonid life stages, and will result in long-term improvements to water quality in the Klamath River (SWRCB 2020b). SWRCB expects the short-term impacts on water quality will not exceed 36 months following the start of the drawdown. The Proposed Action eliminates water quality impacts directly associated with the continued operation of Lower Klamath Project.

4.4.2.3 Oregon Water Quality Certification

ODEQ issued a Section 401 WQC in 2018 (ODEQ 2018a). Based on evaluation of the Proposed Action, ODEQ determined it will comply with Oregon water quality standards, the federal CWA, and state law requirements. ODEQ found that the Proposed Action will cause a short-term reduction of water quality. ODEQ determined that the long-term benefits of the Proposed Action outweigh the short-term adverse impacts because the impacts will be limited in duration, provide a net ecological benefit, and will result in a long-term improvement in water quality (ODEQ 2018a). ODEQ expects the short-term impacts on water quality will not exceed 24 months following the start of the drawdown of the J.C. Boyle Reservoir.

4.4.3 Proposed Measures

The Renewal Corporation proposes to implement the measures outlined in Table 3-1 to address impacts to each resource area. A summary description and analysis of each measure is outlined in the “References” column of Table 3-1.

To ensure those measures are successfully implemented and meet the interests of stakeholders, management plans are being developed. These management plans are outlined in Table 3-2 as well as in the DDP. Below are the specific proposed measures and management plans related to water resources.

4.4.3.1 Water Quality

The Renewal Corporation will implement BMPs that reduce potential impacts to water quality due to pre-construction, dam removal, and restoration activities, including implementing several management plans and protection measures. All measures and plans described in this Exhibit E are being developed to help

protect water quality, there are several specific plans that directly correspond to this resource area; these plans are briefly described below:

- A Water Quality Management Plan (WQMP) will include a program to monitor water quality before, during, and after the Proposed Action; a reporting schedule; adaptive management measures based on monitoring results; provisions for collection and submittal of data; field sampling schedule, water quality parameters, monitoring locations, and analytical methods; a quality assurance plan and quality control measures; sediment load quantification; and other related water quality monitoring and protection plans associated with ground disturbing activities, recreation facilities, fish hatcheries, public water supplies, groundwater wells, and sediment deposits (WQM-1).
- A Stormwater Pollution Prevention Plan will mitigate for stormwater discharges and prevent runoff from ground-disturbing activities from impacting water quality. The plan will include measures to control erosion, stream sedimentation, dust, and soil mass movement; descriptions of site conditions; detailed descriptions of measures to divert runoff, measures to collect and filter runoff, and measures to dissipate energy and prevent erosion; and plans to revegetate disturbed areas (WQM-3).
- A Waste Disposal and Hazardous Materials Management Plan will describe the management and disposal of all hazardous and non-hazardous waste generated during the Proposed Action that is protective of water quality. The plan will include an inventory of hazardous materials and waste; measures for the proper storage, containment of and response to spills of hazardous material; and procedures for the removal and disposal of septic tanks (WQM-2).
- A Construction Management Plan will outline the requirements for construction related permitting including NPDES permits, construction general permits, and permits required by the Water Quality Monitoring and Protection Plan and Spill Prevention, Control, and Countermeasure (SPCC) Plan (WQM-3).
- A Hatcheries Management and Operations Plan will be developed and implemented and will include plans for transfer of ownership and continued operation of Fall Creek hatchery, identification of water supplies, BMPs for construction, minimum flows, and practices to minimize impacts to water quality (WQM-1).
- A Recreation Facilities Plan will include measures to protect water quality during construction, removal, maintenance, and other activities associated with Lower Klamath Project recreation facilities; water quality monitoring in Lower Klamath Project recreation areas; and signage at Lower Klamath Project recreation facilities for water quality impairments (WQM-4; WQM-1).

4.4.3.2 Water Resources

The Renewal Corporation will implement an Erosion and Sediment Control Plan that minimizes erosion and sediment runoff during construction activities, removal of recreation areas, and restoration activities; monitoring measures; proper placement of disposed material (e.g., from deconstruction of the J.C. Boyle Dam), and proper restoration of the J.C. Boyle scour hole (GSM-3).

The Renewal Corporation will implement a Reservoir Drawdown and Diversion Plan describing drawdown procedures, schedule, monitoring efforts, and contingency and notification procedures (GSM-1). The Reservoir Drawdown and Diversion Plan will include, but is not limited to:

- A description of all drawdown facilities and equipment; updated flood frequency evaluation; anticipated drawdown rates and drawdown scenarios; slope-stability analysis;

- A description of dam stability monitoring to include locations of and procedures for monitoring for slumping, cracking, or slope failure. Measures in consideration will include installing piezometer wells, survey monuments, and inclinometers, and monitoring of USGS gauge stream flow;
- Procedures to assess and respond to events that may delay drawdown or cause the drawdown to extend longer than anticipated.

The Renewal Corporation will implement a Reservoir Area Management Plan for reservoir restoration activities. The plan will include a detailed description of proposed activities and procedures to stabilize and restore the former reservoir area; performance criteria for evaluating restoration efforts; a preliminary map of the locations of restoration activities; actions to ensure tributary and floodplain connectivity and enhance wetlands; measures to address invasive plants; and monitoring and adaptive management measures (WRM-1).

The Renewal Corporation will implement a Hydropower Operations Plan identifying measures to protect water quality and fisheries if the drawdown and dam removal have not been initiated within 24 months of issuance of the FERC license surrender order (WRM-3).

4.4.3.3 Water Supply/Water Rights

The Renewal Corporation will implement several measures and BMPs to protect water supply resources. The impacts to groundwater resources will be limited in scope based on reservoir geology, depth, and existing groundwater tables. (SWRCB 2020a). A Water Supply Management Plan will be implemented to protect water supply interests (WRM-2). Components of the plan include measures to:

- Consult with drinking water providers and community and transient non-community water systems to identify measures to minimize impacts to the water supply associated with the Proposed Action and ensure drinking water quality standards are met; submit a report that identifies all drinking water supplies and describes the measures that will be implemented to protect the water supplies.
- Construct a new water supply pipeline for City of Yreka, California for the section of the pipeline that crosses Iron Gate Reservoir, ensure uninterrupted water supply during replacement of the pipeline, and ensure pipeline replacement does not impact water quality. The Renewal Corporation and City of Yreka have developed an approved design.
- Identify all surface water diversions on the Klamath River and which diversions may be impaired by the Proposed Action, and work with water rights holders to address potential impacts.
- Identify potential groundwater wells that may be impacted, conduct outreach efforts, monitor wells if private owners permit, establish mitigation to improve water quality or quantity from affected wells.
- Develop and implement the Fire Management subplan that identifies locations where fire trucks and helicopters may access the Klamath River for residential fire protection efforts.

4.4.4 Unavoidable Adverse Impacts

Short-term increases in suspended sediments in the Klamath River due to the release of sediments that are trapped behind the dams (SWRCB 2020a) are likely to occur. Suspended sediment concentrations are expected to return to previous levels by the end of the first-year post-dam removal. The release of trapped sediments may cause a short-term increase in oxygen demand and reduced dissolved oxygen concentrations because of the unoxidized organic matter in the Hydroelectric Reach and downstream to the Salmon River (SWRCB 2020a). This is not expected to impact the Klamath River downstream from the confluence with the Salmon River. There may be short-term increases in water temperature and decreases in dissolved oxygen in Fall Creek due to hatchery operations (SWRCB 2020a). A long-term unavoidable adverse impact may occur if the FEMA 100-year floodplain inundation extent downstream from Iron Gate Dam changes after dam removal which could expose structures to damage and flooding (SWRCB 2020a).

The Proposed Action and the other restoration, flow enhancement, and water quality improvement projects will be beneficial for water quality, especially for water temperature and chlorophyll-a and algal toxins (SWRCB 2020a). The restoration, flow enhancement, and water quality improvement projects will increase the amount of cold water flowing in the river improving water temperature conditions for salmonids, while the Proposed Project will improve water temperature by returning more natural seasonal and daily variations (SWRCB 2020a).

4.4.5 References

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4.5 Fish and Aquatic Resources

As described in Section 4.1, this Exhibit E incorporates by reference the extensive environmental documentation developed since the 2004 PacifiCorp Application as described in Table 4-14.

Table 4-14 Cross-walk of Fish and Aquatic Resources Reference Documents

Date	Author	Reference Document	Section Number	Page Number(s)
2004	PacifiCorp	Application for New License	E4.0	4-1 – 4-182
2007	FERC	Final EIS	3.3.3	3-174 – 3-348
2012	U.S. BOR	EIS/EIR	3.3	3.3-1 – 3.4-37
2018	KRRC	Definite Plan Report	Appendix I	13-160
2020	SWRCB	Final EIR	3.3 – 3.4	AT1-404 – AT1-670
2020	State of California	401 WQ Certificate	Condition 5 Condition 6	35; 58 – 60 36; 60 – 64
2018	State of Oregon	401 WQ Certificate	4 6 8	3 – 6
2020	SWRCB	Attachment 4: CEQA Findings	N/A	18 – 23
2018	ODEQ	Evaluation and Findings Report	4.4.1 5.2 – 5.3	19 – 20 22 – 24
2011-2020	PacifiCorp	KHSA Interim Measures Implementation Annual Reports	N/A	N/A

4.5.1 Affected Environment

4.5.1.1 Aquatic Habitat

The project area includes reaches of impounded and riverine habitat that have historically supported a diverse array of native aquatic fauna. Approximately 15 RMs within the project area are lentic reservoir habitat. Existing habitat in riverine portions the project area consist of riffles, runs, and pools, with some areas of rapids and fast runs forming during periods when spills occur at the dams.

4.5.1.1.1 J.C. Boyle Development

The upstream portion of J.C. Boyle Reservoir is largely characterized by shallow water and a gently sloping shoreline with dense amounts of aquatic vegetation during the summer months. The shoreline of this upstream reach contains several wetland areas. The river canyon increases in gradient in the lower half of the reservoir where deeper habitats occur. Water level fluctuations of 1 to 2 feet can occur daily, depending on Project operations (PacifiCorp 2004). Spencer Creek, a tributary of the Klamath River that enters J.C. Boyle Reservoir, provides suitable spawning habitat for rainbow trout. All life stages of suckers (larvae, juvenile, and adult) have been documented in the reservoir. The presence of all life stages suggests that this

reach provides suitable habitat for recruitment of several sucker species that may spawn upstream of the Project, including the federally listed shortnose sucker and Lost River sucker (Desjardins and Markle 2000).

The 4.3-mile-long bypass reach at J.C. Boyle has a relatively steep gradient of approximately 2 percent, with habitat types consisting largely of rapids, runs, and pools. There is a minimum flow requirement of 100 cfs immediately downstream of the dam, with an additional 225 cfs of spring water entering the bypass reach approximately one mile downstream of the dam. Spill at the J.C. Boyle Dam can increase flows substantially, causing riffles and runs to become rapids during these flow events. The substrate is dominated by large boulders and cobble, with limited areas that include gravel. Operations in the bypass follow a ramping rate of approximately 810 cfs per hour (PacifiCorp 2004).

The peaking reach at J.C. Boyle is 17.3-miles-long and extends from the J.C. Boyle Powerhouse to the upper extent of Copco Reservoir. The 11 miles of the reach located in Oregon are federally designated as a Wild and Scenic River. The 6.2 miles of the reach, located in California, are designated as a Wild Trout Area by CDFW, and the entire 17.3-mile reach is managed as a wild trout fishery. Peaking operations affect flows in this reach, with flows increasing during the day when generation begins. Specifically, river flows are increased at an up-ramp rate limit of 9-inches per hour below the powerhouse during periods of peak energy demand (i.e. afternoon and early evenings during the summer months) (PacifiCorp 2004).

4.5.1.1.2 Copco Development

The Copco No. 1 Reservoir is impounded by the Copco No. 1 Dam. The reservoir is located in a canyon characterized by deeper water depths than the upstream J.C. Boyle Reservoir. Shallow water habitats are present in coves and backwaters and support dense areas of aquatic vegetation. Outside of the coves and backwater habitats, riparian habitat is generally minimal due to the steep banks associated with the canyon, and these areas support little aquatic vegetation. The reservoir experiences algae blooms during the summer months, dominated by blue-green algae.

The Copco No. 1 Powerhouse discharges directly into the 0.25-mile-long Copco No. 2 Reservoir. The Copco No. 2 Development operates in tandem with the Copco No. 1 Development due to its small size. The 1.5-mile-long Copco No. 2 bypass reach is characterized by a deep, narrow canyon and is dominated by bedrock and boulders. (PacifiCorp 2004).

4.5.1.1.3 Iron Gate Development

The Iron Gate Reservoir, located approximately 15 miles downstream of the Copco Development, discharges directly through the powerhouse and into the downstream reach. The reservoir has an average depth of 62 feet and a maximum depth of 167 feet. The reservoir is lined by steep banks that lack aquatic vegetation. Two tributaries, Jenny and Camp creeks, provide some riparian vegetation in areas where they enter the impoundment. Blue-green algae blooms occur during the warmer summer months. Sucker larvae have been documented in the impoundment, but juvenile suckers are not abundant in this reach, suggesting that

predation may hinder recruitment to juvenile and adult life stages. Two existing fish ladders at the Iron Gate Development are used to collect brood stock for the adjacent Iron Gate Hatchery (PacifiCorp 2004).

The Iron Gate Development includes the first migratory barrier for anadromous fish on the Klamath River. The 190-mile-long reach of the Klamath River between the Iron Gate Development and the Pacific Ocean, along with its tributaries, support anadromous species including spring and fall Chinook salmon, steelhead, green sturgeon (*Acpenser medirostris*), Pacific lamprey (*Entosphenus tridentatus*), and federally threatened coho salmon (*Oncorhynchus kisutch*). Specifically, the reach of the Klamath River immediately downstream of the Iron Gate Dam provides suitable spawning and rearing habitat for fall Chinook salmon. Other anadromous species, including coho salmon and steelhead, use tributaries of the Klamath River for spawning and use the mainstem river as a migratory corridor (PacifiCorp 2004; FERC 2007).

The Fall Creek and Iron Gate fish hatcheries have been used to supplement salmonid stocks in the Lower Klamath Project area. The rearing ponds at the Fall Creek facility are located approximately 11 miles north of the Iron Gate Development. Parts of the facility were last operational in 2003, when 180,000 Chinook salmon yearlings were reared and released annually. PacifiCorp constructed the Iron Gate fish hatchery in 1966 to mitigate for the Iron Gate Dam's blockage of upstream movement by anadromous species, and the loss of salmon and steelhead rearing habitats between Iron Gate Dam and Copco Dam. The hatchery, managed by CDFW, is located adjacent to the Iron Gate Dam, and utilizes salmon and steelhead broodstock from fish collection facilities at the Lower Klamath Project as well as water collected from the Project reservoir. Adult steelhead processed in the hatchery are returned to the Klamath River, and juvenile steelhead and salmon are released from the hatchery. Specific species production focuses on Chinook salmon production, with coho salmon and steelhead also collected and propagated (PacifiCorp 2004; FERC 2007).

4.5.1.2 Fisheries Assemblage

Twenty-nine fish species from eight families have been collected during previous studies in the project area upstream of Iron Gate Dam. Reaches sampled include the J.C. Boyle bypass reach, the J.C. Boyle peaking reach, the Copco No. 1 Reservoir, and the Iron Gate Reservoir. The USFWS and CDFW utilized backpack electrofishing, boat electrofishing, angling, and minnow traps during 1984, 1987, 1988, 1989, and 1990 to sample multiple habitat types (City of Klamath Falls 1990, Desjardins and Markle 2000, PacifiCorp 2000, as cited in PacifiCorp 2004, KRRC 2019). PacifiCorp contracted Oregon State University during 1998 and 1999 to sample additional habitats via trammel nets, trap nets, beach seines, and larval trawl and drift net sets (PacifiCorp 2000, as cited in PacifiCorp 2004). PacifiCorp also conducted additional fisheries assessments via backpack electrofishing, boat electrofishing, angling, and minnow traps during 2001 and 2002. Electrofishing and angling were used to sample riffles, runs, and pools in shallow areas, and boat electrofishing was used to samples these habitat types in deeper reaches (PacifiCorp 2004). The Renewal Corporation utilized boat electrofishing and trammel nets to target sucker species, and all bycatch was recorded during these sampling efforts. Sampling occurred during the spring and fall in the J.C. Boyle, Copco, and Iron Gate reservoirs (KRRC 2019) (Appendix D). Fish species collected throughout the project area

upstream of Iron Gate Dam are described in Table 4-15. The status and distribution of RTE fish species at the Lower Klamath Project are described in Section 4.8

Electrofishing and hook-and-line sampling in the J.C. Boyle Development during November 1989 and 1990 documented a redband trout (*Oncorhynchus mykiss gairdneri*) population that consisted of age classes ranging from young-of-year to fish greater than 2 years of age. Redband trout are thought to spawn in Spencer Creek, a tributary of J.C. Boyle Reservoir. Additional spawning occurs in some sections of the bypass reach, although this reach contains limited areas of gravel that are suitable for spawning (City of Klamath Falls 1990). Additional surveys targeting all fish species in the reservoir conducted during 1998 and 1999 documented a species assemblage comprised largely of chub species, fathead minnows, and bullheads. Conversely, the fish assemblage in the J.C. Boyle bypass reach consists largely of rainbow trout, speckled dace, and marbled sculpin (FERC 2007).

Similar sampling methods in Copco No. 1 Reservoir documented a diverse fishery that is comprised of both warm and coldwater species. The most common species collected during 1987 and 1989 sampling events were yellow perch (*Perca flavescens*), (*Notemigonus crysoleucas*), and largemouth bass (*Micropterus salmoides*), with non-native species comprising 97 percent of the total catch. Despite the presence of non-native competitors, numerous shortnose suckers (*Chasmistes brevirostris*) were also collected. Sampling events conducted during 1998 and 1999 showed a similar fish assemblage, with yellow perch and golden shiners comprising a majority of the catch. Fish assemblage surveys in the Copco No. 2 bypass reach documented a fish assemblage comprised largely of marbled sculpin (*Cottus klamathensis*) and speckled dace (*Rhinichthys osculus*).

The Iron Gate Reservoir has been noted to have a similar species composition as Copco No. 1 Reservoir, likely due to the similar habitat characteristics of steep banks and deepwater habitats. Yellow perch comprise most of the fish assemblage, along with golden shiner, tui chub, pumpkinseed, unidentified chubs, unidentified larval suckers, and largemouth bass (FERC 2007).

Forty-five species from 16 families are known to occur downstream of Iron Gate Dam (Moyle 1976). This fish assemblage includes some freshwater species that are also found within the project area, as well as anadromous species and marine species. Of the 45 fish species documented in the downstream reach between Iron Gate Dam and the Pacific Ocean, 26 species were not documented upstream of Iron Gate Dam during previous fish assemblage assessments. Anadromous species present downstream include Pacific lamprey, green sturgeon, American shad American shad (*Alosa sapidissima*), eulachon (*Thaleichthys pacificus*), chum salmon (*Oncorhynchus keta*), coho salmon, coastal rainbow trout (*Oncorhynchus mykiss irideus*), sockeye salmon (*Oncorhynchus nerka*), and Chinook salmon.

Table 4-15 Fish Species Collected in the Reach of the Klamath River Upstream and Downstream of the Iron Gate Dam

Family	Scientific Name	Common Name	Documented Upstream of Iron Gate Dam[2]	Documented Downstream of Iron Gate Dam[2]
Petromyzontidae (Lampreys)	*Lampetra lethophaga*	Pit-Klamath brook lamprey	R	
	Lampetra similis	Klamath lamprey	R	
	Lampetra tridentate	Pacific lamprey		A
Acipenseridae (Sturgeons)	*Acipenser medirostris*	Green sturgeon		A
	Acipenser transmontanus	White sturgeon		A
Clupeidae (Herrings)	*Alosa sapidissima*	American shad		A
	Clupea pallasi	Pacific herring		O
Cyprinidae (Minnows and Carps)	*Gila bicolor*	Tui chub	R	R
	Gila coerulea	Blue chub	R	R
	Notemigonus crysoleucas	Golden shiner	R	R
	Pimephales promelas	Fathead minnow	R	
	Rhinichthys osculus	Klamath speckled dace	R	R
	Carassius auratus	Goldfish	R	
	Richardsonius balteatus	Redside shiner	R	
Catostomidae (Suckers)	*Catostomus rimiculus*	Klamath smallscale sucker	R	R
	Catostomus snyderi	Klamath largescale sucker	R	R
	Chasmistes brevirostris	Shortnose sucker	R	R
		Shortnose sucker x smallscale sucker	R	
	Deltistes luxatus	Lost River sucker	R	
Ictaluridae (Catfishes)	*Ameiurus natalis*	Yellow bullhead	R	R
	Ameiurus nebulosus	Brown bullhead	R	R
	Ictalurus punctatus	Channel catfish	R	
Osmeridae (Smelts)	*Hypomesus pretiosus*	Surf smelt		O
	Hypomesus transpacificus	Delta smelt		R

Family	Scientific Name	Common Name	Documented Upstream of Iron Gate Dam[2]	Documented Downstream of Iron Gate Dam[2]
	Spirinchus thaleichtys	Longfin smelt		O
	Thaleichthys pacificus	Eulachon		A
Salmonidae (Trouts and Salmon)	*Oncorhynchus clarki*	Cutthroat trout		R
	Oncorhynchus gorbuscha	Pink salmon		A
	Oncorhynchus keta	Chum salmon		A
	Oncorhynchus kisutch	Coho salmon		R,A
	Oncorhynchus mykiss	Coastal rainbow trout/steelhead		R,A
	Oncorhynchus mykiss gairdneri	Redband rainbow trout	R	
	Oncorhynchus nerka	Sockeye salmon		O,A
	Oncorhynchus nerka kennerlyi	Kokanee		R
	Oncorhynchus tshawytscha	Chinook salmon		A
	Salmo trutta	Brown trout	R	R
	Salvelinus fontinalis	Brook trout		R
	Thymallus arcticus	Arctic grayling		R
Atherinidae (Silversides)	*Atherinops affinis*	Topsmelt		O
Gasterosteidae (Sticklebacks)	*Gastersteus aculeatus*	Threespine stickleback		R
Cottidae (Sculpins)	*Clinocottus acuticeps*	Sharpnose sculpin		O
	Cottus aleuticus	Coastrange sculpin		R
	Cottus asper	Prickly sculpin		R
	Cottus klamathensis	Marbled sculpin	R	R
	Cottus princeps	Klamath Lake sculpin	R	
	Cottus tenuis	Slender sculpin	R	
	Leptocottus armatus	Pacific staghorn sculpin		R
Centrarchidae (Sunfishes)	*Archoplites interruptus*	Sacramento perch	R	R
	Lepomis cyanellus	Green sunfish	R	R
	Lepomis gibbosus	Pumpkinseed	R	R
	Lepomis macrochirus	Bluegill	R	R

Family	Scientific Name	Common Name	Documented Upstream of Iron Gate Dam[2]	Documented Downstream of Iron Gate Dam[2]
	Micropterus salmoides	Largemouth bass	R	R
	Pomoxis annularis	White crappie	R	
	Pomoxis nigromaculatus	Black crappie	R	
Percidae (Perches)	*Perca flavescens*	Yellow perch	R	R
Surfperches	*Cymatogaster aggregata*	Shiner perch		O
Gobiidae (Gobies)	*Clevelandia ios*	Arrow goby		O
Pleuronectidae (Righteye Flounders)	*Platichthys stellatus*	Starry flounder		R

Source: City of Klamath Falls 1990, Desjardins and Markle 2000, Moyle 1976, PacifiCorp 2000, PacifiCorp 2004, FERC 2007
[2]R= resident, A=anadromous, O=occasional marine visitor

4.5.1.3 Anadromous Fish Species

4.5.1.3.1 Fall Chinook Salmon

Hamilton et al. (2005) noted that, prior to development, large numbers of Chinook salmon spawned in the tributaries upstream of Upper Klamath Lake and were observed throughout the current project area during the spring run. Approximately 68 miles of Chinook salmon habitat existed between Upper Klamath Lake and Iron Gate dam. Fall Chinook salmon in the Klamath River typically spend less than a year in freshwater. This life history characteristic allows them to utilize streams that may be characterized by unsuitable warm conditions later in the summer (Moyle 2002). The fall Chinook salmon run typically peaks in early September and continues through late October (FERC 2007; SWRCB 2020a).

4.5.1.3.2 Spring Chinook Salmon

Spring Chinook salmon exhibit a stream-type life history. Juveniles remain in streams for over a year before migrating downstream to the ocean. Adults generally enter freshwater before they are sexually mature, and stage in deep pools in the months preceding the spawn. Spring Chinook salmon generally enter the Klamath system between April and July, with the spawn peaking in October. Fry emerge during the spring months and remain in the system throughout the summer (FERC 2007).

4.5.1.3.3 Coho Salmon

Coho salmon were previously abundant and widely distributed in the Klamath River system (NAS 2004). The species experienced a substantial decline throughout California during the last 50 years, and surveys

conducted during 2001 suggest that 17 of the 25 historical coho salmon streams in the Klamath River Basin contain minimal numbers of juveniles (NAS 2004).

4.5.1.3.4 Steelhead

Steelhead (i.e., anadromous rainbow trout) were historically found throughout the Klamath River. Runs of steelhead exceeding several million likely occurred prior to 1900. The size of these runs had decreased to approximately 135,000 by the 1970s (Hardy and Addley 2001). Anthropogenic alterations to the watershed related to agriculture, timber harvest practices, past mining practices, and water diversions have been noted as causes of declines to steelhead populations within the basin (KRBFTF 1991). There are currently three distinct runs of steelhead in the Klamath River Basin; a winter run, a spring run, and a fall run (NAS 2004).

4.5.1.3.5 Green Sturgeon

Green sturgeon are found in nearshore marine waters from Mexico to the Bering Sea. There are currently two distinct population segments: a northern coastal segment consisting of populations that spawn in and north of the Eel River, which is located in northern California, and a southern segment that spawns south of the Eel River. The Klamath River Basin supports the largest spawning population of green sturgeon, which is part of the northern population segment. Preliminary research suggests that green sturgeon population in the Klamath River Basin is stable (SWRCB 2020a). The species generally enter the Klamath River from March through July, which a majority of spawning activity occurring during April and June (NAS 2004).

4.5.1.3.6 Pacific Lamprey

Pacific lamprey are found throughout the mainstem Klamath River and its tributaries below Iron Gate Dam. Adults construct nests in riffle habitats over sandy gravel substrates and die after spawning. Eggs hatch in 2 to 4 weeks, and larvae drift into backwater habitats where they burrow into the substrate. Juveniles stay in freshwater habitats for 5 to 7 years before out migrating to the sea. As adults they parasitize ocean fishes including Pacific salmon, flatfish, rockfish, and pollock (Moyle 2002).

4.5.1.3.7 Eulachon

Eulachon is an anadromous smelt species that reaches the southern end of its range at the Klamath River. Large numbers of eulachon previously entered the river for spawning events during March and April, although they generally only migrated several miles into the river upstream of its confluence with the Pacific Ocean. Spawning occurs in gravel riffles, and larvae are washed a short distance downstream into the estuary. The species has experienced declines throughout its range and has been scarce in the Klamath River since the mid-1970s (NAS 2004).

4.5.1.4 Fisheries Management

Salmon and steelhead are managed in the system through the Klamath Fishery Management Council (KFMC). This council, formed in 1985, is comprised of commercial and recreational fishermen, Yurok and Hoopa Valley Tribal representatives, and state and federal agencies (CDFW, ODFW, NMFS, and the DOI). The council meets each spring to review the previous year's salmonid harvest and abundance predictions. The KFMC then uses this information to make specific management recommendations regarding take (FERC 2007).

The Pacific Fisheries Management Council (PFMC) manages ocean harvest up to 200-miles offshore. The PFMC's management decisions are based on KFMC recommendations. The PFMC utilizes the Pacific Coast Salmon Fishery Management Plan to guide decision making regarding harvest for Chinook and coho salmon, and amendments are frequently made to keep management objectives and best practices up to date. PFMC does not regulate ocean harvest for steelhead, as these species are rarely caught in marine environments (FERC 2007).

The Yurok and Hoopa Valley Tribes have federal rights to the fishery resources of their reservations. Specifically, the tribes have rights to support a moderate standard of living or 50 percent of the total available harvest of Klamath-Trinity based salmon, whichever is less. Of the 50 percent tribal fisheries allocation for Klamath River stocks, 80 percent are designated for the Yurok Tribe and the remaining 20 percent to the Hoopa Valley Tribe. The annual recreational harvest is set as a percentage of the non-tribal harvest allocation (FERC 2007).

4.5.1.4.1 Freshwater Mussels

Mussel species documented in the mainstem Klamath River downstream of the project area include the Rocky Mountain ridged mussel (*Gonidea angulate)*, the western pearlshell (*Margaritifera falcata)*, and members of the Anodonta family (SWRCB 2020a). Davis et al. (2013) noted that *Anodonta sp.*[10] were found almost exclusively downstream of Iron Gate Dam and were absent from reaches further downstream in the Klamath River. Conversely, Rocky Mountain ridged mussel and western pearlshell are more abundant in the downstream reaches of the Klamath River; a 2019 mussel study conducted by the Renewal Corporation corroborated these findings (KRRC 2019). The Oregon floater (*Anodonta oregonensis*) has been documented downstream of J.C. Boyle Reservoir (Byron and Tupen 2017), and the California floater (*Anodonta californiensis*) has been documented in several reaches within the Klamath River Basin (Westover 2010). Overall, mussel densities decrease with increasing distance downstream from Iron Gate Dam (Davis et al. 2013).

10 Davis et al. (2013) did not conduct genetic analysis to distinguish Anodonta specimens to species level

4.5.2 Environmental Analysis

Numerous fish assemblage assessments have been conducted to evaluate the condition of fish and aquatic resources in the Lower Klamath Project area. These studies have demonstrated that project-related waters support a diverse assemblage of aquatic species and habitats, including nursery, rearing, and spawning habitat. Assessments targeting juvenile and young-of-year life stages document the presence of all life stages. The studies also document the presence of mussel species in the project area that are indicative of the overall species composition found throughout the Klamath River Basin. Tributaries to the main stem Klamath River support spawning habitat for salmonids, and the reach of the Klamath River below the developments support spawning habitat for numerous anadromous fish species.

The Renewal Corporation conducted surveys for freshwater mussels and Lost River and shortnose sucker surveys in 2018 to augment the robust aquatic analysis previously performed in the Proposed Action area. The 2019 Annual Aquatic Resources Survey Report is attached in Appendix D. Prior to the construction of the hydroelectric dams, anadromous fish were able to reach cold-water tributaries below Upper Klamath Lake such as Fall Creek, Jenny Creek, Spencer Creek, and Shovel Creek. Steelhead and Chinook will also migrate to spawning habitat above Upper Klamath Lake in the Williamson, Sprague, and Wood rivers. Construction of Lower Klamath Project dams eliminated access to historic anadromous fish spawning and rearing habitat, with corresponding impacts on the fish species' populations and resilience. (SWRCB 2020a)

The Proposed Action will improve and enhance fish and aquatic resources by opening the reach of habitat between the Iron Gate and J.C. Boyle developments, as well as riverine habitat upstream of the J.C. Boyle Development. The Proposed Action will provide spawning, rearing, and migratory habitat for fish that make large scale seasonal movements within the river system. Dam removal will reopen potential spawning habitat for anadromous fish species throughout the 38-mile project reach, as well as the 9-mile reach between Keno Dam and the existing J.C. Boyle Dam. This connectivity will allow for fish spawning runs throughout the entire river reach that is currently impounded, as spawning runs of fish downstream of the project area would no longer be impeded.

The removal of dams will also improve and enhance water quality parameters associated with fish health in the Klamath River. The increased flow and removal of lentic habitat will decrease or remove the blooms of nitrogen-fixing blue-green algae that currently occur during the summer months in Project reservoirs (SWRCB 2020a). Disease vectors for fall Chinook salmon will decrease after dam removal, because spawning fish would be distributed over a greater length of river, reducing crowding and the possible transmission of pathogens. Additionally, the earlier cooling of water temperatures in the fall that will likely occur after dam removal would provide conditions suitable for Chinook salmon spawning to occur earlier in the year. Earlier spawning will result in earlier emergence and growth of Chinook salmon in the reach (SWRCB 2020a).

While habitat suitability and availability will improve for anadromous species, the decrease in lentic habitats with the removal of Lower Klamath Project reservoirs will likely decrease the abundance of warmwater species, including centrarchids that are targeted by anglers on the existing reservoirs. Backwater habitats and associated vegetation will transition to flowing reaches that are less suitable for the many species that

are currently found in the Project reservoirs. Habitat for adult shortnose and (*Deltistes luxatus*) found in impounded habitats will be eliminated through dam removal. Short-term sediment increases that occur immediately after dam removal could reduce the quality of salmonid spawning habitat, as well of the health of juvenile and adult fish during periods of high turbidity. The sediment releases could negatively affect benthic invertebrates in the short-term through increased bedload deposition and suspended sediments.

The Proposed Action will improve and enhance the quantity and quality of available salmonid spawning habitat, and a recovery of benthic invertebrate populations within 1-2 years. Impacts associated with sedimentation and turbidity would be short-term outweighed by the long term benefits of dam removal. The overarching long-term effect will bring the habitat closer to a more natural riverine system, from the current reservoir and reservoir-influenced baseline (SWRCB 2020a).

The wide range of beneficial effects of implementation of the Proposed Action include: long-term beneficial effects on coho salmon critical habitat quality and quantity; long-term beneficial effects on Chinook and coho salmon Essential Fish Habitat (EFH) quality and quantity; long-term beneficial effects on fall-run and spring-run Chinook salmon, coho salmon, steelhead, Pacific lamprey, and redband trout populations due to increased habitat quality and quantity; short-term and long-term beneficial effects on species interactions between introduced resident fish species and native aquatic species due to short- and long-term changes in habitat quality and quantity; and long-term beneficial effects on benthic macroinvertebrate habitat quality (SWRCB 2020a).

4.5.3 Proposed Measures

The Renewal Corporation proposes to implement the measures stated in the DDP, and outlined in Table 3-1, to address impacts to each resource area. A summary description and analysis of each measure is outlined in the “References” column of Table 3-1.

To ensure those measures are successfully implemented and meet the interests of stakeholders, the Aquatics Resources Management Plans will be developed. This includes six subplans outlined in Table 3-2 as well as in the DDP. Below are the specific proposed measures and management subplans related to fish and aquatic resources.

The Renewal Corporation is drafting a Biological Assessment addressing potential impacts and avoidance and minimization measures to protect fish and aquatic species that may be impacted by the Proposed Action. A working draft BA (KRRC 2020a) was reviewed as part of this analysis and the final draft will be submitted to FERC upon completion.

4.5.3.1 Anadromous Fish Spawning

The Proposed Action will increase access to suitable habitat upstream of Iron Gate Dam and thereby increase the availability of spawning sites, resulting in additional food resources, and providing access to areas of better water quality in the long-term (SWRCB 2020a). To address short term impacts of dam

removal, the Renewal Corporation will monitor and maintain suitable salmonid spawning habitat throughout and after implementation of the Proposed Action. These measures include, but are not limited to:

- Implement a Water Quality Management Plan to mitigate for increased turbidity and suspended solids associated with construction activities (WQM-1).
- Implement a Spawning Habitat Availability Report and Plan to identify and improve spawning habitat. This plan will summarize the results of spawning habitat surveys and will propose actions to supplement existing salmonid spawning habitat in the mainstem Klamath River and its tributaries (ARM-1).
- Implement a Fish Presence Plan to monitor anadromous fish access to newly opened reaches of the Klamath River and its tributaries. Monitoring efforts will provide information to identify the status of restoration goals and inform additional actions that may be implemented to improve fish access (ARM-1).
- Implement a Tributary-Mainstem Connectivity Plan. This plan will include descriptions of methods, timing, duration, and frequency for surveys of tributary connectivity and fish passage as it relates to target anadromous fish species (ARM-1).
- Implement an Aquatic Resource Measure to improve tributary accessibility for anadromous fish. Associated efforts include removal of sediment and debris obstructions, and installation of coarse woody debris and riparian vegetation in accordance with the Reservoir Area Management Plan (WRM-1).

An adaptive management approach will be utilized and if necessary, additional actions can include gravel augmentation if spawning habitat conditions remain below target metrics following dam removal.

4.5.3.2 Juvenile Salmonids

The Proposed Action utilizes hatchery resources for juvenile salmonid production and includes implement mitigation plans to aid in the production and survival of salmon smolts:

- Implement a Juvenile Salmonid Rescue and Relocation Plan that will include the collection and transport of mainstem overwintering juvenile salmonids to reduce short-term impacts to smolts (ARM-1).
- Implement a Hatcheries Management and Operations Plan that will include details regarding operations of the Fall Creek Hatchery, annual fish production goals, identification of water sources to be used in hatchery operations, and a description of protective measures to be taken in the event that water supplies become unavailable. Production requirements will be determined by NMFS in the final ESA Section 7 Biological Opinion. Additional contents of the plan will include BMPs regarding ground disturbances associated with construction activities, minimum flow specifications, planned duration of operations for each hatchery, and reporting plans (ARM-2).
- Implement a minimum flow in Bogus Creek to provide volitional fish passage for target fish species (ARM-2).
- Implement successful outmigration of juvenile salmonids measures through maintenance of connectivity between the Klamath River and tributaries and the development of a water quality monitoring network. Additional efforts will include planning for the potential relocation of juvenile fish (ARM-1).

4.5.3.3 Salvage and Relocation

The Renewal Corporation proposes to implement salvage and relocation efforts for sucker species prior to construction efforts.

- Implement an adaptive management plan for sampling, genetic testing, salvage, and relocation of Lost River and shortnose suckers. Relocation of suckers to suitable lentic habitats will mitigate for the loss of impounded habitat that will occur in the Klamath River (ARM-1).

4.5.4 Unavoidable Adverse Impacts

The Proposed Action may result in a short-term exposure of aquatic species to inorganic contaminants associated with the release of sediments currently trapped behind dams. Individual fish species or groups, as well as associated habitat, may be temporarily impacted by these sediment loads through short-term decreases in water quality and potential sedimentation of nests or redds. Species potentially affected by this sediment and associated suspended solids include: Chinook salmon, coho salmon, steelhead, Pacific lamprey, green sturgeon, Lost River sucker, shortnose sucker, redband trout, eulachon, longfin smelt (*Sprinchus thaleichthys*), groundfish species, mussels, and pelagic fish species (SWRCB 2020a).

Due to elevated sediment concentrations during reservoir drawdown and the elimination of reservoir habitat, there are likely to be unavoidable impacts to freshwater mussels within the Proposed Action area (SWRCB 2020a).

4.5.5 References

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4.6 Wildlife Resources

As described in Section 4.1, this Exhibit E incorporates by reference the extensive environmental documentation developed since the 2004 PacifiCorp Application as described in Table 4-16.

Table 4-16 Cross-walk of Wildlife Resources Reference Documents

Date	Author	Reference Document	Section Number	Page Number(s)
2004	PacifiCorp	Application for New License	E5.1.2	5-5 – 5-8 5-45 – 5-119
2007	FERC	Final EIS	3.3.4	3-348 – 3-999
2012	U.S. BOR	EIS/EIR	3.5	3.5-1 – 3.5-101
2018	KRRC	Definite Plan Report	Appendix J	11 – 92
2020	SWRCB	Final EIR	3.5	AT1-671 – AT1710
2020	State of California	401 WQ Certificate	Condition 14	39 – 40; 73 – 75
2018	State of Oregon	401 WQ Certificate	N/A	N/A
2020	SWRCB	Attachment 4: CEQA Findings	N/A	27 – 63
2018	ODEQ	Evaluation and Findings Report	N/A	N/A
2011-2020	PacifiCorp	KHSA Interim Measures Implementation Annual Report (2020)	N/A	N/A

4.6.1 Affected Environment

4.6.1.1 Wildlife Habitats

The Klamath River valley is a natural migration corridor for many wildlife species (FERC 2007). The Lower Klamath Project area contains a variety of plant and terrain types, which support a diverse group of wildlife species (FERC 2007). These valuable habitats include riparian corridors and wetlands, late-successional conifer forest, snag and coarse wood rich habitats, caves, cliffs, talus, willows, and reed canary grass (*Phalaris arundinacea*) (PacifiCorp 2004). Section 4.7 (Botanical Resources) describes in detail the location and availability of these wildlife habitats.

The Lower Klamath Project area has been directly affected by human inhabitation over thousands of years. Prior to European settlement, American Indian tribes hunted for deer (*Odocoileus hemionus*) and elk (*Cervus elaphus*) along with many other mammalian and avian species (Gleason 2001 as cited in PacifiCorp 2004). Following European settlement, large predator species such as the grizzly bear (*Ursus arctos horribilis*) and gray wolf (*Canis lupus*) were systematically eradicated from the Lower Klamath Project area (Gleason 2001 as cited in PacifiCorp 2004). Land was developed for agricultural use, which decreased available wildlife habitat prior to the construction of the dams (Gleason 2001 as cited in PacifiCorp 2004).

Practices such as long-term logging and fire suppression have also affected wildlife habitat in the Lower Klamath Project area (CDFG 1998 as cited in PacifiCorp, 2004). Through logging practices, the reduction of

ponderosa pine reduced available nesting sites for bald eagles (*Haliaeetus leucocephalus*) (Anthony and Isaacs 1989 and BLM 1996 as cited in FERC 2007). Timber harvests have also reduced the number of large-diameter nesting trees suitable for spotted owl (*Strix occidentalis*). However, not all human activities have reduced wildlife habitat; practices such as fire suppression have been shown to increase understory development, creating multi-story stands, a preferred habitat for spotted owls.

4.6.1.2 Wildlife

4.6.1.2.1 Mammals

PacifiCorp conducted a variety of field studies (track surveys, photographic bait stations, and live trapping) in 2002 and 2003 to assess the status of mammalian species in the vicinity of the Lower Klamath Project. Track and bait station surveys were conducted near Lower Klamath Project facilities while the mammal trapping was conducted along the canals. Along with these studies, PacifiCorp recorded incidental observations throughout the entire Lower Klamath Project area (PacifiCorp 2004). Thirty-one mammalian species are known to or may occur in the project area (FERC 2007). Appendix E includes a summary of wildlife species identified during PacifiCorp's 2002-2003 wildlife habitat studies within the Lower Klamath Project area, including the four developments that are included in the Proposed Action.

The Renewal Corporation performed additional terrestrial wildlife surveys in the Lower Klamath Project area in 2017, 2018, and 2019 to provide updated background information (KRRC 2019 and KRRC 2020b). Biologists established transects to cover the study area, that included a 0.25-mile buffer surrounding the Lower Klamath Project area. The Renewal Corporation developed the 0.25-mile study area buffer, in cooperation with the resource agencies during development of the survey work plans. Biologists walked the length of each transect, recording all wildlife observations (e.g., direct visual and auditory observations, scat, and other signs of presence). Field teams recorded wildlife behaviors, particularly breeding activity (KRRC 2019).

Big Game

Species that are managed by Oregon and California wildlife agencies for the purpose of sport hunting are considered big game mammals. In the Lower Klamath Project area, these include black-tailed deer (*Odocoileus hemionus columbianus*), mule deer (*Odocoileus hemionus*) elk (*Cervus canadensis*), black bear (*Ursus americanus*), and cougar (*Felis concolor*). Black-tailed deer and mule deer both occur in the Lower Klamath Project area, although hybrid deer may be the most common (PacifiCorp 2004). ODFW does not distinguish between these two species when managing populations (ODFW as cited in PacifiCorp 2004). The Keno Management Unit is a 1,039 square-mile area in the northern part of the Klamath River valley in Oregon. Approximately 3,000 deer wintered in the Keno Management Area in the 1980s, yet numbers have decreased due to severe winters in 1992-1993 (BLM 1996 as cited in FERC, 2007). Elk and deer populations in California have decreased due to natural and human influences including, timber harvest, livestock grazing, wildlife, fire suppression, reservoirs, predation, poaching, and non-native species

(PacifiCorp 2004). The main reason for the decline in population is likely the loss of early-successional habitat and hard freezes that have killed preferred browse species in the summer range (PacifiCorp 2004).

Elk tend to utilize the same wintering and summer grounds throughout their life span (ODFW 2002a as cited in FERC 2007). Historically, approximately 400 elk are known to winter in the Keno Management Unit (PacifiCorp 2004). The extent of movement by elk in the winter is influenced by the severity of winter conditions (ODFW 2002a as cited in FERC 2007). Forage availability, thermal cover, and hiding cover are the three main factors that affect elk wintering survivability (ODFW 2002a as cited in FERC 2007). Around the Lower Klamath Project factors that influence elk security are very important due high predator density (ODFW 2002a as cited in FERC 2007).

Within the Lower Klamath Project area, canyon and mid-elevation hillsides and plateaus between J.C. Boyle Powerhouse and Iron Gate Dam are considered important deer wintering habitat (City of Klamath Falls 1989 as cited in PacifiCorp 2004). It is considered one of the largest contiguous areas of wintering habitat in southern Oregon and northern California (City of Klamath Falls 1989 as cited in PacifiCorp, 2004). South-facing lower canyon walls and hillsides are the most critical habitat for the wintering Pokegama black-tailed deer herd (City of Klamath Falls 1989 as cited in PacifiCorp 2004).

Surrounding Iron Gate there are 2,235 acres of habitat with wedgeleaf ceanothus (*Ceanothus cuneatus*) and mountain mahogany (*Cercocarpus ledifolius*), which are two major deer-browsing species. The habitat immediately adjacent to the reservoir is sparse and of low quality (BLM 2003b as cited in FERC 2007); however, there is a substantial amount of suitable habitat within Copco No. 2 bypass (1,136 acres), and J.C. Boyle peaking reach (10,517 acres) (PacifiCorp 2004). There are two wildlife management areas near the Lower Klamath Project, that support enhancements to protect big game species. These include the Pokegama Cooperative Habitat Management Project north of J.C. Boyle Dam to north of Copco Reservoir, and Horseshoe Ranch Wildlife Area northwest of Iron Gate Reservoir.

Black bears are another big game species that occur in the Lower Klamath Project area. They have been observed during surveys in J.C. Boyle Bypass, but likely inhabit most of the study area. Compared to average bear density numbers in Oregon, the density near J.C. Boyle Dam is considered high in the western end, and medium towards the eastern end (ODFW 1993 as cited in FERC 2007). It is estimated that half of the California bear population inhabits the north coast / Cascade portion of the state (CDFG 1998a as cited in FERC 2007). Bear populations are expected to be highest in montane chaparral, montane hardwood, and mixed conifer forests (CDFG 1998a as cited in FERC 2007).

Mountain lions were nearly extirpated from the Lower Klamath Project area, but the population has been increasing. Mountain lion populations within the Lower Klamath Project area are considered medium, when compared to state averages (ODFW 1993a as cited in FERC 2007). Mountain lion hunting is allowed in the State of Oregon; however, it is banned in California it is banned except for nuisance circumstances (CDFG website as cited in FERC 2007).

Other Mammals

Along with the 5 big game species, there are 26 aquatic and terrestrial mammal species that occur within or near the Lower Klamath Project area (Table 4-17). PacifiCorp identified the following species that associate with aquatic or riparian habitat during the relicensing field studies of 2002 to 2003: racoon (*Procyon lotor*), beaver (*Castor canadensis*), muskrat (*Ondatra zibethica*), mink (*Neovison vison*), and river otter (*Lontra canadensis*) were all identified within the Lower Klamath Project area. River otter were noted downstream from Iron Gate and J.C. Boyle dams. Beavers have been identified in J.C. Boyle Reservoir and in other wetland habitats within the Lower Klamath Project area (PacifiCorp 2004). Other medium sized mammals that have been documented within the project area include bobcat (*Lynx rufus*), gray fox (*Urocyon cinereoargenteus*), and coyote (*Canis latrans*). These species are all found throughout the project area. Additionally, the Pokegama Wild Horse Herd occurs on a formally established wild horse herd management area near J.C. Boyle Dam (BLM 2000 as cited in FERC 2007).

A series of bat surveys were conducted by the Renewal Corporation between 2017 and 2019. Biologists conducted evening emergence surveys for bats from June 12 through 15, 2019, at J.C. Boyle, Iron Gate, and Copco structures (KRRC 2020b) (Appendix D). The following structures were targeted for additional data to supplement previous summer surveys (2017-2018); J.C. Boyle red barn, Iron Gate diversion tunnel outlet, Iron Gate powerhouse, Lakeview Road bridge (at Iron Gate entrance), maintenance building on Copco access road, Copco No. 1 gatehouse C-12, and Copco No. 1 diversion tunnel outlet.

Renewal Corporation biologists observed evening emergences of *Myotis* subspecies, Big brown bat (*Eptesicus fuscus*) and hoary bat (*Lasiurus cinereus*); with the majority of bats observed from the *Myotis spp*. Bats were observed emerging from all those facilities listed above except for the J.C. Boyle red barn. The results of the June 2019 surveys at these five structures are consistent with the emergence surveys conducted at these same locations in 2018 (KRRC 2020b). Findings from the surveys were shared with CDFW and USFWS in technical meetings providing survey summary results (Appendix B).

Table 4-17 List of Non-Game Mammals in Lower Klamath Project Area during PacifiCorp 2002-2003 and Renewal Corporation 2017-2019 Field Surveys

Common Name		
American Badger	Dusky-Footed Woodrat	Pinyon Mouse
Beaver	Gray Fox	Raccoon
Big Brown Bat	Hoary Bat	River Otter
Black-Tailed Jackrabbit	Kangaroo Rat (sp.)	Striped Skunk
Bobcat	Least Chipmunk	Western Gray Squirrel
Bushy-Tailed Woodrat	Long-Tailed Weasel	Western Harvest Mouse
California Ground Squirrel	Mink	Yellow-Bellied Marmot
Canyon Mouse	Montane Vole	Yellow-Pine Chipmunk
Coyote	Muskrat	Yuma Bat
Deer Mouse		

Source: PacifiCorp 2004, KRRC 2019; KRRC 2020b

Birds

PacifiCorp conducted surveys in 2002 and 2003 to document avian species diversity and abundance in the Lower Klamath Project area. The Renewal Corporation conducted additional terrestrial surveys between 2017 and 2019 to provide more information on special-status species in the Lower Klamath Project area. The surveys were conducted with a 0.25-mile buffer area around the proposed working area for the Proposed Action for terrestrial species of interest including osprey (*Pandion haliaetus*), willow flycatcher (*Empidonax traillii*), nesting great blue heron (*Ardea herodias*), peregrine falcon (*Falco peregrinus*), greater sandhill crane (*Grus canadensis*), and the tricolored blackbird (*Agelaius tricolor*) (KRRC 2019; KRRC 2020b). In addition to land-based transects, biologists surveyed reservoir shorelines and open water by boat to observe aquatic and semi-aquatic species (e.g., western pond turtle (*Actinemys marmorata*), waterfowl). Biologists noted all special-status species observed or heard, their approximate number, location, and behavior (e.g., roosting, loafing, foraging, courtship, mating, incubating eggs, or feeding young). The status of these species in the Lower Klamath Project area is described in greater detail in Section 4.8. Table 4-18 provides a list of bird species that were documented in the Lower Klamath Project area in 2002, 2003 and the Renewal Corporation's 2017-2019 surveys (KRRC 2019; KRRC 2020b).

Table 4-18 List of Birds Documented in the Lower Klamath Project Area

Pelagic Birds and Herons	Waterfowl	Raptors, Gamebirds	Rails, Cranes, Shorebirds, Gulls, Terns, and Doves	Owls, Goatsuckers, Swifts, Humming birds, and Kingfishers	Woodpeckers and Flycatchers
American White Pelican	American Wigeon	American Kestrel	American Avocet	Anna's Hummingbird	Acorn Woodpecker
Black-Crowned Night Heron	Barrow's Goldeneye	Bald Eagle	American Coot	Barn Owl	Ash-Throated Flycatcher
Clark's Grebe	Blue-Winged Teal	Blue Grouse	Black Tern	Belted Kingfisher	Black Phoebe
Common Loon	Bufflehead	California Quail	Black-Necked Stilt	Calliope Hummingbird	Downy Woodpecker
Double-Crested Cormorant	Canada Goose	Cooper's Hawk	Bonaparte's Gull	Common Poorwill	Dusky Flycatcher
Eared Grebe	Canvasback	Golden Eagle	California Gull	Flammulated Owl	Hairy Woodpecker
Great Blue Heron	Cinnamon Teal	Merlin	Caspian Tern	Great Gray Owl	Hammond's Flycatcher
Great Egret	Common Goldeneye	Mountain Quail	Common Snipe	Great-Horned Owl	Lewis' Woodpecker
Green Heron	Common Merganser	Northern Goshawk	Forster's Tern	Northern Pygmy Owl	Olive-Sided Flycatcher
Snowy Egret	Gadwall	Northern Harrier	Greater Yellowlegs	Northern Spotted Owl	Pacific Slope Flycatcher
Western Grebe	Greater White-Fronted Goose	Osprey	Killdeer	Rufus Hummingbird	Pileated Woodpecker
White-Faced Ibis	Hooded Merganser	Peregrine Falcon	Least Sandpiper	Vaux's Swift	Red-Breasted Sapsucker
	Lesser Scaup	Peregrine Falcon	Mourning Dove	Western Screech Owl	Red-Shafted Flicker
	Mallard	Red-tailed Hawk	Ring-Billed Gull		Western Kingbird
	Northern Pintail	Sharp-Shinned Hawk	Rock Dove		Western Wood Peewee
	Redhead	Turkey Vulture	Sandhill Crane		White-Headed Woodpecker
	Ring-Necked Duck	Wild Turkey	Spotted Sandpiper		Willow Flycatcher
	Ruddy Duck		Virginia Rail		
	Snow Goose				
	Wood Duck				

Source: PacifiCorp 2002-2003, KRRC 2019, KRRC 2020b

Waterfowl and Water-related Birds

Approximately 67 percent of all birds observed by PacifiCorp during the 2002 and 2003 field surveys were waterfowl, wading bird species, or open-water marsh birds (PacifiCorp 2004). There were 47 species of water-birds observed (Table 4-18) and of these, 25 were waterfowl species. Five of these species, Canada goose (*Branta canadensis moffitti*), wood duck (*Aix sponsa*), mallard (*Anas platyrhynchos*), blue-winged teal (*Anas discors*), and common merganser (*Mergus merganser*) are permanent residents and use the Lower Klamath Project area as breeding habitat (PacifiCorp 2004). Within the project area, the project reservoirs provide the majority of waterfowl habitat. For example, sandhill crane (*Grus canadensis*) and Canada goose nesting was documented in wetland habitat within J.C. Boyle Reservoir. Common merganser and wood duck nesting was also observed within other reaches (PacifiCorp 2004).

In addition to waterfowl, 19 species of open-water, marsh, and wading birds were documented in the Lower Klamath Project area during the 2002 and 2003 field studies. Some of the most common included four species of grebes: the western grebe (*Aechmophorus occidentalis*), Clark's grebe (*Aechmophorus clarkii*), pied-bill grebe (*Podilymbus podiceps*), and eared grebe (*Podilymbus nigricollis*). Other common species included the American white pelican (*Pelecanus erythrorhynchos*), common loon (*Gavia immer*), double-crested cormorant (*Phalacrocorax auritus*), American coot (*Fulica americana*), great blue heron (*Ardea herodias*), great egret (*Casmerodius albus*), Forster's tern (*Sterna forsteri*), black tern (*Chlidonias niger*), Caspian tern (*Sterna caspia*), ring-billed gull (*Larus delawarensis*), and killdeer (*Charadrius vociferus*) (PacifiCorp 2004). American coots (*Fulica americana*) were observed at Iron Gate, Copco, and J.C. Boyle reservoirs only during the winter, and only seen once in the spring at Iron Gate reservoir. Ring-billed gulls, and double-crested cormorants (*Phalacrocorax auritus*) are known to be year-round residents within the Lower Klamath Project area. Caspian terns and Foster's terns (*Sterna forsteri*) were seen in small numbers foraging on Lower Klamath Project reservoirs during the spring season (PacifiCorp 2004).

The greatest numbers of waterfowl and wading birds were observed on Copco Reservoir, followed by J.C. Boyle and Iron Gate reservoirs with the greatest numbers observed April through June. Out of the six most common species, five of these were water birds or diving ducks: American Coot, lesser scaup (*Aythya affinis*), ring-billed gull, common merganser (*Mergus merganser*), and double-crested cormorant. The reason for the abundance of these species is the large concentration of overwintering birds (PacifiCorp 2004).

Raptors, Vultures, Ravens, and Owls

The Lower Klamath Project area supports many birds of prey due to the diversity and abundance of habitats (PacifiCorp 2004). During the 2002 and 2003 relicensing field studies, 19 bird of prey species were documented in the Lower Klamath Project area. Surveys that targeted Northern goshawk (*Accipiter gentilis*), northern spotted owl (NSO) (*Strix occidentalis caurina*), and great gray owl (*Strix nebulosi*) also identified many other birds of prey. These species were identified during avian point count surveys, reservoir surveys, and bald eagle (*Haliaeetus leucocephalus*) prey surveys (PacifiCorp 2004).

In 2019, the Renewal Corporation conducted a series of bald eagle and golden eagle (*Aquila chrysaetos*) surveys in in the Lower Klamath Project area. The surveys targeted suitable habitat or known nest locations.

Biologists observed a total of 10 active nests, 9 of which were within 2 miles of the proposed work area or 0.5-mile of a haul road (high-impact area). Two of the active nests were golden eagle nests, while the others were bald eagle nests. In addition to the active nests, 12 inactive nests were also located during the surveys. Of the inactive nests, 6 were presumed golden eagle nests, while the remainder were likely bald eagle nests (KRRC 2020b). More bald eagle nests were found surrounding J.C. Boyle Reservoir, while more golden eagle nests were located near Copco and Iron Gate reservoirs (KRRC 2020b) (Appendix D).

The Renewal Corporation conducted eagle surveys in 2018. Biologists observed a total of nine active nests surrounding Copco Lake, Iron Gate Reservoir, and J.C. Boyle Reservoir in 2018. Five of these were golden eagle nests and four were bald eagle nests. Of the nine active nests, seven were within 0.5 mile of the Lower Klamath Project area or more than 2 miles from the Lower Klamath Project area but within 0.5 mile of a haul road (high-impact areas), and two were between 0.5 mile and 2 miles from the Proposed Action area (low-impact area) (KRRC 2019).

In 2018, the Renewal Corporation conducted a series of osprey nesting surveys. Biologists identified 17 active osprey nests, all on utility poles and typically on platforms installed for osprey nesting (KRRC 2019). Biologists observed three active osprey nests in the vicinity of the Iron Gate Reservoir. Of these, three nests were on utility poles; one in the staging area west of the Iron Gate Dam; one was along the western side of the Iron Gate Reservoir; and one was along Copco Road where it turns north at the upstream end of the Iron Gate Reservoir. In addition, biologists observed four active osprey nests along the Klamath River downstream of Iron Gate Dam (excluding the one described above near the dam itself). These four nests were on utility poles along Copco Road between Iron Gate Dam and Interstate 5 (KRRC 2019).

As part of the 2018 terrestrial surveys conducted by the Renewal Corporation, two peregrine falcon nests were observed in 2018, on rocky outcrop/cliff structures within the vicinity of the Lower Klamath Project area (KRRC 2019).

Passerine, Woodpeckers, and Game Birds

PacifiCorp conducted point count bird surveys along 149 plots distributed among habitat types. PacifiCorp documented 93 passerine species, 8 woodpecker species, and 5 gamebird species in the project area. Only a few of a passerine species were confirmed as breeding (by nests or young observed) but a high percentage were observed during the May and June surveys, suggesting the presence of breeding populations (PacifiCorp 2004).

There were seven species identified across all study areas: western wood pewee (*Contopus sordidulus*), song sparrow (*Melospiza melodia*), Brewer's blackbird (*Euphagus cyanocephalus*), yellow warbler (*Setophaga petechia*), brown-headed cowbird (*Molothrus ater*), black-headed grosbeak (*Pheucticus melanocephalus*), and mourning dove (*Zenaida macroura*).These species all use riparian and wetland habitat for breeding, rearing, and feeding. In 2018, the Renewal Corporation conducted studies for tri-colored blackbird, but they were not observed in the Lower Klamath Project area (KRRC 2019).

PacifiCorp identified five gamebird species in the project area in 2002 and 2003: wild turkey (*Meleagris gallopavo*), blue grouse (*Dendragapus obscurus*), California quail (*Callipepla californica*), mountain quail (*Oreortyx pictus*), and mourning dove. The wild turkey was introduced to the Lower Klamath Project area but is now occurring in most forested project areas that have oak or ponderosa pine. Mountain quail were observed in forested habitats from J.C. Boyle bypass to below Iron Gate dam (PacifiCorp 2004).

Eight species of woodpecker were observed during the 2002 and 2003 studies. These include the acorn woodpecker (*Melanerpes formicivorus*), white-headed woodpecker (*Picoides albolarvatus*), Lewis' woodpecker (*Melanerpes lewis*), red-shafted flicker (*Colaptes auratus*), red-breasted sapsucker (*Melanerpes lewis*), downy woodpecker (*Picoides pubescens*), hairy woodpecker (*Leuconotopicus villosus*), and pileated woodpecker (*Dryocopus pileatus*). The red-shafted flicker was the most widely distributed throughout the study area. Nesting colonies of acorn woodpeckers were observed in oak, or mixed oak forests along Copco Reservoir (PacifiCorp 2004).

4.6.1.2.2 Amphibians and Reptiles

PacifiCorp used literature reviews, surveys of potential pond-breeding areas, and stream and terrestrial habitat surveys to identify amphibians and reptiles in the Lower Klamath Project area (Table 4-19). Five amphibians and sixteen reptile species were identified during these surveys (PacifiCorp 2004).

Pond-breeding amphibians in the Lower Klamath Project area include the Pacific treefrog (*Hyla regilla*), western toad (*Bufo boreas*), long-toed salamander (*Ambystoma macrodactylum*), and bullfrog (*Rana catesbeiana*). In the 2002 surveys, adult pond-breeding amphibians were identified at 27 percent of the sites that were hydrologically connected to the Klamath River. In contrast to this, 63 percent of the sites that were isolated from the river had adult pond-breeding amphibians. This is an indication in a difference in habitat quality between the two groups of breeding sites (PacifiCorp 2004). The Pacific giant salamander (*Dicamptodon tenebrosus*) was the only stream-dwelling amphibian species documented in the study area. Larval Pacific giant salamanders were found in the J.C. Boyle bypass reach during electroshocking surveys (PacifiCorp 2004).

Table 4-19 List of Amphibians and Reptiles in the Lower Klamath Project Area during PacifiCorp's 2002 and 2003 Field Surveys

Amphibians	Reptiles
Pacific Giant Salamander	Western Pond Turtle
Western Toad	Southern Alligator Lizard
Treefrog	Northern Sagebrush Lizard
Long-toed Salamander	Western Fence Lizard
Bullfrog	Yellow-Bellied Racer
	Western Skink
	Sharptail Snake
	Ringneck Snake
	Common Kingsnake
	California Mountain Kingsnake
	Striped Whipsnake
	Gopher Snake
	Western Terrestrial Garter Snake
	Rubber Boa
	Common Garter Snake
	Western Rattlesnake

Source: PacifiCorp 2004

PacifiCorp conducted Oregon spotted frog (*Rana pretiosa*) surveys in 2003 in potentially suitable wetland habitat in the J.C. Boyle Reservoir; the Oregon spotted frog was not found within the Lower Klamath Project area (PacifiCorp 2004). In 2003, PacifiCorp conducted surveys for foothill yellow-legged frogs (*Rana boylii*) in the Lower Klamath Project area; no yellow-legged frogs were found in the project area (PacifiCorp 2004).

The J.C. Boyle peaking reach had the largest number of terrestrial reptile detections (1.95 reptiles per plot). The species diversity was also the greatest in the J.C. Boyle peaking reach. The western fence lizard (*Sceloporus occidentalis*) was the most abundant reptile species encountered in any of the wildlife plots, representing 59 percent of overall detections. They appeared in a variety of habitats, throughout the Lower Klamath Project area. The common garter snake (*Thamnophis sirtalis*) was the next most abundant species in the Lower Klamath Project area. They were always found in association with riparian habitats (PacifiCorp 2004).

4.6.1.2.3 Rare, Threatened, and Endangered Wildlife Species

PacifiCorp conducted studies in 2002 and 2003 to document RTE species that occur in the Lower Klamath Project area; the Renewal Corporation performed additional surveys in 2017, 2018, and 2019 to document the presence of RTE species in the Proposed Action areas (KRRC 2019, 2020b) (Appendix D). Section 4.8 provides an inventory and description of RTE wildlife species.

4.6.2 Environmental Analysis

Long-term positive effects of the Proposed Action include increases in winter range habitat, and similar increased movement opportunities for terrestrial mammals, including deer, elk, and other mammalian species. Areas that are currently impounded will become accessible to terrestrial mammals that can utilize these reaches as travel corridors and expand their range. Terrestrial resources will benefit from increased connectivity to fisheries resources. Salmonids will be restored to habitats upstream of Iron Gate Dam, which will increase the distribution of salmon-derived nutrients that can enter the terrestrial food-web (SWRCB 2020a).

The removal of the Lower Klamath Project dams will cause relatively short-term (i.e., less than 2 years), insignificant impacts to wildlife species that inhabit wetland and riparian areas (SWRCB 2020a). The short-term effects include impacts to amphibian communities due to riparian and wetland disturbances during construction efforts in the Proposed Action area, and additional disturbances to downstream amphibian habitat due to sediment releases associated with dam removal. Short-term high suspended sediment concentrations have the potential to adversely affect or cause mortality in sensitive life stages of amphibians and reptiles that occur in the Lower Klamath River. This could result in a mortality of amphibian eggs deposited in the Lower Klamath River, but due to species timing and life history traits, this would be unlikely.

Additional short-term decreases in amphibian habitat availability may occur from downstream riparian erosion during periods of increased flow during dam removal, although the long-term effect of the Proposed Action and associated change in flow regime would likely be decreased erosion to these habitats.

Finally, temporarily displaced or lowered benthic macroinvertebrate populations caused by changes to sediment load may affect food availability for species that utilize invertebrates as a food source, including western pond turtles and numerous amphibian species.

There is the potential for bats to be affected during implementation of the Proposed Action. Multiple bat species may experience disturbances from construction-related noise and may experience habitat alterations associated with roosting habitat when equipment access involves tree removals. Additional roosting habitat may be lost through the removal of project-related structures.

Construction-related noise during implementation of the Proposed Action has the potential to disturb nesting birds. Habitat alterations and the permanent drawdown of existing impoundments will affect habitat availability (e.g., feeding and breeding habitat) for multiple bird species, including waterfowl, wading birds,

passerines, and raptors. Osprey nests have been documented in the Proposed Action area on top of electrical poles, and the existing reservoirs provide habitat and foraging opportunities for osprey and other raptors.

Other bird species in the Lower Klamath Project area that may experience changes in habitat availability include bald and golden eagles. Due to nesting proximity within the Lower Klamath Project area as identified in studies conducted by the Renewal Corporation in 2018 and 2019, bald and golden eagles could be disturbed by drawdown activities. The potential impacts to eagles would be nest abandonment due to noise above ambient conditions, or direct habitat removal due to Proposed Action implementation (SWRCB 2020a). Examples of activities that could result in a noise disturbance would be mobilization during the pre-drawdown phase, drawdown, loud blasting activities, and the use of planes or helicopters during the restoration and post-drawdown phase.

In the 2018 studies, several special-status species were observed and were likely breeding in the study area. The great blue heron colony near the Copco No. 2 penstock would potentially be disturbed due to drawdown-related activities. The peregrine falcon nest above Iron Gate Reservoir near Copco Road would potentially be disturbed by truck traffic and hauling activities and during the demolition of J.C. Boyle power canal and powerhouse.

Gray wolves may sometimes occur in or pass through the Proposed Action area yet are likely not present where disturbances will occur. The Proposed Action is not expected to affect gray wolves that may transiently occur in the Proposed Action area.

4.6.3 Proposed Measures

The Renewal Corporation proposes to implement the measures stated in the DDP and outlined in Table 3-1, to address impacts to each resource area. A summary description and analysis of each measure is outlined in the "References" column of Table 3-1.

To ensure those measures are successfully implemented and meet the interests of stakeholders, management plans are being developed. These management plans are outlined in Table 3-2 as well as in the DDP. Below are the specific proposed measures and management plans related to wildlife resources.

4.6.3.1 Terrestrial and Wildlife Management Plan

The Renewal Corporation will implement the Terrestrial and Wildlife Management Plan which includes the Amphibian and Reptile Relocation Plan, the Bald and Golden Eagle Management Plan, measures to protect the gray wolf, as well as measures to protect migrating bird species and roosting bat species. These plans and measures are summarized below.

- The Renewal Corporation will implement the Amphibian and Reptile Management Plan which will include specifics on survey protocol, locations, and frequency, rescue and relocation techniques and reporting requirements (TRM-1).
- The Renewal Corporation will implement gray wolf measures including locating gray wolves using the CDFW gray wolf activity map. Additional measures including denning surveys, reduced driving speeds, signage on haul roads, limited operating periods, disturbance buffers, and avoidance of key areas may be implemented, as necessary (TRM-1).
- The Renewal Corporation will implement measures for wildlife exclusion and entrapment, including the placement of exclusion fencing, as well as daily checks of the fencing to ensure that the barriers remain intact (TRM-1).
- The Renewal Corporation will implement measures to protect avian species, including willow flycatcher from habitat loss due to vegetation removal.
- The Renewal Corporation will implement bat species avoidance best management procedures prior to and during construction to minimize the potential impacts on roosting bats.
- The Terrestrial and Wildlife Management Plan includes parameters for no net loss of wetland or riparian habitat functions, including identification of wetland areas, wetland fencing to reduce impacts to reptiles and amphibians in these habitats, establishing a 20-foot buffer around delineated wetlands, and restoring wetlands (TRM-1).

4.6.3.2 Construction Management Plan

The Renewal Corporation will implement biological monitoring and reporting during implementation of the Proposed Action, including specific provisions for the Western pond turtle. These measures will be described in the Wildlife Management Plan and include:

- Biological resource awareness training for all construction personnel, including consideration of exotic species and decontamination measures, including on-site biologists during construction (TRM-1).
- On-site pre-construction wildlife surveys prior to initiation of construction activities to identify den sites or burrows and identification of special-status amphibian and reptile habitat (TRM-1).
- Conduct Western pond turtle pre-construction surveys and reporting. An on-site biologist approved by the agencies, will conduct pre-construction surveys immediately prior to the start of any in-water work, each day the in-water work will occur. Any adult Western pond turtles that are found during the surveys will be relocated to a safe location, outside of the work area, away from any indirect impacts (TRM-1).
- Implement a Western pond turtle rescue and relocation plan as part of the Terrestrial and Wildlife Management Plan after reservoir drawdown operations (TRM-1).

4.6.4 Unavoidable Adverse Impacts

Short-term insignificant effects are anticipated and include impacts to wetland habitats associated with construction-related activities. Long-term impacts associated with loss of bat roosting habitat may occur. Other than a possible reduction of bat roosting habitat associated with loss of project structures, no long-term unavoidable adverse effects are expected to occur as a result of the Proposed Action.

4.6.5 References

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State Water Resources Control Board (SWRCB). 2020a. Final Environmental Impact Report for the Lower Klamath Project License Surrender. Available online: https://www.waterboards.ca.gov/waterrights/water_issues/programs/water_quality_cert/lower_klamath_ferc14803_eir.html.

4.7 Botanical Resources

As described in Section 4.1, this Exhibit E incorporates by reference the extensive environmental documentation developed since the 2004 PacifiCorp Application as described in Table 4-20.

Table 4-20 Cross-walk of Botanical Resources Reference Documents

Date	Author	Reference Document	Section Number	Page Number(s)
2004	PacifiCorp	Application for New License	E5.0	5-1 – 5-5 5-8 – 5-44
2007	FERC	Final EIS	3.3.4.1.1	3-348 – 3-361
2012	U.S. BOR	EIS/EIR	3.5.3	3.5-3 – 3.5-23
2018	KRRC	Definite Plan Report	Appendix J	75 - 92
2020	SWRCB	Final EIR	3.15	AT1-857 – AT1-860
2020	State of California	401 WQ Certificate	Condition 9 Condition 14	37; 66 – 67 39 – 40; 73 – 75
2018	State of Oregon	401 WQ Certificate	6	5 – 8
2020	SWRCB	Attachment 4: CEQA Findings	N/A	27–33 58 - 59
2018	ODEQ	Evaluation and Findings Report	N/A	N/A
2011-2020	PacifiCorp	KHSA Interim Measures Implementation Annual Report (2020)	N/A	N/A

4.7.1 Affected Environment

The Lower Klamath Project area spans across 37 RMs, beginning in Oregon at the J.C. Boyle Dam and ending outside Hornbrook, California at the Iron Gate Dam. This wide span of lands results in a diverse mix of flora and fauna due to varying eco-regions. Habitats range from steep upland slopes (3,428 feet elevation) near the California-Oregon state border and continue downstream toward wetland communities located just below sea level (-0.16 feet elevation) (SWRCB 2020a).

The Lower Klamath Project begins at J.C. Boyle Dam, located at RM 230.6 near the base of Upper Klamath Lake in southern Oregon. This eco-region is described as East and West Slope Cascades (FERC 2007). The Lower Klamath Project area is generally within the interior valley, ponderosa pine (*Pinus ponderosa*), and mixed conifer vegetation zones (Franklin and Dyrness, as cited in PacifiCorp 2004). The area east of J.C. Boyle Dam generally includes vegetation typical of the East Slope Cascades physiographic province. Non-forested areas in this valley region of the Klamath River Basin are generally sagebrush steppe vegetation, wetlands, or cultivated land (FERC 2007).

The area between the J.C. Boyle Dam and the California-Oregon border line is classified as the Klamath River Canyon, which has the greatest botanical diversity of any section of the Klamath River (FERC 2007). The Klamath River Canyon includes pine (*Pinus* spp.), oak (*Quercus* spp.), juniper (*Juniperus* spp.), and mixed conifer forest communities, with ponderosa pine (*Pinus pondersosa*) and Oregon white oak (*Quercus*

garrayana) being the dominant tree species (FERC 2007). Areas of oak savannas *Quercus garrayana*) occur but are sparse. Riparian habitats in this region are narrow and include oak, birch (*Betulua occidentalis*), and white alder (*Alnus rhombifolia*). Overall oak production in the Klamath River Canyon was reported to be less than 20 percent of the potential productivity but has a higher acorn production than trees outside the canyon (FERC 2007).

From J.C. Boyle Dam to the eastern end of the Copco Reservoir, the Klamath River cuts through several vegetation zones as it bisects the Cascade Range, forming a steep canyon. Montane vegetation typical of the Cascades is mixed with high desert and interior valley plant communities. The area downstream of the canyon is composed of vegetation similar to that found in the interior valley of Oregon, with oak and grasslands dominating (FERC 2007).

4.7.1.1 Cover Types and Unique Habitats

The SWRCB (2020a) developed a revised table of vegetation types. The Final EIR vegetation report was primarily derived from the 2002 PacifiCorp terrestrial resources study (See Sections 4.7.1.1 and 4.7.1.2) (PacifiCorp 2004). Due to its reference in the vegetation data included in the 2020 Final EIR, the 2002 PacifiCorp vegetation study is included below, followed by a summary of the 2020 Final EIR vegetation study.

In 2002, PacifiCorp identified and mapped 11 upland cover types, 8 riparian and wetland habitats, 4 aquatic habitats, 2 barren habitats, and 5 kinds of agricultural or developed lands in the Lower Klamath Project vicinity. The project vicinity includes the Klamath River from J.C. Boyle reservoir to the Shasta River, the area within 0.25 mile of all Lower Klamath Project facilities, reservoirs, and river reaches (PacifiCorp 2004). The Keno Canyon, Keno Reservoir, and Link River areas were included in the initial analysis of vegetation type but have since been removed from the scope of the Lower Klamath Project. These areas are excluded from the survey data and land areas and percentages were re-calculated to encompass only the areas within the vicinity of the Proposed Action. Table 4-21 depicts vegetation cover data collected in the project vicinity of the Lower Klamath Project.

Table 4-21 Historic Cover Types and Habitats Mapped in the Vicinity of the Lower Klamath Hydroelectric Project

Cover Type/Habitat	Acres	Description, Dominant Species, and Location
All upland tree habitats	26,176	More than 10 percent total cover by tree species; common around Iron Gate Reservoir.
Montane hardwood oak	5,071	Moderately open tree canopy, dense shrub layer, and dense herbaceous layer. Yellow starthistle and medusahead occur in approximately 25 percent of stands in the project vicinity. Most abundant around Iron Gate Reservoir, Copco Reservoir, and along J.C. Boyle peaking reach.
Montane hardwood oak-conifer	8,638	Dense tree cover, sparse shrub layer, moderately open herbaceous layer. Most abundant along the J.C. Boyle peaking and bypassed reaches, at Copco Reservoir, at Fall Creek, and along Copco No. 2 bypassed reach.
Montane hardwood oak-juniper	8,968	Open tree layer, sparse shrub layer, dense herbaceous layer. Yellow starthistle and medusahead occur in 45 percent of stands, primarily around Iron Gate and Copco reservoirs and along Copco No. 2 bypassed reach. Most abundant cover type in the Lower Klamath Project vicinity.
Ponderosa pine	1,853	Moderate canopy cover, relatively sparse shrub cover, moderately open herbaceous layer. Most abundant at J.C. Boyle Reservoir
Juniper	881	Open canopy, shrub layer varies from sparse to dense, herbaceous layer ranges from sparse to dense. Most abundant along Link River and along J.C. Boyle peaking reach.
Mixed conifer	700	Dense tree cover is often two-layered, open shrub layer, moderately sparse herbaceous layer. Approximately 70 percent of stands are along J.C. Boyle bypassed reach.
Lodgepole pine	64	Lodgepole pine stands occur along J.C. Boyle bypassed reach and at J.C. Boyle Reservoir as a result of replanting following timber harvest. Sparse tree layer and shrub layer, dense herbaceous layer.
All upland shrub habitats	4,087	More than 10 percent total cover by shrub species and less than 0 percent total cover by tree species.
Mixed chaparral	4,014	Requires occurrence of two or more shrub species, each covering 5 percent or more of the area. Very few trees, moderate shrub layer, herbaceous layer varies from sparse to dense. Approximately 60 percent occurs along J.C. Boyle bypassed reach and around Copco Reservoir
Sagebrush	72	Moderately dense shrub layer, sparse herbaceous layer. This limited habitat type occurs near the J.C. Boyle Reservoir.
All upland herbaceous habitats	4,766	More than 2 percent total cover by herbaceous species and less than 10 percent total cover of tree and/or shrub species.
Annual grassland	4,442	Total shrub cover is less than 1 percent. Nine of the 11 most frequent herbaceous species are introduced species; two are exotic/invasive species medusahead and yellow starthistle. Cheatgrass is relatively more abundant in annual grasslands along the J.C. Boyle bypassed reach. Medusahead, hairy brome, and yellow starthistle dominate grasslands downriver of J.C. Boyle peaking reach. More than 88 percent of the annual grasslands occur along J.C. Boyle peaking reach and around Copco and Iron Gate reservoirs.
Perennial grassland	324	Sparse shrub cover includes a wide variety of species. A total of 31 graminoid species occurs; 5 introduced annuals, 11 introduced perennials, 2 native annuals, 10 native perennials, 1 native rush, and 2 native sedges. More than 87 percent occurs around J.C. Boyle Reservoir and in the J.C. Boyle peaking and bypassed reaches

Cover Type/Habitat	Acres	Description, Dominant Species, and Location
All wetlands and riparian plant communities	910	
Palustrine emergent wetland	201	Dense herbaceous layer, often with a weedy zone immediately upslope of the bulrush zone. Short-podded thelypody, a special status species, occurs in this habitat type at Keno Reservoir. More than 88 percent occurs adjacent to Keno Reservoir, where wetlands associated with the Klamath Wildlife Area and the wetlands that are not diked southwest of the Klamath Wildlife Area are located. The largest single emergent wetland associated with the project covers more than 63 acres and is near Sportsman's Park at J.C. Boyle Reservoir
Palustrine scrub-shrub wetland	20	Open canopy with moderate shrub layer. Coyote willow (also known as narrowleaf willow) and arroyo willow are the primary hydrophilic shrubs. Arroyo willow is more abundant upriver and upslope. The only shrub layer species in the Link River wetland is arroyo willow; this species was most frequent at J.C. Boyle Reservoir and Fall Creek. Species dominating the Spencer Creek wetland include arroyo willow and coyote willow. Arroyo willow also occurred in the Fall Creek reach. Coyote willow is the dominant shrub layer species in 75 percent of the wetlands from J.C. Boyle Reservoir to Iron Gate Reservoir. More than 80 percent occurs adjacent to J.C. Boyle, Copco, and Iron Gate reservoirs.
Palustrine forested wetland	106	Dense tree cover includes the primarily hydrophilic tree species coyote willow and shining willow; weeping willow is the dominant tree layer species in one of the Keno reservoir wetlands. The two Keno reservoir wetlands have no shrub layer. Brown dogwood and arroyo willow are the only species in the open shrub layer of the two wetlands along Copco No. 2 bypassed reach. Wetlands at Copco and Iron Gate reservoirs had an open shrub layer with coyote willow. More than 80 percent occurs adjacent to Copco and Iron Gate reservoirs.
Palustrine aquatic bed	39	Occurs in all Lower Klamath Project reservoirs and slow-moving sections of the Klamath River.
Riparian grassland	44	Dense herbaceous cover. Reed canarygrass is relatively common along Link River, along Keno reach, and along J.C. Boyle peaking reach.
Riparian shrub	103	Coyote willow, arroyo willow, and Oregon ash saplings are the primary hydrophilic shrubs. Dense herbaceous cover is dominated by reed canarygrass along Link River, J.C. Boyle.
Riparian deciduous	344	Moderate canopy cover includes coyote willow. Moderate shrub and herb layers. Occurs primarily along J.C. Boyle peaking reach and along the Klamath River from Iron Gate development to Shasta River.
Riparian mixed deciduous- coniferous	52	A total of 8 tree, 12 shrub, and 49 herbaceous plant species were documented in this habitat. Dense tree layer, moderate shrub layer, open herbaceous layer. A taller herb layer with reed canarygrass and devil's beggarstick is often present along the river. 37.8 acres are mapped at Fall Creek, 12.0 acres along J.C. Boyle peaking reach, and 1.9 acres around Copco Reservoir.
Riverine and lacustrine habitats	2,816	The reservoirs represent 2,250 acres of lacustrine habitat in the Lower Klamath Project vicinity. Riverine unconsolidated bottom, which includes the semi permanently flooded flowing water of the Klamath River, totaled 551 acres. Riverine and lacustrine unconsolidated shoreline or gravel bar habitats cover 14.7 acres. Several reservoirs and river reaches have pockets of submerged aquatic vegetation.
All barren habitats	914	Less than 2 percent total cover by herbaceous, desert, or non-wildland species; less than 10 percent cover by tree or shrub species.

Cover Type/Habitat	Acres	Description, Dominant Species, and Location
Rock talus	559	Most rock talus habitats are barren with small patches of vegetation where the talus is thin or at the margins of the talus patch. 2 tree, 7 shrub, and 23 herbaceous plant species provided sparse cover in rock talus habitats. Particularly abundant along J.C. Boyle peaking and bypassed reaches.
Exposed rock	355	A wide variety of species occurs in the sparse shrub and moderate herb layers. Most abundant along J.C. Boyle peaking and bypassed reaches and Copco No. 2 bypassed reach; does not occur at Link River.
Developed and Disturbed Habitats	*1,056*	More than 2 percent total vegetation cover is non-wildland vegetation. Includes three developed vegetation types: residential, recreational development, and industrial, where vegetation includes plants grown for landscaping. Also includes agricultural types such as pasture and irrigated hayfields, where vegetation includes plants grown for food and/or fiber. Pastures and irrigated hayfields are distributed over 544 acres. The area along the Klamath River from Iron Gate development to Shasta River has a substantial number of pasture/irrigated hayfields.

Source: SWRCB 2020a

In 2020, the SWRCB estimated locations and total acreage of cover types within the Lower Klamath Project area. The SWRCB mapped vegetation in the Proposed Action area, Middle Klamath River, Lower Klamath River, and Klamath River Estuary (SWRCB 2020a). Only data from the Proposed Action area is depicted in the vegetation summary (Table 4-22). Vegetation cover types that were not found within the Proposed Action area include coastal oak woodland, Douglas fir (*Pseudotsuga menziesii*), Jeffrey pine (*Pinus jeffreyi*), redwood (*Sequoia* spp.), coastal scrub, montane chaparral, estuarine, and wet meadow (and are therefore not included in the table). Habitat types mapped but not included in Table 4-22 include a total of 794 acres of agricultural lands (cropland, deciduous orchard, and pasture), 2,554 acres of developed areas, 1,286 acres of unvegetated habitat (barren, exposed rock and rock talus) and 10,938 acres of aquatic habitat (riverine, lacustrine ad marine) (USDA Forest Service, as cited in SWRCB 2020a). Figure 4-6, Figure 4-7, Figure 4-8, and Figure 4-9 represent the different wetland and forested vegetation communities around each development.

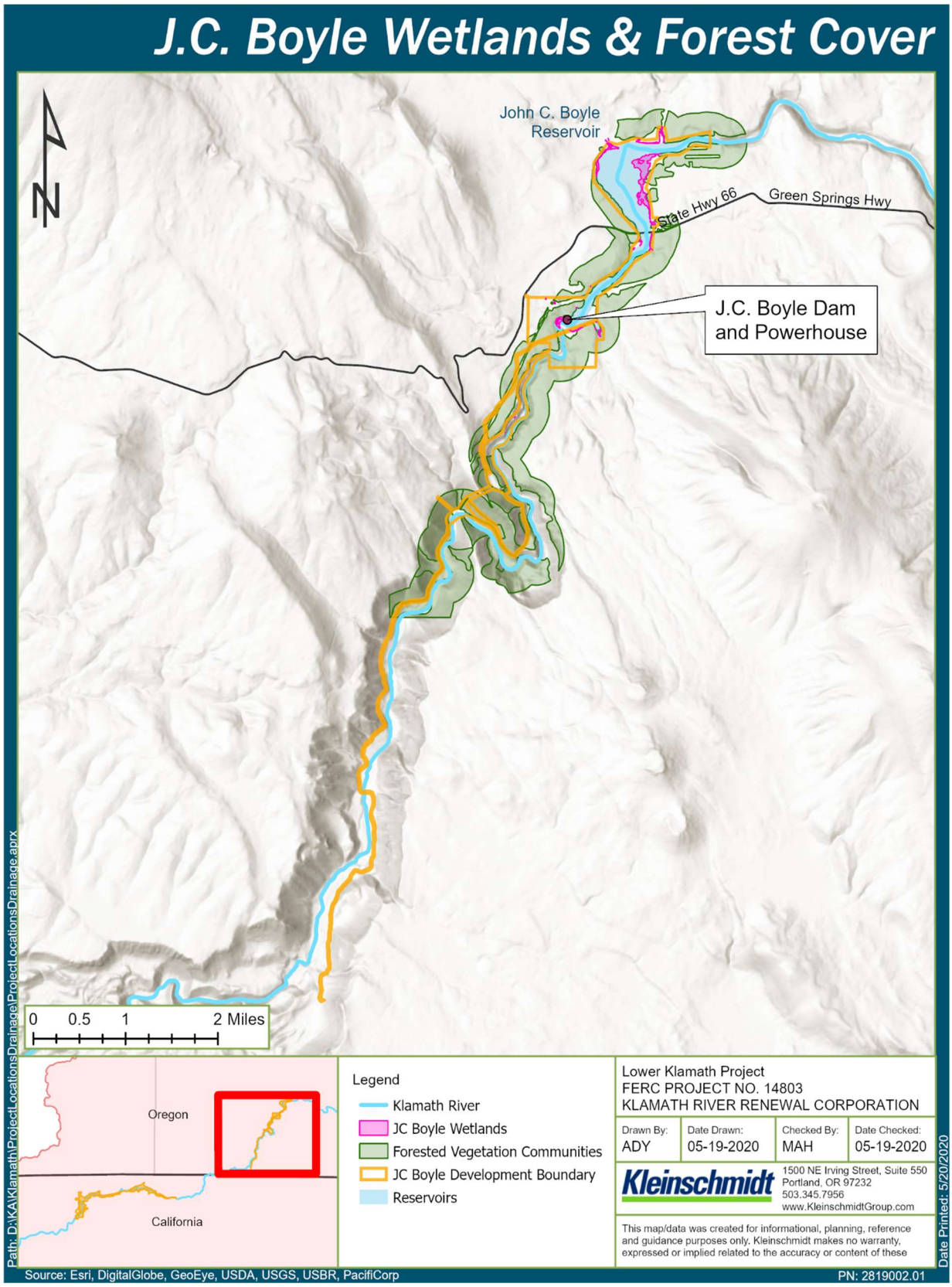


Figure 4-6 J.C. Boyle Wetlands and Forest Cover

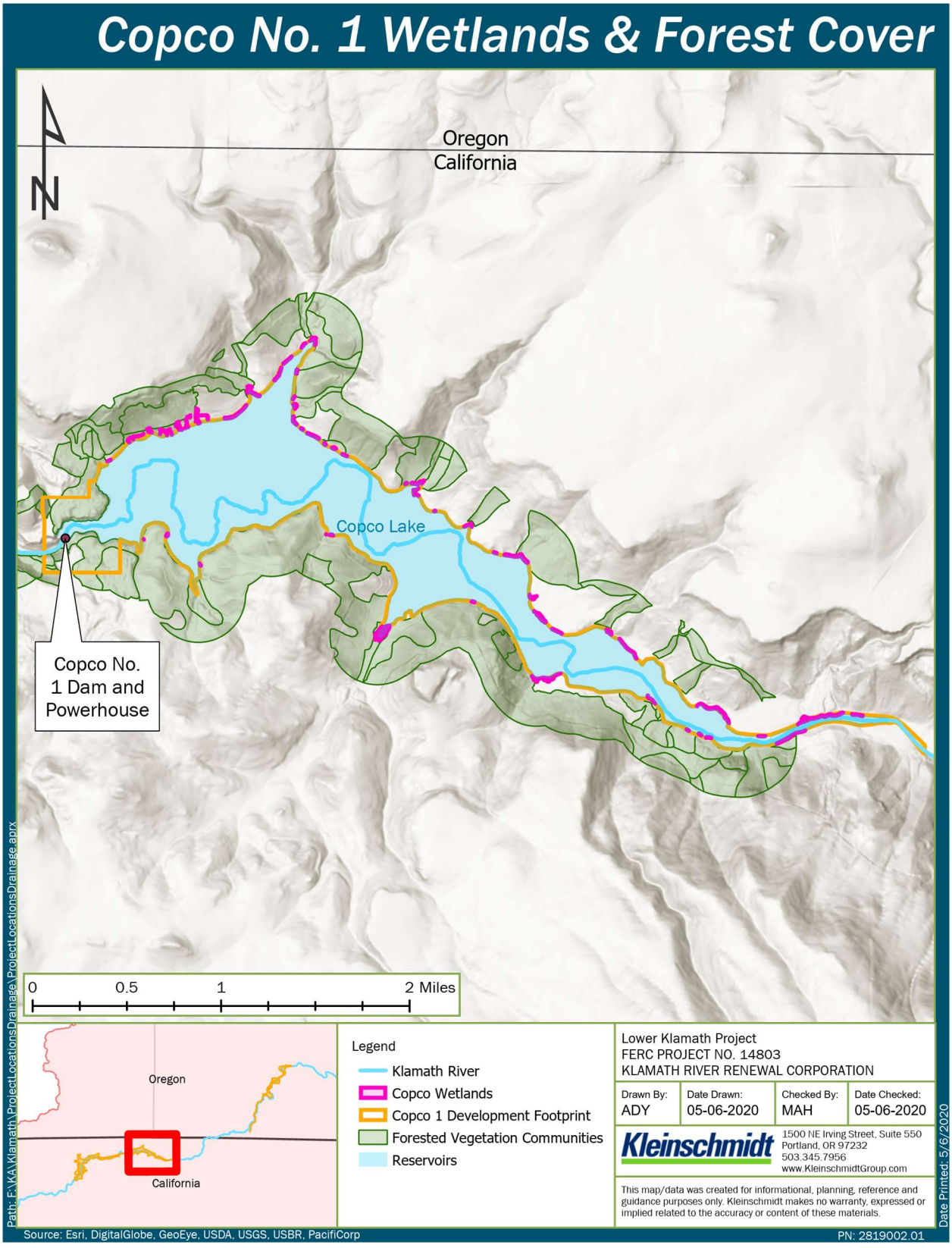


Figure 4-7 Copco No. 1 Wetlands and Forest Cover

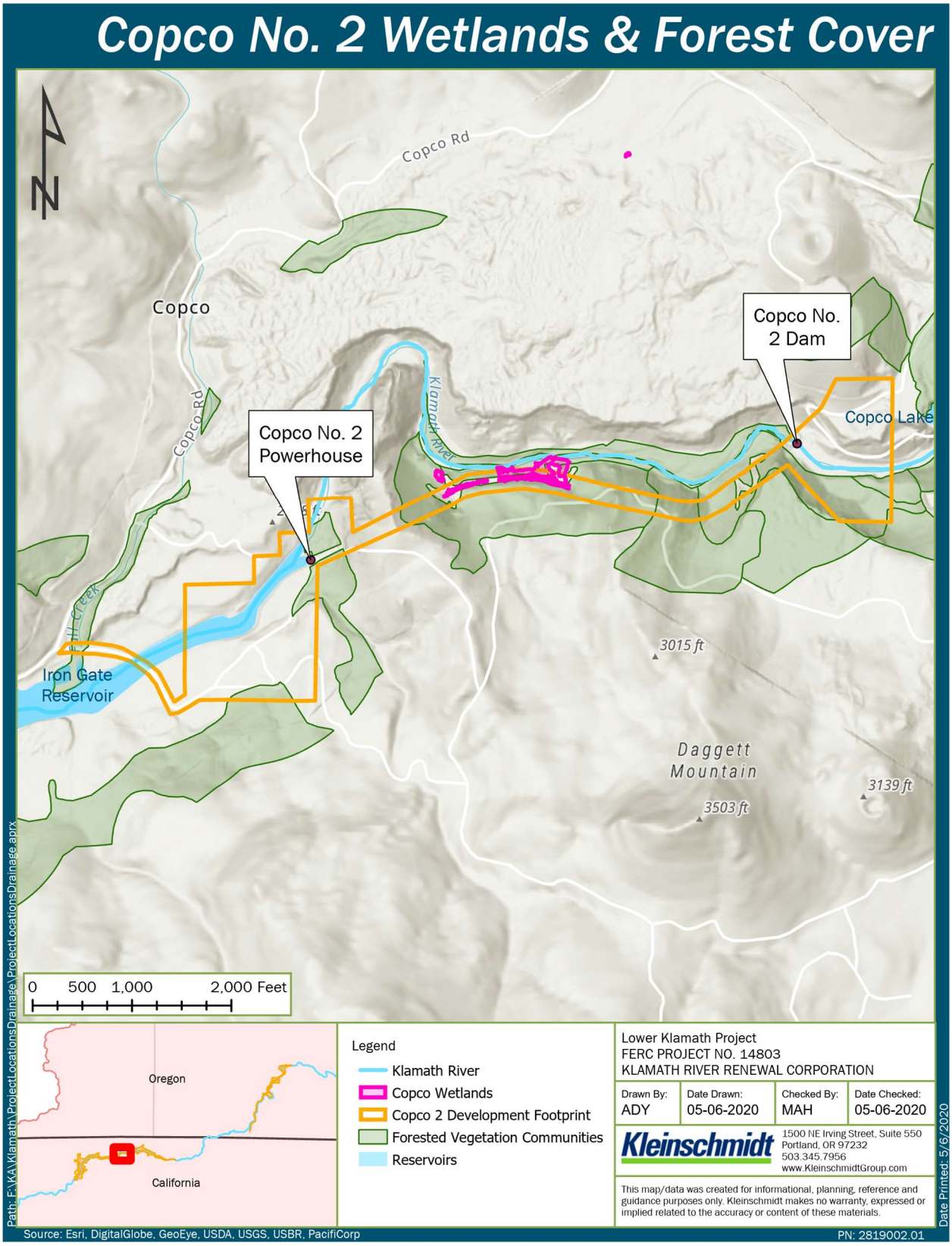


Figure 4-8 Copco No. 2 Wetlands and Forest Cover

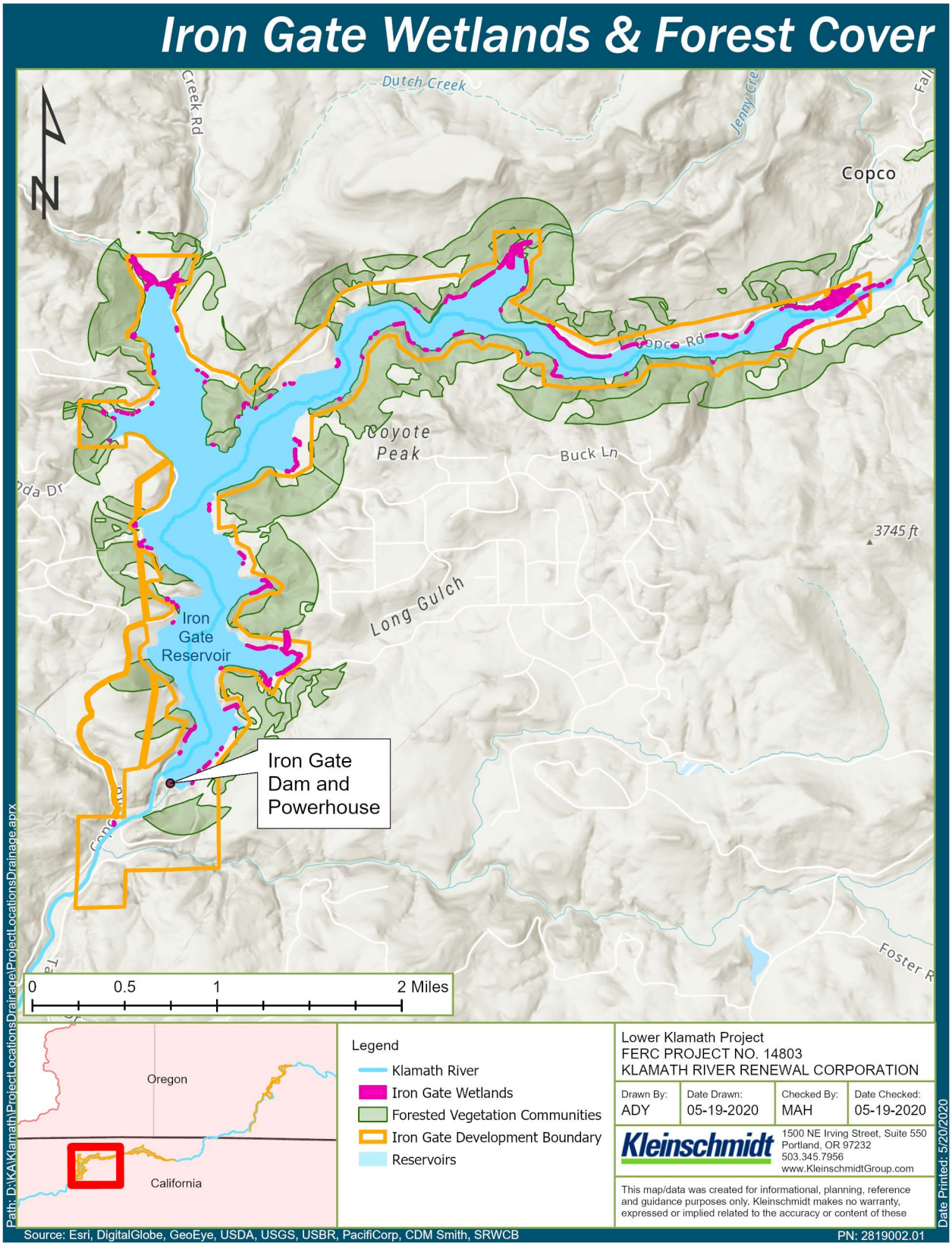


Figure 4-9 Iron Gate Wetlands and Forest Cover

Table 4-22 Historic Cover Types and Habitats Mapped in the Proposed Action Area

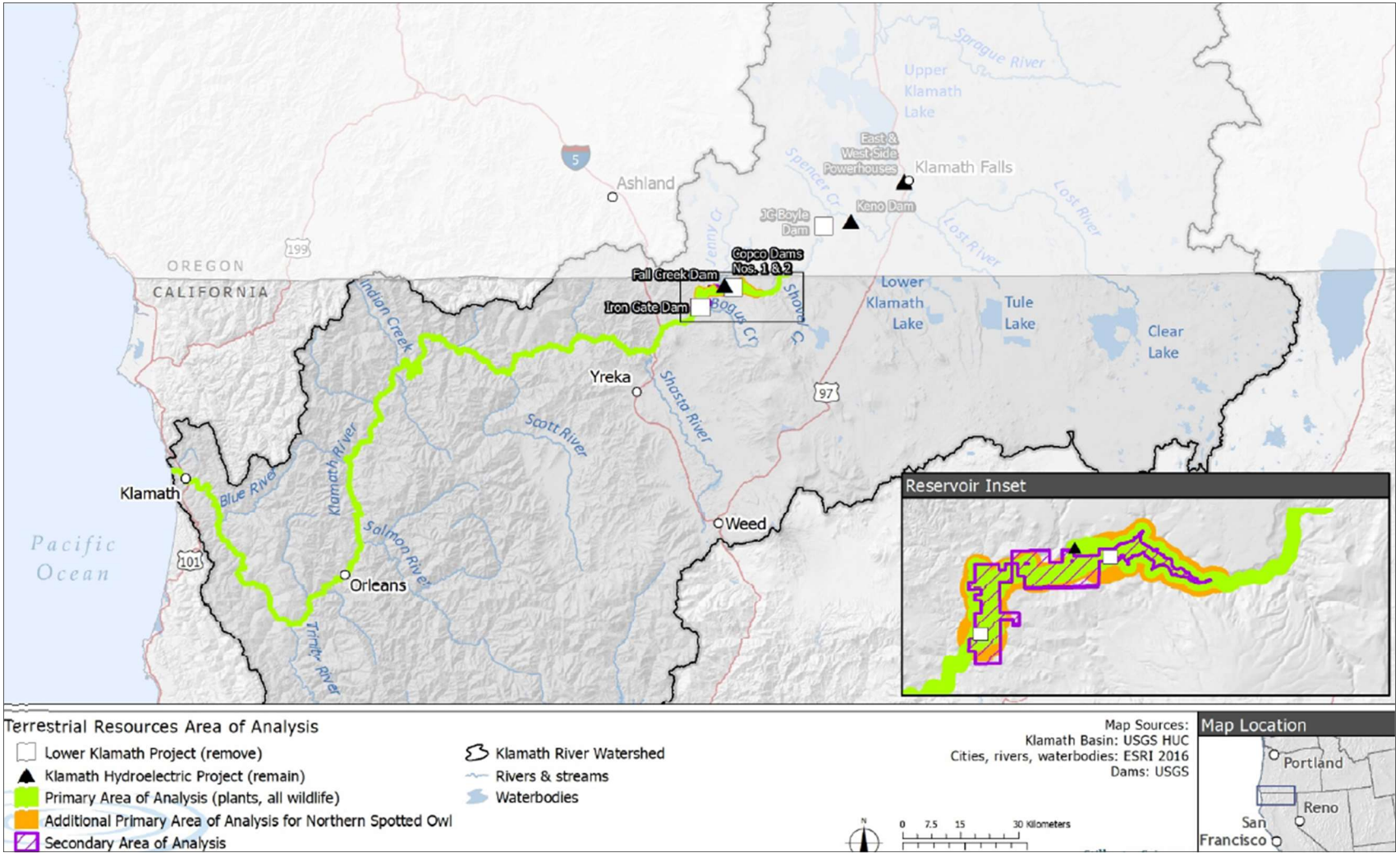
CHWR Vegetation Cover Types (USDA-FS2017a, USFWS 2017a)	Total Acreage	Description	Dominant Species	Alliance Locations
Upland Tree Habitats	5,004			
Juniper (JUN)	457	Occurs in the Modoc Plateau, portions of the Cascades, higher elevations of the Sierra Nevada and parts of the Mojave Desert with a Juniper (*Juniperus spp.*) overstory and grass/shrub understories	Common species White fir and Jeffery and ponderosa pines, as well as curl leaf mountain-mahogany (*Cercocarpus ledifolius*), antelope bitterbrush (*Purshia tridentata*), and big sagebrush (*Artemisia tridentata subsp. tridentata*)	*Juniperus occidentalis* Woodland Alliance Iron Gate Reservoir
Klamath Mixed Conifer (KMC)	9	Occurs in the Klamath Region of northern California and southern Oregon. Generally found between 4,500 and 6,900 feet with dense overstories of mixed conifers and occasional broad-leaved species	Dominant conifer species White fir, Douglas-fir, ponderosa pine, incense cedar, and sugar pine Shrub and herbaceous species Sierra laurel (*Leucothoe davisiae*), Sadler oak (*Quercus sadleriana*), dwarf rose (*Rosa bridgesii*), thimbleberry (*Rubus parviflorus*), twinberry (*Lonicera involucrate*), rattlesnake plantain (*Goodyera oblongifolia*), and prince's pine (*Chimaphila spp.*)	No alliance locations, vegetation cover type found in scattered patches
Montane Hardwood (MHW)	1,813	Often found on steep, rocky, south-facing slopes. Forms a dense forest with a thick layer of leaf litter and sparse cover of herbaceous species	Overstory Canyon live oak except at higher elevations where it is replaced by huckleberry oak (*Quercus vacciniifolia*). Understory Manzanita, mountain mahogany, poison oak, and a few forbs	No alliance locations, vegetation cover type found throughout reach

CHWR Vegetation Cover Types (USDA-FS2017a, USFWS 2017a)	Total Acreage	Description	Dominant Species	Alliance Locations
Montane Hardwood-Conifer (MHC)	2,656	Forms a dense forest with a thick layer of leaf litter and sparse cover of herbaceous species	Dominant Species Tanoak and California black oak Common Species Ponderosa pine, Douglas-fir, incense-cedar, California black oak, tanoak, Pacific madrone, and Oregon white oak	No alliance locations, vegetation cover type found throughout reach
Ponderosa Pine (PPN)	68			*Pinus ponderosa* Forest Alliance Copco No. 1 and Copco No. 2 reservoirs No alliance locations
Sierran Mixed Conifer (SMC)	1	Forms a dense forest, with tree crowns often touching	Co-Dominating Species White fir, Douglas-fir, ponderosa pine, sugar pine, incense-cedar, and California black oak Common Species ceanothus, manzanita, tanoak, bitter cherry, mountain whitethorn, gooseberry (*Ribes spp.*), and rose (*Rosa spp.*)	
Upland Shrub Habitats	**662**			
Mixed Chaparral (MCP	662	Evergreen sclerophyllous shrubland that occurs in the foothills and mid to upper mountain sides of the coast ranges as well as the Sierra Nevada, at elevations below 5,000 feet	Chamise (*Adenostoma fasciculatum*), toyon, California yerba-santa (*Eriodictyon californicum*), and silk-tassel (*Garrya spp.*)	*Ceanothus cuneatus* Shrubland Alliance Iron Gate and Copco Nos. 1 and 2 reservoirs *Rhus trilobata - Crataegus rivularis - Forestiera pubescens* Shrubland Iron Gate Reservoir *Cercocarpus montanus* Shrubland Copco No. 1 and Copco No. 2 reservoirs

CHWR Vegetation Cover Types (USDA-FS2017a, USFWS 2017a)	Total Acreage	Description	Dominant Species	Alliance Locations
Mixed Chaparral (MCP	662	Evergreen *sclerophyllous* shrubland that occurs in the foothills and mid to upper mountain sides of the coast ranges as well as the Sierra Nevada, at elevations below 5,000 feet	Chamise (*Adenostoma fasciculatum*), toyon, California *yerba-santa* (*Eriodictyon californicum*), and silk-tassel (*Garrya spp.*)	*Ceanothus cuneatus* Shrubland Alliance Iron Gate and Copco Nos. 1 and 2 reservoirs *Rhus trilobata - Crataegus rivularis - Forestiera pubescens* Shrubland Iron Gate Reservoir *Cercocarpus montanus* Shrubland Copco No. 1 and Copco No. 2 reservoirs
Upland Herbaceous Habitats	**1,738**			
Annual Grassland (AGS)	1,726	Dominated by non-native, annual plant species, occurs on mostly flat plains within a variety of soil type	Common grasses Wild oats (*Arena spp.*), soft chess (*Bromus hordeaceus*), ripgut brome (*Bromus diandrus*), red brome (*Bromus madritensis*), and wild barley (*Hordeum spp.*) Common forbs Filaree (*Erodium spp.*), turkey mullein (*Ereomocarpus setigerus*), true clover (*Trifolium spp.*), bur clover (*Medicago spp.*), and popcorn flower (*Plagiobothrys spp.*)	Bromus tectorum - *Taeniatherum caput*-medusae Herbaceous Semi-Natural Alliance Iron Gate, Copco No. 1, and Copco No. 2 reservoirs Bromus (*diandrus, hordaceus*) – Brachypodium distachyon Herbaceous Semi-Natural Alliance Copco No. 1 and Copco No. 2 reservoirs
Perennial Grassland (PGS)	12	Generally located below 3,280 feet	Dominant Species California oatgrass and needlegrass species (*Stipa spp.*) Common Species Redtop (*Agrostis stolonifera*), soft chess, orchardgrass (*Dactylis glomerata*), Idaho fescue (*Festuca idahoensis*), Douglas iris (*Iris douglasiana*), and western bracken fern	No alliance locations, vegetation cover type found in scattered patches
Wet Habitats	**3,804**			

CHWR Vegetation Cover Types (USDA-FS2017a, USFWS 2017a)	Total Acreage	Description	Dominant Species	Alliance Locations
Montane Riparian (MRI)	180			
Palustrine (PAL)	129	Less than 20 acres in size, lack active wave-formed or bedrock shoreline features, and are less than 6 feet deep at low water Palustrine Emergent Wetland Dominated by a dense herbaceous layer Palustrine Scrub-Shrub Wetland Open canopy with a moderate shrub layer Palustrine Forested Wetland Dense tree cover that includes hydrophilic tree species Palustrine Aquatic Bed Dominated by pondweeds	Palustrine Emergent Wetland Cattails (*Typha spp.*), bulrushes, sedges, reed (*Phragmites australis*), manna grasses (*Glyceria spp.*), purple loosestrife (*Lythrum salicaria*), dock (*Rumex spp.*), and many species of smartweeds (*Polygonum spp.*) Palustrine Scrub-Shrub Wetland Coyote willow (Salix exigua) and arroyo willow (Salix lasiolepis) are prevalent and coyote willow dominates at the reservoirs. Palustrine Forested Wetland Coyote willow and shining willow (*Salix lasiandra*), brown dogwood (*Cornus glabrata*), and arroyo willow Palustrine Aquatic Bed Pondweeds (*Potamogeton spp.*) and coontail (*Ceratophyllum demersum*)	Typha (*angustifolia, domingensis, latifolia*) Herbaceous Alliance Iron Gate Reservoir Salix exigua Shrubland Alliance Iron Gate Reservoir *Schoenoplectus acutus* Herbaceous Alliance Iron Gate, Copco No. 1, and Copco No. 2 reservoirs
Total Area	**11,208**			

Source: SWRCB 2020a



Source: SCRWB 2020a

Figure 4-10 Area of Analysis of Terrestrial Resource

4.7.1.2 Habitats of Special Concern

PacifiCorp identified three primary vegetative habitats of special concern that occur in the Lower Klamath Project vicinity. These habitats include late-successional conifer forest, snag and coarse wood rich habitats, and wetland habitats which are discussed in Section 4.7.5 (PacifiCorp 2004).

Late-successional conifer forest habitats are described as having the largest and tallest trees, creating a maturing canopy of species that are at least 80 years old. The understory vegetation is rich in species that are shade tolerant. Late-successional conifer forests on the east and west sides of the cascades are unique in that they tend to have more large tree species than typically found in this habitat. These forests offer habitat for a wide range of wildlife species. PacifiCorp determined that only 13 acres of the Lower Klamath Project boundary consisted of late-successional conifer forest in their 2002 vegetation study, found near the J.C. Boyle peaking reach. There were also 8,435 acres of younger forest with small to moderately large diameter (11 to 24 inches) trees.

Snag and coarse wood rich habitats are located within the 26,176 acres of upland tree habitats outlined in Table 4-21 and Table 4-22. Snags and coarse wood offer direct habitat to small mammals, insectivores, and amphibians through dead trees that remain standing, down wood, and standing coarse woody habitat. These species tend to increase in richness with increasing volumes of coarse woody debris. Snags provide important habitat to cavity-nesting birds. In many upland tree habitats, the volume of downed wood appears to be comparable to regional estimates. The Proposed Action does not affect coarse woody debris or snag availability except at a minor level as a result of occasional hazard tree removal and vegetation clearing conducted along transmission lines, roads, and project facilities (PacifiCorp 2004).

Caves, talus, and cliff habitats are unique in that they are often inaccessible to humans, providing protected and unique habitats to a variety of wildlife species and botanical resources. There are several characteristics that make these habitats unique, including wet sweeps, rock crevices, and regulated abiotic conditions (e.g., temperature, humidity). Species found here are often endemic to their given habitats. Caves are especially important to bat species, which use them to roost, to rest on cliff ledges, and hibernate. Complete inventories of the caves in the Lower Klamath Project area have not been conducted. Talus slopes provide habitat for a variety of reptiles and small mammals and cover approximately 560 acres near the project reservoirs and on PacifiCorp-owned lands. Cliffs and exposed rock slopes occupy 375 acres of the Lower Klamath Project area.

4.7.1.3 Wetlands and Vernal Pools

Wetlands play an important role for ecosystems by providing habitat for plant and wildlife species, collecting, and holding water, buffering the effects of floods, and conserving moisture for drier seasons (SWRCB 2020a). Palustrine wetlands occur in 367 acres, or 0.90 percent of the Lower Klamath Project area between J.C. Boyle Reservoir and Iron Gate Dam (PacifiCorp 2004)

(Table 4-21). The relative and absolute cover of wetlands is relatively low throughout the Lower Klamath Project vicinity, measuring less than 2 percent of total vegetation at all areas except J.C. Boyle Reservoir, where wetland cover totals 5.5 percent, or 105.1 acres of total cover. The relative cover of wetland cover types in the remaining Lower Klamath Project vicinity ranges from 0 percent at Iron Gate Dam to the Shasta River reach, to 1.5 percent at Fall Creek reach (PacifiCorp 2002). Palustrine wetland habitats are categorized into four distinct groups: emergent, scrub-shrub, forested, and aquatic bed, which represent 55, 5, 29, and 11 percent of the total wetland area within the project area, respectively. PacifiCorp's (2002) study was conducted in-field, and so is used for the summary of wetlands below.

Palustrine emergent wetlands are dominated by a dense herbaceous layer of persistent emergent vascular plants, typically with 80 percent vegetation cover (USFWS 2020a). Plants generally remain standing throughout the year. Characteristic species of palustrine emergent wetlands include cattails (*Typha spp.),* sedges (*Carex spp*.), bulrushes (*Scirpus spp*.), rushes (*Juncus spp*.), saw grass (*Cladium jamaicaense*), and reed (*Phragmites australis*) (USFWS 2020a). Palustrine emergent wetland is the dominant wetland type at the J.C. Boyle study area (peaking reach, bypass, and reservoir), occupying 161 acres. While this represents less than 1 percent of the total Proposed Action area surrounding J.C. Boyle Dam, it represents 44 percent of all palustrine wetlands throughout the Lower Klamath Project, and 77 percent of the total wetland area at the J.C. Boyle study area. Other wetland habitats at the J.C. Boyle study area include aquatic bed habitat, which represents 18 percent of total wetland area at the J.C. Boyle Reservoir. The combined area of palustrine forested and palustrine scrub-shrub wetlands represents 5 percent of the total wetland area at the J.C. Boyle study area.

Palustrine scrub-shrub wetlands are dominated by woody vegetation less than approximately 16-feet-tall, typically with greater than 20 percent coverage (USFWS 2020a). Species in this wetland include true shrubs, young trees and shrubs, and trees that are small due to environmental conditions. Characteristic species of palustrine scrub-shrub wetlands include alder (*Alnus spp*.), willow (*Salix spp*.), buttonbush (*Cephalanthus occidentalis*), red osier dogwood (*Cornus stolonifera*), honeycup (*Zenobia pulverenta*), spirea (*Spiraea douglassii*), bog birch (*Betula pumila*), and young trees such as red maple (*Acer rubrum*) and black spruce (*Picea mariana*) (USFWS 2020a). Palustrine scrub-shrub is the scarcest wetland throughout the Lower Klamath Project boundary, representing only 5.5 percent of total wetland area throughout the Lower Klamath Project. All surveyed areas except Copco No. 2 Bypass and J.C. Boyle Peaking Reach contain palustrine scrub-shrub habitat, ranging from 0.2 acres at the Iron Gate-Shasta location to 9.2 acres at the Iron Gate Reservoir.

Palustrine forested wetlands are dominated by woody vegetation approximately 16-feet-tall or taller, with greater than 20 percent coverage. Characteristic species of palustrine forested wetlands include Tupelo (*Nyssa*), cottonwood (*Populus deltoids*), bald cypress (*Taodium distichum*), American elm (*Ulmus Americana*), ash (*Fraxinus*), and tamarack (USFWS 2020a). Palustrine forested wetland is the dominant wetland type in the Copco study area (Copco No. 2 Bypass, Fall Creek, and Copco Reservoir) encompassing 62.4 acres. While this represents less than 1 percent of the total Copco project area, it represents 59 percent of all palustrine forested wetlands throughout the Project, and 64 percent of the total wetland area at the Copco study area. Other wetland habitats at the Copco

study area include palustrine emergent wetland, which represents 29 percent of total wetland area at the Copco project area. The combined area of palustrine aquatic bed and palustrine scrub-shrub wetlands represent 7 percent of the total wetland area at the Copco study area. The Iron Gate Reservoir held a large portion of the total palustrine forested habitat, occupying 64 percent of the total wetland area at the Iron Gate Reservoir. The palustrine forested habitat at the Iron Gate Reservoir represents 36 percent of the total acreage of palustrine forested area throughout the Project.

Palustrine aquatic bed wetlands are dominated by plant species that grow on or below the surface of the water for most of the growing season. Plant communities are diverse and require surface water for optimal growth, whether it be permanent standing water or repeated flooding events (USFWS 2020a). Plant types common in palustrine aquatic habitats include algae, aquatic moss, rooted vascular plants, and floating vascular plants. Palustrine aquatic beds were largely located at the J.C. Boyle Reservoir, where 96 percent of the habitat was located. Overall, palustrine aquatic bed habitat represents only 11 percent of the total wetland cover within the Lower Klamath Project area.

As shown in Table 4-22, 129 acres of palustrine wetland habitat was mapped in the 2020 SRWCB Final EIR. A vernal pool survey was not conducted in the project area, and no vernal pool species were documented during the 2004 PacifiCorp vegetation study. Vernal pool species that could potentially occur in the Lower Klamath Project area include slender orcutt grass (*Orcuttia tenuis*) American pillwort (*Pilularia americana*), and Profuse-flowered mesa mint (*Pogogyne floribunda*). Egg lake monkeyflower (*Mimulus pygmaeus*), which is not an explicit vernal pool species but can grow in vernally moist conditions, was documented within the Lower Klamath Project area during the 2001 PacifiCorp surveys (Section 4.8).

In addition to PacifiCorp's 2004 study findings, the Renewal Corporation conducted in-field wetland surveys in May and July 2019. The May 2019 surveys focused primarily on areas where ground-disturbing activities are planned to occur (e.g., disposal areas, staging areas, or bridge replacements) as part of the Proposed Action and where hydrology sources were identified to be independent of the Klamath River or Lower Klamath Project reservoirs. The July 2019 surveys focused on wetlands along and adjacent to reservoir shorelines and sections of the Klamath River within the limits of work (KRRC 2020b). Wetland investigation sites were identified in part by the PacifiCorp survey conducted in 2002 (reported in PacifiCorp 2004). A summary of KRRC's 2018-2019 survey findings are described in Table 4-23 (KRRC 2020b).

Table 4-23 Findings from the Renewal Corporation's 2019 Survey Report

	Location		
	Iron Gate Reservoir	Copco Lake	J.C. Boyle Reservoir
Total Wetlands	21.2 acres	12.9 acres	40.0 acres
Reservoir-Dependent[1] Wetlands	9.6 acres	9.4 acres	38.1 acres
Non-Reservoir-Dependent Wetlands	11.6 acres	3.5 acres	1.9 acres
Total Riparian Vegetation[2]	40.8 acres	32.2 acres	n/a
Reservoir-Dependent Vegetation	10.2 acres	5.3 acres	n/a
Non-Reservoir-Dependent Riparian Vegetation	30.6 acres	26.9 acres	n/a

Source: KRRC 2019
Notes: This total also includes acreage for areas that are dependent on dam-related infrastructure to support wetland hydrology. Riparian areas not mapped in Oregon.

4.7.1.4 Special Status Plant Species

Special status plant species were reported in the 2019 Renewal Corporation Annual Terrestrial Resources Survey Report (KRRC 2020b) (Appendix D). The Renewal Corporation defined special-status species as those which are listed federally and/or by the State as threatened/endangered, and species on the Oregon Natural Heritage Program Lists 1 to 4 or the California Rare Plant Rank 1 to 4. Sensitive species defined by BLM and U.S. Forest Service (USFS) are considered where their respective lands occur in the Lower Klamath Project area (KRRC 2020b). The area of analysis for the terrestrial survey looked at any special status species occurring 1) within a 0.25-mile buffer of the Proposed Action area, defined as the dams and structures to be removed, the disposal sites, the haul and access roads that may undergo improvements, and the reservoirs; and/or 2) in areas such as reservoir shorelines that may be affected by the Proposed Action (KRRC 2020b).

Biologists from the Renewal Corporation conducted field surveys for special status plants with the potential to occur in the Proposed Action area. Species with a potential to occur were identified based on historical records and a review of state and federal plant databases, including but not limited to the Oregon Biodiversity Information Center, the California Natural Diversity Database, and the USFWS Information for Planning and Consultation database. A summary of special status plant

species with the potential to occur within the Lower Klamath Project area can be found in Section 4.8, *Rare, Threatened, and Endangered Species*. In summary, 18 plant species with a status of declining in population and/or in danger of extinction were identified as potentially occurring in the study area. The Renewal Corporation's 2018 and 2019 in-field surveys identified nine special-status plant species in the Lower Klamath Project area. A summary of the special status plants found as well as their observed locations is provided in Section 4.8.

4.7.1.5 Invasive Species

A noxious weed/invasive plant survey was conducted by PacifiCorp at their hydro facilities in 2002 (PacifiCorp 2004). Seventeen noxious weed species were observed in the study areas around Lower Klamath Project reservoirs, river reaches, and bypasses. Table 4-24 contains a list of all noxious weed species observed in the survey area. The most extensive infestations consist of areas of yellow star-thistle (*Centaurea* spp.), cheatgrass (*Bromus tectorum*), and medusahead (*Taeniatherum caput-medusae*). There were 3 areas of extensive noxious weed infestation and 1,112 additional infestation areas covering more than 558 acres of land.

Surveys in 2002 observed that most invasive plants are located on the upper slopes of reservoirs, which are the mesic transition areas between wetland and upland ecology. These conditions are suitable for invasive species within the Lower Klamath Project. Invasive plants were also observed within riparian communities (PacifiCorp 2004).

The table below lists the noxious weeds that were observed during the 2002 survey and provides weed ratings for California and Oregon and the location of each species within the Lower Klamath Project area (PacifiCorp 2004).

Additional noxious weed and invasive plant surveys were completed in the fall of 2017 and spring/summer of 2018 to provide current conditions of invasive plant communities at the Lower Klamath Project. The study area included upland and shoreline areas around the three reservoirs (J.C Boyle Reservoir, Copco Lake, and Iron Gate Reservoir) and other areas where construction activities are planned. Recent survey information for each reservoir is provided in Table 4-24, Table 4-25, and Table 4-26 (KRRC 2019).

Similar to noxious weed and invasive plant surveys completed in 2002, the 2017-18 surveys found that yellow star-thistle and medusa head were two of the dominant invasive plants observed throughout the Proposed Action area. Yellow star-thistle was observed in 106.88 acres (18.89 percent of the Proposed Action uplands) and medusa head was observed in 93.19 acres (16.47 percent of the Proposed Action uplands). Other invasive plants present in substantial areas (between 9 and 16 acres, or 1 to 3 percent of the Proposed Action area) included cheatgrass, teasel, reed canary grass, and Himalayan blackberry (KRRC 2019).

Table 4-24 Invasive Exotic Vegetation Extent in the J.C. Boyle Reservoir Uplands

Scientific Name	Common Name	Area (square feet)	Area (acres)	Percent Cover
Bromus tectorum	cheatgrass	288,780	6.629	4.29%
Dipsacus fullonum	teasel	209,250	4.804	3.11%
Phalaris arundinacea	reed canarygrass	206,210	4.734	3.07%
Elymus caput-medusae	medusa head	190,960	4.384	2.84%
Centaurea solstitialis	yellowstar thistle	61,690	1.416	0.92%
Cirsium vulgare	bull thistle	49,260	1.131	0.73%
Lepidium draba	whitetop	46,510	1.068	0.69%
Mentha pulegium	pennyroyal	17,040	0.391	0.25%
Onopordum acanthium	Scotch thistle	13,620	0.313	0.20%
Rumex acetosella	sheep sorrel	6,370	0.146	0.09%
Convolvulus arvensis	field bindweed	1,670	0.038	0.02%
Linaria dalmatica	Dalmatian toadflax	1,530	0.035	0.02%
Rubus armeniacus	Himalayan	1,330	0.030	0.02%
Acroptilon repens	Russian knapweed	990	0.023	0.01%
	Total	1,095,210	25.142	16.26%

Source: KRRC 2019

Table 4-25 Invasive Exotic Vegetation Extent in Copco Lake Uplands

Scientific Name	Common Name	Area (square feet)	Area (acres)	Percent Cover
Centaurea solstitialis	yellowstar thistle	262,320	6.022	4.42%
Elymus caput-medusae	medusa head	237,180	5.445	4.00%
Rubus armeniacus	Himalayan	234,590	5.385	3.96%
Phalaris arundinacea	reed canarygrass	199,440	4.578	3.36%
Dipsacus fullonum	teasel	91,680	2.105	1.55%
Bromus tectorum	cheatgrass	56,790	1.304	0.96%
Lepidium draba	whitetop	8,010	0.184	0.14%
Mentha pulegium	pennyroyal	6,680	0.153	0.11%
Cirsium vulgare	bull thistle	2,210	0.051	0.04%
Conium maculatum	poison hemlock	1,260	0.029	0.02%
Tribulus Terrestre	puncture vine	730	0.017	0.01%
Bromus madritensis ssp. *rubens*	foxtail chss	240	0.006	0.00%
Carduus nutans	musk thistle	100	0.002	0.00%
	Total	1,101,230	25.281	18.57%

Source: KRRC 2019

Table 4-26 Invasive Exotic Vegetation Extent in the Iron Gate Reservoir Uplands

Scientific Name	Common Name	Area (square feet)	Area (acres)	Percent Cover
Centaurea solstitialis	yellowstar thistle	4,331,51	99.438	36.13%
Elymus caput-medusae	Medusa head	3,631,21	83.361	30.29%
Dipsacus fullonum	teasel	321,720	7.38	2.68%
Bromus tectorum	cheatgrass	318,740	7.31	2.66%
Rubus armeniacus	Himalayan	179,260	4.11	1.50%
Convolvulus arvensis	field bindweed	64,500	1.48	0.54%
Phalaris arundinacea	reed canarygrass	43,300	0.99	0.36%
Conium maculatum	poison hemlock	29,730	0.68	0.25%
Xanthium spinosum	spiny cocklebur	16,040	0.36	0.13%
Tribulus terrestris	puncture vine	9,200	0.21	0.08%
Isatis tinctoria	dyers woad	3,230	0.07	0.03%
Lepidium draba	whitetop	2,860	0.06	0.02%
Mentha pulegium	pennyroyal	150	0.00	0.00%
Linaria vulgaris	butter and eggs	50	0.00	0.00%
Cirsium vulgare	bull thistle	50	0.00	0.00%
	Total	8,951,55	205.498	74.67%

Source: KRRC 2019

4.7.2 Environmental Analysis

The Renewal Corporation has evaluated both short- and long-term effects on botanical resources. Short-term effects refer to impacts that have the potential to occur within 2 years of the Proposed Action (pre-drawdown, drawdown, post-drawdown, and restoration), while long-term refers to impacts that have the potential to occur beyond 2 years of the Proposed Action (SWRCB 2020a). Effects to botanical resources largely consist of short-term effects caused by the removal of recreation areas, heavy machinery, and sediment loads/erosion. The breakdown of potential effects on botanical resources and proposed environmental measures were derived from SWRCB 2020a.

4.7.2.1 Cover Types and Unique Habitats

The Proposed Action will cause short-term effects to native vegetation due to heavy machinery and the spread of invasive species. Invasive species have the potential to colonize previously unoccupied areas due to seeds being artificially dispersed through machinery as it crosses through different habitats. The removal

of the dams, and subsequently the reservoirs, may increase invasive species that disperse through the water, as water will no longer be contained behind the dams.

4.7.2.2 Wetlands

The Proposed Action will alter wetlands and riparian habitats due to disturbances related to construction. Access to sites with heavy machinery may require traversing across and through wetlands, changing local topography. This offers a concern to hydrology and may introduce dust and runoff pollution to these sensitive areas, potentially degrading plant community conditions. Removal of recreation sites could also impact wetland habitats.

Long-term impacts may occur post dam removal. Removal of four dams will significantly change the flow of the Klamath River by eliminating the reservoirs held by these dams. Altering this hydrology will reduce drawdown wetland abundance at reservoirs and along the shoreline. Wetlands are anticipated to re-establish post-drawdown along the shoreline and in the floodplain of the Klamath River. Penstock removal may eliminate patched wetlands that form from water leaks. Erosion and sediment deposition may pose a temporary threat to wetlands.

The SWRCB (2020a) found that the anticipated gains in wetland and riparian acreage are anticipated to considerably exceed a 1:1 replacement ratio for wetland acreage, resulting in no net loss of wetlands. This is considered true even for those areas for which disturbance through fencing is not feasible and for limited areas not yet delineated that may have reductions in riparian or wetland acreage due to changes in the 100 year floodplain downstream of Iron Gate Dam (SWRCB 2020a).

4.7.3 Invasive Species

Invasive plant species are known to take advantage of areas with frequent or periodic disturbance (i.e., roadsides, construction sites). There will be significant construction during all phases of implementation of the Project. Removal and construction activities will be located in areas where invasive plants have the potential to become established. The Proposed Action will likely result in substantial areas of ground disturbance and increase the potential for invasive plant infestations in work areas.

Land clearing and soil disturbance for access roads, staging, equipment and vehicle parking, and vehicle storage could provide invasive plant species an opportunity to become established in construction areas where competition from native, established plant populations has been reduced or eliminated. The construction that will occur throughout implementation of the Proposed Action will require vehicles, equipment, tools, materials, and people to move around the Lower Klamath Project area and this movement will likely act as a “vector” for invasive plant seeds, promoting the spread of invasive plants.

There is a potential for impacts to wetland and riparian vegetation communities along existing reservoir shorelines due to reservoir drawdown, which could allow invasive plants to establish in the drawdown areas.

There could be an increase in the transport of invasive plant seeds that have the potential to displace native plant communities.

4.7.3.1 Special-Status Plant Species

Effects on special-status plan species may occur due to implementation of the Proposed Action. This may result in mortality or damage to these species or their habitat through land disturbance. Several species of special status plants may reside in wetland habitats, which will likely be impacted by reservoir removal. However, the SWRCB found in their Final EIR that implementation of the Proposed Action will likely result in a net increase in the areal extent of riparian and wetland habitat within the Primary Area of Analysis (SWRCB 2020a). This is anticipated to be largely part of natural recruitment along newly exposed mainstem river channel riparian corridors within the former reservoir footprints, but also as a result of active restoration management as described in the Reservoir Area Management Plan (WRM-1)(SWRCB 2020a).

4.7.4 Proposed Measures

The Renewal Corporation proposes to implement the measures stated in the DDP, and outlined in Table 3-1, to address impacts to each resource area. A summary description and analysis of each measure is outlined in the "References" column of Table 3-1.

To ensure those measures are successfully implemented and meet the interests of stakeholders, management plans are being developed. These management plans are outlined in Table 3-2 as well as in the DDP. Below are the specific proposed measures and management plans related to botanical resources.

4.7.4.1 Upland Habitat

Disturbance to upland habitat resulting from construction activities is expected to occur. Avoidance measures will be implemented such that any impact to special-status plants will be less than significant. These measures include, but are not limited to:

- Implement a Reservoir Area Management Plan (WRM-1).
- This plan will include measures for restoration of disturbed upland area, including disposal sites, temporary access roads and staging areas, infrastructure demolition sites, former recreation areas, and the J.C. Boyle power canal (ODEQ 2018a).
- This plan will include measures for restoration, including the requirement to revegetate with only native plants and seeds. Existing native vegetation will be preserved for placement after completion of ground-disturbing activities.
- Disposal areas will be capped with available soil and reseeded consistent with surrounding vegetation mix.

4.7.5 Wetlands

To remove the dams, machinery must access the construction sites, traversing across acres of landscape. Bridges that are required for access to and from the dam sites will be replaced or upgraded prior to the reservoir drawdown (SWRCB 2020b). The Renewal Corporation is striving for a no net loss of wetlands for the duration of the Proposed Action and intends to implement the below measures to help reach that goal. All of these facilities and their impact on wetlands will be addressed in the US Army Corps of Engineers 404, Removal and Fill of Wetlands permit.

The Renewal Corporation proposes to reduce short- and long-term impacts to wetlands and have no net loss of wetland or riparian habitat acreage and functions. These measures include, but are not limited to:

- Implement a Terrestrial and Wildlife Management Plan to identify, protect, and restore wetland riparian habitats (TRM-1).
- Wetland delineation incorporated into the proposed project design to minimize and avoid impacts to wetlands within the Proposed Action vicinity (TRM-1).
- A 20-foot buffer will be established around delineated wetlands, and heavy machinery will be deterred from traversing identified wetlands (TRM-1).
- Fencing will be placed around wetlands that are adjacent to the construction limits of work in order to eliminate access by machinery, vehicle, or by foot (SWRCB 2018) (TRM-1).
- Upon implementation of the Proposed Action, floodplain features may be incorporated into the newly exposed floodplains to ensure no net loss of wetlands. Restored habitats may include wetland restoration where appropriate, floodplain swales, and side-channel restoration (ODEQ 2018b) (TRM-1).
- Revegetate Klamath Riverbanks and tributaries post construction with native wetland plant species (WRM-1).

4.7.6 Invasive Species

The Renewal Corporation proposes to implement measures to aid in the control of invasive exotic vegetation. These measures include, but are not limited to (KRRC 2017; ODEQ 2018b: SWRCB 2020a):

- Implement a Reservoir Area Management Plan (WRM-1).
- This plan will include methods to control invasive plant species during pre-dam removal and the post dam removal monitoring (e.g. manual weed pulling, mowing/cutting, mechanical tilling, shading, herbicides and solarization) (WRM-1).
- Implement a post-dam removal invasive species controls as presented in the Reservoir Area Management Plan. One component of this plan includes the screening of fill material to ensure that invasive plant material/seeds are not introduced during restoration efforts (WRM-1).
- Erosion control BMPs will be implemented and disturbances will be minimized to reduce the likelihood of invasive plants establishing themselves (WRM-1).
- Control invasive exotic species as directed at specific previously identified locations on BLM lands within the Proposed Action area (WRM-1).

4.7.6.1 Special-Status Plant Species

The Renewal Corporation anticipates potential disturbance to special-status plant species resulting from construction activities. The construction team has reviewed the mapping of known special-status plant species. The 60% design proposed disposal area has identified special status plant populations. Measures will be implemented such that any impact to special-status plants will be less than significant. These measures include, but are not limited to:

- Update the list of special-status plants with the potential to occur in wetland and riparian habitats as part of the pre-drawdown phase of the Proposed Action (WRM-1). If conditions dictate feasible, relocate into the new riparian river edge.
- A monitoring program will be developed for any special-status plant species that could be impacted (SWRCB 2020a) (TRM-1).
- Identify and implement avoidance measures in areas of known special status plant occurrence in the Terrestrial and Wildlife Management Plan (TRM-1). If impact to a special status plant may occur, the Renewal Corporation will confer with CDFW prior to determine their preferred best management practice.

4.7.7 Unavoidable Adverse Effects

Short-term impacts, largely related to construction activity in the project vicinity during the dam removal phase of construction, are outlined in the Environmental Analysis section. The Proposed Action includes long-term beneficial effects on terrestrial resources, including but not limited to riparian habitat downstream of the Lower Klamath Project and additional riparian habitat in the former location of both Copco No. 1 and Iron Gate reservoirs (SWRCB 2020a).

4.7.8 References

Federal Energy Regulatory Commission (FERC). 2007. Final Environmental Impact Statement for Hydropower License: Klamath Hydroelectric Project FERC Project No. 2082-027. FERC/EIS-0201F. Washington, DC, Federal Energy Regulatory Commission, Office of Energy Projects, Division of Hydropower Licensing.

Klamath River Renewal Corporation (KRRC). 2019. Klamath River Renewal Project, 2018 Annual Terrestrial Resources Survey Report. Prepared by KRRC Technical Representatives.

Klamath River Renewal Corporation (KRRC). 2020b. Klamath River Renewal Project, 2019 Annual Terrestrial Resources Survey Report. Prepared by KRRC Technical Representatives.

Oregon Department of Environmental Quality (ODEQ). 2018b. Evaluations and Findings Report. Section 401 Water Quality Certification for the Removal of the lower Klamath Project (FERC Project Number 14803). September 2018. Available online: https://www.oregon.gov/deq/FilterDocs/ferc14803report.pdf. Accessed May 15, 2020.

PacifiCorp. 2004. Application for New License for Major Project. Klamath Hydroelectric Project FERC Project No. 2082. February 2004. Final License Application, Volume 2. Exhibit E.

PacifiCorp. 2002. Transmission & Distribution Vegetation Management Program Specification Manual. June 1, 2002. PacifiCorp. Portland, Oregon.

State Water Resources Control Board (SWRCB). 2020a. Final Environmental Impact Report for the Lower Klamath Project License Surrender. Available online: https://www.waterboards.ca.gov/waterrights/water_issues/programs/water_quality_cert/lower_klamath_ferc14803_eir.html.

U.S. Fish and Wildlife Service (USFWS). 2020a. of Wetlands and Deepwater Habitats of the United States. Retrieved from: https://www.fws.gov/wetlands/documents/classwet/index.html#contents. Accessed April 2020.

4.8 Rare, Threatened, and Endangered Species

As described in Section 4.1, this Exhibit E incorporates by reference the extensive environmental documentation developed since the 2004 PacifiCorp Application as described in Table 4-27.

Table 4-27 Cross-walk of Rare, Threatened, and Endangered Species Reference Documents

Date	Author	Reference Document	Section Number	Page Number(s)
2004	PacifiCorp	Application for New License	E5.2-2–E5.2-11	5.35 – 5-79
2007	FERC	Final EIS	3.3.5	3-399 -3-426
2012	U.S. BOR	EIS/EIR	3.5.3.4	3.5-28 – 3.5-49
2018	KRRC	Definite Plan Report	Appendix J	11 - 67
2020	SWRCB	Final EIR	Appendix J	AT1-1419 – AT1-1420
2020	State of California	401 WQ Certificate	Condition 17	41; 78 – 80
2018	State of Oregon	401 WQ Certificate	N/A	N/A
2020	SWRCB	Attachment 4: CEQA Findings	N/A	27 – 63
2018	ODEQ	Evaluation and Findings Report	4.4.1.2 5.2 – 5.3	19 – 20 22 – 24
2011-2020	PacifiCorp	KHSA Interim Measures Implementation Annual Report (2020)	N/A	N/A

4.8.1 Affected Environment

4.8.1.1 Terrestrial Resources

The Renewal Corporation performed terrestrial surveys in the Lower Klamath Project area in 2017, 2018, and 2019 (KRRC 2019 and KRRC 2020b) to establish the potential presence of Rare, Threatened and Endangered (RTE) species. Biologists established transects to cover the study area that included a 0.25-mile buffer surrounding the Lower Klamath Project area. The 0.25-mile study area buffer and work plans were developed in cooperation with CDFW, ODFW, NMFS and the USFWS. Biologists walked the length of each transect, recording all observations (e.g., direct visual and auditory observations, scat, and other signs of presence). Field teams recorded wildlife behaviors, particularly breeding activity (KRRC 2019). From these surveys, a list of RTE species located within the Proposed Action area was created. This list included 3 reptile species, 29 bird species, and 1 mammal.[11]

[11] For the purposes of this Exhibit E, species identified in KRRC 2018 that did not have a state or federal listing status greater than being on watch lists were not included in this analysis. These species include: Bufflehead, mountain quail, Caspian tern, Forster's tern, double crested cormorant, great blue heron, great egret, osprey, Cooper's hawk, Lewis' woodpecker, acorn woodpecker, pileated woodpecker, black capped chickadee, pygmy nuthatch, and the western grey squirrel.

The SWRCB developed a table of RTE species known or with the potential to occur in the Lower Klamath Project Area (SWRCB 2020a). For their analysis, the SWRCB conducted a desktop analysis including the following:

- CNDDB list of state and federal proposed endangered, threatened, candidate species, including those with BLM sensitive status;
- USFWS list of federally listed and proposed endangered, threatened, and candidate species;
- California Native Plant Society online Inventory of Rare and Endangered Vascular Plants of California;
- USDA Forest Service Pacific Southwest Region's (Region 5) documented occurrences of sensitive animals and sensitive and special interest plants;
- BLM species list; and
- NMFS West Coast Region species list of endangered and threatened species and critical habitat.

The data in Table 4-28 and Table 4-29 reflect the desktop analysis conducted by the SWRCB for the Final EIR (SWRCB 2020a), as well as results of terrestrial surveys conducted by KRRC (KRRC 2019, KRRC 2020). Table 4-28 and Table 4-29 identify federal and state listed species, respectively, with the potential to occur in the Project Area. PacifiCorp conducted biological surveys in 2002 and 2003 in the Lower Klamath Project Area (PacifiCorp 2004a). These surveys found that 48 of the listed species were documented to occur within the Lower Klamath Project area, including 1 amphibian, 5 reptile, 40 bird, and 2 mammal species (PacifiCorp 2004a). Although not observed during the recent Renewal Corporation surveys, the Townsend's big-eared bat (*Coryorhinus townsendii*) is known to occur within the Lower Klamath Project area (PacifiCorp 2004a).

Table 4-28 Federal Threatened and Endangered Species with Potential to Occur within the Project Area

Species	Status Federal/USDA/ Forest Service, BLM	Habitat Association	Available Habitat and Occurrence Information within the Primary Area of Analysis
Invertebrates			
Hooded lancetooth *Ancotrema voyanum*	BLMS	Limestone substrates, mostly in an elevation range of 550–3,100 feet	Species was documented in 1992 approximately 4 miles southwest of Orleans and approximately 0.2 miles from the Klamath River (greater than 100 river miles (RM) downstream of Iron Gate Dam).
Oregon shoulderband *Helminthoglypta hertleini*	BLMS	Found on basaltic talus slopes where ground cover/moisture is present; adapted to dry conditions during a portion of the year	Single occurrence has been documented approximately 100 RM downstream of Iron Gate Dam (no documentation date).
Trinity shoulderband *Helminthoglypta talmadgei*	BLMS	Limestone rockslides, litter in coniferous forests, old mine tailings, and along shaded streams	Single occurrence documented at mine tailings in 1954 more than 100 RM downstream of Iron Gate Dam (2017a).
Siskiyou shoulderband *Monadenia chaceana*	BLMS	Lower reaches of major drainages. Talus and rock slides, under rocks and woody debris in moist conifer forests, caves, and riparian corridors in shrubby areas	Single occurrence has been documented approximately 0.25 RM downstream of Copco No. 2 Dam in a lava rockslide (no documentation date).
Tehama chaparral *Trilobopsis tehamana*	FSS, BLMS	Rocky talus and under leaf litter or woody debris within approximately 330 feet of limestone outcrops	Two occurrences in 1990 and 1994—one sighting near the Klamath River and another along the hill slope. Both occurrences are more 20 RM downstream of Iron Gate Dam.
Western bumblebee *Bombus occidentalis*	FSS	Shrub, chaparral, and open grassy areas (urban parks, mountain meadows)	Six sightings from 1969 and earlier are located more than 70 RM downstream of Iron Gate Dam.
Amphibians			
Southern torrent (southern seep) salamander	FSS	In and adjacent to cold, permanent, well-shaded mountain springs, waterfalls, and seeps with rock substrate	• Not observed in California during the PacifiCorp surveys. • Approximately 10 sightings have been recorded, approximately 50 RM or more downstream from Iron Gate Dam typically along

Species	Status Federal/USDA/ Forest Service, BLM	Habitat Association	Available Habitat and Occurrence Information within the Primary Area of Analysis
Rhyacotriton variegatus			tributaries or at the confluence to the Klamath River; the most recent sighting was from 2007. • Found to be widespread in the tributaries of the Lower Klamath River, but due to lack of suitable habitat, will not be expected to occur in the mainstem of the Lower Klamath River.
Foothill yellow-legged frog *Rana boylii*	Petition to list/FSS, BLMS	Shallow tributaries and mainstems of perennial streams and rivers, typically associated with cobble or boulder substrate	• Documented on tributaries to the Klamath River. • Documented in 2017 on the Lower Klamath River, approximately 13 RM upstream of the estuary, approximately 20 RM upstream of the estuary by landowner Green Diamond in 1994, and approximately 50 RM downstream from Iron Gate Dam in 1970 and farther downstream in 1976. • Detections are rare in the Klamath Basin. • PacifiCorp targeted surveys in 2003 at most likely habitat locations (including Bogus and Cottonwood Creek, approximately 0.2 and 7 miles downstream of Iron Gate Dam, respectively) and detected no occurrences. • Historical localities were restricted to a relatively small area that consisted of the mainstem Klamath River in the Klamath River Canyon, California, and its nearby tributaries. • One frog observed at Boise Creek in 1999.
Northern red-legged frog *Rana aurora*	FSS	Breeds in still or slow-moving water with emergent and overhanging vegetation, including wetlands, wet meadows, ponds, lakes, and low-gradient, slow-moving stream reaches with permanent pools; uses adjacent uplands for dispersal and summer retreat	• Not documented in California during the PacifiCorp surveys. • A 1995 sighting was documented approximately 20 RM upstream of the Klamath River Estuary; species located along the north bank of the Klamath River along mats of vegetation.
Reptiles			
Western pond turtle *Actinemys marmorata*	Petition to list/FSS, BLMS	Permanent, slow-moving fresh or brackish water with available basking sites and adjacent open habitats or forest for nesting	• Documented in 2018 at Iron Gate Reservoir with majority of observations along the northern half of the reservoir (Mirror Cove and near Camp Creek and Jenny Creek) and throughout Copco No. 1 Reservoir with majority of observations occurring in the northern Beaver Creek and Raymond Gulch coves. Also observed near the Copco Rd bridge at the upstream end of the reservoir. • Considered common to abundant in many Lower Klamath Project reservoirs and reaches with suitable nesting habitat being present. During PacifiCorp 2002 and 2003 surveys, 6 turtles were documented in the California portion of the J.C. Boyle

Species	Status Federal/USDA/ Forest Service, BLM	Habitat Association	Available Habitat and Occurrence Information within the Primary Area of Analysis
			peaking reach, 12 at Copco No. 1 Reservoir, 18 in the beaver dam pond/wetland between Fall Creek and Iron Gate Reservoir, and 17 at Iron Gate Reservoir. Surveys downstream of the Iron Gate Dam to Shasta River documented one site with 9 turtles; however, it was noted that the survey had several gaps due to sites being inaccessible. • Documented basking during May 2018 wildlife surveys in the reservoirs-9 in Iron Gate Reservoir and between 31-36 in Copco No. 1 Reservoir. • Approximately 10 miles RM downstream of Iron Gate Dam, an individual was observed basking approximately 0.5 miles upstream of Williams Creek at the confluence of a tributary in November 2005. PacifiCorp indicated that most basking probably occurs in Iron Gate Reservoir when water levels decrease, and the turtles use emerging rocks and boulders; however, low water levels reduce the amount of aquatic habitat and make bordering emergent wetlands less accessible due to increased distance.
Northern sagebrush lizard *Sceloporus graciosus*	BLMS	Inhabits sagebrush, chaparral, juniper woodlands, and dry conifer forests	• Documented during PacifiCorp surveys near the edge of a forested wetland along Iron Gate Reservoir. • Documented during 2018 surveys in several areas surrounding Copco No. 1 Reservoir including a large population in a rocky area to the east of Fall Creek, and Iron Gate Reservoir including Bogus Creek fish hatchery, Long Gulch Cove shoreline, Jenny Creek shorelines, and recreational areas.
California mountain kingsnake *Lampropeltis zonata*	BLMS	Inhabits a wide range of habitats, including coniferous forest, oak-pine woodlands, and riparian woodland	• Observed by KRRC biologists on a rocky outcrop below the J.C. Boyle dam during 2018 surveys.
Birds			
Bald eagle *Haliaeetus leucocephalus*	BGEPA, BLMS, FSS	Large bodies of water or rivers with abundant fish; uses adjacent snags or other perches; nests and winter communal roosts in advanced-successional conifer forest within approximately 1 mile of open water	• Documented during the KRRC surveys, two inactive bald eagle nests—one within 0.5 miles of Copco Reservoir and one located between 0.5–2 miles of Iron Gate Reservoir. • Documented in 1997 along the Klamath River, and approximately 2 miles from Copco No. 1 and No. 2 dams.

Species	Status Federal/USDA/ Forest Service, BLM	Habitat Association	Available Habitat and Occurrence Information within the Primary Area of Analysis
			• Documented during PacifiCorp surveys at J.C. Boyle and Copco No. 1 reservoirs. The highest number of bald eagles (12) was found at Copco No. 1 Reservoir.
Northern goshawk *Accipter gentilis*	FSS, BLMS	Mature and old growth stands of coniferous forest, middle and higher elevations; nests in dense part of stands near an opening	• Documented during PacifiCorp surveys flying over J.C. Boyle peaking reach. • Documented in 1981 more than 80 RM downstream of Iron Gate Dam.
Swainson's hawk *Buteo swainsoni*	BLMS	Nests in oaks or cottonwoods in or near riparian habitats; forages in grasslands, irrigated pastures, and grain fields	• Documented occurrences within the Project Vicinity near agricultural fields approximately 10 miles east of Copco No. 1 Reservoir.
Greater sandhill crane *Grus canadensis tabida*	FSS, BLMS	Forages in freshwater marshes and grasslands as well as harvested rice fields, corn stubble, barley, and newly planted grain fields	• Documented nesting habitat at J.C. Boyle Reservoir in May 2018. • Documented during the PacifiCorp surveys at J C. Boyle Reservoir. Other sightings in ponds and near agricultural fields east of Yreka.
Western yellow-billed cuckoo *Coccyzus americanus*	FT/FSS, BLMS No critical habitat proposed within the Primary Area of Analysis	Summer resident of valley foothill and desert riparian habitats; nests in open woodland with clearings and low, dense, scrubby vegetation	• Although not documented in the area, it has been noted that the species has the potential to be in the vicinity. • In coordination with state agencies, it has been noted that breeding habitat is unlikely in the area.
Northern spotted owl *Strix occidentalis caurina*	FT/Critical habitat designated approximately 0.5 miles south east of Copco No. 1 Reservoir	Typically, in older forested habitats, nests in complex stands dominated by conifers, especially coastal redwood, with hardwood understories; some open areas are important for foraging	• Detected during PacifiCorp surveys southeast of Copco No. 1 Reservoir. • Activity center is located approximately 1.7 miles southeast of Copco No. 1 Reservoir. • Designated critical habitat approximately 0.5 miles southeast of Copco No. 1 Reservoir and along the Klamath River approximately 40 RM downstream of Iron Gate Dam. • Critical habitat is located north of the Lower Klamath Project in the Jenny Creek basin, upstream of Copco No. 1 Reservoir, and along portions of the Lower Klamath River. Also documented on National Forest lands and along the Lower Klamath River on lands managed by Green Diamond Resources Company.
Great gray owl *Strix nebulosi*	FSS	Dense, coniferous forest, usually near a meadow for foraging; nests in large, broken-topped snags	• Documented during PacifiCorp surveys east of Fall Creek near Jenny Creek.

Species	Status Federal/USDA/ Forest Service, BLM	Habitat Association	Available Habitat and Occurrence Information within the Primary Area of Analysis
Willow flycatcher *Empidonax traillii*	FSS	Dense brushy thickets within riparian woodland often dominated by willows and/or alder, near permanent standing water; uses brushy, early-succession forests (e.g., clearcuts) in the Pacific Northwest	• Documented during PacifiCorp surveys in riparian and wetland habitats located along the shoreline of Copco No. 1 and Iron Gate reservoirs, along the J.C. Boyle peaking reach, and along Klamath River from Iron Gate Dam to Shasta River. • Documented Iron Gate Reservoir at Jenny Creek in 2008. • Observed during 2018 surveys at Copco No. 1 Reservoir in the northern cove at the confluence of West Fork Beaver Creek, Beaver Creek, and East Fork Beaver Creek in fringe willow.
Tricolored blackbird *Agelaius tricolor*	Petition to list	Feeds in grasslands and agriculture fields; nesting habitat components include open accessible water, a protected nesting substrate (including flooded or thorny vegetation), and a suitable nearby foraging space with adequate insect prey	• A single sighting in 2011 at Copco No. 1 Reservoir and potential for the species to occur due to the potential presence of suitable habitat (open foraging area adjacent to aquatic habitat). • Flock of approximately 25 observed in an agricultural field along Yreka Ager Road, located approximately 12 miles southwest of the Iron Gate Fish Hatchery.
Mammals			
Townsend's western big-eared bat *Corynorhinus townsendii*	FSS, BLMS	Roosts in cavities, usually tunnels, caves, buildings, and mines, but also rock shelters, preferentially close to water. Caves near water's edge are favored.	• Not documented in California during the PacifiCorp surveys. • Two documented occurrences in 1997 at bridges approximately 40 RM downstream of Iron Gate Dam. • Suitable habitat (e.g., man-made structures) is present in the Limits of Work. Structures providing habitat for a non-special-status bat species (Yuma myotis) were documented at the Copco No. 1 powerhouse and the Iron Gate south gatehouse, which may support other bat species.
Spotted bat *Euderma maculatum*	BLMS	Roosts in cracks, crevices, and caves, usually high in fractured rock cliffs solitary or in small groups	• Suitable habitat for this species (e.g., large dam faces) may be present in the Limits of Work. • Although not documented during PacifiCorp roost surveys, species speculated to be rare, but widely distributed, and as a result may be in Primary Area of Analysis.
Pallid bat *Antrozous pallidus*	FSS, BLMS	Roosts in rock crevices, live or dead tree hollows, mines, caves, and a variety of vacant and occupied structures or buildings	• Not documented in California during PacifiCorp surveys; however, it was noted that the presence of a roost site was documented by one dead individual (Yuma myotis), and that it is possible that sites with confirmed evidence of bat use support aggregations of more than one species. • No CNDDB occurrences are documented within the Primary Area of Analysis.

Species	Status Federal/USDA/ Forest Service, BLM	Habitat Association	Available Habitat and Occurrence Information within the Primary Area of Analysis
			• Suitable habitat is present in the Limits of Work. Structures providing habitat for a non-special-status bat species (Yuma myotis) were documented at the Copco No. 1 powerhouse and the Iron Gate south gatehouse, which, along with other structures, trees, rock crevices in the area, may support other bat species.
Fringed myotis *Myotis thysanodes*	BLMS, FSS	Roosts in crevices, cavities, and foliage in a wide variety of habitats including rock crevices, caves, mines, buildings and bridges, and large-diameter snags	• Not documented in California during PacifiCorp surveys; however, it was noted that the presence of a roost site was documented by one dead individual (Yuma myotis), and that it is possible that sites with confirmed evidence of bat use support aggregations of more than one species. • No CNDDB occurrences are documented within the Primary Area of Analysis. • Suitable habitat is present in the Limits of Work. Structures providing habitat for Yuma myotis were documented at the Copco No. 1 powerhouse and the Iron Gate south gatehouse, which, along with other structures, trees, rock crevices in the area, may support other bat species. • Habitat for Myotis species inside Copco No. 1 C-12 gatehouse as a maternity roost of more than 2,000 Myotis spp. (species not noted) was confirmed in June 2018 and several hundred bats (species not noted) also roosting at Copco No. 1 diversion tunnel and Iron Gate diversion tunnel.
Long-eared myotis *Myotis evotis*	BLMS	Roosts in bridges, buildings, under exfoliating tree bark, and in hollow trees, caves, mines, cliff crevices, sinkholes, rocky outcrops on the ground	• Not documented in California during PacifiCorp surveys; however, it was noted that the presence of a roost site was documented by one dead individual (Yuma myotis), and that it is possible that sites with confirmed evidence of bat use support aggregations of more than one species. • Suitable habitat (e.g., man-made structures) is present in the Limits of Work. • Habitat for Myotis species inside Copco No. 1 C-12 gatehouse as a maternity roost of more than 2,000 Myotis spp. (species not noted) was confirmed in June 2018 and several hundred bats (species not noted) also roosting at Copco No. 1 diversion tunnel and Iron Gate diversion tunnel.

Species	Status Federal/USDA/ Forest Service, BLM	Habitat Association	Available Habitat and Occurrence Information within the Primary Area of Analysis
Yuma myotis *Myotis yumanensis*	BLMS	Roosts in bridges, buildings, cliff crevices, caves, mines, and trees	• Structures providing habitat for Yuma myotis were documented at the Copco No. 1 powerhouse and the Iron Gate south gatehouse. • Habitat for Myotis species inside Copco No. 1 C-12 gatehouse as a maternity roost of more than 2,000 Myotis spp. (species not noted) was confirmed in June 2018 and several hundred bats (species not noted) also roosting at Copco No. 1 diversion tunnel and Iron Gate diversion tunnel.
Gray wolf *Canis lupus*	FE/No critical habitat designated	Range of habitats including temperate forests, mountains, tundra, taiga, and grasslands	• The Lower Klamath Project is not within or near the area of current wolf activity; however, wolves have been previously documented in the area. • Since December 2011, at least two packs of gray wolves and three separate individual wolves have been detected in California. Key wolf use areas to date have included western Lassen and eastern Siskiyou counties, although wolves have also been known to utilize parts of Modoc, Plumas, Shasta, and Tehama counties.

Source: SWRCB 2020a; KRRC 2019
Status codes: Federal
FE = Listed as endangered under the federal Endangered Species Act
FT = Listed as threatened under the federal Endangered Species Act
BGEPA = Federally protected under the Bald and Golden Eagle Protection Act
FSS = USDA Forest Service Sensitive species
BLMS = Bureau of Land Management Sensitive Species

Table 4-29 State-Listed Species of Concern with Potential to Occur within the Project Area

Species	Status State	Habitat Association	Available Habitat and Occurrence Information within the Primary Area of Analysis
Amphibians			
Southern torrent (southern seep) salamander *Rhyacotriton variegatus*	SSC	In and adjacent to cold, permanent, well-shaded mountain springs, waterfalls, and seeps with rock substrate	• Not observed in California during the PacifiCorp surveys. • Approximately 10 sightings have been recorded, approximately 50 RM or more downstream from Iron Gate Dam typically along tributaries or at the confluence to the Klamath River; the most recent sighting was from 2007. • Found to be widespread in the tributaries of the Lower Klamath River, but due to lack of suitable habitat, will not be expected to occur in the mainstem of the Lower Klamath River.
Scott Bar salamander *Plethodon asupak*	ST	Rocky forested areas, especially thick moss-covered talus; elevation range of 1,500–2,000 feet	• Not documented in California during the PacifiCorp surveys. • Documented at four locations approximately 30 RM downstream of Iron Gate Dam between 1996 and 2005.
Siskiyou Mountains salamander *Plethodon stormi*	ST	Loose rock talus on north-facing slopes or in dense wooded areas; also, under bark near talus	• Not documented in California during the PacifiCorp surveys. • Documented at five locations approximately 30 RM downstream of Iron Gate Dam between 1972 and 2003.
Pacific tailed frog *Ascaphus truei*	SSC	In and adjacent to cold, clear, moderate- to fast-flowing, perennial mountain streams in conifer forest	• Not documented in California during the PacifiCorp surveys. • Observed at the confluence of a tributary approximately 60 RM downstream from Iron Gate Dam in 1989. Farther downstream, five additional sites are documented along tributaries to the Klamath or at the confluence. • Found to be widespread in the tributaries of the Lower Klamath River, but due to lack of suitable habitat for these species, will not be expected to occur in the mainstem of the Lower Klamath River.
Foothill yellow-legged frog *Rana boylii*	SCT, SSC	Shallow tributaries and mainstems of perennial streams and rivers, typically associated with cobble or boulder substrate	• Documented on tributaries to the Klamath River. • Documented in 2017 on the Lower Klamath River, approximately 13 RM upstream of the estuary, approximately 20 RM upstream of the estuary by landowner Green Diamond in 1994 (CDFW 2017a), and approximately 50 RM downstream from Iron Gate Dam in 1970 and farther downstream in 1976. • Detections are rare in the Klamath Basin. • PacifiCorp targeted surveys in 2003 at most likely habitat locations (including Bogus and Cottonwood Creek,

Species	Status State	Habitat Association	Available Habitat and Occurrence Information within the Primary Area of Analysis
			approximately 0.2 and 7 miles downstream of Iron Gate Dam, respectively) and detected no occurrences. • Historical localities were restricted to a relatively small area that consisted of the mainstem Klamath River in the Klamath River Canyon, California, and its nearby tributaries. • One frog observed at Boise Creek in 1999.
Northern red-legged frog *Rana aurora*	SSC	Breeds in still or slow-moving water with emergent and overhanging vegetation, including wetlands, wet meadows, ponds, lakes, and low-gradient, slow-moving stream reaches with permanent pools; uses adjacent uplands for dispersal and summer retreat	• Not documented in California during the PacifiCorp surveys. • A 1995 sighting was documented approximately 20 RM upstream of the Klamath River Estuary; species located along the north bank of the Klamath River along mats of vegetation.
Reptiles			
Western pond turtle *Actinemys marmorata*	SSC	Permanent, slow-moving fresh or brackish water with available basking sites and adjacent open habitats or forest for nesting	• Documented in 2018 at Iron Gate Reservoir with majority of observations along the northern half of the reservoir (Mirror Cove and near Camp Creek and Jenny Creek) and throughout Copco No. 1 Reservoir with majority of observations occurring in the northern Beaver Creek and Raymond Gulch coves. Also observed near the Copco Rd bridge at the upstream end of the reservoir. • Considered common to abundant in many Lower Klamath Project reservoirs and reaches with suitable nesting habitat being present. During PacifiCorp 2002 and 2003 surveys, 6 turtles were documented in California portion of the J.C. Boyle peaking reach, 12 at Copco No. 1 Reservoir, 18 in the beaver dam pond/wetland between Fall Creek and Iron Gate Reservoir, and 17 at Iron Gate Reservoir. Surveys downstream of the Iron Gate Dam to Shasta River documented one site with 9 turtles; however, it was noted that the survey had several gaps due to sites being inaccessible. • Documented basking during May 2018 wildlife surveys in the reservoirs-9 in Iron Gate Reservoir and between 31-36 in Copco No. 1 Reservoir. • Approximately 10 miles RM downstream of Iron Gate Dam, an individual was observed basking approximately 0.5 miles upstream of Williams Creek at the confluence of a tributary in November 2005. PacifiCorp indicated that most basking probably occurs in Iron Gate Reservoir when water levels

Species	Status State	Habitat Association	Available Habitat and Occurrence Information within the Primary Area of Analysis
			decrease, and the turtles use emerging rocks and boulders; however, low water levels reduce the amount of aquatic habitat and make bordering emergent wetlands less accessible due to increased distance.
Birds			
Common loon *Gavia immer*	SSC	Breeds in forested lakes and large ponds, and inhabits a wide array of water bodies outside of breeding season	• Documented by KRRC biologists at Copco Lake during 2018 surveys
Bank swallow *Riparia*	ST	Nests on cliffs and steep banks, often alongside large water bodies	• One individual was documented during 2018 surveys among a group of tree and cliff swallows near Copco Dam
American white pelican *Pelecanus erythrorhynchos*	SSC	Nests at lakes and marshes and uses almost any lake outside of the breeding season	• Documented during PacifiCorp surveys—55 pelicans on Copco No. 1 Reservoir and 107 pelicans on Iron Gate Reservoir. • Documented at Copco No. 1 and Iron Gate reservoirs. • Documented during 2018 surveys throughout Copco No. 1 Reservoir near the dam and in Keaton Cove and at Iron Gate Reservoir, including Mirror Cove, Juniper Point, upstream extent of the reservoir, and near the boom in front of Iron Gate Dam.
Barrow's goldeneye *Bucephala islandica*	SSC	May be found in northern California during the winter (non-breeding season) along open water and riverine habitat. Nests in cavities, including artificial nest boxes	• Documented during PacifiCorp surveys at Copco and Iron Gate reservoirs primarily between January and April, prior to northward migration. • Documented at Iron Gate Reservoir and on the Klamath River downstream of Iron Gate Dam.
Bald eagle *Haliaeetus leucocephalus*	SFP/SE	Large bodies of water or rivers with abundant fish; uses adjacent snags or other perches; nests and winter communal roosts in advanced-successional conifer forest within approximately 1 mile of open water	• Documented during the KRRC surveys, two inactive bald eagle nests—one within 0.5 miles of Copco Reservoir and one located between 0.5–2 miles of Iron Gate Reservoir. • Documented in 1997 along the Klamath River, and approximately 2 miles from Copco No. 1 and No. 2 dams. • Documented during PacifiCorp surveys at J.C. Boyle and Copco No. 1 reservoirs. The highest number of bald eagles (12) was found at Copco No.1 Reservoir.
Northern harrier *Circus cyaneus*	SSC	Nests, forages, and roosts in wetlands or along rivers or lakes, but also in grasslands, meadows, or grain fields	• Documented during PacifiCorp surveys along the Klamath River from Iron Gate Dam to Shasta River. • Documented along Copco No. 1 Reservoir, along Iron Gate Reservoir and tributaries, and Klamath River downstream of Iron Gate Dam.
Northern goshawk *Accipter gentilis*	SSC	Mature and old growth stands of coniferous forest, middle and higher	• Documented during PacifiCorp surveys flying over J.C. Boyle peaking reach.

Species	Status State	Habitat Association	Available Habitat and Occurrence Information within the Primary Area of Analysis
		elevations; nests in dense part of stands near an opening	• Documented in 1981 more than 80 RM downstream of Iron Gate Dam.
Swainson's hawk *Buteo swainsoni*	ST	Nests in oaks or cottonwoods in or near riparian habitats; forages in grasslands, irrigated pastures, and grain fields	• Documented occurrences within the Project Vicinity near agricultural fields approximately 10 miles east of Copco No. 1 Reservoir.
Golden eagle *Aquila chrysaetos*	BGEPA, SFP	Open woodlands and oak savannahs, grasslands, chaparral, sagebrush flats; nests on steep cliffs or large trees	• Documented during PacifiCorp surveys along the lower reaches of the J.C. Boyle peaking reach and along Iron Gate and Copco No. 1 reservoirs. • Also documented along the Klamath River, downstream of Iron Gate Dam. • Two active golden eagle nests were documented during the KRRC surveys within two miles of Copco No. 1 Reservoir and three inactive nests were documented within 2 miles of Iron Gate Reservoir. In May 2018, a golden eagle was observed at Copco No. 1 Reservoir perched on a slope on the northern shoreline, a pair was observed near a northern cove, and one was observed bathing in the shallow water.
American peregrine falcon *Falco peregrinus*	SFP	Wetlands, woodlands, cities, agricultural lands, and coastal area with cliffs (and rarely broken-top, predominant trees) for nesting; often forages near water	• Documented around Iron Gate Reservoir. • Documented near Iron Gate Dam along the Klamath River.
Greater sandhill crane *Grus canadensis tabida*	ST, SFP	Forages in freshwater marshes and grasslands as well as harvested rice fields, corn stubble, barley, and newly planted grain fields	• Documented nesting habitat at J.C. Boyle Reservoir in May 2018. • Documented during the PacifiCorp surveys at J C. Boyle Reservoir. Other sightings in ponds and near agricultural fields east of Yreka.
Black tern *Chlidonias niger*	SSC	Nests semi-colonially in protected areas of marshes	• Documented during PacifiCorp surveys at J.C. Boyle Reservoir.
Western yellow-billed cuckoo *Coccyzus americanus*	SE	Summer resident of valley foothill and desert riparian habitats; nests in open woodland with clearings and low, dense, scrubby vegetation	• Although not documented in the area, it has been noted that the species has the potential to be in the vicinity. • In coordination with state agencies, it has been noted that breeding habitat is unlikely in the area.
Northern spotted owl *Strix occidentalis caurina*	ST, SSC	Typically, in older forested habitats, nests in complex stands dominated by conifers, especially coastal redwood, with hardwood understories; some open areas are important for foraging	• Detected during PacifiCorp surveys southeast of Copco No. 1 Reservoir. • Activity center is located approximately 1.7 miles southeast of Copco No. 1 Reservoir.

Species	Status State	Habitat Association	Available Habitat and Occurrence Information within the Primary Area of Analysis
			• Designated critical habitat approximately 0.5 miles southeast of Copco No. 1 Reservoir and along the Klamath River approximately 40 RM downstream of Iron Gate Dam. • Critical habitat is located north of the Lower Klamath Project in the Jenny Creek basin, upstream of Copco No. 1 Reservoir, and along portions of the Lower Klamath River. Also documented on National Forest lands and along the Lower Klamath River on lands managed by Green Diamond Resources Company.
Great gray owl *Strix nebulosi*	SE	Dense, coniferous forest, usually near a meadow for foraging; nests in large, broken-topped snags	• Documented during PacifiCorp surveys east of Fall Creek near Jenny Creek.
Black swift *Cypseloides niger*	SSC	Nests in moist crevices behind or beside permanent or semi-permanent waterfalls in deep canyons, on perpendicular sea cliffs above surf, and in sea caves; forages widely over many habitats	• Not documented in California during the PacifiCorp surveys. • Single occurrence is known from 1982 along the banks of the Klamath River, over 100 RM downstream of Iron Gate Dam.
Vaux's swift *Chaetura vauxi*	SSC	Redwood and Douglas-fir habitats with large snags, especially forest with larger basal hollows and chimney trees	• Documented during PacifiCorp surveys at Copco No. 1 and Iron Gate reservoirs, along the J.C. Boyle peaking reaches, along Fall Creek, and along Klamath River from Iron Gate Dam to Shasta River.
Olive-sided flycatcher *Contopus cooperi*	SSC	Primarily advanced-successional conifer forests with open canopies	• Documented during PacifiCorp surveys along Iron Gate Reservoir and along J.C. Boyle peaking reach. • Observed during 2018 surveys at the northern coves and riparian woodlands at Copco No. 1 Reservoir.
Willow flycatcher *Empidonax traillii*	SE	Dense brushy thickets within riparian woodland often dominated by willows and/or alder, near permanent standing water; uses brushy, early-succession forests (e.g., clearcuts) in the Pacific Northwest	• Documented during PacifiCorp surveys in riparian and wetland habitats located along the shoreline of Copco No. 1 and Iron Gate reservoirs, along the J.C. Boyle peaking reach, and along Klamath River from Iron Gate Dam to Shasta River. • Documented near Iron Gate Reservoir at Jenny Creek in 2008. • Observed during 2018 surveys at Copco No. 1 Reservoir in the northern cove at the confluence of West Fork Beaver Creek, Beaver Creek, and East Fork Beaver Creek in fringe willow.
Purple martin *Progne subis*	SSC	Conifer, valley-foothill, montane-hardwood forests with large snags in open areas; most nest sites located in upper slopes of hilly terrain; also, may nest in human-made structures with cavities	• Documented during PacifiCorp surveys upstream of the upper falls at Fall Creek. • Documented at a few locations along the Klamath River, downstream of Iron Gate Dam. Observed nesting during 2018 survey on a utility pole near the intersection of Copco Road and the dam access spur road.

Species	Status State	Habitat Association	Available Habitat and Occurrence Information within the Primary Area of Analysis
Tricolored blackbird *Agelaius tricolor*	SE, SSC	Feeds in grasslands and agriculture fields; nesting habitat components include open accessible water, a protected nesting substrate (including flooded or thorny vegetation), and a suitable nearby foraging space with adequate insect prey	• A single sighting in 2011 at Copco No. 1 Reservoir and potential for the species to occur due to the potential presence of suitable habitat (open foraging area adjacent to aquatic habitat). • Flock of approximately 25 observed in an agricultural field along Yreka Ager Road, located approximately 12 miles southwest of the Bogus Creek Fish Hatchery.
Yellow warbler *Setophaga petechia*	SSC	Open-canopy, deciduous riparian woodland close to water, along streams or wet meadows	• Documented during PacifiCorp surveys at all Lower Klamath Project reservoirs and reaches. • Documented along the Klamath River downstream of Iron Gate Dam. • Observed around Copco No. 1. Reservoir and most frequent in riparian woodlands and hillside seep areas and also at Iron Gate Reservoir, including Bogus Creek fish hatchery, Brush Creek, Camp Creek, and Jenny Creek.
Yellow-breasted chat *Icteria virens*	SSC	Early successional riparian habitats with a dense shrub layer and an open canopy	• Documented during PacifiCorp surveys in wetland and riparian habitats along J.C. Boyle peaking reach, at Copco No. 1 Reservoir, along Fall Creek, and along Klamath River from Iron Gate Dam to Shasta River. • Documented during 2018 surveys in the northern cove of Iron Gate Reservoir near Camp Creek and Horseshoe Ranch Wildlife Area, and at Fall Creek and along the southern portion of Copco No. 1 Reservoir, near Ager Beswick Road east of Keaton Cove.
Mammals			
Western mastiff bat *Eumops perotis californicus*	SSC	Variety of habitats including desert scrub, chaparral, oak woodland, ponderosa pine, mid-elevation conifer (e.g., giant sequoia); roosting habitat mostly associated with significant rock features; forages seasonally at high elevations	• Not documented in California during PacifiCorp surveys. • Documented at Medicine Lake, Siskiyou County. • Range includes the Primary Area of Analysis.
Townsend's western big-eared bat *Corynorhinus townsendii*	SSC	Roosts in cavities, usually tunnels, caves, buildings, and mines, but also rock shelters, preferentially close to water. Caves near water's edge are favored.	• Not documented in California during the PacifiCorp surveys. • Two documented occurrences in 1997 at bridges approximately 40 RM downstream of Iron Gate Dam. • Suitable habitat (e.g., man-made structures) is present in the Limits of Work. Structures providing habitat for a non-special-status bat species (Yuma myotis) were documented at the

Species	Status State	Habitat Association	Available Habitat and Occurrence Information within the Primary Area of Analysis
			Copco No. 1 powerhouse and the Iron Gate south gatehouse, which may support other bat species.
Spotted bat *Euderma maculatum*	SSC	Roosts in cracks, crevices, and caves, usually high in fractured rock cliffs solitary or in small groups	• Suitable habitat for this species (e.g., large dam faces) may be present in the Limits of Work. • Although not documented during PacifiCorp roost surveys, species speculated to be rare, but widely distributed, and as a result may be in Primary Area of Analysis.
Pallid bat *Antrozous pallidus*	SSC	Roosts in rock crevices, live or dead tree hollows, mines, caves, and a variety of vacant and occupied structures or buildings	• Not documented in California during PacifiCorp surveys; however, it was noted that the presence of a roost site was documented by one dead individual (Yuma myotis), and that it is possible that sites with confirmed evidence of bat use support aggregations of more than one species. • No CNDDB occurrences are documented within the Primary Area of Analysis. • Suitable habitat is present in the Limits of Work. Structures providing habitat for a non-special-status bat species (Yuma myotis) were documented at the Copco No. 1 powerhouse and the Iron Gate south gatehouse, which, along with other structures, trees, rock crevices in the area, may support other bat species.
Gray wolf *Canis lupus*	SE	Range of habitats including temperate forests, mountains, tundra, taiga, and grasslands	• The Lower Klamath Project is not within or near the area of current wolf activity; however, individuals have been previously documented in the area. • Since December 2011, at least two packs of gray wolves and three separate individual wolves have been detected in California. Key wolf use areas to date have included western Lassen and eastern Siskiyou counties, although wolves have also been known to utilize parts of Modoc, Plumas, Shasta, and Tehama counties.
American badger *Taxidea taxus*	SSC	Shrubland, open grasslands, fields, and alpine meadows with friable soils	• Not documented in California during PacifiCorp surveys. • A single occurrence (unknown date) was documented approximately 2 miles upstream of Copco No. 1 Reservoir.

Source: SWRCB 2020a, KRRC 2019
Status codes: State
SE = Listed as Endangered under the California Endangered Species Act
ST = Listed as Threatened under the California Endangered Species Act
SCT = State Candidate Threatened
SSC = CDFW Species of Special Concern
SFP = CDFW Fully Protected species

4.8.1.1.1 Avian Fauna

Bald Eagle

The bald eagle was federally delisted as an endangered/threatened species in 2007 (USFWS 2019). However, bald eagles still maintain a level of federal protection under the Bald and Golden Eagle Protection Act. The law dictates that it is unlawful to "take" eagles or any of their parts (including their nest and eggs) without prior authorization, and that these parts are all protected by law. As of 2019, bald eagles remain a "state listed- endangered" species in California (CDFW 2019).

The Renewal Corporation conducted bald and golden eagle surveys in the Proposed Action area in 2017, 2018 and 2019 as follows (KRRC 2019, Appendix D):

- 2017: reconnaissance-level ground surveys on six dates (July, November);
- 2018: ground surveys on 10 dates (January, February, June, August) and helicopter surveys on two dates (June); and
- 2019: ground surveys on 13 dates (February, May, June) and helicopter surveys on three dates (May, June).

As of early 2020, 11 bald eagle nest territories, as represented by occupied nest sites, are known to have been associated with the Proposed Action area during at least one year in the study period 2017-2020. Two of these occupied bald eagle nest territories occurred within a few miles upriver from J.C. Boyle Reservoir. Three of the bald eagle nest territories were observed in the 14-mi. river reach between J.C. Boyle Dam and Copco Reservoir. The remaining six bald eagle territories had nests directly associated with reservoirs, with three observed at J.C. Boyle Reservoir, one at Copco Reservoir, and two at Iron Gate Reservoir (KRRC 2020b). Additional information on the 2019 bald eagle surveys (including the location of eagle nests) can be found within the Klamath River Renewal Project, Annual Terrestrial Resources Report (KRRC 2020b) (Appendix D).

Osprey

Seventeen active osprey nests were observed within the vicinity of Iron Gate Reservoir, Copco Lake, and J.C. Boyle Reservoir. All osprey nests were built on utility poles, and the integrity of these nests is directly correlated to the utility poles being undisturbed. Figures depicting the exact locations of these nests can be found within the Klamath River Renewal Project, 2018 Annual Terrestrial Resources Survey Report in Figures 2-1, 2-2, 2-3, and 2-4[12] (KRRC 2020b).[13]

[12] Klamath River Renewal Project, 2019 Annual Terrestrial Resources Survey Report

[13] The osprey is not listed under a federal or state status, however, it is on CDFW's "watch list."

Willow Flycatcher

The willow flycatcher, a threatened species in California, was observed in the Lower Klamath Project area as recent as 2018 during surveys by the Renewal Corporation biologists. In addition to the bird sightings, biologists noted suitable willow flycatcher habitat along the shores of all three reservoirs, particularly near stream-reservoir confluences (KRRC 2019). The habitat mainly consists of dense, willow-riparian vegetation. The locations of willow flycatcher observations and their habits can be found within the Klamath River Renewal Project, 2018 Annual Terrestrial Resources Survey Report in Figures 3-1, 3-2, and 3-3 [14] (KRRC 2019, Appendix D).

Northern Spotted Owl

The NSO (*Strix occidentalis*) is a federally threatened species and has the potential to occur within the Proposed Action area. NSO habitat primarily includes mature and old-growth trees with a dense canopy closure. During surveys in 2002 and 2003, five NSO sightings were recorded during each survey year. A few of these sightings are likely repeat sightings of the same individuals/pairs. A single detection (a pair of female owls) was noted within 1-mile southeast of the J.C. Boyle Reservoir (PacifiCorp 2004).

The Renewal Corporation conducted a desktop evaluation and field reconnaissance in 2017 to identify the locations for NSO surveys for the 2018 breeding season (KRRC 2019), Six NSO noise-only protocol surveys were conducted at eighteen calling stations in the Proposed Action Area during the 2018 breading season (KRRC 2019; Appendix D). The survey locations where selected based on the work done in 2017 and in coordination with USFWS (KRRC 2019). Field teams conducted visits in April, May, June, July (two visits), and August 2018. As required by the 2012 USFWS NSO Survey Protocol, teams of two, led by a biologist with experience conducting NSO protocol surveys, conducted all surveys. Beginning in June, field teams conducted calling at an additional location near the J.C. Boyle forebay at the end of the power canal due to the presence of large conifers (KRRC 2019). The Proposed Action is not anticipated to result in modification to NSO habitat and therefore, only noise-disturbance protocols were conducted (KRRC 2019). All surveys followed the USFWS 2012 NSO survey protocols (KRRC 2019).

4.8.1.1.2 Reptiles and Amphibians

California Mountain Kingsnake

The California mountain kingsnake (*Lampropeltis zonata*) is listed as a sensitive species by the BLM. It is considered a habitat generalist and is known to occur in a range of habitats, including coniferous forest, oak-pine woodlands, and riparian woodland (Burke Museum 2020a). During surveys in 2018, a specimen was observed on a rocky outcrop near the J.C. Boyle Dam. Between 2000 and 2001, BLM recorded four sightings

[14] Klamath River Renewal Project, 2018 Annual Terrestrial Resource Survey Report

of the California mountain kingsnake within 0.25 miles from the Klamath River near the J.C. Boyle Reservoir (PacifiCorp 2004).

Northern Sagebrush Lizard

The northern sagebrush lizard (*Sceloporus graciosus*) is listed as a sensitive species by the BLM. This reptile inhabits a variety of areas and has been observed in areas throughout the Lower Klamath Project area, including deserts, forests, grasslands, and shrublands. The lizard is an invertivore, feeding on a range of invertebrates including a variety of insects and spiders (USFWS 2020c). Individuals were recorded during 2018 and 2019 surveys in terrestrial habitats adjacent to Iron Gate Reservoir, the Copco Lake area, and J.C. Boyle Reservoir (KRRC 2019; KRRC 2020b).

Western Pond Turtle

The western pond turtle is listed as a species of special concern in California, on Oregon's Sensitive Species List, and is under review for federal listing under the ESA (ODEQ 2018b). The turtle is known to occur in and around the reservoirs within the Lower Klamath Project boundary. The habitat provided by the river and its reservoirs is ideal for the turtles which rely on semi aquatic habitats, such as slow-moving rivers, streams, wetlands, and submerged vegetation. The turtles rely on this habitat for shelter as well as parts of their diet which include aquatic insects, amphibians, crustaceans, and fish (Burke Museum 2020b).

During 2018 surveys, Renewal Corporation biologists observed western pond turtles throughout the Iron Gate Reservoir area, the Copco Lake area, and the J.C. Boyle Reservoir area in shoreline habitats (KRRC 2019). In 2019, the Renewal Corporation conducted a radio-telemetry study on western pond turtles in the Proposed Action area. While the number of turtles captured was not enough to provide a population estimate, western pond turtles were confirmed to be common in J.C. Boyle Reservoir. Visual observation of juveniles indicated that the reservoir supports a breeding population of turtles (KRRC 2020b).

4.8.1.1.3 Mammals

Bat species are discussed in Section 4.6 *Wildlife Resources* under wildlife protection policies of the California and Oregon regulations (KRRC 2019).

4.8.1.2 Botanical Resources

The Renewal Corporation conducted special-status plant surveys in 2018 and 2019 during the blooming seasons of the species known to potentially occur within the Proposed Action area. The surveys extended throughout the entire Lower Klamath Project area, including a 0.25-mile buffer. Plants considered to have "special status" are federally listed (threatened, endangered, or proposed for listing), state listed as threatened or endangered (within California and Oregon), and those on the Oregon Natural Heritage Program

Lists 1 to 4 and California Rare Plant Rank 1 to 4.[15] Species status pertaining to the BLM and USFS lands were also considered in reporting.

Reviewing federal and state databases provided a total of 78 RTE plant species that have potential to occur within the Lower Klamath Project area, including 65 vascular plant species, 3 bryophyte species, and 10 species of lichens (SWRCB 2020a). Of the 78 species presumed to be within the Lower Klamath Project area, 14 species were observed during PacifiCorp 2002 surveys or were previously documented by BLM, ORBIC, or CDFW. As of 2020, 13 of the 14 RTE species still retain special status (PacifiCorp 2004a). The RTE plants determined to potentially occur in the Lower Klamath Project area were primarily associated with a reservoir, and all plants were terrestrial, vascular plants (Table 4-30). Many of these plants prefer wet, meadow, and wetland habitats, and/or utilize moist or wet soils. Table 4-30 identifies the nine plants that were recorded within the Lower Klamath Project area during the 2018 and 2019 special-status plant surveys (KRRC 2019; KRRC 2020b).

[15] For additional information on the ranking systems of Oregon and California, visit the following websites:
(Oregon): https://inr.oregonstate.edu/sites/inr.oregonstate.edu/files/2019-rte-book.pdf
(California): https://www.cnps.org/rare-plants/cnps-rare-plant-ranks

Table 4-30 Preliminary List of Special-Status Plants with Potential to Occur in Lower Klamath Project Area

Species	Status	Habitat	Location of Documented Occurrence(s)	Bloom Time	Proposed Survey Effort
Western yellow cedar *Callitropsis nootkatensis*	Petitioned for federal listing, CNPS List 4.3	Wet to moist sites, from the coastal rainforests to rocky ridgetops near the timberline in the mountains.	NA	NA	In construction areas in suitable habitat.
Greene's mariposa-lily *Calochortus greenei*	FSC, BLM, OC, ONHP List 1, CNPS List 1B	Occurs primarily in annual grassland, wedgeleaf ceanothus chaparral, and oak and oak-juniper woodlands.	Several locations around Iron Gate Reservoir (PacifiCorp 2004; CNDDB, KRRC 2019a).	May through July	In construction areas in suitable habitat.
Bristly sedge *Carex comosa*	ONHP List 2	Marshes, lake shore, and wet meadows.	East Shore of J.C. Boyle Reservoir in two locations (east of dam and south of Highway 66); also, west of dam (ORBIC 2017, KRRC 2019a).	May through September	Along reservoir margins and in construction areas in suitable habitat.
Mountain lady's slipper *Cypripedium montanum*	ONHP List 4, CNPS List 4	Dry, open conifer forests, more often in moist riparian habitats.	J.C. Boyle peaking reach (location details unknown) (PacifiCorp 2004).	March through August	In construction areas in suitable habitat.
Gentner's fritillary *Fritillaria gentneri*	FE, CNPS List 1B	Cismontane woodland, chaparral and mixed hardwood-conifer vegetation dominated by Oregon oak.	Habitat present in the reach along Copco and Iron Gate Reservoirs; no known locations.	Late March to early April; April and May at higher elevations	In construction areas in suitable habitat.
Bolander's sunflower *Helianthus bolanderi*	BLM, ONHP List 3	Occurs in yellow pine forest, foothill oak woodland, chaparral, and occasionally in serpentine substrates or wet habitats.	South of Iron Gate Reservoir near proposed disposal site, J.C. Boyle peaking reach (location details unknown) (PacifiCorp 2004, KRRC 2019a)).	June through October	In construction areas in suitable habitat.

Species	Status	Habitat	Location of Documented Occurrence(s)	Bloom Time	Proposed Survey Effort
Purple flowered Washington lily *Lilium washingtonianum ssp. purpurascens*	CNPS List 4	Forest openings, chaparral, burned clearcuts, and roadsides.	Several locations around Copco Lake, including near Copco Road along the seep area (KRRC 2019a).	June through August	Within the limits of work in suitable habitat.
Bellinger's meadow-foam *Limnanthes floccosa ssp. bellingerana*	FSC, BLM, OC, ONHP List 1, CNPS List 1B	High elevation vernal pools in shallow soiled rocky meadows in spots that are at least partially shaded in the spring.	J.C. Boyle peaking reach (location details unknown) (PacifiCorp 2004).	April through June	In construction areas in suitable habitat.
Detling's silverpuffs *Microseris laciniata ssp. detlingii*	CNPS List 2	Chaparral and grassy openings among Oregon white oak trees.	One location on the western side of Iron Gate Reservoir (CNDDB 2018, KRRC 2019a).	May and June	In construction areas in suitable habitat.
Egg Lake monkeyflower *Mimulus pygmaeus*	FSC, CNPS List 4	Occurs in damp areas or vernally moist conditions in meadows and open woods.	East of J.C. Boyle Reservoir in two locations (north of Highway 66 and southeast of dam); west of dam in two locations in damp mudflats; also, west of canal near access road in one location (PacifiCorp 2004).	May through August	Along reservoir margins and in construction areas in suitable habitat.
Greene's four o-clock *Mirabilis greenei*	CNPS List 4	Dry slopes and flats among juniper and foothill woodlands, and grasslands.	Along the western side of the Iron Gate Reservoir (KRRC 2019a).	May and June	Within the limits of work in suitable habitat.
Holzinger's orthotrichum moss *Orthotrichum holzingeri*	CNPS List 1B.3	Found on vertical calcareous rock surfaces and at the bases of Salix bushes just above rock that is frequently inundated by seasonally high water in dry coniferous forests.	Just upstream of Iron Gate Reservoir on Jenny Creek (CNDDB 2018).	NA	Where in-stream work could occur at Jenny Creek at bridge.
Western yampah *Perideridia erythrorhiza*	FSC, BLM, OC, ONHP List 1	Occurs in moist prairies, pastureland, seasonally wet meadows, and oak or pine woodlands, often in dark wetland soils and clay depressions.	Along three drainages into the western side of J.C. Boyle Reservoir, and in two locations west of the canal near the access road (PacifiCorp 2004, KRRC 2019a)).	Mid July and August	Along reservoir margins and in construction areas in suitable habitat.

Species	Status	Habitat	Location of Documented Occurrence(s)	Bloom Time	Proposed Survey Effort
Howell's yampah (Howell's false caraway) *Perideridia howelii*	ONHP List 4	Moist meadows and stream banks.	One location along the drainage southeast of J.C. Boyle Reservoir; one location along the northern side of Copco Lake north of the road (PacifiCorp 2004).	July and August	Along reservoir margins and in construction areas in suitable habitat.
Yreka phlox *Phlox hirsuta*	FE, CE, CNPS List 1B	Open areas on dry serpentine soils and at elevations ranging from 2,500 to 4,400 feet.	Not known to occur near construction areas; no suitable ultramafic soils occur within 0.5 mile of construction areas (NRCS 2017).	March and April	None – suitable soils, not present in construction areas
Strapleaf willow *Salix ligulifolia*	ONHP List 3	Riverbanks, wetlands, and floodplains.	One location west of J.C. Boyle Dam in a boulder flood channel in the dam release zone (ORBIC 2017, KRRC 2019a)).	March through June	Along reservoir margins and in construction areas in suitable habitat.
Fleshy sage *Salvia dorrii var. incana*	CNPS List 3	Occurs in silty to rocky soils in great basin scrub, pinyon, and juniper woodland.	Three locations around Iron Gate Reservoir (PacifiCorp 2004, KRRC 2019a)).	May through July	In construction areas in suitable habitat.
Lemmon's silene *Silene lemmonii*	ONHP List 3	Open pine woodlands.	J.C. Boyle peaking reach to J.C. Boyle Reservoir (location details unknown) (PacifiCorp 2004).	Spring and Summer	In construction areas in suitable habitat.

Source: KRRC 2020b

Key:
BLM: Bureau of Land Management sensitive species -species that could easily become endangered or extinct. CE: California Endangered
CNDDB: California Natural Diversity Database
CNPS List 1A: California Native Plant Society (CNPS)-Presumed extinct in California CNPS List 1B: rare, threatened, or endangered in California and elsewhere
CNPS List 2: rare, threatened, or endangered in California, but more common elsewhere CNPS List 3: on the review list – more information needed
CNPS List 4: on the watch list – limited distribution FE: Federal Endangered
FSC: Federal Species of Concern
OC: Candidate listing by Oregon Department of Agriculture
ONHP List 1: Oregon Natural Heritage Program threatened with extinction or presumed to be extinct throughout their entire range ONHP List 2: threatened with extirpation or presumed to be extirpated from the State of Oregon
ONHP List 3: more information is needed before status can be determined, but may be threatened or endangered in Oregon or throughout their range ONHP List 4: of conservation concern but not currently threatened or endangered
ORBIC: Oregon Biodiversity Information Center USFWS: United States Fish and Wildlife Service

Table 4-31 Special-Status Plant Observations by Reservoir

Species	Observation Location		
	Iron Gate Reservoir	Copco Lake	J.C. Boyle Reservoir
Greene's mariposa-lily *Calochortus greenei*	Several locations in the vicinity of the Iron Gate Reservoir, including within the footprint of the Iron Gate disposal site.	Along utility corridors between the Copco No. 1 and Copco No. 2 dams, and between Copco No. 2 Dam and Daggett Road bridge.	
Detling's silverpuffs *Microseris laciniata ssp. detlingii*	Present in Iron Gate disposal site east of dam; also, along utility corridor on the southeastern side of the reservoir.	Along the utility corridor between Copco No. 2 Dam and Daggett Road Bridge.	
Bolander's sunflower *Helianthus bolanderi*	Present in the Iron Gate disposal area east of the dam; present in the transmission line corridor to west of Jenny Creek confluence.	Observed in the transmission line corridor northwest of the reservoir.	A large group was observed on the eastern shore in Klamath Sportsman's Park.
Fleshy Sage *Salvia dorrii var. incana*	Two locations near Iron Gate Reservoir; both in proximity to but outside of the construction footprint for removal of utility poles.		
Western Yampah *Perideridia erythrorhiza*			North of the J.C. Boyle Dam in a dry meadow; will likely be outside the area of impact from the drawdown of the reservoir.
Bristly sedge *Carex comosa*			Observed in three locations in Klamath Sportsman Park wetlands on the eastern shore north of the Highway 66 bridge.
Greene's four o'clock *Mirabilis greenei*	Observed in the utility corridor on the northeastern side of the reservoir.	Observed in four locations along the northern side of the Klamath River, downstream of the Copco No. 2 Dam.	
Purple-flowered Washington lily *Lilium washingtonianum* ssp. *purpurascens*	Near the Fall Creek diversion.	Along the northern side of Copco Lake; several observations in mountain seepage -associated wetlands along the northwestern shore of the reservoir.	
Strapleaf willow *Salix ligulifolia*			Observed along the river just downstream of the J.C. Boyle Dam.

Source: KRRC 2020b

4.8.1.3 Aquatic Resources

The Klamath River Basin is home to several aquatic species of special interest. A detailed list of all these species can be found within Table 3.3-1 in the SWRCB Final EIR (Attachment 1 Revisions to Draft EIR Volume I and Volume II). Below is a detailed description of the three federally threatened or endangered aquatic species found within the Lower Klamath Project area.

4.8.1.3.1 Lost River Sucker

The Lost River sucker is endemic to the Klamath River Basin. It has been a state listed species in California since 1974, and in 1988 was listed as federally endangered under the ESA (PacifiCorp 2004b). The Lost River sucker was once plentiful in the river basin; however, the loss of suitable habitat has contributed to a decrease in the population. Alterations to the natural hydrology of the basin, including the construction of dams, the loss of former wetland habitat, and increased amounts of nutrient runoff, have degraded the Lost River sucker's habitat and impacted the size of the population (USFWS 2019).

4.8.1.3.2 Shortnose Sucker

The shortnose sucker is endemic to the Klamath River Basin. It has been a state listed species (California) since 1974, and in 1988 was listed as federally endangered. The species was once plentiful in the river basin; however, similar to the Lost River sucker, the viability of the shortnose sucker is imperiled due to habitat alteration and degradation (USGS 2020).

Since 2016, PacifiCorp has implemented habitat enhancement measures as part of the Habitat Conservation Plan (HCP) for Interim Operations to aid in the conservation of Lost River and shortnose suckers within the Lower Klamath Project area (PacifiCorp 2016b).[16] The HCP for Lost River and shortnose suckers identifies the two main initiatives implemented in the past to minimize impact on sucker populations to be 1) shutting down the East Side and West Side hydroelectric facilities to minimize the intake of suckers, and 2) funding initiatives for sucker conservation, including sucker habitat enhancement.

The Renewal Corporation conducted reservoir sampling for Lost River and shortnose sucker in J.C. Boyle, Copco, and Iron Gate reservoirs during night-time hours in spring and fall 2019. The reservoirs were sampled via trammel nets in late March and early April 2019 and via electrofishing in early November 2019 (KRRC 2020b). Field teams captured shortnose suckers in all three reservoirs but captured Lost River suckers only in J.C. Boyle Reservoir (KRRC 2020b), (Appendix D).

[16] Klamath Hydroelectric Project Interim Operations Habitat Conservation Plan (HCP) for Lost River and Shortnose Suckers, Annual Report on HCP Activities During 2015. PacifiCorp. Portland, Oregon.

4.8.1.3.3 Coho Salmon

Coho salmon is an anadromous fish native to the Klamath River Basin. The specific population of coho salmon which inhabits the basin is identified as the Southern Oregon/Northern California (SONC) evolutionarily significant unit (ESU). The coho salmon unit of the Klamath River Basin was listed as a threatened species under the ESA in 1997. The production of coho salmon in the SONC ESU is lower than it has been historically. Estimates by Hardy and Addley (2001) suggest that the total coho salmon stock (both wild and from hatchery stock) decreased by more than 90 percent between the 1940s and 1983. Hatchery-raised coho salmon are stocked to supplement the declining native population. According to the National Research Council, beginning in 2003 an average of 71,000 coho smolts were released into the Klamath River each year from the Iron Gate Fish Hatchery. Reasons for the decline in coho salmon numbers can be attributed to degradation and loss of adequate spawning and rearing habitat. The presence of dams contributes to such habitat loss (PacifiCorp 2004).

Since 2012, PacifiCorp has been implementing habitat enhancement measures to aid in the conservation of coho salmon within the Lower Klamath Project area (PacifiCorp 2016a) as part of the Klamath Hydroelectric Settlement Agreement. The recent enhancement initiatives recorded in 2020 include (PacifiCorp 2020):

- Iron Gate Flow Releases. Instream flow, flow variability, and flow ramping rate measures to benefit listed coho salmon downstream of Iron Gate Dam.
- Iron Gate Turbine Venting. Turbine venting implemented at the Iron Gate powerhouse in 2015 to enhance dissolved oxygen (DO) concentrations in surface waters downstream of Iron Gate Dam.
- Large Woody Debris (LWD) Retrieval. Retrieval of LWD trapped at or near upstream Lower Klamath Project dams, and release of retrieved LWD pieces on a quarterly basis to contribute to the river's habitat forming features.
- Habitat Enhancement Projects (Coho Enhancement Fund). Habitat enhancement and restoration projects to enhance the survival and recovery of listed coho salmon to be conducted by third parties under the Coho Enhancement Fund component of the HCP. As of December 2019, PacifiCorp has provided funding of over $5,4000,000 into the Coho Enhancement Fund.
- Fish Disease Research (Fish Disease Research). Research studies on fish disease conditions and causal factors downstream of Iron Gate Dam conducted by third parties under the Fish Disease Research Fund component of the HCP.
- Iron Gate Hatchery and Genetic Management Plan (HGMP). Iron Gate Hatchery measures under an approved HGMP to maximize conservation benefits of the hatchery program to coho salmon funded by PacifiCorp and conducted by the CDFW in cooperation with NMFS. Under the HGMP, spawning surveys have been conducted in the 2015-16, 2016-17, 2017-18, 2018-19, and 2019-20 spawning seasons
- Gravel augmentation immediately below Iron Gate Dam. As of December 2019, just under 4,500 cubic yards of spawning gravel has been placed in the Klamath River below J.C. Boyle Dam.

For a list of additional sensitive aquatic species, see Table 3.3-1 in "Attachment 1 Revisions to Draft EIR Volume I and Volume II."

4.8.2 Environmental Analysis

4.8.2.1 Avian Fauna

Avian RTE and species of special concern within the Lower Klamath Project area may be directly and indirectly impacted by the Proposed Action, primarily due to construction-related activities and noise related disturbances, but impacts are expected to be short-term and temporary in nature.

4.8.2.1.1 Eagles

Federally protected bald and golden eagles have been observed utilizing habitat within the Proposed Action area during surveys in 2019 (KRRC 2020b). The Iron Gate Reservoir and Copco Lake are areas where the most eagle activity was observed. Bald eagles have been observed flying within the Proposed Action area and using the reservoirs for foraging. Active and inactive bald eagle nests have been observed within 0.5 mile of the Proposed Action and within what is considered an area of impact (KRRC 2020b). Golden eagle nests were observed within 0.25 mile of the buffer area of the Proposed Action. Golden eagles were observed flying and foraging around the reservoirs (KRRC 2020b).

The Proposed Action includes a drawdown of the reservoirs which could alter the typical foraging habits for eagles. Furthermore, general construction activity could impact the desire of eagles to continue to utilize their current nesting areas. Both of these impacts could affect the suitability of potential eagle habitat within the Proposed Action area in the short-term. The Proposed Action will not cause direct fatalities of bald eagles, but reservoir drawdown will permanently change the forage base for bald eagles that nest near reservoirs. Short-term construction related impacts, such as structure demolition and road upgrades may result in noise and habitat disturbances to bald and golden eagles.

Northern Spotted Owl

No NSO were observed during the Renewal Corporation's 2018 surveys (KRRC 2019) and, at this time, it is assumed that there are no NSO in the Proposed Action area. Suitable habitat for the NSO was found around J.C. Boyle Dam and associated facilities, the disposal site, and haul and access roads. The facilities associated with Copco No. 1, Copco No. 2, and Iron Gate Dams, including their reservoirs were determined to have poor habitat for NSO (KRRC 2019).

4.8.2.1.2 Foraging Birds

Bird species such as the sandhill crane (*Grus canadensis*) and black tern (*Childonias niger*) create "floating" nests in the shallow parts of waterbodies. Although no nests were observed during surveys in 2002 and 2003, the Proposed Action could create fluctuations in water level that could impact the survivability of such nests in riverine and former reservoir areas of the Lower Klamath Project. After the post-drawdown phase

and water levels and flow become more stable, habitat will again become suitable for foraging and nesting for these birds.

Other RTE bird species utilize the riverine and reservoir areas of the Proposed Action for foraging. Osprey are known to establish nests near reservoirs and flooded areas to forage for warm-water fish (PacifiCorp 2004). It was noted in a previous License Application (Final License Application, Volume 2. Exhibit E Botanical and Wildlife Resources Report) for the Lower Klamath Project that the presence of dams and their resulting reservoirs may promote the establishment of osprey populations (PacifiCorp 2004). Implementation of the Proposed Action may alter their established foraging habits.

The Proposed Action could alter the hydrology which could impact the willow-riparian communities existing along the reservoirs, and thus have a potential impact on the available habitat for willow flycatchers. Furthermore, proposed bridge improvements overlap within some of the areas where habitat was discovered. Although the initial impact of the Proposed Action may result in disturbance of existing wetlands (including willow-riparian communities), the Proposed Action will create more interconnected wetland and riparian systems in the stretches on formally dammed rivers such as the Klamath (American Rivers 2002). Over time willow flycatchers will benefit from a more connected system of riparian habitat.

Renewal Corporation biologists observed a great blue heron colony along the shorelines of the Copco No. 2 penstock and noted that the nest could be disturbed due to implementation of the Proposed Action. A single sandhill crane nest was located along the northwestern shoreline of the J.C. Boyle Reservoir (KRRC 2018). This nest could also be impacted if there is significant disturbance to the area around this portion of the reservoir during nesting season.

Two peregrine falcon nests were observed in 2018, on rocky outcrop/cliff structures within the vicinity of the Proposed Action area (KRRC 2019). Renewal Corporation biologists acknowledge that falcons and their nesting sites could be disturbed due to the demolition of the J.C. Boyle power canal/powerhouse and associated truck traffic and hauling activities (KRRC 2019).

In 2018, tricolored blackbirds were observed in an agricultural field approximately 12 miles from the Iron Gate Dam (KRRC 2019). A single male was observed along the Klamath River near the confluence of Fall Creek (within work limits on Daggett Road). This suggests that these birds may frequent the areas in the vicinity of the Proposed Action and thus be exposed to construction-related disturbances from implementation (KRRC 2019).

Other birds including the common loon, American white pelican, and white-faced ibis (*Plegadis chih*i) forage in the shallow marsh waters of rivers and lakes (Audubon 1996). The Proposed Action will likely alter the wetlands and marshes and related organisms which represent a food source for these birds. Migratory birds use the existing reservoirs for foraging, nesting, and/or loafing during their migrations (SWRCB 2020a).

General construction activities will cause an increase in noise levels in the area, which has potential to disturb nesting bird populations.

The existence of similar, undisturbed habitats upriver from the Proposed Action area minimizes the potential impacts on avian life. Ideal nesting and foraging habitat for RTE birds will remain intact in these upriver areas while habitat in the Proposed Action area changes.

4.8.2.2 Reptiles and Amphibians

Western pond turtles may be temporarily disturbed by the fluctuating water levels of the river during the Proposed Action. Short-term impacts are anticipated during reservoir drawdown due to shoreline habitat or entrapment during sediment inflows and drying, and changes in water temperature (SWRCB 2020b). The SWRCB determined that, once the Proposed Action is complete, riverine habitat within the newly connected Klamath River will continue to support all life stages and functions of the western pond turtle (SWRCB 2020b).

Visual pond turtle surveys conducted in 2019 confirm that the turtles are "common" in the reservoir (KRRC 2020b) (Appendix D). The study suggested that the pond turtles overwintered along the shoreline of the impounded reservoirs, specifically within the refugia (KRRC 2020b) (Appendix D). Increased flows and suspended sediment concentrations could cause Western pond turtle to move away from underwater habitat and become vulnerable to predators. These flows and suspended sediment concentrations could also cause a short-term lack of foraging opportunities (SWRCB 2020a).

As the California mountain kingsnake utilizes a more "generalist" habitat, no impacts are anticipated from the Proposed Action.

The northern sagebrush lizard's habitat within the Proposed Action area is not expected to be adversely impacted by construction.

4.8.2.2.1 Mammals

The only RTE or listed mammals which may be directly impacted by the Proposed Action are bats. Bat surveys conducted in 2019 by the Renewal Corporation biologists have confirmed the presence of bats within the Proposed Action area (KRRC 2020b). Two species, Townsend's big-eared bat, a California Species of Special Concern, and the Yuma myotis, are known to roost within many structures across the Proposed Action area. Although the big-eared bat was not directly observed during the most recent surveys in 2019 (KRRC 2020b). The typical roosting habitat for these species is in caves, mines, buildings, or under bridges (Bat Conservation International 2020). The demolition of the associated gatehouses and powerhouses could deprive local bat populations of habitat which they currently use.

In addition to roosting habitat, RTE bat species use the existing reservoirs for foraging habitat. The bats prey on the aquatic emergent insects which inhabit the area (SWRCB 2020a). Macroinvertebrate aquatic habitat will be temporarily disturbed; however, after the initial phases of the Proposed Action, an aquatic environment that would likely be suitable for insect breeding and habitat may be created and provide foraging for bats.

Although never formally surveyed or observed by the Renewal Corporation, transient populations of gray wolves, a federally endangered species in California and parts of Oregon (USFWS 2020b), have potential to occur within the Lower Klamath Project area. The Renewal Corporation will continue to coordinate with federal and state organizations on any new information that is learned regarding these species within the Proposed Action area (KRRC 2019).

4.8.2.3 Botanical Resources

Almost all observations of RTE vegetation were within the Lower Klamath Project reservoir areas. The draining of the reservoirs could alter certain characteristics of the surrounding environment where these plant populations exist. Some of the observed plant species are known to use habitat features that are more likely to be exposed to periods of moisture, such as riparian zones, marshes, damp soil, and wetlands. The drawdown of the reservoirs and the receding of the riverbank could change these habitats by reducing moisture available to certain RTE plants. For example, bristly sedge (*Carex comosa*) and strapleaf willow (*Salix ligulifolia*) are found along waterbodies that will be impacted by the Proposed Action. Conversely, the Proposed Action could potentially create new habitat for other listed plant species.

Special Status plant species were observed in areas that will be disturbed during implementation of the Proposed Action. These areas include the Iron Gate disposal site and the area along the utility corridor where poles will be removed. The locations of these species have been recorded to avoid disturbance in these areas during construction (KRRC 2020b).

4.8.2.4 Aquatic Resources

The Proposed Action will increase the connectivity of fish habitat in the Klamath River and benefit the endangered fish populations within the Klamath River Basin. There will be more connected riverine habitat for the migration and spawning of the coho salmon.

The Copco and J.C. Boyle reservoirs are known to produce large blooms of blue green algae. These large blooms lower water quality, and thus diminish the habitat of fish species of concern. Post-drawdown and implementation of the Proposed Action will result in the river basin becoming more riverine, a reduction of algal blooms, and an increase in water quality, thereby improving habitat for coho salmon and other listed species.

The Lower Klamath Project diminished water quality by creating stagnant water in reservoirs which have higher temperatures than free flowing water. The Proposed Action will have the additional benefit of preventing higher temperatures within reservoirs in the summer, thus improving habitat conditions and alleviating conditions that contribute to fish disease (PacifiCorp 2004b).

4.8.3 Proposed Measures

The Renewal Corporation proposes to implement the measures stated in the DDP, and outlined in Table 3-1, to address impacts to each resource area. A summary description and analysis of each measure is outlined in the "References" column of Table 3-1.

Management plans are under development to ensure those measures are successfully implemented and meet the interests of stakeholders. These management plans are outlined in Table 3-2 as well as in the DDP. Below are the specific proposed measures and management plans related to RTE resources.

4.8.3.1 Terrestrial Resources

The Renewal Corporation will implement measures pertaining to RTE terrestrial resources. The measures include, but are not limited to (SWRCB 2020a; ODEQ 2018b):

- Implement the Terrestrial and Wildlife Management Plan, which will include the Amphibian and Reptile Relocation Plan, the Bald and Golden Eagle Management Plan, measures to protect the Gray Wolf, and measures to rescue and relocate amphibians and reptiles including the western pond turtle (TRM-1).
  - These efforts are outlined in further detail in Section 4.6 *Wildlife Resources.*
- Implement measures for bird and bat species, including the bat best management measures and nesting bird surveys and avoidance and minimization measures, as well as the Construction Management Plan (TRM-1).
  - These measures are outlined in further detail in Section 4.6 *Wildlife Resources.*

4.8.3.2 Aquatic Resources

The implementation of the Proposed Action will result in overall benefits to habitat for coho salmon (SWRCB 2020a). ODFW, cited in ODEQ 2018b, does not anticipate any long-term impacts to native resident fish populations in the Proposed Action area. Additionally, ODEQ found that, with implementation of these proposed measures, the Proposed Action will minimize to the extent practicable the short-term impacts on threatened and endangered species (ODEQ 2018b). The Renewal Corporation proposes to implement measures pertaining to RTE aquatic resources to meet objectives that will be described in NMFS's final ESA Section 7 Biological Opinion. The measures include, but are not limited to:

- Implement the Adaptive Management Plan regarding the sampling, salvage, and relocation of listed sucker species (ARM-1)
- Implement a juvenile coho relocation in specified tributaries if drawdown conditions warrant (ARM-1).
- Perform drawdown during the winter months to limit the suspended sediment concentrations during critical outmigration times (ARM-1).

- The Renewal Corporation will implement abundance and overwintering studies for the western pond turtle (TRM-1).
    - These measures are outlined in further detail in Section 4.5.

4.8.4 Unavoidable Adverse Impacts

The Renewal Corporation (as FERC's designated non-federal representative) is currently developing a draft BA to further define potential impacts of the Proposed Action to federally listed species. The BA will address the significance of any impact to listed species. Short term impacts associated with the release of large amounts of water, heavy construction, noise, sediment, and possibly inorganic contaminants are anticipated, but will be mitigated by managements plans incorporated in the DDP. The Proposed Action will increase the connectivity of fish habitat in the Klamath River and benefit the endangered fish populations within the Klamath Basin.

4.8.5 References

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4.9 Recreation, Land Use, Aesthetic, and Air Quality Resources

As described in Section 4.1, this Exhibit E incorporates by reference the extensive environmental documentation developed since the 2004 PacifiCorp Application as described in Table 4-32 and Table 4-33.

Table 4-32 Cross-walk of Recreation, Land-Use, and Aesthetics Reference Documents

Date	Author	Reference Document	Section Number	Page Number(s)
2004	PacifiCorp	Application for New License	E7.0 E8.0	7-1 – 7-123 8-1 – 8-116
2007	FERC	Final EIS	3.3.6	3-426 – 3-511
2012	U.S. BOR	EIS/EIR	3.14 3.19 3.20	3.14-1 – 3.14-28 3.19-1 – 3.19-36 3.20-1 – 3.20-65
2018	KRRC	Definite Plan Report	Appendix Q	9 – 47
2020	SWRCB	Final EIR	3.19 – 3.20	AT1-863 – AT1-982
2020	State of California	401 WQ Certificate	Condition 19	41 – 42; 81 – 84
2018	State of Oregon	401 WQ Certificate	8	6 – 8
2020	SWRCB	Attachment 4: CEQA Findings	N/A	123 – 126 139 – 141
2018	ODEQ	Evaluation and Findings Report	4.2.4	16
2011-2020	PacifiCorp	KHSA Interim Measures Implementation Annual Report (2020)	N/A	N/A

Table 4-33 Cross-walk of Air Quality Reference Documents

Date	Author	Reference Document	Section Number	Page Number(s)
2004	PacifiCorp	Application for New License	N/A	N/A
2007	FERC	Final EIS	N/A	N/A
2012	U.S. BOR	EIS/EIR	3.9 3.10	3.9-1 – 3.9-31 3.10-1 – 3.10-52
2018	KRRC	Definite Plan Report	N/A	N/A
2020	SWRCB	Final EIR	3.9	AT1-731 – AT1-732
2020	State of California	401 WQ Certificate	N/A	N/A
2018	State of Oregon	401 WQ Certificate	N/A	N/A
2020	SWRCB	Attachment 4: CEQA Findings	N/A	76 – 81 168 – 171
2018	ODEQ	Evaluation and Findings Report	N/A	N/A
2011-2020	PacifiCorp	KHSA Interim Measures Implementation Annual Report (2020)	N/A	N/A

4.9.1 Affected Environment

4.9.1.1 Regional Recreation Opportunities

The Lower Klamath Project is located in Oregon and California, east of the Cascade Mountains and perpendicular to the California Siskiyou Mountains. The Klamath River Basin includes rivers, streams, and lakes throughout the mountainous areas and grasslands in the high plateau areas. In the Klamath River Basin there are four national forests (Klamath, Fremont-Winema, Six Rivers, and Modoc), one joint national and state park (Redwood), one national park (Crater Lake), two national monuments (Lava Beds and Cascade-Siskiyou), and five National Wildlife Refuges (Klamath Marsh, Tule Lake, Clear Lake, Upper Klamath, and Lower Klamath) (Figure 4-11 and Table 4-34) (SWRCB 2020a). These areas provide a variety of water-based recreation opportunities (boating, fishing, swimming), camping, hiking, and wildlife viewing, among others (SWRCB 2020a).

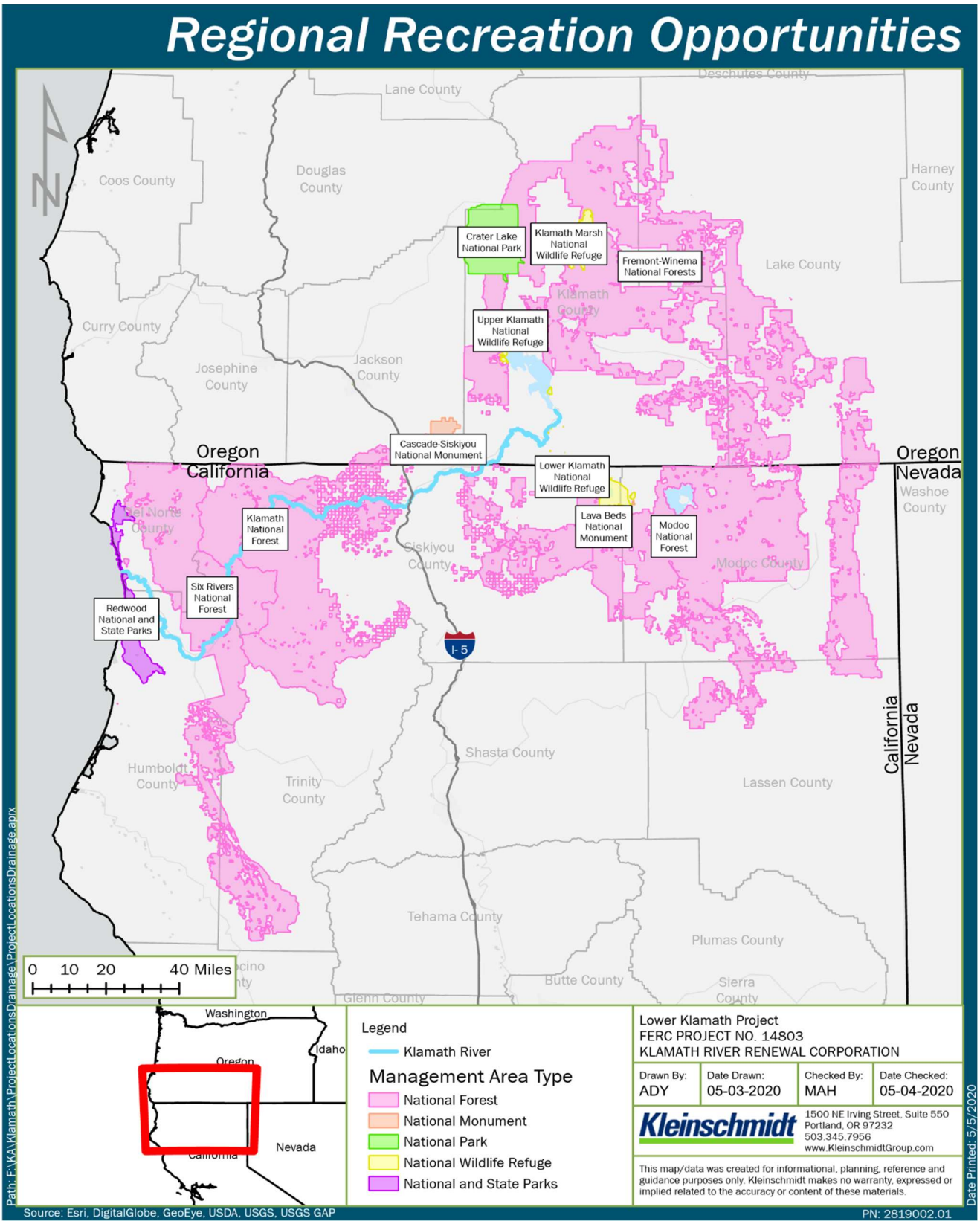

Figure 4-11 Regional Recreational Opportunities

Table 4-34 Regional Recreation Opportunities

Recreation Area	Managed By	Recreation Opportunities
Klamath National Forest	US Forest Service	Camping, sightseeing, hiking, picnicking, fishing, boating, wildlife viewing, biking, hunting
Fremont — Winema National Forest	US Forest Service	Camping, sightseeing, hiking, picnicking, fishing, boating, wildlife viewing, rock climbing, hunting
Six Rivers National Forest	US Forest Service	Camping, hiking, picnicking, fishing, boating, wildlife viewing, hunting
Modoc National Forest	US Forest Service	Camping, sightseeing, picnicking, fishing, boating, wildlife viewing, hunting
Redwood National and State Parks	National Park Service	Camping, sightseeing, hiking, picnicking, fishing, boating, wildlife viewing, mountain biking
Lava Beds National Monument	National Park Service	Camping, hiking, picnicking, wildlife viewing
Cascade-Siskiyou National Monument	National Park Service	Camping, sightseeing, hiking, fishing, boating, wildlife viewing, mountain biking, hunting
Crater Lake National Park	National Park Service	Camping, sightseeing, picnicking, hiking, fishing, rock climbing, swimming
Klamath Marsh National Wildlife Refuge	US Fish and Wildlife Service	Sightseeing, fishing, boating, wildlife viewing, waterfowl hunting
Tule Lake National Refuge	US Fish and Wildlife Service	Hunting, wildlife viewing
Lower Klamath National Wildlife Refuge	US Fish and Wildlife Service	Sightseeing, wildlife viewing, waterfowl, and pheasant hunting
Upper Klamath National Wildlife Refuge	US Fish and Wildlife Service	Sightseeing, picnicking, fishing, boating, wildlife viewing, waterfowl hunting

Source: SWRCB 2020a

4.9.1.1.1 River-based Regional Recreation

Portions of the Klamath River and its tributaries are designated as a national Wild and Scenic River (see additional information below) (SWRCB 2020a). The Klamath River and the many rivers in the area provide a variety of recreational opportunities that include fishing (Table 4-35) and whitewater boating (Table 4-36).

Table 4-35 Regional River Fishing Opportunities

River	Fish Species Caught	Common Types of Fishing
McCloud River	Native trout	Fly fishing, bank fishing
Pit River	Native trout; brown trout; smallmouth bass; rough fish	Fly fishing, bank fishing
Rogue River	Chinook salmon, steelhead	Drift boat, powerboat, fly fishing
Salmon River	Chinook salmon, steelhead, resident trout	Fly fishing, bank fishing
Scott River	Chinook salmon, steelhead, resident trout	Fly fishing, bank fishing
Smith River	Chinook salmon, steelhead	Drift boat, powerboat, fly fishing, bank fishing
Trinity River	Chinook salmon, steelhead, sturgeon, American shad, lamprey	Drift boat, powerboat, fly fishing, bank fishing
Upper Sacramento	Chinook salmon, native and stocked trout, American shad	Fly fishing, bank fishing
Klamath River	Redband trout, salmon	Fly fishing, bank fishing, drift boat

Source: SWRCB 2020a

Table 4-36 Regional Whitewater Boating Opportunities

River	Generalized Use Levels	Boating Class Type1	Miles of Boatable Whitewater	Factors Affecting Use Levels
Clear Creek	Low	III–V	7	Difficult access
Klamath River (upstream of Oregon-California state line)	Moderate	III–IV+	31	Remote, not suited for beginner or intermediate boaters, unless accompanied by a commercial outfitter
Klamath River (downstream from Iron Gate Dam)	Moderate	II–V	122	Most skill levels, easy access, 186 miles support multi-day floats, shoreline camping, scenery, many outfitters, commercial use
North Umpqua River	Moderate	II–IV	32	Easy access, most skill levels, scenery, boatable year-round, shoreline suitable for camping
McCloud River	Moderate	II–IV	35	Proximity to Interstate 5, most skill levels, low flows in summer
Pit River	Low	IV–V	34	Fragmented/short runs with long stretches of flat water between, remote location
Rogue River	High	II–V	100+	Easy access, most skill levels, scenery, boatable year-round, shoreline suitable for camping, many commercial outfitters
Salmon River	Moderate	II–V	44	Requires advanced/expert boating skills, commercial use
Scott River	Low	III–V	20	Recommended for expert boaters only
Smith River	Low	II–V	100+	Requires advanced/expert boating skills, low summer flows
Upper Sacramento River	Low	III–V	36	Proximity to Interstate 5, average solitude
Trinity River	Moderate	II–V	100+	Most skill levels, easy access, commercial use

Source: SWRCB 2020a

4.9.1.1.2 Reservoir and Lake-based Regional Recreation

There are a number of reservoir and lake-based recreation opportunities in the region, including over 85 boatable lakes within Klamath and Jackson counties, Oregon, and Siskiyou County, California (SWRCB 2020a). Siskiyou County also is home to more than 180 high-elevation and wilderness lakes (SWRCB 2020a). Lakes and reservoirs located in the project region are shown in Table 4-37.

Table 4-37 Lakes and Reservoirs in the Project Region

Lake or Reservoir	Approximate Distance from Project (miles)	Approximate Surface Water (acres)	Number of Developed Campsites	Number of Developed/ Improved Boat Launches	Number of Developed Picnic Areas
Hyatt Reservoir	15	1,250	172	2	1
Emigrant Lake	16	806	110	2	2
Howard Prairie Reservoir	17	2,000	303	4	1
Upper Klamath Lake	20	85,120	269	6	1
Lake of the Woods	21	1,113	190	3	1
Fourmile Lake	26	740	25	1	0
Agency Lake	28	5,500	43	3	0
Applegate Reservoir	36	988	66	3	1
Medicine Lake	46	408	77	1	3
Gerber Reservoir	62	3,830	50	2	1
Trinity Lake Unit	73	16,535	500	7	2
Whiskeytown Lake	87	3,200	139	3	1
Shasta Lake	87	29,500	320	7	7
Lost Creek Lake	78	3,430	202	1	2
Willow Lake	31	927	66	7	8
Willow Valley Reservoir	69	200	1	1	1
Lake Siskiyou	46	160	1		
Juanita Reservoir	14	55	23	2	
McCloud Reservoir	58	520	6	1	1

Source: SWRCB 2020a

4.9.1.2 National Wild and Scenic Rivers, Wilderness Areas, Trails, and Scenic Byways

The National WSRA, passed by Congress in 1968, serves to protect certain rivers with outstanding natural, cultural, and recreational values by preserving their free-flowing condition for the enjoyment of present and future generations (PacifiCorp 2004). Under this Act, there are three designated river classifications: 1) wild, or rivers that are free of impoundments and generally inaccessible by trail with watersheds or shorelines essentially primitive and waters unpolluted; 2) scenic, or rivers that are free of impoundments, with shorelines and watersheds largely primitive and shorelines largely undeveloped but accessible in places by

roads; and recreational, or 3) rivers that are readily accessible by road or railroad, that may have some development along their shorelines and that may have undergone some impoundment or diversion in the past. Wilderness areas are public open space lands designated by Congress and granted protection from motorized use and development (PacifiCorp 2004). The National Trails System Act of 1968 promotes the enjoyment and appreciation of trails with four established classes of trails: national scenic trails, national historic trails, national recreation trails, and side and connecting trails (PacifiCorp 2004). Scenic Byways are roads designated by the U.S. Secretary of Transportation for having one or more archeological, cultural, historic, natural, recreational, and scenic qualities. National Wild and Scenic Rivers, Wilderness Areas, Federally Designated Trails, and Scenic Byways located in the project vicinity are described below.

4.9.1.2.1 National Wild and Scenic Rivers

Oregon

An 11-mile segment of the Upper Klamath River/Hell's Corner Reach was designated as a Wild and Scenic River in 1994 (PacifiCorp 2004). The reach starts below the J.C. Boyle Powerhouse and stretches to the California/Oregon border. The BLM's Lakeview District and the Oregon Department of Parks and Recreation co-manage this segment of the river. All 11 miles of this reach are classified as scenic. This river segment was designated due to fisheries, historic, American Indian traditional use, pre-historic, recreational, scenic, and wildlife outstandingly remarkable values (NWSRS 2020). This river segment provides high quality whitewater boating and angling opportunities due to a continuous series of 46 rapids and a significant rainbow trout fishery (FERC 2007).

California

In 1981, Congress designated 286 miles of the Klamath River and its tributaries as Wild and Scenic (PacifiCorp 2004). The designation begins 3,600-feet-below Iron Gate Dam and includes: Salmon River from its confluence with the Klamath River to the confluence of the North and South Forks of the Salmon River; the North Fork of the Salmon River from the Salmon River confluence to the southern boundary of the Marble Mountain Wilderness Area; the South Fork of the Salmon River from the Salmon River confluence to the Cecilville Bridge; the Scott River from its confluence with the Klamath River to its confluence with Schackleford Creek; and all of Wooley Creek (NWSRS 2020). Of this designated reach, 11.7 miles are classified as wild, 23.5 miles are classified as scenic, and 250.8 miles are classified as recreational (NWSRS 2020). This reach is managed by the BLM Redding Field Office, California Resources Agency, Hoopa Valley Indian Reservation, Karuk Tribe of California, USFS Klamath National Forest, USFS Six Rivers National Forest and the Yurok Tribe (NWSRS 2020).

In addition to the designated river segment, another 5.3-mile reach of the river, beginning at the Oregon-California state line and ending at the Copco No. 1 Reservoir is considered eligible and suitable for Wild and Scenic River designation (SWRCB 2020a). While this reach is not designated and is not protected under the National WSRA, agencies are still required to protect this reach's free-flowing character, water quality and outstandingly remarkable values. Outstandingly remarkable values for this reach are scenic, recreational,

fish, and wildlife (SWRCB 2020a). This river segment is listed on the Nationwide Rivers Inventory, further ensuring protection of its river values (SWRCB 2020a).

4.9.1.2.2 Wilderness Areas

Wilderness Areas are located in the Klamath National Forest, but no designated areas are included in the Lower Klamath Project boundary. Five wilderness areas are located within the Klamath National Forest, including Marble Mountain, Russian, Trinity Alps, Red Buttes, and Siskiyou (PacifiCorp 2004).

4.9.1.2.3 Trails

The Pacific Crest National Scenic Trail stretches for 2,650 miles from Mexico to Canada and passes through California, Oregon, and Washington (PacifiCorp 2004). The trail is open to horse and foot traffic only. While portions of the trail are located within 15 miles of the Upper Klamath River, the trail is outside of the project boundary (PacifiCorp 2004).

4.9.1.2.4 Scenic Byways

There are three Scenic Byways located along the Klamath River and within the Klamath and Six Rivers National Forests (SWRCB 2020a). These byways are listed below.

- State of Jefferson National Forest Scenic Byway – located primarily on California State Highway 96 between Shasta River to Happy Camp (SWRCB 2020a)
- Bigfoot National Forest Scenic Byway – located on Highway 96 from Happy Camp to California State Highway 299 (SWRCB 2020a)
- Volcanic Legacy Scenic Byway (or All American Road) – located from Lassen National Park in California through the project area via Highways 97, 140, and 62 on the way to Crater Lake National Park in Oregon (SWRCB 2020a)

4.9.1.3 Lower Klamath Project Recreation Opportunities in the Project Area

Recreation opportunities are located throughout the project boundary with developed public recreation sites concentrated around J.C. Boyle Reservoir, Copco Lake, and Iron Gate Reservoir. Recreation opportunities at the J.C. Boyle Development, Copco No. 1 Development, and Iron Gate Development are summarized in Table 4-38 and further described below.

Table 4-38 Recreation Opportunities at J.C. Boyle, Copco No. 1, and Iron Gate Developments

Site Name	Owner/Manager	Reservoir/River Access	Facilities
J.C. Boyle Development			
Pioneer Park	PacifiCorp	J.C. Boyle Reservoir Access	Picnic areas, boat launches, interpretive signs, restrooms
Topsy Campground	BLM	J.C. Boyle Reservoir Access	Campsites, RV dump, day-use area, boat launch with dock, fishing pier, restrooms
Sportsman's Park[1]	Klamath County	None	Shooting ranges, dirt racetracks, archery courses, model aircraft flying field, off-highway vehicle area, restrooms
Spring Island	BLM	Hell's Corner Reach	Launch area, shoreline fishing access, restrooms
Klamath River Campground*	BLM	Hell's Corner Reach	Campsites, picnic area, shoreline fishing, boating access, restrooms
Oregon-California State Line Take-out	BLM/PacifiCorp	Hell's Corner Reach	Boat put-in/take-out, shoreline fishing access, restrooms
Fishing Access Sites 1-6	PacifiCorp	Hell's Corner Reach	Shoreline fishing access, parking
Copco No. 1 Development			
Mallard Cove	PacifiCorp	Copco Lake Access	Picnic area, restrooms, boat launch with dock
Copco Cove	PacifiCorp	Copco Lake Access	Picnic area, restrooms, boat launch with dock
Iron Gate Development			
Fall Creek/Fall Creek Trail	PacifiCorp/CDFG	Iron Gate Reservoir	Picnic sites, boat launch access, restrooms, hiking trail
Jenny Creek	PacifiCorp	Iron Gate Reservoir	Picnic sites, fishing access, restrooms
Wanaka Springs	PacifiCorp	Iron Gate Reservoir	Picnic sites, boat dock/fishing pier, restrooms, hiking trail
Camp Creek	PacifiCorp	Iron Gate Reservoir	Campsites, large overflow camp area, boarding and fishing docks, swimming area, RV dump station, sports field, interpretive display, restrooms
Juniper Point	PacifiCorp	Iron Gate Reservoir	Campsites, swimming beach, restrooms
Mirror Cove	PacifiCorp	Iron Gate Reservoir	Campsites, boat launch, restroom
Overlook Point	PacifiCorp	Iron Gate Reservoir	Picnic sites, restrooms
Long Gulch	PacifiCorp	Iron Gate Reservoir	Picnic sites, boat launch, restrooms

Site Name	Owner/Manager	Reservoir/River Access	Facilities
Iron Gate Fish Hatchery	CDFW	Klamath River below Iron Gate Dam	Picnic area, picnic shelter, visitor center/interpretive kiosk, restrooms, trail to river

Source: PacifiCorp 2004

[1]These recreation sites are not associated with the Project or in the project boundary.

4.9.1.3.1 J.C. Boyle Development

There are three developed public recreation sites at the J.C. Boyle Development, including Pioneer Park (east and west units), Topsy Campground, and Spring Island River Access (KRRC 2019). In 2014, estimated annual use at the J.C. Boyle Development included 15,500 daytime visits and 1,700 nighttime visits, in recreation days[17] (KRRC 2020c).

Reservoir Recreation Opportunities

A description of the recreation facilities available at the J.C. Boyle Reservoir is included below. Project recreation sites at J.C. Boyle Development are shown in Figure 4-12.

[17] A "recreation day" is defined by FERC as each visit by a person to a development for recreational purposes during any portion of a 24-hour period.

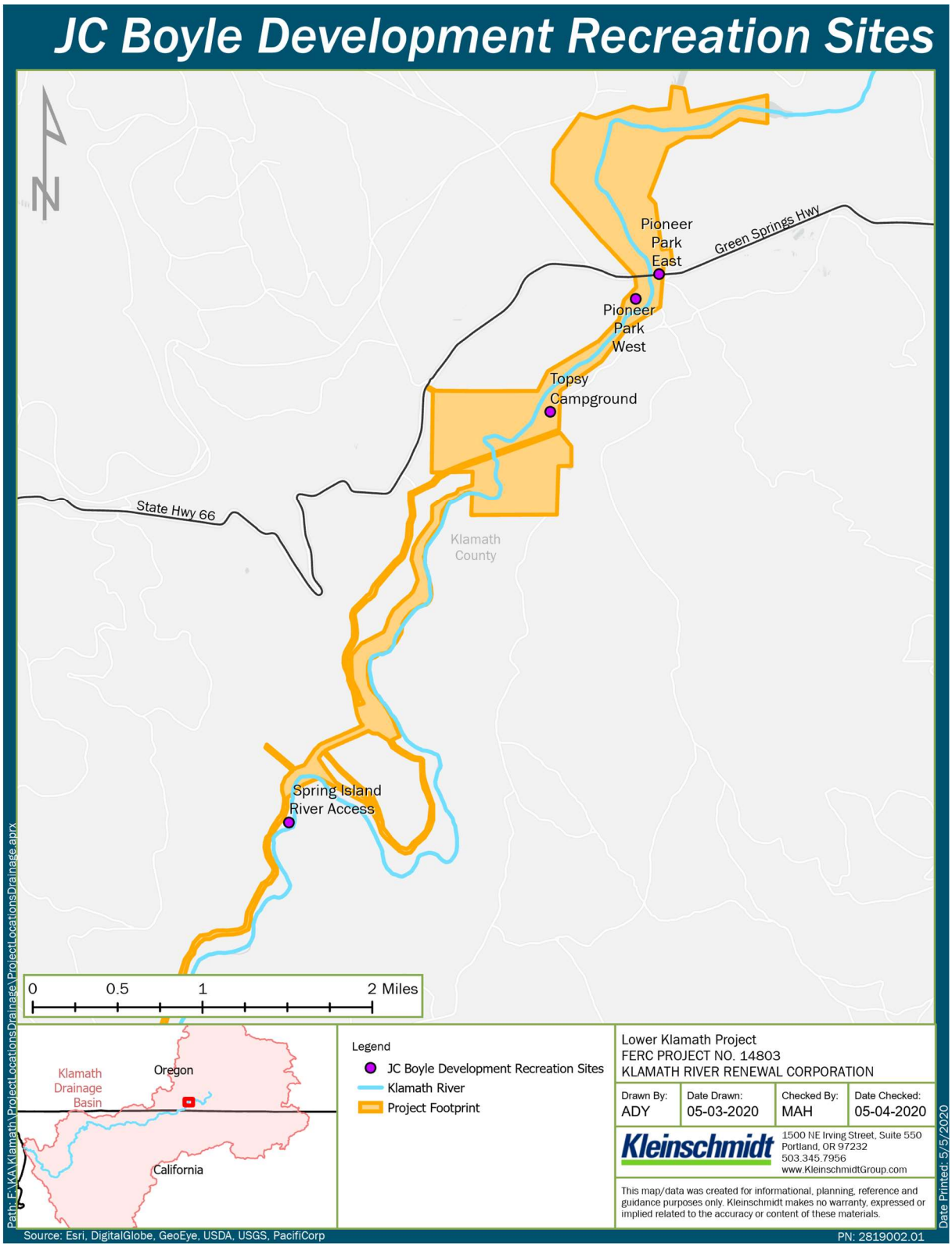

Figure 4-12 J.C. Boyle Development Recreation Sites

Pioneer Park

Pioneer Park is owned and managed by PacifiCorp and consists of a unit on the eastern and western shoreline of the J.C. Boyle Reservoir. Pioneer Park East includes three interpretive signs, a gravel shoreline area, gravel access road and gravel parking area. The interpretive signs provide information regarding the Applegate Trail. The gravel shoreline area provides car-top boat launching and shoreline fishing opportunities. The gravel parking area can accommodate approximately 40 vehicles without trailers or 15 to 20 vehicles with trailers (KRRC 2018).

Pioneer Park West includes 12 picnic tables, 12 fire rings with grills, 2 portable toilets, 1 trash receptacle, 1 trash dumpster, a paved 200-foot-long access road, a gravel/dirt parking area, and informational signs. One of the portable toilets is American Disabilities Act (ADA) accessible. The shoreline provides shoreline fishing access and an informal car-top boat ramp. The gravel and dirt parking area can accommodate approximately 25 vehicles without trailers (KRRC 2018).

Topsy Campground

Topsy Campground is managed by BLM and is located on the southeastern shore of J.C. Boyle Reservoir. The recreation site includes a campground, a day use area, and a boat launch. The campground includes 15 ADA-accessible campsites, with tent pads at 13 of the campsites, restroom facilities, a recreational vehicle (RV) dump station, 5 water faucets, 2 drinking fountains, 14 trash receptacles, and 1 trash dumpster. The day use area and boat launch area share these facilities. The day use area includes two areas with a picnic table and grill. One of these areas is ADA-accessible. The boat launch has two concrete boat lanes, a concrete abutment, a floating dock, and a fishing pier with two benches. There is a paved parking area at the boat launch that has space for three vehicles with trailers (KRRC 2018).

Whitewater and Riverine Recreation Opportunities

The Klamath River between J.C. Boyle Dam and J.C. Boyle Powerhouse, known as the J.C. Boyle bypassed reach, provides approximately 5 miles of whitewater boating opportunities and other river-based activities (FERC 2007). Whitewater flows can reach class III-IV+ rapids, although these conditions occur infrequently.

The 4.5-mile J.C. Boyle peaking reach provides whitewater boating, angling, and camping opportunities. This river segment includes the following recreational values (FERC 2007):

- Nearly continuous class IV and IV+ rapids for whitewater boating.
- Undeveloped setting without obvious human development.
- Abundant wildlife for viewing and hunting.
- High quality fisheries with unique populations of rainbow trout.
- Beautiful scenery.
- Historic and pre-historic cultural resources.

There are six developed public sites for accessing the river, although only one of these sites is located within the project boundary (FERC 2007).

Within the peaking reach is a 17-mile section of the Klamath River known as Hell's Corner (FERC 2007). BLM manages this reach for whitewater boating, including the allowance of commercial boating, both rafting

and kayaking (FERC 2007) with use ranging between 4,000 and 5,000 recreation days annually (FERC 2007).

Spring Island River Access is public land managed by BLM and is classified as a Special Recreation Management Area. The site is located approximately 0.3 miles downstream of the J.C. Boyle Powerhouse at the upstream end of the Upper Klamath Wild and Scenic River section. The site includes informational signs, a carry-down boat launch, picnic tables, vault toilets, and a paved parking area. The site serves as an access to the Upper Klamath Wild and Scenic River (WSR) corridor in addition to being used for fishing, wildlife viewing and picnicking. The site is used as the primary staging area for Upper Klamath whitewater boating trips (KRRC 2018).

Acceptable flow ranges for various flow-dependent activities in the three river reaches associated with J.C. Boyle Development are shown in Table 4-39.

Table 4-39 Acceptable Flow Ranges for River-Based Activities – J.C. Boyle Development

River Reach	Activity	Flow Value – Low (cfs) [1]	Flow Value – High (cfs) [1]
Upper Klamath River	Whitewater boating	1,000	4,000
	Play boating	1,100	1,800
	Fishing	200	1,500
J.C. Boyle Bypass Reach	Whitewater boating	1,300	1,800
	Fishing	200	1,000
Hells Corner Reach	Whitewater boating/kayaking[2]	1,000	3,500
	Whitewater boating/commercial rafting[2]	1,300	3,500
	Fishing[3]	200	1,500

Source: SWRCB 2020a, Appendix R of BOR and CDFG 2012

[1] Values were determined by the Secretarial Determination Recreation Sub-team (2010) from relicensing documents (PacifiCorp 2004; FERC 2007).
[2] Flows are within the desirable range during the daily peak hydroelectric operations period (between 10:00 AM and 2:00 PM).
[3] Flows are within the desirable range for at least 4 hours during the daily non-peak hydroelectric operations period (either between 5:00 AM and 11:00 AM or between 3:00 PM and 9:00 PM).

Dispersed Undeveloped Sites

There are approximately 17 dispersed undeveloped sites located around the J.C. Boyle Reservoir shoreline. There are an additional four dispersed undeveloped sites in the Upper Klamath River/Hell's Corner Reach.

Copco Development

The Copco Development includes two reservoirs, the Copco No. 1 Reservoir and Copco No. 2 Reservoir. The Copco Development includes a stretch of the Klamath River downstream of Copco No. 2 Reservoir to Iron Gate Reservoir. Because of steep topography and difficult access, Copco No. 2 Reservoir does not provide any public access or recreation facilities. There are two developed public recreation sites at the Copco No. 1 Reservoir, including Mallard Cove and Copco Cove. In 2014, estimated annual use at the Copco Development included 3,300 daytime visits and 0 nighttime visits, in recreation days (KRRC 2019).

Reservoir Recreation Opportunities

A description of the recreation facilities available at Copco Lake is included below. Project recreation sites at Copco Development are shown in Figure 4-13.

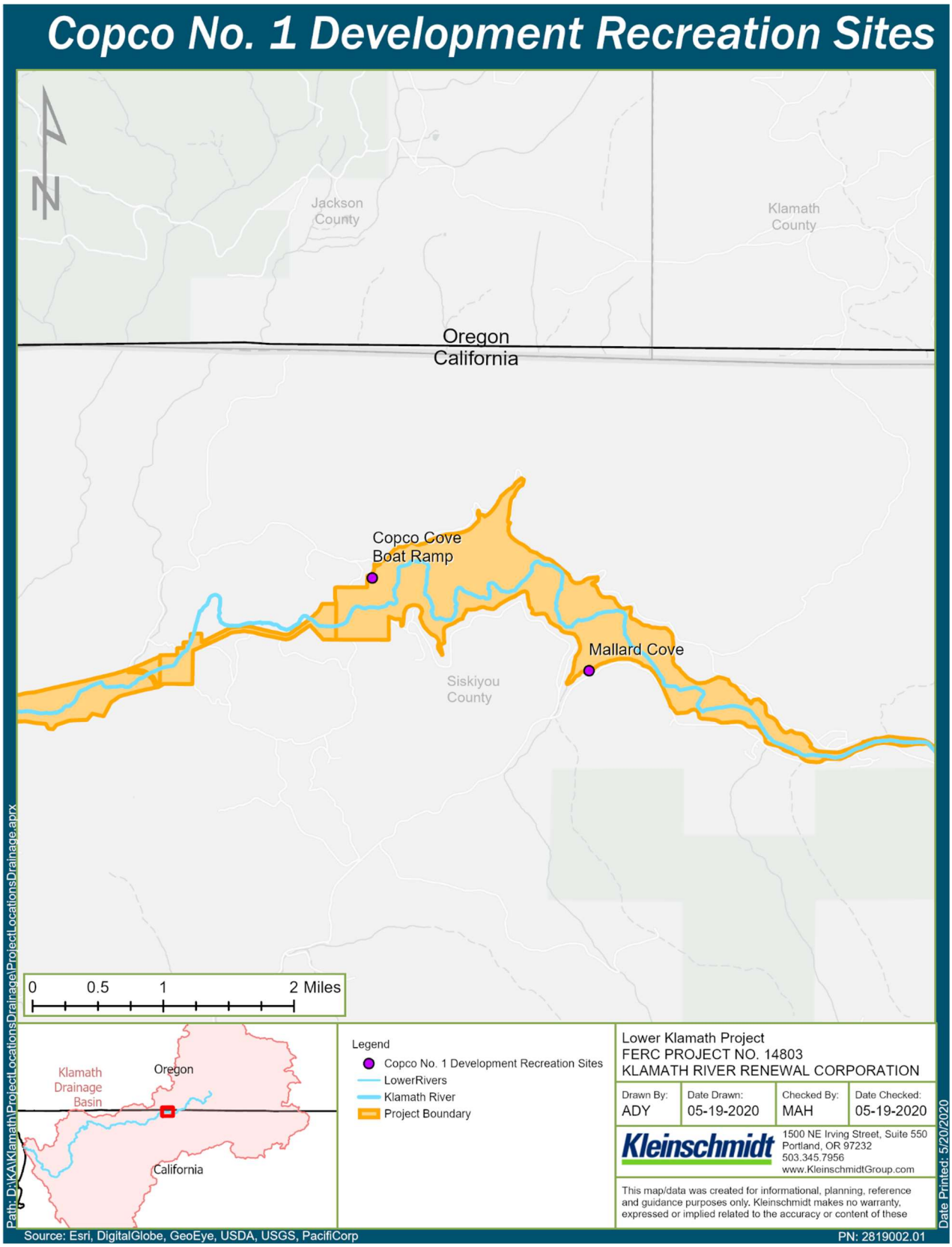

Figure 4-13 Copco No. 1 Development Recreational Opportunities

Mallard Cove

Mallard Cove is owned and managed by PacifiCorp and is located on the southern shore of Copco No. 1 Reservoir (KRRC 2018). The recreation site includes a day use/picnic area, a boat launch, informal camping, 6 informational sites, a gravel access road, and a gravel parking area. The day use/picnic area has 8 wood-plank picnic tables, 12 grills, 7 concrete fire rings or foundations, 1 bathroom with 2 vault toilets and 2 trash receptacles. The boat launch includes a 100-foot-long, 25-foot-wide single-lane concrete ramp; a 25-foot-long, 5-foot-wide courtesy dock consisting of composite decking and poly floats with a concrete abutment; and a 20-foot-long, 5-foot-wide gangway with aluminum frame and pipe railing. The gravel parking area has 8 concrete wheel-stops and parking for approximately 25 vehicles (KRRC 2018).

Copco Cove

Copco Cove is owned and managed by PacifiCorp and is located on the western shore of Copco No. 1 Reservoir. The recreation site includes a picnic area, a boat launch, informal camping, 6 informational signs, 1 portable toilet, 1 trash receptacle, a gravel access road, and a gravel parking area. The picnic area has 2 wood-plank picnic tables each with a fire ring. The boat launch has an 80-foot-long, 25-foot-wide single-lane concrete ramp; and a 14-foot-long, 5-foot-wide concrete boat dock with pipe railing adjacent to the ramp. The gravel parking area has space for approximately five vehicles (KRRC 2018).

Whitewater and Riverine Recreation Opportunities

Below Copco No. 2 Reservoir, a 1.5-mile reach of the Klamath River extends downstream of Copco No. 2 Dam to the backwater of Iron Gate Reservoir. There is no public access to this river reach, although some undocumented boating and fishing opportunities may exist (FERC 2007).

Acceptable flow ranges for various flow-dependent activities in the Copco No. 2 bypass reach are shown in Table 4-40.

Table 4-40 Acceptable Flow Ranges for River-Based Activities – Copco Development

River Reach	Activity	Flow Value Low (cfs) [1]	Flow Value High (cfs) [1]
Copco No. 2 Bypass Reach	Whitewater boating	600	1,500
	Fishing	50	600

Source: SWRCB 2020a; Appendix R of BOR and CDFG 2012
[1] Values were determined by the Secretarial Determination Recreation Sub-team (2010) from relicensing documents (PacifiCorp 2004; FERC 2007).

Dispersed Undeveloped Sites

There are two dispersed undeveloped sites located in the Copco Lake vicinity.

Iron Gate Development

There are nine developed public recreation sites at the Iron Gate Development, including Fall Creek, Jenny Creek, Wanaka Springs, Camp Creek, Juniper Point, Mirror Cove, Overlook Point, Long Gulch, and Iron Gate Fish Hatchery Public Use Areas. The development includes a reach of the Klamath River that runs from downstream of Iron Gate Dam to the Iron Gate Fish Hatchery. In 2014, estimated annual use at the Iron Gate Development included 8,300 daytime visits and 3,600 nighttime visits, in recreation days (KRRC 2019).

Reservoir Recreation Opportunities

A description of the recreation facilities available at Iron Gate Reservoir is included below. Public recreation sites at Iron Gate Reservoir are shown in Figure 4-14.



Figure 4-14 Iron Gate Recreational Opportunities

Fall Creek

Fall Creek is owned and managed by PacifiCorp and is located on the far northeast shore of Iron Gate Reservoir. The recreation site includes a day use area, informal camping, 1 trash receptacle, 1 portable toilet, a gravel boat launch, and a gravel interior road. The day use area includes 2 picnic tables, 2 grills, 2 fire rings and 1 user-defined fire ring. Informal trails provide access to shoreline fishing. The site also provides access to the Fall Creek Trail which leads to the Fall Creek Falls. While there is no formal parking area at the site, visitors generally park along the interior gravel road, which can allow parking for up to 8 vehicles (KRRC 2018).

Jenny Creek

Jenny Creek day use area and campground is owned and managed by PacifiCorp and is located between Copco Road and Jenny Creek on the northern shore of the Iron Gate Reservoir. The recreation site provides 6 primitive day use/campsite areas, 2 trash receptacles, 1 storage building, 1 single-vault toilet building with privacy screen, shoreline fishing access, 2 informational signs, and a gravel parking area. At the day use/campsite areas, there are 4 steel-frame/wood-plank picnic tables and 4 user-defined fire rings at the site. There are several informal trails that provide access to shoreline fishing at Jenny Creek. The gravel parking area provides space for approximately 20 vehicles. Across from the Jenny Creek recreation site is a large gravel parking area along the shoreline of the Iron Gate Reservoir where shoreline fishing occurs. This parking area is not considered part of the Jenny Creek recreation site; however, it can accommodate approximately 12 vehicles (KRRC 2018).

Wanaka Springs

Wanaka Springs is owned and managed by PacifiCorp and is located on the north shore of the Iron Gate Reservoir. The recreation site provides two separate day use areas and informal camping opportunities. The small upper day use area includes 2 wood-plank picnic tables, 1 concrete fire ring, 1 trash receptacle, a gravel access road, and parking space for 2 vehicles. The larger lower day use area includes 3 wood-plank picnic tables, 1 concrete picnic table, 2 concrete fire rings, 1 trash receptacle, 2 single-vault toilet buildings, 1 portable toilet, 3 informational signs and a gravel parking area. A dirt pedestrian trail connects the 2-day use areas and provides access to a 25-foot-long, 5-foot-wide dock. The dock is wooden with a concrete pier and pipe railing, a 15-foot-long gang plank and a concrete walkway on the reservoir shoreline (KRRC 2018).

Camp Creek

Camp Creek is owned and managed by PacifiCorp and is located on Copco Road along the northern shore of Iron Gate Reservoir. The recreation site includes three separate day use areas. The first day use area is located on the shoreline of the Iron Gate Reservoir (KRRC 2018). This area includes 12 developed campsites with a concrete picnic table, concrete fire ring, and 1 parking space. The campsites share 2 water faucets, a 10-foot by 16-foot concrete block well house, and 6 trash receptacles. There is a boat launch with an 80-foot-long 25-foot-wide single-lane concrete ramp and a 25-foot-long, 4-foot-wide boat dock with concrete abutment and piers (KRRC 2018). The ramp and dock are connected by a wooden walkway. There

are 2 floating boat docks, each 20-feet-long and 5-feet-wide, with composite decking and aluminum frames and 20-foot-long, 5-foot-wide gangplanks. These floating docks are located to the north and south of the boat launch and provide shoreline fishing opportunities. The interior access road is used as a parking area and provides space for approximately 6 to 8 vehicles (KRRC 2018).

The second use area is located across from the first day use area and provides overflow camping and parking (space for 60 vehicles) when the developed campsites at the first use area are full (KRRC 2018). The day use area facilities includes: 3 concrete picnic tables; 2 steel-frame/wood-plank picnic tables with concrete foundations; 2 timber shelters; 1 concrete fire ring and 5 user-defined fire rings; 1 RV dump station with approximately 2,000-gallon buried concrete tank; one 10-foot by 16-foot wood-frame double toilet building; 1 portable toilet; 1 trash receptacle; and 1 water faucet. There is an interpretive display that provides information regarding the Wilkes Expedition that stopped at the area of the current recreation site in 1841 (KRRC 2018).

The third day use area is located to the northwest of the first day use area along the reservoir shoreline. This area is often referred to as the "Scotch Creek" or "Dutch Creek" site and can be used as a single campsite or as a group campsite. This area includes 1 steel pipe/wood plank picnic table, 1 concrete fire ring, 1 fishing pier, and 1 boat ramp. The 50-foot-long and 4-foot-wide fishing pier is concrete with pipe railing and ADA-accessible. The boat ramp is used for launching car-top boats (KRRC 2018).

Juniper Point

Juniper Point is owned and managed by PacifiCorp and is located on the northwestern shore of Iron Gate Reservoir. This recreation site includes 9 semi-primitive campsites, 8 steel-frame/wood-plank and wooden picnic tables, 1 concrete picnic table, 15 concrete fire rings and foundations, two 4-foot by 4-foot concrete single-vault toilets, 2 trash receptacles, 1 boat dock, 1 gravel access road, and 4 informational signs. The boat dock is I-shaped and consists of a 25-foot-long concrete abutment; a 50-foot-long composite dock with poly floats and pipe railing; and a 20-foot-long composite gangplank with pipe railing. The dock is also used for shoreline fishing access (KRRC 2018).

Mirror Cove

Mirror Cove is owned and managed by PacifiCorp and is located on the western shore of Iron Gate Reservoir. The recreation site includes a camping area, a boat launch, one 10-feet by 16-feet vault-toilet building, 1 portable toilet, 4 trash receptacles, 7 informational signs, and a gravel parking area. The camping area is accessible by a gravel road and includes 10 campsites, 12 concrete fire rings, and 8 picnic tables. The boat launch includes an 80-foot-long, 25-foot-wide concrete ramp with two lanes; a 30-foot-long concrete boat dock and abutment with pipe railing adjacent to the ramp; and two 30-foot-long, 5-foot-wide composite gangplanks with aluminum frames and pipe railing. The gravel parking area provides space for approximately 20 vehicles (KRRC 2018).

Overlook Point

Overlook Point is owned and managed by PacifiCorp and is located on the western shore of the Iron Gate Reservoir (KRRC 2018). This recreation site includes 1 concrete picnic table, 1 steel-frame/wood-plank picnic table, 1 portable toilet, 2 trash receptacles, and a gravel access road. While there is no defined parking area, the site can accommodate approximately 6 vehicles (KRRC 2018).

Long Gulch

Long Gulch is owned and managed by PacifiCorp and is located on the southern shoreline of Iron Gate Reservoir (KRRC 2018). The recreation site includes a picnic area/informal campsite, a boat launch, 1 portable toilet, 2 trash receptacles, and a gravel parking area. The picnic area includes 2 steel-frame/wood-plank picnic tables and 2 user-defined fire rings, and the boat launch includes an 80-foot-long, 25-foot-wide two-lane concrete boat ramp. The gravel parking area provides space for approximately 16 vehicles (KRRC 2018).

Iron Gate Hatchery Public Use Areas

The Iron Gate Fish Hatchery is owned and funded by PacifiCorp and operated by CDFW and is located downstream of Iron Gate Dam. Adjacent to the fish hatchery is a public day use area and across the river from the hatchery is an undeveloped boat launch. The day use area includes 1 covered picnic shelter, 6 picnic tables, 3 trash receptacles, a small visitor center/interpretive kiosk, a restroom with 2 flush-toilets, an ADA-accessible trail to the shoreline, and a gravel parking area. The parking area provides space for approximately 20 vehicles. Fishing is prohibited in the area and 3,500-feet downstream of the dam (KRRC 2018).

Whitewater and Riverine Recreation Opportunities

Downstream of Iron Gate Dam, the Klamath River extends approximately 200 miles to the Pacific Ocean providing angling opportunities. The reach supports fishing outfitters specializing in salmon, steelhead, and trout fisheries (SWRCB 2020a). The number of outfitters that offer angling services varies from year to year with the Chinook salmon (*Oncorhynchus tshawytscha*) population size. The main run of Chinook salmon in the Klamath River peaks in late fall and is over by mid-January (SWRCB 2020a).

The 123-mile reach of the Klamath River between Iron Gate Dam and the confluence with the Salmon River provides extensive whitewater boating opportunities. This reach provides Class II and III waters suitable for play, standard, and big water boating (FERC 2007).

Acceptable flow ranges for various activities downstream of Iron Gate Dam to the Pacific Ocean are shown in Table 4-41.

Table 4-41 Acceptable Flow Ranges for River-Based Activities Iron Gate Development and Downstream

River Reach	Activity	Flow Value Low (cfs) [1]	Flow Value High (cfs) [1]
Iron Gate to Scott River	Whitewater boating/fishing	800	4,000
Scott River to Salmon River	Boating	800	7,000
	Fishing	800	4,000
Salmon River to Trinity River	Whitewater boating/fishing	800	10,000
Trinity River to Pacific Ocean	Whitewater boating/fishing	1,800	18,000

Source: SWRCB 2020a; Appendix R of BOR and CDFG 2012
[1] Values were determined by the Secretarial Determination Recreation Sub-team (2010) from relicensing documents (PacifiCorp 2004; FERC 2007).

Dispersed Undeveloped Sites

There are four dispersed undeveloped sites located around Iron Gate Reservoir.

4.9.1.4 Land Use

4.9.1.4.1 Land Ownership

Land ownership in the project boundary is shown in Table 4-42. PacifiCorp currently owns the majority of lands within the project boundary. PacifiCorp lands associated with the Proposed Action are divided into two types: Parcel A and Parcel B lands.

Parcel A lands will remain in PacifiCorp's ownership for the foreseeable future as these parcels are not directly associated with the Proposed Action (J.C. Boyle, Copco 1 and 2, and Iron Gate). Parcel B lands are directly related to the four hydroelectric facilities and will be transferred to the Renewal Corporation to implement the Proposed Action (Table 4-42). After completion of the Proposed Action (when license surrender is effective), and pursuant to with the 2016 Amended KHSA, the Renewal Corporation will transfer Parcel B lands to the respective states (Oregon or California) or to a previously designated third-party entity (KRRC 2020c). In accordance with the KHSA, upon completion of the Proposed Action, the Renewal Corporation will not own, operate, or fund operation of potential recreation sites (KRRC 2020c).

Table 4-42 Land Ownership in Acres within the Project Boundary

	BLM Lands	State of Oregon Lands	PacifiCorp Lands	Other Private Lands	Total
J.C. Boyle	82.0	135.2	491.3	3.5	718.2
Copco	0.7	0.0	1,498.0	14.4	1,514.1
Iron Gate	63.7	0.0	1,337.5	1.0	1,402.3
Total	156.1	135.2	3,410.0	28.2	3,736.8

Source: FERC 2007

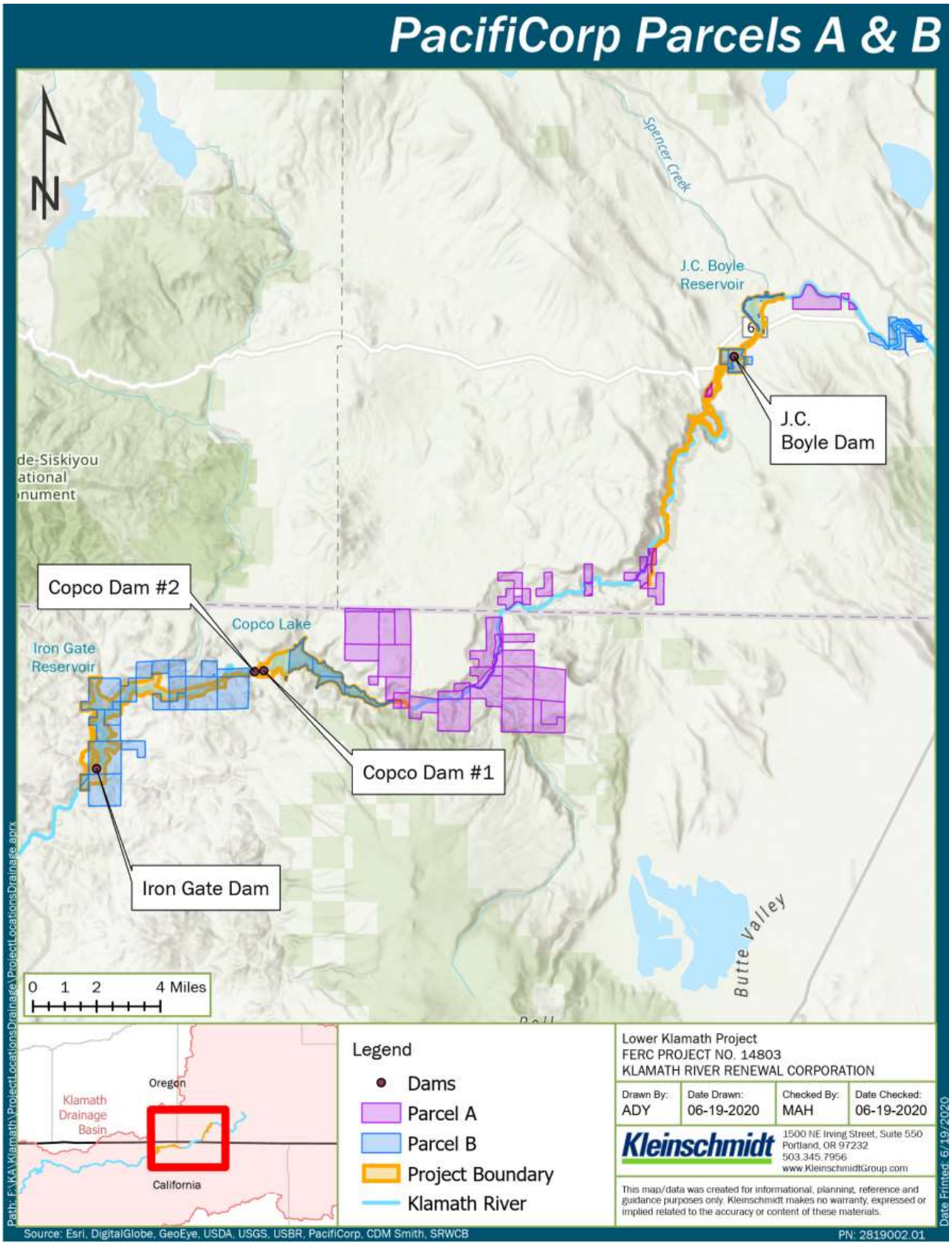

Figure 4-15 Map of Parcel A and Parcel B Lands

Table 4-43 Parcel A and Parcel B Acreages

Parcel	Acreage
A	29.07
B	2704.67

Source: PacifiCorp Siskiyou County, Klamath County, Jackson County GIS 2019

4.9.1.4.2 Land Use Classifications

Land use in the project boundary is shown in Figure 4-16. Major land use categories include agriculture, open space, forestry, recreation, and rural communities. The primary urban areas near the Project are Klamath Falls and the city of Yreka. The majority of land in the project area is classified as agriculture, including grazing lands, and open space (Figure 4-17, Figure 4-18, Figure 4-20, and Figure 4-20).

Most private land can be found surrounding Copco No. 1 Reservoir, with smaller privately-owned parcels located adjacent to Iron Gate and Fall Creek Dam (SWRCB 2020a).

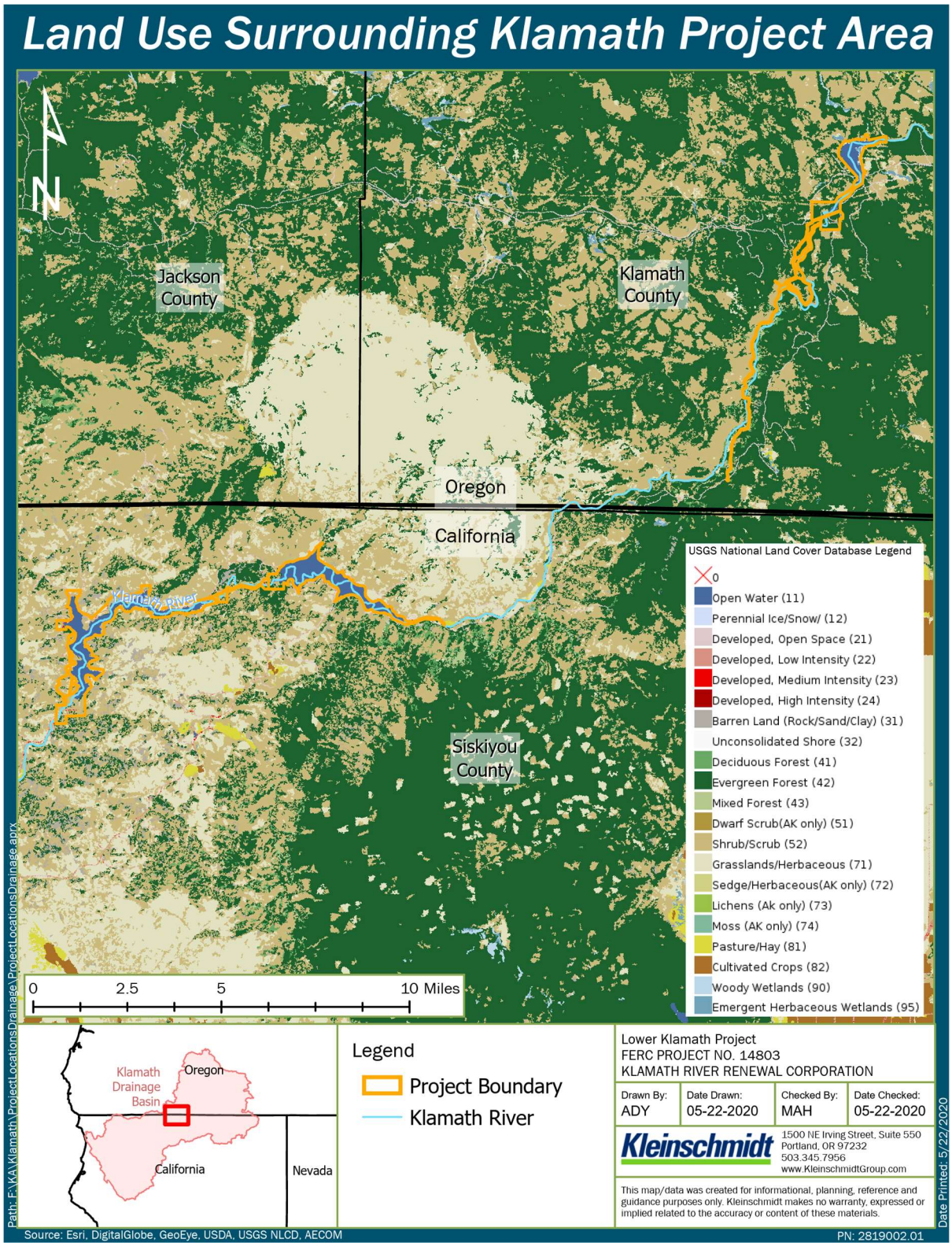

Figure 4-16 Land Use Surrounding Lower Klamath Project Area

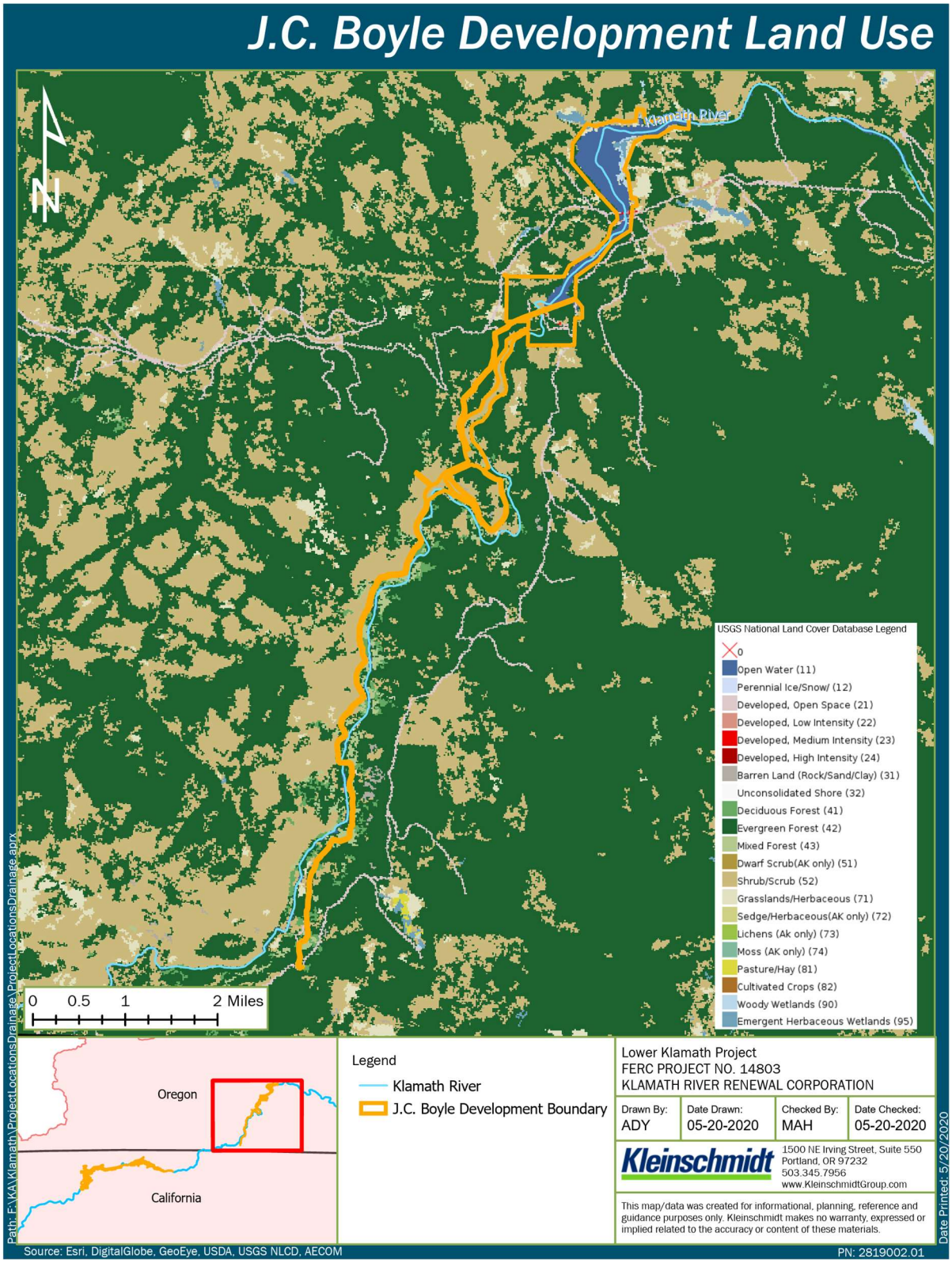

Figure 4-17 J.C. Boyle Development Land Use

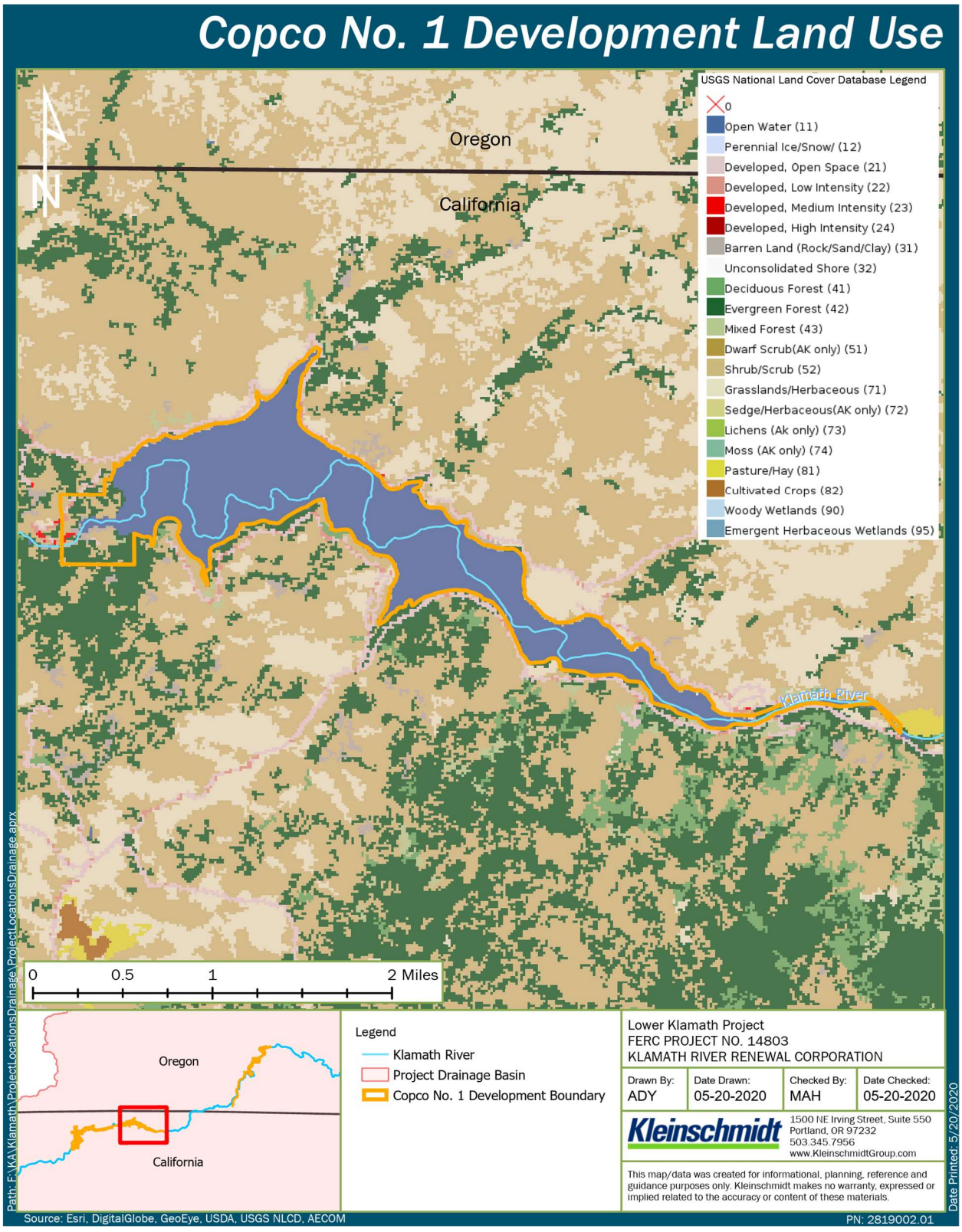

Figure 4-18 Copco No. 1 Development Land Use

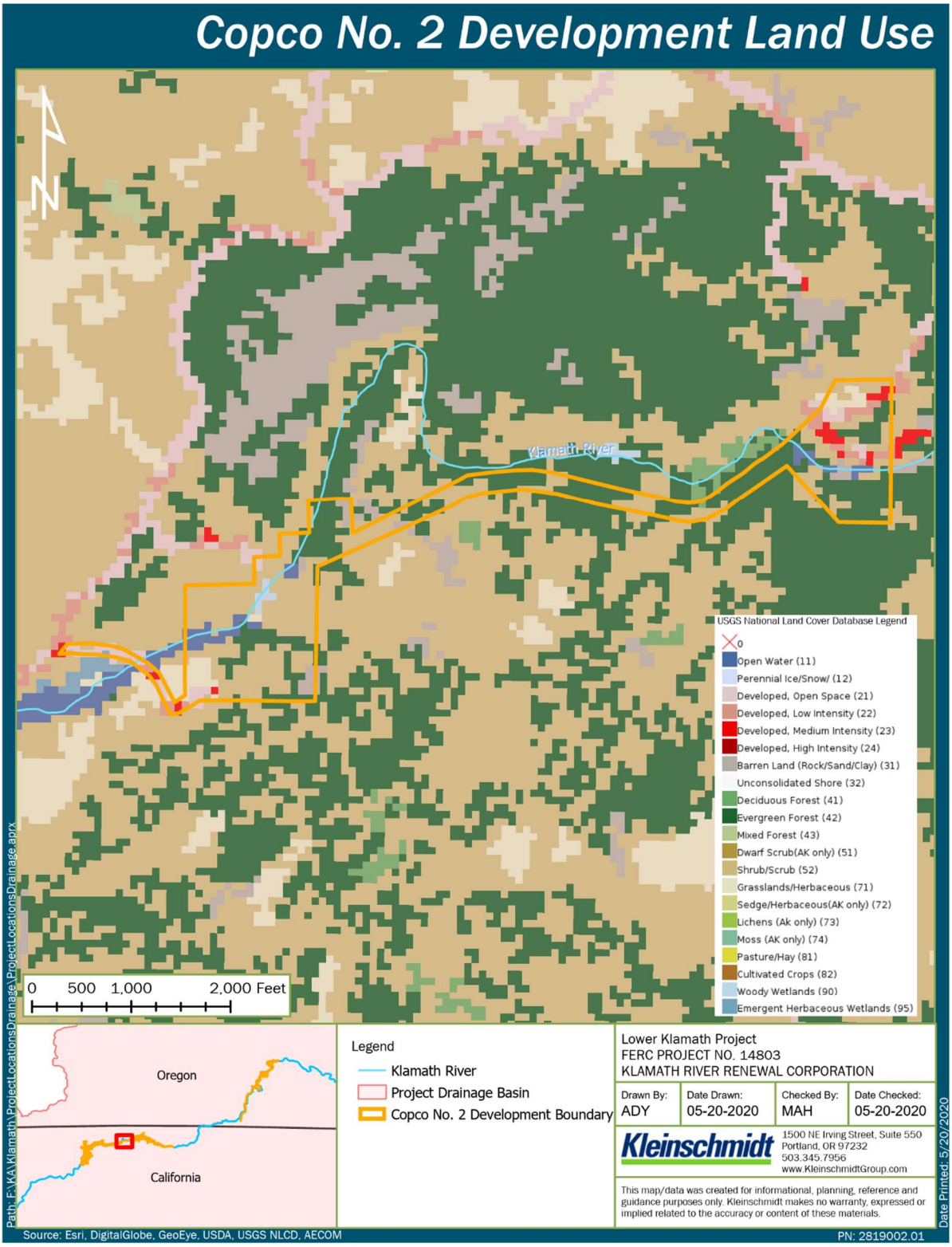

Figure 4-19 Copco No. 2 Development Land Use

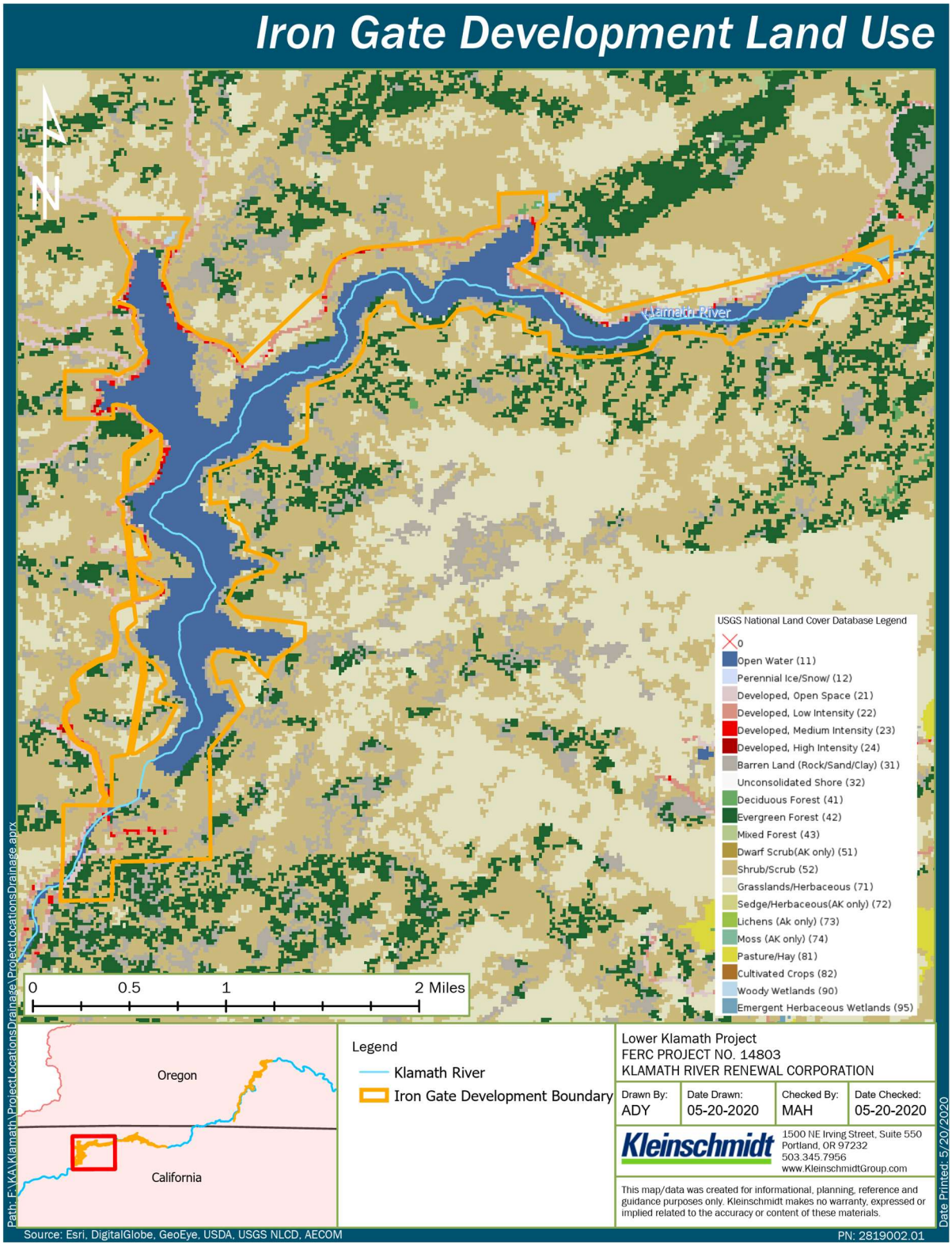

Figure 4-20 Iron Gate Development Land Use

4.9.1.4.3 Land Management

There are several federal, state, and local land management plans, laws and policies used to regulate lands within the Lower Klamath Project area. These are listed below (BOR and CDFG 2012).

- Federal Authorities and Regulations
  Federal Land Policy and Management Act of 1976
  Oregon and California Revested Railroad Grant Lands Act of 1937
  Oregon Public Lands Transfer and Protection Act of 1998
  BLM Redding Resource Management Plan and Record of Decision (1993)
  BLM Klamath Falls Resource Area Resource Management Plan and Record of Decision and Rangeland Program Summary (1995a)
  BLM Medford District Resource Management Plan and Record of Decision (2008)
  Northwest Forest Plan (1994)
  Fremont National Forest Land and Resource Management Plan (1989)
  Winema National Forest Land and Resource Management Plans (1990)
  Six Rivers National Forest Land Management Plan (1995b)
  Kuchel Act of 1964
  Klamath River Basin Compact of 1956
  Tribal Forest Protection Act of 2004
  National Wildlife Refuge System Administration Act of 1966
- State Authorities and Regulations
  California Land Conservation Act of 1965 (Williamson Act)
  California's Farmland Mapping and Monitoring Program
  California Forest Practice Rules
  Oregon Exclusive Farm Use zoning program
  Oregon Forest zoning program
  Oregon Forest Practices Act
- Local Authorities and Regulations
  Klamath Reservation Forest Management Plan (2008)
  Klamath County Land Use Code
  Klamath County Comprehensive Plan (2010b)
  Siskiyou County Land Development Code
  Siskiyou County General Plan (1980)
  Siskiyou County General Plan Land Use Policies (1997)
  Siskiyou County zoning ordinance
  Modoc County General Plan (1988)
  Modoc County zoning ordinance
  City of Yreka General Plan (2003)

City of Yreka municipal code

4.9.1.5 Aesthetic Resources

In 2002 and 2003, PacifiCorp conducted a visual resources assessment in the project vicinity, as reported in the 2004 Land Use, Visual and Aesthetic Resources Final Technical Report (SWRCB 2020a). The report identified and photo-documented key observation points (KOPs) during different seasons and while reservoirs were at different water levels (SWRCB 2020a). The full analysis is available in PacifiCorp's 2004 Report, and a summary of the analysis is included below. As part of the KHSA EIS/EIR (BOR and CDFG 2012), assessment in 2010, and as part of the SWRCB (2020a) assessment in 2017, more recent photos were taken and reviewed from selected locations to verify that conditions were similar to those taken in 2003.

PacifiCorp conducted their visual analysis according to the BLM's Visual Resource Management (VRM) locations including riverside and/or reservoir communities and residences, recreational access sites, campgrounds, scenic byways, and state highways 96, 263, and U.S. Interstate 5 (SWRCB 2020a). The BLM VRM process classifies lands into one of four classes, ranging from Class I, the highest value scenery, and subsequent protections, to Class IV, the lowest value scenery, and subsequent protections. All areas associated with the project dams, except for three areas associated with the J.C. Boyle development in Oregon, were designated as a Class III. For Class III visual resources, BLM objectives are to "partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape" (SWRCB 2020a).

Table 4-44 Key Observation Points Identified in the Project Aesthetics Analysis

Key Observation Point	Description
Hell's Corner Reach — 7	Klamath River from Stateline Takeout
Hell's Corner Reach — 8	Klamath River from Fishing Access #5 (Ager-Beswick Road)
Copco No. 1 Reservoir Area — 1	Copco Reservoir from Mallard Cove Recreation Area
Copco No. 1 Reservoir Area — 2	Copco Reservoir from Copco Cove Recreation Area
Copco No. 1 Reservoir Area — 3	Copco No. 1 Dam and Powerhouse
Copco No. 1 Reservoir Area — 4	Copco No. 2 Dam
Copco No. 1 Reservoir Area — 5	Copco No. 2 Forebay from Copco No. 2 Dam
Copco No. 1 Reservoir Area — 6	Copco No. 2 Powerhouse
Copco No. 1 Reservoir Area — 7	Copco Transmission Line
Fall Creek Area — 1	Fall Creek Recreation Area
Fall Creek Area — 2	Fall Creek Fish Hatchery
Fall Creek Area — 3	Fall Creek from Hatchery Trail
Fall Creek Area — 4	Fall Creek Powerhouse
Fall Creek Area — 5	Fall Creek Transmission Line
Iron Gate Reservoir – 1	Jenny Creek from Jenny Creek Recreation Area
Iron Gate Reservoir — 2	Iron Gate Reservoir from Wanaka Springs Recreation Area
Iron Gate Reservoir — 3	Iron Gate Reservoir from Camp Creek Recreation Area
Iron Gate Reservoir — 4	Iron Gate Reservoir from Juniper Point Recreation Area
Iron Gate Reservoir — 5	Iron Gate Reservoir from Mirror Cove Recreation Area
Iron Gate Reservoir — 6	Iron Gate Reservoir from Overlook Point Recreation Area
Iron Gate Reservoir — 7	Iron Gate Reservoir from Long Gulch
Iron Gate Reservoir — 8	Iron Gate Transmission Line
Iron Gate Reservoir — 9	Iron Gate Dam and Powerhouse
Iron Gate Reservoir — 10	Iron Gate Fish Hatchery and Fish Ladder
Iron Gate Reservoir — 11	Bogus Creek from Viewpoint at Iron Gate Hatchery
Iron Gate Reservoir — 12	Klamath River from Iron Gate Hatchery River Access
Downstream of Iron Gate Dam — 1	Klamath River from Access Below Klamath on Bridge
Downstream of Iron Gate Dam – 2	Klamath River from Collier Rest Area Overlook/Interpretive Area
Downstream of Iron Gate Dam — 3	Klamath River from Tree of Heaven River Access Boat Ramp

Source: SWRCB 2020a

The Lower Klamath Project area is classified as the BLM's VRM rating A for scenic quality (SWRCB 2020a). Landscapes classified as "A" are the most distinctive and include the following factors:

- Color — some intensity or variety in colors and contrast of the soil, rock, and vegetation, but not a dominant scenic element
- Water — water flowing or still, dominant in the landscape when viewed from most key observation points, but not always clear and clean appearing
- Vegetation — a variety of vegetation types as expressed in interest forms, textures, and patterns
- Landform — steep canyons, some interesting erosional patterns or variety in size and shape of landforms or detail features which are interesting though not dominant or exceptional
- Influence of adjacent scenery — adjacent scenery moderately enhances overall visual quality
- Scarcity — distinctive, though somewhat similar to others in the region
- Cultural modifications – some modifications add favorably to visual variety while others add little or no visual variety or may be discordant (SWRCB 2020a).

The Lower Klamath Project area is also classified as the BLM's VRM rating of High for visual sensitivity (SWRCB 2020a). The Project received a classification of High regarding visual sensitivity due to the following factors: recreational sightseers are highly sensitive to changes in visual quality; public interest and controversy in the area has increased in response to proposed project activities; portions of the Project are within the viewshed of residential areas; and much of the Klamath River has been designated under the National WSRA (SWRCB 2020a).

The Lower Klamath Project area is also classified as being located within the foreground/middle-ground distance zone, according to the BLM VRM methodology for distance zones (SWRCB 2020a). This is due to the project's proximity of views from recreational access sites along the river, campgrounds, KOPs along scenic highways, riverside and/or reservoir communities and residences, rivers, or other viewing locations, which are less than three to five miles away (SWRCB 2020a).

Wild and Scenic Rivers and Scenic Highways/Byways

See Section 4.9.1.2 for information on Wild and Scenic Rivers and Scenic Highways/Byways in the Proposed Action area.

4.9.1.6 Air Quality

The air quality of an area reflects the existing emission sources combined with the meteorology, climate, and topography of the area. Air pollution is harmful to health (e.g., respiratory distress, premature death), reduces visibility, and damages vegetation (e.g., agricultural crops, forests) (CARB 2020a). Air quality standards are developed to protect health and the environment and are the maximum amount of a pollutant averaged over a specific period of time that can be present in the air without harming health or the environment (CARB 2020a). The Clean Air Act requires the US EPA to set National Ambient Air Quality Standards (NAAQS) for six criteria air pollutants: ozone, carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur

dioxide (SO_2), particulate matter (PM), and lead (USEPA 2018). Particulate matter is further designated into two different size classes: PM_{10} (particle size less than 10 microns) and $PM_{2.5}$ (particle size less than 2.5 microns). In addition, the state of California has developed California Ambient Air Quality Standards (CAAQS) for 10 pollutants.

The status of criteria pollutants in an area is described by three categories: attainment, non-attainment, and unclassified (USEPA 2020a). An area that meets or exceeds the standard is designated as unclassifiable/attainment. Areas that do not meet the air quality standard are in non-attainment. Areas are designated as unclassifiable if EPA is unable to determine the status based on the available information (USEPA 2020a). Maintenance areas are areas that were previously a non-attainment area but are now consistently meeting the NAAQS.

The affected environment includes the counties in which the Lower Klamath Project is located or where construction vehicles or workers may travel. In California, the Lower Klamath Project and all associated construction and decommissioning activities are within the Siskiyou County Air Pollution Control District (SCAPCD). Siskiyou County is in attainment or unclassified for all criteria pollutants (CARB 2020b) (Table 4-45). The portion of the Lower Klamath Project in the State of Oregon is within an area that is designated as attainment for all criteria air pollutants. There are areas surrounding the Lower Klamath Project where construction vehicles or workers may travel that are in maintenance or non-attainment areas; these areas include the Klamath Falls Urban Growth Boundary (UGB), the Klamath Falls non-attainment area, and the Medford-Ashland Air Quality Maintenance Area (AQMA) (Table 1) (ODEQ 2020). The Klamath Falls UGB is designated as a maintenance area for carbon monoxide and PM_{10}. The Klamath Falls non-attainment area is in non-attainment for $PM_{2.5}$. The Medford-Ashland AQMA is designated as a maintenance area for carbon monoxide and $PM_{2.5}$ (ODEQ 2020)

Table 4-45 Attainment Status of National and State Air Quality Standards, Siskiyou County, California

Criteria Pollutant	Federal Status: Siskiyou County	Status in California (Siskiyou County)	Federal Status: Klamath and Jackson Counties, Oregon
Ozone	Unclassified/Attainment	Attainment	Attainment
Carbon Monoxide	Unclassified/Attainment	Unclassified	Maintenance (Klamath Falls UGB, Medford-Ashland AQMA)
Nitrogen Dioxide	Unclassified/Attainment	Attainment	Attainment
Sulfur Dioxide	Unclassified/Attainment	Attainment	Attainment
PM_{10}	Unclassified	Attainment	Maintenance (Klamath Falls UGB, Medford-Ashland AQMA)
$PM_{2.5}$	Unclassified/Attainment	Attainment	Non-attainment (Klamath Falls Non-attainment Area)
Lead	Unclassified/Attainment	Attainment	NA
Sulfates	NA	Attainment	NA
Hydrogen Sulfide	NA	Unclassified	NA
Visibility Reducing Particles	NA	Unclassified	NA

Source: BOR and CDFG 2012; CARB 2020b; ODEQ 2020; SWRCB 2020a

The US EPA prepares and updates the National Emissions Inventory (NEI) every three years. The NEI is a comprehensive estimate of emissions of criteria pollutants, criteria pollutant precursors, and hazardous air pollutants. Annual emissions from the most recent set of final NEI estimates for Siskiyou County, California, and Klamath County, Oregon, are provided in Table 4-46. In Siskiyou County, the largest emission source of criteria air pollutants is fires. In Klamath County, the largest source of CO, particulate matter, and SO_2 is fires; mobile emissions are the largest source of nitrogen oxides (NO_x).[18]

[18] Nitrogen oxides are the sum of nitrogen dioxide and nitric oxide ($NO_x = NO_2 + NO$)

Table 4-46 Criteria Air Pollutant Emissions (tons per year) in Siskiyou County, CA, and Klamath County, OR, from the 2014 National Emissions Inventory

Source	CO	NO_x	SO_2	$PM_{2.5}$	PM_{10}	Lead
Siskiyou County, California						
Biogenics (e.g., vegetation and soil)	20,076	784	-	-	-	-
Fire Sources (e.g., agricultural field burning, prescribed fires, wildfires)	1,681,226	16,042	10,520	139,857	165,001	0.003
Mobile Sources (e.g., on-road, non-road, aircraft, locomotive	7,197	2,805	8	93	137	0.14
Stationary Sources (e.g., fuel combustion, natural gas, wood)	2,582	250	49	1,002	5,639	0.02
Klamath County, Oregon						
Biogenics (e.g., vegetation and soil)	12,713	815	-	-	-	-
Fire Sources (e.g., agricultural field burning, prescribed fires, wildfires)	156,506	1,520	984	13,050	15,416	-
Mobile Sources (e.g., on-road, non-road, aircraft, locomotive	16,550	3,402	20	138	183	0.08
Stationary Sources (e.g., fuel combustion, natural gas, wood, waste disposal)	2,333	485	50	2,111	13,952	0.02

Source: USEPA 2020b

4.9.2 Environmental Analysis

4.9.2.1 Recreation

The Proposed Action will have impacts on recreation resources in California. SWRCB (2020a).

Construction activities and associated access restrictions, noise, dust, and/or sediment release will result in temporary loss of access to some recreation facilities and associated reservoir-based recreation opportunities. Dust, noise, and sediment release will result in short-term disruptions to some recreation activities in localized areas. While impacts of construction and restoration activities will occur in the temporal and geographic scope of the Proposed Action, they will not result in adverse changes or loss of recreational facilities over a large area or affect a large number of people. Recreation users who may be

temporarily displaced due to construction and restoration can use other regional recreation facilities. No significant impact is anticipated (SWRCB 2020a).

The removal of Iron Gate and Copco No. 1 reservoirs will result in loss of some reservoir-based recreation activities and facilities. Other regional lakes and reservoirs, however, provide reservoir-based recreation opportunities. The Renewal Corporation also proposes to retain and enhance most existing river access facilities and develop future river-based recreation opportunities, and it has developed a Draft Recreation Plan which identifies potentially new and/or modified recreation facilities. Based on these activities and the existence of other reservoir-based recreational opportunities, the removal of Iron Gate and Copco No. 1 is unlikely to result in a loss of recreational facilities affecting a large area or large number of people. No significant impact is anticipated (SWRCB 2020a).

In Klamath and Jackson counties, Oregon and Siskiyou County, California, there are over 85 boatable lakes with boat ramps. Siskiyou County has an additional 180 high-elevation and wilderness lakes. The large number of regional lakes, their close proximity to the Proposed Action, and the extensive opportunities to access these lakes, mitigates any potential for the Proposed Action to increase the use of regional lake and reservoir recreation facilities to the point that deterioration of those facilities would occur or accelerate. No significant impact related to substantial physical deterioration or acceleration of deterioration of regional recreational facilities is anticipated to occur (SWRCB 2020a).

The Proposed Action will result in a long-term loss to the region's Class IV+ rapids (Hell's Corner Reach) for three months during the late summer and early fall each year, including associated business for several commercial outfitters. It will also result in a substantial increase in whitewater boating opportunities in the Copco No. 2 bypass reach during July through September each year due to an increase in acceptable flows for whitewater boating in that reach of the river. It is not expected to change whitewater boating in the J.C. Boyle bypass reach during the months of July through September each year and may cause a potential increase in the number of days with acceptable flows for whitewater boating during the remaining months of the year. No significant impact is anticipated in the Middle and Lower Klamath River, a beneficial impact is anticipated in the Copco No. 2 bypass reach, and significant and unavoidable impact is anticipated in the Hell's Corner Reach (within the upper portion of the dam removal reach) (SWRCB 2020a).

In the Middle Klamath River, between Iron Gate Dam and the confluence with Humbug Creek, there is very little expected change to the 100-year floodplain; however, some flooding could occur potentially affecting existing river-based recreational facilities, including those that support fishing. The Renewal Corporation proposes to move or elevate legally established structures where feasible, reducing the potential for flooding impacts. Downstream of Humbug Creek, there is no expected change to flood elevations and therefore no impacts to river-based recreational facilities. In addition, dam removal is expected to have a positive impact on water quality over the long term, resulting in increased fisheries populations and abundance and increased fishing opportunities. No significant impact to river-based recreation, including fishing, is anticipated in the Middle Klamath River between Iron Gate Dam and Humbug Creek, and a beneficial impact is anticipated for the Hydroelectric Reach, the Middle Klamath River downstream of Humbug Creek, and the Lower Klamath River (SWRCB 2020a).

The Proposed Action will result in short-term negative impacts on river values, river access and use of river-based recreation facilities and opportunities related to Wild and Scenic River (WSR) resources, designations and eligibility for listing. Short-term impacts include increases in turbidity downstream of the project reservoirs that will lead to decreased water clarity and impacts to recreational fishing. Long-term effects will be beneficial due to the elimination of hydropower peaking and the restoration of the Hydroelectric Reach to a more natural condition, thus restoring the river's free-flowing condition, water quality, scenic, wildlife, fishery, and recreation river values. No short-term significant impact is anticipated for the designated California Klamath River WSR segment. No significant impact in the short term is anticipated for the eligible and suitable California Klamath River WSR section. Long-term beneficial impacts are anticipated for the designated California Klamath River WSR segment as well as for the eligible and suitable California Klamath River WSR section.

The Proposed Action will eliminate reservoir-based recreational activities and create additional rivier-based recreational activities. In addition, the 2007 FERC EIS included an analysis of impacts from the Proposed Action on recreation resources in the Oregon-portion of the Project, specifically the JC Boyle Development and associated downstream WSR segments. The EIS indicated that although reservoir-based activities would be eliminated, dam removal could improve water contact recreation by decreasing the frequency and magnitude of blue-green and other algae blooms (FERC 2007). River angling opportunities will be created and likely improved, increasing the amount of Klamath River anglers and business opportunities for angling guides. In addition, natural flows would reduce the number of whitewater opportunities in the peaking reach during summer months. This could lead to the loss of the associated WSR segment's off-road vehicles. Although reservoir-based recreation and whitewater boating opportunities would be reduced and/or modified, the 2007 FERC EIS identified no unavoidable adverse effects from dam removal (FERC 2007).

4.9.2.2 Land Use

The Proposed Action will impact land use and planning in the following ways (SWRCB 2020a, ODEQ 2018b).

The Proposed Action includes the removal of the project reservoirs, restoration of reservoir areas, and transfer of lands from PacifiCorp to the Renewal Corporation, the States of California and Oregon, or a third-party entity. Proposed fencing will be installed to protect revegetation efforts, but this fencing will not physically divide the existing ranching community. In addition, no roads are proposed for removal. Therefore, removal of the reservoirs, construction-related traffic and/or land transfer will not change connectivity between areas of a community, and no significant long- or short-term impact is anticipated. (SWRCB 2020a).

The Proposed Action does not conflict with any public agency land use plans, policies, or regulations, and no significant impact is anticipated in this area (SWRCB 2020a). The Proposed Action conforms with local land use regulations and complies with the requirements for the Klamath County Comprehensive Plan and implementing land use regulations (ODEQ 2018b). Klamath County issued a Land Use Compatibility Statement on April 13, 2018. Furthermore, with implementation of the conditions outlined in the DDP, the Proposed Action is consistent with the applicable elements of the Siskiyou County General Plan and relevant

implementing land use regulations. Therefore, the Proposed Action does not conflict with an applicable land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect in a manner that would prevent the avoidance or mitigation result sought to be achieved by the plan, policy, or regulation.

4.9.2.3 Aesthetic Resources

The Proposed Action will not have significant impacts on aesthetic resources. SWRCB (2020a).

Scenic reservoir views will be replaced with riverine and canyon views. Although this is a significant change, the VRM class would remain a Class III. The visual change would be consistent with riverine and canyon views already available in the project vicinity. (SWRCB 2020a). Although some changes in channel morphology are expected with the removal of dams, these changes are not expected to be readily noticeable to observers or result in adverse changes to scenic quality (SWRCB 2020a).

In addition, the Reservoir Area Management Plan will include revegetation following the reservoir drawdown. Until this occurs, some areas of the reservoir footprint may appear barren and/or sparsely vegetated, however this significant and unavoidable impact is short-term/temporary, until vegetation is reestablished due to reservoir drawdown; no significant impact to long-term/permanent conditions due to reservoir drawdown will result. (SWRCB 2020a).

The Proposed Action will result in the removal of project dam complexes, hatchery modifications, improvements to or construction of new roads, culverts, bridges, water supply infrastructure, and removal and replacement of recreational facilities. As a result, the scenic quality of the project area will be restored to a more natural state. There will be no significant impact to long-term/permanent conditions due to the removal of the project dam complexes and/or hatchery modifications; and no significant impact to long-term/permanent conditions due to improvements to or construction of new roads, bridges, culverts, and water supply infrastructure. (SWRCB 2020a).

In terms of short-term (temporary) visual impacts associated with construction activities and equipment, scenic views in the areas of proposed construction are already lower quality due to existing project facilities. No significant impact to short-term/temporary conditions due to removal of the project dam complexes and/or hatchery modifications; no significant impact to short-term/temporary conditions due to improvements to or construction of new roads, bridges, and culverts and water supply infrastructure; and no significant impact to short-term/temporary conditions due to removal of recreational facilities will occur. (SWRCB 2020a).

Short-term temporary light will be necessary for nighttime construction activities during dam demolition. In addition, security lighting may also be required during this time. This construction or security lighting could result in new sources of substantial light or glare that could adversely affect nighttime views in the area, however, .no new permanent lighting or glare sources will be installed. (SWRCB 2020a).

In terms of changes in visual water quality, short-term temporary changes in visual water quality are expected due to erosion of sediment deposits following the removal of the dams. The scenic quality of the landscape, however, should not adversely change. Long-term permanent changes in visual water quality are expected to improve, including water clarity and fish viewing opportunities due to reduced algal blooms. No significant impact from short-term changes in water quality, including increased turbidity and reduced clarity will occur; and there will be beneficial impacts due to long-term changes in visual water quality from reduced algal blooms (SWRCB 2020a).

4.9.2.4 Air Quality

The Proposed Action will result in emissions of criteria pollutants from multiple sources, including on-road vehicles, off-road construction vehicles and equipment, worker commuting, and fugitive dust from blasting, unpaved roads, windblown dust, and earth-moving activities. Emissions will occur throughout the Proposed Action phases such as dam and facility deconstruction, restoration activities, demotion of and relocation of recreational facilities, and the Yreka water supply pipeline relocation (SWRCB 2020).

The Proposed Action may conflict with the California Regional Haze Plan on a short-term basis (SWRCB 2020).[19] There will not be a significant impact to the California Regional Haze Plan because the Proposed Action does not have long term operational emissions, is limited in duration, and construction vehicle and equipment emissions are controlled under other regulations. There will not be an impact from a short-term cumulative increase in criteria pollutants for which the SCAPCD is in non-attainment because Siskiyou County is designated as unclassified/attainment for all state and federal ambient air quality standards (SWRCB 2020). There may be short-term exposure of sensitive receptors to toxic air contaminants; however, there will not be a significant impact because sensitive receptors are a sufficient distance away from Project activities that fugitive dust and PM emissions will have already settled out of the air (SWRCB 2020). In addition, there is the potential for short-term exposure to objectionable odors from construction equipment or from exposed sediments. It is not anticipated that a substantial number of people will be affected because of the low density of development around the Proposed Action; thus, there will not be a significant impact (SWRCB 2020).

Another potential impact is exceedance of the SCAPCD emissions thresholds in Rule 6.1 (Construction Permit Standards for Criteria Air Pollutants) during dam and powerhouse deconstruction and during other project components (e.g., improvements to roads, bridges, and culverts; modification of water intakes; relocation of structures subject to flood risk) (SWRCB 2020). This impact is expected to be significant and unavoidable because the total daily emissions of NO_x, $PM_{2.5}$, and PM_{10} are estimated to exceed the

[19] The US EPA adopted the Regional Haze Rule in 1999 to protect and improve visibility in Class 1 federal lands, such as national parks, wilderness areas, and scenic areas. Under the Regional Haze Rule, states are required to establish goals for improving visibility and to develop strategies for reducing emissions of pollutants that impair visibility (USEPA 2019).

significance thresholds. Emissions during construction and relocation of the Yreka water pipeline, relocation and demolition of recreation facilities, restoration activities, and construction of cofferdams are not expected to be significant (SWRCB 2020).

4.9.3 Proposed Measures

4.9.3.1 Recreation

The Renewal Corporation proposes to implement the measures the DDP, and outlined in Table 3-1, to address impacts to each resource area. A summary description and analysis of each measure is outlined in the "References" column of Table 3-1.

To ensure those measures are successfully implemented and meet the interests of stakeholders, management plans are being developed. These management plans are outlined in Table 3-2 as well as in the DDP. Below are the specific proposed measures and management plans related to recreation, land use, aesthetic, and air quality resources.

4.9.3.1.1 Recreation Facilities Plan

The Renewal Corporation is drafting a Recreation Facilities Plan to be filed in 2020 (REM-1). The Plan is being developed in coordination with stakeholders (Appendix B). The Renewal Corporation proposes changes to existing recreation sites included in the current license, as shown in Table 4-47.

Following the effective date of license surrender, the Renewal Corporation will transfer Project lands to the States of California and Oregon (Parcel B lands), or a designee. The Renewal Corporation consulted with the States to confirm that, after the effective date for license surrender, they will assume responsibility for operation and maintenance of the sites shown in Table 4-47.

In addition, the Renewal Corporation proposes to construct new sites as may be specified by the States. These sites are not necessary to mitigate the Proposed Action's impacts on recreation and instead will enhance this beneficial use after license surrender is effective (KRRC 2020c). These enhancement sites are listed in Table 4-48. The Renewal Corporation is currently undertaking further consultation, as well as design work, with the States and stakeholders. The Renewal Corporation proposes to construct sites listed in Table 4-48 as may be specified in a cooperative agreement with the States, including their responsibilities for operation and maintenance of these sites after license surrender is effective. The final Recreation Facilities Plan will include the following:

- A list of existing Lower Klamath Project recreation facilities.
- Recreation facilities for removal and associated schedule.
- Possible recreation facilities for development, modification, or maintenance and associated schedule.

- Additional details on recreation site ownership and operation transfer.
- Proposed measures for water quality protection and beneficial impacts associated with proposed project recreation facility actions.
- Water quality monitoring of project recreation areas.
- Public education signage.
- Signage for water quality impairments at project recreation facilities.

4.9.3.1.2 Existing Recreation Facilities

As described in the Recreation Facilities Plan (KRRC 2020c), existing recreation facilities located inside and outside of the Lower Klamath Project boundary will be modified, removed, or retained as listed in Table 4-46. The Renewal Corporation will be responsible for removal or modification of existing sites within the Lower Klamath Project boundary, but not for the removal, modification, or retention existing sites outside of the Lower Klamath Project boundary (KRRC 2020c).

Recreation facilities associated with the Proposed Action consist of two types: (1) facilities that the Renewal Corporation will remove, modify or add (Table 4-47), and (2) other facilities that the Renewal Corporation may develop by agreement with California and Oregon as the likely successor owners following the effective date for license surrender (also Parcel B lands) (Table 4-48).

Table 4-47 Existing Recreation Facilities and Proposed Actions

Site	Proposed Action
J.C. Boyle Reservoir Recreation Sites	
Pioneer Park East[20]	Remove
Pioneer Park West	Modify
Topsy Campground	Modify
Sportsman's Park	Unchanged
Spring Island	Unchanged
Klamath River Campground	Unchanged
Copco Lake Recreation Sites	
Mallard Cove	Remove
Copco Cove	Remove
Iron Gate Reservoir Recreation Sites	
Fall Creek Day Use Area	Retain
Fall Creek Trail	Retain
Overlook Point	Remove
Wanaka Springs	Remove
Jenny Creek	Remove
Camp Creek	Remove
Juniper Point	Remove
Mirror Cove	Remove
Long Gulch	Remove
Iron Gate Fish Hatchery Day Use Area	Modify

Source: KRRC 2020c

[20] A split rail fence will be constructed, extending approximately 200 feet from the Highway 66 Bridge abutment to the existing tree line that begins at the eastern edge of the graveled area to define and protect the newly restored shoreline area.

J.C. Boyle

- Pioneer Park East and West—modify as a potential river recreation site to include whitewater boating, fishing, boating, picnicking/day use, and information shoreline recreation opportunities (KRRC 2020c).
- Topsy Campground—modify by removing all permanent water-based improvements, including boat launches, floating dock, and fishing pier

Table 4-48 Potential New or Modified Recreation Sites

Access Site	Amenities	Expected Recreation Opportunities
Pioneer Park West* (Oregon)	Access road improvements, new boat launch and vehicle turnaround, boat launch staging area, parking area, universally accessible vault toilet, garbage facilities, water spigot, kiosk with angler box, paved trail to ADA spaces, picnic areas and river viewing area and informal kiosk	Whitewater boating, fishing, general boating, informal shoreline recreation
Moonshine Falls (Oregon)	Access road improvements, parking area, universally accessible vault toilet, garbage facilities, water spigot, kiosk with angler box, 1 picnic site, river view point with benches, trail to the boat launch, boat launch staging area and vehicle turnaround, boat launch drop off/staging area, boat slide and accompanying ramp to river's edge, gravel beach	Whitewater boating, fishing, boating, picnicking/day use
Copco Valley (California)	Access improvements, including road, parking area, universally accessible vault toilet, garbage facilities, kiosk with angler box, water spigot, picnic sites, designated dispersed river access sites with gravel connector trail, paved boat ramp, boat launch staging area, hand/launching area/beach	Whitewater boating, fishing, boating, picnicking/day use, informal shoreline recreation
Copco No. 2 Powerhouse (California)	Widened access road, parking area, universally accessible vault toilet, garbage facilities, water spigot, picnic areas, view point with bench, staging area with bench and kiosk with angler box, shoreline trail from boat slide to Daggett Road, boat slide to launch at river edge, boat slide staging area	Whitewater boating, fishing, boating, picnicking/day use, informal shoreline recreation
Camp Creek (California)	New short access road, parking area, trail leading downslope to riverbank, universally accessible vault toilet, garbage facilities, kiosk with angler box, picnic sites, gravel river access area	Fishing, informal shoreline recreation, picnicking/day use, whitewater boating
Iron Gate[1] (California)	Parking area, universally accessible vault toilet, garbage facilities, kiosk with angler box, water spigot, picnic sites, trails to picnic sites, re-grade river's edge/beach, improved boat launch, launch staging area	Boating, fishing, informal shoreline recreation

Source: KRRC 2020c

[1]These sites are a modification of an existing recreation site

The Proposed Action will result in the removal of four dams on the Klamath River, resulting in modified river conditions as compared to existing conditions, and therefore modified and additional whitewater boating

opportunities. The Recreation Facilities Plan (KRRC 2020c) describes in detail the anticipated whitewater boating runs that will likely result from the proposed action. The anticipated whitewater boating runs are summarized in Table 4-49, from north to south in a downstream flow order. Proposed whitewater boat put-in/take-out sites will be available for each whitewater boating run and are listed in Table 4-50 (KRRC 2020c).

Table 4-49 Existing and Anticipated Whitewater Boating Runs on the Klamath River

Run	River Segment	Class Rating
JC Boyle Development		
Upper Big Bend Run (anticipated)	Highway 66 Bridge to the Moonshine Falls area	Anticipated Class III-IV
Big Bend Run (anticipated)	JC Boyle Bypass Reach (between JC Boyle Dam and Spring Island Boater Access	Anticipated Class IV+ with potential for Class V
Upper Hell's Corner Run (existing)	Spring Island Boater Access to just before the Hell's Corner Gorge Run	Class II (III)
Hell's Corner Gorge Run* (existing)	Caldera rapid downstream to the Stateline Take-out	Class IV+
Stateline Run (existing)	Stateline Take-out downstream to Fishing Access Site 1	Class II
Copco No. 1 and No. 2 Developments		
Copco Valley Run (anticipated)	From Fishing Access Site 1 to the Copco Valley/Copco No. 1 Dam area	Anticipated Class II to II+
Ward's Canyon Run (anticipated)	Through Ward's Canyon to the existing Copco No. 2 Powerhouse	Anticipated Class IV
Iron Gate Development		
Iron Gate Run	From the existing Copco No. 2 Powerhouse downstream to the Iron Gate Fish Hatchery	Anticipated Class III for first 4 miles, then Class II for last 2 miles

Source: KRRC 2020c

Table 4-50 Put-in and Take-out Locations for Existing and Anticipated Whitewater Boating Runs on the Klamath River

Run	Put-in Location	Take-out Location
Upper Big Bend	Pioneer Park West	Moonshine Falls
Big Bend	Moonshine Falls	Spring Island Boater Access
Upper Hell's Corner	Spring Island Boater Access	Turtle Camp or BLM Dispersed Site 4
Hell's Corner Gorge	Turtle Camp or BLM Dispersed Site 4	Stateline Take-out
Stateline	Stateline Take-out	Fishing Access Site 1
Copco Valley	Fishing Access Site 1	Copco Valley
Ward's Canyon	Copco Valley	Copco No. 2 Powerhouse
Iron Gate	Copco No. 2 Powerhouse, Camp Creek	Camp Creek, Iron Gate

Source: KRRC 2020c

4.9.3.1.3 Land Use and Aesthetic Resources

As part of the Proposed Action, reservoirs will be drawn down prior to the removal of the dams, exposing previously inundated areas to public view (SWRCB 2020a). Proposed reservoir restoration activities include:

- Revegetating the exposed reservoir areas with native species through hydroseeding and manual planting (WRM-1).
- Grading and revegetation of staging areas and onsite disposal areas (WRM)1.
- Monitoring and adaptive management to ensure affected areas are appropriately revegetated (GSM-3).
- Managing invasive exotic vegetation though activities such as manual weed extraction, soil solarization, tilling, and use of herbicides (TRM-1).
- Installing cattle exclusion fencing if monitoring establishes need around primary tributary reconnections to protect revegetation efforts. (SWRCB 2020a) (REM-1).

The Renewal Corporation proposes to restore upland areas outside of the reservoir footprint but still within the Proposed Action area (SWRCB 2020a). These activities include:

- Revegetating areas, in the short-term, in compliance with SWPPP/Erosion Control Plan (WRM-1).
- Revegetating areas, in the long-term, including upland planting zone areas as described in the Reservoir Areas Management Plan (WRM-1).
- Preparing soils for subsequent planting through disking or ripping (WRM-1).
- Protecting and preserving existing native vegetation where feasible. (SWRCB 2020a) (TRM-1).

4.9.3.2 Air Quality

The Renewal Corporation proposes to implement the measures stated in the DDP, and outlined in Table 3-1, to address impacts to each resource area. A summary description and analysis of each measure is outlined in the "References" column of Table 3-1.

To ensure those measures are successfully implemented and meet the interests of stakeholders, management plans are being developed. These management plans are outlined in Table 3-2 as well as in the DDP. Below are the specific proposed measures and management plans related to air quality.

- The Renewal Corporation will implement measures and BMPs to minimize air pollution emissions and fugitive dust and to maintain air pollution levels below ambient air quality standards throughout the Project. Measures may include using off-road and on-road construction equipment and on-road vehicles to be equipped with engines that meet specific model year emission standards (2010 or newer unless specified) which will help control dust and fugitive emissions during blasting and general construction.
- The Renewal Corporation will develop a blasting plan as part of the Construction Management Plan describing how dust control BMPs will be implemented.

4.9.4 Unavoidable Adverse Impacts

Unavoidable adverse impacts to recreation, land use and aesthetics are summarized as follows:

- Changes to or loss of river conditions that support whitewater boating in the Hell's Corner Reach for three months each year.
- Visual changes resulting from reservoir drawdown and restoration including temporarily bare/unvegetated banks until vegetation is re-established.
- Short-term, temporary lighting for construction and security purposes could result in short-term effects of new sources of substantial light or glare that could temporarily adversely affect nighttime views in the area.

4.9.5 References

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4.10 Socioeconomics

As described in Section 4.1, this Exhibit E incorporates by reference the extensive environmental documentation developed since the 2004 PacifiCorp Application as described in Table 4-51.

Table 4-51 Cross-walk of Socioeconomic Resources Reference Documents

Date	Author	Reference Document	Section Number	Page Number(s)
2004	PacifiCorp	Application for New License	E9.0	9-1 – 9.61
2007	FERC	Final EIS	3.3.8	3-511 – 3-538
2012	U.S. BOR	EIS/EIR	3.15 3.17	3.15-1 – 3.15-102 3.17-1 – 3.17-17
2018	KRRC	Definite Plan Report	N/A	N/A
2020	SWRCB	Final EIR	3.16 – 3.18	AT1-861 – AT1-862
2020	State of California	401 WQ Certificate	N/A	N/A
2018	State of Oregon	401 WQ Certificate	N/A	N/A
2020	SWRCB	Attachment 4: CEQA Findings	N/A	2 126 – 127
2018	ODEQ	Evaluation and Findings Report	N/A	N/A
2011-2020	PacifiCorp	KHSA Interim Measures Implementation Annual Report (2020)	N/A	N/A

4.10.1 Affected Environment

The Lower Klamath Project is located in both Siskiyou and Klamath counties, with J.C. Boule Dam located in Klamath County, Oregon and Copco No. 1, Copco No. 2, and Iron Gate dams located in Siskiyou County, California. Four other counties surrounding the Proposed Action area include Jackson and Curry counties in Oregon, and Humboldt, and Del Norte counties in California (Figure 4-2). These six counties are included in this socioeconomic analysis due to potential impacts to their local economies, such as recreation/tourism, fisheries, and agricultural industries.

There are six federally recognized American Indian tribes within the six-county region: The Klamath Tribes (Klamath-Modoc-Yahooskin), the Quartz Valley Indian Community, the Karuk Tribe, the Yurok Tribe, the Hoopa Valley Tribe, and the Resighini Rancheria.[21] These Tribes have socioeconomic interests that are linked to the Klamath River, including the Lower Klamath Project.

[21] The socioeconomics analysis herein is largely based on the FERC 2007 Final EIS and the BOR and CDFG 2012 Final EIS/EIR which do not include economic information on the Shasta People which are included in the Tribal Recourses section below.

4.10.1.1 Demographic Characteristics

4.10.1.1.1 Population, Race, and Ethnicity

The estimated population of the six-county area in 2019 was 519,016 (U.S. Census Bureau 2020b). Jackson County, Oregon and Humboldt County, California have the largest populations, with approximately 220,900 people and 135,500 people respectively (U.S. Census Bureau 2020b). Population information and a breakdown of population by race and ethnicity for the six counties are presented in Table 4-52. Although the white population represents the largest racial group (88 percent), American Indians comprise a substantial portion of the six-county population (4 percent). Humboldt County supports the greatest population of American Indians (approximately 8,500 individuals), but Del Norte County has the greatest proportion of American Indians (9.3 percent of total population) (Table 4-52).

Table 4-52 Estimated Population in 2019 by County, Race, and Ethnic Group

County	Race (percent of total)					Hispanic or Latino[2]
	Total Population	White	American Indian	Two or More Races	Other Race[1]	
Del Norte County, California	27,812	78.4%	9.3%	5.4%	6.8%	20.0%
Humboldt County, California	135,558	83.4%	6.3%	5.7%	4.6%	11.8%
Siskiyou County, California	43,539	86.1%	5.1%	5.4%	3.5%	12.9%
Klamath County, Oregon	68,238	88.5%	4.9%	4.3%	2.3%	13.4%
Curry County, Oregon	22,925	92.1%	2.6%	3.8%	1.7%	7.3%
Jackson County, Oregon	220,944	91.9%	1.6%	3.6%	3.0%	13.2%
Total	**519,016**	**88.0%**	**4.0%**	**4.5%**	**3.5%**	**12.9%**

Source: U.S. Census Bureau 2020b, Population Estimates Program

1 Other races include Black or African American, Asian, Native Hawaiian and Other Pacific Islander, and "Some Other Race."
2 Hispanics may be of any race.

Six American Indian Reservations are located within the six-county area: Quartz Valley Indian Community, Karuk Reservation, Klamath Reservation, Yurok Reservation, Hoopa Valley Indian Reservation, and the Resighini Rancheria. The Hoopa Valley Indian Reservation has the largest population with over 3,000 residents (U.S. Census Bureau 2020c). Approximately 80 percent of the residents within the Hoopa Valley Reservation are American Indians. Table 4-53 summarizes the population of each reservation.

Table 4-53 2018 Estimated Population and Percent of Residents Identified as American Indian by Tribal Lands within the Six-county Area

Tribe	Total Population	American Indian and Alaskan Native (%)
Quartz Valley Indian Community	198	28.3
Karuk Reservation	1,190	23
Yurok Reservation	1,238	51.5
Hoopa Valley Indian Reservation	3,013	79
Klamath Reservation	38	73.6
Resighini Rancheria	14	92.9

Source: U.S. Census Bureau 2020c, My Tribal Area

4.10.1.1.2 Employment

According to the U.S. Census Bureau, the six-county area had an estimated employment rate of 51 percent 2018 (U.S. Census Bureau 2020b). Employment statistics for the six-county area is based on the 2018 American Community Survey 5-year estimates and are provided in Table 4-54. Employment rates range from 38 to 54 percent, with Jackson County, Oregon having the highest employment rate, and Curry County having the lowest (U.S. Census Bureau 2020b).

Table 4-54 Estimated Employment and Unemployment Rates (percent) by County in 2018

County	Employment Rate	Unemployment Rate
Del Norte County, California	40.10	5.5
Humboldt County, California	54.30	3.6
Siskiyou County, California	46.70	6.7
Klamath County, Oregon	47.90	6.4
Curry County, Oregon	38.20	6.1
Jackson County, Oregon	53.60	4.8

Source: U.S. Census Bureau 2020b, 2018 American Community Survey 5-year estimates; USBLS 2020

4.10.1.1.3 Income

The U.S. Census estimated, in 2018, the average per capita personal income in all six counties of the affected area was $26,516. Income information for the six-county area was based on the 2018 American Community Survey 5-Year Estimates and provides updated information concerning the incidence of poverty on the American Indian reservations in the six-county area in 2010.

Siskiyou County has the highest per capita income of the California counties in the Project area (Table 4-55), at $28,130, but is lower than the California state average of $35,021. Jackson County has the highest per capita income of all of the six counties in the Project area, at $28,728, and is lower than the Oregon state average of $32,045 (U.S. Census Bureau 2020a).

Income throughout all six counties is lower than their respective state averages. Reported 2018 poverty rates in the six counties rage from 14 to 23 percent, with Curry County having the lowest poverty rate, and Del Norte County having the highest. Table 4-55 summarizes the poverty rate of each county. Table 4-56 provides updated information concerning the incidence of poverty on the American Indian Reservations in the six-county area in 2010. The percent of families living on with the Reservations that are below the 2010 poverty level ranges from 18.4 percent in the Quartz Valley Indian Community to 46.2 percent of the families in the Karuk Reservation.

In 2007, the per capita income of American Indian populations was approximately 50 percent less than the rest of the population in their respective counties (FERC 2007). In 2006, the Yurok Tribe conducted a survey to determine the relationship between the tribal communities and the health of the Klamath River. The survey determined that 31 percent of tribal members living within Humboldt, Del Norte, and Curry counties earn less than $10,000 per year, and 80 percent of the survey's respondents were considered "food insecure" (Karrison el al. 2002 as referenced in FERC 2007.

Table 4-55 Estimated 2018 Income and Poverty Statistics by County

County	Per Capita Income[1]	Persons in Poverty[1]
Del Norte County, California	$22,832	22.5%
Humboldt County, California	$26,747	20.3%
Siskiyou County, California	$28,130	19.4%
Klamath County, Oregon	$24,296	20.3%
Curry County, Oregon	$28,365	14.5%
Jackson County, Oregon	$28,728	16.3%
Average	$26,516	**18.4%**

Source: U.S. Census Bureau 2020b, 2018 American Community Survey 5-year estimates.

[1]Income presented in 2018 dollars.

Table 4-56 Income and Poverty on the American Indian Reservations in the Six-county Study Area

		Percent of Families Below Poverty Level in 2018		
	Median Household Income[1]	All Families	Families with Children under 18 Years of Age	Families with Children under 5 Years of Age
Quartz Valley Indian Community	$39,250	18.4	18.2	0
Karuk Reservation	$21,250	46.2	54.9	25
Yurok Reservation	$31,528	27.2	45.9	64.3
Hoopa Valley Indian Reservation	$36,830	31.2	43.4	50.8
Resighini Rancheria	$50,900[1]	33.3	0	N/A

Source: U.S. Census Bureau 2020c, My Tribal Area, 2018 American Community Survey 5-year estimates

[1]No data for median household income, this is mean household income.

4.10.1.2 Economic Sectors

Lower Klamath Project operations provide some employment and income to the surrounding counties. PacifiCorp also pays local and county taxes related to the Project. In 2008 and 2009, PacifiCorp indicated that $305,000 and $290,000 of property taxes were associated with hydroelectric facilities in Siskiyou County (PacifiCorp 2009 as cited in BOR and CDFG 2012).

4.10.1.2.1 Recreation

Recreation is an asset to the regional economy as it attracts visitors from outside the region who spend money and generate economic activity locally. Recreation expenditures and economic activity generally increase with visitation levels. If recreational opportunities along the Klamath River decline, recreational expenditures may decrease and affect the local economy, unless recreational participants engage in substitute or alternative opportunities in the region. The affected area for potential economic effects associated with recreation depends on the recreation activity. The following sections identify the potentially affected area for each activity.

Upstream Recreation

Upstream of the Iron Gate Dam, the Klamath River, including the Lower Klamath Project reservoirs, support a number of recreational pursuits, such as whitewater boating (private and commercial), sport fishing (private and commercial), camping, and waterskiing (Table 4-57).

Table 4-57 Annual Recreation Use and Associated Expenditures in the Upstream Subregion

Primary Activity	Primary Purpose Recreation Days (User Days)	Expenditure Per Person Per Day ($)	Total Expenditure			
			Local and Non-local Visitors	Non-local Visitors to the Project Area	Non-local Visitors, 5-Mile Corridor	Non-local Visitors, 50-Mile Corridor
Boat Fishing	30,270	$5.12	$154,982	$119,340	$119,340	$136,390
Waterskiing	23,040	$7.81	$179,942	$136,760	$136,760	$167,350
Resting/Relaxing	21,120	$4.06	$85,747	$60,020	$60,020	$69,450
Shoreline	15,360	$17.02	$261,427	$130,714	$130,714	$209,143
RV Camping	11,520	$7.05	$81,216	$70,660	$70,660	$70,660
Whitewater	5,090	$134.25	$683,333	$55,736	$93,911	$627,597
Boating		$149.35	$760,191	$63,880	$162,626	$696,311
Other	77,470	$5.54	$429,184	$206,008	$206,008	$339,055
No Primary	7,680	$4.25	$32,640	$23,450	$23,450	$28,350
Activity Total	192,000	$9.94 - $10.34	$1,908,471 - $1,985,329	$802,688 - $810,832	$840,863 - $909,578	$1,647,995 -$1,716,709

Source: FERC 2007

Downstream Recreation

Primary recreation activities downstream of the Iron Gate Dam include whitewater boating, mining, in river fishing, and ocean sport fishing. Estimates of expenditures by non-local visitors in the downstream subregion ranged from $6.2 to $6.5 million in the 5-mile corridor and from $7.3 to $7.7 million in the 50-mile corridor (FERC 2007).

Table 4-58 summarizes the expenditures by participants in various recreational activities. The recreation-related expenditures represent less than 1 percent of personal income for the six-county study region (FERC 2007).

Table 4-58 Annual Recreation Use and Associated Expenditures of Total and Non-local Visitors in the Downstream Subregion

Primary Activity	Total User Days	Commercial User Days	Private User Days	Total Expenditure		
				Local and Non-local Visitors	Non-local Visitors Within 5-Mile Corridor[1]	Non-local Victors Within 50-Mile Corridor[2]
Whitewater	13,673	9,571	4,102	$1,566,226	$371,656	$1,566,226
Boating	Not avail	Not avail	Not avail	$1,771,319	$576,748	$1,771,319
Gold Mining	10,000	0	10,000	$451,350 to $586,350	$451,350- $586,350	$451,350 to - $586,350
Camping	10,526	0	10,526	$543,462	$363,835	$363,835
River Sport Fishing	28,432	204	28,228	$1,486,990	$690,900	$655,070
Ocean Sport Fishing	93,235	7,612	85,623	$4,300,000	$4,300,000	$4,300,000
Total	155,866	17,387	138,479	$8,348,028 to - $8,688,121	$6,177,741 to $6,517,833	$7,336,481 to $7,676,574

Source: FERC 2007

[1] 5-mile corridor includes the area within 5 miles of either side of the Klamath River and 5 miles inland from the coast.
[2] 50-mile corridor includes the area within 5 miles of either side of the Klamath River and 50 miles inland from the coast.

In-River Sport Fishing

Popular Klamath River recreational fisheries include steelhead, which occurs in Siskiyou, Humboldt and Del Norte counties and redband trout, which occurs in Klamath County in Upper Klamath Lake, lower Williamson River, Wood River, and the Keno Reach of the Klamath River (BOR and CDFG 2012).

According to the ODFW statistical creel survey (as cited in BOR and CDFG 2012), approximately 15,191 angler trips (6,109 bank trips, 9,082 boat trips) occurred in Upper Klamath Lake and Agency Lake during March 18, 2009 to September 30, 2009.

Whitewater Boating

Whitewater boating occurs in Jackson County and contributes to the regional economy. The 2012 Final EIS reviewed whitewater boating on the Upper Klamath and Lower Klamath River reaches in Jackson, Klamath, Siskiyou, and Humboldt counties (BOR and CDFG 2012). The Upper Klamath River is defined as the section of the Klamath River upstream of Iron Gate Dam and the Lower Klamath River begins downstream from the Iron Gate Dam.

Table 4-59 provides an estimate of whitewater boating user days for the Klamath River from 1994 through 2009.

Table 4-59 Whitewater Boating User Days on the Klamath River from 1994 to 2009

Year	Upper Klamath River			Lower Klamath River			Klamath River		
	Commercial	Private	Total	Commercial	Private	Total	Commercial	Private	Total
1994	4,471	735	5,206	8,491	3,639	12,130	12,962	4,374	17,336
1995	5,763	602	6,365	12,203	5,230	17,433	17,966	5,832	23,798
1996	5,963	244	6,207	10,280	4,406	14,686	16,243	4,650	20,893
1997	5,509	317	5,826	10,529	4,512	15,041	16,038	4,829	20,867
1998	4,081	314	4,395	11,298	4,842	16,140	15,379	5,156	20,535
1999	4,614	283	4,897	11,885	5,094	16,979	16,499	5,377	21,876
2000	5,100	269	5,369	10,449	4,478	14,927	15,549	4,747	20,296
2001	3,290	243	3,533	10,744	4,605	15,349	14,034	4,848	18,882
2002	3,369	249	3,618	9,783	4,193	13,976	13,152	4,442	17,594
2003	3,075	228	3,303	11,143	4,776	15,919	14,218	5,003	19,221
2004	3,800	281	4,081	9,708	4,161	13,869	13,508	4,442	17,950
2005	3,638	269	3,907	10,695	4,584	15,279	14,333	4,853	19,186
2006	3,714	275	3,989	8,226	3,525	11,751	11,940	3,800	15,740
2007	3,505	259	3,764	8,879	3,805	12,684	12,384	4,065	16,449
2008	3,335	247	3,582	8,643	3,704	12,347	11,978	3,951	15,929
2009	2,405	178	2,583	8,230	3,527	11,757	10,635	3,705	14,340
Average (1994-2009)	4,102	312	4,414	10,074	4,317	14,392	14,176	4,630	18,806

Source: BOR and CDFG 2012

Ocean Sport Fishing

Ocean sport fishing contributes to the six-county area regional economy, particularly in the coastal counties of Humboldt and Del Norte counties, California and Curry County, Oregon. The 2012 Final EIS reviewed the effort (angler days) and landings (number of fish) for recreation fishing. Effort is described as the number of angler days, which illustrates the number of people engaging in angler activities (party/charter, or private boat) at any part of a day. Average expenditures per angler day by non-resident anglers (for lodging, food, gasoline, fishing gear, party/charter boat fees, private boat fuel, equipment rental, access fees, and bait/ice) was estimated to be $200.02 for party/charter mode and $54.66 for private boat mode (in 2012 dollars), based on data collected in a 2000 economic survey of saltwater anglers conducted by NOAA Fisheries

Service. Table 4-60 and Table 4-61 summarize ocean sport fishing efforts and landings in the coastal counties.

Ocean fishing occurs by both private and charter vessels. Typically charter vessels are run by local companies that advertise and sell fishing trips to visitors or residents. Private vessels include privately owned boats and with owners who do not sell trips. The majority of trips from all ports are on private vessels. From 2001 to 2010, trips on charter vessels averaged 25 percent of total salmon angler trips south of Cape Falcon, 7 percent in Humboldt and Del Norte counties, California (excluding 2008, when the fishing off the coast of these counties was closed), and 3 percent in Curry County, Oregon.

Table 4-60 Ocean Sport Salmon Effort (# angler days) during 1981-2010, by Management Area

Year(s)	Humboldt and Del Norte Counties, CA	Curry County, OR
81-85 Avg	46,260	56,260
86-90 Avg	77,500	58,380
91-95 Avg	29,100	22,720
96-00 Avg	18,540	18,360
01-05 Avg	21,000	18,300
06-10 Avg	9,300	7,720
2001	24,700	26,100
2002	21,600	19,700
2003	15,800	14,800
2004	25,600	18,300
2005	17,300	12,600
2006	16,400	10,700
2007	20,500	11,100
2008	0	4,800
2009	5,400	6,000
2010[1]	4,200	6,000

Sources: BOR and CDFG 2012.

[1]2010 data was reported as preliminary, however no updates have been identified and are therefore assumed to be final.

Table 4-61 Ocean Sport Chinook Salmon and Coho Salmon Landings (# fish) during 1981-2010, by Management Area

Year(s)	Humboldt and Del Norte Counties, CA	Curry County, OR
81-85 Avg	34,680	28,460
86-90 Avg	65,680	37,660
91-95 Avg	21,060	10,840
96-00 Avg	8,631	6,178
01-05 Avg	15,885	7,349
06-10 Avg	7,479	2,356
2001	13,010	7,277
2002	16,426	10,042
2003	8,889	5,499
2004	23,404	8,112
2005	17,695	5,817
2006	16,644	2,473
2007	19,297	4,619
2008	0	2,414
2009	680	1,392
2010[1]	774	884

Sources: BOR and CDFG 2012.

[1]2010 data was reported as preliminary, however no updates have been identified and are therefore assumed to be final.

4.10.1.2.2 Commercial Fishing

The commercial fishery in the coastal regions of the six-county area is dominated by coho and Chinook salmon. The magnitude of the United States west coast Chinook salmon production is comparable to Canadian and Alaskan production, but the coho fishery is comparatively much smaller (FERC 2007).

Chinook salmon landings in the area evaluated by the 2012 EIS were highest from 1976 to the late 1980s but declined in the 1990s (FERC 2007). Landings increased briefly between 2001 and 2005 but were followed by record low landings from 2006 to 2010 (Table 4-62) (BOR and CDFG 2012). The gross value of landed salmon also dwindled during this time (Table 4-62). Low escapement rates, or number of fish able to return to the river for spawning, lead to the closure of the commercial salmon fishery in the Humboldt and Del Norte counties, and significant restrictions in other areas in 2006 (BOR and CDFG 2012). Closure of the fishery was expanded state-wide in California in 2008 and 2009. The fishery was reopened in 2010, but low recruitment and escapement rates continue to be a concern, and landings are still restricted in California and Oregon (BOR and CDFG 2012).

Table 4-62 Landings of Troll-Caught Chinook Salmon and Coho Salmon (# fish), 1981-2010, by Management Area

Year(s)	Management Area							
	Monterey	San Francisco	Fort Bragg	Humboldt and Del Norte, CA	Curry County, OR	Central OR	North OR	Total
81-85 Avg	85,260	186,680	124,320	124,020	61,320	170,560	190,200	942,360
86-90 Avg	146,460	360,480	278,380	56,120	33,920	385,940	351,700	1,613,000
91-95 Avg	137,720	205,480	14,760	1,540	1,000	36,820	128,240	525,560
96-00 Avg	156,305	195,662	12,529	3,505	3,542	36,042	89,479	497,064
01-05 Avg	64,827	210,228	96,466	12,401	5,245	117,529	151,698	658,393
06-10 Avg	5,330	24,806	7,906	1,752	1,188	7,736	11,598	60,315
2001	35,940	136,630	14,993	5,523	3,599	72,272	195,001	463,958
2002	69,980	242,872	65,336	13,467	6,803	122,174	162,415	683,047
2003	36,099	202,876	248,875	4,044	5,072	132,156	182,066	811,188
2004	64,707	298,229	107,259	31,915	8,484	140,142	100,965	751,701
2005	117,408	170,531	45,869	7,054	2,266	120,900	118,044	582,072
2006	11,204	47,689	10,835	0	738	1,979	21,759	94,204
2007	14,009	75,254	16,116	8,762	4,097	24,096	11,393	153,727
2008	0	0	0	0	236	208	76	520
2009	0	0	0	0	0	979	8,738	9,717
2010	1,435	1,086	12,577	0	869	11,418	16,022	43,407

Source: BOR and CDFG 2012

Table 4-63 Ex-vessel Value of Troll-Caught Chinook Salmon and Coho Salmon ($1000s, Base Year=2012), 1981-2010, by Management Area

Year(s)	Management Area							
	Monterey	San Francisco	Fort Bragg	Humboldt and Del Norte, CA	Curry County, OR	Central OR	North OR	Total
81-85 Avg	3,671	9,170	5,881	4,536	2,426	4,637	3,965	34,286
86-90 Avg	7,003	16,751	10,884	2,736	2,219	10,983	8,128	58,704
91-95 Avg	4,095	6,097	670	104	98	899	2,349	14,312
96-00 Avg	3,755	4,912	340	81	217	1,038	1,950	12,293
01-05 Avg	2,129	7,422	3,371	440	608	3,206	4,280	21,456
06-10 Avg	307	1,797	925	134	243	500	834	4,740
2001	1,051	4,362	483	161	311	1,586	3,878	11,832
2002	1,766	5,927	1,689	314	420	2,354	3,309	15,779
2003	1,164	6,432	7,233	105	342	3,260	4,539	23,075
2004	2,912	12,672	4,411	1,273	1,096	4,982	5,096	32,442
2005	3,754	7,719	3,039	349	872	3,846	4,577	24,156
2006	497	3,911	1,561	0	275	342	1,757	8,343
2007	925	4,981	2,002	645	607	1,451	789	11,400
2008	0	0	0	0	62	0	150	212
2009	0	0	0	0	27	11	188	226
2010	114	91	1,063	23	245	696	1,286	3,518

Source: BOR and CDFG 2012.

4.10.1.2.3 Tribal Fishery

Fish are an important part of the cultural traditions of the Klamath River Basin tribes. The tribes of the Klamath River Basin have historically been dependent on the salmon fishery in the Trinity and Klamath rivers for ceremonies, sustenance, and livelihood (DOI 1993). By the Treaty of 1864, the tribes have a federal reserved right to the Klamath River fishery (DOI 1993), but with the construction of Copco 1 Dam in 1917, the anadromous fisheries (e.g., salmon and lamprey), were eliminated until fish ladders were added (BOR and CDFG 2012). Tribal fisheries were again depleted when the tribes closed their fishery for Lost River sucker and shortnose sucker, due to biological concerns. Both species were later listed as endangered species in 1988 (BOR and CDFG 2012).

The Yurok and Hoopa Valley Tribes harvest Chinook salmon for commercial, subsistence, and ceremonial purposes. As in the commercial market, the tribes have suffered from a decline in market prices and the number of salmon harvested. In 2006, the Yurok Tribe claimed that they had not had a commercial fishery of spring Chinook salmon, coho salmon, steelhead, lamprey, eulachon, and sturgeon for 15 years prior to

2006, due to concerns for the health of these populations (FERC 2007). The fall Chinook salmon harvest has been much lower in recent decades (1980 to present) compared to historical harvests (BOR and CDFG 2012). The Yurok Tribe has reduced, and in some years halted, their commercial fall Chinook salmon fishery The Tribal Council determined that the abundance of Klamath fall Chinook salmon was insufficient to support a commercial fishery (FERC 2007).

Fish harvests have historically been a means of subsistence, trade, barter, and commercial industry. A survey conducted by the Yurok Tribe concluded that the poverty, food insecurity, dependence on food assistance, and prevalence of diabetes are due to the lack of access to their traditional food sources that had been provided by the Klamath River. With the decrease in tribal commercial fishery, the number of tribal members that need food assistance has increased (Table 4-64). The lack of fishery has had severe impact on the health and income of tribal members, particularly those living within the ancestral territory along the Klamath River (FERC 2007).

Table 4-64 Losses Associated with Tribal Commercial Fishery Closures

Losses Associated with Closure of Tribal Fishery	Respondents Reporting Losses (percent)	Respondents on Food Assistance Reporting Losses (percent)
Loss of income	22	33[1]
Increased food expenses	28	39[1]
Reduction in social and cultural activities	24	32[1]
Loss of goods and services received through barter and trade	18	28[1]
Increased financial stress	18	30[1]
Reduced income from secondary business	8	13[1]
Applied for public assistance due to closure	8	21[1]

Source: Yurok Tribal comments on the draft EIS, filed December 1, 2006 as cited in FERC 2007, most recent available data

[1]Significantly greater proportion of respondents on food assistance affected, Chi-square test, $p<0.05$.

4.10.1.2.4 Irrigation and Agriculture

The KIP provides water to approximately 240,000 acres of agricultural and wildlife refuge land throughout the Klamath River Basin, particularly in Klamath County, Oregon, and Siskiyou and Modoc counties, California (BOR and CDFG 2012). According to the 1997 Census of Agriculture, the KIP supplies water to 1,744 farms and ranches. Approximately 45 percent of the agricultural fields irrigated by the KIP are supported by the Keno Reservoir (FERC 2007).

The agricultural sector represented 7.3 percent of the total employment in Klamath, Modoc, and Siskiyou counties (BOR and CDFG 2012). Agricultural employment in Klamath and Siskiyou counties is much higher than in other counties in the affected area. Although the area irrigated by KIP does not account for all the agricultural income in the two counties, it does contribute to the high agricultural employment (FERC 2007).

Common crops grown within the KIP lands include, alfalfa hay, irrigated pastures, onions, potatoes, small grains, and wheat. Alfalfa had the highest gross revenue between 2005 and 2009, likely due to the high market prices and the high percentage of land dedicated to the crop (Table 4-65) (BOR and CDFG 2012). Potatoes and onions were the second and third most valuable corps.

Table 4-65 Average Gross Farm Revenue Generated on Reclamation's Klamath Project Lands from 2005 to 2009

Representative Crop	Gross Revenue ($1,000)	Gross Revenue per Acre ($/acre)
Alfalfa Hay	$58,769.60	$736.76
Irrigated Pasture	$6,996.10	$161.96
Onions	$21,108.20	$2,804.33
Potato	$39,910.10	$3,114.33
Small Grain	$4,706.10	$350.39
Wheat	$17,119.20	$552.87
Total Gross Revenue	$148,609.40	-

Source: Klamath Basin Hydro-Economic Model (KB_HEM), BOR 2012c, as cited in BOR and CDFG 2012.

4.10.1.2.5 Summary of Economic Sectors within the Six-County Region

The 2012 Final EIS for the Klamath Facilities Removal included an evaluation of the potential impacts of the removal of the four PacifiCorp dams on the Klamath River (Lower Klamath Project), including socioeconomics impacts. This analysis was based on an examination of the potential effects of dam removal on the surrounding counties.

Table 4-66 Summary of the Regional Economy for Klamath and Siskiyou Counties

Industry Sector	Employment[1]		Labor Income[2]		Output[3]	
	Jobs	Percent of Total	$ (million)	Percent of Total	$ (million)	Percent of Total
Agriculture	3,232	6.7	107.8	5.6	497.3	9.7
Mining	84	0.2	3.2	0.2	15.7	0.3
Construction	2,174	4.5	90.1	4.7	242.8	4.7
Manufacturing	2,621	5.4	135.7	7.0	703.6	13.7
Transportation, Information, and Public Utilities (TIPU)	1,920	4.0	109.3	5.7	394.6	7.7
Trade	6,886	14.3	220.5	11.4	455.4	8.9
Service	21,197	44.0	722.0	37.4	2,131.2	41.5
Government	10,091	20.9	539.8	28.0	697.9	13.6
Total	48,205	-	1,928.4	-	5,138.5	-

Source: Reclamation 2012b as cited in BOR and CDFG 2012.

[1] Employment is measured in number of jobs.
[2] Income is the dollar value of total payroll (including positive effects) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production

Table 4-67 Summary of the Regional Economy for Humboldt and Del Norte Counties, CA

Industry sector	Employment[1]		Labor Income[2]		Output[3]	
	Jobs	Percent of Total	$ million	Percent of Total	$ million	Percent of Total
Agriculture	2,481	3.46	111.27	3.73	413.34	5.62
Mining	43	0.06	2.37	0.08	7.38	0.10
Construction	3,672	5.13	192.04	6.44	464.58	6.31
Manufacturing	2,465	3.44	126.28	4.23	798.32	10.85
TIPU	1,967	2.75	105.77	3.55	365.00	4.96
Trade	10,586	14.78	380.59	12.76	777.07	10.56
Service	32,462	45.32	1,113.71	37.34	3,327.87	45.21
Government	17,958	25.07	950.47	31.87	1,206.59	16.39
Total	71,634		2,982.50		7,360.15	

Source: Reclamation 2012b, as cited in BOR and CDFG 2012, most recent available data.

[1]Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[2]Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3]Output represents the dollar value of industry production.

Table 4-68 Summary of the Regional Economy for Curry County, OR

Industry sector	Employment[1]		Labor Income[2]		Output[3]	
	Jobs	Percent of Total	$ million	Percent of Total	$ million	Percent of Total
Agriculture	676	7.81	20.60	6.61	53.21	6.20
Mining	25	0.29	1.26	0.41	4.39	0.51
Construction	673	7.78	21.94	7.04	67.28	7.84
Manufacturing	611	7.06	33.42	10.73	130.97	15.25
TIPU	180	2.08	11.33	3.64	43.17	5.03
Trade	1,252	14.47	38.04	12.21	74.43	8.67
Service	3,885	44.88	114.81	36.86	393.11	45.79
Government	1,354	15.64	70.07	22.50	91.97	10.71
Total	8,656		311.47		858.53	

Source: Reclamation 2012b, as cited in BOR and CDFG 2012, most recent available data.

[1]Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production.

Table 4-69 Summary of the Regional Economy for Del Norte, Humboldt and Siskiyou Counties in California and Klamath County, OR

Industry sector	Employment[1]		Labor income[2]		Output[3]	
	Jobs	Percent of Total	$ million	Percent of Total	$ million	Percent of Total
Agriculture	5,713	4.77	219.03	4.46	910.68	7.29
Mining	127	0.11	5.58	0.11	23.06	0.18
Construction	5,845	4.88	282.12	5.74	707.41	5.66
Manufacturing	5,086	4.24	261.96	5.33	1,501.95	12.02
TIPU	3,887	3.24	215.09	4.38	759.63	6.08
Trade	17,471	14.58	601.06	12.24	1,232.50	9.86
Service	53,659	44.78	1,835.74	37.38	5,459.12	43.68
Government	28,049	23.41	1,490.23	30.35	1,904.47	15.24
Total	119,837		4,910.81		12,498.82	

Source: Reclamation 2012e, as referenced in BOR and CDFG 2012 most recent available data.

[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production.

Table 4-70 Summary of the Regional Economy for Klamath, Jackson, Humboldt, and Siskiyou Counties

Industry Sector	Employment[1]		Labor Income[2]		Output[3]	
	Jobs	Percent of Total	$ (million)	Percent of Total	$ (million)	Percent of Total
Agriculture	3,232	6.7	107.8	5.6	497.3	9.7
Mining	84	0.2	3.2	0.2	15.7	0.3
Construction	2,174	4.5	90.1	4.7	242.8	4.7
Manufacturing	2,621	5.4	135.7	7.0	703.6	13.7
Transportation, Information, and Public Utilities (TIPU)	1,920	4.0	109.3	5.7	394.6	7.7
Trade	6,886	14.3	220.5	11.4	455.4	8.9
Service	21,197	44.0	722.0	37.4	2,131.2	41.5
Government	10,091	20.9	539.8	28.0	697.9	13.6
Total	48,205	-	1,928.4	-	5,138.5	-

Source: Reclamation 2012b, as referenced in BOR and CDFG 2012

[1]Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[2]Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3]Output represents the dollar value of industry production.

4.10.2 Environmental Analysis

4.10.2.1 PacifiCorp Hydroelectric Service and Community

The Proposed Action is not expected to have any effect on customer rates in Oregon and California. Dam removal surcharges for PacifiCorp customers in Oregon and California (CPUC 2011, OPUC 2010) have been fully collected and the agreements for the disbursements of these funds are in place.

4.10.2.1.1 Property Values and Taxes

In prior studies, the outcome of the regional economic real estate analysis was complex indicating that there would be both positive and negative local value changes as a result of dam removal. Dam removal represented only one factor driving the value changes, while local circumstances and ongoing economic trends also had a major influence on predicted values (USBR 2012, Real Estate Sub-team 2012). It is anticipated that land values will decline soon after the reservoirs were drained and that they would

progressively increase in value over time until the terraces above the river are revegetated and the river channel is fully recovered (Bender Rosenthal Inc. 2012 as cited in BOR and CDFG 2012). In the short-term, if reservoir property values decline, there could be adverse effects on property tax revenues to Siskiyou County. In the long-term, if some reservoir land values permanently decline, Siskiyou County property tax revenues might decline relative to the Existing Condition, assuming nothing else changes that could impact property values or property tax revenues. If riverine property values downstream from Iron Gate Dam increase in the long-term, tax revenues to Siskiyou County could and partially offset any loss of tax revenues associated with the decline in reservoir property values.

In prior studies, the outcome of the regional economic real estate analysis was complex indicating that there would be both positive and negative local value changes as a result of dam removal. BOR's Real Estate Sub Team (2012) Report notes that the effect of the Proposed Action on property values would not necessarily only be negative but may be mixed. For example, the Real Estate Sub Team (2012) Report notes that dam removal would reduce or eliminate many of the effects of poor water quality in the river (e.g., extensive algae mats, odors and algal toxins), which could increase values for downstream properties located adjacent to the river, and that more robust runs of anadromous fish could also increase property value. There are many variables that effect market value and market conditions.

PacifiCorp pays in the range of $290,000 to $305,000 annually in property taxes on land attributable to hydroelectric facilities at Copco and Iron Gate dams and approximately $132,000 in property taxes for land attributable to hydroelectric facilities at J.C. Boyle Dam (PacifiCorp 2009 as cited in BOR and CDFG 2012). Under the Proposed Action, the Renewal Corporation will assume ownership of these lands. This would result in a lowering of County tax revenues for operation of County government in the near term. The long-term effect on property tax revenues will be influenced by many variables, (including market conditions) and any effect of the Proposed Action on property tax revenues will diminish overtime.

4.10.2.2 Project-related Economic Sectors

The Proposed Action will not require long-term annual operations and maintenance expenditures for operation of hydroelectric facilities. As a result, the regional economy would lose approximately 49 jobs relative to the Existing Conditions (BOR and CDFG 2012).

Construction activities associated with dam removal will increase economic output, employment, and labor income during all phases of the Proposed Action in Klamath and Siskiyou counties. The Proposed Action will result in a short-term positive effect on the affected counties, for the time it would take to decommission the dams (BOR and CDFG 2012).

Restoration efforts, including repaving roads, replanting vegetation, restoring riverbanks, and monitoring, would occur within the region during the post-drawdown phase. Spending will increase employment, labor income, and output in the region. Most of these expenditures will affect the construction sector of Klamath and Siskiyou counties, which offer the labor force and businesses needed for restoration efforts. The Proposed Action will result in positive, temporary effects to

employment, labor income, and output during the drawdown and post-drawdown periods (2018-2025) relative to the Existing Condition.

4.10.2.3 Recreation

4.10.2.3.1 Reservoir Recreation

Under the Proposed Action, dam removal will eliminate some reservoir recreation activities in the short- and long-term. This analysis assumes the loss of recreation at Copco 1, Iron Gate, and J.C. Boyle reservoirs. The analysis is based on non-local visitors who bring money into the region that would not otherwise be there and stimulate the local economy. Table 4-71 summarize the economic effects of lost reservoir recreation activities compared to the Existing Conditions. Most employment, labor income, and output effects would occur in the services sector.

Table 4-71 Change in Regional Economic Effects from Reservoir Recreation between the Existing Condition and the Proposed Action

	Employment[1]		Labor income[2]		Output[3]	
	Jobs	% Change	$ millions	% Change	$ millions	% Change
Total effect[4]	-4	-57.4	-0.13	-59.1	-0.31	-56.9

Source: Reclamation 2012b, as cited in BOR and CDFG 2012, presented in 2012 dollars.

[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production.
[4] Total Effect = Direct + Indirect + Induced Effects

Although some aspects of the Proposed Action are different from the dam removal scenarios analyzed in the USBR/DOI economic analyses, the primary assumptions regarding the effects of dam removal on reservoir recreation activities are unchanged. The economic impact on the local economy attributable to lost reservoir recreation activities are short term and will be offset, in whole or in part, by the economic benefits to be derived from riverine recreation opportunities and the Renewal Corporation's Recreation Facilities Plan. This transition of recreational opportunities may have some localized short-term negative economic impacts but is not expected to cause any significant long-term negative impacts in the six-county area.

4.10.2.3.2 In-River Sport Fishing

Under the Proposed Action, employment, labor income and output in the regional economy will increase as a result of increased in-river fishing expenditure. Effects will be long-term, occurring predominantly in the service sector. Employment created in this sector could be full time or part time. Annual salmon fishing effort on the Klamath River is estimated at 26,578 angler days under the Proposed Action. Expenditures in the region by non-resident anglers are estimated at $1.789 million (2012 dollars) under the Proposed Action, an

increase of approximately $127,000 from the Existing Condition. Table 4-72 summarizes increased economic activity supported by the Proposed Action relative to the Existing Conditions (BOR and CDFG 2012, NOAA Fisheries Service 2012g as cited in BOR and CDFG 2012).

The increased economic activity of the in-river fishery within the region is reflective of the increased abundance of target fishes such as salmon, steelhead and redband trout. The Proposed Action would increase abundance and distribution of, and improve spawning habitat for, these species. It is expected that the growth of the fishery will likely generate additional expenditures, jobs, labor income, and output in the regional economy.

Table 4-72 Change in Regional Economic Effects from In-river Salmon Fishing between the Existing Condition and the Proposed Action

	Employment[1]		Labor income[2]		Output[3]	
	Jobs	Percent Change	$ millions	Percent Change	$ millions	Percent Change
Total effect[4]	2.6	7.6	0.07	7.7	0.15	7.7

Source: Reclamation 2012b, as cited in BOR and CDFG 2012, presented in 2012 dollars.

[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production.
[4] Total Effect = Direct + Indirect + Induced Effects
Values do not include the contribution of any increase in steelhead and redband fishing under the Proposed Action due to lack of quantitative data.

Although some aspects of the Proposed Action are different from the dam removal scenarios analyzed in the USBR/DOI economic analyses, the primary assumptions regarding the effects of dam removal on in-river fishing sport fishing have not materially changed. Dam removal will advance the long-term restoration of natural fish populations in the Klamath Basin. This will have a beneficial effect on in-river fishing sport fishing and an associated beneficial economic impact on the in-river fishing sport fishing industry in the six-county area.

4.10.2.3.3 Whitewater Boating

Reduced whitewater boating expenditures, particularly in the Upper Klamath River, could result negatively affect the regional economy under the Proposed Action relative to the Existing Conditions. The primary area of whitewater boating on the Upper Klamath River occurs on the Hell's Corner Reach, which is heavily dependent on releases from the J.C. Boyle Dam to provide sufficient and predictable whitewater flows. The combination of the decline in the number of days with acceptable flows, and the lack of consistency and predictability of days with acceptable flows, could prove more challenging for outfitters to continue offering trips for this reach of the Upper Klamath River and could make it more challenging for private users to engage in whitewater boating activities.

The Renewal Corporation is undertaking a flow study in coordination with the outfitters and private users to evaluate the potential use of smaller rafts which are maneuverable in flows less than 1,300 cfs. Further, as described in Section 4.9, the Renewal Corporation is evaluating new access sites in coordination with the States as successor owners. Therefore, while whitewater boating activity on the Upper Klamath River could be negatively affected under the Proposed Action for the long-term, the Renewal Corporation expects that these measures will avoid or mitigate such impacts.

The Lower Klamath River is not dependent on reservoir releases to maintain sufficient whitewater flow; hydrologic modeling indicated that the average number of days with acceptable flow conditions suitable for whitewater boating on the Lower Klamath River will not be impacted by dam removal. It is expected whitewater boating expenditures in the lower Klamath River will be similar to the Existing Conditions.

4.10.2.3.4 Ocean Sport Fishing

Under the Proposed Action, salmon populations would increase, attracting more ocean recreational fishing effort, which would increase spending in the regional economy.

Table 4-73 summarizes annual salmon fishing effort (in total and by non-resident anglers) and non-resident angler expenditures for the Proposed Action (BOR and CDFG 2012, NOAA Fisheries Service 2012h as cited in BOR and CDFG 2012). The economic analysis focuses on nonresident angler expenditures, which represent 'new money' whose injection serves to stimulate the local economy.

Table 4-74 summarizes regional economic effects of ocean sport fishing in the Humboldt, Del Norte, and Curry counties under the Proposed Action relative to the Existing Conditions. The Proposed Action would support an increase in regional activity because of increased angler expenditures. Most employment, labor income, and output effects associated with ocean sport fishing would occur in the services sector. Employment created in this sector could be full or part time. Recreational expenditures for ocean sport fishing will increase under the Proposed Action relative to the Existing Condition, benefitting employment, labor income and output in the region. Effects are expected to be long-term.

Table 4-73 Total Annual Recreational Salmon Effort, Nonresident Effort and Nonresident Expenditures by Fishing Mode and Management Area for the Proposed Action

Management area	Angler Days Total	Angler Days Nonresident		Expenditures Nonresident (2012 dollars)		
	Party/Charter	Private	Party/Charter	Private	Party/Charter	Private
Humboldt and Del Norte Counties, CA	2,378	33,650	2,197	17,027	448,034	953,512
Curry County, OR	545	20,407	281	4,673	57,304	261,688

Source: BOR and CDFG 2012

Table 4-74 Change in Regional Economic Effects from Ocean Sport Salmon Fishing between the Existing Condition and the Proposed Action

Management Area	Total Effects[1]					
	Employment[2]		Labor Income[3]		Output[4]	
	Jobs	Percent Change from No Action	$ millions	Percent Change from No Action	$ millions	Percent Change from No Action
Humboldt and Del Norte Counties, CA	5.5	42.3	0.18	42.8	0.48	42.8
Curry County, OR	1.2	41.4	0.02	42.7	0.09	42.7

Source: Reclamation 2012b, as cited in BOR and CDFG 2012, presented in 2012 dollars.

[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production.
[4] Total Effect = Direct + Indirect + Induced Effects

Although some aspects of the Proposed Action are different from the dam removal scenarios analyzed in the USBR/DOI economic analyses, the primary assumptions regarding the effects of dam removal on coho and Chinook salmon have not materially changed. Dam removal will advance the long-term restoration of natural fish populations in the Klamath Basin. This will have a beneficial effect on ocean recreational fishing and an associated beneficial economic impact on the ocean recreational fishing industry in the six-county area.

4.10.2.4 Commercial Fishing

The Proposed Action will restore a more natural flow regime to the Klamath River as well as expand spawning and rearing habitat for salmon. These improvements will result in a healthier salmon population and an increase in commercial fishing landings and fishing revenues.

Table 4-75 provides projected revenue and changes in revenues under the Proposed Action relative to the Existing Condition in each management area. The differences range from approximately $114,000 in Curry County, Oregon to $3.9 million in San Francisco (Reclamation 2012b and NOAA Fisheries Service 2012a as cited in BOR and CDFG 2012).

Table 4-75 Annual Ex-vessel Revenue by Management Area (2012 dollars)

Management area	Revenue under Proposed Action ($)	Change in Revenue relative to Existing Condition ($)
San Francisco	13,028,998	3,903,445
Fort Bragg	6,000,817	1,797,825
Humboldt and Del Norte Counties, CA	469,121	140,547
Curry County, OR	381,058	114,164
Central Oregon	9,775,879	2,928,821

Source: DO1 2012 and CDFG 2012

Table 4-76 summarizes regional economic effects from the change in ocean commercial fishing revenue between the Existing Condition and the Proposed Action. Additional employment will range from 11 to 218 jobs, labor income will increase between $0.06 million to $2.56 million, and output could increase from $0.13 million to $6.6 million compared to the Existing Conditions. Most employment, labor income, and output effects will occur in the agricultural sector of the regional economy.

Table 4-76 Change in Regional Economic Effects from Ocean Commercial Fishing between the Existing Condition and, the Proposed Action

Management Area	Total Effects[1]					
	Employment[2]		Labor income[3]		Output[4]	
	Jobs	Percent Change	$ millions	Percent Change	$ millions	Percent Change
Central Oregon	136	42.6	1.74	42	4.07	42.6
Fort Bragg	69	42.7	1.05	42.8	2.41	42.8
Humboldt and Del Norte Counties, CA	19	41.7	0.07	42	0.19	42.6
Curry County, OR	11	43.8	0.06	42.8	0.13	42.8
San Francisco	218	42.7	2.56	42	6.6	42.6

Source: BOR and CDFG 2012; Reclamation 2012b, as cited in BOR and CDFG 2012, presented in 2012 dollars.

[1] Total Effect = Direct + Indirect + Induced Effects.

[2] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.

[3] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[4] Output represents the dollar value of industry production.

Although some aspects of the Proposed Action are different from the dam removal scenarios analyzed in the USBR/DOI economic analyses, the primary assumptions regarding the effects of dam removal on coho and Chinook salmon have not materially changed. Dam removal will advance the long-term restoration of natural fish populations in the Klamath Basin. This will have a beneficial effect on a significant beneficial effect on commercial fisheries and an associated significant beneficial economic impact on the coastal commercial fishing industry in the six-county area.

4.10.2.5 Tribal Economy

The Proposed Action will increase fish harvest for subsistence, cultural practices and commercial uses that would be beneficial to American Indian tribes residing in the six-county area. Tribal harvest opportunities for Chinook salmon, Pacific lamprey, steelhead, and other fish species are expected to increase in varying degrees under the Proposed Action. The return of Chinook salmon to the upper stretches of the Klamath River will have great cultural significance for many tribes, particularly the Klamath Tribes who have not had access to salmon for almost a century. A healthier fish population will provide greater opportunities for tribes to engage in subsistence and commercial fishing. In the case of the Yurok Tribe, the tribal guide fishery would improve, bringing additional money into the community. Benefits to be derived from this increased access to fish will include greater social and cultural cohesion associated with harvesting activities and associated ceremonies, greater opportunity to transmit cultural values and practices to the younger generation, and greater ability to provide food security, care for elders in the community, and engage in trade and barter.

Removal of the reservoirs behind the dams will reduce or eliminate the incidence of late-summer, toxigenic phytoplankton blooms that have prompted postings of public health advisories in the Hydroelectric Reach and further downstream on the Klamath River. These water quality improvements will have beneficial effects on tribal cultural practices in the six-county area. Improved water quality will provide healthier conditions for ceremonies and other cultural practices involving water contact (i.e. basket making, collecting medicinal plants).

Construction and monitoring activities associated with tribal program actions will increase jobs, labor income, and output for The Klamath Tribes, Karuk Tribe, and the Yurok Tribe.

4.10.3 Proposed Measures

As shown throughout this section, the Proposed Action may result in some localized short-term negative economic impacts but will not result in any long-term negative impacts to socioeconomic resources within the in the six-county area. The Proposed Action will benefit socioeconomic resources by implementation of the Recreation Facilities Plan and by improving conditions in-river sport fishing, ocean recreational fishing,

commercial fishing and fish harvest for subsistence, cultural practices and commercial uses beneficial to American Indian tribes residing in the six-county. The Renewal Corporation is not proposing any further management measures for socioeconomic resources.

4.10.4 References

Federal Energy Regulatory Commission (FERC). 2007. Final Environmental Impact Statement for Hydropower License: Klamath Hydroelectric Project FERC Project No. 2082-027. FERC/EIS-0201F. Washington, DC, Federal Energy Regulatory Commission, Office of Energy Projects, Division of Hydropower Licensing.

DOI Real Estate Sub-team. 2012. Assessment of Potential Changes to Real Estate Resulting from Dam Removal: Secretarial Determination Regarding Potential Removal of the Lower Four Dams on the Klamath River.

U.S. Bureau of Labor Statistics. (USBLS) 2020. Labor Force Data by County, 2018 Annual Average. https://www.bls.gov/lau/laucnty18.txt. Accessed April 15, 2020.

U.S. Bureau of Reclamation (USBR). 2012. Benefit Cost and Regional Economic Development Technical Report for the Secretarial Determination on whether to remove four dams on the Klamath River in California and Oregon. USBR Technical Services Center, Denver, Colorado.

U.S. Census Bureau. 2020a. Income in the Past 12 months (in 20120 Inflation-adjusted Dollars). [Online] https://data.census.gov/cedsci/table?q=Oregon%20Income&g=0400000US41,06_0500000US41015,41029,41035,06023,06015,06093&tid=ACSST5Y2010.S1901&t=Income%20%28Households,%20Families,%20Individuals%29&hidePreview=true&layer=VT_2018_050_00_PY_D1. Accessed April 6, 2020.

U.S. Census Bureau. 2020b. QuickFacts: Del Norte County, California; Humboldt County, California; Siskiyou County, California; Klamath County, Oregon; Curry County, Oregon; Jackson County, Oregon. [Online] https://www.census.gov/quickfacts/fact/table/delnortecountycalifornia,humboldtcountycalifornia,siskiyoucountycalifornia,klamathcountyoregon,currycountyoregon,jacksoncountyoregon/PST045219. Accessed April 9, 2020.

U.S. Census Bureau. 2020c. My Tribal Area. https://www.census.gov/tribal/?st=06&aianihh=1490. Accessed April 10, 2020

U.S. Department of the Interior (DOI), 1993. Office of the Solicitor. Memorandum M-36979 on the subject of "Fishing Rights of the Yurok and Hoopa Valley Tribe." Available at http://www.doi.gov/solicitor/opinions.html.

U.S. Department of the Interior and California Department of Fish and Game (BOR and CDFG). 2012. Klamath Facilities Removal Final Environmental Impact Statement/Environmental Report.

4.11 Cultural Resources

As described in Section 4.1, this Exhibit E incorporates by reference the extensive environmental documentation developed since the 2004 PacifiCorp Application as described in Table 4-77.

Table 4-77 Cross-walk of Cultural Resources Reference Documents

Date	Author	Reference Document	Section Number	Page Number(s)
2004	PacifiCorp	Application for New License	E6.0	6-1 – 6-144
2007	FERC	Final EIS	3.3.9	3-538 – 3-557
2012	U.S. BOR	EIS/EIR	3.13	3.13-1 – 3.13-54
2018	KRRC	Definite Plan Report	Appendix L	11-69
2020	SWRCB	Final EIR	3.12	AT1-760 – AT1-856
2020	State of California	401 WQ Certificate	N/A	N/A
2018	State of Oregon	401 WQ Certificate	N/A	N/A
2020	SWRCB	Attachment 4: CEQA Findings	N/A	85 – 120
2018	ODEQ	Evaluation and Findings Report	N/A	N/A
2011-2020	PacifiCorp	KHSA Interim Measures Implementation Annual Report (2020)	N/A	N/A

Under 54 USC 306108; hereinafter, 'Section 106', as amended, federal agencies are obligated to account for the effects of undertakings on historic property. Historic property is described under 36 CFR 800.16(l) as "prehistoric or historic sites, buildings, structures, NRHP objects, districts, or locations of traditional use or beliefs" which are eligible for listing in or listed in the NRHP. A historic property is evaluated for listing in the NRHP by criteria found at 36 CFR 60.4 and National Register Bulletin 15 "How to Apply the National Register Criteria for Evaluation."[22] Section 106 is implemented through the Advisory Council on Historic Preservation's regulations, "Protection of Historic Properties" (36 CFR Part 800).

As discussed throughout this section, a plan for identification and protection of cultural and historic elements will be provided in the MOA (per 36 C.F.R. § 800.6(c)) and Historic Properties Management Plan (HPMP). A record of Tribal and cultural consultation is included in Appendix B.

[22] Bulletin 15 defines four types of significance for properties (A-D) and seven criteria considerations (A-G).

4.11.1 Prehistoric Setting

4.11.1.1 Paleoarchaic (12,000 to 7,000 B.P.)

Through the Paleoarchaic period, hunter-gatherers, whose society centered around large game animals, inhabited the project area. The population was characterized by low densities and high mobility, with maximum flexibility (Ames et al. 1998, as cited in PacifiCorp 2004).

4.11.1.2 Early Archaic (7,000 to 4,500 B.P.)

In the Klamath River Canyon, the Early Archaic period provides most of the archeological evidence for initial human occupation (Mack 1983 and 1991, as cited in PacifiCorp 2004). This period is distinguished by a less mobile lifestyle.

4.11.1.3 Middle Archaic (4,500 to 2,500 B.P.)

The Middle Archaic is characterized by an increasing presence of milling stones and pestles at sites, indicating an improved manipulation of the surrounding riverine and marsh environments (PacifiCorp 2004).

4.11.1.4 Late Archaic/Late Prehistoric (2,500 to 200 B.P.)

Several changes characterize the Late Archaic period, including more prominent use of pit houses, development of the bow and arrow, reliance on fishing, and a change in land use patterns with the development of the seasonal “winter village” (Aikens 1993, as cited in PacifiCorp 2004).

4.11.2 Historic Setting

Several Euro-American explorers made expeditions to the project area starting around 1825, however, there is no consensus on which was the original group (Hopkins 1977, as cited in PacifiCorp 2004). These expeditions by fur traders and explorers continued for almost three decades, with prospectors attracted to the lands available for ranching, agricultural, and timber. Development of several railroads and waterways helped the area grow, and in 1909 the Southern Pacific Railroad connected the Klamath River Basin to the rest of the United States. In addition, several laws were passed, promising land to United States citizens (Nilsson and Greenway 1985 as cited in PacifiCorp 2004; City of Klamath Falls 1986, as cited in PacifiCorp 2004). As the population of Klamath Falls increased from 852 to 16,047 during the period of 1900 to 1930 (Dicken and Dicken, ca. 1985, as cited in PacifiCorp 2004), there were many other social and economic changes in the project area. President Theodore Roosevelt created the 80,000-acre Lower Klamath Lake

National Wildlife Refuge in 1908 (Blake et al. 2000, as cited in PacifiCorp 2004) and in 1895, Klamath Falls Light & Water Company built a power plant that provided power for Klamath Falls.

4.11.3 Summary of Previous Cultural Resources Surveys

There have been several archeological surveys in the project area (PacifiCorp 2004), specifically in three regions around the Klamath River Basin (Table 4-78).

Table 4-78 Archaeological Surveys in Lower Klamath Project Area

Region	Surveys
Upper Klamath River Region	Mack 1983, 1989, 1991 Gleason, 2001 Hannon and Olmo, 1990 Leonhardy, 1967 Oetting, 1996
Upper Klamath Lake and Upper Klamath River Basin Regions	Cressman, 1956 Sampson, 1985
In the Immediately Adjacent Areas	Aikens and Jenkins, 1994 Cleland, 1997 Fagan et al. 1994 Nilsson, 1985 Oetting, 1993 Raven, 1984 Ritter, 1989

Cultural surveys were conducted as pedestrian surveys and cultural resources monitoring (SWRCB 2020a). An estimated 8,189 acres of federal, state, and/or private land have been previously surveyed within the records search area and except for some proposed disposal sites, encompasses the current boundaries of the Proposed Project (SWRCB 2020a).

Additionally, the Renewal Corporation conducted an updated records search in 2017 at the California Historical Resources Information System's Northeast center at Chico, State University, for a study area that includes the length of the Klamath River from the Oregon-California state line, 40 miles downstream to Humbug Creek (SWRCB 2020a, Table 4-79) The section of river below Iron Gate Dam (the most downstream Lower Klamath Project dam) was included in the records search since this 18-mile long area lies within the altered FEMA 100-year floodplain following dam removal, where cultural resources have the potential to be affected. The records search area included a 0.5-mile wide buffer, extending on either side of the shorelines of Copco No. 1 Reservoir and Iron Gate Reservoir, and from the center point of the Klamath River in all other areas (SWRCB 2020a).

Table 4-79 Summary of Previous Recorded Cultural Resources for Oregon and California

Resource Type	Component Type					
	Prehistoric	Historic	Multiple	Ethonographic Only	Unknown	Total
Archaeological Site	162	83	44	--	1	290
Ethnographic	--	--	--	1	--	1
Build Environment	--	24	3	--	--	27
Isolated Find	158	17	--	--	1	176
Undetermined	--	--	--	--	8	8
Total	320	124	47	1	10	502

Source: KRRC 2018

4.11.4 Ethnographic Resources

Both the Klamath Tribe and the Shasta Tribe identified a number of ethnographic sites as Traditional Cultural Properties (TCPs) within the project area. There are several tribes that identified a number of river-associated fish and plants as cultural resources and indicated that the Klamath River forms an ethnographic riverscape[23] (Deur 2003 as cited in PacifiCorp 2004).

4.11.5 Lower Klamath Project

As described in Section 4.2, the Project (FERC No. 14803) consists of four hydroelectric developments (J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate) with their associated generation facilities and support structures located along the Klamath River in Klamath County, Oregon, and Siskiyou County, California.

[23] The Renewal Corporation continues to collect information regarding tribal ethnography, TCPs, and the proposed Klamath Riverscape.

Several summary tables,[24] describing the cultural resources inventory and description of cultural resources in the project area can be found in PacifiCorp's 2004, KHP Exhibit E Cultural Resources and are listed below:

- Table E6.2-1. NRHP recommendations and justification for prehistoric sites and site components.
- Table E6.2-2. NRHP recommendations and justification for historic-period sites and site components.
- Table E6.2-3. Historic project structures, date of construction, and NRHP evaluation.[25]
- Table E6.5-1. Results of the Oregon and California record searches.

4.11.6 Environmental Analysis

Cultural resources[26] eligible for the NRHP will likely be adversely affected by the Proposed Action. Through informal consultation the Renewal Corporation worked with SHPOs and applicable tribes and agencies[27] (Appendix B) to determine an Area of Potential Effects (APE)[28] for the Proposed Action (Figure 2-3 of the Project Historic Properties Management Plan as cited by KRRC 2020d). In accordance with Section 304 (16 USC 4702-3) of the NHPA, as amended, distribution of this information will be limited and filed with FERC as Privileged. In addition, as required under 36 CFR § 800.5, the Renewal Corporation will identify and evaluate all adverse effects on NRHP eligible cultural resources within the APE resulting from Proposed Action.

Adverse effects from the Proposed Action could result from:

- Ground disturbing activities such as moving equipment; vegetation clearing; grading; trenching; excavation; and any other earth-moving activity that disturbs historical resources or historic properties, previously undisturbed cultural resources, or cultural resources not yet evaluated for NRHP eligibility.

[24] These tables were procured from the KHP Exhibit E Cultural Resources (PacifiCorp 2004).

[25] The table identifies Historic Contributing elements which were constructed during the period of significance and retain integrity under Criterion A for eligibility to the NRHP. Specifically, for the Proposed Action, the J.C. Boyle Diversion Dam Complex contains both Historic Contributing and noncontributing elements, the Copco No. 1 Complex contains Historic Contributing elements, the Copco No. 2 Complex contains Historic Contributing and noncontributing elements, and the Iron Gate Dam Complex is identified as noncontributing.

[26] Cultural resources include archeological sites, historic structures, TCPs, and the proposed Klamath Riverscape.

[27] The Advisory Council on Historic Preservation (ACHP); United States (U.S.) Department of Agriculture Forest Service (USFS) (Klamath National Forest and Six Rivers National Forest); U.S. Department of Interior Bureau of Land Management [BLM] Redding District, and Klamath Falls Resource Area, Lakeview District), U.S. Bureau of Reclamation (USBR), U.S. Army Corps of Engineers (USACE); Indian tribes (including the Klamath Tribes, Shasta Indian Nation, Modoc Nation, Karuk Tribe, Yurok Tribe Yurok Reservation, Shasta Nation, Quartz Valley Indian Community of the Quartz Valley Reservation of California, Confederated Tribes of Siletz Indians of Oregon, Resighini Rancheria, Cher-Ae Heights Indian Community of Trinidad Rancheria, and the Hoopa Valley Tribe), Oregon and California SHPOs, and other interested parties.

[28] The proposed APE is a 0.5-mile-wide area on each side of the Klamath River from the upper reach of the J.C. Boyle Reservoir to the river mouth at the Pacific Ocean. Around the reservoirs, the APE extends at least an additional 0.5 mile to create a minimum 1-mile-wide area on each side of the reservoirs to address the potential for indirect effects primarily related to viewshed alterations resultant from reservoir removal. Due to the potential for landscape-level visual changes, the APE around each reservoir may extend beyond the 1-mile-wide area to ensure inclusion of areas that are within sight lines of the reservoirs and Area of Direct Impacts (ADI). The maximum extent of the APE has been set at 2 miles from the ADI.

- Construction activities such as blasting and use of access roads, staging areas, and disposal sites that disturbs historical resources or historic properties, previously undisturbed cultural resources, or cultural resources not yet evaluated for NRHP eligibility
- Activities associated with water supply improvements, downstream flood control improvements, river crossings, fish hatchery plans, and recreation facilities removal that disturb any known or previously undisturbed cultural resources.
- Removal of aspects of the Project (J.C. Boyle Diversion Dam Complex, Copco No. 1 Complex, and Copco No. 2 Complex; and appurtenant facilities) that are NRHP eligible.
- Adjustments in the river channel configuration which may expose previously undisturbed cultural resources, or cultural resources not yet evaluated for NRHP eligibility.
- Disturbance caused by recreational off-road vehicles.
- Changes in erosion and sedimentation patterns that disturbs historical resources or historic properties, previously undisturbed cultural resources, or cultural resources not yet evaluated for NRHP eligibility.
- Looting and vandalism activities to sites that were previously inaccessible.29
- Alterations in the landscape-level visual character of the NRHP eligible cultural resources.
- Land easement and transfer.
- Alterations in water quality.

4.11.7 Proposed Measures

The Renewal Corporation will implement the measures included in the DDP, and outlined in Table 3-1, to address impacts to each resource area. A summary description and analysis of each measure is outlined in the "References" column of Table 3-1.

To ensure those measures are successfully implemented and meet the interests of stakeholders, management plans are being developed. These management plans are outlined in Table 3-2 as well as in the DDP. Below are the specific proposed measures and management plans related to cultural resources.

The Renewal Corporation will implement measures to avoid or minimize the adverse effects of the Proposed Action on any NRHP eligible cultural resources in coordination with SHPOs and applicable tribes and agencies. These measures are outlined below.

- The consulting parties are developing a MOA (per 36 C.F.R. § 800.6(c)) with measures that will be included in and implemented by the HPMP.

[29] Details for looting and vandalism prevention are presented in the Lower Klamath Project Looting and Vandalism Prevention Plan.

- The Renewal Corporation will implement the HPMP for the Proposed Action with physical measures to directly protect the site[30], maintain archaeological or American Indian monitors[31], implement avoidance measures (where possible), participate in consultation, implement education and education for those conducting the Proposed Action, and make stipulations for inadvertent discoveries of historic properties, human remains, funerary objects, and objects of cultural patrimony (HCTM-1).
- As part of the HPMP, the Renewal Corporation will implement the Looting and Vandalism Prevention Program which will deter looting and vandalism to tribal cultural resources (TCR) associated with the Proposed Action. The program will involve measures for training, protocols for communication, measures to prevent or restrict public access to the reservoir areas and limit the use of off-road vehicles following the drawdown (HCTM-1).
- Additional measures and management plans related to tribal resources are outlined in Section 4.12 (HCTM-1).
- The Renewal Corporation will implement the Inadvertent Discovery Plan as part of the HPMP, which will establish protocols in the case of an inadvertent TCR such as human burial site or human remains discovered during implementation of the Proposed Action (HCTM-1).

4.11.8 Unavoidable Adverse Impacts

The Renewal Corporation will remove the Historic Contributing Elements of the J.C. Boyle Diversion Dam Complex, the Copco No. 1 Complex, and the Copco No. 2 Complex. A plan for removing these elements and altering the visual character of the Lower Klamath Project will be provided in the HPMP.

4.11.9 References

Klamath River Renewable Corporation (KRRC). 2018. Definite Plan Report for the Lower Klamath Project. Retrieved from: http://www.klamathrenewal.org/definite-plan/.

Klamath River Renewal Corporation (KRRC). 2020d. Lower Klamath Project Draft Historic Properties Management Plan, In Progress. Oakland, California.

PacifiCorp (PacifiCorp). 2004. Application for New License for Major Project. Klamath Hydroelectric Project. FERC Project No. 2082. PacifiCorp. Portland, Oregon. Retrieved from: https://www.pacificorp.com/content/dam/pcorp/documents/en/pacificorp/energy/hydro/klamath-river/relicensing/klamath-final-license-application/Exhibit_E_Table_of_Contents_Introduction_and_General_Description.pdf.

[30] The HPMP includes provisions for a Tribal Cultural Resources Management Program and reports summarizing compliance activities (SWRCB 2020a).

[31] Details for monitoring and inadvertent discovery are presented in the Lower Klamath Project Archaeological Monitoring and Inadvertent Discovery Plan.

State Water Resources Control Board (SWRCB). 2020a. Final Environmental Impact Report for the Lower Klamath Project License Surrender. Available online: https://www.waterboards.ca.gov/waterrights/water_issues/programs/water_quality_cert/lower_klamath_ferc14803_eir.html.

4.12 Tribal Resources

As described in Section 4.1, this Exhibit E incorporates by reference the extensive environmental documentation developed since the 2004 PacifiCorp Application as described in Table 4-80.

Table 4-80 Cross-walk of Tribal Resources Reference Documents

Date	Author	Reference Document	Section Number	Page Number(s)
2004	PacifiCorp	Application for New License	E6.4	6-115 – 6-117
2007	FERC	Final EIS	3.3.8.2.3 3.3.3.3.2	3-532 – 3.534 3-536 – 3-538
2012	U.S. BOR	EIS/EIR	1.3 3.12	1-10 – 1-11 3.12-1 – 3.12-53
2018	KRRC	Definite Plan Report	Appendix L	11-69
2020	SWRCB	Final EIR	3.12	AT1-760 – AT1-856
2020	State of California	401 WQ Certificate	Condition 22	42 – 43; 85 – 86
2018	State of Oregon	401 WQ Certificate	N/A	N/A
2020	SWRCB	Attachment 4: CEQA Findings	N/A	85 – 120
2018	ODEQ	Evaluation and Findings Report	N/A	N/A
2011-2020	PacifiCorp	KHSA Interim Measures Implementation Annual Report (2020)	N/A	N/A

There are six federally recognized American Indian tribes that have a historical presence in the Klamath River Basin: the Klamath Tribes (Klamath-Modoc-Yahooskin), the Karuk Tribe, the Hoopa Valley Tribe, the Resighini Rancheria, Yurok Tribe of the Yurok Reservation, Quartz Valley Indian Community of the Quartz Valley Reservation of California, as well as the Shasta People, who are in the process of becoming federally recognized (Fed. Reg. 2019).

The 253-mile Klamath River and its tributaries were once rich in salmon and trout. These fish were used by American Indians for thousands of years before the first European settlers reached the West Coast.

4.12.1 Affected Environment

4.12.1.1 Klamath Tribes (Klamath-Modoc-Yahooskin)

The Klamath Tribes, which are comprised of the Klamath, Modoc, and Yahooskin, believe that everything needed to live was provided for in the Klamath River Basin (Klamath Tribes 2020). The Klamath Tribes are indigenous inhabitants of the Klamath River Basin located in southern Oregon. According to their history, the "six tribes" lived "along the Klamath Marsh, on the banks of Agency Lake, near the mouth of the Lower Williamson River, on Pelican Bay, beside the Link River, and in the uplands of the Sprague River Valley. The Modoc lands included the Lower Lost River, around Clear Lake, and the territory that extended south as far as the mountains beyond Goose Lake. The Yahooskin Tribe occupied the area east of the Yamsay Mountain, south of Lakeview, and north of Fort Rock" (Klamath Tribes 2020).

After contact with settlers, in 1864, the Klamath Tribes ceded more than 23 million acres of land and entered the reservation era (Klamath Tribes 2020). The Klamath Tribes, however, retained rights to hunt, fish, and gather on the lands reserved for them in perpetuity. In 1986, through the leadership and vision of the Klamath Tribes, the Klamath Restoration Act was adopted into law, re-establishing the Klamath as a sovereign state. Although the Klamath Tribe's land base was not returned to them, they were directed to compose a plan for economic self-sufficiency. The Economic Self-sufficiency Plan is foundational document that reinforces the Klamath Tribes' commitment to participating in and supporting the local economy (Klamath Tribes 2020).

In 1954, the U.S. Congress terminated its federal relationship with the Klamath Tribes under the Klamath Termination Act. The Klamath Indian Tribe Restoration Act (1986), which was provided to restore the federal trust with, and federal services and assistance to the Klamath Tribes, noted that it will not abrogate any water rights of the Tribe and its members or fishing rights or privileges of the Tribe. For time immemorial, the Klamath Tribe now retain their senior tribal water rights on the Klamath River after 38 years of litigation (known as the Klamath River Basin Adjudication) that lasted from 1975 (*United States v Adair)* to 2013, concluding in the Oregon Office of Administrative Hearings declaring that six of the eight treaty-reserved water rights of the Klamath Tribes had been reinstated (State of Oregon 2013).

Additional information on the history and cultural of the Klamath Tribe can be found in the SWRCB Final EIR Section 3.12.2.1 (Klamath Tribes 2020).

4.12.1.2 Karuk Tribe

The Karuk (also spelled *Karok*) Tribe are indigenous inhabitants who have lived or currently live within the State of California and are still one of the largest tribes in California. Happy Camp, California is located in the Karuk Tribe's ancestral territory, which extends along the Klamath River from Bluff Creek in Humboldt County, through Siskiyou County in southern Oregon. Since time immemorial, the Karuk resided along the banks of the Klamath River where they held cultural traditions such as hunting, gathering, fishing, basket-making, and ceremonial dances, and services (Bell 1962).

Bell (1962) notes that the Klamath River has been considered so vital to the Karuk that is serves as a basis for their spatial orientation. For the Karuk, the cardinal directions were *yuruk* (downriver), *karuk* (upriver), *maruk* (away from the river or uphill), and *saruk* (toward the river or downhill). Karuk villages once extended for a 60-mile stretch from the Seiad Valley to Bluff Creek. The Karuk considered the Ka'tim'íim, an ancient ceremonial site on the Klamath River located just above the mouth of the Salmon River, the center of their world (Bell 1962). At the turn of the century, there were three principal population clusters, each consisting of a major ceremonial site, with smaller villages nearby. These were the *Panámniik*, located near the mouth of Camp Creek, the *Ka'tim'íim*, located above the mouth of the Salmon River, and the *Inaam*, located near the mouth of Clear Creek. However, other portions of the Klamath River held additional Karuk villages. In 1852, miners burned down many Karuk villages, but by the late 1860s, over 90 villages still remained (Bell 1962). Today, major towns in Karuk ancestral land are found along the Klamath River Highway in both Siskiyou and Humboldt counties (Bell 1962).

Additional information on the history and cultural of the Karuk Tribe can be found in the SWRCB Final EIR Section 3.12.2.1 (Karuk 2020).

4.12.1.3 Hoopa Valley Tribe

The Hoopa Valley Tribe has lived in its valley in Humboldt County for over 10,000 years. The Hoopa Valley Reservation, located in northern California, covers 144-square-miles of montane forest ranging in elevation from 320 to 5,000 feet (USEPA 2006). The Hoopa Valley Tribe has jurisdiction over all lands within the confines of the Hoopa Valley Indian Reservation boundaries as established by the Executive Order of June 23, 1876, along with other lands acquired by or for them after 1876 (Hoopa Valley Tribe 2012).

The Klamath River is an important resource to the Hoopa Valley Tribe because this is where they collected seaweed and dried it for salt (Sommerfeld 2020). The valley is isolated by mountains, which limited access for other tribes. Commercial fishing plays an important role in the regional and tribal economics. Salmon provide a critical food source on tribal lands, as well as serving a ceremonial purpose.

Additional information on the history and cultural of the Hoopa Valley Tribe can be found in the SWRCB Final EIR Section 3.12.2.1 (2020).

4.12.1.4 Yurok Tribe of the Yurok Reservation

The Yurok Tribe is California's largest American Indian tribe with enrollment at nearly 5,000 members. The Yurok's territory consists of their current reservation land, as well as 1 mile on each side from the mouth of the Klamath River, and up-river for 44 miles (Yurok Tribe 2020). The Yurok Tribe had extensive trade and social networks throughout California and the region. The Yurok Tribe considers the Klamath River an essential resource that carries not only fish and water, but historical connections to their ancestors.

After first contact with European settlers and explorers, the Yurok Tribe was devastated by disease and invasions (Smith 2018). In 1851, the Yurok signed a treaty with the United States government, but European settlers, motivated by gold in California, insisted the government not ratify the treaty. Although the Yurok Reservation was established in 1855, but by 1985, the settlers were arguing that the reservation had been abandoned, and that they instead had rights to the homestead (Smith 2018). The government then divvied up the land parcels, giving small parcels for each Yurok Tribal member, and distributing the rest of the land to non-Native homesteaders (Smith 2018).

In the years that followed, the Yurok Tribe was relocated by the United States government without the ability to practice their cultural traditions. During this time, the Yurok Tribe attempted to establish a federally recognized sovereignty and authority to protect and preserve both their traditions and their ancestral land (Yurok Tribe 2020). In 1993, the Yurok Tribe established the Constitution of the Yurok Tribe, which defined their territory and jurisdiction. The Yurok Reservation spans over 63,000 acres (Yurok Tribe 2020).

Additional information on the history and cultural of the Yurok people can be found in the SWRCB Final EIR Section 3.12.2.1 (Yurok Tribe 2020).

4.12.1.5 Shasta Tribe

The Shasta Tribe is currently represented by various American Indian entities including but not limited to the Shasta Nation, Shasta Indian Nation, and the Etna Band of Indians (SWRCB 2020a). Sources generally agree that the traditional Shasta territory extended north to a point approximately 20 miles north of Ashland, Oregon, and from Clear Creek on the Klamath River east to Mt. Hebron (Silver 1978, Jester 2016, as cited in SWRCB 2020). The Shasta Tribe are members of the Hokan language family (Silver 1978, as cited in SWRCB 2020).

Although there are several groups of the Shasta Tribe, this section focuses on the Klamath River Shasta Tribe (also called the *Wiruhikwaiiruka* or *Kammatwa*) (Daniels 2006, as cited in SWRCB 2020). Silver (1978, as cited in SWRCB 2020) states that "Shasta [people] were organized into autonomous tribelets consisting of extended family groups that occupied a group of villages. The family was the basic social unit of the Shasta, with the village being the political and economic unit. Each village had a chief/headman to provide leadership and organize important social, political, and economic events. Shamans conducted a variety of ceremonies in villages, and the Shasta people considered Mount Shasta to be sacred ground that was used for healing, blessing, and ceremonies. Mount Shasta is a significant part of Shasta traditions and ceremonialism" (SWRCB 2020a).

According to Silver (1978, as cited in SWRCB 2020a), the "Shasta along the Klamath River tended to build their winter villages near the river. Villages had recognized territories with areas for each family, including fishing places with fish weirs along the Klamath. Hunting territories also were held privately over the long term, in contrast to tobacco-growing plots and acorn-gathering trees, which were claimed only for brief periods. Typical villages consisted of brush shelters, bark houses, sweathouses, assembly houses, and winter houses" (SWRCB 2020a).

"Currently, Shasta [people] are represented in the Shasta Nation, Shasta Indian Nation, and the Etna Band of Indians otherwise known as the Ruffey Rancheria. Along with working on federal recognition, through the Ruffey Rancheria Restoration Act, the Shasta people continue to preserve, protect, and maintain TCPs, including sites associated with those practices" (SWRCB 2020a).

Additional information on the history and cultural of the Shasta people can be found in the SWRCB Final EIR Section 3.12.2.1 (SWRCB 2020a).

4.12.1.6 Quartz Valley Indian Community of the Quartz Valley Reservation of California

According to BOR (1939, as cited in SWRCB 2020a), "the Quartz Valley Community is a federally recognized tribe mainly representing people of Karuk and Shasta ancestry, with 174 acres of reservation lands in the Scott Valley, near Fort Jones, California. The Quartz Valley Indian Community's reservation lands are located near the community of Fort Jones. The Quartz Valley Indian Community initially filed their constitution and bylaws with the Office of Indian Affairs in 1939" (SWRCB 2020a).

4.12.1.7 Resighini Rancheria

The Resighini Rancheria is federally recognized Tribe comprised of the Yurok people. As outlined in SWRCB (2020), the Resighini Rancheria "is located on the southern banks of the Klamath River Estuary. The tribe shares a cultural history to that of greater Yurok culture, as described above. Land known as the Resighini Rancheria was designated by Secretarial Order and was officially declared a reservation in 1939, within the original Klamath River Reservation. In 1975, a group of Yuroks stood together and formally created a non-traditional form of government with a constitution and bylaws which was approved and ratified by the Department of Interior of the United States. The Tribe asserts that it maintains fishing and water rights in the Lower Klamath River Basin and strive to protect fishing, wildlife, forestry, surface water, groundwater, and other trust resources" (SWRCB 2020a).

4.12.2 Tribal Resource Inventory

In 2017, the Renewal Corporation performed an updated records inventory search at the California Historical Resources Information System's Northeast Center at Chico State University, for the study area that included the length of the Klamath River from the Oregon-California border, downstream 40 miles to Humbug Creek (CWR 2020). Additionally, the section of river below Iron Gate Dam (the lowest hydroelectric facility) was included since its FEMA floodplain footprint contains cultural resources that have the potential to be affected (CWR 2020). The records search has a 0.5-mile buffer zone. This records inventory was a supplement to the previously performed inventories that were conducted as part of the KHP Relicensing (FERC 2007), and the 2012 KHSA EIS/EIR studies (PacifiCorp 2004 and Cardno Entrix 2012) (SWRCB 2020a).

The records search included gathering information from the following sources, as outlined in SWRCB 2020 Section 3.12.2.3:

- California Historic Landmarks, NRHP, California Register of Historical Resources, California Points of Historical Interest, California Inventory of Historic Resources, and the California State Historic Resources Inventory;
- Klamath National Forest office and the Siskiyou County Museum.
- National Digital Newspaper Program archives provided by the Library of Congress and National Endowment for the Humanities.
- Genealogy Bank newspaper archives provided by NewsBank, Inc.
- California Digital Newspaper Collection repository provided by University of California, Riverside.
- Newspaper archives provided by www.Ancestry.com.
- PacifiCorp, including geographic information system (GIS) shapefiles with previous survey and resource locations, as well as a copy of the final cultural resources technical report prepared for KHP relicensing (PacifiCorp 2004).
- Native American Heritage Commission's Sacred Lands file.
- Previous studies (Kramer 2003a,b; Cardno Entrix 2012; Durio 2003; PacifiCorp 2004, as cited in SWRCB 2020) completed specifically in the Proposed Action project area (including archaeological, ethnographic, or historical overviews, and archaeological excavations) (SWRCB 2020a).

Since TCPs are historical resources by definition (SWRCB 2020a), several summary tables describing resource inventories in the Proposed Action project area are identified in Section 4.11 (Cultural Resources).

The Klamath, Shasta, Karuk, and Yurok Tribes participated in the identification of TCPs and identified a number of culturally important locations that have tribal cultural value.

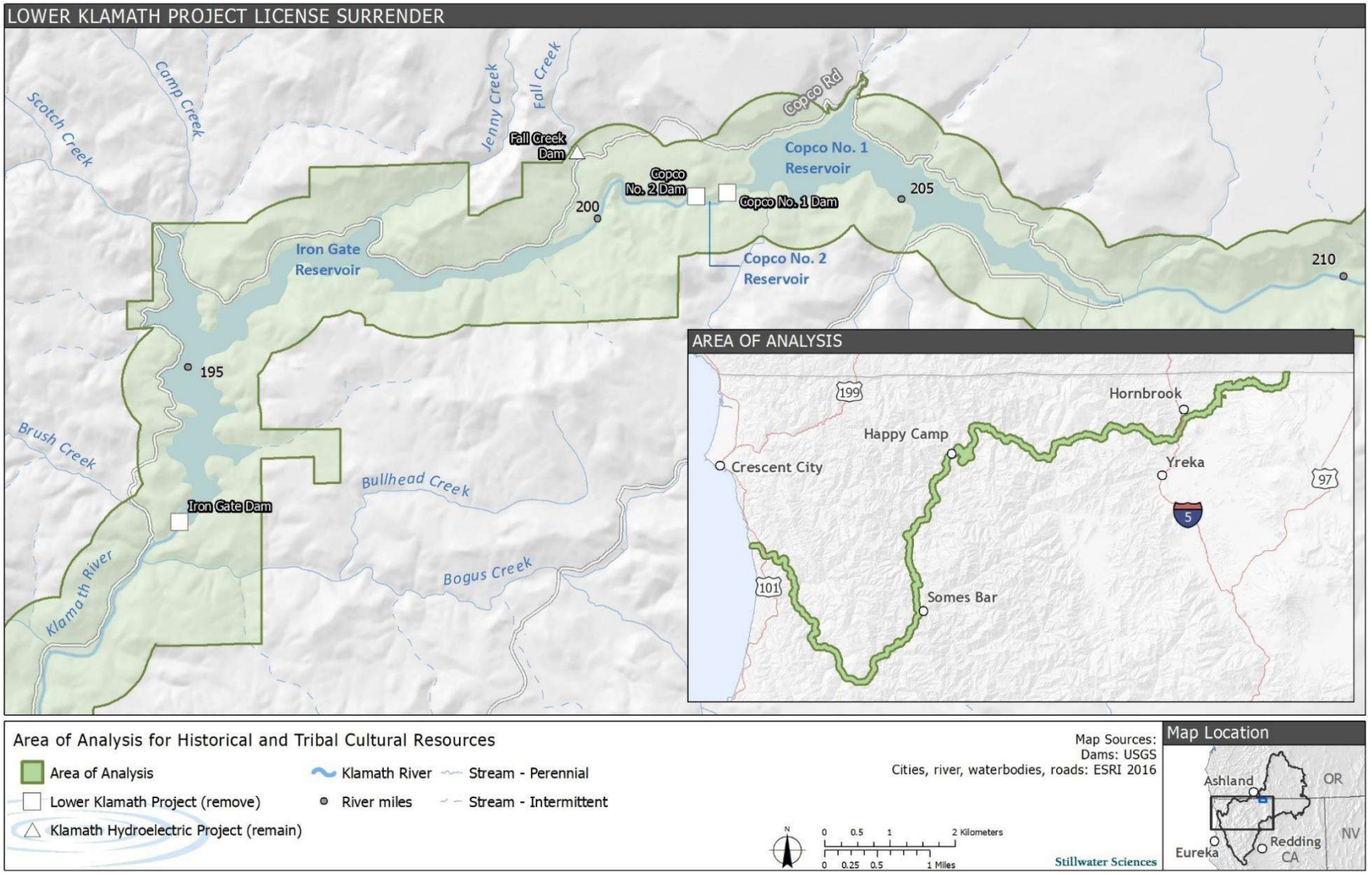
4.12.3 Environmental Analysis

For the purposes of the tribal cultural resource analysis, the environmental setting focuses on the Shasta, Klamath, Karuk, Modoc, Hupa[32], and Yurok people that have historically occupied the territory along and adjacent to the Klamath River in the vicinity of the Lower Klamath Project (Figure 4-21) (SWRCB 2020a). A full description of the historical period context can be found in SWRCB Final EIR Section 3.12.2.2 (2020).

From time immemorial these native people have occupied the areas along the Klamath River. As outlined by the SWRCB (2020a), "ancient stream terraces—composed of gravel and sand and covered in meadows of grass with mixed oak groves—provided ideal conditions for food supply. Additionally, the area of the Upper and Middle Klamath River provided naturally occurring salt deposits, geothermal hot springs, basalt rock caves, and food such as anadromous and resident fish, seeds, roots, birds, and mammals" (SWRCB 2020a).

Although the Klamath River dams have helped in the development of the area and its agricultural community, the presence and operation of the hydropower Project have caused severe problems for anadromous fish, the ecosystem, and the tribes' cultural resources. The removal of these dams will return the cultural and economic focus of the Klamath River to these tribes. These treaty-reserved interests of the four tribes to take fish as well as to access traditional fishing places are subject to the federal trust responsibility which cannot be abrogated or diminished without the specific action of Congress. This issue is discussed in various appropriate places throughout this document (e.g., water quality, fisheries, land use, cultural).

[32] The term Hupa describes the Hupa People. The term Hoopa is used to reference the Hoopa Valley place or the tribal government (SWRCB 2020a).



Source: SWRCB 2020a

Figure 4-21 Area of Analysis for Historical and Tribal Cultural Resources

As a result of the Proposed Action, the following TCPs will be impacted:

- Removal of these four hydroelectric developments will result in the potential to restore the historic fish runs in the Klamath River.
- Natural sediment transport conditions will be re-established if the dams were removed. This will restore needed spawning gravel and woody debris for fish.
- Draining the reservoirs and returning the river and surrounding land to pre-dam conditions will reduce downstream temperatures in the river.
- Removal of the four dams will restore an additional 300 miles for fish migration (American Rivers 2019), increasing the ability for tribes to fish in their ancestral waters.
- Revegetation of native plants, and those traditional vegetations culturally important to the tribes will likely increase.
- In the long-term, the dam removals will return in wildlife benefitting from the year-round, stable food source these fish once provided.
- Threatened or endangered animals such as bald eagles will benefit directly from an increase in available prey, others from the creation of additional habitat.
- The forested areas around the dams will be restored.

The Copco No. 1 dam became operational in 1918, which essentially ended salmon runs in the Upper Klamath River Basin, followed by Copco 2 in 1925, J.C. Boyle Dam in 1958, Iron Gate Dam in 1962, and Keno Dam in 1965 (WEF 2020). The KHP dams have operated for more than 100 years with loss of tribal access to usual and accustomed fishing places, with significant loss of both freshwater and marine fisheries resources, and with no consideration for preservation of river hydrology or morphology for the needs of the fisheries.

In general terms, implementing the Proposed Action will restore the Klamath River ecosystem and native fisheries, and uphold the federal trust responsibility to affected American Indian tribes.

4.12.4 Proposed Measures

The Renewal Corporation proposes to implement the measures stated in the DDP, and outlined in Table 3-1, to address impacts to each resource area. A summary description and analysis of each measure is outlined in the “References” column of Table 3-1.

As outlined in the Section 4.11 (Cultural Resources) Renewal Corporation will implement measures to avoid or minimize adverse effects of the Proposed Action on any NRHP eligible cultural resources in coordination with the SHPOs and applicable tribes and agencies as discussed in the HPMP. The HPMP will include the following Tribal resources-specific measures and land transfers:

- The Renewal Corporation will implement measures that protect and enhance TCRs exposed during implementation of the Proposed Action, both on state and private lands, in California and Oregon. This implementation will continue on a long-term basis following license surrender (HCTM-1).

- The Renewal Corporation will conduct specific implementation of the Yurok Tribe's Cultural Resources Ordinance and Inadvertent Discovery Policy for TCRs discovered on the Yurok Reservation (HCTM-1).
- The Renewal Corporation will transfer some parcels of lands to an entity representative of the affected tribes, which are traditionally and culturally affiliated with TCRs on those lands, in order to foster cultural and conservation practices and promote tribal identity, as well as mitigate for impacts to TCRs caused by the Proposed Action (HCTM-1).
- The Renewal Corporation will continue working with the tribes and states to determine land disposition, including discussions with the Shasta People, including discussions of public wildlife conservation management areas with lands that contain TCRs, and measures that provide the opportunity for the Shasta People to access TCRs through the creation of tribal conservation easements (HCTM-1).
- The Renewal Corporation will identify parcels of land not subject to the KHSA process that may be appropriate for transfer to the affect tribes, which will serve as off-site mitigation for implementation of the Proposed Action and its impact on TCRs (HCTM-1).

4.12.5 Unavoidable Adverse Impacts

The Proposed Action entails measures to avoid or minimize adverse effects of any NRHP-eligible cultural resources. However, pre-dam-removal activities that involve disturbance of the landscape, including construction or improvement of associated roads, bridges, water supply lines, staging areas, disposal sites, hatchery modifications, recreation site removal and/or development, and culvert construction and improvements could result in potential exposure of or damage to known Tribal Cultural Resources.

Drawdown of Iron Gate, Copco No. 1, and Copco No. 2 reservoirs could shift, erode, or temporarily expose historic-period archaeological resources resulting in increased potential for damage and looting. Reservoir drawdown could result in short-term erosion or flood disturbance to historic-period cultural resources located along the Klamath River. Project activities associated with removal of Iron Gate, Copco No. 1, and Copco No. 2 dams could result in physical disturbance to historic-period cultural resources from blasting or other removal techniques.

Ground disturbance associated with reservoir restoration, recreation site removal and/or development, and disposal site restoration could physically disturb historic-period cultural resources. Additionally, ongoing road and recreation site maintenance may have the potential to disturb known historic-period cultural resources.

A plan for identification and protection of cultural and historic elements will be provided in the MOU and HPMP (in progress). If these sites cannot be avoided and were not formally evaluated for eligibility to the NRHP, a testing plan will be developed in consultation with the SHPO and necessary tribes and agencies.

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Exhibit E-1

(2 of 2)

Appendices

Appendix A: Oregon DEQ Evaluation and Findings Report

Evaluation and Findings Report

Section 401 Water Quality Certification for the Removal of the Lower Klamath Project (FERC Project Number 14803)

By: Chris Stine

September 2018

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DEQ is a leader in restoring, maintaining and enhancing the quality of Oregon's air, land and water.

DEQ
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Department of Environmental Quality

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Documents can be provided upon request in an alternate format for individuals with disabilities or in a language other than English for people with limited English skills. To request a document in another format or language, call DEQ in Portland at 503-229-5696, or toll-free in Oregon at 1-800-452-4011, ext. 5696; or email deqinfo@deq.state.or.us.

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Executive Summary

On September 11, 2017, the Klamath River Renewal Corporation submitted a Clean Water Act Section 401 Water Quality Certification Application for the proposed removal of the Oregon portion of the Lower Klamath Project. The purpose of the Project is to achieve a free-flowing condition and volitional fish passage in the Klamath River. To achieve this objective, KRRC proposes to drawdown J.C. Boyle Reservoir, remove all physical project facilities as described in the application, engage in resource protection activities to mitigate impacts affected resources, and perform restoration actions to revegetate and stabilize reservoir areas.

J.C. Boyle Reservoir impounds about 1 million cubic yards of sediment. Hydraulic modeling predicts about 40 to 60 percent of the sediment will erode during drawdown. Because of its fine-grained texture, sediment is expected to remain in the water column during drawdown resulting in little accumulation in the river channel. Suspended sediment concentrations in the water column will peak in the first three months following drawdown but will decrease sharply as seasonal flows decrease. During this period, DEQ expects temporary impacts to water quality including increased turbidity and decreased dissolved oxygen. Short-duration impacts may persist into the year following reservoir drawdown depending on seasonal flow.

DEQ has established a 24-month compliance time schedule after which DEQ expects the effects of the project will no longer contribute to violations of water quality standards. To verify this, the Certification requires KRRC to monitor water quality and adaptively manage Project activities including restoration efforts to ensure these expectations are met. To protect threatened and endangered species, the Certification requires KRRC to perform certain aquatic resource mitigation measures to reduce impacts to resources potentially affected by the Project during and following dam removal. The Certification also prescribes conditions to ensure reservoir areas exposed following dam removal are effectively revegetated to reduce ongoing sources of sedimentation. Last, the Certification includes conditions to ensure the removal of project facilities are achieved in a manner that prevents or minimizes impacts on the Klamath River and its tributaries.

DEQ has evaluated the application for Clean Water Act Section 401 Water Quality Certification for consistency with the applicable provisions of the Clean Water Act Sections 301, 302, 303, 306 and 307; Oregon Administrative Rules (OAR) chapter 340, divisions 041 and 048; Oregon Revised Statute (ORS) ORS 543A.025 (2) to (4) and other appropriate requirements of state law.

DEQ finds the proposed activity will cause temporary lowering of water quality. However, removal of J.C. Boyle Dam and eliminating the effects of peaking hydroelectric operations will improve water quality and result in a net ecological benefit. Based on its evaluation of the proposed action, DEQ is reasonably assured the Project as conditioned by this Certification will comply with Oregon water quality standards, appropriate portions of the federal Clean Water Act, and relevant requirements of state law.

1. Introduction and Background

On September 23, 2016, the Klamath River Renewal Corporation submitted to the Oregon Department of Environmental Quality a request for water quality certification pursuant to section 401 of the federal Clean Water Act[1]. The Klamath River Renewal Corporation proposes to remove the J.C. Boyle hydroelectric development, located in Klamath County, Oregon, consistent with the 2016 amended Klamath Hydroelectric Settlement Agreement and according to the procedures in the Detailed Plan. KRRC also proposes measures to revegetate the reservoir embankment, mitigate for impacts to aquatic and terrestrial resources, and monitor the effects of the project on water quality and other affected resources. The J.C. Boyle hydroelectric development is part of the Lower Klamath Project that also includes the Copco No.1, Copco No.2, and Iron Gate facilities in Siskiyou County, California. The removal of the project's California developments will be addressed under a separate water quality certification administered by the California State Water Resources Control Board.

The Klamath Hydroelectric Project (FERC No. 2082) was built between 1903 and 1962 in Klamath County Oregon and Siskiyou County California. The 169-MW hydroelectric project consists of seven hydroelectric developments and one non-generating dam owned and operated by PacifiCorp Energy. The U.S. Department of the Interior Bureau of Reclamation owns Link River Dam, which PacifiCorp operates in coordination with the company's hydroelectric projects. In 1956, the Federal Energy Regulatory Commission licensed the project to a 50-year term that expired on March 1, 2006. The project has operated under annual licenses issued by FERC since that time.

In 2004, PacifiCorp filed a Final License Application with FERC to relicense the Klamath Hydroelectric Project. During relicensing proceedings, PacifiCorp and more than 40 organizations, including Federal agencies, the States of California and Oregon, Native American tribes, counties, irrigators and conservation and fishing groups negotiated an agreement that would establish a process leading to the removal of PacifiCorp's hydroelectric developments associated with the lower four dams on the Klamath River. On February 18, 2010, parties to agreement, including DEQ, signed the Klamath Hydroelectric Settlement Agreement, which was amended on April 6, 2016.

In 2016, the Klamath River Renewal Corporation was established as a private, non-profit corporation to execute the duties of the Dam Removal Entity consistent with the amended KHSA. On Sept. 23, 2016, PacifiCorp and the Klamath River Renewal Corporation jointly applied to FERC to designate the J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate developments as a new FERC project (the "Lower Klamath Project," FERC No.14803) and transfer this license to the Klamath River Renewal Corporation. On the same day, the Klamath River Renewal Corporation simultaneously filed with FERC an application for license surrender and request to decommission the project. On March 15, 2018, FERC formally separated the project into two licenses consistent with this request, but deferred action on the request to transfer the Lower Klamath Project license (FERC No. 14803) to the Klamath River Renewal Corporation.

[1] On September 11, 2017, KRRC resubmitted their application for section 401 water quality certification. DEQ accepted the refiled application on the same day.

The location of the Lower Klamath Project within the Klamath watershed is presented below in Figure 1 (KRRC 2017).

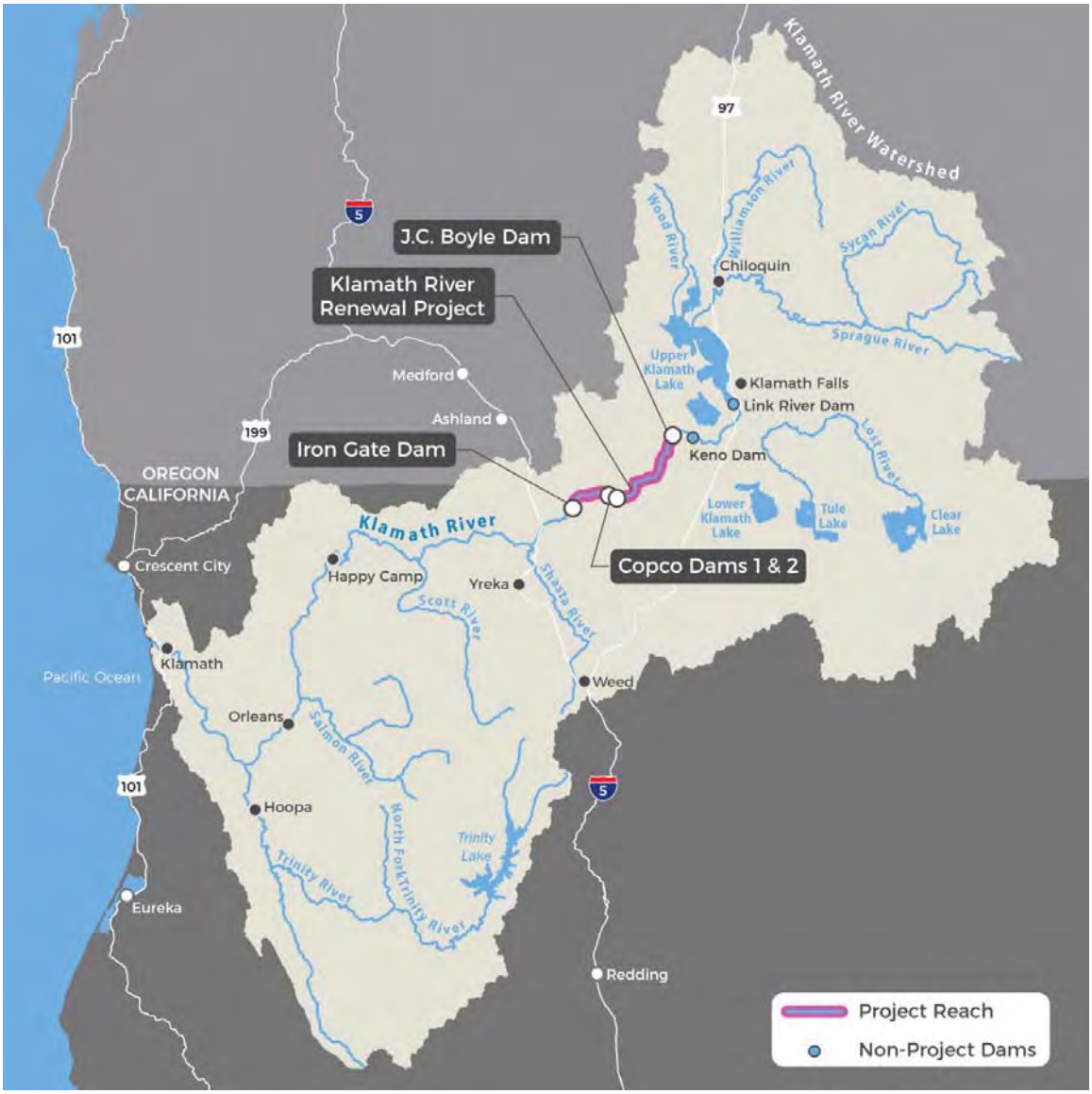

Figure 1: Lower Klamath Project in the Klamath Watershed

2. Requirement for Certification

2.1 Applicable Federal and State Law

Section 401 of the Federal Clean Water Act (33 USC §1341) requires that applicants for a federal license or permit that may cause a discharge to navigable waters provide the federal licensing or permitting agency with certification that the project will comply with state water quality standards and other relevant provisions of state law. Section 401 of the Clean Water Act requires that conditions of a state water quality certification shall become conditions of the federal license or permit. The Oregon Department of Environmental Quality is the state agency designated with the authority to certify or deny requests for section 401 water quality certification. DEQ must act on an application for certification in a manner consistent with the following federal and state requirements:

Federal Requirements

Sections 301, 302, 303, 306, and 307 of the Federal Clean Water Act: These sections prescribe effluent limitations, water quality related effluent limitations, water quality standards and implementation plans, national standards of performance for new sources, and toxic and pretreatment effluent standards.

State Requirements

OAR 340-041 and 340-048-0005 to 340-048-0050: These rules were adopted by the Environmental Quality Commission to prescribe the state's water quality standards (OAR 340-041) and procedures for receiving, evaluating, and taking final action upon a section 401-certification application (OAR 340-048). The rules include requirements for general information such as the location and characteristics of the project, as well as confirmation that the project complies with appropriate local land use plans and any other requirements of state law that have a direct or indirect relationship to water quality.

EQC rules identify the information that must be included in an application for section 401 certification (OAR 340-048-0020(2)). The application together with information provided during public comment and interagency coordination is essential to support the following determinations made by DEQ pursuant to section 401 of the Federal Clean Water Act and state law:

- A determination whether to issue or deny certification.
- Determination of conditions appropriate to include in any granted certificate.
- Preparation of findings as required by ORS 468B.040 and ORS 197.180(1).

Additional EQC rules address the time schedule for compliance with water quality standards following the removal of J.C. Boyle dam (OAR 340-041-0185(5)).

ORS 468B.040: This state statute prescribes procedural requirements and findings with which DEQ must comply as it makes a decision on a section 401-certification application. This statute references federal law requirements, state water quality rules, and other requirements of state law regarding hydroelectric projects.

ORS 197.180(1): This statute requires state agency actions to be consistent with acknowledged land use plans and implementing regulations, or if a plan is not acknowledged, compatible with state land use goals. Findings must support the state agency action.

2.2 General Application of State Water Quality Standards

Oregon water quality standards are contained in Oregon Administrative Rule (OAR) Chapter 340, Division 41 entitled "Department of Environmental Quality Water Pollution Division 41 Water Quality Standards: Beneficial Uses, Policies, and Criteria for Oregon." The water quality standards in Division 41 are composed of three elements: beneficial uses, numeric and narrative criteria, and the antidegradation policy. DEQ develops Total Maximum Daily Loads for waterbodies not attaining water quality standards, as explained below.

2.2.1 Designated beneficial uses

The Federal Clean Water Act and Oregon water quality standards require that water quality be protected and maintained such that existing and potential beneficial uses of public waters are not impaired or precluded by degraded water quality. The regulatory approach is: (1) identify existing and potential beneficial uses (2) develop and adopt numeric and narrative criteria necessary to protect and sustain existing and potential beneficial uses; (3) establish and enforce discharge effluent limitations for each source permitted to discharge treated wastes into public waters to ensure water quality standards are not violated and beneficial uses are not impaired; and (4) establish and implement "best management practices" for a variety of land management activities to minimize water quality degradation and impairment of beneficial uses.

Beneficial uses to be protected have been identified generally for each river basin in Oregon and specifically for significant stream reaches within some basins. Some beneficial uses occur year round, and some occur in specific seasons. See Chapter 5 for the designated beneficial uses in the Klamath Basin.

2.2.2 Narrative and Numeric Criteria

The assumption is made that if water quality meets the numeric and narrative criteria for the most sensitive beneficial uses, then the criteria is fully protective of all beneficial uses. Criteria are established based on best available information at the time of adoption. Development of water quality standards is a continuing process. Conditions in a 401 water quality certification may be devised to sufficiently protect designated beneficial uses given particular facts related to proposed action. As information becomes available, numeric and narrative criteria may be revised and standards may be developed for additional parameters to protect beneficial uses. The spatial and seasonal applicability of water quality criteria is specific to each criteria. Oregon Administrative Rules (OAR 340-041) include water quality criteria that apply to specific reaches and seasons, to a particular basin, and statewide.

2.2.3 Anti-degradation policy

Oregon's antidegradation policy (OAR 340-041-0004) applies to all surface waters. The goal of the antidegradation policy is to prevent unnecessary further degradation of water quality and to protect, maintain, and enhance the quality of existing surfaces waters to ensure the full protection of all existing beneficial resources. For waters that meet applicable water quality standards, the policy states that the existing water quality shall be maintained and protected unless the Environmental Quality Commission makes certain rigorous findings of need. For water bodies that do not meet certain criteria, the policy prohibits further degradation.

2.2.4 Total Maximum Daily Loads

Waterbodies which fail to meet water quality criteria are designated as water quality limited pursuant to CWA section 303(d). The U.S. Environmental Protection Agency requires States to develop total maximum daily loads for waters identified as water quality-limited. A TMDL identifies the maximum pollutant load that a water body may receive from combined point and non-point sources and still meet water quality standards necessary to support all designated beneficial uses. TMDLs quantify wasteload allocations for point sources and load allocations for non-point sources. For hydroelectric projects located on a water quality-limited waterbody, a section 401 certification may serve as the means for implementing allocations assigned to the project. Rules for developing, issuing and implementing TMDLs are in OAR 340-042-0025-0080.

3. Project Information

3.1 Applicant Information

Name and Address of Project Owner and Applicant

Project Owner
PacifiCorp Energy
825 NE Multnomah Blvd. Suite 1500
Portland, OR 97232

Project Applicant
Lester Snow, President KRRC
Klamath River Renewal Corporation
423 Washington Street, 3rd Floor
San Francisco, CA 94111

Name and Address of Owner's Official Representative

Mark Bransom, KRRC Executive Director
2001 Addison Street, Suite 317
Berkeley, CA 94704
Phone: (510) 914-4199

3.2 Documents Filed in Support of Application

KRRC has filed the following documents in support of its section 401 water quality certification application for the Proposed Action:

1. Amended Klamath Hydroelectric Settlement Agreement (April 6, 2016).

2. Application for Certification Pursuant to section 401 of the Federal Clean Water Act And Oregon Law (September 23, 2016; September 11, 2017)

3. Joint Application for Approval of License Amendment and License Transfer (September 23, 2016)

4. Application for Surrender of License for Major Project and Removal of Project Works. (September 23, 2016).

5. Detailed Plan for Dam Removal – Klamath River Dams, Klamath Hydroelectric Project, FERC license No. 2082, Oregon – California. (July 2012).

6. Contact list of property owners pursuant to 18 C.F.R. §4.32(a)(3).

7. Attachment C as filed in the License Transfer Application for Project No. 2082, to describe the project works of the Lower Klamath Project.

8. Final Klamath Facilities Removal Final Environmental Impact Statement/Environmental Impact Report. (December 2012).

9. Klamath Dam Removal Overview Report for the Secretary of the Interior: An Assessment of Science and Technical Information. (March 2013).

10. Klamath River Renewal Project CEQA and 401 Water Quality Certifications Technical Support Document. (September 2017).

11. Findings in Support of Land Use Compatibility for Removal of John C. Boyle Dam. (May 10, 2018).

3.3 Notification of Complete Application

In accordance with OAR 340-048-0042(1), within 90 days of deeming the application complete, DEQ must notify the Applicant that the certification is granted or denied or that a further specified time period is required to process the application. DEQ will comply with this requirement upon determining the application is complete in accordance with OAR 340-048-0020.

3.4 Waters Affected by the Project

The Project is located primarily on the mainstem and tributaries to the Klamath River in the Upper Klamath River watershed. Principle water bodies affected by the Proposed Action are described below.

3.4.1 J.C. Boyle Reservoir

J.C. Boyle reservoir is an in-channel reservoir on the Klamath River from approximately RM 228.3 to RM 224.7. Spencer Creek and other small drainages discharge into the reservoir. Klamath River inflows are typically highest March through May, averaging between 1000 and 5000 cubic feet per second, and lowest in August, averaging between 500 and 750 cubic feet per second (USGS Gauge 11509500). J. C. Boyle Reservoir impounds up to 3,495 acre feet of water and covers 420 surface acres (PacifiCorp 2016). The J.C. Boyle powerhouse operates as a peaking facility in the summer when river flows are too low to operate continuously. Peaking operations occur in the late afternoon and evenings. Water levels in the reservoir fluctuate up to 3 feet daily based on power generation needs. In the remainder of the year, power generation occurs continuously (USDOI 2012). The annual normal maximum and minimum operating levels range 5 feet. The high water level of the impoundment supports perennial marshes along Spencer Creek and intermittent marshes along the margins of the reservoir.

3.4.2 J. C. Boyle Bypass Reach

The J. C. Boyle bypass reach extends approximately 4.3 miles from the base of J. C. Boyle Dam to J. C. Boyle powerhouse at RM 220.4 (PacifiCorp 2016). FERC requires a minimum release of 100 cfs below the dam into the bypass reach. A large spring source discharges 225 cubic feet per second to the Klamath

River at RM 221 and provides cool clear flow to the lower portion of the bypass reach. Additional flow in the bypass reach comes from J. C. Boyle Dam spillway releases, intake fish bypass releases, fish ladder releases, and spills from the forebay overflow chute.

3.4.3 Klamath River below J. C. Boyle Powerhouse, above California Border

The Oregon border with California is at RM 208.5, 11.9 miles below the J. C. Boyle powerhouse. For power generation, water diverts from the reservoir to supply the powerhouse with up to 2500 cubic feet per second. In the reach below the powerhouse, gage data only exists for the post-dam construction era. From 1959-2012, the Klamath River had a mean annual discharge of 1744 cubic feet per second, but discharge fluctuated from 350 cubic feet per second to 10,000 cubic feet per second depending on season and type of water year. Dry year discharge peaked around 2000 cubic feet per second, wet year discharge peaked around 10,000 cubic feet per second. Flows are highest January through April, averaging between 1000 cubic feet per second and 7000 cubic feet per second, and are lowest June through August, averaging between 400 cubic feet per second to 1000 cubic feet per second (USGS Gauge 11510700).

In September 1994, the Klamath River from J.C. Boyle powerhouse to the California border was included in the National Wild and Scenic Rivers System (Public Law 90-542; 16 U.S.C. 1271 et seq.). The US Bureau of Land Management Lakeview District manages the 11-mile reach for the outstandingly remarkable values including wildlife, fisheries, recreation, historic, and scenic qualities.

3.5 Water Rights Held by Applicant

Table 1 describes the water rights at the J. C. Boyle Hydroelectric Project.

Table 1: J.C. Boyle Water Rights

Water Right	Type	Date Effective	Location	Purpose	Capacity
HE-180	State license	1/1/1957-12/31/2006 Administratively extended annually from 2006 to present	J. C. Boyle Power Plant	Power	2500 cubic feet per second for power generation Impoundment to 2793 feet elevation
HE-180	State license	1/1/1957-12/31/2006 Administratively extended annually from 2006 to present	J. C. Boyle Power Plant	Fish use	100 cubic feet per second instream below dam for fish use 200 cubic feet per second instream below powerhouse 9 inches/hour maximum ramping rate at .5 miles below powerhouse
LL-1718	Limited license	12/4/17-11/30/18	J. C. Boyle Power Plant	Power	500 cubic feet per second

3.6 Adjacent Land Use and Ownership

Appendix A presents a list of names and addresses of property owners of land that is contiguous to the J.C. Boyle Development in Oregon (KRRC 2017)

3.7 Ecological Setting

3.7.1 General Locale

The Klamath Basin covers over 12,000 square miles in southern Oregon and northern California. The Klamath River headwaters are in the flat open valleys below Crater Lake, Oregon. These streams gain volume by intercepting groundwater inputs from large porous aquifers that discharge year round. Snowmelt and groundwater inputs keeps these streams clear and cool year round (Isaak 2017).

At the base of the cascades, the relatively low relief, volcanic terrain of the Upper Klamath Basin supports large, shallow natural lakes and wetlands that are naturally high in phosphorus. These lakes and wetlands collect water from the headwater streams as wells as the Sprague, Williamson, and Wood Rivers and other smaller tributaries. Human activities in the upper basin, including wetland draining, agriculture, ranching, logging, and water diversions have altered seasonal stream flows and water temperatures, increased concentrations of nutrients (nitrogen and phosphorus) and suspended sediment in watercourses, and degraded other water quality parameters such as pH and dissolved oxygen concentrations (USDOI, 2012).

The Klamath River exits the low relief terrain at Keno Dam. Here the river gradually changes into a generally steep canyon reach that extends to the California border and continues to the mouth. Water in this reach tends to be more swiftly flowing and cooler from contributions from cool springs and tributaries. The J.C. Boyle Development is located near the start of this reach, approximately 13 miles east of the City of Klamath Falls and 5.6 miles below Keno dam. The upper-most portion of the J.C. Boyle Development is located at RM 228.3 at an elevation of 3,793 feet. The Project diverts up to 2500 cubic feet per second for power development at the J.C. Boyle dam (RM 224.7). The powerhouse discharges to the Klamath River at RM 220.4, elevation 3,330 feet. The bypass reach is 4.3 miles long (PacifiCorp, 2016).

The local climate is one of cool, wet winters and warm, dry summers. Due to generally high elevations, the plateau has cool temperatures and receives a significant amount of snow, which accumulates into moderately deep snowpack (Oregon Watershed Enhancement Manual 2001). Cold air temperatures and precipitation generally occur from November to March and range between 34F and 20F, with an average of 27F. These cold temperatures correspond to periods of higher flows and colder water temperatures. Most precipitation occurs in the winter months of November, December and January (Oregon Watershed Enhancement Manual 2001). The average annual precipitation for the period from 1907 to 1997 at Klamath Falls was 13.4 inches and the average annual precipitation from 1959 to 2009 at Copco 1 was about 20 inches (USDOI, 2012).

Warmer air temperatures and drier conditions occur from April to October, corresponding to periods of lower flows and warmer water temperatures. Summer air temperatures are highest in July, August, and September. July temperatures range between 82F and 47F, and average 63F. The summers are dry with occasional isolated thunderstorms from July to September (Oregon Watershed Enhancement Manual, 2001).

3.7.2 Geology

The geology of the Upper Klamath basin consists of volcanic and sedimentary layers. The bottommost hydrogeological significant unit is the Western Cascades geologic sub province. This unit consists of lava flows, andesitic mudflows, tuffaceous sedimentary rocks, and vent deposits that range in age from 20 to 33 million years old. These rocks have very low permeability and act as a barrier to regional ground-water flow on the western and lower boundaries of the basin. The seven million year old volcanic rocks of the High Cascade sub province overlay the Western Cascades. This unit is relatively thin, measuring only hundreds of feet thick, and consists of volcanic vents, cinder cones, and lava flows with little to no interbedded material. These volcanic rocks are very permeable. Rocks of the Basin and Range sub province were deposited 7-5 million years ago. This unit consists of volcanic rocks interbedded with sedimentary rocks including tuffaceous sandstone, ashy diatomite, mudstone, siltstone, and some conglomerates. These sedimentary deposits are typically poor water producers, and often serve as confining layers for underlying volcanic aquifers. The youngest stratigraphic unit in the upper Klamath Basin consists of sedimentary deposits of the last few million years. These deposits include alluvium along modern flood plains, basin-fill deposits, landslide deposits, and glacial drift and outwash (Gannett, 2010).

The bedrock surrounding and underlying J.C. Boyle Reservoir is principally composed of moderately well bedded to massive, moderately well consolidated sedimentary rocks containing volcanic material. Lava flows overlie these rocks and form many of the ridges above the reservoir. In the downstream portion of the reservoir, downstream from the Highway 66 Bridge, young lava flows line the sides of the reservoir (USDOI, 2012).

Downstream from J.C. Boyle Reservoir, the river canyon begins to open and channel slope decreases. This reach has a relatively low gradient (approximately 0.8 percent) and alternates between pools, bars, runs, and riffles. There is a wide terrace, which supports a riparian corridor of varying width along the channel, beyond which there is a floodplain. There are several side channels in conjunction with lateral bars and islands (USDOI, 2012).

The soils surrounding J.C. Boyle Reservoir, and along the river south to the Oregon-California border generally consist of lacustrine and alluvial clay, silt, fine-grained sand and peat. The primary soil association along both sides of the river is Skookum-rock outcrop-Rubble land complex with 35 to 70 percent slopes (USDOI, 2012).

The watershed above Keno Dam provides little sediment to the Klamath River; because of its large surface area, Upper Klamath Lake traps practically all sediment entering it from its tributaries (USDOI, 2012).

Within J.C. Boyle Reservoir, the substrate is primarily composed of coarse-grained sediment, both as pre-reservoir alluvium and reservoir sediment. The reservoir has an abundance of gravel/sand bars and cobbles, some exposed above the reservoir water surface. The sediment in the upper section of the reservoir is mostly coarse-grained. The reservoir sediment becomes finer grained with distance downstream. In the middle section, the reservoir sediment consists of thin deposits of fine-grained elastic silt with substantial accumulations of organic material. Reservoir sediment was thickest in the lower section of the reservoir, ranging from 14 to 22 feet thick. Sediment in the lower section was uniformly elastic silt with greater than 90 percent fine-grained material. The sediment overlaid coarse-grained pre-reservoir alluvium consisting mostly of silty gravel with sand (USDOI, 2012). The volume of sediment trapped behind J.C. Boyle dam is estimated to be between 990,000 and 600,000 cubic yards (USDOI, July 2012).

3.7.3 Hydrology

Precipitation in the upper Klamath Basin ranges from an annual average of 15 to 25 inches, mostly occurring November through March. Above 5,000 feet, precipitation may fall as rain or snow during the late fall, winter, and spring. Peak stream flows in the upper basin historically occurred during snowmelt runoff in late spring and early summer (USDOI 2013). However, seasonal stream flow fluctuations in upper basin streams were relatively small due to large, porous aquifers that store precipitation and steadily release throughout the year. From 1905-1913, before Keno and Link River Dams were built, flows at Keno, Oregon were typically highest March through June, between 2500 and 5000 cubic feet per second, and lowest in August through October, between 800 and 1300 cubic feet per second (see Figure 2).

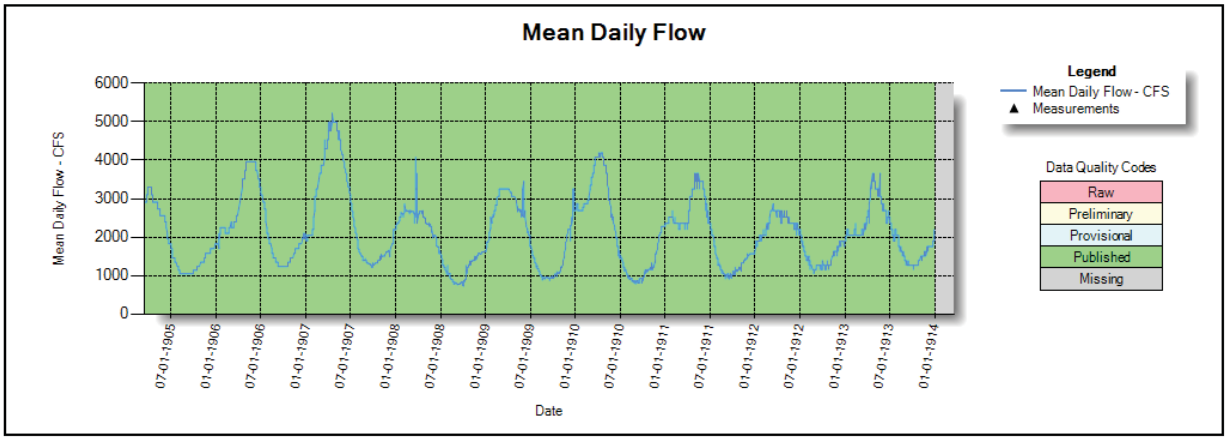

Figure 2: USGS Stream Gage below Keno

Median streamflow at Keno, J.C. Boyle powerhouse and Copco No.1 for the years 1960 to 2009 are shown in Figure 3 (USDOI 2012). The gradient increases sharply just below J.C. Boyle Dam exposing water-bearing zones on the bedrock. Groundwater springs in the 4.3 mile bypass reach increase flow by about 220 to 250 cfs. Because the minimum release below the dam is 100 cfs water at the lower end of the bypass reach is dominated by groundwater inputs.

Figure 4 (USDOI 2012) shows the average daily flow statistics below J.C. Boyle Power Plant. The median monthly flows are greatest in March, during spring runoff.

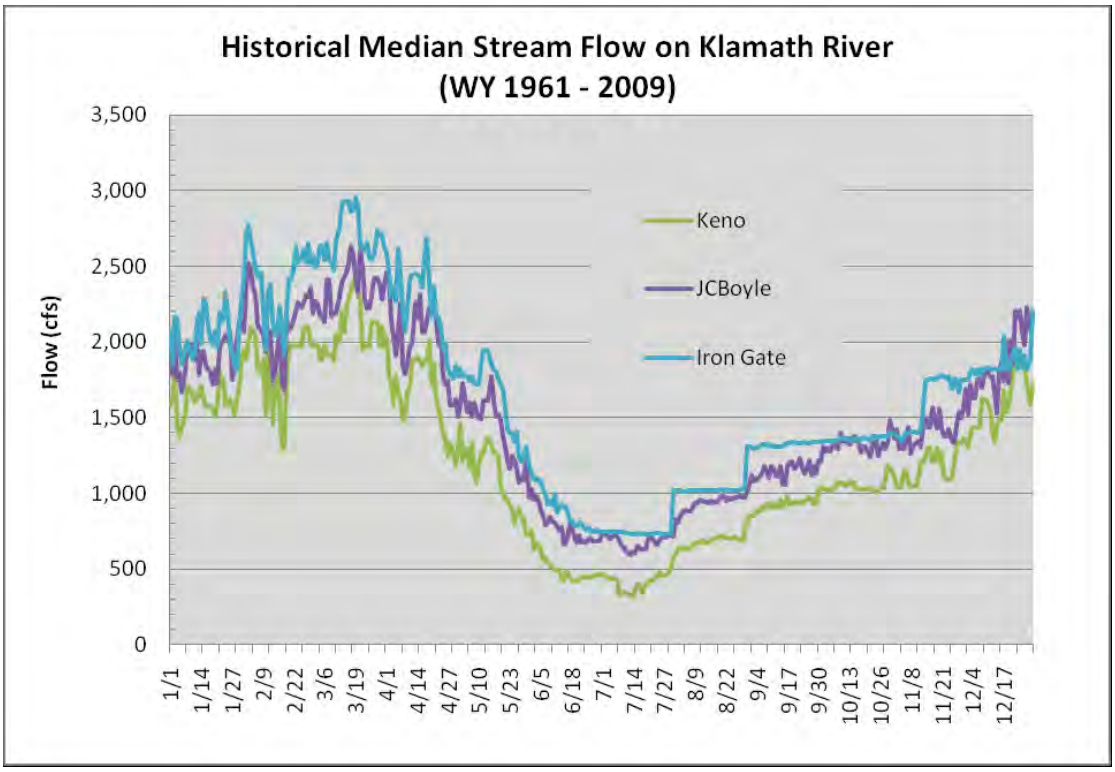

Figure 3: Median Flows at Keno, J.C. Boyle, and Iron Gate 1960-2009

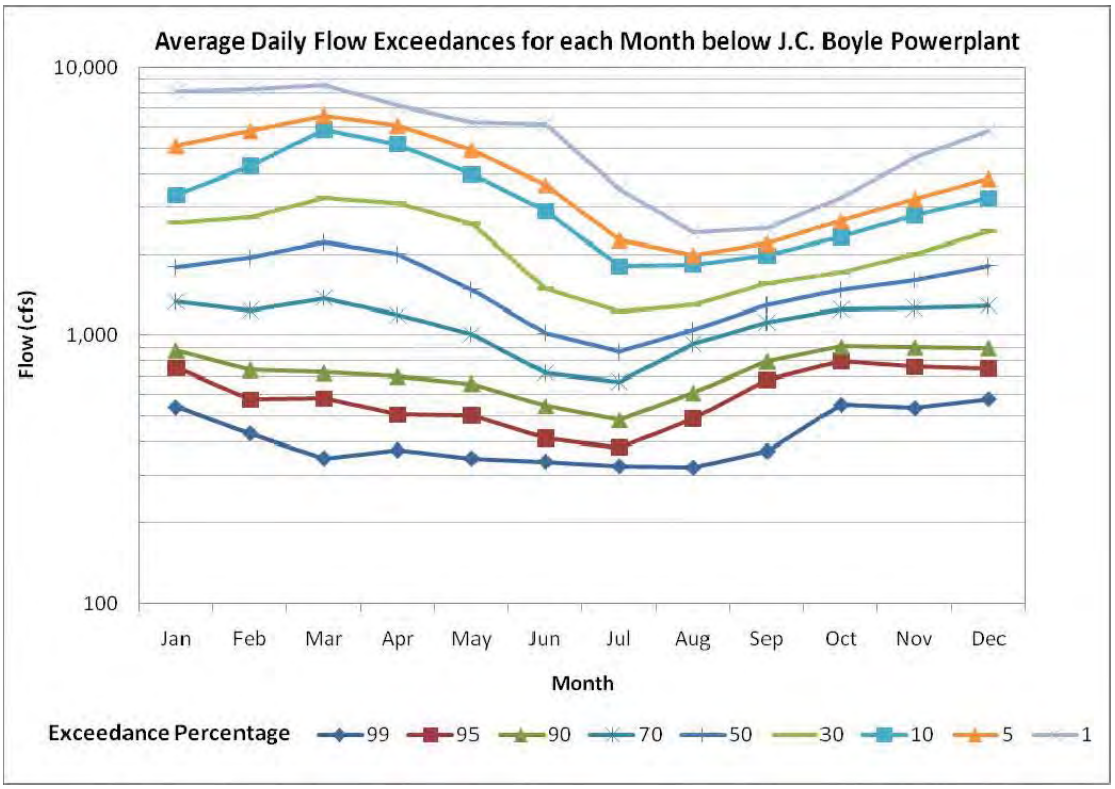

Figure 4: Flow at J.C. Boyle Power Plant (1960-2009)

4. Proposed Action

The KRRC proposes to remove the hydroelectric developments associated with the Lower Klamath Project (FERC No.14803) as described in the Detailed Plan (USDOI July 2012), the September 23, 2016 application to Oregon DEQ for water quality certification, and the Technical Support Document (KRRC 2017) (collectively, the "Application"). The Lower Klamath Project consists of the J.C. Boyle hydroelectric development in Oregon and the Copco No.1, Copco No.2, and Iron Gate hydroelectric developments in California. This section 401 water quality certification specifically addresses the proposed actions located in Oregon. Removal of the Copco No. 1, Copco No. 2, and Iron Gate developments will be addressed under a separate certification evaluation administered by the California State Water Resources Control Board. The dam is shown in Figure 5 (KRRC 2017).

KRRC proposes to remove all physical project elements including J.C. Boyle Dam and reservoir, power canal, powerhouse, transmission lines, recreational facilities and all appurtenant facilities associated with Oregon developments of the Lower Klamath Project. Portions of the power canal slab and underground infrastructure and/or building slabs may be left in place under a partial removal option. KRRC also proposes to mitigate for impacts to aquatic and terrestrial resources, restore and manage reservoir sediments, manage waste materials, monitor and mitigate for impacts to affected resources, and other restoration actions as described in the Application material and summarized in the following sections.



Figure 5: J.C. Boyle Dam

4.1 Reservoir Drawdown and Diversion

KRRC proposes to draw down J.C. Boyle reservoir according to the Reservoir Drawdown and Diversion Plan presented in the Technical Support Document. The plan presents a time schedule for conducting

drawdown based on historical inflow and limits placed on maximum reservoir discharge to maintain stable embankment conditions. Outflow through the two diversion culverts is about 5,700 cfs. Simulated inflow based on hydraulic records from 1961 to 2009 indicate maximum inflow during January and February exceeds 5,000 cfs for just 15 percent of the historic record. Under most modeled scenarios the reservoir will be completely drawn down by mid-February but may partially refill during storm events. The majority of the accumulated sediment is expected to mobilize during the initial drawdown, and subsequent reservoir filling and drawdown is expected to cause only moderate increases in suspended sediment load.

4.1.1 Reservoir Drawdown Procedures

Drawdown of J.C. Boyle Reservoir will begin on or about January 1 of the drawdown year. Beginning at normal operating pool elevation of 3796.7 feet the reservoir will be drawn down by making controlled releases through the spillway gates (elev. 3785.2) and the power intake (elev. 3771.7). Inflow in excess of the 2,800 cfs capacity of the power canal will be passed over the spillway crest. Releases through the power canal will be directed through the powerhouse rather than the emergency spillway. With the power canal and spillway gates open, the reservoir elevation will be held at the lowest elevation for about a week to allow pore water pressure in the dam embankment and rim to stabilize. Because the reservoir has minimal storage capacity, the elevation may fluctuate during this period depending on inflow.

With the reservoir elevation at the lowest level, drawdown would proceed by removing the stoplogs from the two 9.5- by 10 foot box culverts below the spillway crest. Reservoir elevation would decrease rapidly to the culvert invert elevation (3755.2). With the reservoir at this elevation the spillway gates, bridge deck, spillway piers and log boom would be removed. Excavation of the embankment sections would begin July 1 and would remove the remaining impounded section on the river by September 30. Removal of the remaining impoundment sections beginning in July of that year would result in a brief secondary, lesser release. KRRC expects a free-flowing condition through the area of the former reservoir will be restored by September of the drawdown year.

4.1.2 Reservoir Drawdown Monitoring

The shell of the dam consists of porous material that releases water more slowly than the projected reservoir drawdown rate. During drawdown, reservoir elevations will be maintained at set elevations to equalize pore pressure in the embankment materials and reduce potential instability during reservoir drawdown.

KRRC will monitor the J.C. Boyle Dam during drawdown for evidence of impending embankment instability. Monitoring would include daily visual observations of the upstream slope for signs of instability such as cracking or slumping. Survey monuments and at least two inclinometers will also be installed in the year prior to reservoir drawdown and would be monitored on a daily basis for evidence of deep failures within the upstream shell. At least two piezometers would also be installed in the upstream shell and two piezometers in the embankments to monitor pore pressure during reservoir drawdown.

4.2 Facilities Removal

KRRC proposes to perform facilities removal according to the full-removal alternative described in the Application material. The principal actions to accomplish the full removal of the Lower Klamath Project are described below.

4.2.1 Removal Limits

The geographical extent of the proposed action including the removal limits, locations of cut and fill areas, temporary access and staging areas, and project elements scheduled for demolition and removal are

identified on Sheets 1 through 9 of Figure 5.2-1 of the 2017 Technical Support Document. The removal limits include the following elements identified in Table 2.

The Application states KRRC may consider retaining certain elements under a partial removal option as identified in Table 2. KRRC indicated that elements retained under a partial removal option would be not conflict with the objective of achieving a free-flowing river condition and full volitional fish passage. KRRC would undertake investigation and remediation of paints, oils, or other hazardous materials associated with any elements retained under a partial removal option scenario.

Table 2: Removal Limits

Feature	**Full Removal**	**Partial Removal**
Embankment Dam, Cutoff Wall	Remove	Remove
Spillway Gates and Crest Structure	Remove	Remove
Fish Ladder	Remove	Remove
Steel Pipeline and Supports	Remove	Retain
Canal Intake (Screen) Structure	Remove	Retain
Left Concrete Gravity Section	Remove	Retain
Power Canal (Flume)	Remove	Remove walls
Shotcrete Slope Protection	Remove	Retain
Forebay Spillway Control Structure	Remove	Remove
Tunnel Inlet Portal Structure	Remove	Remove
Surge Tank	Remove	Remove
Penstocks, Supports, Anchors	Remove	Remove
Tunnel Portals	Concrete Plug	Concrete Plug
Powerhouse Gantry Crane	Remove	Remove
Powerhouse Substructure/Slab	Remove	Retain
Powerhouse Hazardous Materials	Remove	Remove
Tailrace Flume Walls	Remove	Remove
Tailrace Channel Area	Backfill	Partial Backfill
Canal Spillway Scour Area	Backfill	Partial Backfill
Three 69-kV Transmission Lines, 3.56 mi total	Remove	Remove
Switchyard (fencing, poles, transformers)	Remove	Remove
Buildings – Red Barn, maintenance shop, fire protection building, communications building, 2 residences, storage shed, reservoir level gages house	Remove All	Remove Some

4.2.2 Facilities Removal Methods

KRRC expects the demolition methods, practices, equipment requirements, and estimated workforce to be consistent with other similar large-scale civil construction projects. Project-specific details including professional engineering judgment, planning, and equipment selection will be at the discretion of the general contractor. Alternative methods to meet project requirements may refined or adjusted in the field by the selected contractor based on field conditions and unanticipated circumstances. The following general construction procedures are anticipated to complete the objectives of facilities removal.

Cranes, hoists, and other heavy lifting equipment will be required to remove the spillway gates, hoists, and other mechanical equipment. Cutting equipment, including acetylene torches, will be required to prepare larger pieces for loading on to flatbed trucks and transportation from the site. Deconstruction will require extensive field equipment including jackhammers, hydraulic excavators, shears, air compressors, hydraulic track drills, and sawing equipment. Transportation will require large capacity loaders and off-road and highway rated trucks.

4.2.3 Staging Areas and Waste Disposal Sites

4.2.3.1 Waste Disposal Locations

Estimated quantities of materials generated during removal of J.C. Boyle Dam and Powerhouse, numbers of truck trips, and approximate haul distances for waste disposal are shown in Table 3 (KRRC 2017).

Table 3: Estimated Volume of Waste Material from Removal of J.C. Boyle Facilities

Waste Material	In-Situ Quantity	Bulk Quantity	Disposal Site	Peak Daily Trips	Total Trips
Earth	102,000 CY 7,000 CY	122,000 CY 8,000 CY	Right abutment disposal area Powerhouse tailrace	5 units/160 trips (unpaved road) 5 units/160 trips (unpaved road)	5,600 trips (1 mile RT) 360 trip (8 miles RT)
Concrete at: Dam Power canal Powerhouse	 1,900 CY 30,600 CY 4,600 CY	 2,600 CY 39,800 CY 6,000 CY	Forebay spillway scour hole	2 units/50 trips (unpaved road)	 120 trips (4 miles RT) 1,810 trips (2 miles RT) 270 trips (4 miles RT)
Rebar at: Dam Power canal Powerhouse	 200 tons 3,800 tons 100 tons	 --- --- ---	Landfill near Klamath Falls	2 units/10 trips (OR66)	 20 trips (44 miles RT) 380 trips (48 miles RT) 10 trips (52 miles RT)
Mech. and Elec at: Dam Power canal Powerhouse	 700 tons 300 tons 1,500 tons	 --- --- ---	Landfill near Klamath Falls	2 units/10 trips (OR66)	90 trips (44 miles RT) 40 trips (48 miles RT) 200 trips (52 miles RT)
Building Waste	10 buildings 12,000 ft_2	2,700 CY	Landfill near Klamath Falls	2 units/10 trips (OR66)	270 trips (44 miles RT)
Power lines	3.5 miles of 69-kV	---	Landfill near Klamath Falls		

KRRC proposes to utilize two project locations for permanent placement of solid waste material generated during deconstruction activities. The first is the original borrow pit used to source rockfill material used in the construction of J.C. Boyle dam. Earth materials generated during dam deconstruction will be transported to this 6-acre site located beneath existing power lines near the right dam abutment for permanent placement. Material will be graded into a hill of about 35 feet and contoured to blend into the surrounding topography. Preparation of the disposal site would include clearing of existing vegetation and stripping and stockpiling of what little topsoil is present.

KRRC proposes to cover the disposal site will with topsoil and hydroseed the surface. Erosion monitoring will be completed on an annual basis for 5 years following placement to assess whether significant erosion and slope deterioration has occurred.

KRRC will place concrete rubble from the dam, flume, forebay, and powerhouse in the eroded scour hole below the forebay spillway structure. Previously eroded rock and soil near the toe of the slope will be used to cover the concrete material. Up to 12 inches of topsoil will be placed on top of the restored area and seeded for restoration.

4.2.3.2 Staging Areas

KRRC has identified four temporary staging areas for equipment and material placement during facilities removal. These include: one 5.0 acre area and one 7.1 acre area near the right abutment of J.C. Boyle dam, one 1.1 acre area located near the J.C. Boyle forebay, and one 1.8 acre area at the powerhouse. The staging areas would be prepared by clearing vegetation and minor grading. The staging areas would be restored post construction by minor grading and hydroseeding.

4.2.4 Recreational Facility Removal

Developed recreation sites at J.C. Boyle Reservoir include campgrounds, day use areas, and boat launches. The key elements of these recreation sites are summarized below, including a description of the recreation facilities available at these developed sites, and proposed removal requirements. Developed public recreation sites discussed in this section include the following:

4.2.4.1 Pioneer Park (East and West Units)

Managed by PacifiCorp as part of the Project, Pioneer Park consists of two separate day use areas on the western and eastern shoreline of J.C. Boyle Reservoir. Both sites have access from SR 66 and are located on each side (west and east) of the SR 66 Bridge over a narrow point of the reservoir. Estimated annual use in 2001/2002 was 16,700 recreation days for both sites.

Site restoration following dam removal would require removal of all features and the access roads and parking areas to be regraded, seeded, and planted to prevent impacts to water quality due to run-off, erosion and sediment input.

4.2.4.2 Topsy Campground

Managed by BLM, Topsy Campground is located on the southeastern shoreline of J.C. Boyle Reservoir and is accessible via the Topsy Grade Road off SR 66. The site consists of a campground, small day use area, and a boat launch. All roads within the campground are asphalt. Estimated annual use in 2001/2002 was 5,600 recreation days for this site. BLM collects user fees at the site.

Site restoration following dam removal would require removal of the boat launch, floating dock, and fishing pier, including approximately 68 cubic yards of concrete, and the affected area to be regraded, seeded, and planted. The remainder of the campground would be retained for public use.

4.3 Reservoir Management

4.3.1 Reservoir Restoration

The Application contains a Reservoir Area Management Plan to stabilize and restore the reservoir embankment following drawdown. The 2017 Reservoir Area Management Plan revises and updates a 2011 plan developed by the USBR with assistance from the National Marine Fisheries Services and agencies from the Department of the Interior. The 2017 Reservoir Area Management Plan proposed by KRRC includes elements to manage and monitor sediment and restore aquatic habitat in river reaches following reservoir drawdown. Figure six (KRRC 2017) identifies the locations of proposed restoration actions in J.C. Boyle Reservoir.

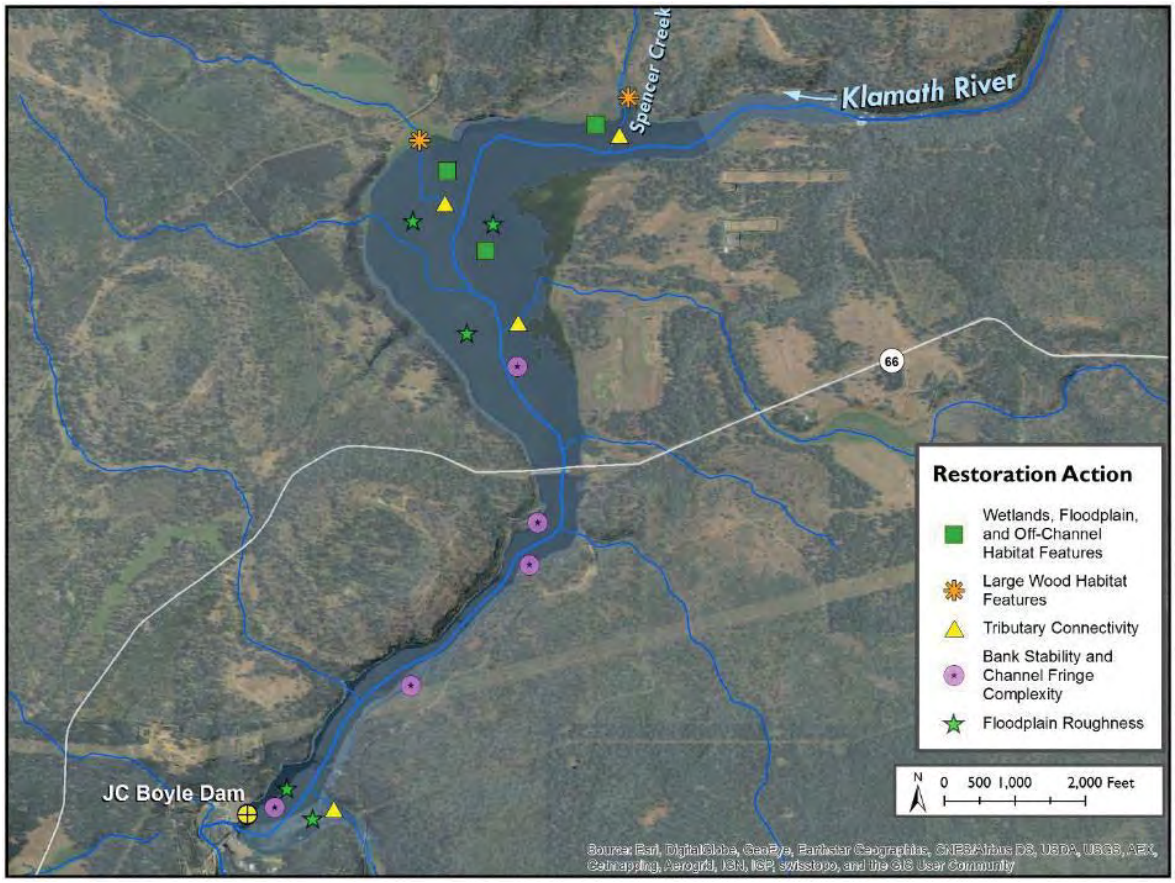

Figure 6: J.C. Boyle Proposed Restoration Area

4.3.1.1 Measures to Manage Remaining Sediment

The Reservoir Area Management Plan proposes revegetation and active habitat restoration of reservoir areas following drawdown. The following sequence describes the activities and restoration features that will be implemented in the reservoir areas to manage remaining sediments not eroded during drawdown:

1) Pre-Removal (1-2 years prior to drawdown): conduct pre-treatment of invasive exotic vegetation species and collect seeds ;

2) Reservoir drawdown (January to March, year of drawdown): perform reservoir drawdown with natural erosion and evacuation of accumulated reservoir sediment deposits, stabilize sediments and exposed areas with hydroseeding;

3) Post-drawdown first summer/fall (dry season immediately after drawdown): conduct additional seeding application where needed for exposed areas and remaining reservoir deposits with grasses and ground cover, manual removal/treatment of invasive exotic vegetation, and installation of riparian trees and shrubs;

4) Post-removal (year after dam removal is complete): maintain vegetation, continue to remove and treat invasive exotic vegetation, install habitat features;

5) Establishment period (years 2 through 5 post-dam removal): continued monitoring and maintenance of vegetation, removal of invasive exotic vegetation, fish passage monitoring, and enhancement of habitat features as needed;

6) Long term (years 5 through 10 post-dam removal): continued monitoring and adaptive management, removal of invasive exotic vegetation, and fish passage monitoring.

4.3.1.2 Measures to Monitor Remaining Sediment

KRRC proposes to monitor sediment stability following drawdown to ensure the objectives of the 2017 Reservoir Area Management Plan are met. The following actions are proposed to establish initial conditions and to inform adaptive management decisions related to reservoir restoration:

1) Permanent ground photo points will be established throughout the reservoir areas that enable sufficient vantage points of critical areas within the reservoirs. Photos will be taken to provide initial conditions for monitoring data to develop informed maintenance and corrective actions;

2) High resolution vertical aerial photos will be completed for the reservoir areas;

3) LiDAR will be collected for the reservoir areas after sediment evacuation and initial ground cover stabilization and used to create initial conditions surface models.

4.3.1.3 Measures to Restore Klamath River within J.C. Boyle Reservoir

The Klamath River is expected to re-occupy the historical channel alignment within the footprint of J.C. Boyle Reservoir following drawdown. To meet the objectives of the Reservoir Area Management Plan KRRC proposes to implement the following restoration techniques as appropriate:

1) Tributary Connectivity: KRRC will monitor the exposed confluence areas of tributaries to the Klamath River for evidence of fish barriers caused by sediment deposition. KRRC will undertake efforts to manually correct for barriers caused by sedimentation or head-cutting. Large woody debris structures may be placed at key locations to enhance habitat complexity and promote sediment stabilization.

2) Wetlands, Floodplain and Off-Channel Habitat Features: KRRC may incorporate floodplain features into newly exposed floodplains to promote habitat complexity and restore hydrologic function of the reservoir area. Restored habitat types may include wetland restoration in appropriate low-lying depressional areas, floodplain swales, and side-channel restoration.

4.3.2 Upland Restoration

Upland areas disturbed during construction activities will be revegetated according to the procedures for upland planting zone areas described in the Reservoir Management Plan. These areas include disposal

sites, temporary access roads and staging areas, infrastructure demolition sites, former recreation areas, and the J.C. Boyle power canal. In general, compacted areas will be prepared for replanting by ripping or disking the ground to improve permeability and revegetation potential. Existing native vegetation will be preserved for placement after completion of ground-disturbing activities. Filled areas will be capped with available soil and reseeded consistent with surrounding vegetation mix.

4.4 Other Project Elements

4.4.1 Aquatic Resource Measures

4.4.1.1 Aquatic Resource Measure AR-6: Sucker

The short-term effects of the dam removal are anticipated to result in mostly sublethal, and in some cases lethal impacts to Lost River and shortnose suckers within Hydroelectric Reach reservoirs. Lost River suckers and shortnose suckers are lake-type fish and are not anticipated to persist in the Klamath River following conversion of the reservoirs to freeflowing riverine conditions.

KRRC proposes to conduct surveys to document genetics and abundance of Lost River and shortnose suckers in LKP reservoirs. To mitigate the effects of drawdown and dam removal, adult Lost River and shortnose suckers in reservoirs downstream from Keno Dam will be captured and relocated to isolated water bodies in the Klamath Basin. The proposed relocation of rescued suckers to isolated waterbodies is to ensure hybridized suckers do not mix with sucker populations designated as recovery populations in Upper Klamath Lake. KRRC expects salvaging and translocating 100 Lost River and 100 shortnose suckers from J.C. Boyle reservoir. The salvage effort will likely translocate less than 10 percent of the sucker populations in the respective reservoirs.

4.4.1.2 Western Pond Turtle Study

The Western pond turtle (*Actinemys marmorata* or *Emys marmorata*) is a freshwater turtle species native to western North America, including the Klamath Basin. Western pond turtles are known to inhabit the rivers, streams, and wetlands surrounding the project area including J.C. Boyle Reservoir. The Oregon Sensitive Species List includes the western pond turtle and it is a species of special concern in California. It is also state- listed as endangered in Washington State, and is currently under review for federal listing under the Endangered Species Act.

Western pond turtles overwinter in open water habitat. Because reservoir drawdown will occur during this period, turtles overwintering in shallow portions of J.C. Boyle may be impacted by the proposed action in the following ways:

- Increased risk of predation as adults and hatchlings move from exposed overwintering or nest sites to new locations of aquatic habitat;
- Potential mortality from exposure to freezing conditions following drawdown;
- Burial from sediment slumping or bank failure;
- Turtles overwintering in shallow, upstream portions of the reservoir may be vulnerable to washing downstream during sediment export.

KRRC proposes to conduct surveys of existing turtle nesting habitat to determine the need for mitigation measures to reduce potential impacts during and following reservoir drawdown. A preliminary scope for the investigation has been developed with input from ODFW and include the following goals:

1) Determine the abundance of western pond turtles in the J.C. Boyle Reservoir area; and

2) Identify where western pond turtles are overwintering in the J.C. Boyle Reservoir area.

The investigation would include mark/recapture surveys and a tracking study using temperature monitors with or without radio telemetry.

4.4.2 Other Resource Management Plans

The Technical Support Document (KRRC 2017) presents the following plans that provide direction on the management of resources affected by the removal of the Lower Klamath Project.

4.4.2.1 Water Quality Management Plan

KRRC proposes to monitor water quality before, during, and after the drawdown of J.C. Boyle Reservoir and the removal of project facilities. The Water Quality Management Plan is presented in Application. Key elements of the plan pertaining to the monitoring of water quality in the Oregon hydroelectric reach are summarized below.

Monitoring Locations

KRRC proposes to collect grab and continuous water quality data at the following two locations in Oregon:

- Klamath River below Keno Dam (RM 233.4)
- Klamath River below J.C. Boyle Dam (RM 224.6)

Monitoring Parameters

The proposed monitoring parameters, frequency, and sample type proposed by KRRC (KRRC, 2017. p. 7-38) are presented in Table 4 below.

Table 4: Water Quality Management Plan Proposed by KRRC

Constituent	Frequency	Type of Sample
Temperature	Hourly, 12 months per year	Continuous Sonde
Dissolved Oxygen	Hourly, 12 months per year	Continuous Sonde
pH	Hourly, 12 months per year	Continuous Sonde
Conductivity	Hourly, 12 months per year	Continuous Sonde
Turbidity	Hourly, 12 months per year	Continuous Sonde
Chemical Oxygen Demand	Monthly, daily during drawdown	Grab
Total Nitrogen	Monthly	Grab
Total Phosphorous	Monthly	Grab
Microcystis Cell Count	Monthly	Grab

Duration

The Water Quality Management Plan proposes to conduct water quality monitoring 12 months of the year beginning at least one year prior to dam removal and up to three years following dam removal.

Section 7 of this report presents DEQ's evaluation of the project's effects on water quality. Based on the findings of this evaluation DEQ will include certification conditions for water quality monitoring deemed necessary to support a finding that DEQ is reasonably assured the project will not violate water quality

standards. The conditions may include some or all of the monitoring plan elements proposed by KRRC or other monitoring elements deemed necessary to support a certification decision.

4.4.2.3 Hazardous Material Management Plan

KRRC has prepared a Hazardous Materials Management Plan to provide guidance for the appropriate management and disposal of hazardous materials encountered during facilities removal. The Plan is included in the Application. KRRC expects to encounter a variety of hazardous materials during removal of the powerhouse, infrastructure buildings, and other facilities scheduled for removal. Prior to drawdown, KRRC proposes to complete a Phase I Environmental Site Assessment and, if recommended, a Phase II Environmental Site Assessment to characterize the nature, extent, and risk associated with environmental contaminants at the site.

5. Klamath River Water Quality

5.1 Beneficial Uses in the Klamath River

The following are the designated beneficial uses of the Klamath River in the J.C. Boyle Development reach, per OAR 340-041-0180 Table 180A:

- Public domestic water supply (with adequate pretreatment (filtration and disinfection) and natural quality to meet drinking water standards)
- Private domestic water supply (with adequate pretreatment (filtration and disinfection) and natural quality to meet drinking water standards)
- Industrial water supply
- Irrigation
- Livestock watering
- Fish and aquatic life, including Redband and Lahontan cutthroat trout
- Wildlife and hunting
- Fishing
- Boating
- Water contact recreation
- Aesthetic quality
- Hydro power
- Commercial navigation and transportation

Figure 7 further defines the fish use in the J.C. Boyle hydroelectric project vicinity as Redband or Lahontan Cutthroat Trout.

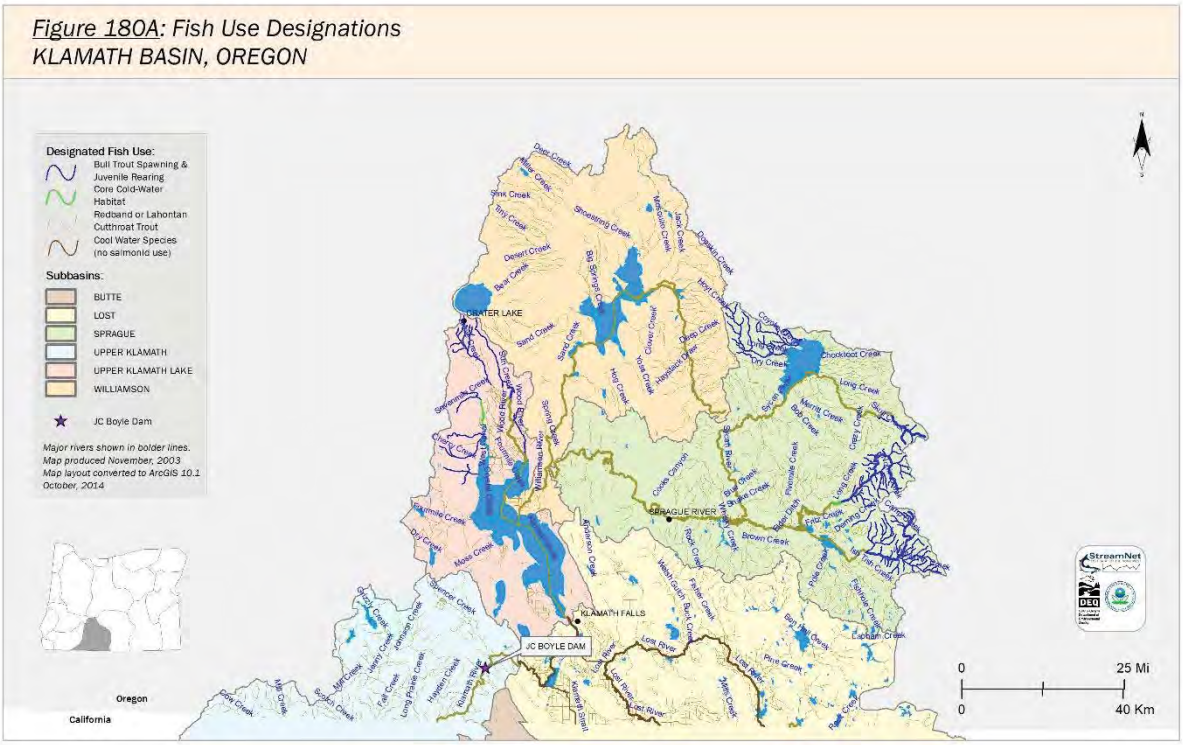

Figure 7: Fish Use in the Klamath Basin, OAR 340, Division 041 - Figure 180A

5.2 Native and Extirpated Fish Species

Fish species currently or historically present in the Oregon hydroelectric reach are identified in Table 5.

Table 5: Current and Historical Fish Presence in Oregon Hydroelectric Reach

Upper end of J.C. Boyle Reservoir to J.C. Boyle dam "J.C. Boyle Reservoir" (RM 228.3 - RM 224.7)			
Native Species currently present:		**Federal ESA**	**Oregon ESA**
Redband Trout**	***(Oncorhynchus mykiss)***		
Slender Sculpin	(*Cottus tenuis)*		
Klamath Lake Sculpin	(*Cottus princeps)*		
Lost River Sucker	***(Deltistes luxatus)***	**Endangered**	**Endangered**
Shortnose Sucker	***(Chasmistes brevirostris)***	**Endangered**	**Endangered**
Klamath Largemouth Sucker	(*Catostomus synderi)*		
Blue Chub	(*Gila coreulea)*		
Tui Chub	(*Siphateles bicolor bicolor*)		
Klamath Speckled Dace	(*Rhinichthys osculus klamathensis)*		
Marbled Sculpin	(*Cottus klamathensis)*		

Klamath River Lamprey	(Entosphenus similis)		
Klamath Small-scale Sucker	(Catastomus rimiculus)		
Historic Native Species – Not currently present			
Spring-run/fall-run Chinook Salmon	(Oncorhynchus tshawytscha)		
Steelhead trout	**(*Oncorhynchus mykiss*)**		
Coho Salmon**	**(*Oncorhynchus kisutch)***	***Threatened**	
Pacific Lamprey**	**(*Entosphenus tridentata*)**		
* Coho salmon in the Klamath River Basin are a component of the Southern Oregon and Northern California Coast (SONCC) coho salmon ESU, which was listed as threatened in 1997 under the ESA.			
****Coho Salmon, Redband Trout and Pacific Lamprey within the Oregon portion of the Klamath Basin are also listed as Sensitive Species on the Oregon State Sensitive Species list.**			
Non-native species currently present			
Pumpkin seed, yellow perch Sacramento perch, largemouth bass, White Sturgeon, black crappie, white crappie, goldfish, brown bullhead, fathead minnow			
Klamath River: J.C. Boyle Dam downstream to California Oregon border: River mile (RM 224.7 – approx. RM 208.5) *J.C. Boyle powerhouse is located at RM 220.4			
Native Species currently present		**Federal ESA**	**Oregon ESA**
Redband Trout	**(*Oncorhynchus mykiss)***		
Klamath Smallscale Sucker	(Catastomus rimiculus)		
Klamath River Lamprey	(Entosphenus similis)		
Marbled Sculpin	(*Cottus klamathensis)*		
Klamath Speckled Dace	(*Rhinichthys osculus klamathensis)*		
Historic Native Species – Not currently present		**Federal ESA**	**Oregon ESA**
Spring-run/fall-run Chinook Salmon	**(*Oncorhynchus tshawytscha*)**		
Steelhead trout	**(*Oncorhynchus mykiss)***		
Coho Salmon	***(Oncorhynchus kisutch)***		
Pacific Lamprey	**(*Entosphenus tridentata*)**		
Non-native species currently present:			
Fathead Minnow			

(Written communication, Ted Wise, ODFW, February 28, 2018)

5.3 Threatened and Endangered Aquatic Species

Table 6 presents species in Klamath County listed by USFWS and NMFS as threatened or endangered. Habitat for each of these species includes segments of the Klamath River.

Table 6: Federally Listed Threatened and Endangered Species in Klamath County

Group	Common Name	Scientific Name	Status
Amphibians	Oregon spotted frog	Rana pretiosa	Threatened
Fishes	Lost River sucker	Deltistes luxatus	Endangered
Fishes	Shortnose Sucker	Chasmistes brevirostris	Endangered
Fishes	Bull Trout	Salvelinus confluentus	Threatened
Fishes	Coho salmon*	Oncorhynchus kisutch	Threatened
Fishes	Oregon chub	Oregonichthys crameri	Recovery

* Coho salmon in the Klamath River Basin are a component of the Southern Oregon and Northern California Coast (SONCC) coho salmon ESU, which was listed as threatened in 1997 under the ESA.

In addition to federal threatened and endangered species listings, Oregon has its own method of listing species. The Oregon Conservation Strategy (ODFW 2016) identifies 294 Strategy Species, which are Oregon's "Species of Greatest Conservation Need". Strategy Species are defined as having small or declining populations, are at-risk, and/or are of management concern. Oregon's Strategy Species include amphibians, birds, mammals, reptiles, fish, invertebrates, and plants and algae. The strategy documents information on the special needs, limiting factors, data gaps, conservation actions, and available resources for each of Oregon's Strategy Species. Table 7 presents Oregon Conservation Strategy species with habitat in the Klamath River in Oregon below Keno Dam.

Table 7: Oregon Conservation Strategy Listed Species

Group	Common Name	Scientific Name	Status
Amphibians	Western toad	*Anaxyrus boreas*	State sensitive
Fishes	Coho salmon	*Oncorhynchus kisutch*	State sensitive
Fishes	Fall Chinook	*Oncorhynchus tshawytscha*	State sensitive
Fishes	Pacific lamprey	*Entosphenus tridentatus*	State sensitive
Fishes	Redband trout	*Oncorhynchus mykiss gairdneri*	State sensitive
Fishes	Spring Chinook	*Oncorhynchus tshawytscha*	State sensitive
Fishes	Summer steelhead	*Oncorhynchus mykiss*	State sensitive
Reptile	Western pond turtle	*Actinemys marmorata*	State sensitive

5.4 Water Quality Impairment in the Klamath River

The federal Clean Water Act's section 303(d) and Oregon Administrative Rule (OAR 340-041-0046), require DEQ to maintain a list of water quality limited waters, which is also referred to as the 303(d) list.. Klamath River reaches included on the State's 2012 303(d) list are shown in Table 8.

Table 8: Water Quality Impairments in Klamath River from JC Boyle to Stateline[2]

Water Body (Stream/ Lake)	River Miles	Param-eter	Season	Criteria	Beneficial Uses	Status	Assess-ment Year
Klamath River	207 to 231.1	Dissolved Oxygen	January 1 - May 15	Spawning: Not less than 11.0 mg/L or 95% of saturation	Resident trout spawning	Cat 5: Water quality limited, 303(d) list, TMDL needed	2004
Klamath River	207 to 231.1	Dissolved Oxygen	Year Round (Non-spawning)	Cold water: Not less than 8.0 mg/l or 90% of saturation	Cold-water aquatic life	Cat 5: Water quality limited, 303(d) list, TMDL needed	2004
Klamath River	207 to 231.1	Temperature	Year Round (Non-spawning)	Redband or Lahontan cutthroat trout: 20.0 degrees Celsius 7-day-average maximum	Redband or Lahontan cutthroat trout	Cat 5: Water quality limited, 303(d) list, TMDL needed	2004
Klamath River	207 to 285.3	Arsenic	Year Round	Table 40 Human Health Criteria for Toxic Pollutants	Human health; Aquatic life	Cat 5: Water quality limited, 303(d) list, TMDL needed	2012

5.5 Current Water Quality

Water flowing into the project area originates in the Upper Klamath Basin, a 3,700 square mile watershed characterized by volcanic soils rich in phosphorus, shallow lakes and wetland areas. The dominant factor driving water quality impairment in the upper basin is the high rate of primary production responsible for massive summertime algal blooms. Algal productivity in Upper Klamath Lake is supported by high rates of nutrient loading, principally nitrogen and phosphorus, and is further influenced by abundant sunlight and shallow depth. These conditions historically supported high rates of primary production as confirmed through analysis of algal deposition in sediment core samples.

More recently, human development in the basin, including water diversion, drainage and agricultural practices has greatly increased sediment and nutrient input. These activities have increased rates of phosphorus loading and created a competitive advantage for the proliferation of nitrogen-fixing strains of blue-green algae including *Aphanizomemon flos-aquae*. Certain strains of cyanobacteria, including *A.*

[2] List can be downloaded at: https://www.oregon.gov/deq/wq/Pages/WQ-Assessment.aspx

flos-aquae, release cyanotoxins when dead cells lyse. The release of cyanotoxins can cause nerve and liver damage in mammals.

The algal growth cycle has profound effects on water quality. Respiration and photosynthesis cause wide diurnal swings in dissolved oxygen and high pH that exceed safe levels for many aquatic species. During mid-summer, lake pH can reach levels that increase solubility of nutrients bound to lake-bottom sediments. This nutrient recycling mechanism represents an additional source of nutrient loading and further accelerates the rate of primary production. Ammonia, a by-product of algal metabolism, is produced during intense summer algal blooms in concentrations that are harmful to aquatic life.

The algal growth cycle decreases in late summer as the loss of seasonal sunlight reduces support for continued growth. As cells die, cellular decomposition depletes dissolved oxygen causing near-anoxic late summer conditions particularly in the Keno Reach between Link River and Keno Dams. Much of the dead algal biomass remains suspended in the water column and is eventually exported downstream; however, some material settles to the lake bottom whose nutrients may be recycled into the water column in subsequent years. Water quality generally improves in the higher gradient reach below Keno Dam above the J.C. Boyle development. Turbulence in this reach increases dissolved oxygen and promotes the conversion of ammonia to nitrate and nitrite.

Nutrient levels in the Klamath River generally decrease with distance downstream from Upper Klamath Lake due to particulate trapping in reservoirs, dilution, and uptake along the river channel. Cold springs contribute 200 – 250 cubic feet per second of groundwater to the Klamath River just downstream of the J.C. Boyle powerhouse (approximate river mile 221). On an annual basis, nutrients typically decrease downstream of J.C. Boyle due to the dilution by the springs downstream from J.C. Boyle Reservoir.

Klamath River data below J.C. Boyle reservoir (approximate river mile 224.6) indicate compliance with the pH criteria and the chlorophyll *a* guidance value. Data indicate non-attainment of the dissolved oxygen criteria from about February 15 and October 15.

Effect of Hydropower Operations on Water Quality

Hydropower operations affect water quality in the hydroelectric reach (reservoir, bypass reach and peaking reach) as discussed further below.

Reservoir Impoundment

J.C. Boyle dam slows and impounds a segment of the Klamath River causing retention of sediment, organic matter, and other material. Nutrient-rich material retained behind the dam promotes algal growth and affects parameters including dissolved oxygen and pH. The presence of the dam also interrupts the thermal regime that would otherwise exist without the dam. J.C. Boyle reservoir has a relatively short hydraulic residence time and does not thermally stratify in the classic sense. However, cold, denser water entering the reservoir sinks to deeper levels resulting in observable thermal stratification. Furthermore, incoming water tends to be higher in dissolved oxygen. Because this water sinks rather than mixes, middle and upper portions of the reservoir frequently experience periods of low dissolved oxygen particularly in late summer.

Bypass Reach

J.B. Boyle dam diverts up to 3,000 cfs of water to the power canal. PacifiCorp currently operates the project under annual licenses that require a minimum release below the dam of 100 cfs. Water diversions reduce downstream transport of inorganic material necessary to maintain habitat complexity and healthy

benthic environment. The effects of reduced flows in the bypass reach include a coarsening of the substrate and reduced habitat complexity below the dam. Flows in this section are augmented by up to 250 cfs from groundwater sources such that water chemistry in the lower bypass reach is dominated by groundwater characteristics. Summertime water temperatures in the bypass reach can decrease by 5–15°C during bypass operations.

Hydroelectric Peaking Reach

Hydropower operations directly affect water quality in the peaking reach below the J.C. Boyle powerhouse. PacifiCorp's annual licenses allow daily ramping up to 9 inches per hour for upramp and downramp operations. Frequent changes in river stage increase sedimentation and turbidity at the margins and degrade habitat necessary to support beneficial uses. Furthermore, because discharge through the powerhouse is frequently much greater than flows in the bypass reach, water quality characteristics in the peaking reach are dominated by water quality from J.C. Boyle reservoir. For these reasons, the rapid transition during peaking operations can cause changes to hydrology and water quality that are detrimental to beneficial uses downstream of the J.C. Boyle powerhouse.

6. Water Quality Standards

Oregon water quality standards are given in OAR 340, Division 041. DEQ expects the proposed action to temporarily impact the following water quality parameters following drawdown of the reservoir.

6.1 Statewide Narrative Criteria

OAR 340-041-0007

Relevant Sections

(1) Notwithstanding the water quality standards contained in this Division, the highest and best practicable treatment and/or control of wastes, activities, and flows must in every case be provided so as to maintain dissolved oxygen and overall water quality at the highest possible levels and water temperatures, coliform bacteria concentrations, dissolved chemical substances, toxic materials, radioactivity, turbidities, color, odor, and other deleterious factors at the lowest possible levels . . .

(10) The formation of appreciable bottom or sludge deposits or the formation of any organic or inorganic deposits deleterious to fish or other aquatic life or injurious to public health, recreation, or industry may not be allowed;

(11) Objectionable discoloration, scum, oily sheens, or floating solids, or coating of aquatic life with oil films may not be allowed;

(12) Aesthetic conditions offensive to the human senses of sight, taste, smell, or touch may not be allowed.

Project nexus

The proposed action includes the removal of transformer oils, lubricating fluids, fuels, and other chemicals that may deleterious to fish or aquatic life, cause discoloration, scum, oily sheens, or floating solids, or result in offensive aesthetic conditions if released to waters of the state.

6.2 Bacteria

OAR 340-041-0009

(1) Numeric Criteria: Organisms commonly associated with fecal sources may not exceed the criteria in subsections (a)-(c) of this section:

(a) Freshwater contact recreation

(A) A 90-day geometric mean of 126 E. coli organisms per 100 mL;

(B) No single sample may exceed 406 E. coli organisms per 100 mL.

Project nexus

Project facilities at the J.C. Boyle Dam include an on-site septic system. To reduce the potential for bacterial contamination to surface waters, the on-site septic system should be decommissioned in accordance with Oregon Administrative Rule Chapter 340, Division 71.

6.3 Biocriteria

OAR 340-041-0011

Waters of the State must be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities.

Relevant Definitions

(5) "Appropriate Reference Site or Region" means a site on the same water body or within the same basin or ecoregion that has similar habitat conditions and represents the water quality and biological community attainable within the areas of concern.

(6) "Aquatic Species" means plants or animals that live at least part of their life cycle in waters of the state.

(17) "Designated Beneficial Use" means the purpose or benefit to be derived from a water body as designated by the Water Resources Department or the Water Resources Commission.

(19) "Ecological Integrity" means the summation of chemical, physical, and biological integrity capable of supporting and maintaining a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of the natural habitat of the region.

(50) "Resident Biological Community" means aquatic life expected to exist in a particular habitat when water quality standards for a specific ecoregion, basin or water body are met. This must be established by accepted biomonitoring techniques.

(75) "Without Detrimental Changes in the Resident Biological Community" means no loss of ecological integrity when compared to natural conditions at an appropriate reference site or region.

Project nexus

This narrative criterion recognizes compliance with individual criteria may not fully capture the synergistic effects resulting from multiple stressors and cumulative impacts on aquatic species and other resident biological communities. Use of the biocriteria guards against cumulative effects of stressful water quality conditions that otherwise meet water quality numeric criteria. Consequently, this biocriteria

standard extends broad protections to all beneficial uses and complements numeric criteria to address physical or chemical impacts to aquatic habitats.

Benthic macroinvertebrates are indicators of the biological condition of waterbodies. Generally, waterbodies in healthy biological condition support a wide variety and high number of macroinvertebrate taxa, including many that are intolerant of pollution. Indices of biological integrity use benthic macroinvertebrates as general indicators of water quality based upon the richness or diversity of pollution tolerant and resistant species. Benthic macroinvertebrates are also particularly sensitive to changes in fine and coarse sediment load, which could occur under the Proposed Action (USDOI, Dec. 2012).

6.4 Dissolved Oxygen

OAR 340-041-0016

Relevant Sections

(1) For water bodies identified as active spawning areas in the places and times indicated on the following Tables and Figures set out in OAR 340-041-0101 to 340-041-0340: Tables 101B, 121B, and 190B, and Figures 130B, 151B, 160B, 170B, 180A, 201A, 220B, 230B, 260A, 271B, 286B, 300B, 310B, 320B, and 340B, (as well as any active spawning area used by resident trout species), the following criteria apply during the applicable spawning through fry emergence periods set forth in the tables and figures and, where resident trout spawning occurs, during the time trout spawning through fry emergence occurs:

   (a) The dissolved oxygen may not be less than 11.0 mg/l. However, if the minimum intergravel dissolved oxygen, measured as a spatial median, is 8.0 mg/l or greater, then the DO criterion is 9.0 mg/l;

   (b) Where conditions of barometric pressure, altitude, and temperature preclude attainment of the 11.0 mg/l or 9.0 mg/l criteria, dissolved oxygen levels must not be less than 95 percent of saturation;

   (c) The spatial median intergravel dissolved oxygen concentration must not fall below 8.0 mg/l.

(2) For water bodies identified by the Department as providing cold-water aquatic life, the dissolved oxygen may not be less than 8.0 mg/l as an absolute minimum. Where conditions of barometric pressure, altitude, and temperature preclude attainment of the 8.0 mg/l, dissolved oxygen may not be less than 90 percent of saturation. At the discretion of the Department, when the Department determines that adequate information exists, the dissolved oxygen may not fall below 8.0 mg/l as a 30-day mean minimum, 6.5 mg/l as a seven-day minimum mean, and may not fall below 6.0 mg/l as an absolute minimum (Table 21);

(3) For water bodies identified by the Department as providing cool-water aquatic life, the dissolved oxygen may not be less than 6.5 mg/l as an absolute minimum. At the discretion of the Department, when the Department determines that adequate information exists, the dissolved oxygen may not fall below 6.5 mg/l as a 30-day mean minimum, 5.0 mg/l as a seven-day minimum mean, and may not fall below 4.0 mg/l as an absolute minimum (Table 21).

Table 9: Applicable Dissolved Oxygen Criteria for Klamath Basin

River Miles	River Segment	Dissolved Oxygen Criteria	Salmonid Spawning Period	Non-spawning period (year round) numeric criteria (mg/L)	Spawning Period Numeric Criteria
231.5 - 253	Upper Klamath Lake Outlet to Keno Dam	Cool water	None	6.5 as a 30-day mean minimum 5.0 as a 7-day minimum mean 4.0 as an absolute minimum	NA
207 – 231.5	Keno Dam to Oregon – California State line	Cold water	Jan. 1 – May 15[3]	8.0 as a 30-day mean minimum 6.5 as a 7-day minimum mean 6.0 as an absolute minimum	11.0 mg/L or not less than 95% saturation

Project nexus

Dissolved oxygen is one of the principal parameters used to determine water quality in support of aquatic life. Maintaining adequate concentrations of dissolved oxygen is vital to the support of fish, invertebrates, and other aquatic life. Sediment impounded by the dam contains organic and inorganic substances that will temporarily increase biochemical oxygen demand during reservoir drawdown. DEQ will require monitoring and certain mitigation measures, as described in Section 7, to mitigate the effects of reduced oxygen saturation to the extent practicable. DEQ expects dam removal will result in improved water quality conditions and a net ecological at the conclusion of the compliance time schedule established in Section 6.9.

6.5 Nuisance Phytoplankton Growth

OAR 340-041-0019

(1)(a) The following values and implementation program must be applied to lakes, reservoirs, estuaries and streams, except for ponds and reservoirs less than ten acres in surface area, marshes and saline lakes:

(b) The following average Chlorophyll-a values must be used to identify water bodies where phytoplankton may impair the recognized beneficial uses:

(A) Natural lakes that thermally stratify: 0.01 mg/1;

(B) Natural lakes that do not thermally stratify, reservoirs, rivers and estuaries: 0.015 mg/1;

[3] Per Feb. 2004 memo from DEQ to EPA, DEQ is applying the spawning criteria for resident trout spawning from Jan.1 through May 15 each year.

Project nexus

Chlorophyll-*a* is a surrogate for algal biomass. Excessive blooms can violate the Chlorophyll-*a* value for open waters and the Statewide Narrative Criteria for aesthetic conditions.

Excessive phytoplankton growth can also contain certain species of toxic algae, including *Microcystis aeruginosa,* which contains microcystin, a cyanotoxin that can cause sickness in humans and can bioaccumulate in aquatic organisms. Oregon Administrative Rules do not contain criteria for microcystin. The Public Health Division of the Oregon Health Authority issues Advisory and Sampling Guidance documents for harmful algal blooms. OHA developed a guideline value for microcystin in recreational water bodies of 4 µg/L (OHA, 2018).

6.6 pH

OAR 340-041-0185(1)

(1) pH values may not fall outside the following ranges:

(a) Fresh waters except Cascade lakes: pH values may not fall outside the range of 6.5-9.0. When greater than 25 percent of ambient measurements taken between June and September are greater than pH 8.7, and as resources are available according to priorities set by the Department, the Department will determine whether the values higher than 8.7 are anthropogenic or natural in origin;

(b) Cascade lakes above 5,000 feet altitude: pH values may not fall outside the range of 6.0 to 8.5.

Project Nexus

The pH of water determines the solubility and biological availability of chemical constituents such as nutrients phosphorus, nitrogen, and carbon and heavy metals such as lead and copper. In the case of heavy metals, the degree to which they are soluble determines their toxicity. The pH is also affected by biological processes such as photosynthesis and algal respiration. During drawdown, the availability of organic and inorganic compounds will increase in the water column. Chemical and biological activity caused by this activty may temporarily affect pH in the water column.

6.7 Temperature

OAR 340-041-0028

(4) Biologically Based Numeric Criteria. Unless superseded by the natural conditions criteria described in section (8) of this rule, or by subsequently adopted site-specific criteria approved by EPA, the temperature criteria for State waters supporting salmonid fishes are as follows:

[…]

(e) The seven-day-average maximum temperature of a stream identified as having Lahontan cutthroat trout or redband trout use on subbasin maps and tables set out in OAR 340-041-0101 to 340-041-0340: Tables 121B, 140B, 190B, and 250B, and Figures 180A, 201A, 260A and 310A may not exceed 20.0 degrees Celsius (68.0 degrees Fahrenheit).

Project Nexus

Temperature significantly influences the biological activity and growth of aquatic organisms. The higher the water temperature, the greater the biological activity. Because oxygen saturation deceases with higher

temperature, water temperature also directly influences the rate of chemical reactions in water, which in turn affects biological activity. During drawdown, the thermal regime below the dam will change due to the thermal mass associated with the impounded water. DEQ expects this effect to be temporary. Once the reservoir is empty, the river temperature will likely reflect the natural thermal regime.

6.8 Toxic Pollutants

OAR 340-041-0033

Toxic Substances

(1) Toxic Substances Narrative. Toxic substances may not be introduced above natural background levels in waters of the state in amounts, concentrations, or combinations that may be harmful, may chemically change to harmful forms in the environment, or may accumulate in sediments or bioaccumulate in aquatic life or wildlife to levels that adversely affect public health, safety, or welfare or aquatic life, wildlife or other designated beneficial

Project Nexus

Contaminated sediments affect water quality through the transmission of toxic compounds to water. Once in the water, toxic compounds can enter the food chain and cause harm to aquatic life and human health. Oregon DEQ does not have numeric sediment criteria. Rather, DEQ uses a risk-based approach that considers the contaminants present, concentrations, extent of contamination, toxicity of contaminants, and pathways of exposure to aquatic life and human health. Risk-based screening levels are found in DEQ guidance documents (DEQ 2017a, DEQ 2017b). DEQ's risk-based assessment results in a determination of acceptable or unacceptable risk, and actions required to reduce risk to acceptable levels.

6.9 Compliance Time Schedule

Oregon Administrative Rules allow DEQ to issue a section 401 water quality certification for the federal license or permit authorizing the removal of J.C. Boyle Dam on the Klamath River that includes a time schedule for compliance with water quality standards. DEQ may issue a certification if DEQ finds the long-term ecological benefits outweigh short-term impacts, and that long-term water quality improvements will occur in a timely manner. As described below, DEQ finds that dam removal and related restoration activities will provide a net ecological benefit, with long-term benefits of river restoration outweighing unavoidable short-term adverse impacts to water quality.

6.9.1 Basin-Specific Criteria (Klamath)

Criteria for rendering a decision are given in OAR 340-041-0185(5) and are evaluated below.

6.9.1.1 Limited Duration

The dam removal and its associated water quality impacts will be of limited duration.

Studies filed in support of the 2012 EIS/EIR determined reservoir drawdown would have a significant short-term effect on suspended sediment and dissolved oxygen concentrations. The analysis found the short- and long-term effects of the action on other parameters would be less than significant. For this reason, analyses in the 2012 EIS/EIR include only modeled responses to suspended sediment and dissolved oxygen concentrations. DEQ believes it is reasonable to estimate the duration of water quality impairment due to project-related effects based on the expected duration of impacts to suspended sediment and dissolved oxygen concentrations.

Suspended Sediment

Modeling data predict suspended sediment concentrations will peak briefly above 2,000 to 3,000 mg/l but will quickly decrease below 100 mg/L for 5–7 months, and below 10 mg/L for 6–10 months following

drawdown. Because most sediment export will occur during the initial drawdown period and because of the comparatively small volume of material impounded by J.C. Boyle dam, suspended sediment concentrations are not expected to sustain into the second year following drawdown at levels that impair beneficial uses. However, DEQ expects sediment redistribution and the effects of seasonally high flow events to cause temporary periods of elevated suspended sediment during the second year following drawdown. Based on this evaluation, DEQ expects no adverse effects caused by elevated suspended sediment concentrations after the second year (i.e., 24 months) following the start of reservoir drawdown.

Dissolved Oxygen

The 2012 EIS/EIR did not model the effects of dam removal on dissolved oxygen in Oregon. However, the modeled effects of dissolved oxygen below Iron Gate Dam indicates minimum dissolved oxygen concentrations remain generally above 5.0 mg/l within 15 miles downstream of the dam and increase above 8.0 mg/l about three months following drawdown. Because J.C. Boyle Reservoir contains significantly less sediment, DEQ believes dissolved oxygen deficits will be far less and of shorter duration than modeled effects below Iron Gate Dam. Furthermore, because oxygen deficits are influenced by oxygen-demanding substances in sediments, DEQ believes the duration of any oxygen impairment experienced in the Oregon hydroelectric reach will not be longer than the duration of suspended sediment in the water column. For this reason, DEQ believes project effects on dissolved oxygen will not exceed 24 months following the start of reservoir drawdown.

Finding: DEQ expects the overall impact to water quality will be of limited duration.

6.9.1.2 Net Ecological Benefit

Dam removal and related restoration activities will provide a net ecological benefit.

DEQ finds the long-term benefits outweigh the short-term impacts expected during dam removal because dam removal will restore the free-flowing condition of the river, provide improved habitat and access for salmonids, reduce fish disease, improve other aspects of water quality, and add approximately four miles of riverine habitat that will in turn contribute to increased water quality. Removal of the Oregon developments of the Lower Klamath Project will eliminate water quality impairments related to the management of the resource for power production described above in section 5.5. Following dam removal, DEQ expects rapid re-colonization of the former peaking reach by macroinvertebrates. These benefits that will accrue following the compliance time schedule far outweigh the short-term (e.g., during the compliance time schedule) water quality impacts of dam removal.

Finding: DEQ finds that dam removal will result in a net ecological benefit.

6.9.1.3 Minimizing Adverse Effects to Beneficial Uses

The dam removal will be performed in a manner minimizing, to the maximum extent practicable, adverse impacts to water quality, threatened and endangered species, and beneficial uses of the Klamath River.

Drawdown of J.C. Boyle Reservoir is scheduled to occur in January of the drawdown year to coincide with seasonally high flows and lowest seasonal water temperature. The timing of the proposed action was selected to minimize oxygen deficits caused by increased sediment loading because available data indicated high seasonal background dissolved oxygen levels (i.e., winter, high flow conditions) and colder winter water temperatures increase dissolved oxygen solubility.

KRRC has also proposed aquatic resource measures to minimize the effect of dam removal on aquatic species potentially affected by the proposed action. The measures were developed in consultation with state and federal resource agencies, tribal representatives, and other stakeholders and include methods to minimize the effects of the action on threatened and endangered species in the basin.

Finding: DEQ finds that implementation of these measures will minimize to the extent practicable the short-term impacts of dam removal on water quality, threatened and endangered species, and beneficial uses of the Klamath River.

6.9.2 DEQ Finding: Compliance Time Schedule for Dam Removal

DEQ establishes a time schedule, as allowed by OAR 340-041-0185(5), of 24 months from the start of drawdown for project effects to no longer contribute to violations of Oregon water quality standards. The time schedule expects that water quality impacts are directly related to sediment mobilization which occurs principally during periods of highest seasonal flow. While DEQ expects most sediment mobilization to occur during the first season, it is reasonable to expect additional movement during the subsequent years as transported material redistributes during high flow events. The potential for sediment movement attenuates rapidly after drawdown because of revegetation efforts, drying and hardening of exposed sediment, and the reduced volume of remaining sediment. Upon completion of the time schedule, DEQ expects no residual effects of the proposed action will cause violations of water quality standards.

7. Evaluation and Findings

7.1 Reservoir Drawdown

J.C. Boyle Dam impounds about 1,000,000 cubic yards (+/- 30 percent) of sediment, sixty-six percent of which consists of fine-grained material. Sediment thickness ranges up to about 20 feet and is greatest within the former river channel near the dam. During drawdown, hydraulic velocity through the reservoir will increase causing downcutting at the sediment interface beginning at the reservoir's upstream end and progressing along the flow path as the surface elevation decreases. Erosional forces are less near the reservoir margins. For this reason, sediment outside the former river channel is considered to be less susceptible to movement and will likely remain as permanent terrace deposits. Overall, the volume of sediment export is estimated at 36 to 57 percent of the total sediment mass depending on hydrologic conditions during the drawdown year. Figure 8 (KRRC, 2017. p. 2-6) depicts a typical cross section illustrating the relative depth of sediments in the former river channel and marginal areas.

KRRC estimates that J.C. Boyle reservoir will be mostly drawn down by the end of February of the drawdown year. Because of limited storage, the reservoir may partially refill and drain in response to storm events. During an extremely wet year it is also possible the reservoir may not fully empty until late March. However, modeling efforts predict most sediment mobilization will occur during the initial drawdown period with lesser quantities mobilized during subsequent refilling and draining events. In July of the drawdown year KRRC expects to remove the final elements of the impoundment releasing a small additional volume of sediment and causing a brief increase in suspended sediment concentrations.

DEQ expects the immediate effects of reservoir drawdown to cause a general lowering of water quality that will peak during the first 1-3 months and gradually improve as sediment load decreases and a natural seasonal hydrograph is restored. Sediments contain organic and inorganic substances that will increase turbidity, reduce oxygen saturation, increase the presence of algal material, decrease light penetration, and increase nutrient concentrations. Suspended sediment concentrations will decrease gradually with declining seasonal flows and as the remaining volume of residual sediment is exported from the reservoir basin. As suspended sediment moves downstream and concentrations decrease, water quality in the affected reach will gradually improve as sediment redistributes to areas of lower hydraulic energy and bankside restoration efforts stabilize the exposed reservoir terraces. By the end of the compliance time schedule established in Section 6.9, DEQ expects the effects of dam removal will no longer contribute to exceedances of water quality standards.

Dam removal will eventually lead to a restored natural river condition in which the effects of the operating hydroelectric project and the removal of the facilities will no longer affect water quality. Once river flows return to a natural hydrograph, water quality and suspended sediment load in the project reach will be influenced by incoming water quality, ambient conditions, and the hydrology of the free flowing river system.



Figure 8: Cross Section of J.C. Boyle Reservoir Sediments

7.1.1 Evaluation of Reservoir Drawdown on Water Quality

Reservoir drawdown and the rapid export of accumulated sediment will have immediate and significant effects on downstream water quality. The principle effect will be a sharp rise and prolonged presence of suspended sediment in the water column. Included in the sediment load are other materials such as nutrients, algal cell material, organic and inorganic contaminants or other substances that may directly or indirectly affect water quality. DEQ's evaluation of the effects of reservoir drawdown on the water quality is presented in the following sections.

7.1.1.1 Suspended Sediment

Short-Term Effects

The Applicant proposes to initiate reservoir drawdown on or about January 1 of the drawdown year when precipitation, river flows, and turbidity are near seasonally high levels. Hydraulic modeling estimates suspended sediment concentrations will increase sharply following drawdown and may briefly exceed 2,000 mg/l to 3,000 mg/l for up to two months. Figures 9 through 11 (USDOI. 2012. Vol 1. 3.2 -92) depict modeled suspended sediment response below J.C. Boyle dam for two years following drawdown assuming dry, median, and wet hydrologic conditions. Under all modeled flow scenarios, suspended sediment concentrations decrease steadily for several months as the volume of erodible sediment decreases and reservoir water is diluted by inflow from above the project. In July of the drawdown year, KRRC expects to begin final deconstruction of the J.C. Boyle embankment section resulting in a free-flowing river condition by about September of the drawdown year. This final breach will mobilize a small volume of remaining material causing suspended sediment concentrations to increase briefly as indicated in the figures; however, overall sediment concentrations will continue to decrease late into the year with declining seasonal flows. Depending on hydrologic conditions, the return of higher winter flows the year following drawdown may further erode and mobilize sediment causing a secondary increase in suspended sediment concentrations. However, DEQ expects most of the erodible material will have been transported downstream within the 24 months following drawdown.

Suspended sediment can cause a range of stressful conditions in fish and other aquatic life. These conditions range from minor changes in behavioural patterns to sub-lethal effects caused by moderate to major physiological stress. DEQ does not have a water quality standard for suspended sediments. However, DEQ evaluated the proposed action to ensure adequate protection of existing and beneficial uses, compliance with statewide narrative criteria and basin-specific criteria that require minimizing, to maximum extent practicable, impacts of dam removal on threatened and endangered species, and

beneficial uses in the Klamath Review. Short-term effects of suspended sediment on salmonids were evaluated using guidance that relates salmonid exposure time to suspended sediment concentrations and a severity index that ranks overall effects on salmonids. [NCRWQCB 2006, Newcombe and Jensen 1996, as cited in KRRC, 2017)]. The water quality effects determination uses a predicted suspended sediment value of 30 mg/L over a 4-week exposure period as a general threshold of significance. Hydraulic modeling predicts suspended sediment concentrations will persist near or above 30 mg/l for a period up to four months following dam removal under low and median conditions and slightly longer under wet hydrologic conditions. Salmon were extirpated from the Oregon hydroelectric reach following construction of the California Lower Klamath Project dams located in California. However, it is reasonable to conclude these conditions will result in similarly stressful conditions on resident aquatic life.

The Oregon Department of Fish and Wildlife does not anticipate permanent long term impacts to any of the affected native resident fish populations. The reversion of the J.C. Boyle reservoir habitat to a riverine environment will benefit the resident Redband Trout population and the other native resident fishes. Source populations to populate impacted river reaches below J.C. Boyle dam and the J.C. Boyle reservoir reach exist in Spencer Creek and the mainstem Klamath River reach below Keno dam. ODFW believes that the direct effects of the dam removal activities on the native fish assemblages will likely have dissipated by 24 months. ODFW further considers it likely any major passage barriers resulting from the actual dam removal and reservoir drawdown will be resolved within the 24-month compliance time schedule; however, ODFW typically prescribes a five-year monitoring period to verify these expectations[4].

Long-Term Effects

The Oregon hydroelectric reach will be restored to a free-flowing condition following reservoir drawdown and dam removal. By the end of the compliance time schedule, DEQ expects the temporary effects of the proposed action will no longer cause violations to Oregon water quality standards. Once the river's natural hydrograph is restored DEQ expects seasonal variation in suspended sediment loading consistent with similar locations above the project. In general, however, sediment input above the project area is low due to lower rates of precipitation and runoff, more resistant and permeable geologic terrain, and relatively low topographic relief. As a result, DEQ expects any changes to long-term suspended sediment transport to be minor.

Dam removal also eliminates the adverse effect of hydropower operations on water quality described specifically in section 5.5. Relative to the existing condition, the Klamath River will no longer experience stage change variations due to daily peaking operations of J.C. Boyle Powerhouse. Restoring natural flow variation in the peaking reach will improve vegetation, increase soil stability, and reduce sediment input from riparian areas.

[4] Ted Wise, Oregon Department of Fish and Wildlife. Email correspondence to Chris Stine, Oregon Department of Environmental Quality. 5/15/2018.

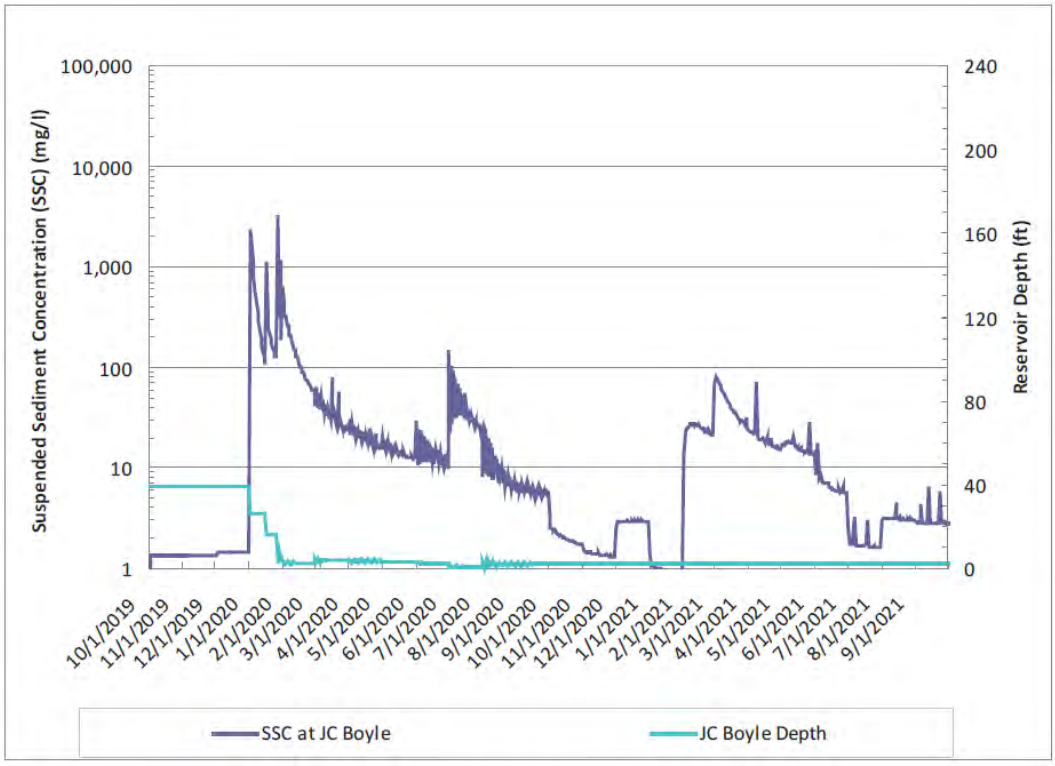

Figure 9: Modeled Suspended Sediment Concentrations below JC Boyle - Dry Hydrology

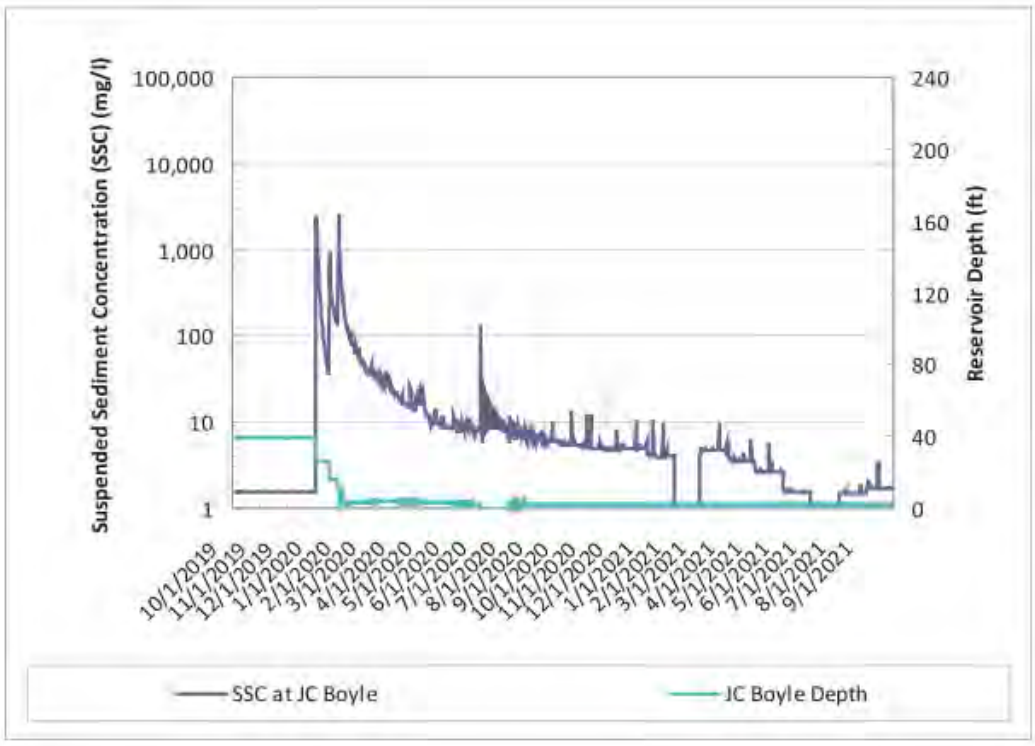

Figure 10: Modeled Suspended Sediment Concentrations below JC Boyle - Median Hydrology

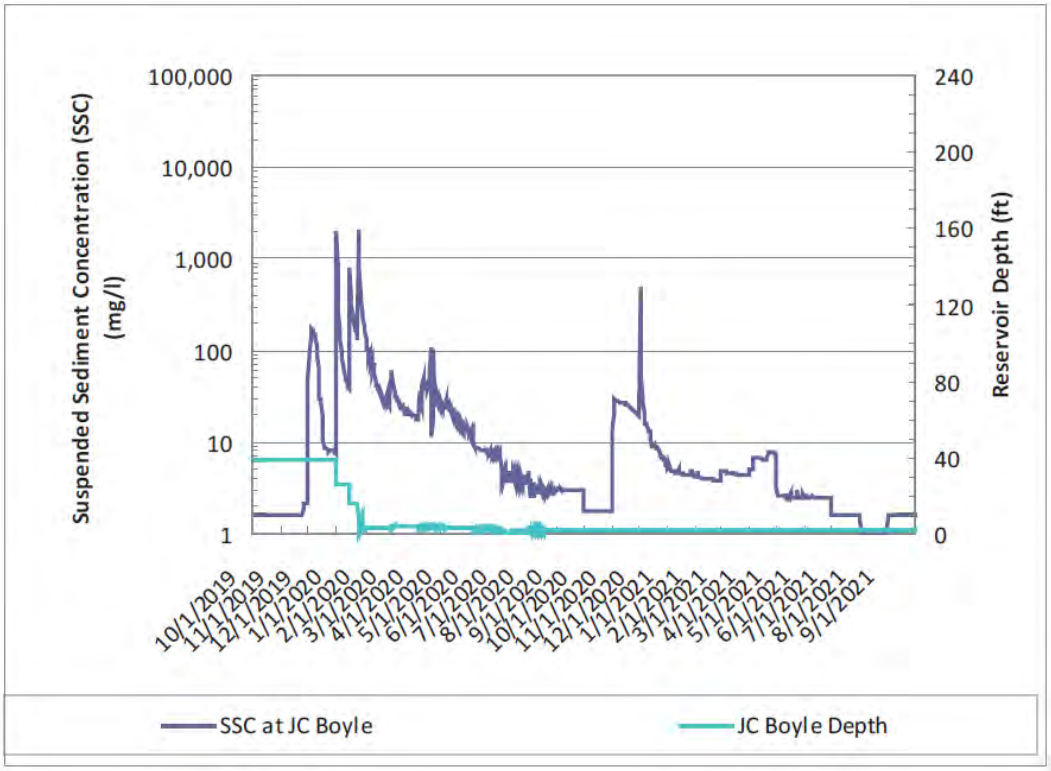

Figure 11: Modeled Suspended Sediment Concentrations below JC Boyle - Wet Hydrology

7.1.1.2 Dissolved Oxygen

Short-Term effects

Sediment loading during reservoir drawdown will cause short-term increases in immediate and biological oxygen demand and corresponding reductions in dissolved oxygen downstream from J.C. Boyle Reservoir. Oxygen demand is driven principally by oxidation of organic matter contained in impounded reservoir sediments once it is released to the water column. Oxygen saturation is expected to decrease following drawdown and gradually increase as organic matter is oxidized and through aeration of the water column and suspended sediment concentrations decrease.

The Applicant did not model predicted oxygen levels in the Oregon hydroelectric reach in response to dam removal. DEQ determined that modeling in the reach below Iron Gate Dam is sufficient for comparative purposes. In the reach below Iron Gate Dam, the minimum dissolved oxygen concentration occurs within about two miles below the dam with peak immediate oxygen demand and biological oxygen demand occurring about six weeks following drawdown. As the sediment plume flows downstream the effect on dissolved oxygen decreases due to chemical and biological oxidation of organic material, reaeration, and dilution. Model estimates predict dissolved oxygen levels return to 5 mg/l about 15 miles below Iron Gate Dam under all modelled hydrologic scenarios.

DEQ expects the effects of dissolved oxygen depletion below J.C. Boyle Dam will be considerably less than the modeled effects below Iron Gate Dam for several reasons. First, the volume of sediment impounded by J.C. Boyle is much less than the volume behind either Copco No.1 or Iron Gate dams. The smaller volume of material will presumably have less effect on water quality. Secondly, J.C. Boyle sediment contains a higher mineral fraction (e.g., sand) than is present in Iron Gate Reservoir. DEQ

believes the higher mineral content will result in lower immediate oxygen demand. Third, DEQ believes any dissolved oxygen deficit may be partially mitigated by drawing reservoirs down in the cold, high-flow winter months when oxygen saturation potential is highest. The timing of the scheduled drawdown also maximizes dilution and minimizes rates of biological oxygen demand. Last, the gradient on the Oregon section of the hydroelectric reach is steeper than the portions below the California developments. The steepness increases turbulence and reaeration of flows in this reach.

Oxygen deficits are driven, in part, by oxygen demand of the release of sediments. Because modeling data predict suspended sediments concentrations decline following drawdown, DEQ believes the duration of any oxygen deficit experienced in the hydroelectric reach will be brief.

Long-Term Effects

The previous section describes the period of reduced dissolved oxygen that DEQ expects in response to reservoir drawdown. Sediments containing high biochemical demand will temporarily depress oxygen saturation. However, as this material passes downstream and concentrations become diluted by inflow from above the project, oxygen saturation will increase. By the end of the 24-month compliance time schedule DEQ expects no residual project-related effects that will cause violations to the biologically-based numeric criteria established to support the dissolved oxygen water quality standard.

Following completion of the 24-month compliance time schedule, DEQ expects dissolved oxygen concentrations in the Oregon hydroelectric reach will be unaffected by the influence of dam removal or the operation of hydroelectric project. Oxygen saturation in this reach will be influenced by inflow from upstream sources, ambient conditions, and the natural seasonal hydrograph. Cold groundwater sources and higher flows in the steeper sections of the bypass reach should improve oxygen conditions relative to current hydroelectric operations. However, DEQ expects no adverse effects to dissolved oxygen caused by dam removal after conclusion of the compliance time schedule.

7.1.1.3 Nuisance Phytoplankton Growth, Chlorophyll-a, Nutrients

Short-Term Effects

J.C. Boyle dam intercepts the downstream transport of particulate matter including organic nutrients such as total nitrogen and total phosphorous. Reservoir drawdown will increase concentrations suspended material including these and other nutrients present in sediments.

DEQ expects minimal adverse effects on water quality from the release of nutrient compounds during reservoir drawdown. Organic nutrients and other fine-grained material are expected to remain in suspension with little deposition occurring in the Oregon hydroelectric reach. Furthermore, drawdown is proposed during months of colder temperatures and diminished available sunlight that reduces primary production, nutrient cycling, and bioavailability. Because nutrients will be exported quickly through the system during a period of reduced bioavailability DEQ believes potential effects on water quality (e.g., phytoplankton production, pH fluctuations, etc.) will be minimal. DEQ expects nutrient concentrations to decrease as the remaining sediment volume decreases and as inflow into the project area dilutes the concentration of suspended material.

Long-Term Effects

Removal of the dam will have no long-term effect on nutrient concentrations, chlorophyll-a, or phytoplankton growth in the hydroelectric reach relative to the pre-development condition of the river. J.C. Boyle Reservoir is a small, comparatively fast flushing reservoir that has not historically experienced

algal blooms as severe as those in the larger Lower Klamath Project reservoirs. Restoration of a natural hydrograph in this reach will further reduce conditions that favor primary production.

DEQ believes dissolved and particulate nutrients associated with impounded sediments will remain in suspension and will flow quickly out of the hydroelectric reach following drawdown. Runoff from exposed reservoir embankments may represent minor sources of nutrient input; however, contributions from these sources will be minor and temporary. DEQ expects nutrient concentrations in the river will be unaffected by physical impoundments or the residual effects of dam removal after compliance of the compliance time schedule.

7.1.1.4 pH

Short-Term Effects: pH

Drawdown will be completed during the colder months when temperature, sunlight, and other factors generally limit biological activity that may affect pH. For this reason, DEQ expects no significant adverse short-term affects on pH during drawdown.

Long-Term Effects: pH

DEQ expects no adverse project-related effects on pH following completion of the compliance time schedule. Hydrogen ion concentration is strongly influenced by biological activity, dissolved oxygen, and temperature. Because DEQ expects no long-term adverse effects on these parameters, DEQ believes the proposed action will similarly have no influence on long-term hydrogen ion concentration.

Restoration of the seasonal flow regime will likely moderate pH variability during the spring and fall relative to current operating conditions. DEQ expects enhanced periphyton growth in the peaking reach following dam removal. The effects of photosynthesis and respiration in this reach will likely contribute to higher diel pH variability on a long-term basis. However, any long-term change in annual pH levels from current conditions will occur in response to adaptations to a restored hydrograph rather than residual effects from dam removal.

7.1.1.5 Temperature

Short-Term Effects: Temperature

Reservoir drawdown and dam removal will have little short-term effect on water temperature in the hydroelectric reach. Drawdown will occur during winter months when water temperatures generally meet the biologically-based numeric criteria for temperature. Also, because the volume of J.C. Boyle Reservoir is small, KRRC expects reservoir drawdown to increase flows by just 19 cfs. DEQ expects any thermal contribution from the release of stored reservoir water will be obscured by other factors such as the large volumes of cold groundwater accretion in the bypass reach.

Long-Term Effects: Temperature

Dam removal will eliminate all project-related water storage in the hydroelectric reach. The natural thermal regime of this reach will be restored quickly following removal of all river impoundments. Because dam removal will eliminate thermal storage caused by water impoundment, DEQ believes the project will no longer exert thermal influence in the hydroelectric reach following completion of drawdown.

7.1.1.6 Turbidity

Reservoir drawdown will rapidly release a large volume of sediment that will have an immediate effect on turbidity downstream of J.C. Boyle Dam. No modeling data are available to predict turbidity response. However, the expected response of suspended sediment concentrations may be interpreted to qualitatively assess project effects on turbidity. Figures 9 to 11 illustrate modeled suspended sediment response under three flow scenarios. The figures suggest suspended sediment concentrations rapidly attenuate during the first year following drawdown and approach pre-removal levels during periods of the second year. DEQ believes turbidity will respond similarly although the relative increase in turbidity over incoming conditions will be verified during water quality monitoring.

7.1.1.7 Organic and Inorganic Contaminants

Sediment volume in J.C. Boyle reservoir is small. Because Link River and Keno Dams trap sediment transport above the project, the sediment entering J.C. Boyle reflects the composition of terrestrial soils. Inorganic and organic contaminants are present in the sediment, elutriate (sediment pore water), and fish tissue in J.C. Boyle Reservoir (CDM, 2011). However, the concentration of contaminants is generally low, the pattern of distribution of contaminants is not consistent, and concentrations generally reflect background levels.

In 2004-2005, a study evaluated sediment contamination in J.C. Boyle Reservoir sediment cores. The study found generally low levels of metals, pesticides, chlorinated acid herbicides, polychlorinated biphenyls, volatile organic compounds, semi-volatile organic compounds, cyanide, and dioxins. Where chemicals in sediment were detected above reference screening levels, the degree of exceedance was small and were consistent with regional background conditions (CDM, 2011)

7.1.1.8 Biocriteria

Short-Term Effects: Biocriteria

The short-term effects of reservoir drawdown include increased loading of suspended sediments and periods of reduced dissolved oxygen concentrations. The short-term effect of reservoir drawdown will have adverse effects on aquatic resources. These effects may range from nuisance and sub-lethal effects such as reduced foraging and navigational skills to lethal effects such as burial of sessile organisms including filter-feeding macroinvertebrates.

KRRC proposes to mitigate for the immediate effects of dam removal on resident populations of Lost River Sucker and Shortnose Sucker, which are listed as endangered by the US Fish and Wildlife Service. The proposal requires KRRC to salvage and translocate up to 100 of each species to off-channel habitat prior to drawdown.

KRRC also proposes to conduct an abundance and overwintering study of the Western Pond Turtle and, if warranted, undertake appropriate mitigation measures to reduce impacts to populations in or near J.C. Boyle Reservoir.

DEQ expects reservoir drawdown will significantly impact aquatic resources and the biocriteria water quality standard during the compliance time schedule. However, DEQ believes measures proposed by the Applicant will mitigate short-term effects to aquatic resources to the extent practicable.

Long-Term Effects: Biocriteria

The Oregon Department of Fish and Wildlife does not anticipate any long-term impact to native resident fish populations in the affected reach. ODFW further believes that direct effects of the dam removal

activities on the native fish assemblages will likely have dissipated by 24 months, although it is uncertain if specific fish populations will have returned to pre-drawdown abundance within 24 months.

DEQ expects the long-term effects of reservoir drawdown and dam removal to be beneficial aquatic resources and support attainment of the biocriteria water quality standard. Drawdown and dam removal will eliminate current peaking operations below J.C. Boyle powerhouse. Frequent and rapid stage change in this reach reduces the abundance and complexity of macroinvertebrate communities, causes stranding of juvenile fish, and prevents the establishment of stable riparian vegetation and habitat.

DEQ expects that following dam removal benthic macroinvertebrates will recolonize this reach rapidly through drift or dispersal of adults from established upstream communities. Additionally, reformation of river channels in the reservoir reaches would expand suitable substrate for macroinvertebrate habitat. Overall, DEQ believes long-term benefits will accrue through the restoring connectivity and habitat complexity to levels consistent with pre-development conditions. Based on this expectation and the assessment provided by ODFW, DEQ believes the aquatic conditions necessary to support the biocriteria water quality standard will be met within the compliance time schedule established in Section 6.9.

7.1.2 Findings: Reservoir Drawdown

DEQ has established a compliance time schedule of 24 months from the start of drawdown after which DEQ expects residual impacts attributable to the proposed action will no longer contribute to violations of Oregon water quality standards. Based on our review and evaluation of the proposed action, DEQ anticipates reservoir drawdown may cause exceedances of certain water quality standards for up to 24 months following the start of reservoir drawdown. However, DEQ expects these impacts to be temporary and will be mitigated to the extent practicable by measures proposed by the Applicant and as enforced by conditions required by this section 401 water quality certification. DEQ finds these actions acceptable and necessary to achieve a net ecological benefit and provide long-term improvements to water quality.

DEQ is reasonably assured that impacts caused by reservoir drawdown will not cause violations to water quality standards following conclusion of the compliance time schedule provided KRRC complete reservoir drawdown and related activities according to the methods and schedule proposed in the Application and the conditions of this section 401 water quality certification. In particular, the following conditions are required:

1. Water Quality Management Plan

To confirm that project effects do not contribute to conditions that violate water quality standards by the conclusion of the 24-month compliance time schedule, the KRRC must implement a Water Quality Management Plan in accordance with the conditions in Section 2 the section 401 water quality certification.

2. Miscellaneous Measures Protective of Beneficial Uses
   a) To ensure protection of existing beneficial uses, KRRC shall provide or maintain fish passage at all artificial obstructions created or affected by the Proposed Action that prevent or delay the migration of native migratory fish in accordance with the conditions in Section 4(a) of this section 401 water quality certification.
   b) To minimize to the extent practicable adverse effects to threatened and endangered species, KRRC shall implement Aquatic Resource Measure AR-6 and implement a Western Pond Turtle abundance and overwintering study and, if necessary, mitigation in accordance with the conditions in sections 4(b) and 4(c) of this section 401 water quality certification, respectively.

3. Reservoir Drawdown and Diversion Plan

KRRC must prepare and implement a Reservoir Drawdown and Diversion Plan in accordance with the conditions in Section 5 the section 401 water quality certification. The Reservoir Drawdown and Diversion Plan is required to confirm that drawdown procedures are performed in a manner consistent with those evaluated in this water quality certification.

4. Annual Compliance Report

KRRC must annually prepare a compliance report in accordance with the conditions in Section 11 of the section 401 water quality certification.

7.2 Facilities Removal

The KRRC proposes to remove J.C. Boyle dam, powerhouse, canal, all appurtenant facilities associated with the J.C. Boyle hydroelectric development of the Lower Klamath Project according to the removal limits described in the Application as the Full Removal Alternative. Facilities Removal will include deconstruction and removal of all physical elements of the hydroelectric facility, the permanent on-site placement of fill material, waste management and disposal, decommissioning of temporary and/or permanent staging areas and access roads, recreational facilities, and other activities necessary to achieve Facilities Removal.

DEQ's evaluation of project effects on water quality is presented in the following sections.

7.2.1 Evaluation of Facilities Removal on Water Quality

DEQ's evaluation of the Applicant's proposal to remove project facilities on water quality is presented in the following sections.

7.2.1.1 Suspended Sediment

Construction and deconstruction activities associated with Facilities Removal can compact, erode, and destabilize surface areas and increase the potential for erosion and sedimentation in stormwater runoff. Facilities Removal will occur following completion of reservoir drawdown. It is reasonable to assume that deconstruction activities will be performed during seasonally wet periods, which will increase the potential for sediment loading in stormwater runoff.

Three locations are proposed for permanent on-site placement of deconstruction material. These include the J.C. Boyle powerhouse tailrace, the emergency spillway scour hole, and the original borrow pit near the dam's right abutment. Four temporary staging areas are proposed including near the forebay, near the powerhouse, and two locations near the right abutment. Other elements scheduled for removal are identified in Table 3.

Short-Term Effects: Suspended Sediment

Temporary impacts can occur during the use of heavy equipment to prepare access roads and staging areas, deconstruct project elements, and transport material to permanent on-site and off-site locations. DEQ expects the Applicant will apply for and receive coverage under a National Pollution Discharge and Elimination System 1200C construction stormwater permit administered by DEQ to implement and comply with appropriate measures to reduce pollutants in stormwater runoff during Facilities Removal.

Long-Term Effects: Suspended Sediment

Disturbed areas that are not properly restored after completion of site-disturbing activities can develop erosional drainages that can result long-term sources sediment input. DEQ will require the Applicant to develop and implement an Erosion and Sediment Control Plan to provide controls and monitoring to

ensure long-term stability of on-site disposal locations. DEQ will review the plan prior to approval for implementation. DEQ expects the conditions required by the plan will adequately protect against long-term erosion and sediment runoff and include requirements to take appropriate actions, as warranted, to correct site conditions that fail to provide long-term stability of disturbed areas.

7.2.1.2 Dissolved Oxygen

Material can enter waterways during Facilities Removal that can increase oxygen demand. Substances in sediment runoff or accidental chemical spills can temporarily reduce oxygen saturation. DEQ will require the Applicant to implement measures in the Erosion and Sediment Control Plan and appropriate spill prevention measures in a Spill Prevention Control and Countermeasure Plan to reduce the potential for releases to waterways during Facilities Removal.

7.2.1.3 Nuisance phytoplankton growth

DEQ considers it unlikely the actions associated with Facilities Removal will have a short-term or long-term effect on algal production. However, to the extent that actions undertaken during Facilities Removal may affect materials either directly or indirectly in a manner that promotes algal growth if released to waterways, DEQ expects these actions to be adequately mitigated through implementation of plans and conditions required by this water quality certification.

7.2.1.4 pH

Facilities Removal may introduce construction materials, such as concrete, welding slag, chemicals, or other material, into waterways that may affect water quality parameters, including pH. DEQ expects potential impacts to this parameter may be mitigated by implementing provisions of the Erosion and Sediment Control Plan that addresses best management practices during deconstruction activities.

7.2.1.5 Temperature

DEQ considers it unlikely the actions associated with Facilities Removal will have a short-term or long-term effect on water temperature.

7.2.1.6 Turbidity

Short-Term Effects: Turbidity

Actions requiring the removal of physical project elements in or near open water can increase short-term turbidity. The principal activities requiring work in the Klamath River include the removal of the embankment and spillway sections of J.C. Boyle dam and the back-filling the powerhouse tailrace. Other actions, such as the removal of the wooden bridge below J.C. Boyle Dam, the restoration of the forebay scour hole, or activities considered as partial removal options described in the Application, may also temporarily increase turbidity.

The Applicant expects deconstruction of the dam will be completed within about one year following the start of drawdown. Water quality impacts during this period will include a prolonged period of elevated turbidity primarily associated with sediment export. DEQ expects the effects of dam deconstruction and removal will be largely indistinguishable from those caused by drawdown. DEQ further believes the magnitude and duration of effects attributable to dam deconstruction and removal will be less than that of sediment transport. For this reason, DEQ expects the effects of dam removal to not cause a violation of the turbidity water quality standard after conclusion of the 24-month compliance time schedule prescribed in Section 6.9.

Long-Term Effects: Turbidity

DEQ will require the Applicant to undertake restoration and monitoring actions consistent with a Sediment and Erosion Control Plan approved by DEQ to prevent erosive conditions that may increase sediment runoff and/or increased turbidity in the Klamath River and its affected tributaries.

7.2.1.7 Organic and Inorganic Contaminants

Facilities Removal may introduce construction materials, including organic or inorganic contaminants, into waterways that may decrease water quality and reduce support for beneficial uses. DEQ expects this possibility may be mitigated by implementing provisions of the Erosion and Sediment Control Plan that address best management practices during Facilities Removal.

7.2.1.8 Biocriteria

Facilities Removal will temporarily reduce water quality necessary to fully support aquatic resources near the project area. The proposed activity will temporarily increase sedimentation and turbidity and may introduce substances that may have direct or indirect effects on water quality parameters necessary to support aquatic resources. DEQ expects the duration of water quality impacts will be less than 24 month compliance time schedule presented in Section 6.9. DEQ also expects the effects of these actions may be partially mitigated by implementing appropriate management plans, such as the Erosion and Sediment Control Plan, which address best management practices to reduce impacts during site disturbing activities.

The long-term effects of the action will provide a net benefit for aquatic resources. Removal of J.C. Boyle dam will restore the area of substrate habitat beneath the dam's embankment section and convert about four miles of lacustrine habitat to riverine conditions. Benthic macroinvertebrates are expected to recolonize this reach from established upstream communities. Restoration of this reach will benefit aquatic resources and support long-term attainment of the biocriteria water quality standard.

7.2.2 Findings: Facilities Removal

Based on our evaluation of project effects, DEQ expects that removing the physical elements of the project according to the full removal alternative presented in the Application will temporarily increase sedimentation and turbidity due activities proposed in flowing portions of the river. However, DEQ believes these effects will be of lesser magnitude and shorter duration than related impacts caused by sediment mobilization during reservoir drawdown. Because the effects of these actions will partially overlap, DEQ believes the observed effects of Facilities Removal will be indistinguishable from the greater impacts associated with reservoir drawdown.

Based on these findings, DEQ is reasonably assured that impacts caused by completing Facilities Removal will not cause violations to water quality standards following conclusion of the compliance time schedule provided KRRC complete the proposed action according to the methods and schedule proposed in the Application and the conditions of this section 401 water quality certification. The following conditions are required:

1. Remaining Facilities and Operations Plan

KRRC must prepare and implement a Remaining Facilities and Operations Plan in accordance with the conditions in Section 7 of the section 401 water quality certification. The Remaining Facilities and Operations Plan must identify elements that will not be removed during project implementation and describe their potential impact on water quality.

2. Site Restoration, Sediment and Erosion Control

KRRC must develop an Erosion and Sediment Control Plan and undertake site restoration actions in accordance with the conditions in Section 8(a) of the section 401 water quality certification.

3. Waste Disposal and Management Plan

KRRC must develop and implement a Waste Disposal and Management Plan in accordance with the conditions in Section 9 of the section 401 water quality certification.

4. Spill Response

The Licensee shall maintain a Spill Prevention, Control, and Countermeasure Plan in effect at all times in accordance with 40 CFR Part 112 and the conditions in Section 10 of this section 401 water quality certification.

5. Stormwater Management

The Licensee shall register with DEQ for coverage under National Pollution Discharge Elimination System general permit 1200-C before any construction activities occur that cumulatively disturb more than one acre of and may discharge stormwater to surface waters of the state.

6. On-Site Septic Systems

To reduce the potential for bacterial pollution, the Licensee shall decommission all Lower Klamath Project on-site septic systems in accordance with Oregon Administrative Rule Chapter 340, Division 71.

7.3 Reservoir Management and Restoration

Following completion of reservoir drawdown, the KRRC proposes to complete reservoir restoration activities as proposed in the Reservoir Area Management Plan presented in Appendix G of the Technical Support Document. The plan revises and supersedes the previous Reservoir Area Management Plan dated 2011and prepared by US Bureau of Reclamation in support of the Secretarial Determination. The revised plan establishes short- and long-term goals intended to promote mobilization and dispersal of sediments during drawdown; stabilize remaining reservoir soils; restore volitional fish passage in the Klamath River and affected tributaries; promote revegetation efforts using native stock; and minimize the establishment of invasive exotic vegetation during restoration efforts. The plan proposes to accomplish these goals through coordinated programs to promote reservoir revegetation (e.g., native plant propagation, control of invasive exotic vegetation), reservoir restoration (e.g., tributary connectivity, creation of aquatic habitats, bank stabilization, placement of large wood), monitoring, and adaptive management.

7.3.1 Evaluation of Reservoir Management and Restoration on Water Quality

DEQ's evaluation of the Applicant's proposal to conduct reservoir management actions according to the Reservoir Area Management Plan on water quality 13 is presented in the following sections.

7.3.1.1 Suspended Sediment

Modeling data predict reservoir drawdown will mobilize from about 40 to 60 percent of accumulated sediment depending on the magnitude of flows during drawdown. Much of the remaining sediment will be located in the broad floodplain upstream of the SR 66 bridge. Sediments remaining on exposed terraces are susceptible to slumping, cracking, and erosion. A principle objective of the Reservoir Area Management Plan is to stabilize these soils by establishing native vegetation on exposed terraces during the first year following drawdown. The plan includes a proposal to hydroseed exposed terraces soon after drawdown followed in the summer by planting pole cuttings, saplings, and salvaged woody vegetation. The Applicant proposes an integrated pest management program and best management practices to

increase survival and reduce weeds and invasive exotic vegetation. The plan also includes maintenance measures (e.g., watering, weed suppression, monitoring) to ensure survival. Restoration actions include tributary connectivity and placement of structures (e.g., large wood) to reduce erosion and dissipate hydraulic energy.

DEQ expects the measures proposed in the Reservoir Area Management Plan will promote restoration of the former reservoir area and reduce the potential for erosion and long-term sediment input to the Klamath River and affected tributaries. DEQ will require KRRC to implement the monitoring and adaptive management provisions of the plan to ensure these objectives are met and the project dies not contribute to increased sedimentation of the Klamath River.

7.3.1.2 Dissolved Oxygen

Short-Term Effects: Dissolved Oxygen

DEQ expects saturated sediments to slowly release pore water resulting in elutriate runoff from exposed terrace deposits. Soluble substances, such as nutrients, pesticides, or others chemicals, may temporarily increase oxygen demand in receiving waters. The physical erosion of soft sediment shortly after drawdown may increase inputs of particulate matter that can also reduce oxygen potential. However, the saturated conditions that may support pore water drainage and soft erodible surfaces are considered temporary conditions that will diminish as sediments dry, and terraces stabilize. For this reason, DEQ considers the effects of these actions minor and unlikely to measurably affect dissolved oxygen saturation.

Long-Term Effects: Dissolved Oxygen

Completion of the reservoir restoration objectives will have a positive effect on water quality, including dissolved oxygen. The proposed actions will increase vegetation cover, habitat complexity, stream connectivity, and off-channel hydrology. DEQ expects these actions may reduce solar thermal gain, reduce sediment input, and increase oxygen saturation potential and nutrient utilization. DEQ will require water quality monitoring above and below the project actions to verify this expectation.

7.3.1.3 Nuisance phytoplankton growth

Short-Term Effects: Nuisance phytoplankton growth

Pore water drained from exposed sediment terraces may transport dissolved substances, including nutrients, to receiving waters. DEQ expects the potential for sediment runoff is greatest in the year following drawdown before revegetation efforts have fully stabilized terrace sediments. DEQ believes there is a low potential for short-duration nutrient input to promote nuisance algal growth for several reasons. First, DEQ expects the potential for nutrient loading to be greatest in the months immediately following drawdown during a period of seasonally low algal productivity. In addition, the conversion of the reservoir to a free-flowing condition reduces the aquatic conditions necessary to support algal growth. Last, DEQ expects the measures proposed in the restoration plan will establish vegetation that will stabilize sediment and aid in biological uptake of available soluble nutrients. For these reasons, DEQ considers it unlikely the proposed action will contribute to a violation of this water quality standard.

Long-Term Effects: Nuisance phytoplankton growth

DEQ expects reservoir restoration efforts to have a positive effect on water quality. In particular, the objectives of creating and maintaining tributary connectivity will increase streamflow and reduce conditions that promote algal growth. Other restoration goals, including creating off-channel habitat and channel complexity improve aquatic function and reduce conditions that favor nuisance algal production.

To ensure the objectives of the plan are met, DEQ will require KRRC to implement the monitoring and adaptive management provisions of the plan.

7.3.1.4 pH

Short-Term Effects: pH

Before sediment terraces are fully stabilized, DEQ recognizes the potential for elutriate runoff to introduce chemicals into receiving waterways. Because of restoration efforts and general sediment drying, the potential for elutriate runoff from sediments is considered short and unlikely to significantly affect the chemical composition or pH of the receiving waters. In the long-term,

Long-Term Effects: pH

DEQ expects the proposed action to have no measureable effect on pH once restoration efforts reach full potential. Should revegetation efforts or habitat restoration result in increased aquatic vegetation; DEQ considers it possible that diel pH variation may occur because of respiration and photosynthetic growth. However, these effects will presumably occur on a local scale and will not likely result in measureable pH variation in the mainstem Klamath River.

7.3.1.5 Temperature

DEQ expects reservoir restoration efforts to have a long-term positive effect on water temperature. Revegetation of reservoir embankment areas will presumably increase riparian shade potential thereby reducing thermal gain. In addition, creating and maintaining off-channel habitat and stream channel complexity may promote increased hyporheic exchange through marginal stream gravels. Hyporheic flow can cool overall water temperature and create localized zones of cool water refugia. DEQ expects reservoir restoration efforts identified in the Reservoir Area Management Plan will have a net ecological benefit and a positive effect on water quality including water temperature.

7.3.1.6 Turbidity

Short-Term Effects: Turbidity

The Applicant proposes field methods to achieve the objectives of the Reservoir Area Management Plan that may temporarily increase turbidity. These include physically removing sediment barriers to fish passage, increasing the roughness of floodplain sediments to promote seed propagation, placement of features such as large wood structures, and maintenance of existing plantings. These actions may temporarily disturb surface soils and increase turbidity. However, DEQ believes the effects of these actions may be mitigated by implementing best management practices proposed in the plan.

Long-Term Effects: Turbidity

Overall, DEQ finds the proposed action will likely reduce turbidity in the Klamath River and its affected tributaries. This is because the objectives of the restoration plan, which include creating and maintaining off-channel habitat, providing energy-dissipating structures in stream margins, and reducing sediment barriers including head-cuts, increase hydrologic complexity that can promote particulate settling. DEQ will require KRRC to monitor water quality and implement reporting and adaptive management portions of the Reservoir Area Management Plan to verify these expectations.

7.3.1.7 Organic and Inorganic Contaminants

DEQ expects the potential for sediment runoff is greatest in the year following drawdown before revegetation efforts have fully stabilized terrace sediments. DEQ believes there is a potential that erosion or elutriate runoff may transport organic or inorganic compounds present in sediment into receiving

waters. However, chemical analyses of sediments during the Secretarial Determination studies determined the concentration of most organic and inorganic chemicals in sediments was low and generally consistent with local background levels. For this reason, and because DEQ expects the proposed revegetation efforts will reduce the occurrence of runoff, DEQ believes the potential is low for the proposed activity to introduce organic or inorganic contaminants into the Klamath River or affected tributaries. DEQ believes this potential decreases further as objectives of the Reservoir Area Management Plan are achieved and implemented.

7.3.1.8 Biocriteria

DEQ believes implementation of the Reservoir Area Management Plan will increase the quantity and complexity of habitat for aquatic resources and, for this reason, will improve support for the biocriteria water quality standard. This position is based on the expectation that the Applicant will implement, achieve, and maintain the goals and objectives of the plan. In particular, the plan seeks to stabilize reservoir soils, restore volitional fish passage, increase off-channel habitat and create habitat complexity. If maintained, benthic macroinvertebrates are expected to recolonize this reach from established upstream communities. These objectives collectively improve water quality and create improved substrate necessary to support diverse benthic communities. DEQ will require KRRC to implement monitoring, reporting, and adaptive management components of the plan to ensure restoration goals are met and attainment of the biocriteria water quality standard is achieved.

7.3.2 Findings: Reservoir Management

Based on our evaluation of project effects, DEQ expects implementation of the measures proposed in the Reservoir Area Management Plan will have an overall positive effect on long-term water quality and result in a net ecological benefit. This position is based on the expectation that KRRC will implement the plan as proposed and according to any revisions or conditions required by this water quality certification. DEQ expects the effects of any short-duration water quality impacts, such as temporary increased turbidity or the possibility of elutriate runoff, are low and may be adequately mitigated by implementing the conditions of this certification.

Based on these findings, DEQ is reasonably assured that the effects of implementing reservoir restoration activities as proposed in the Reservoir Area Management Plan will not cause violations to water quality standards following conclusion of the compliance time schedule identified in Section 6.9. This finding is based on the expectation that KRRC completes the proposed actions according to the methods and schedule proposed in the Application and the conditions of this section 401 water quality certification, including the following:

1. Miscellaneous Measures Protective of Beneficial Uses

To maintain support for existing beneficial uses in the affected area, KRRC shall maintain fish passage at all artificial obstructions created or affected by the Proposed Action in accordance with the conditions in Section 4(a) of this water quality certification. The KRRC shall protect beneficial uses to the extent practicable as required by the conditions in Section 4.

2. Reservoir Area Management Plan

The KRRC shall develop and implement a Reservoir Area Management Plan in accordance with the conditions in Section 6 of this section 401 water quality certification. DEQ will require measures to minimize to the extent practicable impact to the Klamath River following dam removal.

8. Antidegradation

Water quality standards have three elements: the beneficial uses protected by the standard, numeric and narrative criteria that support these uses, and an antidegradation policy that governs how and when existing water quality may be lowered. EPA recently updated the antidegradation policy, as described in 40 CFR 131.12.

Section 131.12 Antidegradation policy and implementation methods.

(a) The State shall develop and adopt a statewide antidegradation policy. The antidegradation policy shall, at a minimum, be consistent with the following:

(1) Existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.

(2) Where the quality of the waters exceeds levels necessary to support the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water, that quality shall be maintained and protected unless the State finds, after full satisfaction of the intergovernmental coordination and public participation provisions of the State's continuing planning process, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located. In allowing such degradation or lower water quality, the State shall assure water quality adequate to protect existing uses fully. Further, the State shall assure that there shall be achieved the highest statutory and regulatory requirements for all new and existing point sources and all cost-effective and reasonable best management practices for nonpoint source control.

(i) The State may identify waters for the protections described in paragraph (a)(2) of this section on a parameter-by-parameter basis or on a water body-by-water body basis. Where the State identifies waters for antidegradation protection on a water body-by-water body basis, the State shall provide an opportunity for public involvement in any decisions about whether the protections described in paragraph (a)(2) of this section will be afforded to a water body, and the factors considered when making those decisions. Further, the State shall not exclude a water body from the protections described in paragraph (a)(2) of this section solely because water quality does not exceed levels necessary to support all of the uses specified in section 101(a)(2) of the Act.

(ii) Before allowing any lowering of high water quality, pursuant to paragraph (a)(2) of this section, the State shall find, after an analysis of alternatives, that such a lowering is necessary to accommodate important economic or social development in the area in which the waters are located. The analysis of alternatives shall evaluate a range of practicable alternatives that would prevent or lessen the degradation associated with the proposed activity. When the analysis of alternatives identifies one or more practicable alternatives, the State shall only find that a lowering is necessary if one such alternative is selected for implementation.

(3) Where high quality waters constitute an outstanding National resource, such as waters of National and State parks and wildlife refuges and waters of exceptional recreational or ecological significance, that water quality shall be maintained and protected.

(4) In those cases where potential water quality impairment associated with a thermal discharge is involved, the antidegradation policy and implementing method shall be consistent with section 316 of the Act.

(b) The State shall develop methods for implementing the antidegradation policy that are, at a minimum, consistent with the State's policy and with paragraph (a) of this section. The State shall provide an

opportunity for public involvement during the development and any subsequent revisions of the implementation methods, and shall make the methods available to the public.

340-041-0004

Oregon's antidegradation policy can be found in its entirety in OAR 340-041-0004. The purpose of the antidegradation policy is described below:

Antidegradation

(1) Purpose. The purpose of the Antidegradation Policy is to guide decisions that affect water quality such that unnecessary further degradation from new or increased point and nonpoint sources of pollution is prevented, and to protect, maintain, and enhance existing surface water quality to ensure the full protection of all existing beneficial uses. The standards and policies set forth in OAR 340- 041-0007 through 340-041-0350 are intended to supplement the Antidegradation Policy.

Application of Standard

Under the federal Clean Water Act, states are required to adopt water quality standards and these standards must include an antidegradation policy. By regulation, EPA requires that antidegradation policies must maintain and protect existing uses and where water quality is better than what is required to support existing and designated beneficial uses, the state may allow additional degradation of waters only after satisfying specified procedural and substantive requirements.

DEQ's antidegradation policy provides a means for maintaining and protecting water quality of surface waters by requiring that all activities with the potential to affect existing water quality undergo review and comment prior to any decision to approve or deny a permit or certificate for the activity. The antidegradation policy complements the use of water quality criteria. View DEQ's antidegradation policy implementation document and other associated documents here:

http://www.oregon.gov/deq/wq/Pages/WQ-Standards-Antidegradation.aspx

Oregon Administrative Rules specifically address the expected temporary lowering of water quality in the Klamath River under the Proposed Action. As discussed in section 6.9 of this report, DEQ has demonstrated compliance with the requirements in OAR 340-041-0185(5).

DEQ Evaluation and Findings:

DEQ implements the antidegradation policy through the antidegradation review. Tier 1 and Tier 2 reviews are included in this antidegradation review.

- Existing Use Protection: The EPA Tier 1 antidegradation regulations are for protection of existing uses, defined in EPA's regulations as "those uses actually attained in the waterbody on or after November 28, 1975." The basic protection provided by Tier 1 applies to all waters, regardless of use designation. There have been no changes to the Klamath River since DEQ updated the designated uses in 2003. The existing uses in the Klamath River through the Project are equivalent to the designated uses. DEQ has determined that the Proposed Action, following implementation of the section 401 water quality certification with conditions, will protect designated uses, which are equivalent to existing uses. This analysis results in a finding that the project will protect existing uses.
- High Quality Water Protection: The antidegradation policy ensures that an activity in Oregon waters will not result in a lowering of water quality unless DEQ or the EQC finds that such a lowering is necessary and the benefits of the lowered water quality outweigh the environmental costs of the reduced water quality and that other conditions in the antidegradation policy also

apply. Usually, if DEQ finds that the activity will result in a lowering of water quality, DEQ must demonstrate in an in-depth Tier 2 review that such a lowering meets antidegradation requirements set out in 340-041-0004(6), for high quality waters, or 340-041-0004(9), for water quality limited waters, whichever is applicable. However, OAR 340-041-0185(5) applies to the Proposed Action. DEQ has evaluated the Proposed Action and has demonstrated compliance with the requirements in OAR 340-041-0185(5). The Proposed Action will result in short term lowering of water quality, but the Proposed Action is not expected to cause or contribute to a permanent lowering of water quality or an exceedance of water quality standards at the end of the compliance period specified in the water quality certification.

- DEQ is therefore, reasonably assured that the project is consistent with Oregon's antidegradation policy and that an in-depth antidegradation review is not necessary.

Based on the antidegradation review DEQ finds that federal requirements at 40 CFR 131.12 have been met; that state requirements at OAR 340-041-0004 have been met and that the Proposed Action subject to the conditions in the section 401 water quality certification is consistent with antidegradation requirements.

9. Compliance with CWA Sections 301, 302, 303, 306 and 307

In order to certify a project pursuant to section401 of the federal Clean Water Act, DEQ must find that the project complies with applicable provisions of Sections 301, 302, 303, 306 and 307 of that Act and state regulations adopted to implement these sections. Sections 301, 302, 306 and 307 of the federal Clean Water Act deal with effluent limitations, water quality related effluent limitations, national standards of performance for new sources and toxic and pretreatment standards. These requirements address point source discharges such as cooling water discharges, stormwater, and sewage discharges. Section 303 of the Act relates to Water Quality Standards and Implementation Plans. The federal Environmental Protection Agency has adopted regulations to implement Section 303 of the Act. The EQC has adopted water quality standards consistent with the requirements of Section 303 and the applicable EPA rules. Water quality standards are presented in OAR Chapter 340, Division 41. EPA has approved the Oregon standards pursuant to the requirements of Section 303 of the Act. Therefore, the Project must comply with Oregon Water Quality Standards to qualify for certification. As discussed above in this report, the proposed Project will comply with Oregon Water Quality Standards and therefore Section 303 of the Clean Water Act, provided the conditions to the section 401 Certification are satisfied.

Required NPDES Permits

Facilities engaged in upland construction activities that will disturb more than one acre of land and which may reasonably result in surface water discharge to waters of the state must obtain a construction stormwater permit from DEQ. Prior to initiating the project, DEQ will require KRRC to apply for and obtain coverage under a National Pollution Discharge Elimination System 1200C construction stormwater permit to minimize pollution discharge from ground-disturbing activities.

10. Evaluation of other Appropriate Requirements of State Law

Once a Proposed Action is determined to qualify for section 401 certification, additional determinations may be made to identify additional conditions that are appropriate in a certification to assure compliance with other appropriate requirements of state law, pursuant to section 401(d) of the Clean Water Act. Such requirements are "appropriate" if they have any relation to water.

10.1 Department of Water Resources

Under ORS 468.045(2) DEQ is required to make findings that its approval or denial is consistent with the standards established in ORS 543A.025(2) to (4). These standards can be summarized below:

1. Standards that mitigate restore and rehabilitate fish and wildlife resources adversely affected by the Project;
2. Any plan adopted by the Pacific Northwest Power and Conservation Planning Council;
3. The Environmental Quality Commission's water quality standards;
4. Operational standards that ensure the Project does not endanger public health or safety, including "practical protection from vulnerability to seismic and geologic hazards";
5. Standards that protect, maintain, or enhance wetland resources such that the Project may not result in a net loss to existing wetland resources; and
6. Standards that protect, maintain, or "enhance other resources in the Project vicinity including recreational opportunities, scenic and aesthetic values, historic, cultural and archaeological sites, and botanical resources" such that reauthorization may not result in net loss to these existing resources.

The original license (and water right) HE 180 for the J.C. Boyle project expired at the end of December 2006. On November 1, 2011, OWRD issued a draft proposed order and a draft proposed water right to re-license the J.C. Boyle Project until December 30, 2020. OWRD accepted comments, but have since just continued the hydroelectric license on a year-to-year authorization according to ORS 543A.150. Following completion of decommissioning, OWRD would consider the conversion of the hydroelectric right to an instream water right.

10.2 Division of State Lands

ORS 196.795-990 requires that permits be obtained from the Oregon Division of State Lands prior to any fill and removal of material from the bed or banks of any stream. Such permits, when issued, may be expected to contain conditions to assure protection of water quality to protect fish and aquatic habitat.

The proposed dam removal will include construction and de-construction activities that typically require a removal-fill permit from DSL. Permits issued by DSL are administratively coordinated with issuance of a dredge and fill permit by the U.S. Army Corps of Engineers under section 404 of the Clean Water Act.

KRRC shall demonstrate consistency with the substantive requirements of ORS 196.795-990 prior to initiating facilities removal.

10.3 Department of Land Conservation and Development

ORS Chapter 197 contains provisions of state law requiring the development and acknowledgement of comprehensive land use plans. This chapter also requires state agency actions to be consistent with acknowledged local land use plans and implementing ordinances.

OAR 340-048-0020 (2)(i)(A) require the application for section 401 certification to include land use compatibility findings prepared by the local planning jurisdiction. In the event a LUCS has not or cannot be issued, compatibility with local land use may alternatively be demonstrated pursuant to OAR 340-048-0020(2)(i)(B and C):

If land use compatibility findings have not been obtained, (the applicant may provide an exhibit which) identifies the specific provisions of the local land use plan and implementing regulations applicable to the activity and describes the relationship between the activity and each of the land use provisions identified in paragraph (A) of this subsection; and discusses the potential direct and indirect relationship to water quality of each finding or land use provision.

KRRC provided a memorandum via email on May 10, 2018 to demonstrate that the Project is compatible with the applicable comprehensive plan and land use regulations of Klamath County. DEQ will submit this exhibit to Klamath County for review and comment.

In the memorandum, KRRC compared the Klamath project activities to Klamath County Land Development Code ("KCLDC"), which implements the acknowledged Klamath County Comprehensive Plan ("KCCP"). KRRC notes that the Dam structure and related facilities proposed for removal, together with temporary staging and material disposal areas are located within the Forestry (F) zone designation. While portions of the reservoir proposed for drawdown are located in the Forestry/Range (FR) zone designation, the drawdown action is not a regulated activity under KCLDC.

The KRRC analyzed the KCLDC with respect to the following dam removal activities:

(1) use, maintenance, and improvement of roads and other transportation facilities for construction access; (2) use of land for temporary construction staging areas; (3) development of and use of disposal sites for material from the deconstruction of the dam structure and associated facilities; (4) vegetation removal; (5) and demolition of various structural improvements.

Road Maintenance: KCLDC 50.040.A. permits outright in all County zones "[n]ormal … maintenance, repair, and preservation activities of existing transportation facilities." The Project will use multiple existing roads and bridges for construction access and hauling and transportation of material. KRRC proposes routine maintenance on access roads within the project area. Therefore, the Project's road maintenance complies with the KCLDC road maintenance code.

Road Improvement: KCLDC 50.040.B conditionally permits road widening and construction as an "Extensive Impact Service and Utility" use in every County zone. The Project contemplates widening the access road from OR 66 to JC Boyle Dam and the Disposal Access Road. Therefore, the Project's road widening needs comply with the KCLDC road improvement code.

Dam Alteration and Temporary Staging Areas: The Forestry (F) zoning designation applies to the Dam structure/powerhouse and all associated staging areas. The Forestry (F) zone permits outright "[p]hysical alterations to the land auxiliary to forest practices," including but not limited to landfills, dams, and

reservoirs. KCLDC 55.015.C. KRRC notes that KCLDC 55.015.C authorizes dam removal outright, together with necessary construction staging areas required for this purpose.

Disposal Sites: KRRC will develop two disposal sites for the Project by clearing vegetation and stripping and stockpiling topsoil. Both disposal sites are located in the Forestry (F) zone. Physical alterations auxiliary to forest practices associated with dams and landfills are permitted outright. KRRC notes that disposal sites associated with dam removal or "alteration" is allowed outright as an accessory activity.

Property Development Standards: KRRC notes that Development in the Forestry (F) zone is also subject to limited property development standards. The standards include minimum lot size, residential density, lot size and shape, building heights and setbacks, fences walls and screenings, landscaping, signs, parking and access. KRRC notes that standards for residential density, lot size and shape, building heights and setbacks, fences, walls and screenings do not apply to the apply to the project since these standards apply to subdivision, partitions or residential developments.

KRRC notes that the minimize lot size for development in the Forestry (F) zone is 80 acres. KRRC will undertake all Project's activities on lots larger than 80 acres. The Project will not include any signs that viewable from public streets. KRRC notes that there are no established parking standards for activities associated with the Project. KRRC notes that Access to or from a state highway is subject to Oregon Department of Transportation. KCLDC 71.020.C. KRRC notes that the Project will not eliminate existing access points.

Vegetation/tree Removal: The KRRC proposes the removal of trees to facilitate road widening and the removal of vegetation to prepare disposal sites and construction staging areas. KRRC notes that such activities are not subject to regulation under the KCLDC.

Facilities Removal: the KRRC proposes demolition of certain private transportation facilities. KRRC also contemplates removal of recreational facilities in and around the Dam's reservoir. KRRC notes that these activities are not subject to regulation under the KCLDC

Removal of Transportation Facilities: KRRC proposes demolition of several road and one bridge as part of the Project activities. KRRC notes that demolition and/or removal of transportation facilities is not subject to regulation under the KCLDC except in conjunction with new land construction.

Removal of Recreational Facilities: KRRC notes that the Project contemplates removal of recreational facilities in the Dam's reservoir. KRRC notes that Oregon Statewide Planning Goal 8 concerns recreation needs. The KRRC notes that the KCLDC is the County's instrument for implementing the acknowledged in lieu of Goal compliance, and KCCP. KCLDC 10.020. No provision of the KCLDC prohibits or otherwise regulates KRRC from removing the facilities as discussed above.

DEQ Evaluation

Information presented in the memorandum and referenced above maintains the proposed activities comply with the requirements of Klamath County Comprehensive plan and implementing land use regulations. This section 401 water quality evaluation specifically addresses the potential impact of Project operations on water quality standards. Water quality criteria which may be impacted by Project operations are evaluated earlier in this document. DEQ conditions proposed activities, as warranted, providing reasonable assurance that these activities will comply with applicable water quality criteria.

DEQ Finding

DEQ believes the material submitted by KRRC in lieu of the LUCS application in the memorandum adequately identifies and addresses specific provisions of local land use and the implementing regulations applicable to the proposed activity. Furthermore, DEQ is reasonably assured that operation of the Project will not violate the water quality standards given in OAR 340, Division 041 conditioned on the

implementation of requirements described in each section of this Evaluations and Findings Report and the conditions in the section 401 certification. DEQ believes the memorandum prepared by KRRC adequately represents an exhibit as defined by OAR 340-048-0020(2)(i)(B) which demonstrates Project conformity with local land use regulations.

10.4 Department of Fish and Wildlife

The Oregon Department of Fish and Wildlife administers the following state laws to provide and maintain passage around artificial obstructions, protect aquatic habitat and protect and restore native fish stocks.

- **ORS 541.890 – 541.972**

  Oregon Plan for Salmon and Watersheds

  Restore native fish populations and the aquatic systems that support them, to productive and sustainable levels that will provide environmental, cultural and economic benefits.

- **ORS 496.435**

  Policy to Restore Native Stocks

  Restore native stocks of salmon and trout to historic levels of abundance.

- **ORS 509.580 - 509.645**

  ODFW's Fish Passage Law

  Provide upstream and downstream passage at all artificial obstructions in Oregon waters where migratory native fish are currently or have historically been present.

- **OAR 635-007-0502-0509**

  Native Fish Management Policy

  To ensure the conservation and recovery of native fish in Oregon.

- **OAR 635-500-0100-0120**

  Trout Management

  Maintain the genetic diversity and integrity of wild trout stocks; and protect, restore and enhance trout habitat.

- **OAR 635-415-0000-0010**

  Fish and Wildlife Habitat Mitigation Policy

  Require or recommend mitigation for losses of fish and wildlife habitat. Applying these state laws, ODFW, in its recommendations to FERC under Section 10(j) of the Federal Power Act, identified certain measures as necessary for the protection, mitigation and enhancement of fish resources.

ODFW has participated in the licensing process for the Proposed Action and on the team that developed the aquatic mitigation measures.

10.5 Department of Environmental Quality

- **ORS 454.705 et seq. and OAR 340-071 and 340-073**
  On-site Disposal of Sewage
  The purpose of these rules is to prevent health hazards and protect the quality of surface water and groundwater. DEQ will require KRRC to decommission any on-site sanitary systems proposed for removal in accordance with procedures required by state law.

- **ORS 466.605 et seq. and ORS 468.300-460**
  Requirements for Reporting and Cleanup of Spills of Petroleum products and Hazardous Materials
  Requires submittal of plans and specifications for water pollution control facilities to DEQ for review and approval prior to construction. One of the purposes of these statutes and rules promulgated pursuant thereto is to prevent contamination of surface or groundwater.

  DEQ will require the project proponent to implement their Hazardous Material Management Plan to meet statutory requirements and guard against downstream violation of these state regulations.

11. Public Comment

On May 23, 2018, DEQ issued a public notice seeking public comment on the draft Evaluations and Findings Report and Section 401 Water Quality Certification. On June 12, 2018, DEQ also held two public meetings and hearings at Oregon Institute of Technology in Klamath Falls, Oregon. The public comment period closed at 5:00 p.m. July 2, 2018. During this period DEQ received more than 100 comments from the public. DEQ developed its final certification decision in consideration of all comments received during this period.

Sediments

Comment: Sediment contains toxic chemicals

Response: Numerous sediment studies estimate the volume of sediment impounded by J.C. Boyle Dam range from about 900,000 to 1.3 million cubic yards. The report "Screening-Level Evaluation of Contaminants in Sediments from Three Reservoirs and the Estuary of the Klamath River, 2009-2011", prepared for the US Department of Interior as part of the Secretarial Determination studies evaluated sediment and elutriate chemistry, laboratory bioassays, bioaccumulation studies, and tissue of fish from the reservoirs. The report concluded: "Klamath Reservoir sediments can be considered relatively clean, with no chemicals present at levels that would preclude their release into downstream or marine environments. Accordingly Klamath Reservoir sediments are expected to pose no adverse effects, limited effects, or minor effects under the five exposure pathways under the Proposed Action and No Action alternatives." Where chemicals were identified at concentrations above DEQ screening level values, these compounds generally reflected the native presence, distribution and concentration in surrounding terrestrial soils and did not indicate the concentration or chemical alteration of reservoir sediments.

Comment: Sediment release will harm fish

Response: Reservoir drawdown will occur during seasonal flows to maximize sediment export. Sediment concentrations are expected to peak during the first three months but decrease rapidly thereafter. Aquatic

Resource plans developed in consultation with State, federal and Tribal fisheries agencies include mitigation measures to reduce impacts during reservoir drawdown. Exposure to high concentrations of suspended sediment can cause short-term stress, including mortality, in individual members of certain aquatic species. However, aquatic resource agencies conclude the short-term effects including the potential loss of individual animals will not adversely affect future populations of aquatic resource. Rather, fisheries agencies expect seasonal flow regimes and improved water quality will enhance aquatic habitat characteristics.

Comment: Dam removal will create sediment deposits in the river channel

Response: The Upper Basin contributes lower volumes of sediment from terrestrial erosion than occurs from lower river tributary systems. Core sample analysis indicate sediment grain-size behind J.C. Boyle Dam is generally small. The Secretarial Determination report on sediment characterization "predicted little to no discernible fine sediment deposition due to the overall fine grain nature of the sediments".

Authority

Comment: Extend public comment period to July 23, 2018

Response: In response to requests from the public, DEQ extended the public comment period through July 23, 2018.

Comment: Dam removal should be decided based on popular vote

Response: The Federal Power Act grants the Federal Energy Regulatory Commission the authority to regulate interstate energy transmission and the licensing of energy projects including major hydroelectric facilities. Under section 401 of the federal Clean Water Act, federal agencies cannot issue permits for actions that may result in a discharge to waters of the state without first receiving water a quality certification from the state. Neither license orders issued by FERC nor water quality certifications issued by states require ratification by other processes including approvals by popular vote.

Comment: USC §1341(a)(2) stipulates that states must notify downstream states when a discharge is authorized that may affect the downstream state.

Response: The KRRC filed applications for section 401 water quality certification with both the Oregon DEQ and the California State Water Resources Control Board. The DEQ and SWRCB collaborated closely during the development of our respective certifications. The draft certifications include requirements to consult on certain actions such as the development of resource protection implementation plans. Because FERC cannot issue a surrender order absent one certification, the requirements contained in the certifications demonstrate this requirement is met.

Comment: Project violates DEQ's water pollution prevention laws found in ORS 468B.

Response: ORS 468B.005 provides definitions for water pollution control laws including state policy regarding water quality and water pollution prevention. Oregon Administrative Rules 340-041-0185 contains water quality standards and policies that are specific to the Klamath Basin. Under these rules DEQ may issue a water quality certification for the federal license authorizing the removal of J.C. Boyle reservoir provided DEQ make certain findings. As presented in the Evaluation and Findings report, these findings are met. Specifically, DEQ determined that the water quality impacts of dam removal will be of limited duration, dam removal will occur in a manner minimizing adverse impacts, and dam removal will have a net ecological benefit. Additionally, DEQ has included a compliance schedule in the water quality certification so that by the end of the specified time schedule, the dam removal will not cause or contribute to a violation of water quality standards.

Comment: No contingency plan in the event KRRC cannot complete proposed action.

Response: On May 22, 2018, FERC approved the Independent Board of Consultants for the removal of the Lower Klamath Project. The BOC shall review and assess all aspects of the proposed dam removal process and the financial ability of the KRRC to carry out the process. FERC's decision to transfer the LKP license to the KRRC and, subsequently, issue a license surrender order will be based on responses to information requested by FERC in their March 15, 2018 order, including information pertaining to the:

1) Adequacy of available funding and reasonableness of updated cost estimates for the most probable cost and maximum cost for the full removal alternative, and the assumptions made to calculate those estimates;

2) Adequacy of amounts and types of insurance coverage and bonding arrangements for dam removal.

Effects on Community

Comment: Dams provide clean renewable energy

Response: The water quality certification addresses the proposed action's effect on water quality and aquatic life, as required under State of Oregon water quality regulations. Oregon's water quality rules prevent DEQ from considering the effect of project elements that do not have a direct nexus to water quality.

Comment: Failure to achieve objectives will harm property values and cause local taxes to increase.

Response: DEQ's concluded there was reasonable assurance the proposed action will comply with applicable provisions of Sections 301, 302, 303, 306, and 307 of the Clean Water Act, water quality standards found in OAR 340, Division 041, and other appropriate requirements of state law. Consequences of the project that do not address these provisions are not included in our analysis.

Comment: Loss of flood control, firefighting water, water management, recreational opportunities

Response: The water quality certification addresses the proposed action's effect on water quality and aquatic life, as required under State of Oregon water quality regulations. When evaluating applications for water quality certification, DEQ does not address other uses of reservoir water, like for firefighting.

Comment: Reservoir removal will harm nearby water wells.

Response: The Definite Plan includes a mitigation plan that provides for the deepening (or replacement) of an existing affected domestic or irrigation groundwater well so the groundwater production rate from the well is returned to conditions prior to dam removal. Implementing the groundwater mitigation plan is not a condition of the water quality certification.

Ecological Restoration

Comment: Restoration measures will not stabilize embankments

Response: The section 401 water quality certification requires KRRC to prepare and implement a Reservoir Area Management Plan within 90 days of license surrender. The plan will require measures to enhance soil stability through additional plantings, irrigation to maintain revegetated areas, contouring sediment to reduce slope, adding energy dissipating features such as large wood or boulders, modifying stream channel slope, or other methods deemed appropriate to achieve the goals and objectives of the plan. The plan will also require monitoring efforts to confirm these objectives are achieved. Last, the plan will include adaptive management procedures to develop and implement alternate strategies in the event restoration measures fail to achieve performance objectives. DEQ believes the requirements placed on the development and implementation of the plan provide sufficient direction and flexibility to achieve bankside stability.

Comment: Restoration benefits will outweigh short-duration impacts of dam removal.

Response: Comment acknowledged.

Comment: Reservoir restoration should include native plantings to increase riparian shade, suppress weeds, and stabilize sediment.

Response: DEQ agrees with the objectives in the comment.

Comment: Ecological restoration should include large wood placement for habitat enhancement.

Response: Use of large woody debris placements to achieve restoration objectives is proposed in the Reservoir Area Management Plan included in the 2017 Technical Support Document reviewed by DEQ.

Comment: Material should not be side-cast down the canyon during restoration of the JC Boyle canal.

Response: DEQ wishes to clarify the portion of the certification referenced by this comment. Actions originally proposed by KRRC included the reuse of existing side-cast material in the floor of the power canal as a measure to restore this area. KRRC does not propose, nor does DEQ support, the disposal of material on the canyon hillside.

Water Quality

Comment: Monitoring requirements do not ensure compliance

Response: Water quality monitoring is an essential tool to assess the effect of the proposed action on water resources. While monitoring by itself does not ensure compliance, data collected during the monitoring effort may guide decision-making to correct impairments observed during the monitoring period.

Comment: Project will lower water quality and harm fish

Response: Reports, modeling studies, and data reviewed by DEQ support the conclusion that dam removal will cause temporary impacts but will result in a net long-term improvement of water quality. The certification requires mitigation measures to reduce short-term adverse effects of the proposed action.

Comment: Dams benefit water quality by trapping contaminants and managing flow

Response: As noted in DEQ's Evaluation and Findings Report, water quality generally improves in the higher gradient reach below Keno Dam above the J.C. Boyle development. Turbulence in this reach increases dissolved oxygen and promotes the conversion of ammonia to nitrate and nitrite. The Evaluation and Findings Report also notes that J.C. Boyle dam slows and impounds a segment of the Klamath River causing retention of sediment, organic matter, and other material. Nutrient-rich material retained behind the dam promotes algal growth and affects parameters including dissolved oxygen and pH. The presence of the dam also interrupts the natural thermal regime that would otherwise exist without the dam.

Comment: Include water storage and release requirements to manage water following dam removal.

Response: Because the storage volume of J.C. Boyle Reservoir is comparatively small (i.e., up to 3,495 acre-feet) the increase in flow to drain the reservoir within the expected two-month schedule is also low. The increase in flow during drawdown does not warrant additional controls to manage water during reservoir drawdown.

Comment: The action will increase downstream temperature

Response: Studies referenced in the 2012 EIS concluded that removing J.C. Boyle Dam and eliminating hydropower peaking operations could alter overall water temperatures and diel temperature variation in the J.C. Boyle Bypass and Peaking Reaches. Absent the thermal mass from the reservoir, temperature models predict greater diel variability in the bypass reach because of reduced influence from groundwater sources. Restoration of a natural flow regime would slightly reduce maximum temperatures and decrease

diel variability in the peaking reach. The EIS concluded these changes would be less than significant in the bypass reach and beneficial in the peaking reach.

Comment: The water quality certification should require monitoring for TSS and TDS

Response: Total Suspended Solids and Suspended Sediment Concentration both measure the solid-phase material within the water column. Analyses for Total Suspended Solids are used to assess the performance of conventional treatment processes and the need for effluent filtration in reuse applications. Because the source of solid-phase material in the water column is derived from accumulated sediment, DEQ will require water measurements for suspended sediment concentrations.

Total Dissolved Solids (TDS) refers to the amount of dissolved substances in the liquid. These substances can include salts, minerals, metals, calcium and other compounds. The most commonly used method of determining TDS is measuring specific conductivity to detect the presence of ions in water. Section 2(c)(ii) of the section 401 water quality certification requires monitoring for conductivity.

Comment: Certain pesticides including DDT, DDE, and DDD and semi-volatile organic compounds were identified in sediment above bioaccumulation screening level values. Why doesn't the certification require sampling for these compounds?

Response: DEQ reviewed available information on the chemical composition, grain size, volume, and erodibility of reservoir sediments. In particular, DEQ considered data in the 2009-2011 Secretarial Determination reservoir sediment evaluation. The study included chemical analysis from 26 sediment sample locations in J.C. Boyle Reservoir. The findings of the study concluded:

- Reservoir sediments are not highly contaminated
- No consistent pattern of elevated chemical composition
- No single reservoir is more or less contaminated than others
- Chemical levels above screening levels may reflect regional background concentrations

The Secretarial Determination study on reservoir sediments indicates the chemical composition is consistent with regional background levels and does not suggest the Project has affected the concentration or alteration of contaminants. In addition, the 2011 Screening-Level Evaluation of Contaminants in Sediments from Three Reservoirs and the Estuary of the Klamath River concluded "the majority of sediment is of small size fraction and would remain in suspension during transport to the Pacific Ocean." For these reasons, DEQ believes the proposed action will not negatively affect water quality or beneficial uses below J.C. Boyle Dam.

Comment: The dams improve water quality

Response: Several commenters stated the reservoirs improve water quality by trapping sediment, releasing cold water, moderating flow releases during seasonal low flow periods, and providing habitat for threatened or endangered species. Overall, DEQ finds that the presence and operation of J.C. Boyle Dam has a negative influence on water quality. Hydropower diversions reduce instream flows and river

function necessary to maintain oxygenation, assimilate, nutrients, transport sediment, and regulate water chemistry.

Comment: The following changes were suggested to the Water Quality Monitoring Plan requirements:

1. Omit chlorophyll-a sampling during winter months
   Response: DEQ will retain the requirement for monthly collection of grab samples. Section 2(d)(v) provides DEQ with discretion to modify monitoring requirements following the first year of data collection.
2. Require the same nitrogen and phosphorus parameters as in IM-15
   Response: DEQ coordinated monitoring requirements for nutrients and other parameters with the California State Water Resources Control Board. Consistency with monitoring requirements of other programs was not a principle objective.
3. No averaged sonde readings; discrete measurements every half hour
   Response: DEQ will adjust the certification to require the sub-hourly collection of measurements.
4. Comprehensive upstream and downstream monitoring for algae, temp, flow
   Response: The certification requires KRRC to monitor water quality at locations above and below the proposed action.
5. Adaptive management section for accumulated toxic sediment in river channel
   Response: As discussed elsewhere, sediment evaluation data indicate the chemical composition of impounded sediments reflects local background conditions and will generally remain suspended in the water column during drawdown. The certification provides DEQ with the discretion to modify monitoring requirements as warranted by water quality conditions.
6. Future water quality management for salmon, steelhead, suckers.
   Response: The objective of the certification is to confirm whether the proposed action is contributing to water quality violations upon completion of the compliance schedule. Future management of water resources after completion of the project is not a requirement of the certification.
7. Expand scope of monitoring beyond project area
   Response: DEQ's 401 authorities allow the Department to require monitoring to measure the effects of a proposed action on water quality. DEQ cannot require monitoring or other actions for activities that occur outside the area affected by the proposed activity.

Fish, Fish Passage and Aquatic Resources

Comment: Coho salmon are not native to Upper Klamath basin

Response: KRRC applied to DEQ for section 401 water quality certification for the removal of the Oregon developments of the Lower Klamath Project. DEQ's certification decision considers the effect of the proposed action on designated beneficial uses found in OAR 340, Division 041. KRRC's application does not request DEQ evaluate the effects of the action on fish reintroduction efforts.

Comment: Consider other reintroduction options before removing dams

Response: The water quality certification addresses the proposed project (reservoir drawdown, removal of dam and associated facilities, reservoir restoration and aquatic measures) effect on water quality and

aquatic life, as required under State of Oregon water quality regulations. DEQ did not evaluate options that were not of the proposed project as described in the application for water quality certification.

Comment: Aquatic resource measures to protect ESA listed Lost River and Short-Nosed Suckers should include genetic testing to screen for hybridization.

Response: Measures to mitigate impacts to aquatic resources were developed in consultation with appropriate resource agencies. Section 4(b) of the certification requires the Licensee to mitigate project effects on adult Lost River Sucker and Shortnose Sucker in J.C. Boyle Reservoir prior to drawdown. The measure proposes to relocate a portion of the population to off-channel habitat locations that do not currently contain Lost River Sucker and Shortnose Suckers. Requiring additional actions such as genetic testing is not required under Oregon water quality rules to protect these or other designated beneficial uses from potential impacts of the proposed action.

Comment: Project provides hatchery production

Response: The comment refers to production at the Iron Gate Hatchery below Iron Gate Dam. Because this facility is in California, the effects of the proposed action is not considered in DEQ's 401 analysis.

Comment: J.C. Boyle Reservoir submerged existing reef barriers including a section of the Klamath River identified as Moonshine Falls, which may represent an obstruction to fish passage. The 401 should identify this potential obstruction requiring mitigation.

Response: The certification requires KRRC mitigate for effects of the proposed action that negatively affect water quality and support for beneficial uses. KRRC is not responsible for altering naturally occurring physical features such as geologic outcrops.

Comment: The action will harm aquatic resources including endangered species.

Response: The 2012 EIS included aquatic resource plans to reduce short-term (<2 years) adverse effects of dam decommissioning. In 2017, an Aquatic Technical Work Group including representatives of KRRC, state and federal resource agencies, and tribal fisheries scientists refined these measures based on new scientific information developed since issuance of the 2012 EIS. These measures are subject to the final Biological Opinions for the Project. DEQ supports implementation of the proposed measures relevant to Oregon resources affected by the proposed action.

Comment: Dams provide flow augmentation to aid fish migration

Response: J.C. Boyle Dam is currently managed for the express purpose of hydropower production. The minimum required release below J.C. Boyle Dam is 100 cfs. No anadromous fish migration currently occurs upstream of Iron Gate Dam in California. For these reasons, and because of the small volume of the reservoir, J.C. Boyle is not managed to augment flow in the bypass reach below the dam.

Other Comments and Recommendations

Comment: Require a site security plan in the event cultural resources are encountered per Section 5(c)(iii).

Response: Section 5 of the certification requires the Licensee to develop a Reservoir Drawdown Plan that includes contingency and notification procedures for unforeseen events including the inadvertent discovery of cultural resources. The certification requires the Licensee to submit the Reservoir Drawdown Plan to DEQ for review and approval within 90 days after issuance of the FERC license surrender order. In Oregon, treatment of burials found on State or private lands are covered under Oregon Revised Statute (ORS) 97.745. The Licensee is required to perform actions required by the Plan in accordance with applicable state law including those governing the management of cultural resources encountered during reservoir drawdown.

Comment: Identify coordination between Licensee and BLM during removal of Topsy Campground.

Response: Topsy Campground is managed by BLM. It is the Licensee's responsibility to coordinate with BLM during the removal of water-related improvements at the campground required by this certification.

Comment: The Licensee should prepare an aquatic invasive species control plan to prevent the introduction of invasive species into the Klamath River and its tributaries.

Response: Section 4(e) of the Certification requires the Licensee to obtain coverage under NPDES General Permit 1200-C for discharge of construction stormwater. Coverage under this permit requires development of a site-specific Erosion and Sediment Control Plan. DEQ will require conditions in the Erosion and Sediment Control Plan to minimize the introduction of invasive species during ground-disturbing activities in the Project area.

Water Quality Certification Comments

Comment: Sunset Provision

KRRC seeks a general "sunset provision" seeking to limit KRRC's obligations upon license surrender. Specifically, KRRC seeks to include the following clause in Section 12 of the Draft Certification:

> *Sunset Provision: This certification shall terminate upon the effective date of surrender of FERC License No. P-14803 for the Lower Klamath Project, subject to prior assignment of continuing responsibilities to third parties.*

Reply: The State agrees that the FERC surrender order remains in effect until all conditions are satisfied. However, since these conditions may include license surrender articles imposed by FERC, or mandatory conditions required by States through their 401 authorities, including this provision is deemed unnecessary and potentially confusing. Assigning responsibilities to third-party contractors does not relieve the Licensee from compliance with the FERC surrender order.

Comment: Project-Specific Fee

KRRC requests DEQ give further consideration to the question of whether "project specific fees" may be assessed pursuant to ORS 543.080 on the KRRC's proposed project. If such fees are to be imposed, the KRRC would also appreciate further discussion and a better understanding of the need for, and amount of such fees, relative to the criteria established by ORS 543.080(4) for making these determinations.

DEQ Response: State law authorizes a project specific fee to be imposed for DEQ's "reasonable and necessary oversight of a holder's implementation of the protection, mitigation and enhancement measures included in * * * a Federal Energy Regulatory Commission license." DEQ finds that monitoring of adaptive management associated with the various resource restoration implementation plans will require DEQ consultation and oversight for a minimum of five years. The project-specific fee takes into account the following factors:

(a) Experimental nature of the proposed mitigation;

(b) Significance of the resource affected;

(c) Need for ongoing agency involvement in reviewing the effectiveness of the proposed measure;

(e) Overall nature of the protection, mitigation or enhancement measures.

DEQ will provide KRRC a biennial summary of the agency's project specific expenditures, and this summary will confirm that the amounts charged are for permissible purpose of compensating the "agency's reasonable and necessary oversight of a holder's implementation of the protection, mitigation and enhancement measures included in * * * a Federal Energy Regulatory Commission license."

Comment: Align Proposed Action with Description in Definite Plan

KRRC requests DEQ change references to "Detailed Plan" and "Technical Support Document" to "Definite Plan".

Reply: DEQ issued its May 2018 Draft Certification based on an evaluation of the proposed action as described in the Detailed Plan, the application for section 401 water quality certification, and the September 30, 2017 Technical Support Document. Because the July 2018 Definite Plan was issued after the Draft Certification, DEQ could not rely on or cite information in the Definite Plan in its analysis.

DEQ will update references as noted above provided the changes reflected in the Definite Plan are consistent with the description of activities evaluated by DEQ. However, in order to determine that the description of activities evaluated by DEQ are identical between the Detailed Plan or Technical Support Document, or both, and the Definite Plan, DEQ requests that KRRC provide a document that makes this representation for each of the proposed changes between these documents. Unless until KRRC makes such representation, DEQ will retain the existing reference in the final certification. Modifications to the final certification may be accomplished consistent with state law should any changes be made to proposed action that may affect state water quality.

Comment: Maximum Limit on KRRC's Monitoring Obligations

KRRC seeks to reduce the duration of water quality monitoring from "a minimum of four years" (as provided in the Draft Certification) to "a maximum of three years" following dam removal. KRRC requests this adjustment to align the monitoring program in the 401 with that in the Definite Plan.

Reply: Absent this sampling term DEQ cannot establish reasonable assurance of compliance with WQ standards following compliance period. DEQ cannot fix a maximum term to the monitoring program in this instance. The minimum period of four years recognizes the two-year term of the compliance period plus an additional two years to provide DEQ reasonable assurance that Project-related impacts will no longer contribute to any violation of water quality standards and that should monitoring indicate an issue effective adaptive management may be employed to remedy, if necessary. Section 2(d)(v) of the Draft Certification provides DEQ with discretion to continue or discontinue monitoring requirements based on demonstrated compliance with water quality standards.

Comment: Western Pond Turtle Monitoring Plan

KRRC has worked with ODFW to develop a Western pond turtle-monitoring plan. KRRC believes the requirements are too open ended and vague and should be tied to specific triggers and performance measures. KRRC provides the following suggested redline revision:

> *In consultation with ODFW and subject to approval by DEQ, the Licensee shall conduct abundance and overwintering studies. KRRC and ODFW shall coordinate review of the findings of the studies and if potential impacts to the western pond turtle population of the J.C. Boyle reservoir would exceed 75 percent, then the Licensee shall, as DEQ deems warranted, implement appropriate mitigation actions to reduce potential impacts to Western Pond Turtle populations prior to drawdown of JC Boyle Reservoir."*

Reply: DEQ's authority to prescribe a time schedule for compliance in a 401 certification for the removal of JCB Dam requires DEQ to consider the potential effects of the action on threatened and endangered species, including state-listed species such as the Western Pond Turtle. DEQ has requested assistance from ODFW on protection measures necessary to avoid, minimize, and mitigate for impacts to WPT during reservoir drawdown and restoration.

KRRC is currently implementing a tracking study to estimate WPT abundance and overwintering locations. Until this information is obtained and reviewed, DEQ, in consultation with ODFW, does not feel it is appropriate to prescribe threshold conditions for requiring mitigation should such mitigation be required. If the study suggests mitigation (e.g., translocating affected turtles for the duration of reservoir drawdown) will be required, these actions would likely begin late summer prior to drawdown and conclude in May or June of the drawdown year and not likely extend into subsequent years.

Comment: Remaining Facilities and Operations Plan

The Draft Certification requires KRRC to develop a Remaining Facilities Plan to identify structural portions of the project that will not be removed as proposed in the Full Removal Alternative. The plan requires KRRC to assess remaining elements for potential effects on water quality and propose measures, as appropriate, to reduce these impacts. KRRC proposes the following language to this condition:

> *"d) Provisions to assure that any ongoing measures will be implemented once title of the facilities and/or responsibility for operations is transferred to another entity, which transfer shall occur not*

later than the effective date of surrender of FERC License No. P-14803 for the Lower Klamath Project."

Reply: DEQ recognizes that ultimately KRRC may transfer title of facilities or operational responsibilities to another entity. The following modification language is deemed necessary to provide sufficient assurance of long-term oversight under all reasonably foreseeable conditions:

"d) Provisions deemed necessary by DEQ to assure that any ongoing measures will be implemented once title of the facilities and/or responsibility for operations is transferred to another entity, which transfer shall occur not later than the effective date of surrender of FERC License No. P-14803 for the Lower Klamath Project."

12. Recommendation for Certification

DEQ has evaluated KRRC's application for section 401 water quality certification and related supporting documents. DEQ has determined that the proposed action will comply with the applicable provisions of Sections 301, 302, 303, 306 and 307 of the Clean Water Act, Oregon Administrative Rules, Chapter 340, Division 41 and other appropriate requirements of state law, provided KRRC conducts activities as proposed and implements the section 401 conditions proposed in this document.

Based on the preceding analysis and findings, the Director, or assigned signatory, conditionally approves KRRC's application for certification for the removal of the Lower Klamath Project, FERC Project No. 14803, pursuant to section 401 of the Federal Clean Water Act and ORS 468B.040 and consistent with the findings of this document.

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Appendix A

Names and addresses of property owners of land that is contiguous to the J.C. Boyle Development in Oregon.

OWNER_NAME	MAPTAXLOT_	SITUS_ADDR	SITUS_CSZ	OWNER_ADDR	OWNER_AD_1	OWNER_AD_2	OWNER_CSZ	FERC_DIST_FT
COLLMAN NANCY	R-4006-00000-00200-000	26360 HWY 66	KENO, OR 97627	453 ALLISON			ASHLAND, OR 97520	0
GLIDDEN ALDEN B & STARLA L	R-3907-03000-00300-000	N/A	N/A	1800 FAIRMOUNT			KLAMATH FALLS, OR 97601	400
GREEN DIAMOND RESOURCE COMPANY	R-3907-03100-00300-000	N/A	N/A	ATTN: GENERAL COUNSEL	1301 FIFTH AVE STE 2700		SEATTLE, WA 98101-2613	25
GREEN DIAMOND RESOURCE COMPANY	R-3907-03200-00300-000	N/A	N/A	ATTN: GENERAL COUNSEL	1301 FIFTH AVE STE 2700		SEATTLE, WA 98101-2613	25
GREEN DIAMOND RESOURCE COMPANY	R-4007-00600-00700-000	N/A	N/A	ATTN: GENERAL COUNSEL	1301 FIFTH AVE STE 2700		SEATTLE, WA 98101-2613	25
GREEN DIAMOND RESOURCE COMPANY	R-3906-00000-00100-000	N/A	N/A	ATTN: GENERAL COUNSEL	1301 FIFTH AVE STE 2700		SEATTLE, WA 98101-2613	0
GREEN DIAMOND RESOURCE COMPANY	R-3907-02900-00100-000	N/A	N/A	ATTN: GENERAL COUNSEL	1301 FIFTH AVE STE 2700		SEATTLE, WA 98101-2613	0
GREEN DIAMOND RESOURCE COMPANY	R-3907-02900-00200-000	N/A	N/A	ATTN: GENERAL COUNSEL	1301 FIFTH AVE STE 2700		SEATTLE, WA 98101-2613	0
GREEN DIAMOND RESOURCE COMPANY	R-3907-02900-00300-000	N/A	N/A	ATTN: GENERAL COUNSEL	1301 FIFTH AVE STE 2700		SEATTLE, WA 98101-2613	0
GREEN DIAMOND RESOURCE COMPANY	R-3907-02900-00400-000	N/A	N/A	ATTN: GENERAL COUNSEL	1301 FIFTH AVE STE 2700		SEATTLE, WA 98101-2613	0
GREEN DIAMOND RESOURCE COMPANY	R-3907-03000-00500-000	N/A	N/A	ATTN: GENERAL COUNSEL	1301 FIFTH AVE STE 2700		SEATTLE, WA 98101-2613	0
GREEN DIAMOND RESOURCE COMPANY	R-3907-03100-00100-000	N/A	N/A	ATTN: GENERAL COUNSEL	1301 FIFTH AVE STE 2700		SEATTLE, WA 98101-2613	0
GREEN DIAMOND RESOURCE COMPANY	R-3907-03100-00200-000	N/A	N/A	ATTN: GENERAL COUNSEL	1301 FIFTH AVE STE 2700		SEATTLE, WA 98101-2613	0
GREEN DIAMOND RESOURCE COMPANY	R-4006-01200-00100-000	N/A	N/A	ATTN: GENERAL COUNSEL	1301 FIFTH AVE STE 2700		SEATTLE, WA 98101-2613	0
GREEN DIAMOND RESOURCE COMPANY	R-4006-01200-00300-000	N/A	N/A	ATTN: GENERAL COUNSEL	1301 FIFTH AVE STE 2700		SEATTLE, WA 98101-2613	0
GREEN DIAMOND RESOURCE COMPANY	R-4007-00600-00100-000	N/A	N/A	ATTN: GENERAL COUNSEL	1301 FIFTH AVE STE 2700		SEATTLE, WA 98101-2613	0
GREEN DIAMOND RESOURCE COMPANY	R-4007-00600-00600-000	N/A	N/A	ATTN: GENERAL COUNSEL	1301 FIFTH AVE STE 2700		SEATTLE, WA 98101-2613	0
J SPEAR RANCH CO	R-4006-00000-00201-000	26221 HWY 66	KENO, OR 97627	P O BOX 257			KLAMATH FALLS, OR 97601	200
KLAMATH COUNTY	R-3907-03000-00200-000	N/A	N/A	305 MAIN ST RM #121			KLAMATH FALLS, OR 97601	400
KLAMATH COUNTY	R-3907-02900-00500-000	N/A	N/A	305 MAIN ST RM #121			KLAMATH FALLS, OR 97601	0

KLAMATH COUNTY	R-3907-02900-00600-000	N/A	N/A	305 MAIN ST RM #121			KLAMATH FALLS, OR 97601	0
KLAMATH COUNTY	R-3907-03200-00200-000	N/A	N/A	305 MAIN ST RM #121			KLAMATH FALLS, OR 97601	0
PACIFIC POWER & LIGHT CO	R-3907-00000-01800-000	N/A	N/A	C/O PROPERTY TAX DEPT.	825 NE MULTNOMAH	SUITE 1900	PORTLAND, OR 97232	0
PACIFIC POWER & LIGHT CO	R-4006-00000-00100-000	N/A	N/A	C/O PROPERTY TAX DEPT.	825 NE MULTNOMAH	SUITE 1900	PORTLAND, OR 97232	0
PACIFIC POWER & LIGHT CO	R-4006-01200-00400-000	N/A	N/A	C/O PROPERTY TAX DEPT.	825 NE MULTNOMAH	SUITE 1900	PORTLAND, OR 97232	0
PACIFIC POWER & LIGHT CO	R-4006-01200-00500-000	N/A	N/A	C/O PROPERTY TAX DEPT.	825 NE MULTNOMAH	SUITE 1900	PORTLAND, OR 97232	0
PACIFIC POWER & LIGHT CO	R-4006-01200-00600-000	N/A	N/A	C/O PROPERTY TAX DEPT.	825 NE MULTNOMAH	SUITE 1900	PORTLAND, OR 97232	0
PACIFIC POWER & LIGHT CO	R-4006-01200-00700-000	N/A	N/A	C/O PROPERTY TAX DEPT.	825 NE MULTNOMAH	SUITE 1900	PORTLAND, OR 97232	0
PACIFIC POWER & LIGHT CO	R-4006-01200-00800-000	N/A	N/A	C/O PROPERTY TAX DEPT.	825 NE MULTNOMAH	SUITE 1900	PORTLAND, OR 97232	0
PACIFIC POWER & LIGHT CO	R-4007-00600-00300-000	N/A	N/A	C/O PROPERTY TAX DEPT.	825 NE MULTNOMAH	SUITE 1900	PORTLAND, OR 97232	0
PACIFIC POWER & LIGHT CO	R-4007-00600-00400-000	N/A	N/A	C/O PROPERTY TAX DEPT.	825 NE MULTNOMAH	SUITE 1900	PORTLAND, OR 97232	0
PACIFIC POWER & LIGHT CO	R-4106-00000-00800-000	N/A	N/A	C/O PROPERTY TAX DEPT.	825 NE MULTNOMAH	SUITE 1900	PORTLAND, OR 97232	0
PACIFIC POWER & LIGHT CO	R-4106-00000-00900-000	N/A	N/A	C/O PROPERTY TAX DEPT.	825 NE MULTNOMAH	SUITE 1900	PORTLAND, OR 97232	0
UNITED STATES	R-4006-00000-00400-000	N/A	N/A					0
UNITED STATES	R-4006-01200-00200-000	N/A	N/A					0
UNITED STATES	R-4007-00600-00200-000	N/A	N/A					0
UNITED STATES	R-4106-00000-00300-000	N/A	N/A					0

Source: KRRC Application Attachment 6 – Contact List of Oregon Property Owners.

Appendix B: Consultation Record

KRRP Agency Consultation Record

Date	Type of Consultation	Agency	Contact/Title	E-mail	Phone Number	Address	Summary of Consultation	Meeting Notes Source Document
Aquatic Resources Management Plan								
August 28, 2020	Juvenile Salmonid Plan-Outline Submittal	ATWG					Submitted Juvenile Salmonid Plan outline to ATWG for review.	
September 11, 2020	Juvenile Salmonid Plan-Outline Review	CDFW	Kurt Bainbridge				Provided comments on Juvenile Salmonid Plan Outline	
Hatchery Management and Operations Plan								
November 4, 2020	Draft Hatchery Management Plan	CDFW	Jason Roberts	Jason.Roberts@wildlife.ca.gov			Draft review for comments	
Reservior Area Management Plan								
July 28, 2020	RAMP-Outline Submittal	RTWG					Submitted RAMP outline to RTWG for review.	
August 7, 2020	RAMP-Outline Review	CDFW	Amy Henderson; Kurt Bainbridge				Provided comments on RAMP Outline	
August 31, 2020	RAMP-Annotated Outline Submitta	RTWG					Submitted RAMP-Annotated Outline to RTWG for Review	
September 10, 2020	RAMP-Annotated Outline Review	CDFW	Amy Henderson				No comments on RAMP annotated outline	
September 16, 2020	RAMP-Annotated Outline Review	RWQCB	Kristen Gangl				No comments on RAMP annotated outline	
Terrestrial and Wildlife Management Plan								
May 23, 2017	Terrestrial Measures Meeting	NMFS, NMFS, USFWS, USGS, OR DEQ, ODFW, CDFW, NCRWQCB, SWRCB, Karuk Tribe, Yurok Tribe, Hoopa Valley Tribe, Klamath Tribes					Staging areas need to be identified and disposal area boundaries need to be confirmed. Most activities on PacifiCorp land, but need to consider if there would be any access requirements across other lands (e.g. BLM, USFS). USFWS to check on availability of northern spotted owl habitat suitability layer. Recommend doing 6 visits in 2018 for noise disturbance only. USFWS expects no take of spotted owl and informal consultation, or not likely to adversely affect determination in conformance with the preliminary BiOp findings from 2012. Additional coordination will be needed with CDFW to address potential impacts on eagle habitat. The project needs to determine whether any approvals would be needed from BLM and whether any species only listed by BLM should be included. Same question with respect to USFS land and species of concern. Project areas will need to be surveyed for potential vernal pool habitats that could support vernal pool species. The list should be reviewed for the potential inclusion of listed snail species. CDFW is considering listing the Foothill yellow-legged frog as a candidate species. Western pond turtle additional presence surveys of the reservoir areas were not recommended. The group recommended against relocation of special status plants as a mitigation strategy.	
July 27, 2017	Project Overview Tour	USFWS, ODFW, ODSL, CDFW					A field tour of the three dams, associated infrastructure, and proposed upland disposal sites was conducted for agency staff on July 27, 2017. Meeting minutes were not taken.	
October 27, 2017	Terrestrial Resources Coordination	USFWS, ODFW, CDFW, SWRCB					December 2011 gray wolf was detected in northern California and now there is a CDFW wolf map of the packs general area of use available online. It was suggested that the species status tables need to be updated, including foothill yellow-legged frog, western pond turtle, fisher, and black-backed woodpecker. Biological monitoring for certain species may be required if present during construction, such as sandhill crane (if found nesting). CDFW will send MMRP with mitigation measure that describes monitoring.	
November 20, 2017	Terrestrial Resources Coordination	USFWS, ODFW, CDFW, SWRCB					USFWS commented that drones probably would not be allowed as proposed in the eagle survey plan. . A separate call with USFWS will be held to discuss this issue further. KRRC provided an update on the Northern Spotted Owl recon with USFWS. USFWS, ODFW, and CDFW have provided comments on Appendix E to KRRC for incorporation into the document.	
January 10, 2018	Terrestrial Species Coordination	BLM, USFWS, ODFW, CDFW, SWRCB					If Eagle surveys are passive (ground-based), no MOU would be needed from CDFW. If surveys plan to use of drones/helicopters will need MOU with CDFW. ODFW will require a scientific take permit for use of helicopters and drones. Conclusion: Only ground based surveys early in the season. May consider using drones/helicopters later in the season. Agencies currently discussing potential for a new hatchery at Fall Creek. This are a would be included in the plant/wildlife surveys planned for 2018. Surveys will include both the proposed hatchery area and areas needed for support structures/activities (e.g. houses, parking, storage, access, etc.). Restoration areas may need some temporary irrigation. May use riparian water right if parcel connected to river, but reservoir bottoms made up of multiple parcels, so not all locations may have riparian water right. Could be an issue in both CA and OR. Work with Ted Wise to help coordinate water rights for temporary irrigation. Plan to use local nurseries to contract grow desired species for restoration.	
February 13, 2018	Terrestrial Species Coordination	USFWS, ODFW, CDFW, SWRCB					Results of Eagle surveys are consistent with previous information on eagle use of the project area. The group discussed how field survey results for all resources would be recorded and reported to agencies throughout the survey period. CDFW asked about process for obtaining enough seed for restoration. The team has been in contact with local nurseries and plans to release growing contracts in the next month or two. KRRC to discuss regulatory requirements driving request for western pond turtle survey with ODFW. KRRC to develop a process for documenting and reporting survey results.	
March 28, 2018	Terrestrial Species Coordination	BLM, USFWS, ODFW, CDFW, SWRCB					The timing of drawdown may be shifting from 2020 to 2021. The BA evaluation needs to consider other state, local, private actions that are planned or recently completed that may have effects on listed species. These could include State restoration activities, fish passage corrections, fish screening, etc. Fish screening activities mentioned by ODFW might be relevant. ODFW will provide information on recent and planned projects. ODFW mentioned the active reintroduction of spring chinook. Also, Spencer Creek and Jenny Creek are source populations relative to short-term impacts on fish populations (e.g. redband trout, resident salmonids, and other native fish). The NSO habitat is in Oregon, primarily on BLM land and USFWS has limited data about those areas. ODFW can provide a contact for the Oregon Dept. of Forestry for more information about planned activities.	
April 24, 2018	Terrestrial Species Coordination	USFWS, ODFW, CDFW, SWRCB					Tri-colored Blackbird was emergency listed by CDFW a year ago–will be included in Special Status Wildlife surveys in May. The restoration planning team are planning to do invasive plant surveys and seed collection activities in May, Grow testing - there is a tentative plan to collect more reservoir sediment for additional grow tests on the shores of the reservoirs. CDFW can amend the current stream bed alteration agreement for geotechnical and sediment sampling to cover additional samples. ODFW and the team continue to work on western pond turtle (WPT) survey details. WPT surveys are not in the current access agreement with PacifiCorp. ODFW indicated they are available to help with WPT surveys, if approved. The distance of Foothill yellow-legged frog (FYLF) from known populations and temporal separations will likely result in no effect on FYLF, so there are no species-specific surveys planned. General wildlife surveys of Fall Creek should pay special attention to the potential for FYLF presence in the creek. ODFW expects tributaries to recolonize with migratory fish, which should not create an impact on FYLF because there are already resident redband trout present and the FYLF evolved with the other species present in the system. ODFW and CDFW may consider this issue further. Listing decision is scheduled for 2020.	
October 22, 2019	Eagle Protection Measures	USFWS					Address Project overview of construction. Establish common understanding of data collected to date.	
March 2, 2020	Eagle Protection Measures	USFWS					Reviewed territory anlaysis, discussed mitgation options, outlined an Eagle Conservation Plan approach	
March 19, 2020	Eagle Conservation Strategy and Permit	USFWS					Phil Detrich (Sub Consultant for eagle permit) and Ken Sanchez (RES) meet with Heather Beeler,USFWS Eagle Permit Coordinator, to discuss, March 10, 2020 site visit and eagle permit and conservation strategy presentation and territory analysis	
April 23, 2020	Eagle Conservation Strategy and Permit	USFWS					Phil Detrich (Sub Consultant for eagle permit) and Ken Sanchez (RES) meet with Heather Beeler,USFWS Eagle Permit Coordinator, to discuss eagle permit and conservation strategy presentation and territory analysis	
April 29, 2020	Eagle Conservation Strategy and Permit	USFWS					Ken Sanchez (RES) meets with Thomas Leeman (USFWS Migratory Birds Chief) to update on Eagle Conservaiton Strategy	

April 30, 2020	Eagle Conservation Strategy and Permit	USFWS					Phil Detrich (Sub Consultant for eagle permit) and Ken Sanchez (RES) meet with Heather Beeler,USFWS Eagle Permit Coordinator, to discuss eagle permit and conservation strategy presentation and territory analysis	
August 29, 2020	Terrestrial and Wildlife Management Plan Annotated Outline	ODFW/CDFW					Submitted Draft outline to agencies for review	
September 16, 2020	Terrestrial and Wildlife Management Plan	CDFW					Call with Amy Henderson to discuss the TWMP Annotated Outline	
September 30, 2020	Oregon WPT Management	ODFW					Called with Ted Wise and Kalysta Adkins to discuss ODFW protocol for Western Pond Turtles at J.C. Boyle	
Water Supply Monitoring and Management Plan								
September 30, 2020	site visit	Caltrans	Kevin Boudreau				detailed overview of Collier Rest Area drinking water treatment facility	
November 9, 2020	phone meeting	CA Water Board Division of Drinking Wate	Craig Bunas/Associate Enginee	craig.bunas@waterboards.ca.gov	530-224-4887		• Background info from Lisa > permits, mgmt plans, Collier • Requirements: coliform and E. coli in treated (2x month) and raw (1/month) • Turbidity: continuous in treated and raw • Nitrate yearly, nitrite every 3 years in raw (filtered not required) • Lead/copper: no requirement, (b/c transient) • Other: chlorination in treated water (they do continuous) • Strategy implementation: • Indicate schedule to Caltrans months in advance • Public notice: ○ Needs to be re-worded for turbidity ○ Craig can help with re-wording ○ Notice: for transient/non-community, post on Caltrans website, and at the location itself (tier 2 notification, 30 days), tier 1 is 24 hrs (but turbidity not typically an acute health threat) ○ No other permits, just a public notice • Collier will continue coliform and turbidity sampling even if we're delivering drinking water • If E. coli in finished water, tier 1 notice, if no E. coli, tier 2 notice • Drinking water delivery/dispenser ○ Licensed potable water truck, registered through CA ○ Worst case scenario > 6 months ○ Some are attached to the truck, some have a pipe going to several spigots • Since it's transient, it can be shut down (legally)	
Cultural Resources Working Group								
November 10, 2016	FERC Notice of Applications Filed with the Commission Consultation	FERC					FERC Notice of the following applications filed by PacifiCorp and KRRC and available for public inspection: Amendment and Partial Transfer of License (Project Nos. 2082-062 and 14803-000) and for Surrender of License (Project Nos. 2082-063 and 14803-001).	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
July 14, 2017	FERC Klamath Hydroelectric Project – Request for Additional Information by Timothy Konnert, Chief, West Branch Division of Hydropower Licensing	FERC					Schedule A – Additional information request from FERC for Project Nos. 2082-063 and 14803-001	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
August 8, 2017	Letter from Mark Bransom, KRRC Executive Director, to Julianne Polanco, CA SHPO	CA SHPO					Invitation to participate in Cultural Resources Working Group to assist FERC in meeting its Section 106 obligations.	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
August 8, 2017	Letter from Mark Bransom, KRRC Executive Director, to Christine Curran, OR SHPO	OR SHPO (OR State Archaeologist)					Invitation to participate in Cultural Resources Working Group to assist FERC in meeting its Section 106 obligations.	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
August 8, 2017	Letter from Mark Bransom, KRRC Executive Director, to Jeanne Goetz, Heritage Resources Specialist, Yreka, CA	USDA (Yreka, CA)					Invitation to participate in Cultural Resources Working Group to assist FERC in meeting its Section 106 obligations.	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
August 8, 2017	Letter from Mark Bransom, KRRC Executive Director, to Russ Howison, PacifiCorp						Invitation to participate in Cultural Resources Working Group to assist FERC in meeting its Section 106 obligations.	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
August 8, 2017	Letter from Mark Bransom, KRRC Executive Director, to Laird Naylor, Bureau of Land Management (Klamath Falls, OR)	BLM (Klamath Falls, OR)					Invitation to participate in Cultural Resources Working Group to assist FERC in meeting its Section 106 obligations.	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
August 8, 2017	Letter from Mark Bransom, KRRC Executive Director, to Eric Ritter, Bureau of Land Management (Redding, CA)	BLM (Redding, CA)					Invitation to participate in Cultural Resources Working Group to assist FERC in meeting its Section 106 obligations.	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
September 5, 2017	CRWG Meeting	USFS, USACE, CA SHPO, OR SHPO					Topics discussed: Introductions, project background, project overview, schedule, previous cultural studies, next steps for Section 106 process, future meetings.	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
October 18, 2017	Consultation with Tribes for Klamath and Lower Klamath Projects by Steve Hocking, Chief Environmental and Project Review Branch, Division of Hydropower Administration Compliance, FERC	Karuk Tribe, Hoopa Valley Tribe, Confederated Tribes of the Warm Springs Reservation of Oregon, Confederated Tribes of the Grand Ronde Community of Oregon, Klamath Tribe, Cow Creek Tribes of the Warm Springs Reservation of Oregon, Elk Valley Rancheria (California), Quartz Valley Indian Community of the Quart Valley Reservation of California, Resighini Rancheria, Pit River Tribe (California), Confederated Tribes of Siletz Indians of Oregon, Tolowa Dee-Ni Nation	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	Invitation to request meeting with FERC staff regarding Project Nos. 2082-062 and 14803-000. Invitation sent to representatives of: Hoopa Valley Tribe, Karuk Tribe, Confederated Tribes of the Warm Springs Reservation of Oregon, Confederated Tribes of the Grand Ronde Community of Oregon, Klamath Tribe, Cow Creek Tribes of the Warm Springs Reservation of Oregon, Elk Valley Rancheria (California), Quartz Valley Indian Community of the Quart Valley Reservation of California, Resighini Rancheria, Pit River Tribe (California), Confederated Tribes of Siletz Indians of Oregon, Tolowa Dee-Ni Nation.	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
December 12, 2017	Form Letter from Mark Bransom, KRRC, to Chairman Thomas O'Rourke, Yurok Tribe	Yurok Tribe	Rosie Clayburn - Tribal Heritage Preservation Officer	rclayburn@yuroktribe.nsn.us	707-482-1350 ext. 1309	PO Box 1027 Klamath, CA 95548	Meeting Invitation and Initiation of Informal Consultation for the Lower Klamath Project (FERC No. 14803)	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
December 14, 2017	CRWG Meeting	BLM, CA SHPO, OR SHPO					Topics discussed: regulatory context and project definitions, dam removal comparative context, previous APEs for Klamath River EIS/EIRS, proposed project APE, subarea 1 components, overview of proposed APE maps, built environment evaluation approach for dam facilities	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
December 29, 2017	Letter from Markham Quehrn, PerkinsCoie, to Kimberly D. Bose, FERC Secretary	FERC					Response to July 14, 2017 Additional Information Request; Application for Surrender of License for Major Project and Removal of Project Works; Project Nos. 2082-063 and 14803-001. The submittal includes responses to AIRs # 1, 5, 6, 7, 8, 14, 17, 22, 23, 28 and 29. FERC had already approved the KRRC's request to extend the time for the KRRC's response to AIRs # 2, 3, 4, 9, 10, 11, 12 13, 15, 16, 18, 19, 20, 21, 24, 25, 26 and 27 until July 1, 2018.	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
December 29, 2017	Notice of Tribal Consultation Meetings by Nathaniel J. Davis, Sr., FERC Deputy Secretary	Hoopa Valley Tribe, Karuk Tribe, Quartz Valley Indian Community, Klamath Tribes, and Yurok Tribes	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	Notice of tribal consultation meetings with representatives of the Hoopa Valley Tribe, Karuk Tribe, Quartz Valley Indian Community, Klamath Tribes, and Yurok Tribes on January 16-19, 2018.	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys

January 16, 2018	Transcript	Hoopa Valley Tribe	Keduescha Lara-Colegrove - Tribal Historic Preservation Officer	hvt.thpo@gmail.com	530-625-4284, ext.112	P.O. Box 1348 Hoopa, CA 95546	Scoping Meeting held at Hoopa Valley Tribe Neighborhood Facilities, 11860 Highway 96, Hoopa, CA 95546	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
January 16, 2018	Transcript	Quartz Valley Indian Tribe	Crystal Robinson - Environmental Director	Crystal.robinson@qvir-nsn.gov	530-468-5907 ext. 318	13601 Quartz Valley Road, Fort Jones, CA 96031	Scoping Meeting held at Quartz Valley Indian Reservation of California, 13601 Quartz Valley Road, Ft. Jones, CA 96031	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
January 17, 2018	Transcript	Karuk Tribe	Alex Watts-Tobin - Tribal Historic Preservation Officer	atobin@karuk.us	530-627-3446, ext. 3015	39051 Hwy 96, P. O. Box 282, Orleans, CA 95556	Scoping Meeting held at Karuk Department of Natural Resources	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
January 18, 2018	Transcript						Scoping Meeting held at Klamath Tribes Administration Building, 501 Chiloquin, Chiloquin, OR 97624	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
January 19, 2018	Transcript	Yurok Tribe	Rosie Clayburn - Tribal Heritage Preservation Officer	rclayburn@yuroktribe.nsn.us	707-482-1350 ext. 1309	PO Box 1027 Klamath, CA 95548	Scoping Meeting held at Yurok Tribe Klamath Tribal Office, 190 Klamath Boulevard, Klamath, CA 95548	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
February 5, 2018	Transcript	Modoc Tribe of Oklahoma	Blake Follis - Environmental Director	Blake.follis@gmail.com	918.724.2335	22 North Eight Tribes Trail, Miami, OK 74354	Tribal Consultation Meeting Teleconference with Modoc Tribe of Oklahoma	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
May 3, 2018	Letter from Mark Bransom, KRRC Executive Director to Dennis Griffin, OR State Archaeologist	OR SHPO (OR State Archaeologist)					Initiation of Informal Consultation for the Lower Klamath Project (FERC No. 14803)	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
May 3, 2018	Letter from Mark Bransom, KRRC Executive Director to Julianne Polanco, CA SHPO	CA SHPO					Initiation of Informal Consultation for the Lower Klamath Project (FERC No. 14803)	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
March 15, 2018	FERC Order Amending License and Deferring Consideration of Transfer Application	FERC					Order Amending License And Deferring Consideration Of Transfer Application: Order by FERC granting the application to amend the project license for Project Nos. 2082-062 and 14803-000 and defer its decision on the proposed partial license transfer from PacifiCorp to KRRC.	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
March 15, 2018	CRWG Meeting	BLM, CA SHPO, OR SHPO					Topics discussed: Tribal consultation update. FERC scoping meetings with Tribes (In January and February 2018, FERC held public scoping meeting with six federally-recognized tribes, consisting of the Hoopa Valley Tribe, Karuk Tribe, Klamath Tribes, Modoc Tribe of Oklahoma, Quartz Valley Rancheria, and Yurok Tribe. FERC's main objective was to identify any concerns with the amendment and transfer application proceedings; it was not to initiate Section 106 consultation.), project schedule, 2018 cultural resources work plan, MOA fast track concept, communications protocol, next steps, AECOM action items.	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
April 6, 2018	KRRC Informal Consultation and Project Introduction Meeting	Karuk Tribe, Klamath Tribe, Shasta Indian Nation, Shasta Nation, Quartz Valley	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	Topics discussed: Project overview, project schedule, AECOM's role, informal consultation, summary of previous cultural resource studies, AECOM's work to date, items to consider.	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
May 3, 2018	Letter from Mark Bransom, KRRC Executive Director, to Julianne Polance, CA SHPO	CA SHPO					Initiation of Informal Consultation for the Lower Klamath Project (FERC No. 14803)	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
May 3, 2018	Letter from Mark Bransom, KRRC Executive Director to Dennis Griffin, OR SHPO (State Archaeologist)	OR SHPO (OR State Archaeologist)					Initiation of Informal Consultation for the Lower Klamath Project (FERC No. 14803)	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
June 1, 2018	Letter from Julianne Polanco, CA SHPO, to Mark Bransom, KRRC Executive Director	CA SHPO					As part of Section 106 Consultation, CA SHPO provided comments on the preliminary Area of Potential Effect, Lower Klamath Project (FERC No. 14803) Siskiyou County, CA. [In reply refer to: ERC_2018_0507_001]	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
June 7, 2018	Letter Mark Bransom, KRRC Executive Director, to Julianne Polanco, CA SHPO	CA SHPO					Response to letter dated June 1, 2018: Initiation of Consultation and Preliminary Area of Potential Effect, Lower Klamath Project (FERC No. 14803) Siskiyou County, CA – SHPO File # FERC_2018_0507_001	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
June 28, 2018	Letter from Dennis Griffin (State Archaeologist), Oregon SHPO to Mark Bransom, KRRC Executive Director	OR SHPO (OR State Archaeologist)					SHPO Case No. 17-1370, FERC 14803, KRRC Lower Klamath Project, Removal of dams Oregon and California, Multiple locations, Klamath County: comments and questions regarding proposed APE and traditional cultural property within the Big Bend, OR area	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
July 11, 2018	Letter from Mark Bransom, KRRC Executive Director, to Laird Naylor, BLM (Klamath Falls, OR)	BLM (Klamath Falls, OR)					Request for Comments on the Lower Klamath Project (FERC No. 14803) Preliminary Area of Potential Effects	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
July 11, 2018	Letter from Mark Bransom, KRRC Executive Director, to Eric Ritter, BLM (Redding, CA)	BLM (Redding, CA)					Request for Comments on the Lower Klamath Project (FERC No. 14803) Preliminary Area of Potential Effects	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
July 11, 2018	Letter from Mark Bransom, KRRC Executive Director, to Keduescha Lara-Colegrove, Hoopa Valley Tribe THPO	Hoopa Valley Tribe THPO	Keduescha Lara-Colegrove - Tribal Historic Preservation Officer	hvt.thpo@gmail.com	530-625-4284, ext.112	P.O. Box 1348 Hoopa, CA 95546	Request for Comments on the Lower Klamath Project (FERC No. 14803) Preliminary Area of Potential Effects	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
July 11, 2018	Letter from Mark Bransom, KRRC Executive Director, to Alex Watts-Tobin, Karuk Tribe THPO	Karuk Tribe THPO	Alex Watts - Tobin Tribal Historic Preservation Officer	atobin@karuk.us	530-627-3446, ext. 3015	39051 Hwy 96, P. O. Box 282, Orleans, CA 95556	Request for Comments on the Lower Klamath Project (FERC No. 14803) Preliminary Area of Potential Effects	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
July 11, 2018	Letter from Mark Bransom, KRRC Executive Director, to Perry Chocktoot, Klamath Tribes THPO	Klamath Tribes THPO	Perry Chocktoot - Tribal Historic Preservation Office	Perry.chocktoot@klamathtribes.com	541.783.2764 ext. 107	P.O. Box 436, Chiloquin, OR 97624	Request for Comments on the Lower Klamath Project (FERC No. 14803) Preliminary Area of Potential Effects	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
July 11, 2018	Letter from Mark Bransom, KRRC Executive Director, to Blake Follis, Modoc Tribe of Oklahoma Environmental Director	Modoc Tribe of Oklahoma	Blake Follis - Environmental Director	Blake.follis@gmail.com	918.724.2335	22 North Eight Tribes Trail, Miami, OK 74354	Request for Comments on the Lower Klamath Project (FERC No. 14803) Preliminary Area of Potential Effects	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
July 11, 2018	Letter from Mark Bransom, KRRC Executive Director, to Crystal Robinson Quartz Valley Indian Reservation, Environmental Director	Quartz Valley Indian Reservation	Crystal Robinson - Environmental Director	Crystal.robinson@qvir-nsn.gov	530-468-5907 ext. 318	13601 Quartz Valley Road, Fort Jones, CA 96031	Request for Comments on the Lower Klamath Project (FERC No. 14803) Preliminary Area of Potential Effects	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys

July 11, 2018	Letter from Mark Bransom, KRRC Executive Director, to Janice Crowe, Shasta Indian Nation, Chair	Shasta Indian Nation	Janice Crowe - Chairwoman	Twocrowes63@att.net	530-244-2742	19349 Kinene Court, Redding, CA 96003	Request for Comments on the Lower Klamath Project (FERC No. 14803) Preliminary Area of Potential Effects	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
July 11, 2018	Letter from Mark Bransom, KRRC Executive Director, to Roy Hall, Jr., Shasta Nation, Chief	Shasta Nation	Roy Hall Jr. - Chief	shastanation@hotmail.com	530-468-2314	P.O. Box 1054, Yreka, CA 96097	Request for Comments on the Lower Klamath Project (FERC No. 14803) Preliminary Area of Potential Effects	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
July 11, 2018	Letter from Mark Bransom, KRRC Executive Director, to Rachel Sundberg, Cher-Ae Heights Indian Community of the Trinidad Rancheria, THPO	Cher-Ae Heights Indian Community of the Trinidad Rancheria THPO	Megan Van Pelt - Executive Director	meganvanpeld@resighinirancheria.com	707-954-1173	P.O. Box 529 Klamath, CA 95548	Request for Comments on the Lower Klamath Project (FERC No. 14803) Preliminary Area of Potential Effects	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
July 11, 2018	Letter from Mark Bransom, KRRC Executive Director, to Jeanne Goetz, Heritage Program Manager/Tribal Liaison, USFS, Klamath National Forest	USFS - Klamath National Forest					Request for Comments on the Lower Klamath Project (FERC No. 14803) Preliminary Area of Potential Effects	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
July 11, 2018	Letter from Mark Bransom, KRRC Executive Director, to Frankie Joe Myers, Yurok Tribe Office of Tribal Heritage Preservation, THPO	Yurok Tribe THPO	Rosie Clayburn - Tribal Heritage Preservation Officer	rclayburn@yuroktribe.nsn.us	707-482-1350 ext. 1309	PO Box 1027 Klamath, CA 95548	Request for Comments on the Lower Klamath Project (FERC No. 14803) Preliminary Area of Potential Effects	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
July 16, 2018	Email from Eric Ritter, BLM (Redding, CA) to Araxi Polony, KRRC	BLM (Redding, CA)					Response to Request for Comments on Lower Klamath Project (FERC No. 14803)	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
July 23, 2018	Letter from Mark Bransom, KRRC Executive Director, to Eric Ritter, BLM (Redding, CA)	BLM (Redding, CA)					Response to E-Mail Dated July 16, 2018: Preliminary Area of Potential Effects (APE), Lower Klamath Project (FERC NO. 14803) Siskiyou County, CA, and Klamath County, OR	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
July 23, 2018	Letter from Mark Bransom, KRRC Executive Director, to Dennis Griffin (State Archaeologist) OR SHPO	OR SHPO (OR State Archaeologist)					Response to Letter Dated June 28, 2018: Initiation of Consultation and Preliminary Area of Potential Effects (APE), Lower Klamath Project (FERC NO. 14803) Siskiyou County, CA and Klamath County, OR – SHPO Case No. 17-1370	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
August 14, 2018	CRWG Meeting	BLM, USFS, CA SHPO, OR SHPO, Karuk Tribe, Klamath Tribe, Modoc Nation, Shasta Indian Nation, Shasta Nation, Quartz Valley, Yurok Tribe	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	Topics discussed: introduction, project overview, Tribal caucus update, project status update, comments and questions, Fall Creek and Iron Gate hatcheries update, City of Yreka Intake and Pipeline Replacement, recreation plan and restoration, seed collection program, Area of Potential Effects (APE), review of 2017-2018 field studies, approach to site evaluations, next steps, logistics and planning.	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
August 24, 2018	Letter from Mark Bransom, KRRC Executive Director, to Julianne Polanco, CA SHPO	CA SHPO					Request for Comments on Appendix L of the Definite Plan, Lower Klamath Project (SHPO No: FERC_2018_0507_001)	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
August 24, 2018	Letter from Mark Bransom, KRRC Executive Director, to Dennis Griffin (State Archaeologist), OR SHPO)	OR SHPO (OR State Archaeologist)					Request for Comments on Appendix L of the Definite Plan, Lower Klamath Project (SHPO Case No 17-1370)	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
September 18, 2018	CRWG Meeting	BLM, USFS, CA SHPO, OR SHPO, Karuk Tribe, Klamath Tribe, Modoc Nation, Shasta Indian Nation, Shasta Nation, Quartz Valley, Yurok Tribe	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	Topics discussed: introductions, Tribal Caucus update, project update, regulatory recap, APE discussion, agreement document discussion and schedule, action items.	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
September 28, 2018	Letter from Julianne Polanco, CA SHPO, to Mark Bransom, KRRC Executive Director	CA SHPO					As part of Section 106 Consultation, CA SHPO provided comments on Appendix L of Definite Plan, Lower Klamath Project (FERC No. 14803) Siskiyou County, CA. [In reply refer to: FERC_2018_0507_001]	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
September 28, 2018	Letter from Dennis Griffin (State Archaeologist), Oregon SHPO to Mark Bransom, KRRC Executive Director	OR SHPO (OR State Archaeologist)					SHPO Case No. 17-1370, FERC 14803, KRRC Lower Klamath Project, Removal of dams Oregon and California, Multiple locations, Klamath County: comments and questions regarding Appendix L: Cultural Resources Plan	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
October 1, 2018	Letter from Jason Allen, Oregon SHPO to Mark Bransom, KRRC Executive Director	OR SHPO (OR State Archaeologist)					SHPO Case No. 17-1370, FERC 14803, KRRC Lower Klamath Project, Removal of dams Oregon and California, Multiple locations, Klamath County: comments and questions regarding Appendix L of Definite Plan	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
October 29, 2018	CRWG Meeting	BLM, USFS, CA SHPO, OR SHPO, Karuk Tribe, Klamath Tribe, Shasta Indian Nation, Shasta Nation, Quartz Valley, Yurok Tribe	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	Topics discussed: Tribal Caucus update, project updates (APE, recreation plan, reservoir and rim stability), geoarchaeology review, document preparation and schedule, action items.	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
November 15, 2018	Letter from Elena Nilsson, AECOM, on behalf of KRRC to Julianne Polanco, CA SHPO	CA SHPO					Submittal of Revised Area of Potential Effects, Lower Klamath Project, Siskiyou County, California (SHPO No. FERC_2018_00507_001)	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
November 29, 2018	CRWG Meeting	BLM, USFS, CA SHPO, OR SHPO, Karuk Tribe, Klamath Tribe, Shasta Indian Nation, Shasta Nation, Siletz Tribe, Quartz Valley, Yurok Tribe, American Whitewater	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	Topics discussed: schedule and meetings, Tribal Caucus update, October meeting minutes and action item review, recreation plan update, phase II study plan.	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
December 4, 2018	Letter from Mark Bransom, KRRC Executive Director, to Frankie Myers, Yurok Tribe THPO	Yurok Tribe THPO	Rosie Clayburn - Tribal Heritage Preservation Officer	rclayburn@yuroktribe.nsn.us	707-482-1350 ext. 1309	PO Box 1027 Klamath, CA 95548	State Water Resources Control Board's AB52 Consultation Impacts and Mitigation Measures for the Lower Klamath Project (FERC No. 14803).	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
December 4, 2018	Letter from Dennis Griffin (State Archaeologist), Oregon SHPO to Mark Bransom, KRRC Executive Director	OR SHPO (OR State Archaeologist)					SHPO Case No. 17-1370, FERC 14803, KRRC Lower Klamath Project, Removal of dams Oregon and California, Multiple locations, Klamath County: comments and questions regarding proposed revised APE	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
December 4, 2018	Email from Kirk Ranzetta (AECOM) to BOR	BOR					Request from KRRC to BOR to participate in Section 106 consultation.	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
December 4, 2018	Email from Lisa Vehmas (U.S. Bureau of Reclamation) to Kirk Ranzetta (AECOM)	BOR					Response to email: BOR confirms that "we don't think we need to be involved, but am looping in Stacey Leigh who is the regional Cultural Resources lead now. Also cc'd is Joe Giliberti, Reclamation's Federal Preservation Officer".	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
December 13, 2018	Letter from Tracy Schwartz, Oregon SHPO, to Mark Bransom, KRRC Executive Director	OR SHPO (OR State Archaeologist)					SHPO Case No. 17-1370, FERC 14803, KRRC Lower Klamath Project, Removal of dams Oregon and California, Multiple locations, Klamath County: Oregon SHPO concurs that Ape for above-ground architectural resources is sufficient for the scope and scale of undertaking.	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys

December 21, 2018	Letter from Julianne Polanco, CA SHPO, to Mark Bransom, KRRC Executive Director	CA SHPO					As part of Section 106 Consultation, CA SHPO provided comments on Revised Area of Potential Effect, Lower Klamath Project (FERC No. 14803) Siskiyou County, CA. CA SHPO agreed that APE as defined was appropriate per 36 CFR 800.4(a)(1) and stated that based on information discovered during consultation, the APE may need to be revised accordingly. [In reply refer to: FERC_2018_0507_001]	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
February 19, 2019	CRWG Meeting	CA SHPO, OR SHPO, Karuk Tribe, Shasta Indian Nation, Shasta Nation, Quartz Valley	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	Topics discussed: proposed Section 106 timeline, November 2018 meeting minutes and action item review, phase II study plan general research methods, general field methods, inadvertent discovery plan, SHPO meetings and action items.	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
April 1, 2019	Lower Klamath Project Phase II Archaeological Research Design and Testing Plan, Non-redacted Administrative Draft – Confidential, Consultation						Report prepared for KRRC by AECOM with environmental context, cultural context, research design, general research methods, site-specific research methods, and resource evaluation.	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
April 3, 2019	Yurok Tribe and KRRC Tribal Consultation	Yurok Tribe	Rosie Clayburn - Tribal Heritage Preservation Officer	rclayburn@yuroktribe.nsn.us	707-482-1350 ext. 1309	PO Box 1027 Klamath, CA 95548	Topics discussed: Phase II Study Plan, IDP, PA Update, SHPO Meeting – Riverscape concept, NAHC Meeting, Tribal Caucus and CRWG meeting facilitator, April 24, 2019 Project Tour, April 25, 2019 Tribal Caucus and CRWG Meeting, General Comments on Tribal Consultation, CRWG and Caucus, Next Steps/Review Action Items	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
April 4, 2019	Shasta Nation and KRRC Tribal Consultation	Shasta Nation	Roy Hall Jr. - Chief	shastanation@hotmail.com	530-468-2314	P.O. Box 1054, Yreka, CA 96097	Topics discussed: Phase II Study Plan, IDP, PA Update, SHPO Meeting – Riverscape concept, Tribal Caucus and CRWG meeting facilitator, April 24, 2019 Project Tour, April 25, 2019 Tribal Caucus and CRWG Meeting, General Comments on Tribal Consultation, CRWG and Caucus, Next Steps/Review Action Items	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
April 5, 2019	Shasta Indian Nation and KRRC Tribal Consultation	Shasta Indian Nation	Janice Crowe - Chairwoman	Twocrowes63@att.net	530-244-2742	19349 Kinene Court, Redding, CA 96003	Topics discussed: Phase II Study Plan, IDP, PA Update, SHPO Meeting – Riverscape concept, Tribal Caucus and CRWG meeting facilitator, April 24, 2019 Project Tour, April 25, 2019 Tribal Caucus and CRWG Meeting, General Comments on Tribal Consultation, CRWG and Caucus, Next Steps/Review Action Items	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
April 25, 2019	CRWG Meeting	BLM, USFS, CA SHPO, OR SHPO, Karuk Tribe, Klamath Tribe, Shasta Indian Nation, Shasta Nation, Siletz Tribe, Quartz Valley, Yurok Tribe	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	Topics discussed: Lower Klamath Project Area Tour site visit summary, Tribal Caucus update, project update, schedule update, Phase II Study Plan update, monitoring and inadvertent discovery plan, Shasta Nation presentation, and action items.	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
June 12, 2019	CRWG Meeting	BLM, OR SHPO, Klamath Tribe, Shasta Indian Nation, Shasta Nation, Quartz Valley, Yurok Tribe	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	Topics discussed: Tribal Caucus summary, project update, recreation plan update, cultural resources plan update and Section 106 outreach, action items.	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
June 25, 2019	Notice of Teleconference for Tribal Consultation Meeting by Kimberly D. Bose, FERC Secretary	FERC, Yurok Tribe	Rosie Clayburn - Tribal Heritage Preservation Officer	rclayburn@yuroktribe.nsn.us	707-482-1350 ext. 1309	PO Box 1027 Klamath, CA 95548	Teleconference July 9, 2019 from 1 pm to 3 pm EST. Purpose of meeting: FERC staff to meet with representatives of Yurok Tribe to discuss application to transfer the Lower Klamath Project No. 14803, consisting of the J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate developments, to the KRRC and eventual removal of the four developments.	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
July 9, 2019	Transcript and Errata Sheet	Yurok Tribe	Rosie Clayburn - Tribal Heritage Preservation Officer	rclayburn@yuroktribe.nsn.us	707-482-1350 ext. 1309	PO Box 1027 Klamath, CA 95548	Teleconference with Yurok Tribe to discuss PacifiCorp and the Klamath River Renewal Corporation's application. Docket Nos. P-2082-062 and P-14803-000, Federal Energy Regulatory Commission, 888 First Street, NE, Washington, D.C.	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
July 30, 2019	CRWG Meeting	BLM, USFS, CA SHPO, OR SHPO, Karuk Tribe, Shasta Indian Nation, Shasta Nation, Yurok Tribe	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	Topics discussed: Continued consultation between cultural resources stakeholders with KRRC and AECOM. Meeting focused on continuing discussion of Phase II Study Plan and providing an overview of the Monitoring and Inadvertent Discovery Plan (MIDP). Meeting also included Tribal Caucus Update and Built Environment Update.	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
September 5, 2019	CRWG Meeting	BLM, USFS, CA SHPO, OR SHPO, Karuk Tribe, Klamath Tribe, Shasta Indian Nation, Shasta Nation, Yurok Tribe	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	Topics discussed: MIDP, the Phase II Evaluation Program, the Fall Creek Hatchery improvements plan, and language included in the upcoming draft Programmatic Agreement (PA).	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
October 29, 2019	CRWG Meeting	BLM, USFS, OR SHPO, Karuk Tribe, Klamath Tribe, Shasta Nation, Quartz Valley, Yurok Tribe	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribale Contacts	Topics discussed: Update on MIDP and Phase II Evaluation Program. Introduce draft Looting and Vandalism Prevention Plan. Continue review of Programmatic Agreement. Review of Ethnographic Summaries. Identification of culturally important plants.	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
April 24, 2019	Lower Klamath Project Area Tour						Tour of Project Area	https://jacobs2k.sharepoint.com/:w:/s/KlamathRiverDamRemovalProject2/EUXfRf5Z2VhOm0742eGBHmgB4SDXmVvhhFo4F4eoWVswqA?e=dyBxys
Restoration Technical Working Group								
October 3, 2019	RTWG Mtg	CDFW, NOAA					Provide an update on reservoir restoration plans. Further engage regulatory agencies, tribes, and various stakeholders to understand likely permit terms and conditions. Share additional field data, research results, restoration actions, and constraints	
July 2, 2020	RTWG Mtg 1	RWQCB, SWRCB, CDFW, NMFS, ODEQ, ODFW, Yurok Tribe, USFWS					Initiation of RTWG Mtg. 1. Introduce restoration team, organization, Reservoir Area Management Plan (RAMP), present schedule for RAMP development, Present Purpose and Use statement and request feedback/input. Present schedule for agency input to streamline review and meet FERC submitall deadline of January 31, 2021.	
July 16, 2020	RTWG Mtg 2	RWQCB, SWRCB, CDFW, NMFS, ODEQ, ODFW, Karuk Tribe, USFWS					RTWG introductions to KRRC Leadership and RES Restoration Team Leadership. Finalize RAMP Purpose and Use Statement and introduce RAMP Outline major and minor headers. The RTWG is asked to review the Outline when provided.	
July 30, 2020	RTWG Mtg 3	RWQCB, SWRCB, CDFW, NMFS, ODEQ, ODFW, Karuk Tribe, Yurok Tribe, USFWS					RTWG review Outline major headers, Outline major and minor headers in review with comments due back Aug 5. Present Revegetation and IEV discussion. Annotated outline to be prepared submitted for review following receipt of comments on Outline.	
August 13, 2020	RTWG Mtg 4	RWQCB, SWRCB, CDFW, NMFS, ODEQ, ODFW, Karuk Tribe, Yurok Tribe, USFWS					RTWG review Outline (no comments received). Presentation on Geomorphology including anticipated conditions post-drawdown, Reservoir area restoration approach, restoration overview, activities, and dam footprints.	
September 10, 2020	RTWG Mtg 5	RWQCB, SWRCB, CDFW, NMFS, ODEQ, ODFW, Karuk Tribe, Yurok Tribe, USFWS					RTWG review of program and past presentations, Monitoring and adaptive management discussion of revegetation and physical restoration of sedimetn supply through tributaries; Management plan crosswalk, and recap of previous meeting discussion.	
November 4, 2020	Discuss Restoration Limits of Work	NMFS	Bob Pagliuco	bob.pagliuco@noaa.gov			Discussion of NOAA Restoration Center limits of work for non-priority tributaries; screenshare to describe extent of work activities and restoration limits of work	Dave Coffman, Gwen Santos, Dan Chase attended call
Aquatics Technical Working Group								
May 24, 2017	Sucker Mitigation Plan Meeting	USFWS, USGS					USFWS, ODFW, and CDFW discusse salvage terms of Klamath small-scale sucker (KSS). USFWS would defer to ODFW about trapping and moving KSS. USFWS can provide technical assistance and coordination for flow control to assist with sucker trapping and salvage. USGS and USFWS recommended trammel nets. Follow up with Klamath Tribes' tribal council to discuss sucker mitigation plan.	
October 26, 2017	Aquatic Resources Planning Workshop	NMFS, USFWS, USGS, ODFW, CDFW, Water Board, Yurok Tribe					KRRC will coordinate with NMFS to refine juvenile salmonid monitoring and salvage as part of AR-2, Action 3. NMFS representatives will try to identify past research that looked into juvenile salmonids avoiding high SSC mainstem areas when comfortable tributaries were available. KRRC is planning laboratory experiments to associate turbidity and suspended sediment concentrations. For AR-4, KRRC will relate the recommended release period of yearling Coho salmon from Iron Gate Hatchery to Klamath River suspended sediment concentrations. SWRCB requested additional information on juvenile salmonid behavioral response to high suspended sediment concentrations. KRRC will respond with a memo of additional literature and other information addressing the topic.	

May 23, 2017	Aquatic Mitigation Measures Meeting	NMFS, NMFS, USFWS, USGS, OR DEQ, ODFW, CDFW, NCRWQCB, SWRCB, Karuk Tribe, Yurok Tribe, Hoopa Valley Tribe, Klamath Tribes					Trapping, handling, and transporting spawning condition anadromous fish risks were addressed. CDFW is concerned with the genetic composition of trapped fish (mainly Chinook salmon) and moving fish into tributaries with populations with minimal hatchery influence. There appeared to be a general consensus to alter the previously written AR-1 to minimize capture and relocation of fish, and instead focus on other actions to meet the intent of the measure. There appeared to be a general consensus to alter the previously written AR-2 to minimize capture and relocation of fish, and instead focus on other actions to meet the intent of the measure. There appeared to be a general consensus to alter the previously written AR-5 to instead focus on other actions to meet the intent of the measure. There appeared to be a general consensus to refine the previously written AR-7 to focus on baseline monitoring and a possible pilot study, prior to committing to rescue and relocation. The group recommended monitoring baseline and post-dam removal freshwater mussel distribution and abundance. There appeared to be a general consensus to alter the previously written AR-3, and focus on other actions to meet the intent of the measure. The group recommended focusing fall pulse flow effort on acquiring water leases in the Shasta and Scott rivers to promote tributary spawning of adult salmonids. Monitor green sturgeon movements in the Klamath River and estuary to determine if fall pulse flows necessary to promote green sturgeon outmigration.	
June 13, 2017	Aquatic Mitigation Measures Meeting	NMFS, USFWS, CDFW, Karuk Tribe, Hoopa Valley Tribe					Mitigation measures included in 2012 EIS were not proposed by NMFS and were not considered by NMFS in the determination of effects to listed fish. The 2012 EIS was a preliminary EIS and never signed by the Secretary of the Interior. Question on whether the State Water Resources Control Board (SWRCB) will adopt the same significance criteria. SWRCB is lead for CEQA and CDFW is the supporting agency. CDFW would accept assistance with researching literature that would address the deficiencies of the original ARs. New proposed AR mitigation strategy to incorporate habitat restoration and monitoring rather than transporting fish. Monitoring should include species information and habitat metrics, and establish water quality triggers to require additional restoration actions to mitigate for anticipated effects. The federal, state, and tribal biologists who have convened to discuss the ARs, could serve as an expert panel as they have the most knowledge of the Klamath River system and fisheries.	
June 19, 2017	Aquatic Mitigation Measures - Suckers - Meeting	USFWS, USGS, ODFW, CDFW, Klamath Tribes					USFWS did not designate critical habitat or designate a recovery area downstream of Keno Dam. Sink populations in reservoirs. ODFW considers potentially hundreds of suckers in Topsy Reservoir, 40-50 Lost River suckers (LRS) and shortnose suckers (SNS) were found during recent die-off. Samples for pathology could be collected during 2017/2018 sampling events, ODFW pathologist is interested in reviewing samples (Craig Banner-retired). ODFW believes that parasites/disease present in reservoir fish are probably the same as in UKL. USFWS would still be concerned with disease as recent samples (n=9) taken from Clear Lake were disease-free. CDFW needs to make a determination regarding whether or not California is willing to accept salvaged suckers from Oregon reaches of the Klamath River and, if yes, to which locations would relocation of those suckers be acceptable. Sampling events should be covered under the existing MOU as long as CDFW/USGS/BOR/USFWS are involved in the field effort. MOU may need to be amended to cover spring sampling periods and other techniques (e.g., electrofishing). Amending the MOU is a fairly simple and expedient process.	
August 15, 2017	Aquatic Mitigation Measures Meeting	NMFS, USFWS, ODFW, ODEQ, CDFW, SWRCB, NCRWQCB, Karuk Tribe, Yurok Tribe					Recommendations for AR-2 focused on salvaging yearling Coho from the mainstem Klamath River prior to reservoir drawdown. Salvaging and relocating yearling Coho from the mainstem to off-channel ponds would preserve the unique life history strategy. There was discussion on the efficacy and concerns with relocating salmonids to off-channel habitats but there are constructed off-channel ponds that are well connected to tributaries and the mainstem. Moving fish to these complexes (e.g., Seiad Creek area) would provide fish with choices on where to move and when. Attendees were in support of not addressing lamprey ammocoetes as there are few ammocoetes below Iron Gate Dam based on past USFWS and Karuk Tribe sampling. Recommendations in support of removing AR-5 actions.	
October 4, 2019	Aquatic Technical Work Group	CDFW, USFWS, ODFW, NOAA, Karuk Tribe, Yurok Tribe					Provide updates on aquatic resources. Further engage regulatory agencies, tribes, and various stakeholders to understand likely permit terms and conditions. Update on design-build schedule.	
August 27, 2020	Juvenile Salmonid Plan Meeting	NOAA, ODFW, SWRCB, CDFW, USFWS, Karuk Tribe					Presenting and soliciting feedback on update of Juvenile Salmonid Plan.	
BLM FERC Terms / Grants (SF299) Right-of-Way								
September 22, 2020	Video Meeting	BLM	Debra Boudreau, Joan Cole	dboudreau@blm.gov, dj1cole@blm.gov			Camas is developing a list of SF 299s in the area of JC Boyle to cross check ownership. We would like some assistance from the BLM with GIS information. Discussed the application for a new road around the Scour Hole. Need SF 299 for new for Scour Hole access rd.	
September 30, 2020	Zoom	BLM	Alden Neel	aneel@blm.gov			Introduced the project to the CA BLM office. Discussed how their land intersects with the project. Went parcel by parcel and described the planned work within the BLM boundary. BLM requested annoated maps describing work activities to discuss with their land specialst.	
USACE CWA Section 404								
May 1, 2020	Conference Call	SF USACE	Kasey Sirkin/Lead Biologist	L.K.Sirkin@usace.army.mil	707-443-0855		KRRC team provided a Project Update and anticipated schedule for permit development and issuance.	
May 19, 2020	Conference Call	SF USACE Portland USACE	Kasey Sirkin/Lead Biologist Benny Dean/Regulatory Project Manager |	L.K.Sirkin@usace.army.mil/Benny.A.Dean@usace.army.mil			KRRC team provided the Portland District an overview of the project and schedule. Reviewed the logistics for SF USACE to be the lead for the USACE 404 permit.	CAM-USACE Consultation Rec 20200519
June 3, 2020	Conference Call	SF USACE Portland USACE Region 10 EPA WA Dept of Ecology USFWS ODEQ NMFS	See consultation notes.				KRRC team provided an overview of the SEF results for the J.C. Boyle dam removal. Results indicated the sediment behind the J.C. Boyle dam is of low toxicity.	See RDG SEF Presentation
June 8, 2020	Conference Call	USACE (SF and Portland District) EPA					Reviewed strategy to use SEF protocols for CA dams.	
July 1, 2020	Conference Call	USACE (SF) EPA					EPA indicated that they would likely take the role of PSET for all four dams. EPA indicated additional information they would need to conclude if sediment are "clean", included approximate sediment deposition in each reservoir.	
ESA Section 7 Biological Opinion								
April 28, 2017	Lower Basin Meeting	NMFS, USFWS, CDFW, BOR					NMFS recommends a sub-group meet to discuss Coho and AR-2;. There is a vast historical water quality dataset available on USFWS and KBMP websites. Approximately 25% of hatchery fish are marked at Iron Gate, AR-3 (Fall Pulse Flows) measureswill largely be determined by water availability and depend on the year's precipitation and hydrology.	
December 6, 2017	Definite Plan Initial Consultation	NMFS, USFWS					Review the action area, species lists, schedules, and data needs and updates since the 2012 consultation on dam decommissioning. NMFS should coordinate with CDFW on hatchery issues. KRRC should review species list with BOR, provide administrative draft Definite Plan to NMFS/USFWS, complete species list and provide to NMFS/USFWS, set up a BA review workshop, discuss potential Fall Creek hatchery permitting requirements with NCRWQCB, contact Patricia Grantham at USFS for fire burn areas GIS data, follow-up with USFWS on a plan for administrative record keeping requirements, and obtain new Coho effects analysis from SWRCB prior to the administrative draft EIR.	

February 8, 2018	Definite Plan Consultation	NMFS, USFWS, BOR					Services to discuss and provide more direction on FERC coordination and the action area (e.g. downstream tributaries). The group reviewed the draft tracking table to follow changes to the BA since the 2012 BA and agreed that the format and content were appropriate. NMFS requested a range of calendar years for the action be provided in the BA (since the project schedule is uncertain).	
March 6, 2018	Definite Plan Consultation	NMFS, USFWS					The BA should describe the status of populations but would not need to include the physical characteristics of the tributary habitats, since those would not change under the project. KRRC to check if the Williamson River Oregon spotted frog critical habitat is within the action area. USFWS to inquire about including the Western lily in the BA evaluation. USFWS to check with Klamath Falls office about including the Lost River in the action area. KRRC to contact Reclamation about Keno fish passage and Lost River screening as part of their consultation. KRRC to provide the draft hydrology narrative to USFWS and NMFS. The BA should describe the stressors in the watershed that may affect the timing of exposure in the mainstem.	
March 30, 2018	Definite Plan Consultation	NMFS, USFWS					Topics addressed the hatchery and water diversions as part of the FERC federal action in the BA or included as an interrelated/interconnected action. The BA should also be clear that the hatchery is not KRRC responsibility/action. KRRC and NMFS to develop procedural questions for FERC regarding inclusion of hatchery and NEPA processes. NMFS and CDFW to investigate fish passage blockages on Fall Creek.	
March 20, 2020	Draft BA	NMFS, USFWS					Discussed timeline for review of the BA. USFWS/NMFS: Assurance they have a complete consultation package – unsure of the complete consultation package. USFWS – still some questions regarding the suckers and the survey work that is going on now. Discussed extended drawdown, NMFS requested more information on hydrology modeling. Considered mitigation that could be implemented, such as shifting hatchery release and ways to protect listed fish.PacifiCorp to drawdown on the reservoir with current release points – base flows in Dec can be 1,000 cfs, and through turbine is ~1,850.	
April 8, 2020	90% Design TWG Meeting #1	NMFS, USFWS, ODFW, CDFW, Karuk Tribe, and Yurok Tribe					Design-Build Team to present current approach and analysis on reservoir drawdown and to obtain agency initial response to shape future direction.	
April 23, 2020	90% Design TWG Meeting #2_Part 1	NMFS, USFWS, USBR, ODFW, CDFW, , Karuk Tribe, Yurok Tribe					Updated the TWG the USBR and KRRP model assumptions for various drawdown scenarios and to discuss the overall hydraulic capacity of the Iron Gate Dam tunnel. Define “Drawdown”.	
April 24, 2020	90% Design TWG Meeting #2_Part 2	NMFS, USFWS, USBR, Stillwater Sciences, ODFW, CDFW, CA SWB, Karuk Tribe, Yurok Tribe					Stillwater Sciences and SWRCB attended to discuss the FEIR analysis for coho, KRRP model assumptions for various drawdown scenarios and to discuss the overall hydraulic capacity of the Iron Gate Dam tunnel. Define “Drawdown”.	
April 24, 2020	Draft BA	NMFS					Discussed presentation from Stillwater, was consistent with information shared with the FEIR. Jan 1 – Mar 15 – active sediment could be done – not certain that drawdown would stop at that time.	
April 29, 2020	Draft BA	NMFS					Discussed level of desired detail for project description, focus on effects to fish and how to minimize adverse effects, keep it streamlined. Discussed over structure of BA.	
April 30, 2020	90% Design TWG Meeting #3	NMFS, USFWS, ODFW, CDFW, Yurok Tribe					Updated the TWG on the revised Iron Gate rating curve for Dry, Medium and Wet years. Reviewed USBR 2012 WSE vs KRRP 2020 WSE with Iron Gate hydraulic limitations.	
May 7, 2020	90% Design TWG Meeting #4	NMFS, USFWS, ODFW, CDFW, BOR, Yurok Tribe					Update the drawdown modeling to show that peak sediment flow will not have/include anticipated dates. Recommend setting up another meeting to further outline the "channel footprint and velocity" and "out of river" date.	
May 7, 2020	Draft BA	NMFS					Technical team to convene on volitional fish passage. Discussed purpose and goals of forming ATWG.There was some confusion about eh new drawdown scenario during wet years. How likely is this to occur?	
May 14, 2020	90% Design TWG Meeting #5	NMFS, USFWS, ODFW, CDFW, BOR, Yurok Tribe					PacifiCorp drought year reservoir drawdown update Model update and KBRA WSE elevations Operations subgroup overview	
May 20, 2020	Draft BA	NMFS					If using median water year, seems to be more accurate of a model. Would like to use median impact year rather than median water year. Need to discuss why it was used in the BA. Verfied that USBR results can be used in the BA. Would like to keep the blocks of time instead of the rolling average for the xposure duration.Juvenile outmigration can be shown in two week blocks.	
May 21, 2020	90% Design TWG Meeting #6	NMFS, USFWS, ODFW, CDFW, BOR, Karuk Tribe					Updated the TWG on the revised PacifiCorp reservoir drawdown and engineering. Update Iron Gate Figure to include the elevation of the coffer dam at 2208. Update the operations and Sucker sampling survey work to provide Karuk (T. Soto) lamprey photos for identification purposes.	
June 4, 2020	90% Design TWG Meeting #7	NMFS, USFWS, ODFW, CDFW, BOR, Karuk Tribe					Updated the TWG on the PacifiCorp drought year reservoir drawdown and engineering. Update the operations and Sucker sampling survey work for identification purposes.	
June 18, 2020	90% Design TWG Meeting #8	NMFS, USFWS, ODFW, CDFW, BOR, Karuk Tribe					Updated the TWG on the BOR 2012 updated modeling and suspended sediment.	
June 23, 2020	Draft BA	NMFS					Discussed TWG call. For BA intend to present median impact year in the effects section body and will include the severe impact year with an appendix. Want to present the most severe impact year in the BA. Planned on early July for a draft, with Nov 1 for formal consultation. Refugia with the stairstep – distances between stair steps – enough refugia to find better oxygenated water. Sediment impacts at drawdown – starting DO, starting water temp, peak SSC. Analysis of the timing – then look at drawdown – when most likely the peak in the sediment would happen – look through information on the timing – if quantitative analysis, then retouch base before.	
July 2, 2020	90% Design TWG Meeting #9	NMFS, USFWS, ODFW, CDFW, BOR, Karuk Tribe					Updated the TWG on AR measures - correct naming and language, use of summary tables for Median and Severe Impacts Years for coho and Chinook. Discussed technincal memo on revised SSC modeling following drawdown, inclusion of USBR SRH-1D model. Update on BA analysis and progress.	
July 9, 2020	Sucker Mitigation Plan Meeting	USFWS					Summary of sucker sampling results from 2018-2020 and review of schedule for sucker genetic assay development. Overview of sucker salavage plan - salvage up to 600 suckers, not to exceed 3,000 suckers, transport, and release into Tule Lake, coordinate with USFWS and The Klamath Tribes for broodstock programs. Discussed prioritizing spring 2021 sampling over fall 2021. Limited salvage potential during drawdown. Discussed different organizations' interests in assisting with sampling, including USFWS. Went over level of effort, where to focus effort, and logistics of gear used. Went over relocation sites, which fish go where (OR and CA suckers should stay in their states' waters). Reviewed permitting requirements including Section 7, MOU, SCP and STP.	
July 23, 2020	Sucker Mitigation Plan Meeting	USFWS					Genetics update – status of Abernathy funding and schedule. Submitted requests for PacifiCorp access. Talked timeline for federal permitting.	
August 13, 2020	Draft BA	NMFS					Update to status of BA. Bring to common underderstanding of where the BA has both responded to original NMFS comments, updated to represent 60% design, and reformatted for user ease. Further discussed document organization. Discussed changes to listed plant surveys and finalization of killer whale critical habitat. To follow up on killer whale.	

August 18, 2020	Draft BA	USFWS					Discussed fish passage and plan to follow up with focus group. Requested additional USFWS to be included in RTWG. Discussed lamprey as big part of KBRA cost and determination, need to connect with Damon. Additional follow up on USFWS calls on sucker section review and bull trout effects section review.	
August 26, 2020	Pacific Lamprey passage/salvage discussion	USFWS					Meeting with Damon Goodman to discuss potential passage issues for Pacific Lamprey at replacement stream crossings in the Hydroelectric Reach. Damon suggested that roughened channel would be a suitable alternative to stream simulation and that there are not many concerns for PL passage in natural bottom streams. He expressed some concern with Fall Creek manmade structures and may need to provide PL passage there. We also discussed potential impacts to juvenile PL in the mainstem Klamath following drawdown, but this does not seem to be a big concern.	
September 16, 2020	Fish Passage Criteria	ODFW, NOAA, CDFW					This call was scheduled to go over fish passage criteria with the agencies to ensure we are all on the same page. KRRC presented slides to the group, explaining proposed fish passage monitoring metrics and adaptive management. Each agency acklnowledged that we are on the same page now with how fish passage barriers will be identified, monitored, and addressed.	
October 8, 2020	Fish Passage Plan	ODFW, NOAA, CDFW, USFWS					This call was to discuss with the agencies the proposed Klamath River fish passage monitoring plan to be implemented by KRRC following dam removal. During this call, Dan ran through a slideshow on the fish passage monitoring plan. There were some productive discussions, and the agency representatives seemed to approve of most of the plan as we presented it.	
NHPA Section 106 Consultation								
May 28, 2003	Letter from CA SHPO to PacifiCorp	CA SHPO	Knox Mellon, CA SHPO	calshpo@ohp.park.ca.gov	916-653-6624	Office of Historic Preservation, Department of Parks and Recreatio, PO Box 942896, Sacramento, CA 94296-0001	Comments regarding propsed modification to Iron Gate.	
November 10, 2016	FERC Notice of Applications Filed with the Commission Consultation	FERC					FERC Notice of the following applications filed by PacifiCorp and KRRC and available for public inspection: Amendment and Partial Transfer of License (Project Nos. 2082-062 and 14803-000) and for Surrender of License (Project Nos. 2082-063 and 14803-001).	
July 14, 2017	FERC Klamath Hydroelectric Project – Request for Additional Information by Timothy Konnert, Chief, West Branch Division of Hydropower Licensing	FERC					Schedule A – Additional information request from FERC for Project Nos. 2082-063 and 14803-001	
August 8, 2017	Letter from Mark Bransom, KRRC Executive Director, to Julianne Polanco, CA SHPO	CA SHPO					Invitation to participate in Cultural Resources Working Group to assist FERC in meeting its Section 106 obligations.	
August 8, 2017	Letter from Mark Bransom, KRRC Executive Director, to Christine Curran, OR SHPO	OR SHPO (OR State Archaeologist)					Invitation to participate in Cultural Resources Working Group to assist FERC in meeting its Section 106 obligations.	
August 8, 2017	Letter from Mark Bransom, KRRC Executive Director, to Jeanne Goetz, Heritage Resources Specialist, Yreka, CA	USDA (Yreka, CA)					Invitation to participate in Cultural Resources Working Group to assist FERC in meeting its Section 106 obligations.	
August 8, 2017	Letter from Mark Bransom, KRRC Executive Director, to Russ Howison, PacifiCorp						Invitation to participate in Cultural Resources Working Group to assist FERC in meeting its Section 106 obligations.	
August 8, 2017	Letter from Mark Bransom, KRRC Executive Director, to Laird Naylor, Bureau of Land Management (Klamath Falls, OR)	BLM (Klamath Falls, OR)					Invitation to participate in Cultural Resources Working Group to assist FERC in meeting its Section 106 obligations.	
August 8, 2017	Letter from Mark Bransom, KRRC Executive Director, to Eric Ritter, Bureau of Land Management (Redding, CA)	BLM (Redding, CA)					Invitation to participate in Cultural Resources Working Group to assist FERC in meeting its Section 106 obligations.	
September 5, 2017	CRWG Meeting	USFS, USACE, CA SHPO, OR SHPO					Topics discussed: Introductions, project background, project overview, schedule, previous cultural studies, next steps for Section 106 process, future meetings.	
October 18, 2017	Consultation with Tribes for Klamath and Lower Klamath Projects by Steve Hocking, Chief Environmental and Project Review Branch, Division of Hydropower Administration Compliance, FERC	Karuk Tribe, Hoopa Valley Tribe, Confederated Tribes of the Warm Springs Reservation of Oregon, Confederated Tribes of the Grand Ronde Community of Oregon, Klamath Tribe, Cow Creek Tribes of the Warm Springs Reservation of Oregon, Elk Valley Rancheria (California), Quartz Valley Indian Community of the Quart Valley Reservation of California, Resighini Rancheria, Pit River Tribe (California), Confederated Tribes of Siletz Indians of Oregon, Tolowa Dee-Ni Nation	See Table 2 for a List of Tribal Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribal Contacts	See Table 2 for a List of Tribale Contacts	Invitation to request meeting with FERC staff regarding Project Nos. 2082-062 and 14803-000. Invitation sent to representatives of: Hoopa Valley Tribe, Karuk Tribe, Confederated Tribes of the Warm Springs Reservation of Oregon, Confederated Tribes of the Grand Ronde Community of Oregon, Klamath Tribe, Cow Creek Tribes of the Warm Springs Reservation of Oregon, Elk Valley Rancheria (California), Quartz Valley Indian Community of the Quart Valley Reservation of California, Resighini Rancheria, Pit River Tribe (California), Confederated Tribes of Siletz Indians of Oregon, Tolowa Dee-Ni Nation.	
December 12, 2017	Form Letter from Mark Bransom, KRRC, to Chairman Thomas O'Rourke, Yurok Tribe	Yurok Tribe	Rosie Clayburn - Tribal Heritage Preservation Officer	rclayburn@yuroktribe.nsn.us	707-482-1350 ext. 1309	PO Box 1027 Klamath, CA 95548	Meeting Invitation and Initiation of Informal Consultation for the Lower Klamath Project (FERC No. 14803)	
December 14, 2017	CRWG Meeting	BLM, CA SHPO, OR SHPO					Topics discussed: regulatory context and project definitions, dam removal comparative context, previous APEs for Klamath River EIS/EIRS, proposed project APE, subarea 1 components, overview of proposed APE maps, built environment evaluation approach for dam facilities	
December 29, 2017	Letter from Markham Quehrn, PerkinsCoie, to Kimberly D. Bose, FERC Secretary	FERC					Response to July 14, 2017 Additional Information Request; Application for Surrender of License for Major Project and Removal of Project Works; Project Nos. 2082-063 and 14803-001. The submittal includes responses to AIRs # 1, 5, 6, 7, 8, 14, 17, 22, 23, 28 and 29. FERC had already approved the KRRC's request to extend the time for the KRRC's response to AIRs # 2, 3, 4, 9, 10, 11, 12 13, 15, 16, 18, 19, 20, 21, 24, 25, 26 and 27 until July 1, 2018.	
December 29, 2017	Notice of Tribal Consultation Meetings by Nathaniel J. Davis, Sr., FERC Deputy Secretary	Hoopa Valley Tribe, Karuk Tribe, Quartz Valley Indian Community, Klamath Tribes, and Yurok Tribes	See Table 2 for a List of Tribal Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribal Contacts	See Table 2 for a List of Tribale Contacts	Notice of tribal consultation meetings with representatives of the Hoopa Valley Tribe, Karuk Tribe, Quartz Valley Indian Community, Klamath Tribes, and Yurok Tribes on January 16-19, 2018.	
January 8, 2018	Letter from KRRC inviting Initiation of Informal Consultation for the Lower Klamath Project (FERC No. 14803).	Confederated Tribes of the Warm Springs Reservation of Oregon, Karuk Tribe, Rohnerville Rancheria, Modoc Tribes of Oklahoma, Blue Lake Rancheria, Confederated Tribes of the Grande Ronde, Winnemem Wintu, Elk Valley Rancheria, Cow Creek Tribes, Klamath Tribes, Confederated Tribes of the Siletz Indians, Quartz Valley, Yurok, Trinidad Rancheria, Shasta Indian Nation, Round Valley Indian Tribes, Tolowa Dee-Ni Nation, Hoopa Valley Tribe, Pit River Tribe, Tsnungwe Council, Resighini Rancheria, Shasta Nation, Table Bluff Reservaiton, Big Lagoon Rancheria, Wintu Tribe	See Table 2 for a List of Tribal Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribal Contacts	See Table 2 for a List of Tribale Contacts	Letter: Initiation of Informal Consultation for the Lower Klamath Project (FERC No. 14803)	

January 16, 2018	Transcript	Hoopa Valley Tribe	Keduescha Lara-Colegrove - Tribal Historic Preservation Officer	hvt.thpo@gmail.com	530-625-4284, ext.112	P.O. Box 1348 Hoopa, CA 95546	Scoping Meeting held at Hoopa Valley Tribe Neighborhood Facilities, 11860 Highway 96, Hoopa, CA 95546	
January 16, 2018	Transcript	Quartz Valley Indian Tribe	Crystal Robinson - Environmental Director	Crystal.robinson@qvir-nsn.gov	530-468-5907 ext. 318	13601 Quartz Valley Road, Fort Jones, CA 96031	Scoping Meeting held at Quartz Valley Indian Reservation of California, 13601 Quartz Valley Road, Ft. Jones, CA 96031	
January 17, 2018	Transcript	Karuk Tribe	Alex Watts-Tobin - Tribal Historic Preservation Officer	atobin@karuk.us	530-627-3446, ext. 3015	39051 Hwy 96, P. O. Box 282, Orleans, CA 95556	Scoping Meeting held at Karuk Department of Natural Resources	
January 18, 2018	Transcript						Scoping Meeting held at Klamath Tribes Administration Building, 501 Chiloquin, Chiloquin, OR 97624	
January 19, 2018	Transcript	Yurok Tribe	Rosie Clayburn - Tribal Heritage Preservation Officer	rclayburn@yuroktribe.nsn.us	707-482-1350 ext. 1309	PO Box 1027 Klamath, CA 95548	Scoping Meeting held at Yurok Tribe Klamath Tribal Office, 190 Klamath Boulevard, Klamath, CA 95548	
February 5, 2018	Transcript	Modoc Tribe of Oklahoma	Blake Follis - Environmental Director	Blake.follis@gmail.com	918.724.2335	22 North Eight Tribes Trail, Miami, OK 74354	Tribal Consultation Meeting Teleconference with Modoc Tribe of Oklahoma	
May 3, 2018	Letter from Mark Bransom, KRRC Executive Director to Dennis Griffin, OR State Archaeologist	OR SHPO (OR State Archaeologist)					Initiation of Informal Consultation for the Lower Klamath Project (FERC No. 14803)	
May 3, 2018	Letter from Mark Bransom, KRRC Executive Director to Julianne Polanco, CA SHPO	CA SHPO					Initiation of Informal Consultation for the Lower Klamath Project (FERC No. 14803)	
March 15, 2018	FERC Order Amending License and Deferring Consideration of Transfer Application	FERC					Order Amending License And Deferring Consideration Of Transfer Application: Order by FERC granting the application to amend the project license for Project Nos. 2082-062 and 14803-000 and defer its decision on the proposed partial license transfer from PacifiCorp to KRRC.	
March 15, 2018	CRWG Meeting	BLM, CA SHPO, OR SHPO					Topics discussed: Tribal consultation update. FERC scoping meetings with Tribes (In January and February 2018, FERC held public scoping meeting with six federally-recognized tribes, consisting of the Hoopa Valley Tribe, Karuk Tribe, Klamath Tribes, Modoc Tribe of Oklahoma, Quartz Valley Rancheria, and Yurok Tribe. FERC's main objective was to identify any concerns with the amendment and transfer application proceedings; it was not to initiate Section 106 consultation.), project schedule, 2018 cultural resources work plan, MOA fast track concept, communications protocol, next steps, AECOM action items.	
April 6, 2018	KRRC Informal Consultation and Project Introduction Meeting	Karuk Tribe, Klamath Tribe, Shasta Indian Nation, Shasta Nation, Quartz Valley	See Table 2 for a List of Tribal Contacts	See Table 2 for a List of Tribal Contacts	See Table 2 for a List of Tribal Contacts	See Table 2 for a List of Tribale Contacts	Topics discussed: Project overview, project schedule, AECOM's role, informal consultation, summary of previous cultural resource studies, AECOM's work to date, items to consider.	
May 3, 2018	Letter from Mark Bransom, KRRC Executive Director, to Julianne Polance, CA SHPO	CA SHPO					Initiation of Informal Consultation for the Lower Klamath Project (FERC No. 14803)	
May 3, 2018	Letter from Mark Bransom, KRRC Executive Director to Dennis Griffin, OR SHPO (State Archaeologist)	OR SHPO (OR State Archaeologist)					Initiation of Informal Consultation for the Lower Klamath Project (FERC No. 14803)	
June 1, 2018	Letter from Julianne Polanco, CA SHPO, to Mark Bransom, KRRC Executive Director	CA SHPO					As part of Section 106 Consultation, CA SHPO provided comments on the preliminary Area of Potential Effect, Lower Klamath Project (FERC No. 14803) Siskiyou County, CA. [In reply refer to: ERC_2018_0507_001]	
June 7, 2018	Letter Mark Bransom, KRRC Executive Director, to Julianne Polanco, CA SHPO	CA SHPO					Response to letter dated June 1, 2018: Initiation of Consultation and Preliminary Area of Potential Effect, Lower Klamath Project (FERC No. 14803) Siskiyou County, CA – SHPO File # FERC_2018_0507_001	
June 28, 2018	Letter from Dennis Griffin (State Archaeologist), Oregon SHPO to Mark Bransom, KRRC Executive Director	OR SHPO (OR State Archaeologist)					SHPO Case No. 17-1370, FERC 14803, KRRC Lower Klamath Project, Removal of dams Oregon and California, Multiple locations, Klamath County: comments and questions regarding proposed APE and traditional cultural property within the Big Bend, OR area	
July 11, 2018	Letter from Mark Bransom, KRRC Executive Director, to Laird Naylor, BLM (Klamath Falls, OR)	BLM (Klamath Falls, OR)					Request for Comments on the Lower Klamath Project (FERC No. 14803) Preliminary Area of Potential Effects	
July 11, 2018	Letter from Mark Bransom, KRRC Executive Director, to Eric Ritter, BLM (Redding, CA)	BLM (Redding, CA)					Request for Comments on the Lower Klamath Project (FERC No. 14803) Preliminary Area of Potential Effects	
July 11, 2018	Letter from Mark Bransom, KRRC Executive Director, to Keduescha Lara-Colegrove, Hoopa Valley Tribe THPO	Hoopa Valley Tribe THPO	Keduescha Lara-Colegrove - Tribal Historic Preservation Officer	hvt.thpo@gmail.com	530-625-4284, ext.112	P.O. Box 1348 Hoopa, CA 95546	Request for Comments on the Lower Klamath Project (FERC No. 14803) Preliminary Area of Potential Effects	
July 11, 2018	Letter from Mark Bransom, KRRC Executive Director, to Alex Watts-Tobin, Karuk Tribe THPO	Karuk Tribe THPO	Alex Watts - Tobin Tribal Historic Preservation Officer	atobin@karuk.us	530-627-3446, ext. 3015	39051 Hwy 96, P. O. Box 282, Orleans, CA 95556	Request for Comments on the Lower Klamath Project (FERC No. 14803) Preliminary Area of Potential Effects	
July 11, 2018	Letter from Mark Bransom, KRRC Executive Director, to Perry Chocktoot, Klamath Tribes THPO	Klamath Tribes THPO	Perry Chocktoot - Tribal Historic Preservation Office	Perry.chocktoot@klamathtribes.com	541.783.2764 ext. 107	P.O. Box 436, Chiloquin, OR 97624	Request for Comments on the Lower Klamath Project (FERC No. 14803) Preliminary Area of Potential Effects	
July 11, 2018	Letter from Mark Bransom, KRRC Executive Director, to Blake Follis, Modoc Tribe of Oklahoma Environmental Director	Modoc Tribe of Oklahoma	Blake Follis - Environmental Director	Blake.follis@gmail.com	918.724.2335	22 North Eight Tribes Trail, Miami, OK 74354	Request for Comments on the Lower Klamath Project (FERC No. 14803) Preliminary Area of Potential Effects	
July 11, 2018	Letter from Mark Bransom, KRRC Executive Director, to Crystal Robinson Quartz Valley Indian Reservation, Environmental Director	Quartz Valley Indian Reservation	Crystal Robinson - Environmental Director	Crystal.robinson@qvir-nsn.gov	530-468-5907 ext. 318	13601 Quartz Valley Road, Fort Jones, CA 96031	Request for Comments on the Lower Klamath Project (FERC No. 14803) Preliminary Area of Potential Effects	
July 11, 2018	Letter from Mark Bransom, KRRC Executive Director, to Janice Crowe, Shasta Indian Nation, Chair	Shasta Indian Nation	Janice Crowe - Chairwoman	Twocrowes63@att.net	530-244-2742	19349 Kinene Court, Redding, CA 96003	Request for Comments on the Lower Klamath Project (FERC No. 14803) Preliminary Area of Potential Effects	
July 11, 2018	Letter from Mark Bransom, KRRC Executive Director, to Roy Hall, Jr., Shasta Nation, Chief	Shasta Nation	Roy Hall Jr. - Chief	shastanation@hotmail.com	530-468-2314	P.O. Box 1054, Yreka, CA 96097	Request for Comments on the Lower Klamath Project (FERC No. 14803) Preliminary Area of Potential Effects	
July 11, 2018	Letter from Mark Bransom, KRRC Executive Director, to Rachel Sundberg, Cher-Ae Heights Indian Community of the Trinidad Rancheria, THPO	Cher-Ae Heights Indian Community of the Trinidad Rancheria THPO	Megan Van Pelt - Executive Director	meganvanpeld@resighinirancheria.com	707-954-1173	P.O. Box 529 Klamath, CA 95548	Request for Comments on the Lower Klamath Project (FERC No. 14803) Preliminary Area of Potential Effects	
July 11, 2018	Letter from Mark Bransom, KRRC Executive Director, to Jeanne Goetz, Heritage Program Manager/Tribal Liaison, USFS, Klamath National Forest	USFS - Klamath National Forest					Request for Comments on the Lower Klamath Project (FERC No. 14803) Preliminary Area of Potential Effects	
July 11, 2018	Letter from Mark Bransom, KRRC Executive Director, to Frankie Joe Myers, Yurok Tribe Office of Tribal Heritage Preservation, THPO	Yurok Tribe THPO	Rosie Clayburn - Tribal Heritage Preservation Officer	rclayburn@yuroktribe.nsn.us	707-482-1350 ext. 1309	PO Box 1027 Klamath, CA 95548	Request for Comments on the Lower Klamath Project (FERC No. 14803) Preliminary Area of Potential Effects	
July 16, 2018	Email from Eric Ritter, BLM (Redding, CA) to Araxi Polony, KRRC	BLM (Redding, CA)					Response to Request for Comments on Lower Klamath Project (FERC No. 14803)	
July 23, 2018	Letter from Mark Bransom, KRRC Executive Director, to Eric Ritter, BLM (Redding, CA)	BLM (Redding, CA)					Response to E-Mail Dated July 16, 2018: Preliminary Area of Potential Effects (APE), Lower Klamath Project (FERC NO. 14803) Siskiyou County, CA, and Klamath County, OR	
July 23, 2018	Letter from Mark Bransom, KRRC Executive Director, to Dennis Griffin (State Archaeologist) OR SHPO	OR SHPO (OR State Archaeologist)					Response to Letter Dated June 28, 2018: Initiation of Consultation and Preliminary Area of Potential Effects (APE), Lower Klamath Project (FERC NO. 14803) Siskiyou County, CA and Klamath County, OR – SHPO Case No. 17-1370	

August 14, 2018	CRWG Meeting	BLM, USFS, CA SHPO, OR SHPO, Karuk Tribe, Klamath Tribe, Modoc Nation, Shasta Indian Nation, Shasta Nation, Quartz Valley, Yurok Tribe	See Table 2 for a List of Tribal Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribal Contacts	See Table 2 for a List of Tribale Contacts	Topics discussed: introduction, project overview, Tribal caucus update, project status update, comments and questions, Fall Creek and Iron Gate hatcheries update, City of Yreka Intake and Pipeline Replacement, recreation plan and restoration, seed collection program, Area of Potential Effects (APE), review of 2017-2018 field studies, approach to site evaluations, next steps, logistics and planning.	
August 24, 2018	Letter from Mark Bransom, KRRC Executive Director, to Julianne Polanco, CA SHPO	CA SHPO					Request for Comments on Appendix L of the Definite Plan, Lower Klamath Project (SHPO No: FERC_2018_0507_001)	
August 24, 2018	Letter from Mark Bransom, KRRC Executive Director, to Dennis Griffin (State Archaeologist), OR SHPO)	OR SHPO (OR State Archaeologist)					Request for Comments on Appendix L of the Definite Plan, Lower Klamath Project (SHPO Case No 17-1370)	
September 18, 2018	CRWG Meeting	BLM, USFS, CA SHPO, OR SHPO, Karuk Tribe, Klamath Tribe, Modoc Nation, Shasta Indian Nation, Shasta Nation, Quartz Valley, Yurok Tribe	See Table 2 for a List of Tribal Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribal Contacts	See Table 2 for a List of Tribale Contacts	Topics discussed: introductions, Tribal Caucus update, project update, regulatory recap, APE discussion, agreement document discussion and schedule, action items.	
September 28, 2018	Letter from Julianne Polanco, CA SHPO, to Mark Bransom, KRRC Executive Director	CA SHPO					As part of Section 106 Consultation, CA SHPO provided comments on Appendix L of Definite Plan, Lower Klamath Project (FERC No. 14803) Siskiyou County, CA. [In reply refer to: FERC_2018_0507_001]	
September 28, 2018	Letter from Dennis Griffin (State Archaeologist), Oregon SHPO to Mark Bransom, KRRC Executive Director	OR SHPO (OR State Archaeologist)					SHPO Case No. 17-1370, FERC 14803, KRRC Lower Klamath Project, Removal of dams Oregon and California, Multiple locations, Klamath County: comments and questions regarding Appendix L: Cultural Resources Plan	
October 1, 2018	Letter from Jason Allen, Oregon SHPO to Mark Bransom, KRRC Executive Director	OR SHPO (OR State Archaeologist)					SHPO Case No. 17-1370, FERC 14803, KRRC Lower Klamath Project, Removal of dams Oregon and California, Multiple locations, Klamath County: comments and questions regarding Appendix L of Definite Plan	
October 29, 2018	Tribal Caucus Meeting	Karuk Tribe, Klamath Tribes, Shasta Indian Nation, Shasta Nation, Confederated Tribes of Siletz, Yurok Tribe	See Table 2 for a List of Tribal Contacts				Monitoring plan and Shasta Nation's perspective on project.	
October 29, 2018	CRWG Meeting	BLM, USFS, CA SHPO, OR SHPO, Karuk Tribe, Klamath Tribe, Shasta Indian Nation, Shasta Nation, Quartz Valley, Yurok Tribe	See Table 2 for a List of Tribal Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribal Contacts	See Table 2 for a List of Tribale Contacts	Topics discussed: Tribal Caucus update, project updates (APE, recreation plan, reservoir and rim stability), geoarchaeology review, document preparation and schedule, action items.	
November 15, 2018	Letter from Elena Nilsson, AECOM, on behalf of KRRC to Julianne Polanco, CA SHPO	CA SHPO					Submittal of Revised Area of Potential Effects, Lower Klamath Project, Siskiyou County, California (SHPO No. FERC_2018_00507_001)	
November 29, 2018	CRWG Meeting	BLM, USFS, CA SHPO, OR SHPO, Karuk Tribe, Klamath Tribe, Shasta Indian Nation, Shasta Nation, Siletz Tribe, Quartz Valley, Yurok Tribe, American Whitewater	See Table 2 for a List of Tribal Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribal Contacts	See Table 2 for a List of Tribale Contacts	Topics discussed: schedule and meetings, Tribal Caucus update, October meeting minutes and action item review, recreation plan update, phase II study plan.	
December 4, 2018	Letter from Mark Bransom, KRRC Executive Director, to Frankie Myers, Yurok Tribe THPO	Yurok Tribe THPO	Rosie Clayburn - Tribal Heritage Preservation Officer	rclayburn@yuroktribe.nsn.us	707-482-1350 ext. 1309	PO Box 1027 Klamath, CA 95548	State Water Resources Control Board's AB52 Consultation Impacts and Mitigation Measures for the Lower Klamath Project (FERC No. 14803).	
December 4, 2018	Letter from Dennis Griffin (State Archaeologist), Oregon SHPO to Mark Bransom, KRRC Executive Director	OR SHPO (OR State Archaeologist)					SHPO Case No. 17-1370, FERC 14803, KRRC Lower Klamath Project, Removal of dams Oregon and California, Multiple locations, Klamath County: comments and questions regarding proposed revised APE	
December 4, 2018	Email from Kirk Ranzetta (AECOM) to BOR	BOR					Request from KRRC to BOR to participate in Section 106 consultation.	
December 4, 2018	Email from Lisa Vehmas (U.S. Bureau of Reclamation) to Kirk Ranzetta (AECOM)	BOR					Response to email: BOR confirms that "we don't think we need to be involved, but am looping in Stacey Leigh who is the regional Cultural Resources lead now. Also cc'd is Joe Giliberti, Reclamation's Federal Preservation Officer".	
December 13, 2018	Letter from Tracy Schwartz, Oregon SHPO, to Mark Bransom, KRRC Executive Director	OR SHPO (OR State Archaeologist)					SHPO Case No. 17-1370, FERC 14803, KRRC Lower Klamath Project, Removal of dams Oregon and California, Multiple locations, Klamath County: Oregon SHPO concurs that Ape for above-ground architectural resources is sufficient for the scope and scale of undertaking.	
December 5, 2018	Meeting with Shasta Indian Nation/Sami Jo Difuntorum	Shasta Indian Nation	See Table 2 for a List of Tribal Contacts				Monitoring Plan and IDP, Representation, CRWG Meeting Notes, Upcoming Meetings.	
December 21, 2018	Letter from Julianne Polanco, CA SHPO, to Mark Bransom, KRRC Executive Director	CA SHPO					As part of Section 106 Consultation, CA SHPO provided comments on Revised Area of Potential Effect, Lower Klamath Project (FERC No. 14803) Siskiyou County, CA. CA SHPO agreed that APE as defined was appropriate per 36 CFR 800.4(a)(1) and stated that based on information discovered during consultation, the APE may need to be revised accordingly. [In reply refer to: FERC_2018_0507_001]	
February 19, 2019	CRWG Meeting	CA SHPO, OR SHPO, Karuk Tribe, Shasta Indian Nation, Shasta Nation, Quartz Valley	See Table 2 for a List of Tribal Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribal Contacts	See Table 2 for a List of Tribale Contacts	Topics discussed: proposed Section 106 timeline, November 2018 meeting minutes and action item review, phase II study plan general research methods, general field methods, inadvertent discovery plan, SHPO meetings and action items.	
April 1, 2019	Lower Klamath Project Phase II Archaeological Research Design and Testing Plan, Non-redacted Administrative Draft – Confidential, Consultation						Report prepared for KRRC by AECOM with environmental context, cultural context, research design, general research methods, site-specific research methods, and resource evaluation.	
April 3, 2019	Yurok Tribe and KRRC Tribal Consultation	Yurok Tribe	Rosie Clayburn - Tribal Heritage Preservation Officer	rclayburn@yuroktribe.nsn.us	707-482-1350 ext. 1309	PO Box 1027 Klamath, CA 95548	Topics discussed: Phase II Study Plan, IDP, PA Update, SHPO Meeting – Riverscape concept, NAHC Meeting, Tribal Caucus and CRWG meeting facilitator, April 24, 2019 Project Tour, April 25, 2019 Tribal Caucus and CRWG Meeting, General Comments on Tribal Consultation, CRWG and Caucus, Next Steps/Review Action Items	
April 4, 2019	Shasta Nation and KRRC Tribal Consultation	Shasta Nation	Roy Hall Jr. - Chief	shastanation@hotmail.com	530-468-2314	P.O. Box 1054, Yreka, CA 96097	Topics discussed: Phase II Study Plan, IDP, PA Update, SHPO Meeting – Riverscape concept, Tribal Caucus and CRWG meeting facilitator, April 24, 2019 Project Tour, April 25, 2019 Tribal Caucus and CRWG Meeting, General Comments on Tribal Consultation, CRWG and Caucus, Next Steps/Review Action Items	
April 5, 2019	Shasta Indian Nation and KRRC Tribal Consultation	Shasta Indian Nation	Janice Crowe - Chairwoman	Twocrowes63@att.net	530-244-2742	19349 Kinene Court, Redding, CA 96003	Topics discussed: Phase II Study Plan, IDP, PA Update, SHPO Meeting – Riverscape concept, Tribal Caucus and CRWG meeting facilitator, April 24, 2019 Project Tour, April 25, 2019 Tribal Caucus and CRWG Meeting, General Comments on Tribal Consultation, CRWG and Caucus, Next Steps/Review Action Items	
April 23, 2019	Tribal Caucus Meeting	Karuk Tribe, Shasta Nation, Yurok Tribe, Quartz Valley Indian Reservation, Shasta Indian Nation, Klamath Tribe			See Table 2 for a List of Tribal Contacts		The Tribal Caucus again convened to discuss aspects of the project that are of mutual interest to the member Tribes, and in response to KRRC's earlier request for their assistance in developing and refining an Inadvertent Discovery Plan and Monitoring Plan for the project. During past Tribal Caucus discussions, members have also expressed the importance of developing a Looting and Vandalism Prevention Plan to help protect Tribal resources and artifacts over the course of the project and beyond.	
April 24, 2019	Lower Klamath Project Area Tour	BLM, USFS, CA SHPO, OR SHPO, Karuk Tribe, Klamath Tribe, Shasta Indian Nation, Shasta Nation, Siletz Tribe, Quartz Valley, Yurok Tribe					Tour of Project Area	
April 25, 2019	CRWG Meeting	BLM, USFS, CA SHPO, OR SHPO, Karuk Tribe, Klamath Tribe, Shasta Indian Nation, Shasta Nation, Siletz Tribe, Quartz Valley, Yurok Tribe	See Table 2 for a List of Tribal Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribal Contacts	See Table 2 for a List of Tribale Contacts	Topics discussed: Lower Klamath Project Area Tour site visit summary, Tribal Caucus update, project update, schedule update, Phase II Study Plan update, monitoring and inadvertent discovery plan, Shasta Nation presentation, and action items.	
June 12, 2019	CRWG Meeting	BLM, OR SHPO, Klamath Tribe, Shasta Indian Nation, Shasta Nation, Quartz Valley, Yurok Tribe	See Table 2 for a List of Tribal Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribal Contacts	See Table 2 for a List of Tribale Contacts	Topics discussed: Tribal Caucus summary, project update, recreation plan update, cultural resources plan update and Section 106 outreach, action items.	
June 12, 2019	Tribal Caucus Meeting	Shasta Nation, Yurok Tribe, Shasta Indian Nation, Klamath Tribe	See Table 2 for a List of Tribal Contacts				Topics discussed: Tribal Caucus summary, project update, recreation plan, draft monitoring and inadvertent discovery plan, looting and vandalism prevention program, action items.	
June 25, 2019	Notice of Teleconference for Tribal Consultation Meeting by Kimberly D. Bose, FERC Secretary	FERC, Yurok Tribe	Rosie Clayburn - Tribal Heritage Preservation Officer	rclayburn@yuroktribe.nsn.us	707-482-1350 ext. 1309	PO Box 1027 Klamath, CA 95548	Teleconference July 9, 2019 from 1 pm to 3 pm EST. Purpose of meeting: FERC staff to meet with representatives of Yurok Tribe to discuss application to transfer the Lower Klamath Project No. 14803, consisting of the J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate developments, to the KRRC and eventual removal of the four developments.	
July 9, 2019	Transcript and Errata Sheet	Yurok Tribe	Rosie Clayburn - Tribal Heritage Preservation Officer	rclayburn@yuroktribe.nsn.us	707-482-1350 ext. 1309	PO Box 1027 Klamath, CA 95548	Teleconference with Yurok Tribe to discuss PacifiCorp and the Klamath River Renewal Corporation's application. Docket Nos. P-2082-062 and P-14803-000, Federal Energy Regulatory Commission, 888 First Street, NE, Washington, D.C.	

July 30, 2019	Tribal Caucus Meeting	Shasta Nation, Yurok Tribe, Shasta Indian Nation, Karuk Tribe	See Table 2 for a List of Tribal Contacts				Topics discussed: draft monitoring and inadvertent discovery plan, phase II study plan, recreation plan, looting and vandalism prevention plan, documentation of existing project facilities.	
July 30, 2019	CRWG Meeting	BLM, USFS, CA SHPO, OR SHPO, Karuk Tribe, Shasta Indian Nation, Shasta Nation, Yurok Tribe	See Table 2 for a List of Tribal Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribal Contacts	See Table 2 for a List of Tribale Contacts	Topics discussed: Continued consultation between cultural resources stakeholders with KRRC and AECOM. Meeting focused on continuing discussion of Phase II Study Plan and providing an overview of the Monitoring and Inadvertent Discovery Plan (MIDP). Meeting also included Tribal Caucus Update and Built Environment Update.	
September 5, 2019	Tribal Caucus Meeting	Shasta Nation, Klamath Tribe, Yurok Tribe, Shasta Indian Nation, Karuk Tribe, Quartz Valley Tribe	See Table 2 for a List of Tribal Contacts				Topics discussed: draft monitoring and inadvertent discovery plan, phase II study plan, recreation plan, looting and vandalism prevention plan, documentation of existing project facilities.	
September 5, 2019	CRWG Meeting	BLM, USFS, CA SHPO, OR SHPO, Karuk Tribe, Klamath Tribe, Shasta Indian Nation, Shasta Nation, Yurok Tribe	See Table 2 for a List of Tribal Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribal Contacts	See Table 2 for a List of Tribale Contacts	Topics discussed: MIDP, the Phase II Evaluation Program, the Fall Creek Hatchery improvements plan, and language included in the upcoming draft Programmatic Agreement (PA).	
October 14, 2019	Yurok Tribe Meeting - Phase II Plan	Yurok Tribe	See Table 2 for a List of Tribal Contacts				Topics discussed: regulatory requirements and actions to date, downscaled Phase II Plan, Tribe's concerns, cultural resources regulatory compliance effort, including license transfer, Section 106 requirements for KRRC and SHPO requirements.	
October 14, 2019	Shasta Indian Nation Meeting - Phase II Plan	Shasta Indian Nation	See Table 2 for a List of Tribal Contacts				Topics discussed: regulatory requirements and actions to date, downscaled Phase II Plan, Tribe's concerns, cultural resources regulatory compliance effort, including license transfer, Section 106 requirements for KRRC and SHPO requirements.	
October 15, 2019	Quartz Valley Tribe Meeting - Phase II Plan	Quartz Valley Tribe	See Table 2 for a List of Tribal Contacts				Topics discussed: regulatory requirements and actions to date, downscaled Phase II Plan, Tribe's concerns, cultural resources regulatory compliance effort, including license transfer, Section 106 requirements for KRRC and SHPO requirements.	
October 29, 2019	CRWG Meeting	BLM, USFS, OR SHPO, Karuk Tribe, Klamath Tribe, Shasta Nation, Quartz Valley, Yurok Tribe	See Table 2 for a List of Tribal Contacts	See Table 2 for a List of Tribale Contacts	See Table 2 for a List of Tribal Contacts	See Table 2 for a List of Tribale Contacts	Topics discussed: Update on MIDP and Phase II Evaluation Program. Introduce draft Looting and Vandalism Prevention Plan. Continue review of Programmatic Agreement. Review of Ethnographic Summaries. Identification of culturally important plants.	
October 30, 2019	Klamath Tribes Meeting - Phase II Plan	Klamath Tribes	See Table 2 for a List of Tribal Contacts				Klamath Tribal Resolution 92-047, phase II Plan	
8/6/2020	Conversation with Perry Chocktoot (Klamath Tribes)	Klamath Tribes	See Table 2 for a List of Tribal Contacts				Topics discussed, as reported by Brian Person (AECOM): ramifications of FERC decision, Phase II implementation plan, arranging teleconference to discussed revised plan, LVPP draft and IDP draft; Klamath Tribe's ancestral territory and potential for collaboratively monitoring of project with members of other Tribes; description of ancestral territory in plan's Section 3.2.1.	
ODEQ NPDES 1200C								
April 22, 2020	Conference Call	ODEQ	Chris Stine/Hydroelectric Specialist ODEQ (others)	Chris.stine@state.or.us			Kick-off call to present project to ODEQ NPDES division.	CAM-KRRP Project Intro. Memo (OR NPDES)
August 12, 2020	Conference Call	ODEQ	Chris Stine/Hydroelectric Specialist Jill Seale Stormwater Specialist	Chris.stine@state.or.us /Jill.SEALE@state.or.us			-Coordination call to present to Jill the project, as she was designated the NPDES 1200C agency contact. - Jill indicated the following 1. OR 1200 does not require analytical, requires visual 2. Do not regulate riparian, river just upland 3. No interest in pursuing TSO	
August 25, 2020	Conference Call	ODEQ	Chris Stine/Hydroelectric Specialist Jill Seale Stormwater Specialist	Chris.stine@state.or.us /Jill.SEALE@state.or.us			Reviewed project actions, including drawdown scenarios and exposed reservoir banks.	
September 8, 2020	Conference Call	ODEQ	Chris Stine/Hydroelectric Specialist Jill Seale Stormwater Specialist	Chris.stine@state.or.us /Jill.SEALE@state.or.us			Reviewed requirements of the 401 ESCP versus the 1200C 401.	
September 24, 2020	Conference Call	ODEQ	Chris Stine/Hydroelectric Specialist Jill Seale Stormwater Specialist	Chris.stine@state.or.us /Jill.SEALE@state.or.us			Follow-up call from 9/8/2020 on outstanding items of requirements.	
ODFW Fish Passage Approval								
September 4, 2020	Oregon Fish Passage Permit	ODFW					Call to discuss fish passage plan requirements for JC Boyle dam and reservoir footprint. From this call we learned that there is no formal application for submitting a fish passage plan. However, ODFW acknowledged that KRRC's design team has worked closely with ODFW throughout the restoration design process, so most of the materials are complete and just need to be packaged. Moving forward, RES will compile the materials needed to meet the administrative rules for fish passage design criteria that are called out in statute OAR 635-412-0005.	
ODOT Encroachment Permit								
July 15, 2020	phone meeting and email follow-up	ODOT	Julee Scruggs	julee.y.scruggs@odot.state.or.us	541-864-8811		approach to Hwy. 66 will be considered general maintenance and will not require a permit. Conceptual design was provided to ODOT to confirm.	
October 2, 2020	email consultation	ODOT	Julee Scruggs	julee.y.scruggs@odot.state.or.us	541-864-8811		A second approach to Hwy. 66 will also be considered general maintenance and will not require a permit. Conceptual design was provided to ODOT to confirm.	
ODSL Removal Fill								
June 15, 2020	Conference Call	ODSL	Bethany Harrington/Aquatic Resource Coordinator	bethany.harrington@state.or.us	Desk: 541-388-6142		○ Wetland delineation: - DSL can commit to a 60-day review timeline. - There are no specific requirements we would like to discuss prior to submittal however, it would be most helpful to turn in the completed delineation as soon as possible. Once this occurs, the applicant will get an email from DSL requiring a fee. It is important the fee is paid right away as the review cannot start without the fee having been processed. It will also be critical for the applicant to respond right away to questions/clarifications needed by DSL. □ ○ Compensatory mitigation: -Compensatory wetland mitigation will be needed for isolated wetlands and "canal wetlands" impacted by spoils or equipment. This can be in the form of permittee responsible mitigation or Payment-In-Lieu if the impacts are less than 0.2 acres. If permittee responsible mitigation is chosen, we are willing to discuss waiving the deed restriction requirement for this project. ○ Functions and values assessment (FVA): ○ Isolated and "canal" wetlands will need a traditional FVA using the Oregon Rapid Wetland Assessment Protocol (ORWAP). ○ No FVA required for areas other than isolated and "canal wetlands". □ ○ Design Criteria: - DSL can permit with a 60% design and then modify the design after permitted when the 90% designs are complete in areas other than isolated and "canal" wetlands. - For isolated wetlands and "canal" wetlands the design submitted must show the accurate extent of wetland impacts. ○ Permit Duration: - DSL is limited to a five-year permit by administrative rule. ○ Fees: -A wetland delineation fee will be required. -An application fee for the impacts to the isolated and "canal wetlands" will be required when an actual application is submitted and goes through the full permit process at a later date.	

August 12, 2020	Conference Call & Followup Email	ODSL	Bethany Harrington/Aquatic Resource Coordinator Lynne McCallister/Jurisdiction Coordinator,	bethany.harrington@state.or.us lynne.mcallister@state.or.us	541-388-6145/503-986-5300		ODSL provided comments on conference call: - cut and paste your content into sections labeled per our report format and then add information and report sections where needed to meet OAR requirements. - remove all report sections, maps, and table sections pertaining to reservoirs in California, so the report will be only for the JC Boyle Dam project area. - there is missing OHW and reservoir mapping within the study area. We discussed changing the study area to omit features that weren't delineated, but it didn't seem realistic to do that. We came to the resolution that you would map OHW and normal operating pool from air photos, LiDAR, and other imagery as appropriate and then provide separate accuracy estimates for the different mapping methods (include in the report mapping section and in the map accuracy statement). Sam indicated that you already have OHW mapped from aerials and normal operating pool from bathymetry that can be used, so this should minimize additional effort on this task. - provided guidance for depicting a large study area with multiple map sets at different scales and what I need to be able to see and interpret from the maps at each scale (index map, large scale of whole study area, small scale maps only where you mapped a feature, sampled a plot, ground photo). The minimum map scale for detailed delineation maps is discretionary depending on the shape and size of the study area and mapped features. All areas should be realistically depicted and legible when all labeling and symbology is included, and unmapped areas should be large enough in 2-dimension to show uplands. Any magnified insets should include a scale bar. I misspoke on the minimum scale. OAR states that for most study areas 1"=100' is appropriate, and 1"=250' may be sufficient for large study areas. A scale of 1"=400' may be more appropriate for your index map, but I would likely also accept a slightly smaller scale than that for the index. - You stated that you had delineated everything within the study area except OHW and normal operating pool. I explained that you can change your study area boundary if necessary to omit any features that were not delineated, but only the study area will receive concurrence (as an option if you discover you need to do that).	
October 7, 2020	Conference Call	USACE	Benny Dean/Regulatory Project Manager	Benny.A.Dean@usace.army.mil	541.465.6769		Camas confirmed that USACE Portland District will rely on the SF USACE 404 permit instead of evaluating the JPA conducted with ODSL.	
October 12, 2020	Conference Call	ODSL	Bethany Harrington/Aquatic Resource Coordinator Lynne McCallister/Jurisdiction Coordinator,	bethany.harrington@state.or.us lynne.mcallister@state.or.us			- Purpose of call was to determine what ODSL needed in order for the exisiting wetland report to meet ODSL's requirements. Below are summary notes from ODSL follow-up email: •To minimize time revising the delineation report, feel free to cut and paste your content into sections labeled per our report format and then add information and report sections where needed to meet OAR requirements. I referred you to division 90 OAR, the required report format, the report checklist, and the large/linear project guidance (see links below). •You agreed to remove all report sections, maps, and table sections pertaining to reservoirs in California, so the report will be only for the JC Boyle Dam project area. •There is missing OHW and reservoir mapping within the study area. We discussed changing the study area to omit features that weren't delineated, but it didn't seem realistic to do that. We came to the resolution that you would map OHW and normal operating pool from air photos, LiDAR, and other imagery as appropriate and then provide separate accuracy estimates for the different mapping methods (include in the report mapping section and in the map accuracy statement). Sam indicated that you already have OHW mapped from aerials and normal operating pool from bathymetry that can be used, so this should minimize additional effort on this task. •I provided guidance for depicting a large study area with multiple map sets at different scales and what I need to be able to see and interpret from the maps at each scale (index map, large scale of whole study area, small scale maps only where you mapped a feature, sampled a plot, ground photo). The minimum map scale for detailed delineation maps is discretionary depending on the shape and size of the study area and mapped features. All areas should be realistically depicted and legible when all labeling and symbology is included, and unmapped areas should be large enough in 2-dimension to show uplands. Any magnified insets should include a scale bar. I misspoke on the minimum scale. OAR states that for most study areas 1"=100' is appropriate, and 1"=250' may be sufficient for large study areas. A scale of 1"=400' may be more appropriate for your index map, but I would likely also accept a slightly smaller scale than that for the index. •You stated that you had delineated everything within the study area except OHW and normal operating pool. I explained that you can change your study area boundary if necessary to omit any features that were not delineated, but only the study area will receive concurrence (as an option if you discover you need to do that).	
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RWQCB CA Section 402 NPDES (General Construction Permit) Dam Removal								
April 21, 2020	CA NPDES Kick Off	CA SWB, NC RWQCB	See Notes.				Project Introduction	CAM-KRRP Project Intro. Memo (CA NPDES)
April 28, 2020	Kick-off meeting with NCWQCB	NC RWQCB						Camas OneNote
May 12, 2020	Kick-off meeting with NCWQCB	NC RWQCB						CAM-CA NPDES Consultation Rec 20200512.pdf
July 28, 2020	State and Regional meeting	CA SWB, NC RWQCB						Camas OneNote
August 4, 2020	meeting	CA SWB, NC RWQCB						Camas OneNote
August 11, 2020	CA NPDES Coordination Call	CA SWB, NC RWQCB	See Notes.				Project Overview, Applicant status, Jurisdictional boundaries, schedule	CAM-CA NPDES Con. R - 20200811.pdf
August 19, 2020	Charter Team Meeting	CA SWB, NC RWQCB	See Notes.				Kiewit Schedule overview, TSO/401 alignment, roles and responsibilities	CAM-CA NPDES Con. R - 20200819.pdf
September 2, 2020	Charter Team Meeting	CA SWB, NC RWQCB	See Notes.				Permit redundancy, TSO development, SWPPP overview, Monitoring/BMPs.	CAM-CA NPDES Con. R - 20200902.pdf
September 9, 2020	Charter Team Meeting	CA SWB, NC RWQCB	See Notes.				Bioassessment requirements	CAM-CA NPDES Con. R - 20200909.pdf
September 16, 2020	Charter Team Meeting	CA SWB, NC RWQCB	See Notes.				SWPPP Logistics, NC Basin Plan requirements	CAM-CA NPDES Con. R - 20200916.pdf
September 22, 2020	Charter Team Meeting	CA SWB, NC RWQCB	See Notes.				High level Project overview	CAM-CA NPDES Con. R - 20200922.pdf
September 30, 2020	Charter Team Meeting	CA SWB, NC RWQCB	See Notes.				High level Kiewit site activities overview	CAM-CA NPDES Con. R - 20200930.pdf
October 21, 2020	Charter Team Meeting	CA SWB, NC RWQCB	See Notes.				high-level presentation of RES's restoration plans by D. Coffman and K. Williams	CAM-CA NPDES Con. R - 20201021.pdf
October 28, 2020	401/CGP Crossover Mtg	CA SWB, NC RWQCB	See Notes.				discussion of how CGP and 401 overlap, and how TSO modifies CGP	CAM-CA NPDES Con. R - 20201028.pdf
Siskiyou County Encroachment Permit								
October 8, 2020	On-site Meeting	Siskiyou County Public Works	Tim Bynum/Encroachment Officer/ Safety Officer Scott Waite/Siskiyou Director of Transportation	tbynum@co.siskiyou.ca.us/swaite@co.siskiyou.ca.us			On-site review of project and permit expectations.	

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Appendix C: Geological and Soil Resources

1. GEOLOGICAL AND SOIL RESOURCES

J.C. Boyle Reservoir

The reservoir's wide and shallow upstream reach includes a formerly low-gradient valley that transitions to a deep and narrow stretch as the river incises into a bedrock canyon. The bedrock surrounding and underlying J.C. Boyle Reservoir is principally composed of moderately well-bedded to massive, moderately well-consolidated sedimentary rocks interfingered with volcanic material. Common lithologies include resistant basalt and basaltic andesite and less resistant volcaniclastic deposits (SWRCB 2018 and DOI 2012). Spencer Creek flows into the reservoir along the right bank at the upstream end.

J.C. Boyle Peaking Reach

This reach includes the bypass reach below the J.C. Boyle Dam and the peaking reach below the powerhouse. The bypass reach's gradient averages 1.4 percent to 2.3 percent. Substrates within the reach include boulder and bedrock cascades with intermittent pools and boulders, to large cobble riffles, runs, and pools. The peaking reach's gradient ranges from 0.3 percent to 2 percent. Substrates within the reach include cobble riffles and runs with intermittent pools and gravel bars, stepped terraces related to lacustrine deposits, and bedrock and boulders in higher gradient areas. Lower gradient areas include substrates of small cobble/gravel and alternating riffles, runs, and pools. The reach includes a broad terrace floodplain as well as areas of lateral bars and islands. Shovel Creek enters the Klamath River at RM 211.1 (SWRCB 2018).

Copco 1 Reservoir

The Copco 1 Reservoir is at a topographic transition area on the Klamath River, such that approximately 80 percent of the reservoir occupies a formerly lower gradient reach of the river. This break in stream gradient is largely the result of cinder cones and associated lava flows at the downstream portion of the reservoir (FERC 2007). Surficial deposits around Copco No.1 Reservoir include talus and rockfall debris, colluvium, alluvium and alluvial fans associated with tributary drainages, and older (likely Quaternary) fluvio-lacustrine terrace deposits. Fluvio-lacustrine terrace deposits surround much of the reservoir shoreline, extending to approximately 40 feet above the current reservoir level. These deposits consist of diatomite, fine-grained diatomaceous sediment and dense, coarse-grained alluvial deposits. Lacustrine diatomite deposits also exist below the current range of reservoir levels and appear as prominent benches in the bathymetry. Several streams enter Copco 1 Reservoir, including Long Prairie Creek, Beaver Creek, Deer Creek, and Raymond Gulch. Sediment depositions and/or delta formations are present at the mouths of the larger streams in the reservoir (SWRCB 2020).

Copco 2 Reservoir

Copco No. 2 Reservoir is a short impoundment (just over 0.25 mile) that lies immediately downstream of Copco No. 1 Dam. The narrow reservoir inundates a confined river valley deeply incised into the same young lava flows and associated volcanic rocks described above for the downstream portion of Copco No. 1 Reservoir (SWRCB 2020).

Copco 2 Bypass Reach

Downstream from Copco 2 Dam, the Copco 2 Bypass Reach is characterized by a confined, boulder-and bedrock-dominated channel. The average gradient of the reach is about 1.9 percent with minimal floodplain area. Fossilized boulder-cobble bars dominate the channel cross section with bedrock ledges also within the reach. Near the end of the reach, the Copco 2 Powerhouse discharges water into the Klamath River (DOI 2012).

Iron Gate Reservoir and Tributaries

Iron Gate Reservoir overlies a topographic transition on the Klamath River, where a steeper reach of river upstream transitions into the lower gradient reach downstream from Iron Gate Reservoir. Downstream of Iron Gate Reservoir, the topography widens, and the channel is less restricted by the localized basalt lava flow (FERC 2007). The reservoir has relatively steep side-slopes and a narrow channel with numerous side drainages. Tributaries entering from the north include the Fall, Jenny, Dutch, Camp, and Scotch creeks. Of these tributaries, Camp Creek and Jenny Creek supply the most sediment to the reservoir (SWRCB 2020).

Iron Gate Dam to Hilt Mine

Downstream from Iron Gate Dam consists of a narrow floodplain and terraces confined by bedrock hills of the Western Cascade volcanic deposits and sedimentary rocks of the Cretaceous Hornbrook Formation. The channel is mostly single thread with a few areas of split flow that form mid-channel cobble-boulder bars and side channels of short length. Most of the bars are at least partially vegetated, leaving few areas of exposed bars in the reach. Main tributaries that enter this reach include the Brush, Bogus, Little Bogus, Willow, and Cottonwood creeks. Except for Cottonwood Creek, these tributaries form relatively small alluvial fans at their confluences with the Klamath River. Cottonwood Creek forms a large alluvial fan at its confluence with the river (DOI 2012).

Hilt Mine to Indian Girl Mine

The Klamath River channel in this reach becomes more bedrock-dominated and confined within a narrow canyon. Alluvial bars are limited to the vicinity of the larger tributary confluences, such Williams Creek near RM 179 and the Shasta River near RM 177. The Shasta River is a source of fine gravel, sand, and finer sediment. However, the lack of substantial sedimentation in the vicinity of its confluence with the Klamath River suggests the Shasta River supplies little coarse sediment (Ayres Associates 1999, as cited in SWRCB 2020). The only other notable tributary in the reach is Ash Creek, which forms a fan of negligible size at its confluence with the Klamath River. Other notable features in this reach are associated with in-stream mining, including cobble-boulder benches and bars and a few wing-dam pits (Reclamation 2012, as cited in DOI 2012).

Indian Girl Mine to Scott River

From Indian Girl Mine, the river valley broadens slightly within the canyon and allows for the preservation of broad gravelly terraces that have been extensively mined. In areas not obscured by mining, overflow channels are present on the terrace surfaces. Unvegetated bars are more prevalent in this reach and exist as point bars along the inside bends of channel meanders as well as mid-channel bar and side channel complexes. The channel maintains a mostly single thread meandering morphology with some areas of split flow around mid-channel bars.

From Miller Gulch (RM 163.8) to Horse Creek (near RM 149.7), the river valley broadens again to include terraces with at least two levels and gravel bars. A narrow section exists in this reach from between RM 154 and RM 150 and is confined by bedrock on both sides of the river and by the Kohl Creek alluvial fan near

RM 152. From RM 150 to Horse Creek, the river valley widens with a large remnant stream channel in the Cherry Flat area that has been extensively placer mined (DOI 2012).

From Horse Creek to Scott River (RM 149.6), the river valley narrows and is confined by bedrock on both sides of the river. Terraces and bars are restricted to the insides of meander bends. Several small tributaries enter in this reach, forming steep alluvial fans at the confluence with the Klamath River, some of which have narrow terraces cut on their front edges. Channel morphology is single thread with a few small, unvegetated, mid-channel bars and point bars (Reclamation 2012, as cited in DOI 2012).

Scott River to China Point

The Scott River is a major source of gravel and finer sediment to the Klamath River (Ayres Associates 1999, as cite in SWRCB 2020). Downstream from Scott River from RM 145.1 to 133.8, the extent and height of unvegetated gravel bars increases and bars become more prevalent with discontinuous narrow alluvial terraces forming along the canyon margins. Large alluvial fans control river position from RM 145.1 to 133.8 along the south side of the river. At Seiad Valley, large alluvial fans from the Seiad, Little Grider, and Grider creeks form a wider alluvial valley in which terraces are cut on the front edges of the fans and large bars and riffles are formed along the river channel as a result of tributary sediment contributions (DOI 2012).

Extensive placer mining has occurred on floodplains and terraces within the Seiad Valley area.
From RM 131.4 to 123.3, the Klamath River flows through a winding bedrock canyon with unvegetated bars located on the insides of meander bends. Valley terraces and bedrock-cored bars are prevalent in this reach. From RM 121.5 to China Point, the canyon narrows as it enters bedrock of the Jurassic Galice Formation. Bedrock benches form along the channel margins. At China Point, an extensive, unvegetated gravel bar lies on the inside of the bend along with a higher alluvial terrace. On the south side of the river, a remnant channel is elevated above the present channel. Tributaries that contribute sediment to the river in this reach include Thompson, Fort Goff, Portuguese, Grider, Walker, O'Neil, and Macks creeks (DOI 2012 and SWRCB 2020).

China Point to Trinity River

From China Point to Deason Flat (RM 119.8-106), the channel is narrow with numerous valley terraces that have been extensively mined. Well-developed bars and riffles are formed at tributary confluences and meander bends. The lower 3 miles of this reach (RM 107-104) contain a greater number of unvegetated bars, which are formed by sediment inputs from the Elk and Indian creeks and channel constrictions downstream from RM 104. Tributaries in this reach contain large landslides, with Indian Creek watershed containing the most of any tributary (DOI 2012 and SWRCB 2020).
From Deason Flat to Dutch Creek (RM 106-93), the river flows through a narrow bedrock canyon with low bedrock benches and gravelly veneers. Wider sections interspersed in this reach have small valley terraces that have been extensively mined and unvegetated gravel bars. This reach also contains notable landslides along the main stem, the largest of which is on the west side of the river between RM 98.5 and RM 93. Independence and Clear creeks contribute large amounts of sediment to the river in this reach (DOI 2012 and SWRCB 2020).

From Dutch Creek to Trinity River (RM 93-43.3), the river is contained in a narrow bedrock canyon with intermittent alluvial reaches. This reach includes the wider alluvial valley at Orleans (RM 58.5). Geomorphic features include valley terrace and bars, alluvial terraces and bars, bedrock benches and alluvial fans. Numerous landslides lie along the river and interact with the river through sediment contributions and controlling channel position. This reach is the downstream limit of channel mining on the Klamath River.

Tributaries that are major contributors of sediment include Salmon River, Trinity River, Bluff Creek, Camp Creek and Ukonom Creek (DOI 2012 and SWRCB 2020).

Trinity River to Klamath River Estuary

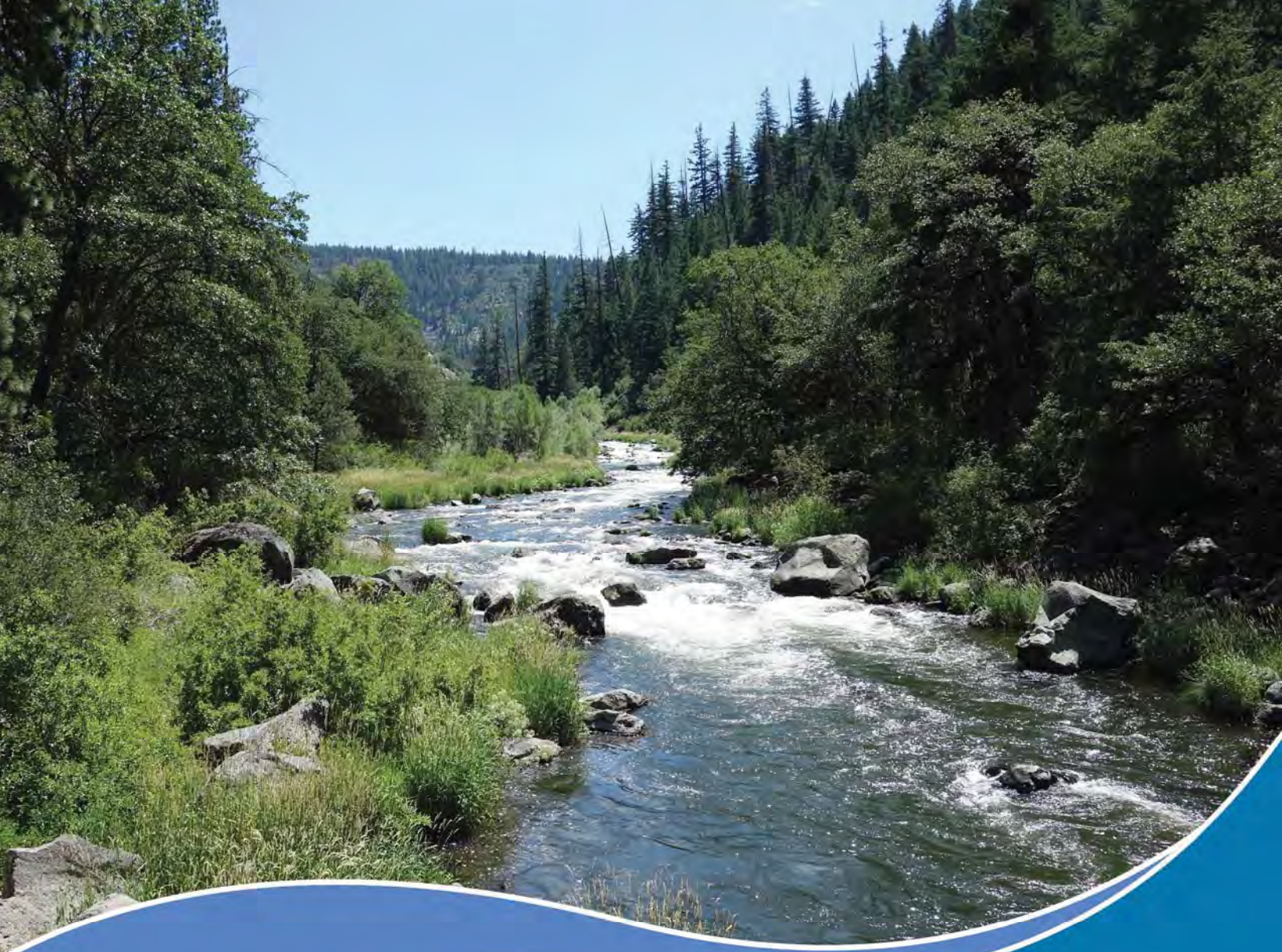
From Trinity River to Cappell Flat (RM 43.3-33), a narrow bedrock canyon with few bars and no floodplain or terraces exists. Landslides and alluvial fans are less common, but locations still exist where these features have temporarily dammed the river based on remnant boulders in the channel and deposits on opposite banks (DOI 2012). The Trinity River is a major source of sediment (Ayres Associates 1999, as cited in SWRCB 2020).

From Cappell Flat to Starwein Flat (RM 33-10), the river flows through a narrow, confined valley with minimal floodplain and terraces. Bars are well developed and are either alternate bars formed in straighter reaches or point bars formed at meander bends. The extent of the bars increases in the downstream direction. Tributaries create split flow channels, mid-channel bars and riffles at their confluences with the main stem. Major sediment contributors include Blue, Pecwan, Cappell, Bear, and Tectah creeks.

From Starwein Flat to the mouth (RM 10-0), the Klamath River transitions into a wide valley with floodplain surfaces and narrow terrace remnants. Well-developed bars of variable height lie along the reach and several large pools and few riffles are present. Turwar Creek is the only major sediment producer in this reach, contributing mostly fine materials to the Klamath River (Reclamation 2012, as cited in DOI 2012). The lower 7 miles of the Klamath River are relatively narrow and confined, typically between 650- and 800-feet-wide, with steeper gradient than in upstream reaches. The channel is approximately 1,600-feet-wide at large bends and in areas with active erosion and channel migration (SWRCB 2020).

The mouth of the river is characterized by a delta with a large barrier bar parallel to the coastline. Landward of the barrier bar is a shallow estuary approximately 2,500-feet-long by less than 1,000-feet-wide. The Klamath River through the estuary is highly dynamic, changing positions during large flood events and transporting most of its suspended sediment load out to the ocean. The relatively small size of the estuary is maintained by ongoing deposition of medium grained sand and silty sand (USBR 2010a, as cited in SWRCB 2020).

Appendix D: KRRC Technical Reports



Klamath River Renewal Project

2018 Annual Terrestrial Resources Survey Report

April 2019

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RIVER RENEWAL
CORPORATION

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Acronyms and Abbreviations

BLM	Bureau of Land Management
Cal-IPC	California Invasive Plant Council
CDFA	California Department of Food and Agriculture
CDFW	California Department of Fish and Wildlife
CE	California Endangered
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
COTO	*Corynorhinus townsendii* (Townsend's big-eared bat)
EIS/EIR	Environmental Impact Statement/Environmental Impact Report
°F	degrees Fahrenheit
FE	Federal Endangered
FSC	Federal Species of Concern
GNR	Global not reported
GPS	Global Positioning System
IEV	invasive exotic vegetation
IPaC	USFWS Information for Planning and Consultation database
KCBC	Klamath County Board of Commissioners
KNF	Klamath National Forest
KRRC	Klamath River Renewal Corporation
MYYU	*Myotis yumanensis* (Yuma myotis)
NMFS	National Marine Fisheries Service
NRCS	Natural Resources Conservation Service
NSO	Northern Spotted Owl
OC	Candidate listing by Oregon Department of Agriculture
ODA	Oregon Department of Agriculture
ODFW	Oregon Department of Fish and Wildlife
ONHP	Oregon Natural Heritage Program
ORBIC	Oregon Biodiversity Information Center
Project	Klamath River Renewal Project
SDA	Siskiyou Department of Agriculture
SNR	State not reported
USBR	United States Bureau of Reclamation
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service

Chapter 1 Introduction

1. INTRODUCTION

This report summarizes the terrestrial resources surveys conducted in 2018 for the Klamath River Renewal Project (Project). The Klamath River Renewal Corporation (KRRC) and its consultants carried out field investigations to collect existing condition information on the following terrestrial resources:

- Special-status wildlife
- Northern spotted owl
- Bald and golden eagles
- Bats
- Western pond turtle
- Special-status plants
- Vegetation communities
- Invasive exotic vegetation

1.1 Purpose of the Terrestrial Resources Surveys

The KRRC and project stakeholders require information on the existing condition of terrestrial resources to inform the ongoing Project design and regulatory permit processes, as described in previous studies and regulatory compliance documents, including the 2012 Environmental Impact Statement/Environmental Impact Report (EIS/EIR) (USBR and CDFW 2012) and the Joint Preliminary Biological Opinion (NMFS and USFWS 2012). As described in the Definite Plan, Appendix J (KRRC 2018), the KRRC has incorporated terrestrial resources surveys and avoidance and minimization measures into the Project as Terrestrial Resources Measures. These measures include the 2018 surveys described in this annual report. This report provides the findings of the surveys, along with conclusions based on an analysis of the information collected with regard to its suitability for informing the design and meeting regulatory requirements.

1.2 Study Area

This report describes the methods followed during field investigations for each resource listed above, which were based on survey work plans developed in close coordination with federal and state resource agencies, including the United States Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife (CDFW), and Oregon Department of Fish and Wildlife (ODFW). Unless otherwise noted, surveys were conducted by KRRC biologists within a specific buffer around the limits of work (hereinafter referred to as study areas) for each resource. The KRRC developed these study areas in cooperation with the resource agencies listed above during development of the survey work plans (Appendix J of the Definite Plan [KRRC 2018]). Each of the following sections of this report focuses on a different terrestrial resource; the study area for each resource is described in the corresponding section. The limits of work (or Project area) include the dams and structures to be removed, the disposal sites, the haul and access roads that may undergo improvements, and the reservoirs, and are defined in the Definite Plan (KRRC 2018). The limits of work represent the physical extent of on-the-ground construction activities, including demolition, removal, and

restoration activities proposed as a part of this Project, as well as the extent of the J.C. Boyle Reservoir, Iron Gate Reservoir, and Copco Lake (see Figure 5.1-1 of the Definite Plan [KRRC 2018]). The 0.25-mile buffer shown in the overall Project map (Figure 1-1, Appendix A) represents the study area applied to general wildlife surveys and vegetation community surveys, as detailed in Sections 2 and 8, respectively. Surveys for osprey, northern spotted owl, eagles, and bats used different study areas, which are described in their respective sections and specified in related figures.

Figures cited in the text of this report are provided in Appendix A.

Chapter 2 Special-Status Wildlife

2. SPECIAL-STATUS WILDLIFE

The KRRC identified special-status wildlife species with potential to occur in or near the Project area from a variety of sources. PacifiCorp identified several special-status wildlife species as occurring in or near the Project area (PacifiCorp 2004), and the United States Bureau of Reclamation and CDFW compiled this in the 2012 EIS/EIR (USBR and CDFW 2012). The KRRC also obtained information on the occurrences of special-status wildlife from USFWS, CDFW, ODFW, the Bureau of Land Management (BLM), and the United States Forest Service (USFS) from sources that include the Oregon Biodiversity Information Center (ORBIC), the California Natural Diversity Database (CNDDB), and the USFWS Information for Planning and Consultation (IPaC) database. Special-status wildlife species that were considered during survey planning included those that are federal and/or state threatened, endangered, proposed, or candidate species, California Species of Special Concern, Oregon Natural Heritage Program (ONHP) List 1 and 2 species, and Oregon Sensitive species. BLM and USFS Sensitive Species, Assessment Species, Tracking Species, and Survey and Manage species were also considered, where BLM and USFS lands occur in the study area; however, not all of these species trigger a regulatory concern.

Most of the special-status species are birds; some are year-round residents while others are migratory, using the study area either for nesting or for overwintering. In addition, a small number of special-status invertebrate, amphibian, reptile, and mammal species have the potential to occur in or near the Project area. A comprehensive list of special-status species with potential to occur in or near the Project area is provided in Appendix J of the definite plan (KRRC 2018); this document focuses more narrowly on presenting the results of 2018 field surveys.

The primary objective of the 2018 surveys for special-status wildlife was to collect baseline information on the species using the study area and on the habitats present that have potential to support special-status wildlife. This information is needed to identify potential impacts on species and/or habitats from Project activities, identify federal and state permit requirements, and develop measures needed to avoid or minimize potential impacts on species and habitats. The KRRC applied a 0.25-mile buffer around the Project area to generate the study area for the special -status wildlife surveys. The rationale for this study area is described in more detail in Section 2.1. Based on input from USFWS, CDFW, and ODFW, the KRRC did not conduct focused surveys requiring trapping or other invasive methods, with the exception of surveys for western pond turtle (see Section 6). Rather, field surveys focused on identifying suitable habitats for these species, to determine whether and to what extent suitable habitat exists in the study area and where it may be modified, affected, or destroyed by Project activities.

Northern spotted owls, bald eagles, golden eagles, bats, western pond turtle, and special-status plants are discussed in separate sections of this document.

2.1 Methods

KRRC biologists conducted general wildlife surveys from May 14 through 24 and June 11 through 15, 2018. Biologists established transects to cover the 0.25-mile study area described in Section 1.2. The KRRC developed the 0.25-mile study area in cooperation with the resource agencies during development of the survey work plans, which are provided in Appendix J of the Definite Plan (KRRC 2018). Biologists walked the length of each transect, recording all wildlife observations, including direct visual and auditory observations, scat, and other signs of presence. Field teams recorded wildlife behaviors, particularly breeding activity. In addition to land-based transects, biologists surveyed reservoir shorelines and open water by boat to record observations of aquatic and semi-aquatic species (e.g., western pond turtle, waterfowl, etc.). Biologists noted all special-status species seen or heard, and their approximate number, location, and behavior (e.g., roosting, loafing, foraging, courtship, mating, incubating eggs, or feeding young).

The following special-status species received additional focus:

- Osprey (*Pandion haliaetus*): There are several osprey nest platforms within 0.25 mile of the limits of work that may be removed or disturbed during construction. Biologists surveyed all nest platforms, transmission line towers, and reservoir and river shorelines within a slightly larger 0.75-mile study area for osprey nests.
- Willow flycatcher (*Empidonax traillii*): Because willow flycatcher is a California endangered species, its habitat is protected. Biologists noted and mapped willow flycatcher habitat during wildlife and vegetation surveys.
- Nesting great blue heron (*Ardea herodias*): Nesting bird colonies are protected under California and Oregon state laws. Biologists visually surveyed the study area for great blue heron colonies during wildlife surveys.
- Peregrine falcon (*Falco peregrinus*): Peregrine falcons may use the same nest for multiple years, and these nest sites are protected under state laws. Biologists visually surveyed the study area for nesting peregrine falcon during wildlife surveys.
- Greater sandhill crane (*Grus canadensis tabida*): Sandhill crane is a California threatened species, and nest sites are protected. Biologists visually surveyed the study area for nesting sandhill crane during wildlife surveys.
- Tricolored blackbird (*Agelaius tricolor*): Tricolored blackbird is a California threatened species, and nesting colonies are protected. Biologists visually surveyed the study area for tricolored blackbird colonies during wildlife surveys.

2.2 Findings

Biologists observed a total of 32 special-status wildlife species in the study area during the special-status wildlife surveys conducted in May and June 2018 (Table 2-1). For the purposes of this report, species observations were organized in association with the three Project reservoirs closest to the observation (i.e., if a species was observed in a tributary to the Iron Gate Reservoir, it was grouped with other species observed in the vicinity of the Iron Gate Reservoir). Some species were found at all three reservoirs, while others were only observed at one or two reservoirs. Of the 33 special-status wildlife species observed, there were 3 reptile species, 29 bird species, and 1 mammal species.

Table 2-1: Special-Status Species Observed in the Study Area during 2018 Surveys

Species	Iron Gate Reservoir Area	Copco Lake Area	J.C. Boyle Reservoir Area
Reptiles			
Western Pond Turtle *Actinemys marmorata*	Observed throughout reservoir shorelines; noted in Mirror Cove and near Camp and Jenny Creeks. Observed in Jenny Creek near the Copco Road bridge.	Observed throughout reservoir shorelines, typically within coves.	Observed throughout reservoir shorelines; occurring in higher numbers at the southernmost portion of the reservoir on top of the boom near the dam.
Northern Sagebrush Lizard *Sceloporus graciosus*	Observed throughout the reservoir area. Noted near the fish hatchery, Long Gulch Cove shoreline, Jenny Creek shorelines, and recreational areas.	Observed throughout the reservoir area, particularly on dry, rocky slopes. Noted in rocky areas to the east of Fall Creek.	Observed throughout the reservoir area on dry, rocky slopes. Noted in the dam spillway area.
California Mountain Kingsnake *Lampropeltis zonata*			Observed on a rocky outcrop below the dam.
Birds			
Bufflehead *Bucephala albeola*	Observed throughout reservoir in mixed rafts with other waterfowl.	Observed throughout the reservoir in mixed rafts with other waterfowl.	Observed in the northern portion of reservoir.
Mountain Quail *Oreotyx pictus*		Observed throughout the reservoir area; a large covey was observed just east of Beaver Creek cove.	Observed throughout the reservoir area; noted along the utility line corridor west of the canal and at the Topsy Campground near the Highway 66 bridge.
Vaux's Swift *Chaetura vauxi*			Observed flying over the eastern shore of the reservoir.
Greater Sandhill Crane *Grus canadensis tabida*			Active nest observed on the northwestern shore of reservoir; adults also heard calling from the emergent wetlands along the northeastern shore.
Caspian Tern *Sterna caspia*	Observed throughout the reservoir, flying overhead and foraging.	Observed throughout the reservoir, flying overhead and foraging.	Observed throughout the reservoir, flying overhead and foraging.
Forster's Tern *Sterna forsteri*		Observed throughout the reservoir.	Observed in the southern portions of the reservoir.

Species	Iron Gate Reservoir Area	Copco Lake Area	J.C. Boyle Reservoir Area
Common Loon *Gavia immer*		Observed throughout the reservoir; noted in Keaton Cove.	
Double-crested Cormorant *Phalacrocorax auritus*	Observed throughout the reservoir; noted in Long Gulch Cove, Camp Creek, and on the boom near the dam.	Observed throughout the reservoir; most often flying overhead or foraging/resting in the northern coves.	Observed throughout the reservoir; noted along the northeastern shore, and on the boom near the dam.
American White Pelican *Pelecanus erthorhynchos*	Observed throughout the reservoir; noted in Mirror Cove, Juniper Point, and the upstream extent of the reservoir, as well as on the boom near the dam.	Observed throughout the reservoir; noted near the dam and in Keaton Cove.	Observed throughout the reservoir; noted in the vicinity of the Highway 66 bridge and on the boom near the dam.
Great Blue Heron *Ardea herodias*	Observed throughout the reservoir; noted in Mirror Cove, Jenny Creek, and Bogus Creek.	Observed throughout the reservoir area; noted perching atop the canyon along the Copco Bypass Reach. Active nesting colony observed in the riparian area near the Copco No. 2 penstock.	Observed throughout the reservoir area; noted near Spencer Creek, along the northeastern shore, and near Topsy Campground.
Great Egret *Casmerodius albius*	Observed along the Klamath River immediately downstream of the fish hatchery.	Observed throughout the reservoir area.	
Osprey *Pandion haliaetus*	Observed throughout the reservoir. Several active nests observed on platforms atop utility poles.	Observed throughout the reservoir. Several active nests observed on platforms atop utility poles.	Observed throughout the reservoir. Several active nests observed on platforms atop utility poles.
Golden Eagle *Aquila chrysaetos*	A pair observed along the southern shoreline of the upstream extent of the reservoir.	Observed perched on a slope above the northern shoreline of the reservoir. A pair was also observed near a northern cove; one bathing in the shallow water.	
Northern Harrier *Circus hudsonius*	Observed along the northern shoreline in the northeast portion of the reservoir and just downstream of the dam.		
Cooper's Hawk *Accipiter cooperii*	Observed along the northern shoreline of the reservoir. A potential nest was observed near the confluence of Camp and Dutch Creek.	Observed throughout the reservoir area; noted in the forested seep area along the northern shoreline of the reservoir.	Observed throughout the reservoir; noted on the southeastern side of the reservoir in the dense mixed woodlands just north of the dam spillway.
Bald Eagle *Haliaeetus leucocephalus*	Observed throughout the reservoir area; noted flying over Long Gulch Cove, along the southeastern side of reservoir, and near the dam.	Observed throughout the reservoir area; noted flying overhead near Keaton Cove.	Observed throughout the reservoir area; most frequently observed flying overhead or perched in pines in the vicinity of the Highway 66 bridge.
Lewis Woodpecker *Melanerpes lewis*	Observed throughout the reservoir area; noted at the fish hatchery.	Observed throughout the reservoir area; noted along the northern shoreline at Beaver Creek cove.	Observed along the eastern shoreline of the reservoir.

Species	Iron Gate Reservoir Area	Copco Lake Area	J.C. Boyle Reservoir Area
Acorn Woodpecker *Melanerpes formicivorus*	Observed along the eastern shoreline of the reservoir, southwest of Horseshoe Ranch Wildlife Area, and near the fish hatchery.	Observed throughout the reservoir area in relatively dense oak and mixed forests.	
Pileated Woodpecker *Drycopus pileatus*			Observed throughout the reservoir area in densely forested habitats.
American Peregrine Falcon *Falco peregrinus anatum*	An active nest was observed on the northeastern side of the reservoir in a rocky outcrop above Copco Road.		An active nest was reported by BLM on a cliff along the eastern side of the Klamath River Canyon, less than 1 mile southeast of the end of the canal.
Olive-sided Flycatcher *Contopus cooperi*		Observed in riparian woodlands along the northern shoreline, particularly at Beaver Creek cove.	Observed throughout the reservoir area.
Willow Flycatcher *Empidonax traillii*	Observed in willow riparian habitat at Jenny Creek near the confluence with the reservoir.	Observed in reservoir fringe willow habitat at the confluence of Beaver Creek.	
Purple Martin *Progne subis*	Observed on a utility pole just west of reservoir; possibly nesting there.	Nesting activity observed in a cavity in a utility pole near the intersection of Copco Road and dam access road. Also observed nesting in a utility pole along the Copco No. 2 bypass reach.	
Bank Swallow *Riparia riparia*		One individual observed among a group of tree and cliff swallows near the dam.	
Black-capped Chickadee *Parus atricapillus*			Observed throughout the reservoir area.
Pygmy Nuthatch *Sitta pygmaea*	Observed in a few locations around the reservoir, including in the woodland south of Jenny Creek.	Observed throughout the reservoir area, including in forested areas near the dam and near the upstream extent of the reservoir.	Observed throughout the reservoir area in ponderosa pine forests.
Yellow-breasted Chat *Icteria virens*	Observed in a northern cove of the reservoir near Camp Creek and Horseshoe Ranch Wildlife Area. Also observed near the fish hatchery.	Observed in riparian habitats throughout the reservoir, mostly along the southern shoreline east of Keaton Cove. Also observed along Fall Creek.	Observed in dense riparian areas; noted near the proposed staging area in the southeastern corner of the reservoir.
Tricolored Blackbird *Agelaius tricolor*	One individual observed just downstream of the Copco No. 2 powerhouse along the north bank of the River.		
Yellow Warbler *Dendroica petechial*	Observed throughout the reservoir area near tributaries including Brush Creek, Camp Creek, and Jenny Creek, and at the fish hatchery.	Observed throughout the reservoir area, typically in riparian woodlands and the hillside seep area.	Observed throughout the reservoir area; noted nesting in the willow riparian area near the dam spillway.

Species	Iron Gate Reservoir Area	Copco Lake Area	J.C. Boyle Reservoir Area
Mammals			
Western Gray Squirrel *Sciurus griseus*	Observed in densely forested habitats associated with tributaries to the reservoir.	Observed in densely forested habitats; noted near the falls at Fall Creek, along the northern shoreline in the seep area, and along the southern shoreline near Ager Beswick Road.	Observed throughout the reservoir in forested stands with dense canopies, including near the disposal area. An individual and a nest were observed in the staging area just east of the dam.

Note:

BLM = Bureau of Land Management

2.2.1 Osprey

KRRC biologists observed osprey throughout the study area for osprey (i.e., within 0.75 mile of the limits of work; see Figures 2-1 through 2-4), and found a total of 17 active osprey nests. Active nests were those with adults and/or chicks observed at the nest. Biologists also observed several inactive nests. All nests were on utility poles, typically but not always on platforms installed on the pole to provide for osprey nesting.

Biologists observed three active osprey nests in the vicinity of the Iron Gate Reservoir (Figures 2-1 and 2-2). Of these, one was on a utility pole in the staging area west of the Iron Gate Dam (Photograph 2-1); one was on a utility pole along the western side of the Iron Gate Reservoir; and one was on a utility pole along Copco Road where it turns north at the upstream end of the Iron Gate Reservoir. In addition, biologists observed four active osprey nests along the Klamath River downstream of Iron Gate Dam (excluding the one described above near the dam itself). These four nests were on utility poles along Copco Road between Iron Gate Dam and Interstate 5 (Figure 2-1).



Photograph 2-1: Active Osprey Nest on a Utility Pole in the Staging Area West of the Iron Gate Dam

Biologists observed a total of five active nests in the vicinity of Copco Lake (Figure 2-3). Of these, one was on a utility pole in the parking area for the Copco No. 1 powerhouse and a second was on a utility pole along the eastern side of the Copco No. 1 Reservoir, directly upslope from the Copco No. 1 Dam. The three other active nests are atop utility poles along Copco Road along the northern side of Copco Lake. Biologists observed one inactive osprey nest atop a utility pole upslope from the Copco No. 2 Dam on the southern side of the river.

Biologists observed a total of five active osprey nests in the vicinity of the J.C. Boyle Reservoir (Figure 2-4). Of these, one nest was on a utility pole along the Klamath River just south of the J.C. Boyle Dam, and two others were atop utility poles along the southern end of the J.C. Boyle Reservoir east of the dam. Biologists observed an additional inactive nest on a utility pole in that vicinity. Biologists observed an active nest along the southeastern side of the J.C. Boyle Reservoir and an active nest atop a utility pole in the proposed J.C. Boyle disposal site.

2.2.2 Willow Flycatcher

Biologists observed a single willow flycatcher at two locations: in willow riparian habitat at the confluence of Jenny Creek and Iron Gate Reservoir (Figure 3-1) and along the northern shoreline of Copco Lake just south of the confluence with Beaver Creek (Figure 3-2). Willow flycatcher nesting habitat typically consists of dense riparian vegetation (e.g., Geyer and Shining willow thickets), with foraging taking place in these areas or in other riparian habitats (e.g., bigleaf maple or Oregon ash groves). The locations of these willow flycatcher habitat types are shown on Figures 3-1 through 3-3. Biologists found these habitats along the shoreline of Iron Gate Reservoir, most notably at the larger stream confluences (e.g., Scotch Creek, Camp/Dutch Creek, and Jenny Creek). Biologists also noted patches of willows along the shoreline of Copco Lake, particularly at the confluences with Beaver Creek, Raymond Gulch, and at Mallard Cove. In addition, willow flycatcher habitat is present along Fall Creek. Suitable habitat is also present just below the J.C. Boyle Dam and patches of willows occur along portions of the J.C. Boyle power canal.

2.2.3 Nesting Great Blue Heron

During helicopter surveys for eagles (see Section 4) biologists observed a great blue heron colony along the Klamath River in the Copco No. 2 bypass reach (Figure 4-1). Biologists noted at least 12 nests during the helicopter survey, and herons were heard vocalizing in this area by ground crews. This colony is located in riparian habitat approximately 100 feet north of the Copco No. 2 penstock (Photograph 2-2).



Photograph 2-2: Active Great Blue Heron Colony near the Copco No. 2 Penstock

2.2.4 Peregrine Falcon

Biologists observed a peregrine falcon nest in a rocky outcrop north of Iron Gate Reservoir, east of Jenny Creek (Figure 4-1). A second peregrine falcon nest is known by BLM to be located on a cliff along the eastern side of the Klamath River canyon below J.C. Boyle (Hayner 2018) (Figure 4-2). BLM also provided the general location of a prairie falcon (*Falco mexicanus*) nest approximately 1 mile upstream, also along the eastern side of the canyon (Hayner 2018). Although prairie falcon is not a sensitive species in Oregon, it is protected along with nearly all other bird species under the Migratory Bird Treaty Act, and nest disturbance must be avoided.

2.2.5 Sandhill Crane

KRRC biologists observed an active sandhill crane nest along the northwestern shore of the J.C. Boyle Reservoir (Figure 4-3). In May 2018, the nest was occupied by two adults brooding three eggs. Biologists also heard sandhill cranes vocalizing from the dense bulrush habitat along the northeastern shore of the J.C. Boyle Reservoir, where the cranes were likely nesting.

2.2.6 Tricolored Blackbird

The KRRC biologists did not observe tricolored blackbird colonies in the study area. However, in June 2018, biologists observed a flock of 25 tricolored blackbirds in an agricultural field along the Yreka-Ager Road, approximately 12 miles southwest of the Iron Gate Dam. In addition, biologists observed a single male

tricolored blackbird in June 2018 among a flock of red-winged blackbirds in the bulrush habitat near the confluence of Fall Creek and the Klamath River, within the limits of work along Daggett Road.

2.3 Conclusions

KRRC biologists observed several special-status wildlife species in the study area during 2018 surveys, as listed in Table 2-1. Of the 33 special-status species observed, three were reptiles, 29 were birds, and one was mammalian.

Biologists observed 15 active osprey nests in the osprey study area (i.e., within 0.75 mile of proposed limits of work) (Figures 2-1 through 2-4). This number is consistent with previous PacifiCorp surveys that noted 16 active nests in the hydroelectric reach (PacifiCorp 2004). All osprey nests were on utility poles or towers, typically on platforms installed for that purpose. These osprey nests have the potential to be disturbed during proposed construction activities. Biologists will evaluate each nest site to determine the potential for disturbance; relocation or removal of some nests and nesting platforms may be needed. During the 2019 breeding season, additional nest surveys will be conducted to confirm the locations of active nests, collect additional information to determine the potential for nest disturbance during construction, and develop a plan for nest removal, exclusion, or relocation and monitoring activities.

KRRC biologists observed willow flycatchers on two occasions during the 2018 surveys. Both detections were of individual birds in willow riparian habitat. Biologists observed suitable willow flycatcher habitat most often around the Iron Gate Reservoir, but also along Copco Lake (Figures 3-1 and 3-2). Habitat was primarily associated with the confluences of larger streams, but patches of willow thickets were also found along reservoir shorelines away from streams or other apparent surface water sources. Some proposed Project activities overlap with these locations, such as bridge improvements and reservoir drawdown. As construction plans are developed, avoidance and minimization measures will be developed, if necessary. Wetland investigations in 2019 will focus on mapping and quantifying suitable willow flycatcher habitat along with other wetland habitats (e.g., tule/bulrush communities).

KRRC biologists observed several other special-status bird species during the 2018 surveys, and many are assumed to be breeding in the study area. During 2019 surveys, biologists will confirm specific nest sites and further evaluate them for potential impacts from Project activities, including:

- Great blue heron colony near the Copco No. 2 penstock – potential for disturbance from demolition activities
- Peregrine falcon nest above Iron Gate Reservoir near Copco Road – potential for disturbance from truck traffic and hauling activities
- Peregrine and prairie falcon nests in the Klamath River Canyon – potential for disturbance from demolition of J.C. Boyle power canal and/or powerhouse

KRRC biologists will continue to coordinate with CDFW, ODFW, and USFWS to obtain any new information on special-status wildlife use of the study area. One such species is the gray wolf (*Canis lupus*). Gray wolves

may occur transiently in the study area. In Oregon, the Rogue pack uses the Wood River Valley more than 10 miles northeast of Upper Klamath Lake (ODFW 2017). In California, the only currently known gray wolf pack is the Lassen Pack, which inhabits portions of Lassen and Plumas counties to the southeast of the study area (CDFW 2018a).

Chapter 3 Northern Spotted Owl

3. NORTHERN SPOTTED OWL

Northern spotted owl (NSO) (*Strix occidentalis*), a federally threatened species, has the potential to occur in or near the Project area. If an NSO activity center (i.e., an area of concentrated activity of either a pair of NSO or a single territorial NSO) is located within established disturbance distances from proposed construction activities, there could be an adverse effect, such as nest abandonment. Based on USFWS guidelines, established disturbance distances are as follows: 1 mile from blasting (e.g., at the dams), 0.5 mile from helicopter use (e.g., at the reservoirs during restoration work), and 0.25 mile from heavy equipment use, rock crushing, and hauling (USFWS 2006).

The 2012 Joint Preliminary Biological Opinion included several measures specifically addressing potential effects on NSO (measures NSO 1 through 4) (NMFS and USFWS 2012). These measures included protocol-level surveys to identify any NSO activity centers (including any nesting sites) that are near proposed construction and disposal areas, to avoid or minimize the potential for disturbance during NSO nesting, roosting, or foraging activities. The KRRC developed the NSO survey plan in coordination with USFWS to outline protocol surveys to be conducted during the 2018 breeding season, as described below.

3.1 Methods

Based on a desktop evaluation and field reconnaissance conducted in 2017 with USFWS, the KRRC determined that NSO protocol surveys would focus on suitable habitat around J.C. Boyle Dam and associated facilities, the disposal site, and haul and access roads. Facilities associated with Copco No. 1 Dam, Copco No. 2 Dam, and Iron Gate Dam and associated reservoirs were not included based on the lack of suitable habitat for NSO. Because the Project is not anticipated to result in modification of NSO habitat, the KRRC conducted protocol surveys for noise-only disturbance following the 2012 USFWS NSO Survey Protocol (USFWS 2012).

Biologists confirmed calling routes and stations in the field to achieve complete coverage of all habitat in the survey area, allowing biologists to hear responding owls within the entire survey area. The spacing of calling stations was determined by the topography and acoustical characteristics of the area (e.g., background noise such as creeks); stations were spaced between 0.25 and 0.5 mile apart. Eighteen calling stations were initially identified, as shown on Figures 5-1 and 5-2. One calling station (Number 2) was subsequently determined to be on inaccessible private property and was therefore eliminated from the survey route.

During the 2018 breeding season, KRRC biologists conducted six NSO protocol surveys at eighteen calling stations. Field teams conducted visits in April, May, June, July (two visits), and August 2018. As required by the 2012 USFWS NSO Survey Protocol, teams of two, led by a biologist with experience conducting NSO protocol surveys, conducted all surveys. Beginning in June, field teams conducted calling at an additional location near the J.C. Boyle forebay at the end of the power canal. The new location is along the west access road, approximately 800 feet north of the junction with the east access road. The lead biologist (as defined

in the USFWS protocol) recommended calling at this location due to the presence of large conifers on the slope up toward the west from the access road.

Field teams initiated NSO surveys approximately one-half hour following sunset, and recorded weather conditions, including wind, precipitation, cloud cover, and moon phase. Surveys were not conducted under inclement weather, including rain, heavy fog, or high (> 12-mile-per-hour) winds. At each calling station, field teams used a calling device to broadcast NSO calls. Calls were broadcast for approximately 1 minute, and then biologists listened for responses for approximately 1 minute, alternating this for a total of 10 minutes at each station. Following the calling session at each station, field teams used high-intensity flashlights to briefly scan nearby trees for the presence of owls. Teams noted observations of other wildlife, including visual observations and vocalizations. Field teams also noted noises from the river or other sources (e.g., vehicles on nearby roads).

3.2 Findings

Field teams did not note any calling responses or visual identifications of NSO during the 2018 NSO protocol surveys. Biologists heard and saw great horned owls during several visits, and one follow-up daytime stand search confirmed the presence of a great horned owl fledgling in the vicinity of an NSO calling station. Field data sheets are provided in Appendix B.

3.3 Conclusions

Field teams did not detect northern spotted owls, NSO nests, or activity centers during the 2018 NSO surveys. KRRC biologists conducted surveys consistent with the 2012 USFWS NSO Survey Protocol (USFWS 2012), with six visits spaced out over the 2018 breeding season.

USFWS has the authority to determine whether additional follow up surveys are warranted in 2019. Based on the findings of the 2018 surveys, the KRRC does not propose additional NSO surveys for the Project. If the proposed construction locations are changed in such a way that suitable habitat would be modified, or if additional information on the presence of NSO in the study area is obtained, additional NSO surveys may be warranted in 2019.

Chapter 4 Eagles

4. EAGLES

Bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) are protected under the Bald and Golden Eagle Protection Act (16 Code of Federal Regulations 668) and the Migratory Bird Treaty Act (16 United States Code §§ 701-12), and are fully protected under California law. Bald eagles are listed as Endangered under the California Endangered Species Act but are not listed in the State of Oregon. The Upper Klamath Basin provides suitable habitat for and is known to support bald eagle and golden eagle populations.

The 2012 EIS/EIR (USBR and CDFW 2012) describes measures to reduce Project impacts on bald and golden eagles. The objective of the eagle surveys was to identify, document, and confirm eagle presence and eagle use of areas that may be directly or indirectly disturbed by Project construction.

4.1 Existing Information

4.1.1 Bald Eagle

The upper Klamath Basin provides extensive bald eagle nesting and foraging habitat and supports the largest wintering population of bald eagles in the coterminous United States (Shuford et al. 2004). In some years, as many as 117 bald eagle pairs nest and 1,100 individuals winter in the Klamath Basin (PacifiCorp 2004). Shorelines provide a rough approximation of bald eagle habitat extent as they breed, forage, and roost near water (Isaacs and Anthony 2011). Bald eagles often nest in large trees with a line of sight to water; however, nests have also been documented on rocky outcrops, on the ground, on cliffs, and on artificial structures such as power poles (USFWS 2007). Bald eagles often use the same nests for multiple years, and nesting sites are known to exist in the vicinity of the Project area.

The Oregon Cooperative Fish and Wildlife Research Unit conducted bald eagle nest surveys in the Klamath River area on March 27, 2002, and May 29, 2002 (PacifiCorp 2004). Surveyors recorded six known nests within a 10-mile buffer of the Project area, with distances to the nearest facility ranging from approximately 0.7 mile to 7.1 miles (two near J.C. Boyle Reservoir, three near the J.C. Boyle peaking reach, and one near Copco Lake). Aerial surveys conducted in 2003 found another nest approximately 540 feet southeast of Copco No. 1 Dam.

PacifiCorp (2004) documented additional bald eagle observations at the Iron Gate Reservoir, Copco Lake, and J.C. Boyle Reservoir, and at other locations along the middle and lower Klamath River. Targeted avian surveys recorded at least 37 individual sightings of bald eagles in flight, perched, or foraging in 2002, and numerous incidental sightings occurred during general wildlife surveys, facility surveys, and other field studies (PacifiCorp 2004). These data were used to establish the presence of historical nesting and foraging habitat throughout the limits of work and the surrounding area. By agency request, exact nesting locations were not published in the PacifiCorp 2004 report.

4.1.2 Golden Eagle

Golden eagles occur throughout northern California and Oregon, preferring open and semi-open habitats. Nesting habitat includes cliffs and trees large enough to support nest structures (e.g., pine juniper and oak trees). Foraging and nesting habitats occur throughout the vicinity of the Project area. Though natural densities for this species in southern Oregon and northern California are low, historical records indicate the presence of nesting activity on cliffs from the J.C. Boyle bypass reach to Iron Gate Reservoir (USBR and CDFW 2012). During PacifiCorp surveys, biologists observed golden eagles in several locations, including Copco Lake, Iron Gate Reservoir, and near J.C. Boyle powerhouse, but no nests were found (PacifiCorp 2004).

4.2 Methods

Prior to initiating field surveys, KRRC biologists reviewed existing databases (CNDDB and ORBIC) and reports on bald and golden eagles to locate historically known nests and territories. During 2017, the USFWS and the BLM provided an updated dataset of bald and golden eagle nests and territories that have been monitored in the region (Willy 2017 and Hayner 2017). In addition, the KRRC obtained data from previous aerial helicopter surveys conducted in the Klamath Basin by Frank Isaacs of the Oregon Eagle Foundation (Isaacs 2017; Willy 2017).

Biologists conducted a viewshed analysis to identify the potential impact area. Using ArcGIS (ESRI, Version 10.4.1), biologists generated visibility extents using a 30-foot resolution National Elevation Dataset topographic surface and observer points derived from the limits of work (see Survey Area section below).

In defining the study area for the eagle surveys, KRRC biologists considered the viewshed analysis and the nature, timing, and location of proposed construction activities. The study area included areas of high and low potential impact

- High-Impact Areas: High-impact areas include a 0.5-mile buffer surrounding the limits of work, as well as those access roads that are anticipated to have an increase in traffic and movement of heavy equipment. High-impact activities include proposed construction and demolition activities associated with the decommissioning of the dams and facilities and creation of disposal sites.
- Low-Impact Areas: Low-impact areas include a 2-mile buffer surrounding the limits of work, excluding the extent of each reservoir where minimal or no work will occur.

The study area encompassed the extent of the viewshed in these high- and low-impact areas and represents the portion of the habitat that may be affected by Project activities. In the 2018 surveys, biologists also opportunistically surveyed beyond the study area boundaries to account for the wide-ranging nature of the eagle species and to gain a general understanding of eagle use and occupancy in the study area.

Biologists conducted concurrent bald and golden eagle surveys. The surveys focused on areas with suitable nesting, roosting, or foraging habitat for bald and golden eagles, as well as known nest locations. The survey goals were to identify nest site locations, characterize baseline eagle nesting activity, and document other

key habitat features. Field surveys employed a variety of techniques and multiple temporal windows to capture dynamic seasonal activity. All survey data were digitally recorded through Collector for ArcGIS, using iPads (Apple, Inc.), which preserve the location and survey time for each observation. The KRRC biologists conducted field reconnaissance surveys from July 24 to 26, 2017, and from November 6 to 8, 2017. Surveyors assessed habitats in the study area, noted bird activity, and attempted to locate all previously identified nests. Additionally, because the viewshed analysis considered bare earth topography (i.e., it did not account for existing vegetation), biologists used the reconnaissance surveys to ground-truth the results of the viewshed analysis to determine where trees further limited the viewshed. Biologists spent 1 day at each dam and associated facilities and reservoir.

The 2018 bald and golden eagle survey protocol was informed by the review of existing data, information obtained during the 2017 reconnaissance surveys, discussions with the wildlife agencies, and established protocols including:

- *Bald Eagle Nest Survey and Reporting Guide: Reporting Observations at Nest Sites in Oregon* (Isaacs 2009),
- *Protocol for Evaluating Bald Eagle Habitat and Populations in California* (Jackman and Jenkins 2004), and
- *Interim Golden Eagle Inventory and Monitoring Protocols* (Pagel et al. 2010).

Field teams collected data using a combination of ground-based and aerial surveys (via a helicopter). Field surveys emphasized microhabitats that could support nesting eagles (e.g., rocky cliffs for golden eagles and large conifers for bald eagles). Survey efforts included:

1. Two breeding season surveys (late January through July 2018).

    a. An initial nest search was conducted early in the breeding season (i.e., from January 29 to February 1, 2018) to determine occupancy. Two biologists conducted ground-based observations from vehicles and on foot, spending 1 day at each reservoir and corresponding dam. Surveys included observing historical nests and recording all eagle detections. For this early-breeding season survey, the survey area included all known golden eagle nests within 10 miles of the limits of work, and bald eagle nests within 2 miles. Survey distances were established in coordination with USFWS.

    b. Two teams of two biologists conducted a second survey from June 4 to 7, 2018, to observe eagle behavior and mid-season nesting activity, and to determine the number of active nests and nestlings in the survey area. One team conducted ground-based surveys, spending 1 day at each reservoir. The second team conducted aerial helicopter surveys for 2 days, covering all reservoirs, and a ground-based survey for 1 day. All historical and newly discovered nests and locations where eagle pairs or territorial behavior had been previously observed were revisited from the ground and helicopter.

2. To identify adult and sub-adult habitat use, one additional survey was conducted from August 20 to 22, 2018, after the young had fledged. Three teams of two biologists each conducted ground-based surveys.

4.3 Findings

Observations of bald and golden eagles are summarized in Table 4-1. Results are summarized by location, date, species, and age. The status of each nest site observed is summarized in Table 4-2, including the proximity of the nest to the Project area and noting whether the nest was determined to be active or inactive in 2018. The number of nestlings observed at active nests is summarized in Table 4-3 by species. Observations and behavioral notes not captured in the tables are noted in the following sections.

Reconnaissance Surveys 2017

- During the July 2017 survey, biologists located three of the four known nests within a 0.5-mile radius of the Project area (nests BE1-36, BE1-31, and BE1-32). Biologists observed one sub-adult bald eagle near nest BE1-36. This nest was presumed active for this year because substantial whitewash and prey remains (fish bones) were found under the nest. The other two nests did not exhibit conspicuous indications of activity; no whitewash, prey remains, or sub-adults were observed.

- During the November 2017 survey, biologists located one golden eagle nest and three bald eagle nests. Bald eagle nest BE1-36 contained abundant whitewash and there were prey remains at the nest site. The other two nests (BE1-31 and BE1-32) did not have signs of recent activity but were in good structural condition. The assumed golden eagle nest (GE4-206) was notably small and did not appear to be recently active. Biologists observed two nests that were not included in historical data and had the potential to be active eagle nests. Biologists attempted to view 14 historic nests that were either inaccessible or were not found.

January – February 2018

Eagle Activity

- Observers recorded approximately 50 eagles, including 30 bald eagles and 20 golden eagles; however, some may have been resightings of the same individuals. Both species of eagles appeared to prefer certain perches, and surveyors noted the use of these same perches during different survey times and dates.

- Common bald eagle behavior included:

    - perching on trees and utility poles close to and within sight of the reservoirs, with several adult bald eagle pairs perched together;.
    - soaring on thermals with other bald eagles and golden eagles, usually near the reservoirs but also over the Klamath River;
    - foraging in Iron Gate Reservoir; and
    - vocalizing from a perch at Copco Lake.

Table 4-1: Total Number of Eagle Observations by Site,[1] Survey, Species, and Age

Iron Gate Reservoir						
Survey Date	Golden Eagle Adults	Golden Eagle Sub-Adults	Golden Eagle Young of the Year	Bald Eagle Adults	Bald Eagle Sub-Adults	Bald Eagle Young of the Year
July 2017	0	0	0	0	0	0
November 2017	0	0	0	0	0	0
January – February 2018[2]	12	0	0	6	1	0
June 2018	8	0	2	18	5	0
August 2018	0	0	0	2	0	0
Total	**20**	**0**	**2**	**26**	**6**	**0**
Copco Lake						
Survey Date	Golden Eagle Adults	Golden Eagle Sub-Adults	Golden Eagle Young of the Year	Bald Eagle Adults	Bald Eagle Sub-Adults	Bald Eagle Young of the Year
July 2017	0	0	0	0	0	0
November 2017	1	0	0	1	2	0
January – February 2018[2]	8	0	0	6	10	0
June 2018	10	2	3	4	2	2
August 2018	0	0	4	5	0	1
Total	**19**	**2**	**7**	**16**	**13**	**3**
J.C. Boyle Reservoir						
Survey Date	Golden Eagle Adults	Golden Eagle Sub-Adults	Golden Eagle Young of the Year	Bald Eagle Adults	Bald Eagle Sub-Adults	Bald Eagle Young of the Year
July 2017	0	0	0	0	1	0
November 2017	1[3]	0	0	0	1	0
January – February 2018[2]	0	0	0	6	1	0
June 2018	1	0	1	6	2	5
August 2018	2	1	0	3	1	0
Total	4	1	1	15	6	5

Notes:

1 The number of eagles observed is influenced by the visibility at each site and should not be interpreted as relative abundance across sites. Visibility at J.C. Boyle Reservoir is poorer than at Copco Lake and Iron Gate Reservoir.

2 The number of eagles detected during the winter survey period is likely to include wintering and migratory individuals.

3 Species identification unconfirmed.

Table 4-2: Active and Inactive Bald and Golden Eagle Nests Observed in 2018 Field Surveys

Nest Name	Golden Eagle		Bald Eagle		Bald or Golden Eagle – Species not Confirmed
Nest Status in 2018	Active	Inactive	Active	Inactive	Inactive
Within 0.5 mile of Project area	1	0	1	3	2
Between 0.5 and 2 miles from Project area	2	3	0	3	0
Total Nests within 2 Miles	**3**	**3**	**1**	**6**	**2**
Outside of 2-mile buffer surrounding Project area, but within 0.5 mile of haul roads	2	0	3	0	0

Table 4-3: Number of Nestlings Observed at Each Active Nest in 2018

Nest Name	Golden Eagle Nestlings	Bald Eagle Nestlings
BE1-32	–	2
BE1-15	–	1
GE4-206	1	–
BE1-43	–	2
F_GE3	2	–
GE3-3	1	–
GE3-5	2	–
F_GE4	2	–
F_BE2 (outside of survey area)	–	2
Total Number of Nestlings	**8**	**7**

Notes:
BE = Bald eagle nest
GE = Golden eagle nest
F_GE = New golden eagle nest found during these 2017 – 2018 surveys, not included in historically active data
F_BE = New bald eagle nest found during these 2017 – 2018 surveys, not included in historically active data

- Golden eagle activity included:
  - perching on trees and cliffs that were not typically near or within sight of the reservoirs;
  - foraging on the ground;
  - soaring on thermals with other eagles;
  - flying in pairs; and
  - performing undulating flight behavior (i.e., breeding behavior).
- Biologists identified three potential golden eagle territories around Iron Gate Reservoir, one of which was in the 0.5-mile high-impact area. Territories were identified by observations of high levels of

golden eagle activity and/or undulating flight behavior, and observations of birds perching for long periods. At Iron Gate Reservoir, field teams identified two potential bald eagle territories, where they observed pairs of bald eagles perched. At Copco Lake, biologists identified two potential golden and bald eagle territories, based on high golden and bald eagle activity.

- Although biologists observed substantial eagle activity during the early 2018 surveys, it is difficult to determine how many of the observed birds represented resident birds, due to the potential presence of wintering and migratory birds.
- At J.C. Boyle Reservoir, there was notably less eagle activity observed than at the other two sites; however, this may have been due to low visibility at J.C. Boyle Reservoir, due to the high density of trees and limited road access. Biologists were unable to define areas of high eagle activity at J.C. Boyle Reservoir during the survey period.

Eagle Nests

- Biologists were unable to access 26 historically active nests due to poor visibility resulting from dense tree cover, limited access through private property, or poor road conditions. Observers were able to survey the area around 15 other historical nests, including six historically active nests. The conditions of the nests varied. Some appeared old and unused, while others appeared to have been recently active.
- At J.C. Boyle Reservoir, biologists found a pair of bald eagle adults less than 100 feet from the known nest BE1-15, which was visibly in good condition. Field teams found a sub-adult bald eagle perched near what was likely an active nest, BE1-36 (based on July 2017 survey information). In a few cases where a nest was likely active and could not be observed from a distance, biologists did not approach the nest, so as not to disturb the eagles. This occurred often at J.C. Boyle due to low visibility and dense tree cover. Figures 6-1 through 6-7 present the eagle nest survey results for the 2018 survey season.

June 2018

Eagle Activity

- With the exception of nestlings, some of the observations noted in Table 4-1 may have been resightings of the same eagle.
- Observed eagle activities were similar to those described above. More golden eagles were observed in the vicinity of the reservoirs during this survey than during previous surveys. Golden eagles also exhibited territorial behavior toward bald eagles and were observed vocalizing.
- Bald eagles exhibited territorial behavior toward other eagles and raptors. Most bald eagle observations were close to the reservoirs; however, there were some observations near the Klamath River or over ridgelines.

Eagle Nests

- At J.C. Boyle Reservoir, biologists observed three bald eagle nests and one golden eagle nest, with one to two chicks observed per nest. At both Copco Lake and Iron Gate Reservoir, biologists observed three active golden eagle nests, with one to two nestlings per nest.

- Biologists estimated golden eagle nestlings to be 5 to 8 weeks old, and bald eagle nestlings to be 8 to 11 weeks old at the time of the survey. Biologists often observed adults perched or flying near these nests and occasionally visiting the nests to feed nestlings. Field teams also found several inactive nests, as well as many potential alternate nests. One of the active golden eagle nests identified was not previously recorded as an active nest. Additionally, there were several historically active nests that no longer exist. This may be a result of the nest being abandoned, the nest structure falling, the tree or surrounding forest being disturbed or logged, or the effects of a wildfire.

August 2018

Due to several fires in the surrounding areas, conditions during the August 2018 surveys were smoky, and visibility became especially poor in the afternoon, making long-distance observations difficult.

Eagle Activity

- Biologists observed two young-of-the-year golden eagles flying over a nest that was classified as active during the June 2018 surveys (F_GE3). Additionally, field teams observed two young-of-the-year golden eagles flying over a new nest that was not found during previous surveys (F_GE4). This suggests that young-of-the-year golden eagles stayed near their territories following fledging for at least a few weeks and can be detected by post-fledging surveys.

- Biologists did not observe any young-of-the-year bald eagles near their nest territories during these surveys; however, one young-of-the-year bald eagle was observed begging food from an adult bald eagle, indicating that young-of-the-year bald eagles and their parents had moved farther from their nest territories to forage elsewhere at the time of the August 2018 surveys.

Eagle Nests

- Golden eagle nest (F_GE4) was located on a cliff face that was surveyed by helicopter in June 2018. The nest was apparently missed at that time, although an adult golden eagle was observed nearby. The nest structure was found during the ground-based survey in August 2018, and there were two fledged eaglets in close proximity.

4.4 Conclusions

Biologists observed a total of nine active nests surrounding Copco Lake, Iron Gate Reservoir, and J.C. Boyle Reservoir in 2018 (Table 4-2). Five of these were golden eagle nests and four were bald eagle nests. Of the nine active nests, seven were within 0.5 mile of the Project area or more than 2 miles from the Project area

but within 0.5 mile of a haul road (high-impact areas), and two were between 0.5 mile and 2 miles from the Project area (low-impact area).

Additionally, biologists observed a total of nine inactive nests within 2 miles of the Project area (Table 4-2). It is not uncommon for eagles to suspend breeding in some years or use alternative nest sites (USFWS 2004); therefore, these inactive nests will continue to be surveyed in 2019.

Project activities (e.g., site preparation) are scheduled to begin in early 2020. Biologists will conduct three bald and golden eagle surveys in 2019 to determine nest occupancy, and to gather more information on baseline eagle activity immediately prior to construction. If the start of construction is delayed, this field schedule will be reevaluated.

Similar to the field surveys conducted in 2018, a synthesized field survey to encompass bald and golden eagle nesting habitat will include:

1. One courtship/early-breeding season survey between late January and late February. Biologists will conduct ground-based surveys on foot and in vehicles when eagles are most likely to be found near nest sites and displaying courtship behavior, to determine territory occupancy.

2. One mid-nesting season survey will be conducted between late April and early May. Biologists will conduct ground-based surveys on foot and in vehicles, and aerial surveys from a helicopter. This survey will be conducted at a time when the number and age of nestlings at each active nest, as determined from previous surveys, can be estimated.

3. One late-nesting season survey will be conducted between late June and early July. Biologists will conduct ground-based surveys on foot and in vehicles, and aerial surveys from a helicopter. This survey will be conducted at a time when the number of fledglings can be estimated, and behavior and habitat use following fledging can be observed.

Chapter 5 Bats

5. BATS

Based on a review of California and Oregon occurrence records, presence of suitable habitat, species range overlap, and previous survey results, eight bat species have potential to occur in the Project area. *Yuma myotis* have been previously documented at structures in the Project area (PacifiCorp 2004). Townsend's big-eared bat and *Yuma myotis* have been previously documented in the Klamath Basin outside of the Project area, in maternity roosts at Hoover Ranch and Salt Caves (approximately 6 miles east of Copco Lake and 9 miles downstream from the J.C. Boyle powerhouse) (Cross et al. 1998; PacifiCorp 2004).

Oregon and California state regulations provide protection for bats through general wildlife protection policies. TER-6 of the 2012 EIS/EIR (USBR and CDFW 2012) describes measures to reduce Project impacts on bats. The 2012 EIS/EIR recommended surveys to identify the locations of active bat roosts in facilities that may be affected by the dam removal. KRRC has incorporated this measure into the Project. Structures with the potential to support bats include all built structures in the Project area, bridges, and diversion tunnels. All of these features were included in the surveys.

5.1 Methods

The KRRC biologists conducted surveys for all bat species with potential to occur at Project structures. The objectives of the surveys were to identify which species occupy the habitat throughout the year, understand how the habitat is used throughout the year, and quantify habitat usage. A reconnaissance-level assessment was conducted from July 24 to 26, 2017. The KRRC planned a follow-up visit during the 2017 maternity season to conduct emergence surveys, but the survey was canceled due to lack of right-of-entry to PacifiCorp property for the specific survey task.

Biologists conducted four focused, seasonal bat surveys in 2018: one in late winter, two in summer, and one in fall. The 2018 seasonal bat roost surveys assessed habitat suitability and determined roosting activity at Project structures. Additionally, a biologist accompanied interior inspections of the Iron Gate and Copco diversion tunnels in February 2018.

During all surveys, KRRC biologists conducted daytime visual inspections of the interior and exterior of each facility proposed for removal or modification for indications of bat use (e.g., occupancy, guano, staining, smells, or sounds). Dead specimens were identified in the field using a dichotomous key. When live bats were found, species were identified visually to the extent possible, using night vision when needed to minimize disturbance. All surveys were conducted cautiously to avoid disturbing bats at potential roost sites. Because interior access to human-occupied houses was prohibited, those structures were assessed from the exterior only.

5.1.1 Winter 2018

On February 13 and 14, 2018, a KRRC biologist participated in inspections inside the Iron Gate and Copco diversion tunnels to assess the interior habitat features. Both tunnels were accessed by a small inflatable boat, and inspections were attended by one engineer and one safety/confined space entry specialist, in addition to the KRRC biologist.

On March 1, 2018, two KRRC biologists conducted interior and exterior inspections of structures at Copco No. 1 and Copco No. 2. These winter bat surveys were originally planned for late January/early February but were delayed and were ultimately limited to the Copco No. 1 and Copco No. 2 dams due to access constraints. Care was taken to target areas where guano and staining had been seen during the 2017 survey and to minimize the potential for disturbance of hibernating bats.

5.1.2 Summer 2018

A team of three KRRC biologists conducted surveys from May 14 through 18, 2018, and a team of four biologists conducted surveys from June 16 through 22, 2018. In addition to interior/exterior inspections, summer efforts included dusk emergence surveys and acoustic detection at structures known to house roosting bats, and at structures where suitable roosting habitat or sign was found but occupancy was uncertain based on previous surveys. Night vision was used during all emergence surveys, and an infrared camera was used to capture images of an emergence at the Copco No. 1 C-12 gatehouse. Points of egress were documented during all emergence surveys. Two iPads (Apple, Inc.) running Echo Meter Touch 2 Pro (Wildlife Acoustics) and one Dell laptop running Sonobat software (Version 4) with a Binary Acoustics ultrasonic microphone (Binary Acoustic Technology, LLC) were deployed during all emergence surveys. Field teams conducted emergence surveys when weather conditions were suitable for the evening emergence of bats (e.g., warm temperatures and minimal rain and wind).

In May, biologists placed drop cloths around significant roost locations and inspected them during the June visits to passively assess bat activity levels. Field teams installed long-term temperature and humidity data loggers in structures with significant roosts. Biologists discussed maintenance routines, bat observations, and previous bat management techniques with PacifiCorp staff. Bridges in the Project area that are scheduled for removal or modification were also inspected.

5.1.3 Fall 2018

Two KRRC biologists conducted surveys from October 29 through November 1, 2018, to support the development of the Project Bat Management Plan (currently in draft). The team inspected the interior and exterior of all buildings being used by bats, and other structures that may be removed and that provide suitable roosting habitat (such as buildings that contain suitable crevices and cavities without evidence of recent bat use, bridges, and trees). Previously installed temperature data loggers were checked for maintenance and continued operation. Detailed photographs and notes were taken at each structure to document specific locations for exclusion, and to record other structural characteristics such as roofing and other building construction materials.

5.2 Findings

Bat survey findings are summarized in Table 5-1. Summaries of the results from the winter, summer, and fall 2018 surveys follow the table. Bat roosts were confirmed in ten buildings at Copco No. 1 and Copco No. 2, the diversion tunnel at Copco No. 1, three buildings and the diversion tunnel at Iron Gate, and one building at J.C. Boyle (Figures 7-1 through 7-5). Photographs 5-1 through 5-5 depict the exterior view of some of the structures with large roosts. Photographs 5-6 and 5-7 show the interior conditions of the diversion tunnels.

Table 5-1: 2017-2018 Bat Findings

Building Name	Suitability[1]	Evidence of Bat Use?	Live Bats Present?	Species Confirmed	Survey Dates	Additional Notes
Copco No. 1 and Copco No. 2						
Vacant House 1 (tan)	high	Yes	Yes – small numbers of bats present under exterior side panels in summer. Absent in fall and winter.	MYYU (visual, acoustic)	July 2017, February 2018, May and June 2018, October through November 2018	None
Vacant House 2 (blue)	high	Yes	Yes – small numbers of bats present under exterior side panels in summer. Absent in fall and winter.	MYYU (visual, acoustic)	July 2017, February 2018, May and June 2018, October through November 2018	None
Vacant House 3 (yellow-green)[2]	high	Yes	Yes – large colony in garage behind wood window framing and under rotting wood panels. Present in summer. Absent in fall and winter.	MYYU (visual, acoustic)	July 2017, February 2018, May and June 2018, October through November 2018	None
Vacant House 4 (peach)	high	Yes	Yes – present between flashing and fascia board all around roof edge in summer. Absent in fall and winter.	MYYU (visual, acoustic)	July 2017, February 2018, May and June 2018, October through November 2018	None
Vacant House #21601 (light yellow)[2]	high	Yes	Yes – 200 to 300 bats roosting in attic in summer. Absent in fall and winter.	MYYU (visual, acoustic)	July 2017, February 2018, May and June 2018, October through November 2018	Temperature/humidity data logger installed.
C-11 Gatehouse (at Copco No. 1)	high	Yes	About 20 Myotis clustered in exposed roof apex (interior) in fall. Not found in summer. Not surveyed in winter.	MYYU (visual)	July 2017, June 2018, October through November 2018	None

Building Name	Suitability[1]	Evidence of Bat Use?	Live Bats Present?	Species Confirmed	Survey Dates	Additional Notes
C-12 Gatehouse (at Copco No. 1)[2]	high	Yes	Yes – 2,000 to 3,000 bats present in summer. Several dozen present in fall. Not surveyed in winter.	MYYU (visual, acoustic)	July 2017, June 2018, October through November 2018	Temperature/humidity data logger installed. Infrared images of emergence.
Copco No. 1 powerhouse	high	Yes	Yes – several dozen bats clustered on walls in transformer bays and small numbers in lower level in summer. Absent in fall and winter.	MYYU (visual, acoustic)	July 2017, February 2018, June 2018, October through November 2018	Abundant staining/guano on lower level but no large roosts found. Small number of COTO detected acoustically during summer emergence, but not confirmed to be present in the powerhouse.
Diversion Tunnel Outlet[2]	high	Yes – via emergence only.	Yes – ~100 bats emerged in summer, absent in winter.	MYYU (visual, acoustic)	February 2018 inspection, June 2018 emergence.	Small number of COTO detected acoustically on summer emergence, but not confirmed to be present inside tunnel. Highly suitable habitat.
Copco No. 2 powerhouse	high	Yes	Yes – not found during interior inspections, but confirmed summer use by evening emergence of ~50 bats.	MYYU (visual, acoustic)	July 2017, February 2018, June 2018, October through November 2018	Six dead Myotis adults and pups found on ground level and lower level in summer. Small number of COTO detected acoustically during summer emergence, but not confirmed to be present in the powerhouse.
House 19038 (next to schoolhouse)	high	Yes – abundant guano in garage.	No	NA	July 2017, February 2018, June 2018, October through November 2018	Potential entry points noted.
Maintenance Building (next to switchyard)	high	Yes – guano and staining in garage.	No	NA	July 2017, June 2018, October through November 2018	Potential entry points noted.

Building Name	Suitability[1]	Evidence of Bat Use?	Live Bats Present?	Species Confirmed	Survey Dates	Additional Notes
Bunkhouse	mod	No	No	NA	July 2017, February 2018, June 2018, October through November 2018	Potential entry points noted.
Cookhouse	mod	Yes	Yes – small number of bats present in awning over side door outside in summer. Absent in fall and winter.	MYYU (visual)	July 2017, February 2018, May and June 2018, October through November 2018	No signs of interior use. Potential entry points noted.
Vacant House (light blue) on Access Road	mod	No	No	NA	July 2017	None
Occupied House next to Vacant House 4	mod	Unknown	Unknown	NA	July 2017 exterior only.	No interior survey access to occupied residences. Resident stated he is not aware of any bats in the attic.
Schoolhouse	low-mod	No	No	NA	July 2017	None
Haz Waste Storage/Wood Shop	low-mod	No	No	NA	July 2017, February 2018, June 2018	None
Groundwater Well House (at entrance to Copco Village)	low-mod	No	No	NA	July 2017, October through November 2018	Small amount of guano on roof indicates bat use of rock crevices above/behind the structure.
Maintenance Building (next to Copco No. 2 powerhouse)	low	No	No	NA	July 2017, June 2018	None
Equipment Shed (in front of bunkhouse/cookhouse)	low	No	No	NA	July 2017, February 2018, June 2018	None
Copco No. 2 Dam (concrete dam and associated structures)	low	No	No	NA	July 2017	None

Building Name	Suitability[1]	Evidence of Bat Use?	Live Bats Present?	Species Confirmed	Survey Dates	Additional Notes
Tin Pumphouse (across from light blue house on Access Road)	low	No	No	NA	July 2017	None
Control Center at Copco No. 2 powerhouse	low	No	No	NA	July 2017, February 2018, June 2018	None
Iron Gate						
Diversion Tunnel Outlet[2]	high	Yes – via summer evening emergence only.	Yes – several hundred bats emerged during May and June 2018 surveys. Absent in winter.	MYYU (visual, acoustic)	February 2018 inspection, May 2018 emergence, June 2018 emergence	Small number of COTO detected acoustically on summer emergence, but not confirmed to be roosting inside tunnel. Highly suitable habitat.
Penstock Intake Structure[2]	high	Yes	Yes – several hundred bats roosting inside at top of structure in summer. Absent in fall.	MYYU (visual, acoustic)	July 2017, June 2018, October through November 2018	Temperature/humidity data logger installed.
Communication Building/ Powerhouse	high	Yes	Yes – several hundred bats emerged from concrete shaft in lower portion of powerhouse in summer. Heavy guano/staining.	MYYU (visual, acoustic)	July 2017, May and June 2018, October through November 2018	Temperature/humidity data logger installed. Lowest, subterranean level of powerhouse not accessed due to confined space entry restriction.
Barn/Garage at Iron Gate Village	high	Yes	Yes – bats present in rafters/ ceiling in summer, abundant guano. Absent in fall.	MYYU (visual, acoustic)	July 2017, May and June 2018, October through November 2018	Temperature/humidity data logger installed.
Residence 1 (occupied) blue/gray	mod-high (attic)	Unknown	Unknown	NA	June 2017 exterior only	No interior survey access to occupied residences.
Residence 2 (occupied) tan with green roof	mod-high (attic)	Yes	Yes – ~15 bats huddled behind clock on back porch. Potential attic access through loose screen over vent.	MYYU (visual, acoustic)	July 2017 exterior only	No interior survey access to occupied residences.

Building Name	Suitability[1]	Evidence of Bat Use?	Live Bats Present?	Species Confirmed	Survey Dates	Additional Notes
Fish Holding Facilities	mod	No	No	NA	July 2017, June 2018, October through November 2018	None
Diversion Tunnel Gate Structure	mod	No	No	NA	July 2017, June 2018, October through November 2018	None
Restrooms (near powerhouse)	low-mod	No	No	NA	July 2017, June 2018	None
Emergency Spill Equipment shed	low	No	No	NA	July 2018	None
J.C. Boyle						
Spillway Control Center[2]	high	Yes	Yes – several hundred bats present in summer. Absent in fall.	MYYU (visual)	July 2017, May and June 2018, October through November 2018	Temperature/humidity data logger installed.
Office/Red Barn	high	Yes – abundant guano in attic.	No	MYYU (visual – dead specimen)	July 2017, May and June 2018, October through November 2018	Found two dead *Myotis* sp. adults inside the attic – desiccated.
Fish Screen House	mod-high	No	No	NA	July 2017, June 2018, October through November 2018	None
Fire Protection Building	mod	Yes	Yes – outside only, a few bats in exterior crevice near roof edges (western side and eastern side) in summer. Absent in fall.	MYYU (visual)	July 2017, June 2018, October through November 2018	

Building Name	Suitability[1]	Evidence of Bat Use?	Live Bats Present?	Species Confirmed	Survey Dates	Additional Notes
Dam Communications	mod	No	No	NA	July 2017, June 2018, October through November 2018	None
J.C. Boyle powerhouse	mod	No	No	NA	July 2017, June 2018, October through November 2018	None
Maintenance Building (next to powerhouse)	low-mod	No	No	NA	July 2017, June 2018, October through November 2018	None
Truck Shop	low-mod	No	No	NA	July 2017, May 2018 and June 2018, October through November 2018	Maintenance staff have found a few dead bats inside over the years, but no roosting. No sign found inside. Multiple potential access points along roof at the covered parking area.
Headgate Control	low-mod	No	No	NA	July 2017, June 2018	None
Gate Control and Communications	low-mod	No	No	NA	July 2017, October through November 2018	None
Power Canal/Spillway	low	No	No	NA	July 2017, June 2018	None
HazMat Storage Shed	low	No	No	NA	July 2017	None
Pump House	low	No	No	NA	July 2017	None
Two occupied residences	Unknown	Unknown	Unknown	NA	NA	No interior survey access to occupied residences.

Building Name	Suitability[1]	Evidence of Bat Use?	Live Bats Present?	Species Confirmed	Survey Dates	Additional Notes

Notes:

[1] "High" suitability was assigned to structures with bats present and/or where signs of heavy bat use were found, or to structures that showed little or no sign of use or could not be accessed but contain external or internal features generally preferred by roosting bats, such as attics/roof spaces, soffits, fascias, weather boarding, spaces between roof felt/membrane and tiles/slates, window frames, cave/cavity walls, flashing, and the like. "Moderate" suitability was assigned to structures where no bats or very few bats were found, with little or no sign of bat use, that contain points of entry/exit and limited internal and external features preferred by roosting bats. "Low" suitability for roosting was assigned to well-sealed structures with no points of entry/exit, and generally lacking cavities, crevices, and other features generally preferred by roosting bats.

[2] Photograph included in report

NA = Not Applicable

MYYU = *Myotis yumanensis* (Yuma myotis)

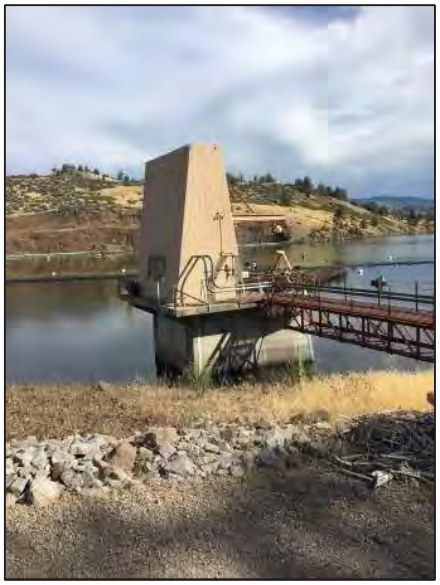
COTO = *Corynorhinus townsendii* (Townsend's big-eared bat)



Photograph 5-1: Garage of Vacant House 3, Copco Village



Photograph 5-2: Vacant House #21601, Copco Access Road



Photograph 5-3: Penstock Intake, Iron Gate



Photograph 5-4: Spillway Control Center, J.C. Boyle



Photograph 5-5: C-12 Gatehouse, Copco No. 1

Although there is potential for other bat species to be present, the only species confirmed to be roosting in structures were Yuma myotis (*Myotis yumanensis*) (Table 5-1). The Lakeview Road Bridge at Iron Gate contains expansion joints that indicate bat use, and emergence surveys at this bridge are planned for summer 2019. The KRRC biologists did not detect any roosting bats or signs of bat use at any other Project bridges where removal or modifications are planned.

5.2.1 Winter 2018

On February 13, 2018, conditions were sunny and clear. Air temperatures outside the Iron Gate tunnel were 48 degrees Fahrenheit (°F) at 12:50 P.M. Inside the tunnel, temperatures were 67 °F at the entrance (1:35 P.M.) and 52 °F at the terminus (1:51 P.M.). Most of the Iron Gate tunnel is rock, except for the entrance and just before the closure gate, where it is lined with reinforced concrete (25 feet at the entrance and 120 feet leading to the closure gate) (Photograph 5-6). Water depths in the tunnel ranged from 2.7 feet to 5.5 feet. The full length of the accessible portion of the tunnel—approximately 500 feet in length from the entrance to the closure gate, of which approximately 354 feet is unlined, exposed rock— was surveyed. Cliff swallow nests were observed just inside the tunnel entrance. Pigeons were present at various locations throughout the tunnel. No bats or signs of bat use were found; however, both the rock- and concrete-lined portions of the tunnel provide interior spaces and/or irregular rock surfaces suitable for use by roosting bats.



Photograph 5-6: Iron Gate Diversion Tunnel Interior Section of Unlined Rock, February 13, 2018

On February 14, 2018, conditions were sunny and clear. Air temperatures outside the Copco tunnel were 41°F at 10:15 A.M. Inside the tunnel, temperatures were 48°F at the entrance (10:20 A.M.) and 44°F at the terminus (10:30 A.M.). The entire length of the Copco tunnel is unlined, exposed rock (~160 feet) (Photograph 5-7). Water depths in the tunnel ranged from 1.1 feet to 3.2 feet. The full length of the accessible portion of the tunnel was surveyed, from the entrance to the closure gate. Cliff swallow nests and a few pigeons were observed in the tunnel. No bats or signs of bat use were found; however, the tunnel provides suitable habitat.



Photograph 5-7: Copco Diversion Tunnel Interior Substrate and Cliff Swallow Nests, February 14, 2018

On March 1, 2018, the midday outdoor temperature was 45°F. No bats were observed in any structures at Copco No. 1 and Copco No. 2, and no new signs of bat activity were found at these sites.

5.2.2 Summer 2018

During the May surveys, the average high daytime outdoor temperature was 74°F. In June, the average high during the day was 83°F. Biologists observed evening emergences of several hundred bats from both the Copco and Iron Gate diversion tunnels and an attic at Copco "Vacant House #21601." More than 2,000 *Myotis* spp. emerged from the Copco No. 1 C-12 gatehouse, the interior of which had not previously been inspected due to access constraints.

Field teams heard small numbers of Townsend's big-eared bats (*Corynorhinus townsendii*) during acoustic surveys outside the diversion tunnel outlets and the Copco No. 1 and Copco No. 2 powerhouses; however, it is not certain that these bats came from inside the structures or tunnels. Particularly at the Copco diversion tunnel, access limitations prohibit targeted placement of recording equipment at or near the mouth of the tunnel. Only small numbers of roosting bats have been observed emerging from the Copco powerhouses during summer surveys, despite abundant sign of previous bat use in these structures. Maintenance staff reported that sonic deterrents (Bird-X Transonic Pro) and mothballs and other naphthalene products were used in the past few years in these powerhouses in an attempt to deter bats, but that these efforts were not effective.

5.2.3 Fall 2018

During the week of October 29, 2018, the average high daytime outdoor temperature was 63°F. Bats were only present in two structures: the C-11 and C-12 gatehouses at Copco No. 1. Several dozen bats were counted in the attic at C-12, and about a dozen were seen in the open, at the roof apex inside C-11.

5.3 Conclusions

Significant bat roosts are present in many structures across the Project area. The KRRC biologists will continue coordinating with Project engineers on plans for structure retention, modification, and removal. Sufficient information was collected to provide recommendations for take avoidance, humane exclusion, and compensatory roosting habitat for each structure. The KRRC will provide these site-specific details in a Bat Management Plan. Seasonal surveys in 2019 will focus on structures that will require exclusion, modification, and/or replacement.

The KRRC will develop and finalize a Bat Management Plan in 2019, prior to commencement of any Project activities that could disturb roosting bats. According to the current Project timeline, site preparation is scheduled to begin in early to mid-2020, which will include work in the diversion tunnels. Therefore, humane exclusion in these locations is anticipated to occur in fall-winter 2019. Building removal is currently scheduled to occur after reservoir drawdown, in March 2021. Therefore, exclusion and installation of replacement habitat in these locations is anticipated to occur in 2020.

The KRRC will assess significant roosting habitat outside of buildings as Project activities such as tree removal are further refined. Although no roosting trees have yet been identified, the KRRC will provide general recommendations for removal of potential tree-roosting habitat in the Bat Management Plan. The KRRC will evaluate significant roosting habitat in the vicinity of major Project disturbances for its potential to be affected by noise or vibrations during ongoing survey efforts, or as otherwise dictated by the Project schedule.

Chapter 6 Western Pond Turtle

6. WESTERN POND TURTLE

Western pond turtles are known to occur at Project reservoirs. The United States Geological Survey conducted visual surveys of basking turtles at J.C. Boyle Reservoir in the mid- to late-1990s and recorded turtle use (Wray 2017). The 2001-2003 PacifiCorp surveys also noted the presence of western pond turtles and suitable basking and nesting habitat at Project reservoirs (PacifiCorp 2004), as shown on Figure 8-1 through 8-3.

The western pond turtle is listed on the Oregon Sensitive Species List and is a species of special concern in California. A petition for listing under the federal Endangered Species Act is currently being considered by USFWS, with a decision regarding listing expected by 2021. In light of its special status, the KRRC conducted an evaluation of potential risks to western pond turtles during drawdown when turtles would be hibernating. In coordination with ODFW, CDFW, and USFWS, the KRRC concluded that there is potential for impacts, including mortality, to western pond turtles from the effects of drawdown and other components of the proposed action. Based on this evaluation, it was determined that the following additional investigations were warranted:

- Conduct surveys of Project reservoirs for basking western pond turtles during special-status wildlife surveys. Document turtle observations and map suitable habitat.
- Conduct a mark/recapture survey and tracking study at J.C. Boyle Reservoir to a) estimate the abundance of western pond turtles in the J.C. Boyle Reservoir area and b) obtain data on western pond turtle overwintering locations and behaviors. The methodology for the study was developed in coordination with ODFW, as described further below.

6.1 Methods

6.1.1 Western Pond Turtle Surveys and Habitat

The KRRC biologists noted observations of western pond turtles in the 0.25-mile study area during general wildlife surveys. Biologists recorded the number of turtles, behavior, and other observations. Surveyors observed habitat along reservoir shorelines via boat.

6.1.2 Western Pond Turtle Tracking Study at J.C. Boyle Reservoir

The western pond turtle tracking study was led by the KRRC, with assistance from ODFW biologists. The study was initiated during late summer, when turtles would have finished breeding but would still be active prior to the hibernation season. In coordination with ODFW, two primary objectives were identified:

1. Capture enough western pond turtles (30+) for a mark-recapture study, to produce a population estimate for the J.C. Boyle Reservoir.

2. Capture 14 western pond turtles (8 females and 6 males) and attach radio transmitters and temperature data loggers to them for a telemetry tracking study. The purpose of the telemetry study was to determine the timing and locations of western pond turtle overwintering in the J.C. Boyle Reservoir.

Field teams conducted initial trapping in August 2018, with an additional capture effort conducted in September 2018.

Trap locations are shown on Figures 9-1 and 9-2. During the August trapping event (August 6 through 12, 2018), field teams focused trapping in areas of J.C. Boyle Reservoir where turtles had been observed in the greatest numbers during previous visual surveys, including those conducted by the KRRC biologists in 2018 and historical PacifiCorp surveys (PacifiCorp 2004). This included along the western shore of the reservoir, north of the Highway 66 bridge (referred to as the "west" site, as shown on Figure 9-2); and the southeastern cove near Topsy Campground and the southwestern cove behind the floating log barrier immediately upstream of the dam (referred to together as the "south" site, as shown on Figure 9-1). During the September trapping event (September 4 through 7, 2018), field teams also deployed traps in other areas around the reservoir, including the western and eastern shores south of the bridge, the northernmost shore of the reservoir, and the mouth of Spencer Creek.

The August trapping event consisted of six nights of trapping. Field teams deployed traps in the south or west sites on alternating nights. On the first night of trapping (August 6, 2018), field teams deployed 12 traps in the south site. Due to the low capture rate, teams deployed 20 traps on each subsequent trapping night. Field teams deployed traps in the evenings between approximately 7:00 and 9:00 P.M. and collected them the next morning between approximately 7:30 and 9:30 A.M. Overnight traps were deployed for at least 12 hours each.

Due to the low capture rate, the trapping strategy was altered during the September trapping event to include day trapping, longer trap deployment, and trapping in areas outside the south and west sites. Field teams deployed traps overnight as described above for three nights (September 4 through September 6, 2018), and also deployed traps during the day on September 5 and September 6, 2018. Some of the day traps were deployed around 8:00 A.M. and retrieved in the afternoon approximately 8 hours later; others were left in place, rebaited, and allowed to run another night. In addition, field teams used hand nets to attempt to catch turtles from kayaks and during snorkeling.

The primary trapping method employed commercial opera house-style crab traps baited with canned sardines, diced clams, or cat food. Field teams placed traps near downed trees, snags, and other refugia where turtles tend to forage, and placed traps away from the shore so that terrestrial predators could not easily reach the bait. Field teams also employed hand capture, dip nets, and seine nets as secondary trapping methods. Inflatable kayaks were used to access trap sites around the reservoir.

When caught, turtles were collected in tubs and taken to land for processing in accordance with the methods described in Bury et al. (2012). Processing included recording morphometric data (e.g., size, weight, age, and gender), taking photographs, and making qualitative observations about turtle morphology

and health. Biologists took photographs of each turtle to document size, coloration, growth rings, plastron patterns, and other identifying features. Notches were filed into the marginal shields according to the notching code described by Holland (1994), to provide identifying marks for future studies.

For the telemetry study, biologists affixed suitably sized turtles with a radio transmitter (Holohil Ltd. Model RI-2B, up to 12-month battery life) and temperature logger (Thermochron Model DS1922L). A two-part epoxy was used to affix the transmitter and temperature logger to a suitably sized costal scute toward the back of the turtle. The epoxy was nonexothermic and did not produce heat that could harm the turtle. Application of epoxy to scute sutures (where carapace growth occurs) was avoided. The epoxy was colored black with printer toner to improve camouflage. The epoxy was allowed to dry and harden before releasing the turtle back to the site where it was caught. Field teams confirmed the functionality of the radio transmitter prior to deployment. The transmitter, temperature logger, and epoxy were allowed to make up a maximum of 5 percent of total turtle body weight; smaller turtles were not considered suitable for tracking.

In accordance with the permit restrictions, the KRRC biologists turned over live bycatch of any nonnative, nonfish animals, which included only American bullfrogs (*Lithobates catesbeianus*), to ODFW for euthanization. Live bycatch of fishes included three nonnative species identified by ODFW staff as goldfish, largemouth bass, and pumpkinseed. On three occasions, small fish were found dead in traps; these all appeared to be the same species and were later identified as goldfish.

To provide environmental baseline temperature data, teams attached temperature data loggers to 250-foot cables which were deployed along a transect in the south and west trapping areas during the August event (Figures 9-1 and 9-2). Along each transect, three temperature loggers were deployed in the upland area in suitable terrestrial overwintering habitat, one data logger was placed on shore, and three were deployed in the reservoir along the weighted cable to provide information about the temperature gradient across potential in-water overwintering habitats.

6.2 Findings

Biologists observed western pond turtles in all three Project reservoirs during the 2018 wildlife surveys in May and June (Figures 8-1 through 8-3). Observations of turtle habitat generally agreed well with historical PacifiCorp turtle habitat mapping.

Western pond turtles were observed in the following numbers at each reservoir:

- Iron Gate Reservoir: 8
- Copco Lake: 42
- J.C. Boyle Reservoir: 46

The KRRC did not conduct formal basking surveys, so these numbers do not represent a population estimate.

During the August 2018 trapping event at J.C. Boyle, field teams deployed 112 traps over the six nights of trapping. Biologists captured a total of five individuals (three at the west site and two at the south site), for a capture rate of 4.5 percent. All turtles were caught within the first three nights of trapping. Traps with each of the three baits (sardines, clams, and cat food) resulted in captures. Attempts to capture turtles via hand capture and seine nets were unsuccessful, mainly due to the abundance of aquatic vegetation on and below the water surface. No turtles were recaptured during this event. Preliminary radio telemetry indicated that the two turtles caught and tagged at the north site had moved south of the bridge (approximately 0.5 river mile from where they were released) over the course of 2 days.

Only four of the five turtles captured during the August event were tagged with radio transmitters and temperature data loggers. One female turtle exhibited signs of an unknown shell disorder; her vertebral scutes were detaching from the carapace. The costal scutes appeared intact, but there was concern that the shell integrity would continue to deteriorate, so the team did not affix a transmitter or temperature logger to this animal.

During the September trapping event, the team deployed an equivalent of 89 traps (i.e., 89 trap deployments lasting 12 hours) over 3 days and nights of trapping. Biologists caught five turtles in traps, four of which were tagged with radio transmitters and temperature loggers. One juvenile turtle caught with a hand net was too small for a radio transmitter.

In summary, biologists outfitted a total of eight western pond turtles with transmitters and temperature loggers during the two 2018 trapping events. Trap locations and successful capture sites are shown on Figures 9-1 and 9-2. Trapping effort details and photographs are provided in Appendix C.

The trapping study did not include a formal visual survey; however, biologists observed western pond turtles throughout the J.C. Boyle Reservoir in numbers comparable to those observed in previous visual surveys. Areas of concentrated turtle use were identified by field teams near the dam and along the western shore north of the Highway 66 bridge. In addition to these areas, biologists observed 5 to 10 turtles in the large southeastern cove, and groups of 3 to 6 turtles in smaller coves around the reservoir. Biologists most commonly observed turtles basking on logs or stumps, or basking aquatically at the water surface.

6.3 Conclusions

Biologists observed western pond turtles in all three Project reservoirs during 2018 wildlife surveys in May and June. Field teams observed the highest number of turtles in the J.C. Boyle Reservoir.

The number of turtles caught during the two trapping events at the J.C. Boyle Reservoir (11 caught in total, eight tagged with tracking equipment) was below the targets set for the telemetry study (14 turtles) and population study (30+ turtles). Possible explanations for the low capture rate include:

- Other prey sources (aquatic snails, tadpoles, small fish, and various invertebrates) were already abundant throughout the reservoir, so turtles were not attracted to the bait. The unusually fast

growth rate and large average size of western pond turtles noted in J.C. Boyle Reservoir indicated a consistently high availability of food sources.

- Successful trapping with baited traps has been widely reported during fall months, but baited traps are generally more successful in the spring. Western pond turtles typically feed less as the summer goes on because they cannot digest food while overwintering. If the J.C. Boyle Reservoir population typically initiates overwintering in late summer, then they would likely have reduced their feeding rates and been less prone to capture in baited traps.

As part of the tracking study, the KRRC biologists are conducting winter field visits to the J.C. Boyle Reservoir to locate radio-tagged turtles. The locations of turtles will be determined to the extent feasible from shore; however, if turtles are found to be overwintering in deeper waters far from shore and more precise locations are desired, a boat may be used. The locations of overwintering radio-tagged turtles will help determine whether western pond turtles at J.C. Boyle Reservoir tend to overwinter on land or in reservoir sediments. If turtles are found overwintering in shallow sediments, the specific locations of those turtles in the reservoir will aid in determining whether they could be affected by erosion and other potential effects during drawdown.

In spring 2019, the KRRC biologists will conduct additional trapping for approximately six nights, to attempt to capture enough turtles to enable a population estimate and to recover data loggers. As with the initial trapping effort, traps will be set by inflatable kayak or by shore to the extent possible. Radio-transmitters will be used to locate the radio-tagged turtles and set traps nearby. If trapping efforts are insufficient to capture enough additional untagged turtles for a population estimate, additional efforts such as snorkeling may be used.

Biologists will also retrieve environmental data loggers measuring ambient air and water temperatures in spring 2019. Thermographs from environmental data loggers will be compared to those carried by turtles, to aid in determining whether turtles are overwintering on land or in water (and potentially at what depth in the water/sediment), and if they remain stationary or are active for part of the winter.

Chapter 7 Special-Status Plants

7. SPECIAL-STATUS PLANTS

Several special-status plant species have been identified as occurring in the Project area. PacifiCorp (2004) documented several special-status plant species during extensive surveys in 2002 and 2003. In addition, the KRRC biologists identified occurrences of special-status plant species through state and federal databases (ORBIC 2017; CNDDB 2018; IPaC 2018); the California Native Plant Society (CNPS) Inventory of Rare and Endangered Plants of California (CNPS 2018a); and information obtained from USFWS (Yreka), BLM (Klamath Falls), and USFS (Klamath National Forest).

For the purposes of the surveys, special-status plants were defined to include those species with federal status (federally listed as threatened, endangered, or proposed for listing), state threatened or endangered species, species included in ONHP Lists 1 and 2, and species listed as California Rare Plant Rank 1 and 2. Where BLM and USFS lands occur in the study area, BLM and USFS Sensitive Species are also considered.

The objective of the surveys was to identify any special-status plants that are present 1) in the study area (i.e., within a 0.25-mile buffer around the Project area) and/or 2) in areas such as reservoir shorelines that may be affected by the Project.

7.1 Methods

Based on documented occurrences and the presence of suitable habitat, the KRRC biologists developed a focused list of special-status plant species, as shown in Table 7-1.

Table 7-1: Special-Status Plants with Potential to Occur in or near the Project Area

Species	Status	Habitat	Location of Documented Occurrence(s)	Bloom Time	Survey Effort
Greene's mariposa-lily *Calochortus greenei*	FSC, BLM, OC, ONHP List 1, CNPS List 1B	Occurs primarily in annual grassland, wedgeleaf ceanothus chaparral, and oak and oak-juniper woodlands	Several locations around Iron Gate Reservoir	May through July	Within the limits of work in suitable habitat
Bristly Sedge *Carex comosa*	ONHP List 2	Marshes, lake shore, and wet meadows	Eastern shore of J.C. Boyle Reservoir in two locations (east of dam and south of Highway 66); also, west of dam	May through September	Along reservoir margins and within the limits of work in suitable habitat
Mountain Lady's Slipper *Cypripedium montanum*	ONHP List 4, CNPS List 4	Dry, open conifer forests, more often in moist riparian habitats	J.C. Boyle peaking reach (location details unknown)	March through August	Within the limits of work in suitable habitat

Species	Status	Habitat	Location of Documented Occurrence(s)	Bloom Time	Survey Effort
Gentner's fritillary *Fritillaria gentneri*	FE, CNPS List 1B	Cismontane woodland, chaparral; mixed hardwood-conifer vegetation dominated by Oregon oak	Habitat present in the reach along Copco Lake and Iron Gate Reservoir; no known locations	Late March to early April; April and May at higher elevations	Within the limits of work in suitable habitat
Bolander's sunflower *Helianthus bolanderi*	BLM, ONHP List 3	Occurs in yellow pine forest, foothill oak woodland, chaparral, and occasionally in serpentine substrates or wet habitats.	South of Iron Gate Reservoir near proposed disposal site; J.C. Boyle peaking reach (location details unknown)	June through October	Within the limits of work in suitable habitat
Bellinger's meadow-foam *Limnanthes floccosa* ssp. *bellingerana*	FSC, BLM, OC, ONHP List 1, CNPS List 1B	High elevation vernal pools in shallow soiled rocky meadows in spots that are at least partially shaded in the spring	J.C. Boyle peaking reach (location details unknown)	April through June	Within the limits of work in suitable habitat
Detling's silverpuffs Microseris *laciniata* ssp. *detlingii*	CNPS List 2	Chaparral and grassy openings among Oregon white oak trees	One location on the western side of Iron Gate Reservoir	May through June	Within the limits of work in suitable habitat
Egg Lake monkeyflower *Mimulus pygmaeus*	FSC, CNPS List 4	Occurs in damp areas or vernally moist conditions in meadows and open woods	East of J.C. Boyle Reservoir in two locations (north of Highway 66 and southeast of dam); west of dam in two locations in damp mudflats; also west of canal near access road in one location	May through August	Along reservoir margins and within the limits of work in suitable habitat
Holzinger's orthotrichum moss *Orthotrichum holzingeri*	CNPS List 1B.3	Found on vertical calcareous rock surfaces and at the bases of Salix bushes just above rock that is frequently inundated by seasonally high water in dry coniferous forests	Just upstream of Iron Gate Reservoir on Jenny Creek		Where in-stream work could occur at Jenny Creek at bridge
Western yampah *Perideridia erythrorhiza*	FSC, BLM, OC, ONHP List 1	Occurs in moist prairies, pastureland, seasonally wet meadows, and oak or pine woodlands, often in dark wetland soils and clay depressions	Along three drainages into the western side of J.C. Boyle Reservoir and in two locations west of canal near access road	Mid July through August	Along reservoir margins and within the limits of work in suitable habitat
Howell's yampah (Howell's false caraway) *Perideridia howelii*	ONHP List 4	Moist meadows, stream banks	One location along the drainage southeast of J.C. Boyle Reservoir; one location along the northern side of Copco Lake north of the road	July and August	Along reservoir margins and within the limits of work in suitable habitat

Species	Status	Habitat	Location of Documented Occurrence(s)	Bloom Time	Survey Effort
Yreka phlox *Phlox hirsuta*	FE, CE, CNPS List 1B	Open areas on dry serpentine soils, found at elevations ranging from 2,500 to 4,400 feet.	Not known to occur near the limits of work; no suitable ultramafic soils occur within 0.5 mile of the limits of work (NRCS 2017)	March and April	None – suitable soils not present within the limits of work
Strapleaf willow *Salix ligulifolia*	ONHP List 3	Riverbanks, wetlands, floodplains	One location west of J.C. Boyle Dam in a boulder flood channel in the dam release zone	March through June	Along reservoir margins and within the limits of work in suitable habitat
Fleshy sage *Salvia dorrii* var. *incana*	CNPS List 3	Occurs in silty to rocky soils in great basin scrub, pinyon, and juniper woodland	Three locations around Iron Gate Reservoir	May through July	Within the limits of work in suitable habitat
Pendulous bulrush *Scirpus pendulus*	BLM, ONHP List 2, CNPS List 2	Occurs along streambanks and in wet meadows	One location along Fall Creek	June through August	Along reservoir margins and within the limits of work in suitable habitat
Lemmon's silene *lemmonii*	ONHP List 3	Open pine woodlands	J.C. Boyle peaking reach to J.C. Boyle Reservoir (location details unknown)	Spring and summer	Within the limits of work in suitable habitat
Western yellow cedar *Callitropsis nootkatensis*	Petitioned for federal listing, CNPS List 4.3	Wet to moist sites, from the coastal rainforests to rocky ridgetops near the timberline in the mountains	Not documented during PacifiCorp surveys or listed on CNDDB or ORBIC for the Project area; may occur based on information from USFWS Yreka office (May 23, 2017)		Within the limits of work in suitable habitat

Key:

BLM: Bureau of Land Management sensitive species—species that could easily become endangered or extinct
CE: California Endangered
CNDDB: California Natural Diversity Database
CNPS List 1A: California Native Plant Society (CNPS)—presumed extinct in California
CNPS List 1B: rare, threatened, or endangered in California and elsewhere
CNPS List 2: rare, threatened, or endangered in California, but more common elsewhere
CNPS List 3: on the review list—more information needed
CNPS List 4: on the watch list—limited distribution
FE: Federal Endangered
FSC: Federal Species of Concern
OC: Candidate listing by Oregon Department of Agriculture
ONHP List 1: Oregon Natural Heritage Program (ONHP) threatened with extinction or presumed to be extinct throughout their entire range
ONHP List 2: threatened with extirpation or presumed to be extirpated from the State of Oregon
ONHP List 3: more information is needed before status can be determined, but may be threatened or endangered in Oregon or throughout their range
ONHP List 4: of conservation concern but not currently threatened or endangered
ORBIC: Oregon Biodiversity Information Center
USFWS: United States Fish and Wildlife Service

In consideration of the various peak bloom times of the species listed in Table 7-1, the KRRC biologists planned three surveys: early season (April), mid-season (May), and late season (July). The mid-season and part of the late season surveys were conducted in 2018. The early season survey was not conducted, due to

lack of access to PacifiCorp lands. A wildfire in the California portion of the study area in July restricted the late season survey to the J.C. Boyle Reservoir study area.

The KRRC biologists conducted focused surveys for special-status plants in the areas where construction would occur. These focused surveys followed the CDFW "Protocols for Surveying and Evaluating Impacts to Special-Status Native Plant Populations and Sensitive Natural Communities" (CDFW 2018b). In areas along reservoir shorelines, where changes in hydrology and geomorphology could occur due to the Project, biologists focused surveys on the locations of known and potential occurrences of special-status plants documented during surveys conducted by PacifiCorp (2004) and data obtained from a desktop review of existing databases (CNDDB, ORBIC, and CNPS).

In accordance with the CDFW protocol, detailed floristic surveys conducted in areas where construction would occur entailed identification of every plant taxon observed, to the taxonomic level necessary to determine rarity and listing status. These planned construction areas include proposed disposal sites, staging areas, utility line corridors, facility removal areas, and locations where clearing could occur for road modifications such as road widening, turnouts, equipment and material storage, and bridge replacement or modification. In these areas, biologists walked parallel transects generally spaced 5 to 10 meters apart and recorded plant species observed. Biologists also surveyed reservoir shorelines from a boat, focusing on areas of suitable habitat and locations of known and potential occurrences of special-status plants. Biologists recorded Global Positioning System (GPS) coordinates for all special-status plants found, along with descriptions of habitat conditions and proximity to proposed work activities or other notable features.

7.2 Findings

As shown on Figures 10-1 through 10-3, the KRRC biologists identified seven special-status plant species (including one potential observation) in the study area, as follows:

- *Calochortus greenei* (Greene's mariposa-lily) was observed in several locations in the vicinity of the Iron Gate Reservoir, including in the footprint of the Iron Gate disposal site. The species was also observed along utility corridors between the Copco No. 1 and Copco No. 2 Dams. A *Calochortus* species was observed along the southeastern side of Copco Lake in two locations, which will be revisited to confirm species identification in future surveys during the appropriate bloom time. In addition, there is one known historical observation of the species northeast of the staging areas for the Copco No. 1 Dam; however, this area could not be accessed during the 2018 surveys and will be visited in 2019.
- *Salvia dorrii* var. *incana* (fleshy sage) was observed in two locations near Iron Gate Reservoir; both locations are in proximity to but outside of the potential disturbance area associated with proposed removal of utility poles.
- A previously documented population of *Perideridia erythrorhiza* (western yampah) north of the J.C. Boyle Dam was verified. The plants are in a dry meadow and will likely be outside the area of impact from the drawdown of the reservoir.

- *Carex comosa* (bristly sedge) was observed along the J.C. Boyle Reservoir at the location of a previously documented occurrence. The plants were not in bloom during the survey, so that area will be revisited during future surveys to confirm species identification.

In addition to the species with known potential to occur discussed above, the KRRC botanists observed three other rare plant species in the study area:

- *Mirabilis greenei* (Greene's four o'clock), CNPS 4.2, was observed in four locations along the northern side of the Klamath River, downstream of the Copco No. 2 Dam.
- *Iris longipetala* (coast iris), CNPS 4.2, was observed in one location along the northwestern shoreline of the J.C. Boyle Reservoir.
- *Lilium washingtonianum* ssp. *purpurascens* (purple-flowered Washington lily), CNPS 4.3, was observed in two locations: near the Fall Creek diversion and along the northern side of Copco Lake.

7.3 Conclusions

The KRRC biologists documented special-status plants in the study area, including some locations near or in the Project area, as shown on Figures 10-1 through 10-3. Additional special-status plant surveys will be conducted in 2019 to complete surveys within the early (April) and the late (July) bloom times. In addition, biologists will visit the locations of unconfirmed sightings during the appropriate bloom times to confirm occurrences of specific species (e.g., *Carex comosa*). Additional areas insufficiently surveyed during 2018 will be covered, including the proposed Fall Creek hatchery area and bypass river reaches.

Chapter 8 Vegetation Communities

8. VEGETATION COMMUNITIES

The KRRC biologists classified and mapped vegetation communities to identify the location of sensitive natural communities that may be affected by the Project.

8.1 Methods

PacifiCorp mapped existing vegetation cover types/wildlife habitat in a primary study area of 0.25 mile surrounding the reservoirs, facilities, and river reaches (PacifiCorp 2004). The intent of the 2018 vegetation community mapping conducted by the KRRC was to verify the general extent of vegetation communities and classify them to the alliance level in accordance with the Manual of California Vegetation (CNPS 2018b). An alliance is a floristically defined vegetation type identified by its dominant and/or characteristic species.

In June 2018, the KRRC biologists conducted vegetation community mapping in the 0.25-mile study area. During mapping efforts, the KRRC biologists walked the length of proposed construction areas and visually classified the vegetation communities into similar (or dissimilar) groups. The team mapped polygons to delineate each area where vegetation communities and percent cover were internally consistent. In each polygon, the dominant and characteristic plant species were recorded, and the percent cover for the ground, understory, and canopy layers was noted. A list of all identified species was compiled for each polygon. Upon encountering an area with different dominant species and/or percent coverage, a new polygon, denoting a new alliance, was established. Vegetation community and coverage data were then used to classify each area by alliance in accordance with CNPS methods.

8.2 Findings

Biologists recorded 17 alliances in the 0.25-mile study area (Table 8-1). Vegetation communities (as alliances) are depicted on Figures 11-1 through 11-16.

Table 8-1: Vegetation Community Alliances Recorded in the Study Area

Alliance Scientific Name	Alliance Common Name	Lifeform	California Rarity	Global Rarity
Pinus ponderosa	Ponderosa pine forest	Tree	S4	G5
Fraxinus latifolia	Oregon ash groves	Tree	S3.2	G4
Acer macrophyllum	Bigleaf maple forest	Tree	S3	G4
Quercus garryana	Oregon white oak woodland	Tree	S3	G4
Juniperus occidentalis	Western juniper woodland	Tree	S4	G5
Ceanothus cuneatus	Wedgeleaf ceanothus chaparral	Shrub	S4	G4
Cercocarpus montanus	Birchleaf mountain mahogany chaparral	Shrub	S4	G5
Purshia tridentata	Bitterbrush scrub	Shrub	S3	G4
Prunus subcordata	Klamath plum shrubland	Shrub	NA	NA
Prunus virginiana	Chokecherry thicket	Shrub	S2	G4
Salix lucida	Shining willow grove	Tree	S3.2	G4
Salix geyeriana	Geyer willow thicket	Shrub	S2	G4
Salix sp.	Willow thicket	Tree/Shrub	NA	NA
Schoenoplectus acutus	Hardstem bulrush marsh	Herb	S4	G5
Carex sp.	Sedge meadow	Herb	NA	NA
Bromus tectorum – Taeniatherum caput-medusae	Cheatgrass – medusahead grassland	Herb	SNR	GNR
Bromus (diandrus, hordeaceus)	Annual brome grassland	Herb	SNR	GNR

Key

California Rarity/Global Rarity
S1/G1: Statewide/Worldwide <6 viable occurrences and/or <518 hectares
S2/G2: 6 to 20 occurrences and/or 518 to 2,590 hectares
S3/G3: 21 to 100 occurrences and/or 2,590 to 12,950 hectares
S4/G4: >100 occurrences and/or > 12,950 hectares
S5/G5: Demonstrably secure because of its worldwide abundance
SNR – State not reported
GNR –Global not reported
NA – Alliance not identified by CNPS

8.3 Conclusions

CDFW has ranked natural communities according to their rarity in the state of California. Natural Communities with ranks of S1-S3 are considered Sensitive Natural Communities (CDFW 2018c). Biologists identified the following sensitive natural communities in the study area:

- Oregon ash groves
- Bigleaf maple forest
- Oregon white oak woodland

- Bitterbrush scrub
- Chokecherry thicket
- Shining willow grove
- Geyer willow thicket

The KRRC did not conduct wetland surveys or focused delineations during the 2018 field season. Biologists mapped emergent wetlands along the fringes of the reservoirs and riparian habitat primarily associated with streams and drainages that flow into the reservoirs. Additional sensitive vegetation communities may be identified during wetland investigations to be carried out in 2019.

In 2019, the KRRC will delineate wetlands in the Project area in accordance with the 1987 United States Army Corps of Engineers Wetland Delineation Manual and applicable Regional Supplements (i.e., Western Mountains, Valleys, and Coast Region and Arid West). Additionally, the KRRC will use the Oregon Rapid Wetland Assessment Protocol to assess functional values of wetlands, as applicable to areas in Oregon. In addition, the KRRC will conduct additional mapping of wetlands and riparian habitats adjacent to reservoirs and/or associated with streams but outside the direct limits of work.

Chapter 9 Invasive Exotic Vegetation

9. INVASIVE EXOTIC VEGETATION

After a close review of invasive exotic vegetation (IEV) survey findings for the Project area documented by PacifiCorp in 2002-2003 (PacifiCorp 2004), the KRRC determined that surveys reflecting current IEV conditions were required. Information on IEV locations and extent are needed to effectively plan for control of IEV in the Project area, to support restoration success.

9.1 Methods

In 2017 and 2018, KRRC biologists conducted surveys of invasive exotic plant species targeted by federal, state, and county agencies. The timing of these surveys corresponded to when IEV were positively identifiable (by leaf or flower) (Table 9-1). The study area included uplands around the reservoir edges and other areas within the limits of work.

Biologists conducted a partial survey in late fall of 2017, between November 10 and December 8. At that time, 15 to 20 percent of the shoreline at each reservoir was surveyed on foot. A principal survey was conducted between May 19 and June 22, 2018, in a study area that included all areas where construction activities are planned and along reservoir shorelines. Early spring surveys were planned but not executed because access was not granted by PacifiCorp.

The November 2017 surveys were conducted by two biologists, but the 2018 surveys were conducted by three to four biologists at a time. Biologists surveyed approximately 566 acres in total, which included the Project acreage above the water surface (uplands). When feasible, biologists divided into teams of two. A two-person team allowed for a fast, systematic survey of Project shorelines with one biologist walking near the shoreline below riparian vegetation and the second biologist walking in parallel along the upper portion of the bank, closer to the boundary of the Project area. Biologists kept in constant communication to ensure that each invasive species of concern was recorded accurately, and that no data were repeated or skipped.

The KRRC developed a prioritized list of invasive species (Table 9-1) based on historical data and on lists of IEV species with a potential to occur in the Project area derived from data available from the California Department of Food and Agriculture, Oregon Department of Agriculture, California Invasive Plant Council, Klamath and Siskiyou County Departments of Agriculture, and the Klamath National Forest. Biologists logged the presence of high- and medium-priority invasive species (as designated in Table 9-1, last column) with either a point representing an 8-foot-diameter circle for smaller populations, or a polygon representing a larger IEV population. If multiple species were present in the same area, they were all included in the GPS data of either the point or polygon. Because areas of invasive vegetation can serve as seed banks for the Project site, areas of dense invasive coverage outside the limit of work were also recorded. These areas will be used to inform the invasive species removal plan but were not used to calculate the area of IEV coverage.

Table 9-1: Prioritized List of IEV Species

Scientific Name	Common Name	CDFA[1]	ODA[2]	Cal-IPC[3]	Klamath County[4]	Siskiyou County[5]	Klamath NF[6]	# of Agencies[7]	Priority[8]
Chondrilla juncea	skeleton weed	AW	B & T	Moderate	A	CA-A	High	5	High
Centaurea diffusa	diffuse knapweed	AW	B	Moderate	A	CA-A	High	4	High
Centaurea virgata ssp. *squar.*	squarrose knapweed	NR	A & T	Moderate	A	CA-A	High	4	High
Euphorbia esula	leafy spurge	AW	B & T	NR	B	CA-A	High	4	High
Onopordum acanthium	Scotch thistle	AW	B	High	B	CA-A	High	4	High
Acroptilon repens	Russian knapweed	BW	NR	Moderate	A	CA-A	High	3	High
Carduus acanthoides	plumeless thistle	AW	NR	limited	A	NR	High	3	High
Centaurea stoebe ssp. micr.	spotted knapweed	NR	B	High	B	CA-A	High	3	High
Cytisus scoparius	Scotch broom	BW	B	High	A	CA-C	High	3	High
Lepidium latifolium	perennial pepperweed	BW	B & T	High	B	NR	High	3	High
Lythrum salicaria	purple loosetrife	BW	B	High	A	NR	High	3	High
Carduus nutans	musk thistle	AW	B	Moderate	B	CA-A	High	2	High
Fallopia japonica	Japanese knotweed	BW	NR	Moderate	A	NR	High	2	High
Linaria dalmatica	Dalmatian toadflax	NR	B	Moderate	B	CA-A	High	2	High
Onopordum tauricum	Taurian thistle	AW	A	NR	NR	NR	High	2	High
Sonchus arvensis	field sowthistle	AW	NR	NR	NR	NR	High	2	High
Tamarix parviflora	small flower tamarisk	NR	NR	High	NR	NR	High	2	High
Anchusa officinalis	alkanet	NR	B & T	NR	NR	NR	NR	1	Medium
Bromus madritensis ssp. *rubens*	foxtail brome	NR	NR	High	NR	NR	NR	1	Medium
Bromus tectorum	cheatgrass	NR	NR	High	NR	NR	NR	1	Medium
Centaurea solstitialis	yellow starthistle	CW	B	High	B	CA-C	Moderate	1	Medium
Cirsium ochrocentrum	Beaumont thistle	AW	NR	NR	NR	NR	NR	1	Medium
Convolvulus arvensis	field bindweed	CW	B & T	NR	NR	NR	NR	1	Medium
Crupina vulgaris	bearded creeper	AW,Q	B	Limited	NR	NR	NR	1	Medium
Dipsacus fullonum	teasel	NR	B	Moderate	A	NR	NR	1	Medium
Elymus caput-medusae	medusahead	CW	B	High	C	NR	NR	1	Medium
Foeniculum vulgare	fennel	NR	NR	Moderate	NR	NR	High	1	Medium

Scientific Name	Common Name	CDFA[1]	ODA[2]	Cal-IPC[3]	Klamath County[4]	Siskiyou County[5]	Klamath NF[6]	# of Agencies[7]	Priority[8]
Halogeton glomeratus	saltlover	AW	B	Moderate	NR	NR	NR	1	Medium
Isatis tinctoria	dyer's woad	BW	B	Moderate	A	CA-B	Moderate	1	Medium
Linaria vulgaris	butter and eggs	NR	B	Moderate	A	NR	NR	1	Medium
Phalaris arundinacea	reed canary grass	NR	B & T	Not Listed	NR	NR	NR	1	Medium
Rubus armeniacus	Himalayan blackberry	NR	B	High	NR	NR	NR	1	Medium
Salvia aethiops	Mediterranean sage	BW	B	Limited	B	NR	High	1	Medium
Tribulus terrestris	puncture vine	CW	B	Limited	B	NR	High	1	Medium
Xanthium spinosum	spiny clotbur	NR	B	None	A	NR	NR	1	Medium
Aegilops cylindrica	goatgrass	BW	B	Watch	NR	NR	NR	0	Low
Avena barbata	slender oat	NR	NR	Moderate	NR	NR	NR	0	Low
Brassica nigra	black mustard	NR	NR	Moderate	NR	NR	NR	0	Low
Bromus diandrus	ripgut grass	NR	NR	Moderate	NR	NR	NR	0	Low
Cirsium arvense	Canada thistle	BW	B	Moderate	B	CA-B	Moderate	0	Low
Cirsium vulgare	bull thistle	NR	B	Moderate	C	CA-C	Low	0	Low
Conium maculatum	poison hemlock	NR	B	Moderate	B	NR	Low	0	Low
Festuca arundinacea	tall fescue	NR	NR	Moderate	NR	NR	NR	0	Low
Hirschfeldia incana	summer mustard	NR	NR	Moderate	NR	NR	NR	0	Low
Hordeum murinum	foxtail barley	NR	NR	Moderate	NR	NR	NR	0	Low
Hypericum perforatum	Klamath weed	CW	B	Limited	B	NR	Low	0	Low
Lepidium draba	hoary cress	BW	NR	Moderate	B	NR	Moderate	0	Low
Leucanthemum vulgare	oxeye daisy	NR	NR	Moderate	NR	NR	NR	0	Low
Marrubium vulgare	white horehound	NR	B	Limited	NR	NR	NR	0	Low
Mentha pulegium	pennyroyal	NR	NR	Moderate	NR	NR	NR	0	Low
Persicaria wallichii	Himalayan knotweed	BW	NR	Watch	NR	NR	NR	0	Low
Rumex acetosella	common sheep sorrel	NR	NR	Moderate	NR	NR	NR	0	Low
Torilis arvensis	field hedge parsley	NR	NR	Moderate	NR	NR	NR	0	Low

Notes: (Lighter cells indicate a high priority to the corresponding agency)

1. CDFA: California Noxious Weed List (CDFA 2018); Ratings descriptions as follows:

"A"	A pest of known economic or environmental detriment and is either not known to be established in California or it is present in a limited distribution that allows for the possibility of eradication or successful containment. If found entering or established in the state, A-rated pests are subject to state (or commissioner when acting as a state agent) enforced action involving eradication, quarantine regulation, containment, rejection, or other holding action.
"B"	A pest of known economic or environmental detriment and, if present in California, it is of limited distribution. At the discretion of the individual county agricultural commissioner they are subject to eradication, containment, suppression, control, or other holding action.
"C"	A pest of known economic or environmental detriment and, if present in California, it is usually widespread. If found in the state, they are subject to regulations designed to retard spread or to suppress at the discretion of the individual county agricultural commissioner. There is no state enforced action other than providing for pest cleanliness.
"Q"	An organism or disorder suspected to be of economic or environmental detriment, but whose status is uncertain because of incomplete identification or inadequate information.
"W"	This notation indicates that a plant is included in the CCR Section 4500 list of California State Noxious Weeds.

2. ODA Noxious Weed Policy and Classification System (ODA 2018). (Equivalent to the Pacific Northwest Invasive Plant Council (PNW-IPC). Ratings descriptions as follows:

A	A weed of known economic importance which occurs in the state in small enough infestations to make eradication or containment possible; or is not known to occur, but its presence in neighboring states make future occurrence in Oregon seem imminent. Recommended action: Infestations are subject to eradication or intensive control when and where found.
B	A weed of economic importance which is regionally abundant, but which may have limited distribution in some counties. Recommended action: Limited to intensive control at the state, county or regional level as determined on a site specific, case-by-case basis. Where implementation of a fully integrated statewide management plan is not feasible, biological control (when available) shall be the primary control method.
T	A designated group of weed species that are selected and will be the focus for prevention and control by the Noxious Weed Control Program. Action against these weeds will receive priority.

3. Cal-IPC. The Cal-IPC Plant Inventory (Cal-IPC 2018). Ratings descriptions as follows:

High	These species have severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal and establishment.
Moderate	These species have substantial and apparent-but generally not severe-ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal, though establishment is generally dependent upon ecological disturbance.
Limited	These species are invasive but their ecological impacts are minor on a statewide level or there was not enough information to justify a higher score. Their reproductive biology and other attributes result in low to moderate rates of invasiveness. Ecological amplitude and distribution are generally limited, but these species may be locally persistent and problematic.

Alert	An Alert is listed on species with High or Moderate impacts that have limited distribution in California, but may have the potential to spread much further.
Watch	These species have been assessed as posing a high risk of becoming invasive in the future in California.

4. KCBC. Noxious Weeds in Klamath County for the year 2019 (KCBC 2019). Ratings descriptions as follows:

A	A weed of known economic importance which occurs in the county in small enough infestations to make eradication/containment possible, or if not known to occur, but its presence in neighboring counties make future occurrence in Klamath County seem imminent.
B	A weed of economic importance which in some parts of the county is abundant but may have limited distribution in other parts of the county. Where implementation of a fully integrated county wide management plan is infeasible, biological control shall be the main control approach.
C	A weed which in most parts of the county is abundant. While not subject to enforcement regulations, these species can cause similar economic and ecological impacts as other noxious weed species. Education and control recommendations will be the main approach.

5. SDA. Identification and Characteristics of Invasive Noxious Weed Infestations. (SDA 2015). Ratings:

A	"A" Rated: A pest of known economic or environmental detriment and is either not known to be established in California or it is present in a limited distribution that allows for the possibility of eradication or successful containment. A-rated pests are prohibited from entering the state. A-rated pests are subject to state (or commissioner) enforced action involving eradication, quarantine regulation, containment, rejection, or other holding action.
B	"B" Rated: A pest of known economic or environmental detriment and it is of limited distribution. Subject to state endorsed holding action and eradication to provide for containment. At the discretion of the individual county agricultural commissioner they are subject to eradication, containment, suppression, control, or other holding action.
C	"C" Rated: A pest of known economic or environmental detriment and is usually widespread. They are subject to regulations designed to retard spread or to suppress at the discretion of the individual county agricultural commissioner. There is no state enforced action other than providing for pest cleanliness.

6. USFS-KNF: KNF Noxious Weed and Non-native Invasive Plant List (USFS 2013). Ratings descriptions as follows:

High	These species are currently either limited in distribution, highly invasive, or not present on the KNF. Treatment may vary by location.
Moderate	These species are generally common and are treated on a case by case basis depending on location (Wilderness and Research Natural Area (RNA) increase the priority for treatment).
Low	These species are either widespread throughout the KNF or are not considered to be highly invasive in our area. Usually not treated unless located in a high priority area, such as Wilderness or RNA.

7. Number of Agencies Considering Plant a High Priority for Eradication

8. IEV Survey and Control Priority

Cal-IPC = California Invasive Plant Council
CDFA = California Department of Food and Agriculture
IEV = Invasive Exotic Vegetation
KCBC = Klamath County Board of Commissioners
KNF = Klamath National Forest
ODA = Oregon Department of Agriculture
SDA = Siskiyou Department of Agriculture
USFS = United States Forest Service

The majority of the study area was accessible by foot, except for the southern end of J.C. Boyle Reservoir and the southeastern side of Iron Gate Reservoir. South of Highway 66, J.C. Boyle Reservoir narrows between two rock face cliffs for approximately 0.75 mile. The majority of the southeastern side of Iron Gate is inaccessible because there are no roads, and steep cliffs border the reservoir. For these areas, biologists surveyed from a boat, landing along the shoreline to walk selected accessible areas. For areas too steep to survey by foot, biologists carefully maneuvered the boat to the shoreline and used a pair of binoculars to identify plants.

Ninety percent of the area surrounding Copco Lake is privately owned; consequently, access from the landside was not permitted in most areas. However, during the summer survey in 2018, the water levels in the reservoir were 10 to 15 feet lower than the high water mark, and the biologists were able to use this extended shoreline area to walk along the reservoir without trespassing on any private land.

9.2 Findings

Tables 9-2, 9-3, and 9-4 list the IEV species found in the areas surrounding the J.C. Boyle Reservoir, Copco Lake, and Iron Gate Reservoir, respectively. The area values were calculated as the area where each species was dominant in the survey area. Percent cover represents the area of the dominant species in the study area, divided by the total area of the study area (excluding the reservoir footprints themselves). Figures 12-1 through 12-26 depict the IEV vegetation communities, based on the dominant species, as shown in the tables. Although the figures show invasive species recorded beyond the Project boundary, only areas of invasive species within the limits of work were used to calculate the extent of each species.

Table 9-2: Invasive Exotic Vegetation Extent in the J.C. Boyle Reservoir Uplands

Scientific Name	Common Name	Area (square feet)	Area (acres)	Percent Cover
Bromus tectorum	cheatgrass	288,780	6.629	4.29%
Dipsacus fullonum	teasel	209,250	4.804	3.11%
Phalaris arundinacea	reed canarygrass	206,210	4.734	3.07%
Elymus caput-medusae	medusa head	190,960	4.384	2.84%
Centaurea solstitialis	yellowstar thistle	61,690	1.416	0.92%
Cirsium vulgare	bull thistle	49,260	1.131	0.73%
Lepidium draba	whitetop	46,510	1.068	0.69%
Mentha pulegium	pennyroyal	17,040	0.391	0.25%
Onopordum acanthium	Scotch thistle	13,620	0.313	0.20%
Rumex acetosella	sheep sorrel	6,370	0.146	0.09%
Convolvulus arvensis	field bindweed	1,670	0.038	0.02%
Linaria dalmatica	Dalmatian toadflax	1,530	0.035	0.02%
Rubus armeniacus	Himalayan blackberry	1,330	0.030	0.02%
Acroptilon repens	Russian knapweed	990	0.023	0.01%
	Total	**1,095,210**	**25.142**	**16.26%**

Table 9-3: Invasive Exotic Vegetation Extent in Copco Lake Uplands

Scientific Name	Common Name	Area (square feet)	Area (acres)	Percent Cover
Centaurea solstitialis	yellowstar thistle	262,320	6.022	4.42%
Elymus caput-medusae	medusa head	237,180	5.445	4.00%
Rubus armeniacus	Himalayan blackberry	234,590	5.385	3.96%
Phalaris arundinacea	reed canarygrass	199,440	4.578	3.36%
Dipsacus fullonum	teasel	91,680	2.105	1.55%
Bromus tectorum	cheatgrass	56,790	1.304	0.96%
Lepidium draba	whitetop	8,010	0.184	0.14%
Mentha pulegium	pennyroyal	6,680	0.153	0.11%
Cirsium vulgare	bull thistle	2,210	0.051	0.04%
Conium maculatum	poison hemlock	1,260	0.029	0.02%
Tribulus terrestris	puncture vine	730	0.017	0.01%
Bromus madritensis ssp. *rubens*	foxtail chess	240	0.006	0.00%
Carduus nutans	musk thistle	100	0.002	0.00%
	Total	**1,101,230**	**25.281**	**18.57%**

Table 9-4: Invasive Exotic Vegetation Extent in the Iron Gate Reservoir Uplands

Scientific Name	Common Name	Area (square feet)	Area (acres)	Percent Cover
Centaurea solstitialis	yellowstar thistle	4,331,510	99.438	36.13%
Elymus caput-medusae	Medusa head	3,631,210	83.361	30.29%
Dipsacus fullonum	teasel	321,720	7.386	2.68%
Bromus tectorum	cheatgrass	318,740	7.317	2.66%
Rubus armeniacus	Himalayan blackberry	179,260	4.115	1.50%
Convolvulus arvensis	field bindweed	64,500	1.481	0.54%
Phalaris arundinacea	reed canarygrass	43,300	0.994	0.36%
Conium maculatum	poison hemlock	29,730	0.682	0.25%
Xanthium spinosum	spiny cocklebur	16,040	0.368	0.13%
Tribulus terrestris	puncture vine	9,200	0.211	0.08%
Isatis tinctoria	dyers woad	3,230	0.074	0.03%
Lepidium draba	whitetop	2,860	0.066	0.02%
Mentha pulegium	pennyroyal	150	0.003	0.00%
Linaria vulgaris	butter and eggs	50	0.001	0.00%
Cirsium vulgare	bull thistle	50	0.001	0.00%
	Total	**8,951,550**	**205.498**	**74.67%**

9.3 Conclusions

Yellowstar thistle (106.88 acres and 18.89 percent cover of Project uplands) and medusa head (93.19 acres and 16.47 percent cover of Project uplands) were dominant throughout the entire Project area. Cheatgrass, teasel, reed canary grass, and Himalayan blackberry each cover between 9 and 16 acres (i.e., 1 to 3 percent) of the total Project upland area. IEV species present in the upland areas of the Project having less than 2 acres of coverage each include field bindweed, whitetop, bull thistle, poison hemlock, pennyroyal, spiny cocklebur, Scotch thistle, puncture vine, sheep sorrel, dyer's woad, Dalmatian toadflax, Russian knapweed, foxtail chess, musk thistle, and butter and eggs.

At J.C. Boyle Reservoir, the dominant IEV species differ from those identified throughout the rest of the study area. The reason for this may be J.C. Boyle Reservoir's higher elevation, closed canopy forest coverage, and gradual slopes. Cheatgrass, teasel, reed canarygrass, and medusa head make up the dominant species at the J.C. Boyle Reservoir area.

The dominant IEV species at the Copco Lake area are yellowstar thistle, medusa head, and Himalayan blackberry. In comparison to the landscape surrounding the J.C. Boyle Reservoir, uplands surrounding Copco Lake are drier due to their lower elevation, lack of overstory cover, and higher evapotranspiration rate.

The dominant IEV species at the Iron Gate Reservoir are yellowstar thistle, medusa head, and teasel. The upland areas at this reservoir are the driest of all due to their low elevation, openness, and high evapotranspiration rate.

The findings and conclusions of the IEV surveys are being used to inform the Reservoir Area Management Plan, including selecting methods for IEV eradication and control during Project implementation.

Chapter 10 References

10. REFERENCES

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Appendix A Figures

CDM Smith 3/15/2019 USER Bateska PATH \\colsvr2\Common\Cummings\Klamath\Revisions\MXDs\Figure_1_1_Overall_Project_Map_and_Study_Area.mxd

Spencer Creek
J.C. Boyle Reservoir
State Hwy 66 Bridge
Topsy Campground
Copco Lake
Klamath Canyon
Fall Creek
Beaver Creek
Dutch Creek
Camp Creek
Jenny Creek
Beaver Creek Cove
Raymond Gulch
Horseshoe Ranch Wildlife Area
Juniper Point
Mirror Cove
Iron Gate Reservoir
Long Gulch Cove
Brush Creek
Iron Gate Fish Hatchery
Bogus Creek
Copco No. 2 Bypass
Copco No. 2 Penstock
Keaton Cove
Ager Beswick Rd
Jackson County
Klamath County
Siskiyou County
Klamath National Forest
Klamath National Forest
Yoplaman Crk
Sheepy Crk
Camp 4 Crk
Tom Crk
Hayden Crk
Dry Prairie Crk
Klamath Riv
Rock Crk
Ash Crk
Slide Crk
Dutch Crk
Jenny Crk
Beaver Crk
Willow Crk
Eagle Crk
Shovel Crk
Bullfrog Crk
Brush Crk
Day Crk
Bogus Crk
Cedar Crk
Deer Crk
Jordan Crk
Milk Crk
Shackleburg Crk
Negro Crk
Iron Crk
Bear Crk
Little Bogus Crk
Willow Crk
Cottonwood Crk
Ditch Crk
Jackson Crk
Cave Harm Crk
Hutton Crk
Camp Crk
Dutch Crk
Slide Crk
Jenny Crk
Beaver Crk
Willow Crk
Eagle Crk
Shovel Crk
Ash Crk
Klamath Riv
Rock Crk
Bullfrog Crk
Brush Crk
Day Crk
Bogus Crk
Cedar Crk
Deer Crk
Jordan Crk
Milk Crk
Shackleburg Crk
Negro Crk
Iron Crk
Bear Crk
Little Bogus Crk
Willow Crk
Cottonwood Crk
Ditch Crk
Jackson Crk
Cave Harm Crk
Hutton Crk
66
5

Washington
Montana
Oregon
Idaho
Wyoming
Nevada
Utah
California
Arizona
Map Location

N

0 2.5 5
Miles

Data Source: 2018 TIGER/Line Shapefiles
Basemap Source: Esri, USGS, NOAA

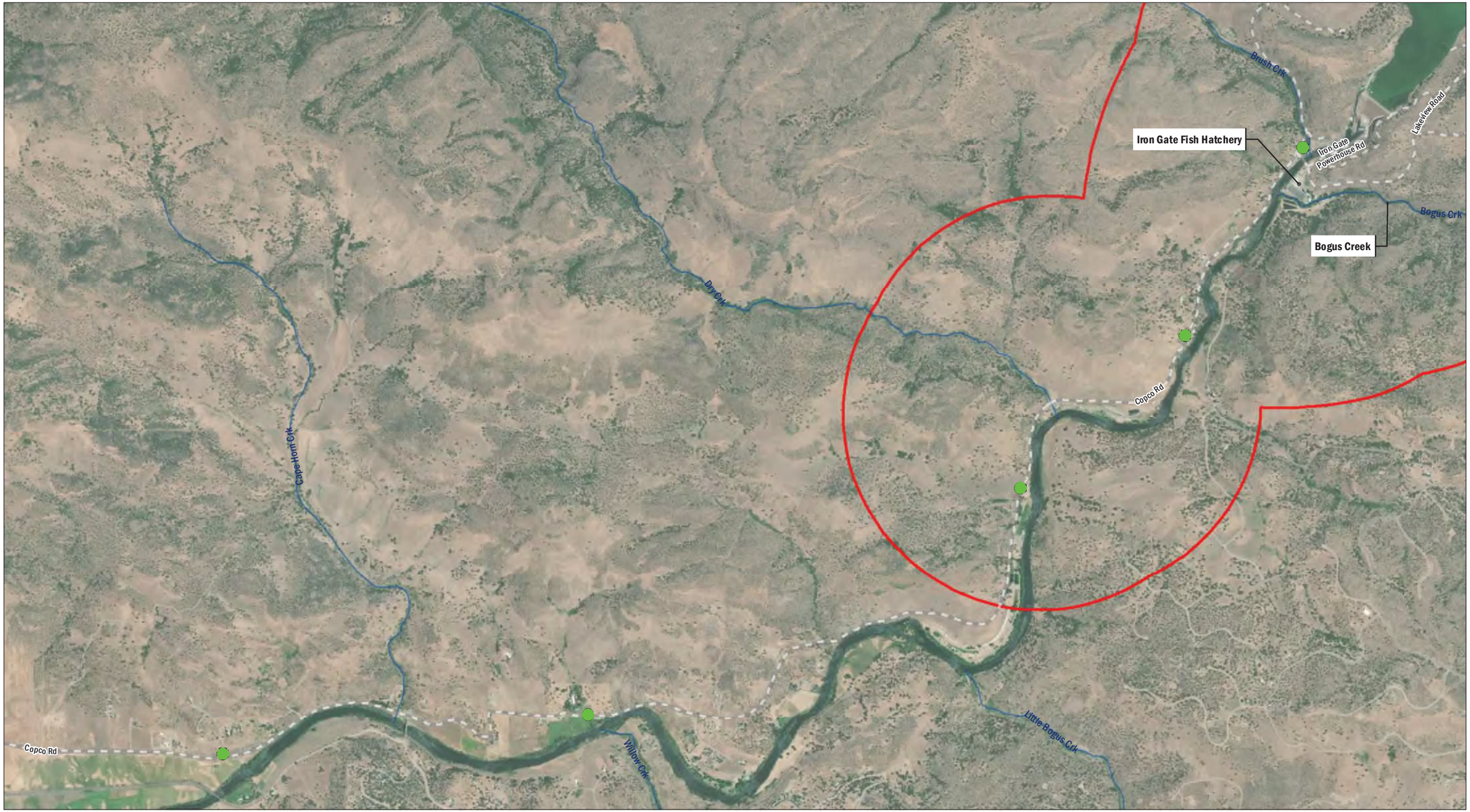
Klamath River Renewal Corporation
Klamath River Renewal Project

Primary Road
Access Route
Stream
Water Body
State
County
National Forest
Wildlife Area
0.25 Mile Study Area Buffer

FIGURE 1-1

Overall Project Map and Terrestrial Resources Study Area

CDM Smith 3/15/2019 USER Bateska PATH \\cdsvr2\Common\Cummings \Klamath\Revisions \MXDs \Figure_2_1_Osprey_Observations_and_Nest_Locations.mxd



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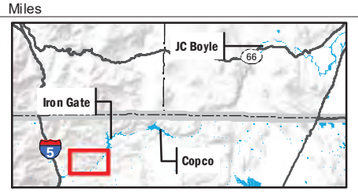
0 0.5 1

Miles

Data Source: CDM Smith
Basemap Source: Esri, USGS, NOAA

Klamath River Renewal Corporation
Klamath River Renewal Project



Osprey Nest Active Status
- Active, Osprey
- Inactive, Osprey

- State
- County
- Stream
- Access Route
- 0.75 Mile Study Area Buffer

FIGURE 2-1

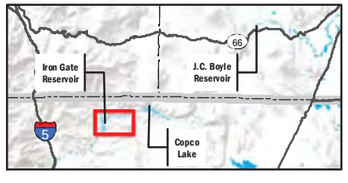
Osprey (Pandion haliaetus) Observations and Nest Locations Klamath River (Below Iron Gate Dam)

CDM Smith 3/15/2019 USER Bateska PATH \\colsvr2\Common\Cummings \Klamath\Revisions \MXDs \Figure_2_2_Osprey_Observations_and_Nest_Locations.mxd



Data Source: CDM Smith
Basemap Source: Esri, USGS, NOAA

Klamath River Renewal Corporation
Klamath River Renewal Project



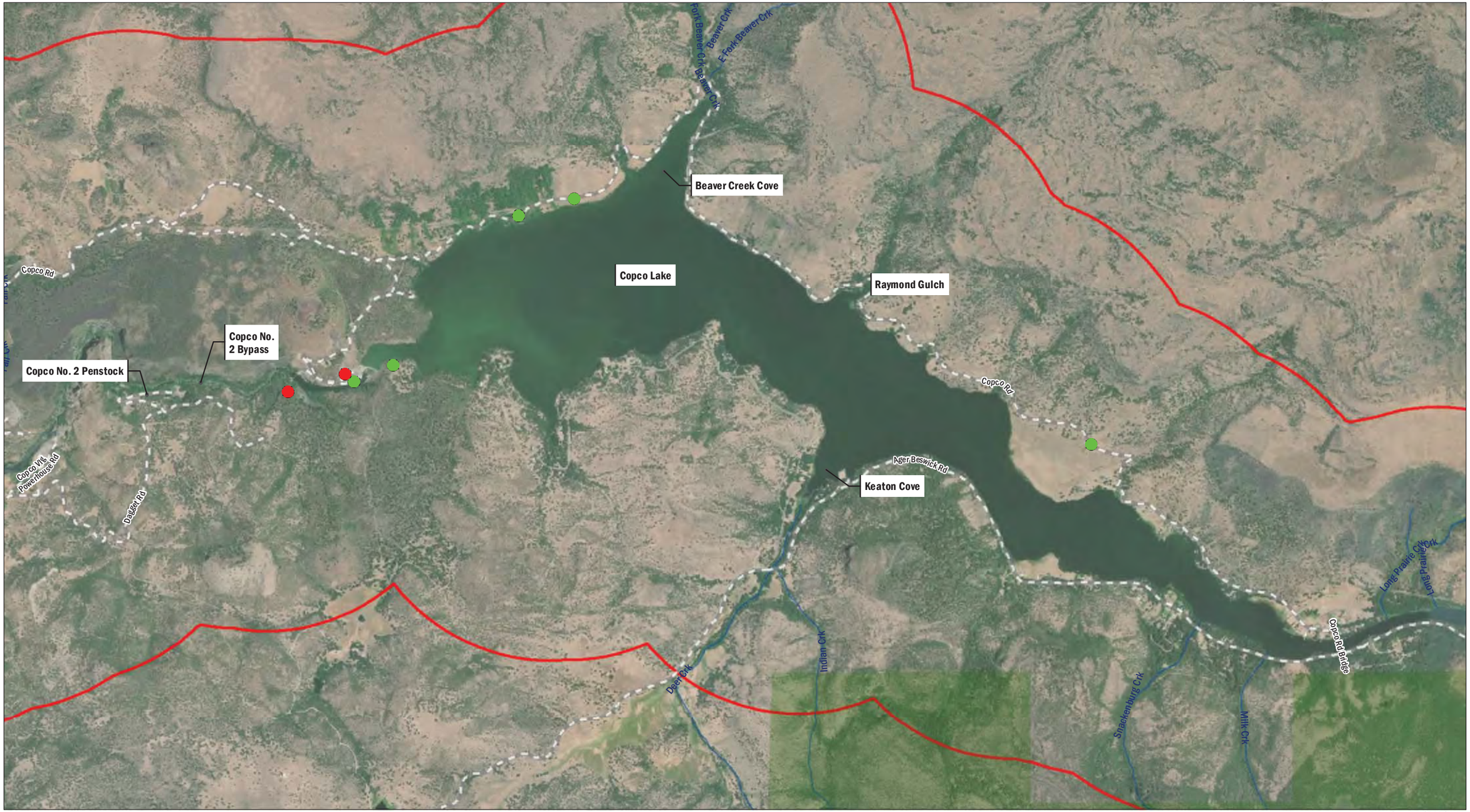
Osprey Nest Active Status
- Active, Osprey
- Inactive, Osprey

- State
- County
- Access Route
- Stream
- 0.75 Mile Study Area Buffer

FIGURE 2-2

Osprey (Pandion haliaetus) Observations and Nest Locations Iron Gate Reservoir

CDM Smith 3/15/2019 USER Bateska PATH \\colsvr2\Common\Cummings \Klamath\Revisions \MXDs \Figure_2_3_Osprey_Observations_and_Nest_Locations.mxd



Data Source: CDM Smith
Basemap Source: Esri, USGS, NOAA

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Klamath River Renewal Project

Osprey Nest Active Status
- Active, Osprey
- Inactive, Osprey

- State
- County
- Stream
- Access Route
- 0.75 Mile Study Area Buffer

FIGURE 2-3

Osprey (Pandion haliaetus) Observations and Nest Locations Copco Lake

CDM Smith 3/15/2019 USER Bateska PATH \\colsvr2\Common\Cummings \Klamath\Revisions \MXDs \Figure_2_4_Osprey_Observations_and_Nest_Locations.mxd



Data Source: CDM Smith
Basemap Source: Esri, USGS, NOAA

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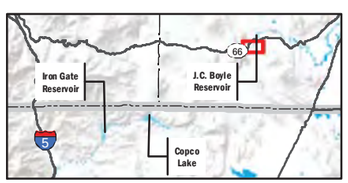
Klamath River Renewal Project



Osprey Nest Active Status
- Active, Osprey
- Inactive, Osprey

- State
- County
- Primary Road
- Access Route
- 0.75 Mile Study Area Buffer

FIGURE 2-4

Osprey (Pandion haliaetus) Observations and Nest Locations J.C. Boyle Reservoir

CDM Smith 3/15/2019 USER Bateska PATH \\cdsvr2\Common\Cummings\Klamath\Revisions\MXDs\Figure_3_1_Willow Flycatcher_Habitats_and_Observations.mxd



Data Source: CDM Smith
Basemap Source: Esri, USGS, NOAA

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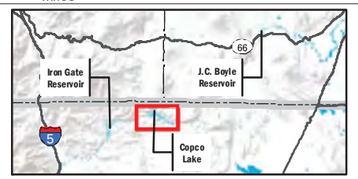
Klamath River Renewal Project



Willow Flycatcher Observation

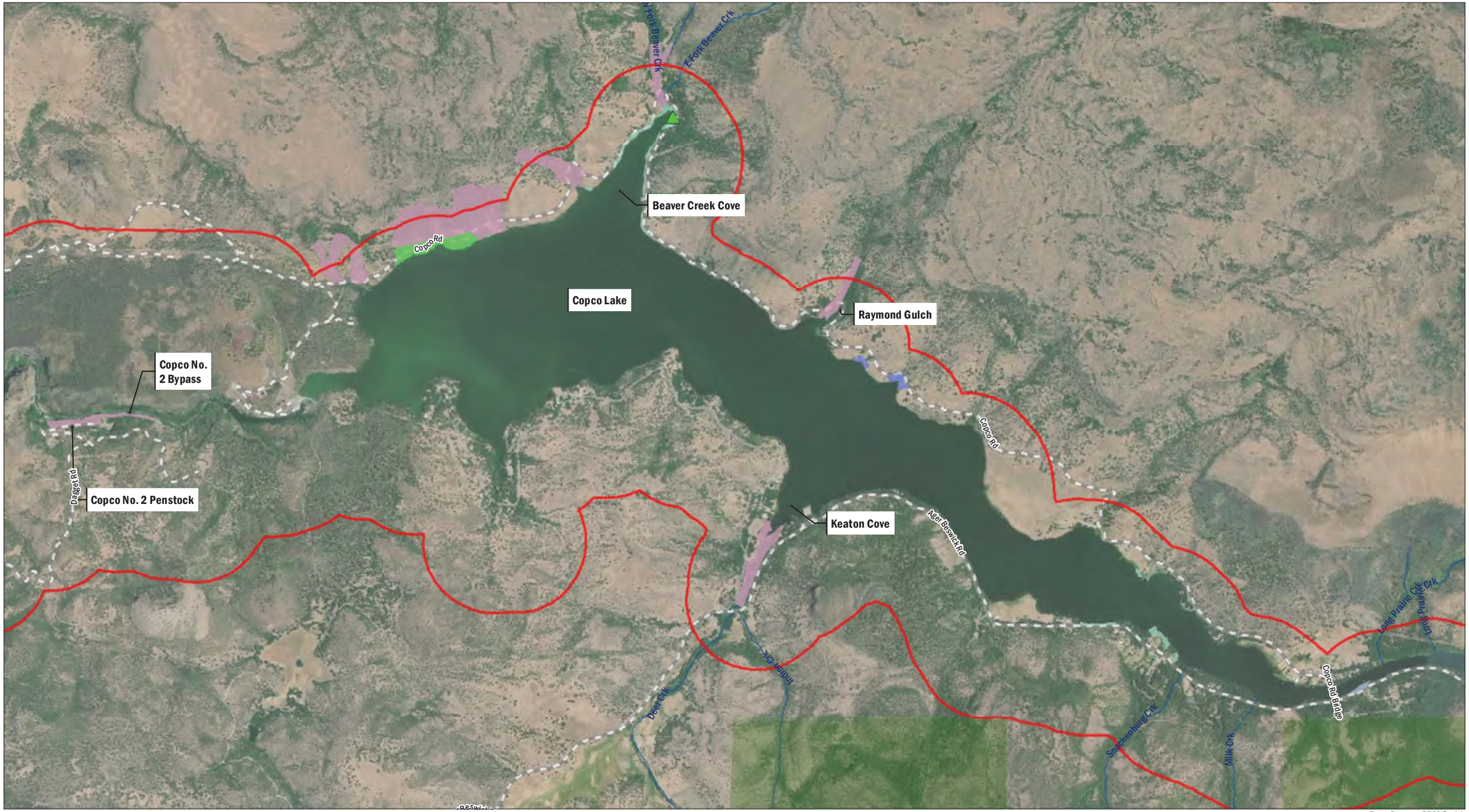
Willow Flycatcher Habitat
- Bigleaf maple forest
- Geyer willow thicket
- Oregon ash grove
- Shining willow grove
- Willow thickets

- State
- County
- Stream
- Access Route
- 0.25 Mile Study Area Buffer

FIGURE 3-1

2018 Willow Flycatcher Habitat and Observations
Iron Gate Reservoir

CDM Smith 3/15/2019 USER:Bateska PATH: \\cdsvr2\Common\Cummings \Klamath\Revisions \MXDs \Figure_3_2_Willow Flycatcher_Habitats_and_Observations.mxd



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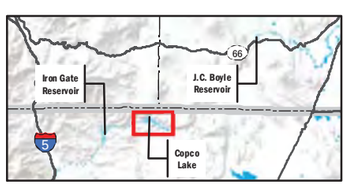
Klamath River Renewal Project



Willow Flycatcher Observation

Willow Flycatcher Habitat
- Bigleaf maple forest
- Geyer willow thicket
- Oregon ash grove
- Shining willow grove
- Willow thickets

- State
- County
- Stream
- Access Route
- 0.25 Mile Study Area Buffer

FIGURE 3-2

2018 Willow Flycatcher Habitat and Observations
Copco Lake

AECOM Oakland CA 3/15/2019 USER Bateska PATH \\colsvr2\Common\Cummings\Klamath\Revisions\MXDs\Figure_3_3_Willow Flycatcher_Habitats_and_Observations.mxd



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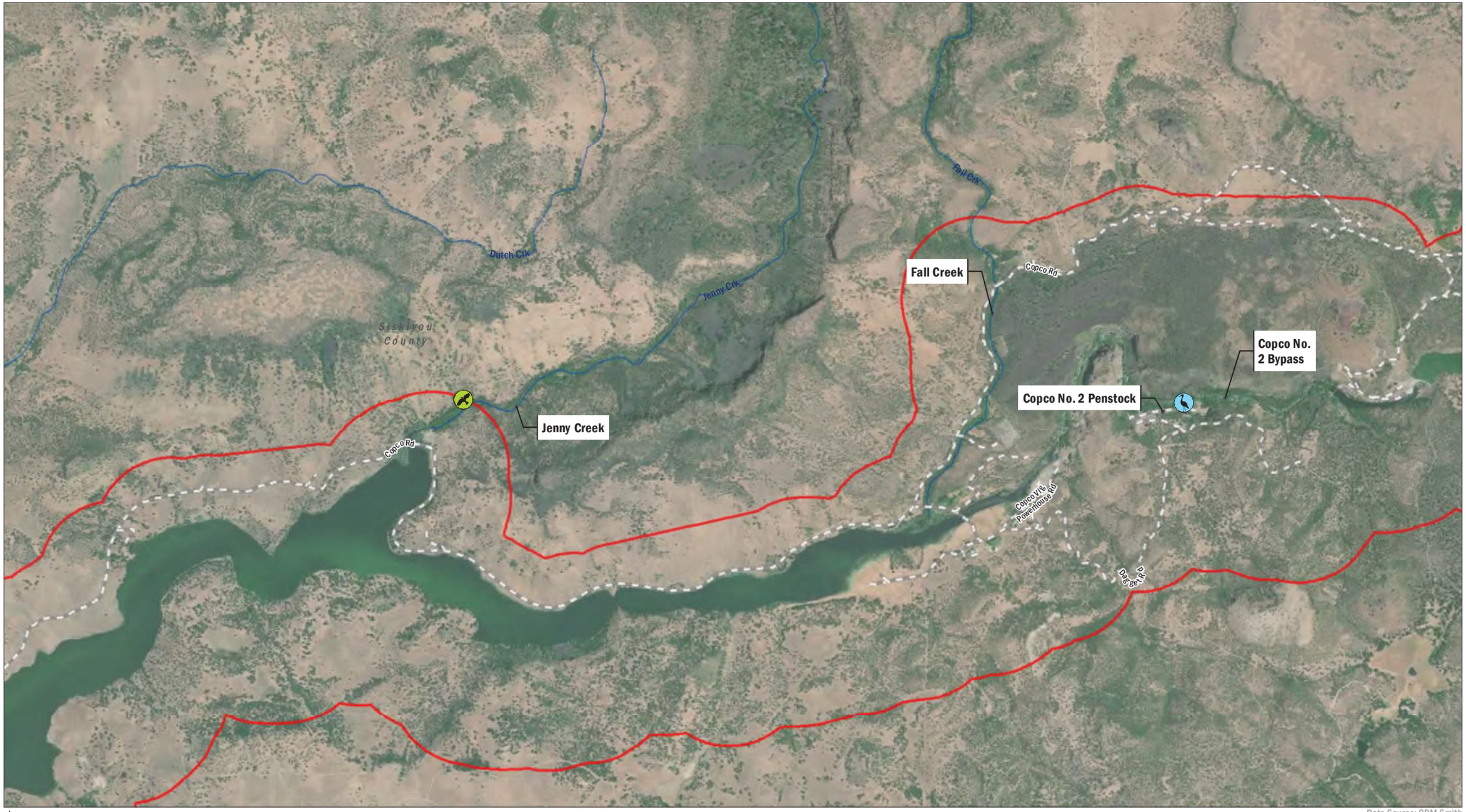
Klamath River Renewal Project

FIGURE 3-3

2018 Willow Flycatcher Habitat and Observations
J.C. Boyle Reservoir and Canal

CDM Smith 3/15/2019 USER Bateska PATH \\cols\r2\Common\Cummings\Klamath\Revisions\MXDs\Figure_4_1_Other_Special_Status_Wildlife_Observations.mxd



Data Source: CDM Smith
Basemap Source: Esri, USGS, NOAA

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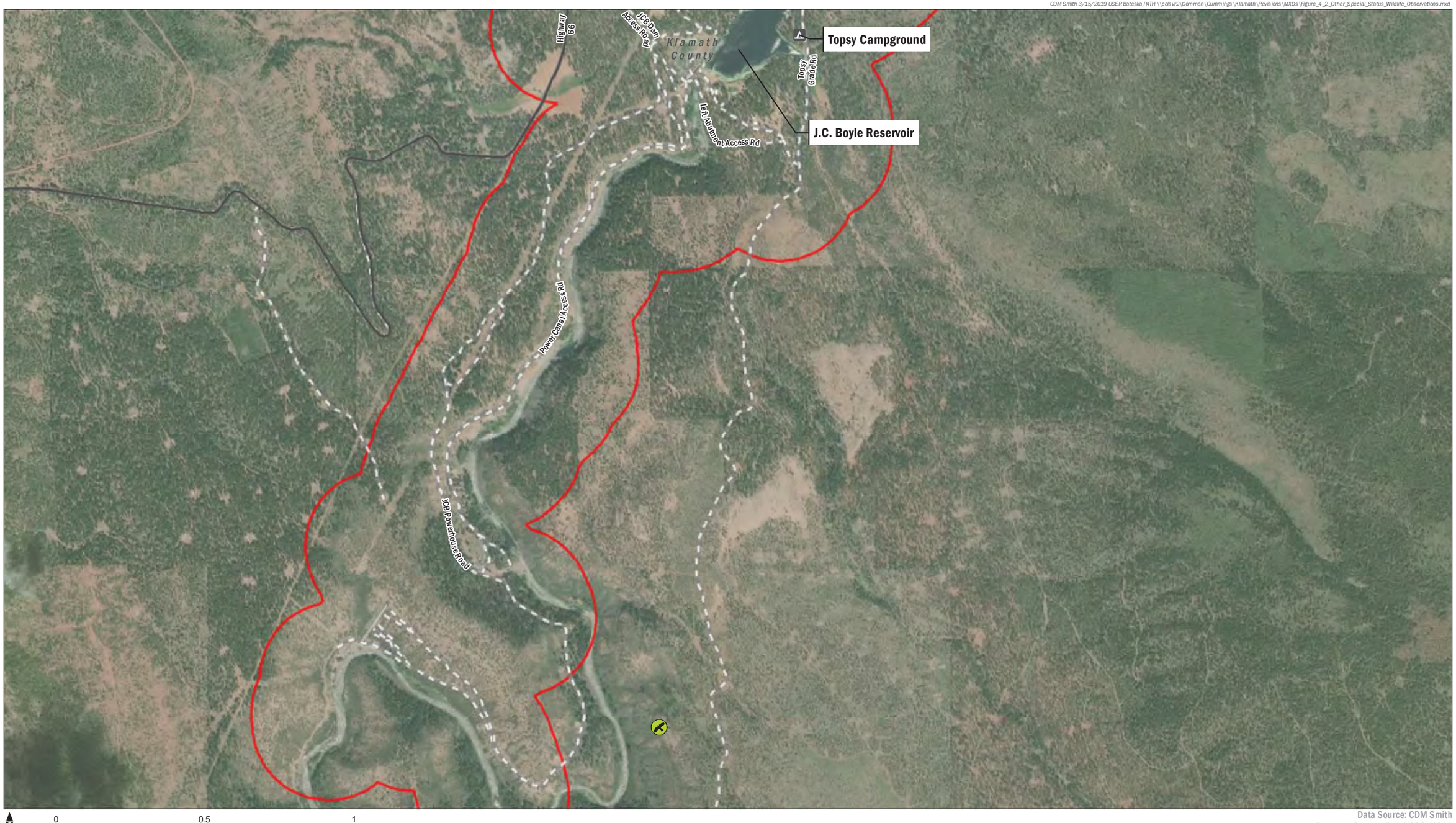
Klamath River Renewal Project

FIGURE 4-1

Other Special Status Wildlife Observations
Iron Gate Reservoir

CDM Smith 3/15/2019 USER Bateska PATH \\cols\r2\Common\Cummings\Klamath\Revisions\MXDs\Figure_4_2_Other_Special_Status_Wildlife_Observations.mxd



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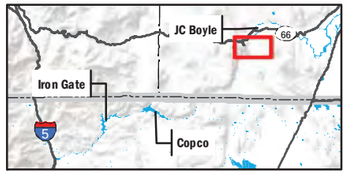

- Great Blue Heron Colony
- Sand Hill Crane Nest
- Peregrine Falcon Nest
- State
- County
- Primary Road
- Access Route
- 0.25 Mile Study Area Buffer

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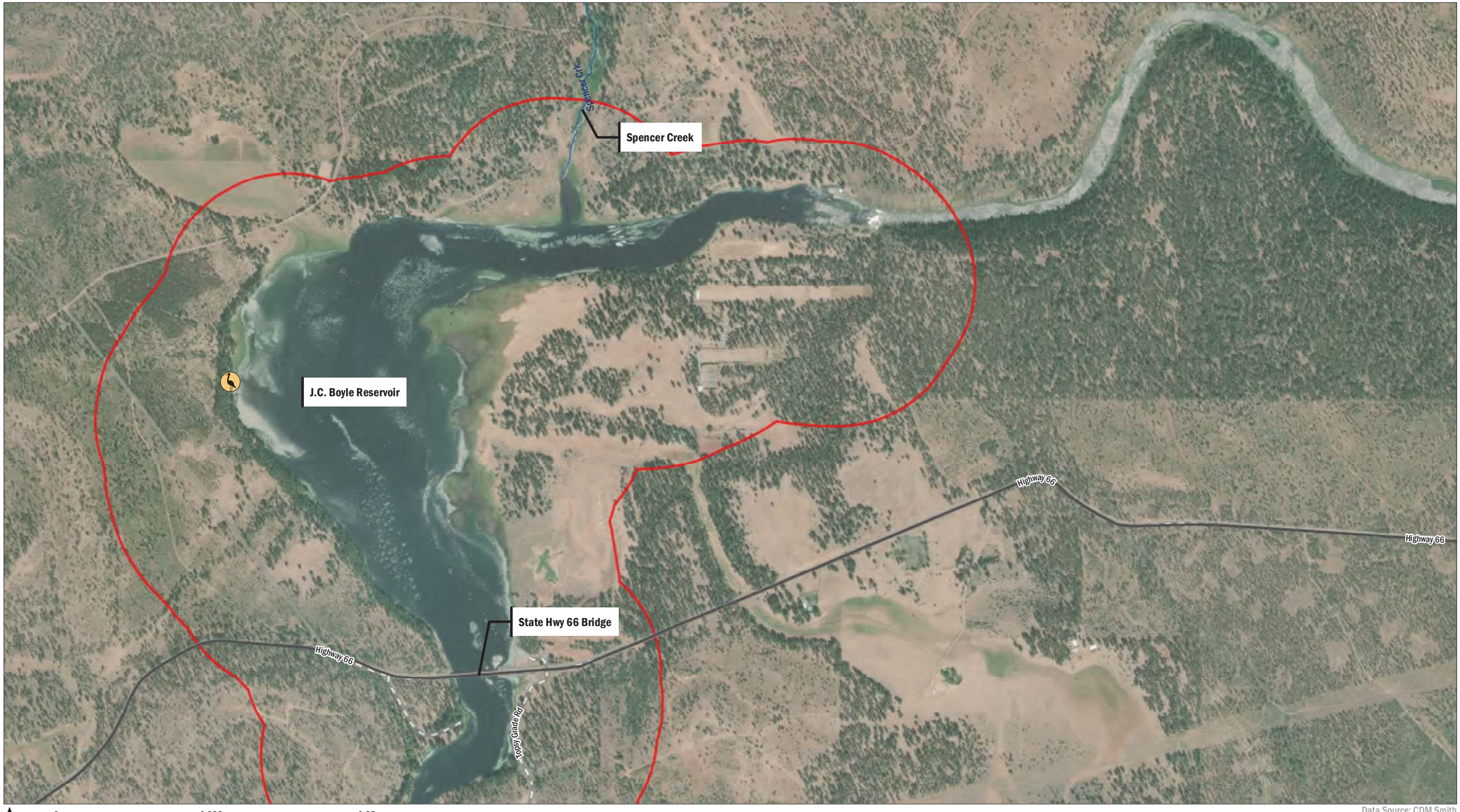
Klamath River Renewal Project

FIGURE 4-2

Other Special-Status Wildlife Observations
Klamath River (Below J.C. Boyle Dam)

CDM Smith 3/18/2019 USER KHALAFA PATH \\colsvr2\Common\Cummings\Klamath\Revisions\MXDs\Figure_4_3_Other_Special_Status_Wildlife_Observations.mxd



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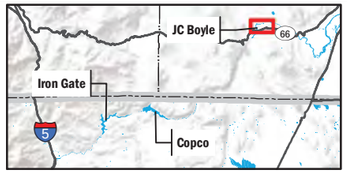
Basemap Source: Esri, USGS, NOAA

Klamath River Renewal Corporation
Klamath River Renewal Project



- Great Blue Heron Colony
- Sand Hill Crane Nest
- Peregrine Falcon Nest

- State
- County
- Stream
- Primary Road
- Access Route
- 0.25 Mile Study Area Buffer

FIGURE 4-3

Other Special Status Wildlife Observations
J.C. Boyle Reservoir

CDM Smith 3/18/2019 USER KHALAFA PATH \\colsvr2\Common\Cummings\Klamath\Revisions\MXDs\Figure_5_2_Nothern_Spotted_Owl_Calling_Stations.mxd



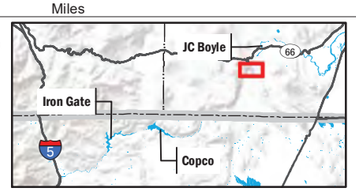
N

0 0.325 0.65

Miles

Data Source: CDM Smith
Basemap Source: Esri, USGS, NOAA

Klamath River Renewal Corporation
Klamath River Renewal Project



NSO Callling Station

State
County
Secondary Road
Access Route

FIGURE 5-1

Northern Spotted Owl (NSO) Calling Stations
J.C. Boyle Lower Stations

CDM Smith 3/18/2019 USER KHALAFA PATH \\colsvr2\Common\Cummings\Klamath\Revisions\MXDs\Figure_5_1_Nothern_Spotted_Owl_Calling_Stations.mxd



N

0 0.25 0.5

Miles

Data Source: CDM Smith
Basemap Source: Esri, USGS, NOAA

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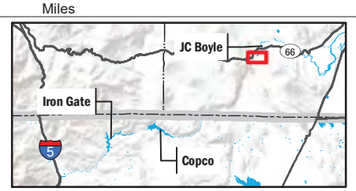
Klamath River Renewal Project

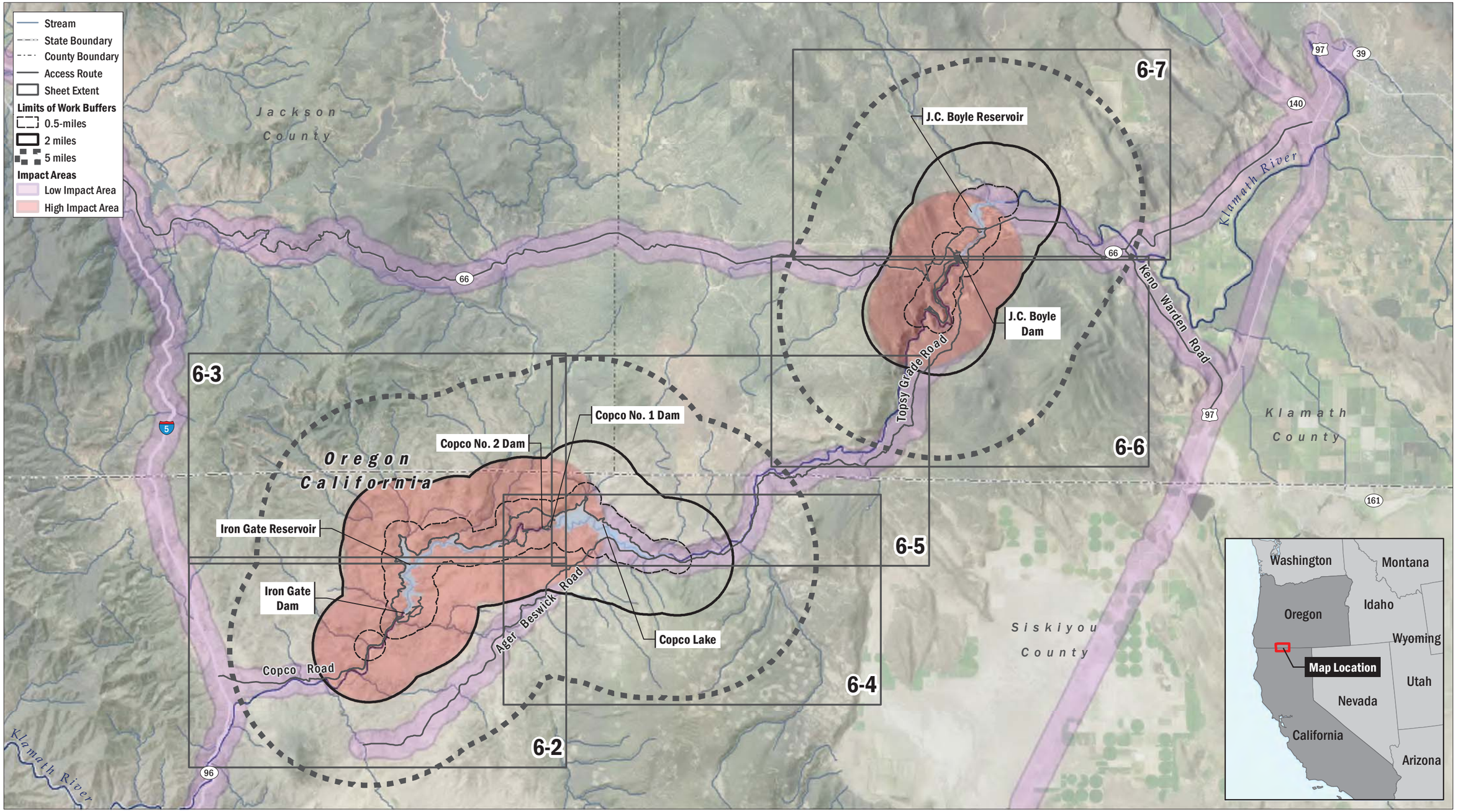


NSO Callling Station

State
County
Stream
Primary Road
Access Route

FIGURE 5-2

Northern Spotted Owl (NSO) Calling Stations
J.C. Boyle Upper Stations



DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 3/20/2019

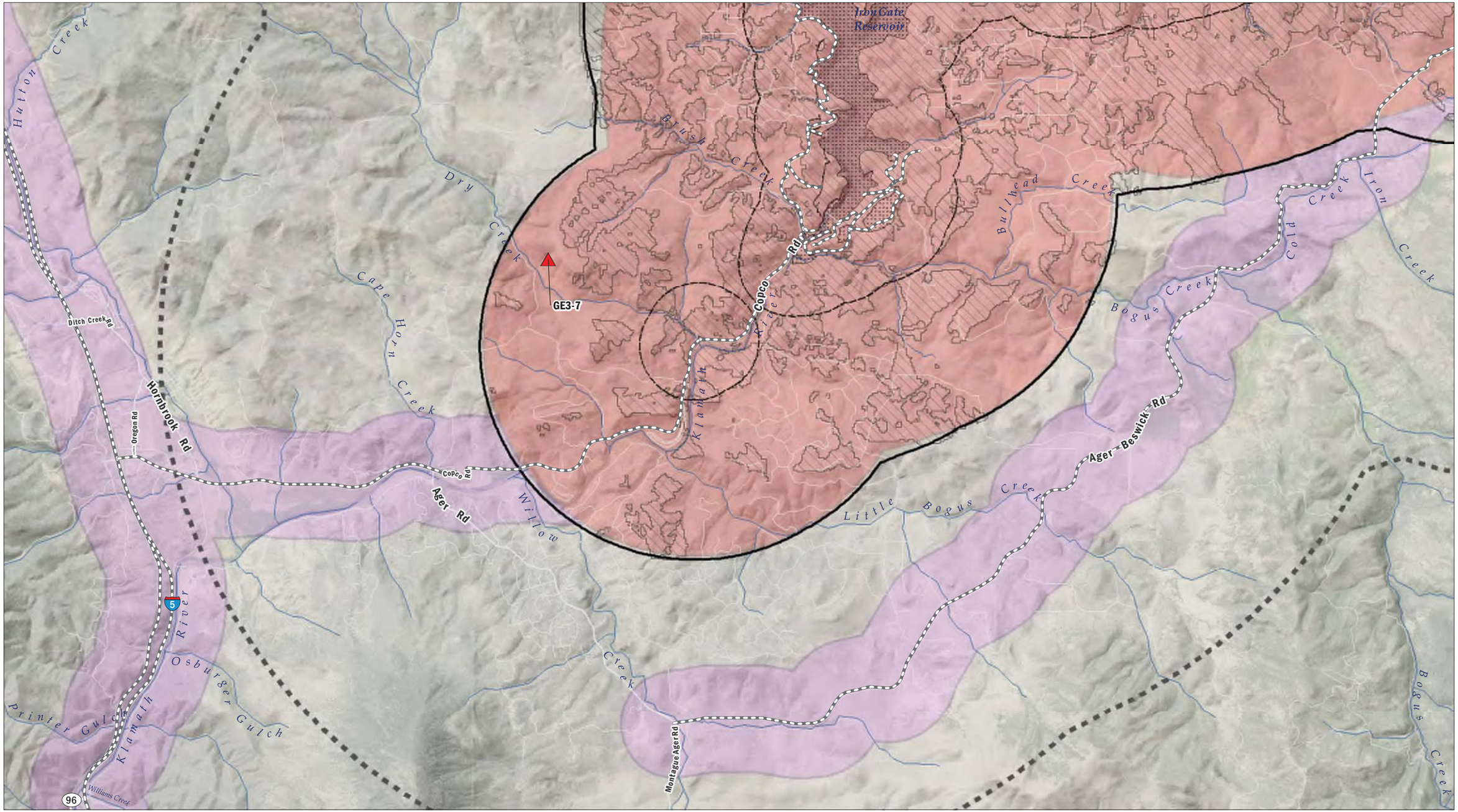
PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project

FIGURE 6-1

2018 Eagle Nest Survey Results Overview

AECOM Oakland CA 12/4/2018 USER alexander.remar PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\Eagles\Figure_5-2-7_EagleNests_Mapbook.mxd

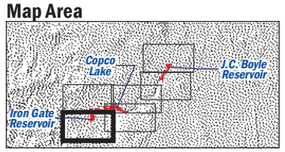


AECOM

Klamath River Renewal Corporation

Klamath River Renewal Project

Map Area



- Access Routes
- Limits of Work
- 2-Mile Viewshed from Limits of Work

Impact Areas

- Low Impact Area
- High Impact Area

Eagle Nest Active Status

- Inactive, Golden Eagle

Limits of Work Buffers

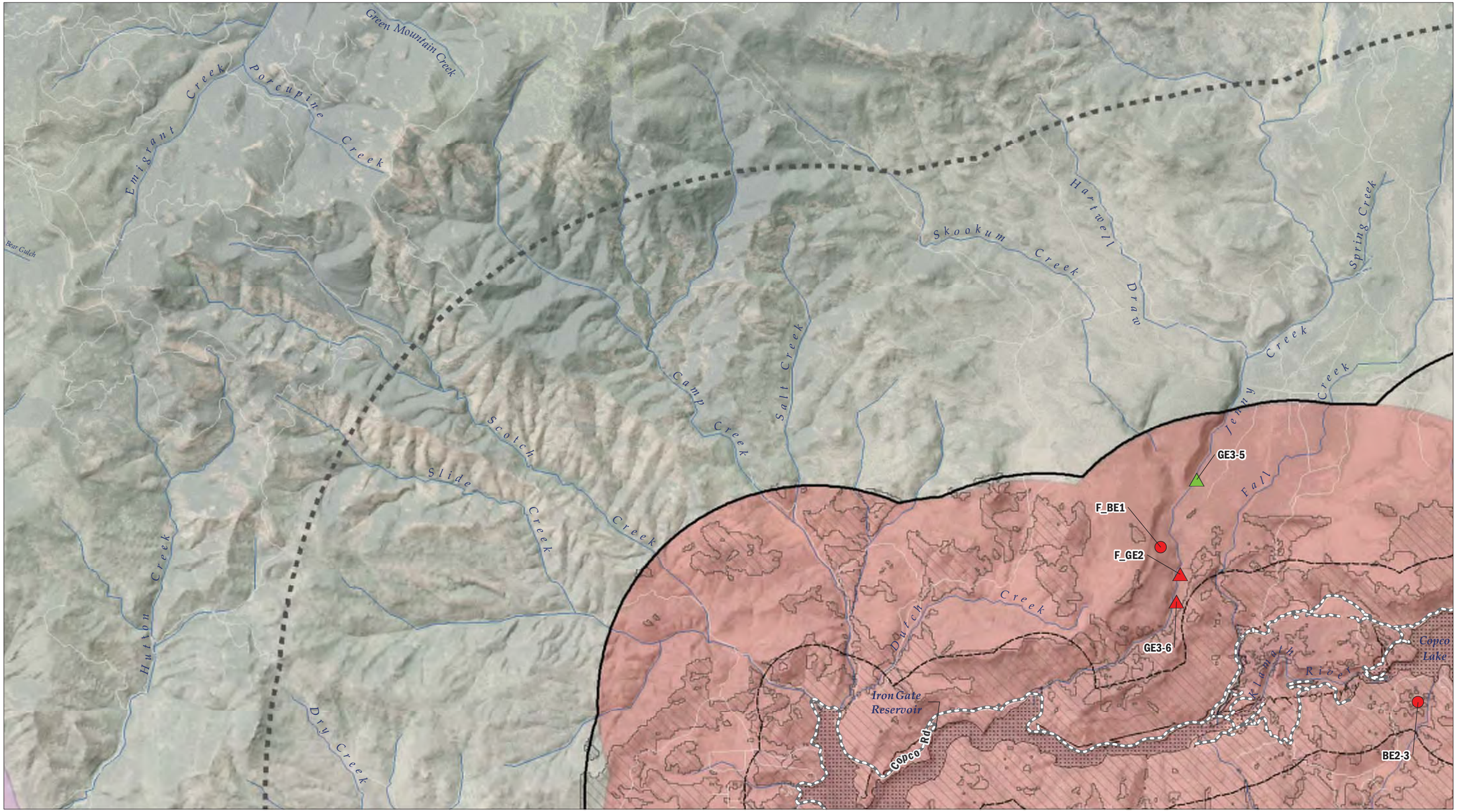
- 0.5-miles
- 2 miles
- 5 miles

FIGURE 6-2

2018 Eagle Nest Survey Results

Sheet 1 of 6

AECOM Oakland CA 12/4/2018 USER alexander.remar PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\Eagles\Figure_5-2-7_EagleNests_Mapbook.mxd

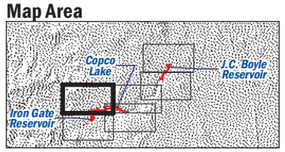


AECOM

Klamath River Renewal Corporation

Klamath River Renewal Project

Map Area



- Access Routes
- Limits of Work
- 2-Mile Viewshed from Limits of Work

Impact Areas

- Low Impact Area
- High Impact Area

Eagle Nest Active Status

- Active, Golden Eagle
- Inactive, Bald Eagle
- Inactive, Golden Eagle

Limits of Work Buffers

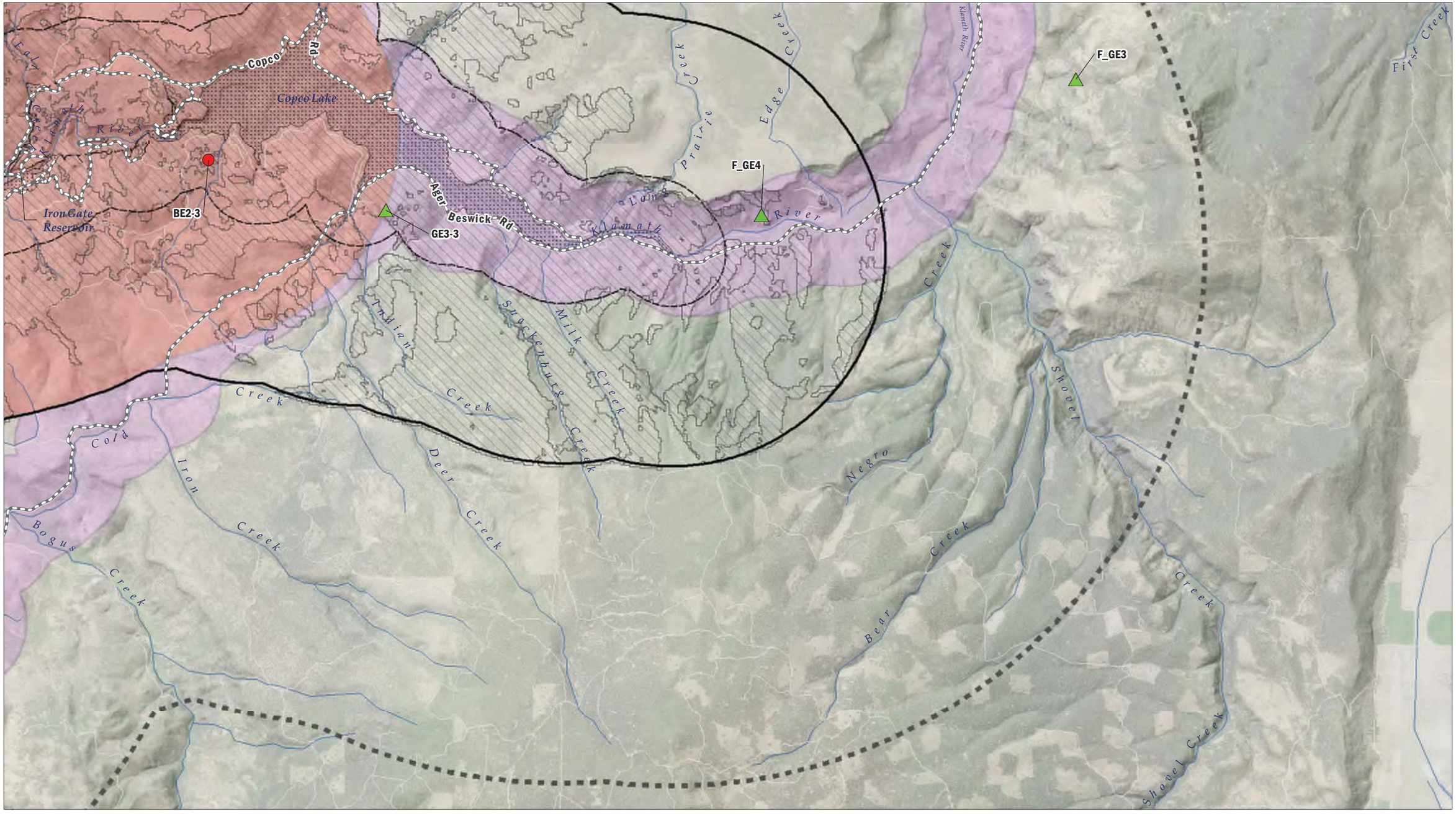
- 0.5-miles
- 2 miles
- 5 miles

FIGURE 6-3

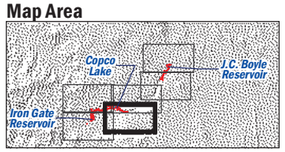
2018 Eagle Nest Survey Results

Sheet 2 of 6

AECOM Oakland CA 12/4/2018 USER alexander.remar PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\Eagles\Figure_5-2-7_EagleNests_Mapbook.mxd



Map Area



Access Routes
Limits of Work
2-Mile Viewshed from Limits of Work

Impact Areas
Low Impact Area
High Impact Area

Eagle Nest Active Status
Active, Golden Eagle
Inactive, Bald Eagle

Limits of Work Buffers
0.5-miles
2 miles
5 miles

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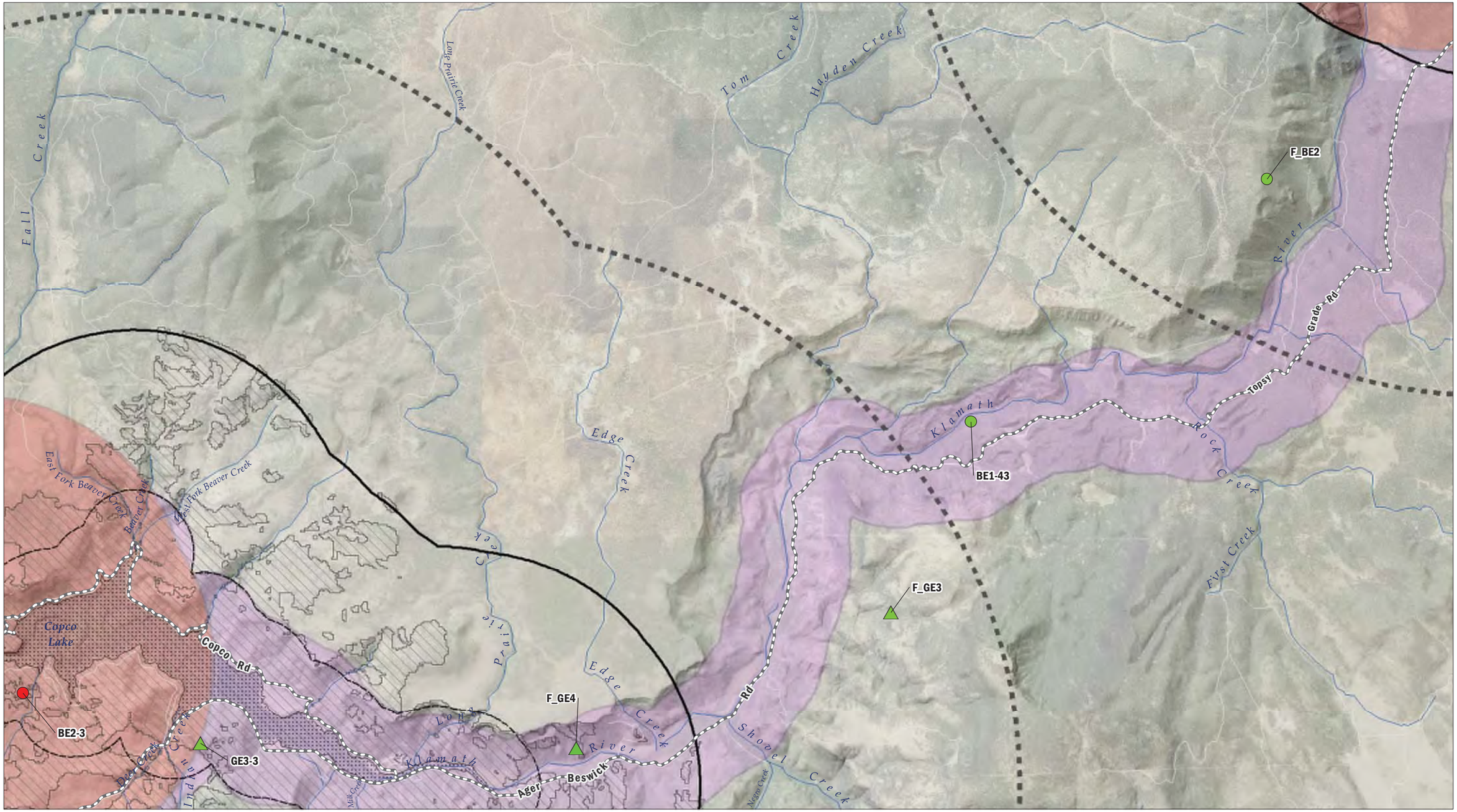
FIGURE 6-4

2018 Eagle Nest Survey Results
Sheet 3 of 6

AECOM Oakland CA 12/4/2018 USER alexander.remar PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\Eagles\Figure_5-2-7_EagleNests_Mapbook.mxd



N

0 2

Miles

NAIP Imagery, 2014

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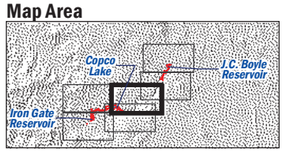
Klamath River Renewal Project

Map Area



- Access Routes
- Limits of Work
- 2-Mile Viewshed from Limits of Work

Impact Areas

- Low Impact Area
- High Impact Area

Eagle Nest Active Status

- Active, Bald Eagle
- Active, Golden Eagle
- Inactive, Bald Eagle

Limits of Work Buffers

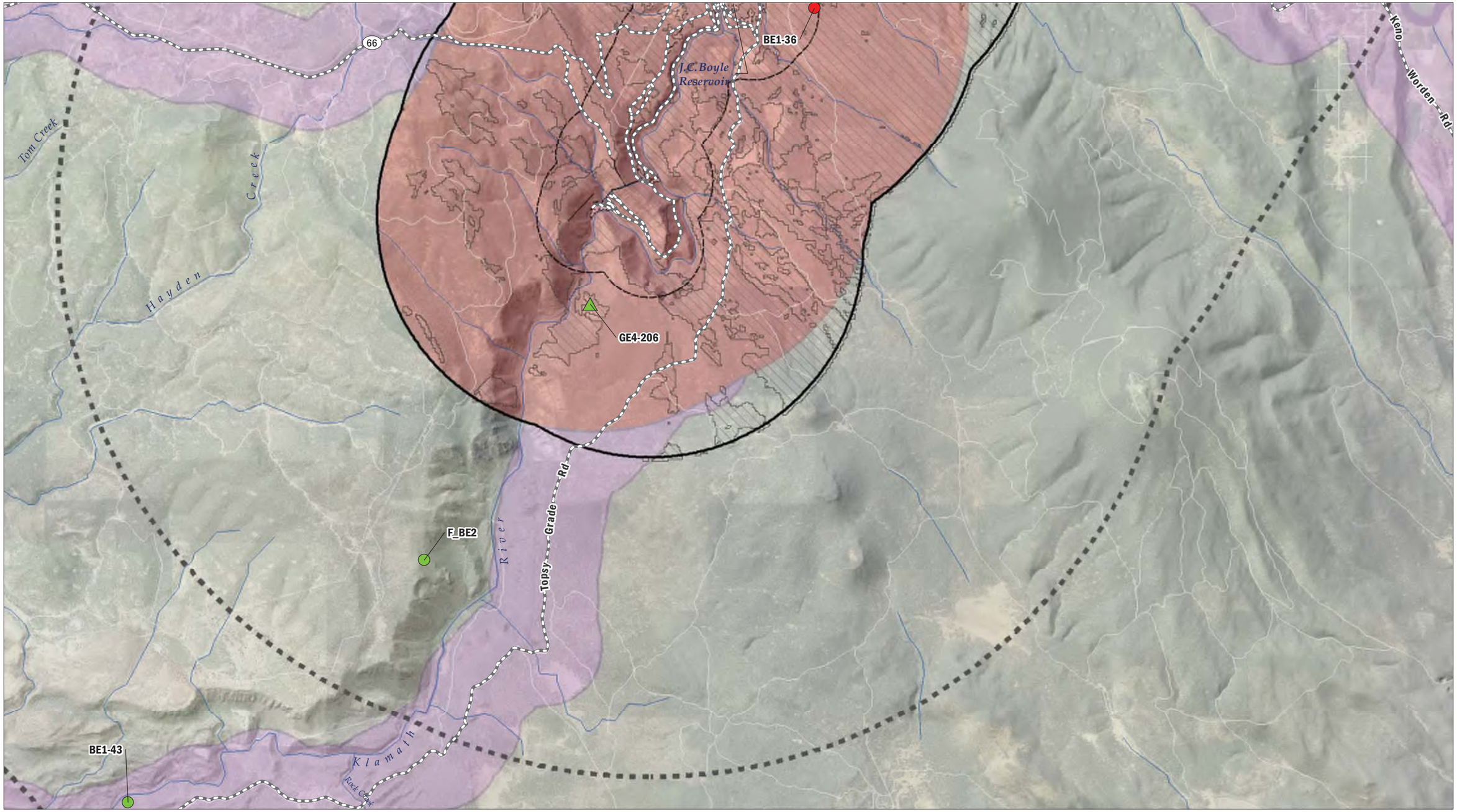
- 0.5-miles
- 2 miles
- 5 miles

FIGURE 6-5

2018 Eagle Nest Survey Results

Sheet 4 of 6

AECOM Oakland CA 12/4/2018 USER alexander.remar PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\Eagles\Figure_5-2-7_EagleNests_Mapbook.mxd



N

0 2

Miles

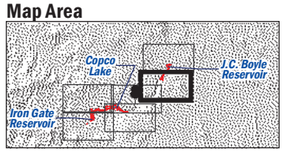
NAIP Imagery, 2014

AECOM

Klamath River Renewal Corporation

Klamath River Renewal Project

Map Area



Access Routes

Limits of Work

2-Mile Viewshed from Limits of Work

Impact Areas

Low Impact Area

High Impact Area

Eagle Nest Active Status

Active, Bald Eagle

Active, Golden Eagle

Inactive, Bald Eagle

Limits of Work Buffers

0.5-miles

2 miles

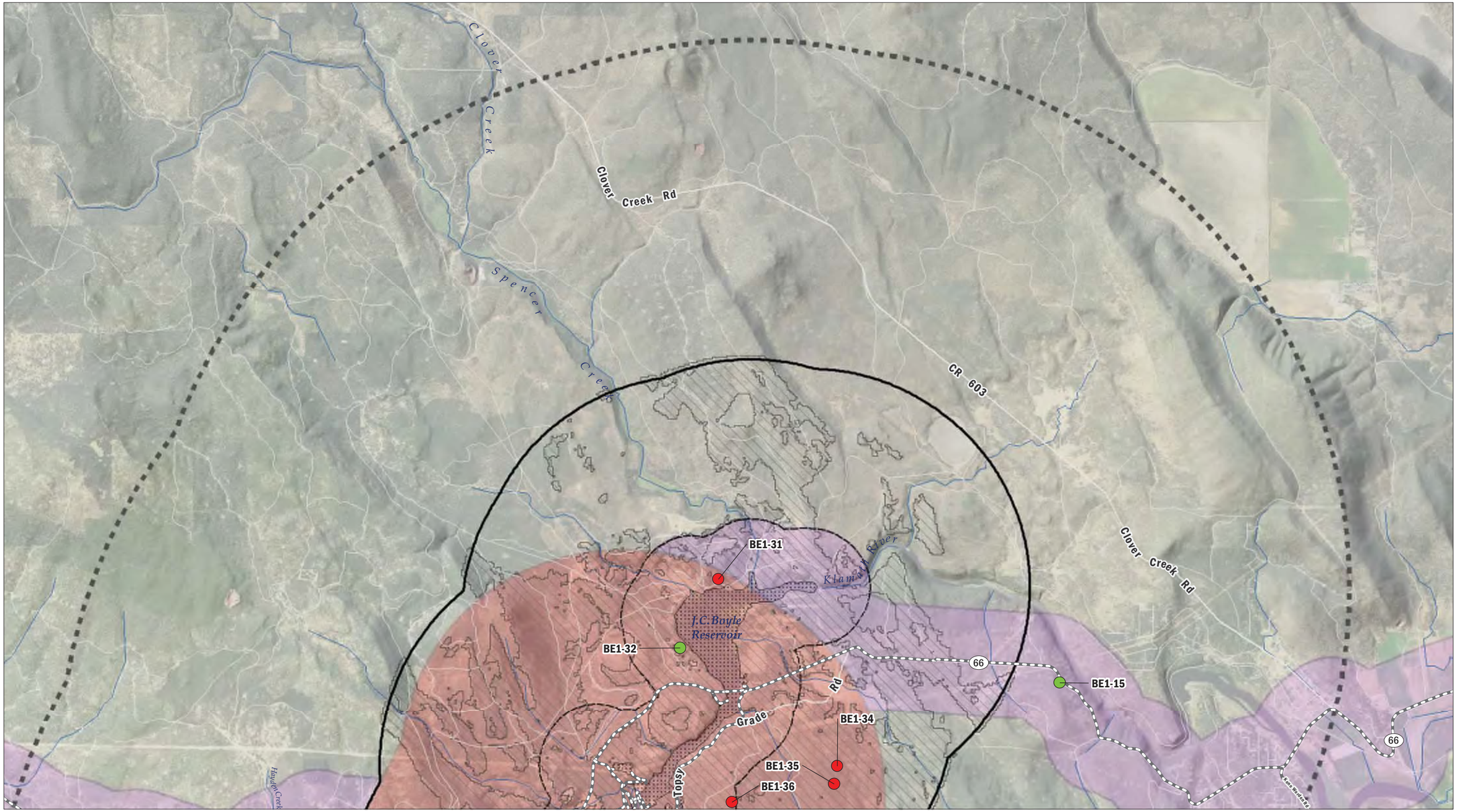
5 miles

FIGURE 6-6

2018 Eagle Nest Survey Results

Sheet 5 of 6

AECOM Oakland CA 12/4/2018 USER alexander.remar PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\Eagles\EagleNests_ActiveStatus_TEMP.mxd



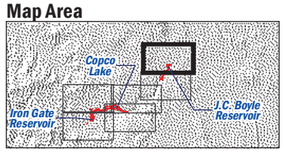
NAIP Imagery, 2014

AECOM

Klamath River Renewal Corporation

Klamath River Renewal Project

Map Area



- Access Routes
- Limits of Work
- 2-Mile Viewshed from Limits of Work

Impact Areas
- Low Impact Area
- High Impact Area

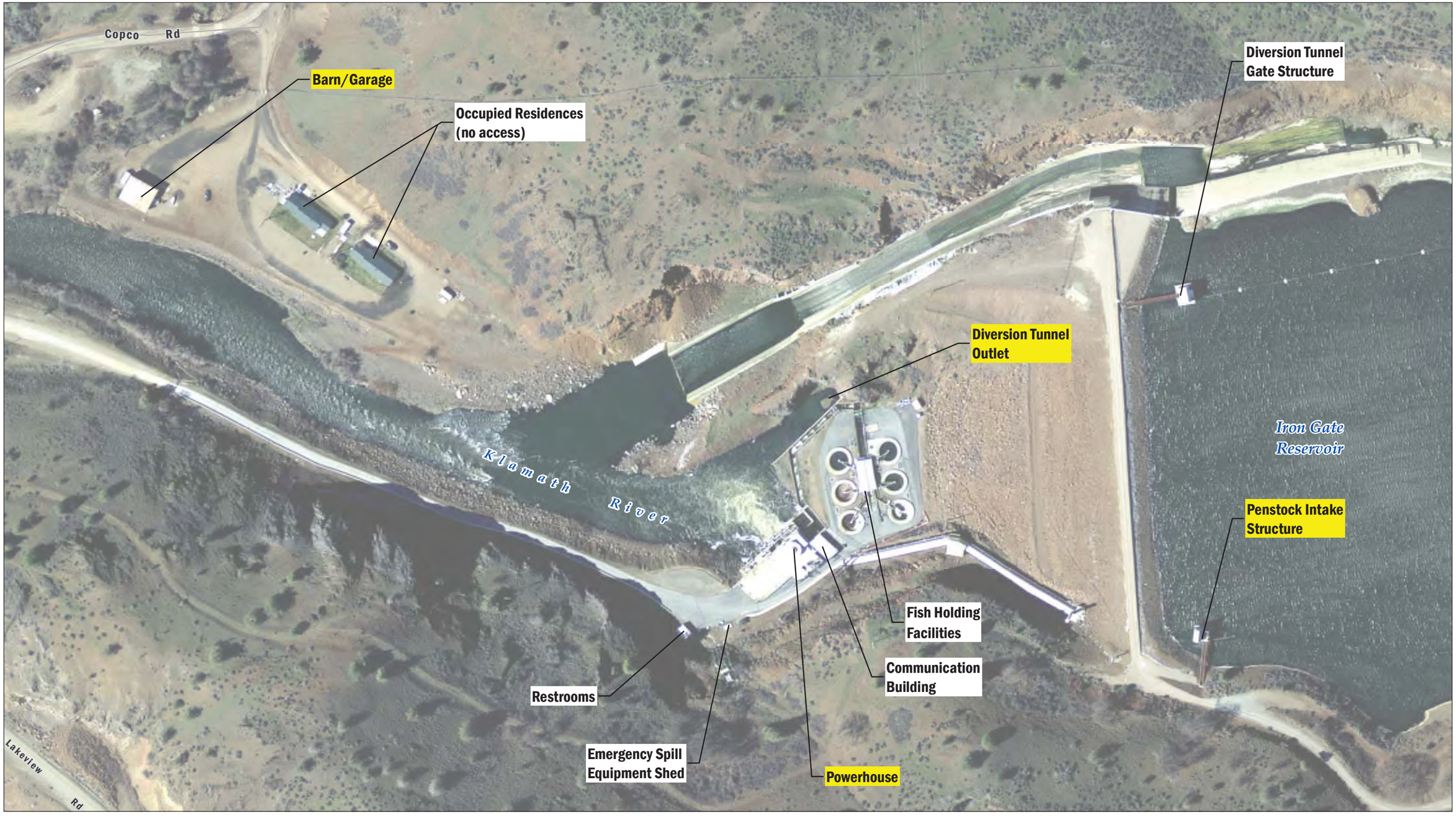
Eagle Nest Active Status
- Active, Bald Eagle
- Inactive, Bald Eagle

Limits of Work Buffers
- 0.5-miles
- 2 miles
- 5 miles

FIGURE 6-7

2018 Eagle Nest Survey Results
Sheet 6 of 6

AECOM Oakland CA 2/28/2019 USER alexander.remar PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\Bats\BatSurveys_2017-2018\Figure 6-5 2017-2018 Bat Surveys.mxd



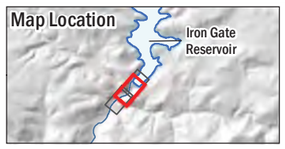
0 300
Feet

DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 2/28/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project



Labels

- Active Bat Roost Confirmed
- Roosting Bats Not Found

FIGURE 7-1

2017-2018 Bat Surveys
Iron Gate Dam Area

AECOM Oakland CA 2/28/2019 USER alexander.remar PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\Bats\BatSurveys_2017-2018\Figure 6-4 2017-2018 Bat Surveys.mxd

(I) FOREBAY AND SPILLWAY



(II) PENSTOCKS AND POWERHOUSE



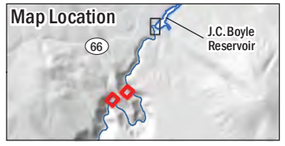
0 300
Feet

DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 2/28/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project



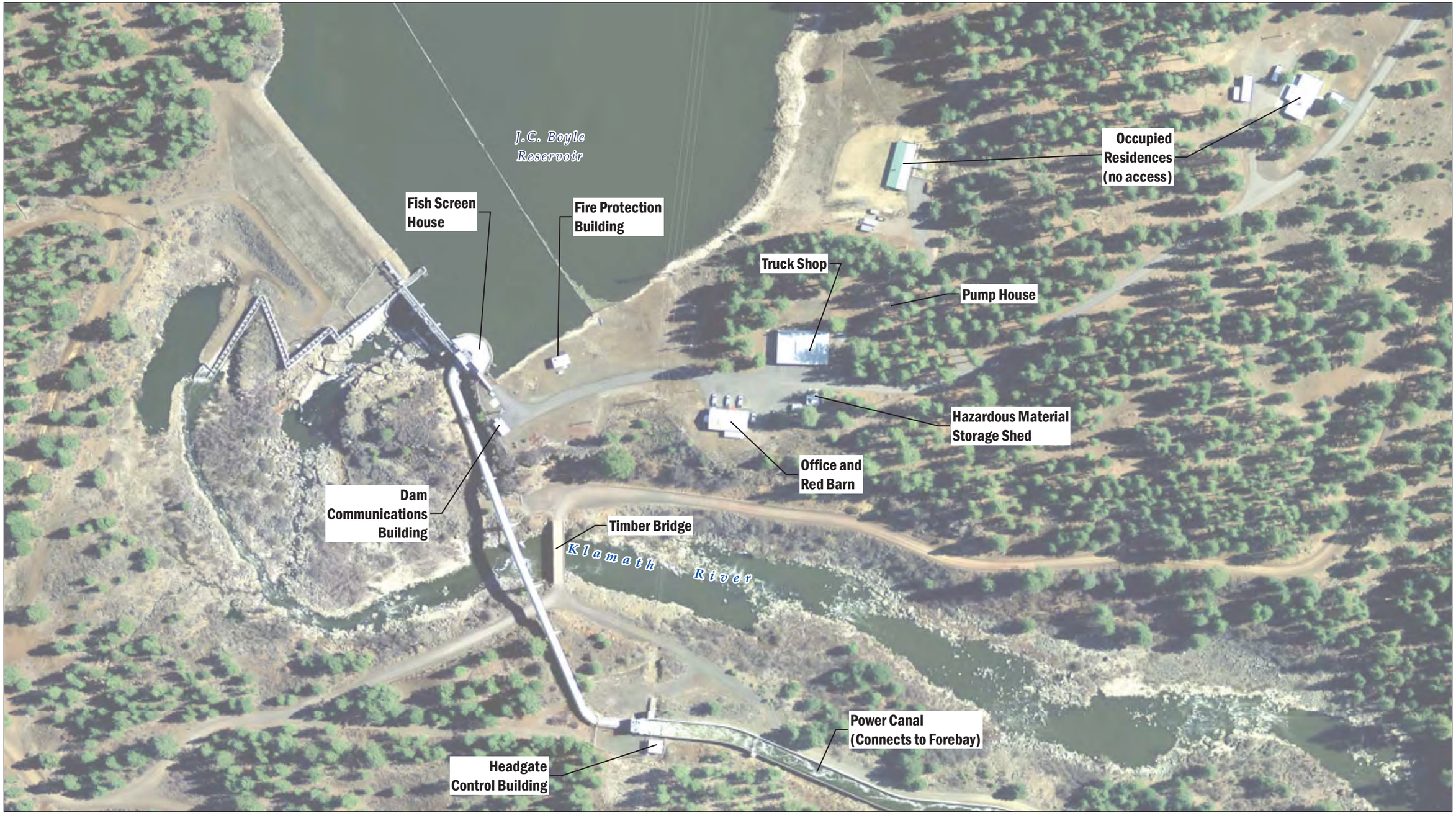
Labels

- Active Bat Roost Confirmed
- Roosting Bats Not Found

FIGURE 7-2

2017-2018 Bat Surveys
J.C. Boyle Forebay and Spillway Area, Penstocks and Powerhouse Area

AECOM Oakland CA 2/28/2019 USER alexander.remar PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\Bats\BatSurveys_2017-2018\Figure 6-3 2017-2018 Bat Surveys.mxd



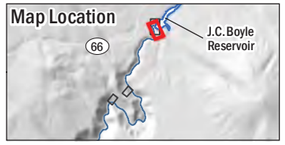
0 300
Feet

DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 2/28/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

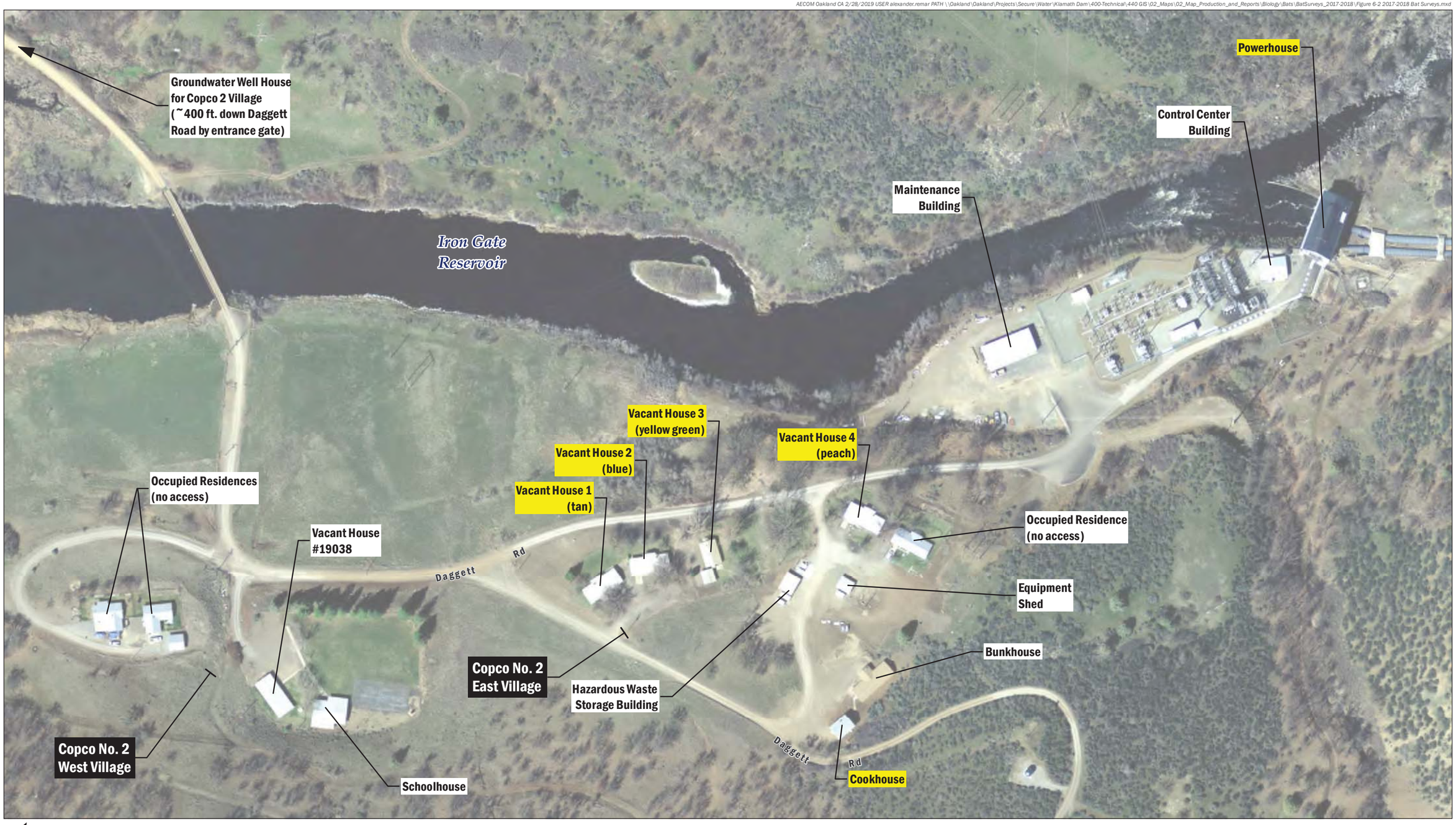
AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project

Map Location


Labels
Roosting Bats Not Found

FIGURE 7-3
2017-2018 Bat Surveys
J.C. Boyle Dam Area

AECOM Oakland CA 2/28/2019 USER alexander.remar PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\Bats\BatSurveys_2017-2018\Figure 6-2 2017-2018 Bat Surveys.mxd

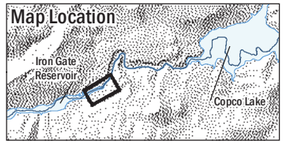


DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 2/28/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project



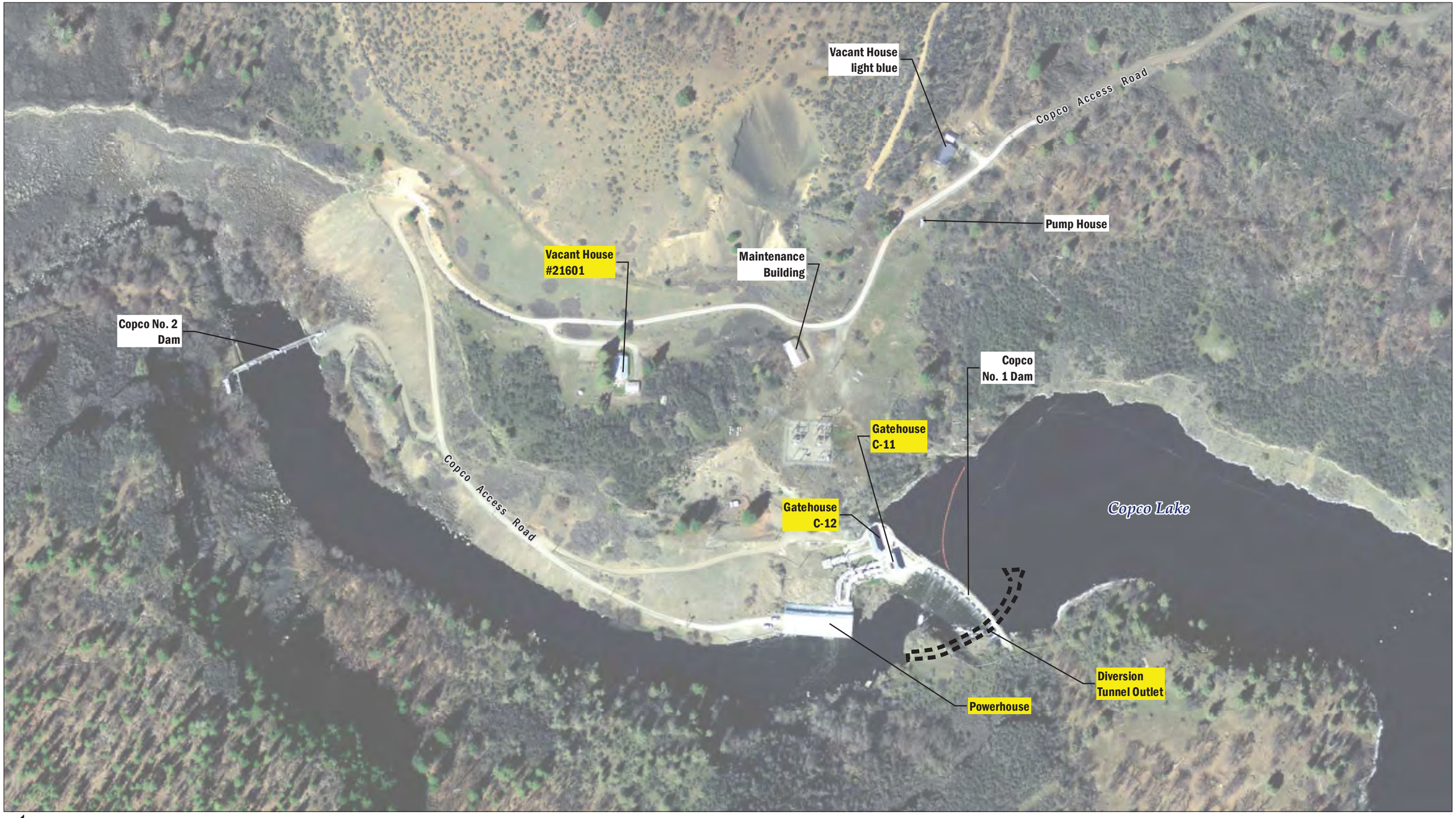
Labels

- Active Bat Roost Confirmed
- Roosting Bats Not Found

FIGURE 7-4

2017-2018 Bat Surveys
Copco No. 2 Powerhouse Area

AECOM Oakland CA 2/28/2019 USER alexander.remar PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\Bats\BatSurveys_2017-2018\Figure 6-1 2017-2018 Bat Surveys.mxd



0 300
Feet

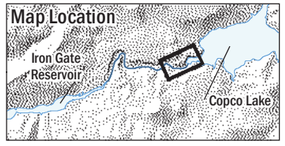
DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 2/28/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project

Map Location



Labels

- Active Bat Roost Confirmed
- Roosting Bats Not Found

FIGURE 7-5

2017-2018 Bat Surveys
Copco No. 1 Dam Area and
Copco No. 2 Dam Area

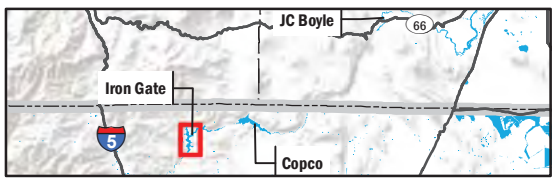
AECOM Oakland CA 3/21/2019 USER BANKSTONSE PATH C:\Users\bankstonse\Desktop\Figure_8-1a_Western_Pond_Turtle_Sightings_and_Habitat.mxd

Camp Crk
Ditch Crk
Juniper Point
Mirror Cove
Iron Gate Reservoir
Long Gulch Cove
Copco Rd
Upstream Left Abutment Access Rd
Brush Crk
Lakeview Road
Siskiyou County
Iron Gate Powerhouse Rd

2018 Western Pond Turtle Observations
Historical Western Pond Turtle Observations (PacifiCorp 2004)
Historical Turtle Habitat (PacifiCorp 2004)
Basking
Basking & Nesting
No Habitat
State
County
Stream
Access Route
0.25 Mile Study Area Buffer

N
0 0.5
Miles

Data Source: CDM Smith
Basemap Source: Esri, USGS, NOAA

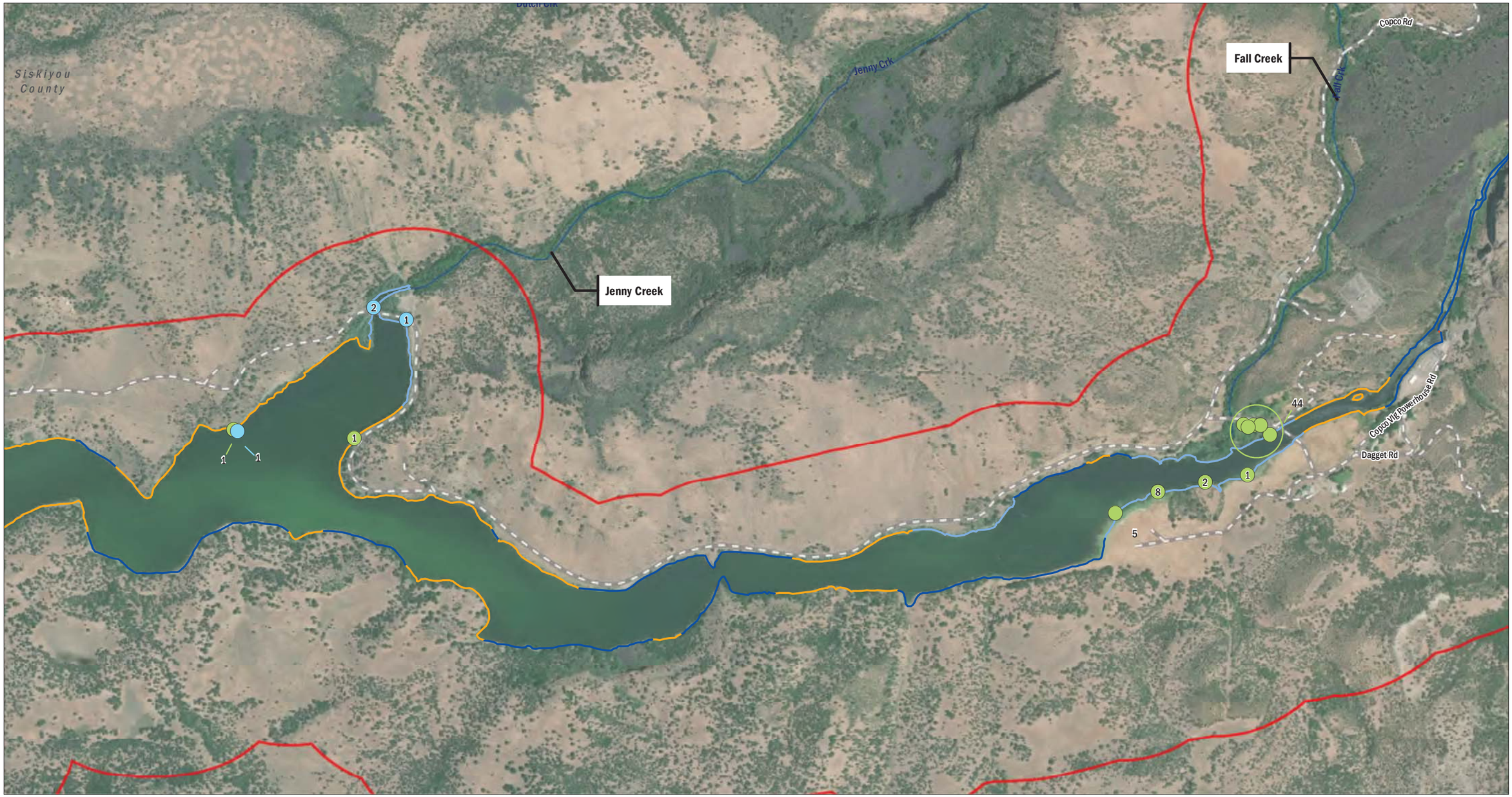


Klamath River Renewal Corporation
Klamath River Renewal Project

FIGURE 8-1A

Western Pond Turtle Sightings and Habitat
Iron Gate Reservoir

CDM Smith 3/21/2019 USER BANKSTONSE PATH C:\Users\bankstonse\Desktop\Figure_8-1b_Western_Pond_Turtle_Sightings_and_Habitat.mxd

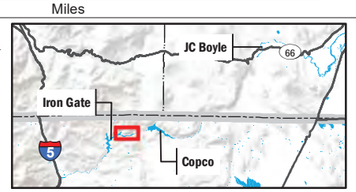


N

0 0.325 0.65

Miles

Data Source: CDM Smith
Basemap Source: Esri, USGS, NOAA



2018 Western Pond Turtle Observations

Historical Western Pond Turtle Observations (PacifCorp 2004)

Historical Turtle Habitat (PacifiCorp 2004)

- Basking
- Basking & Nesting
- No Habitat
- Not Surveyed

- State
- County
- Stream
- Access Route
- 0.25 Mile Study Area Buffer

Klamath River Renewal Corporation
Klamath River Renewal Project

FIGURE 8-1B

Western Pond Turtle Sightings and Habitat
Iron Gate Reservoir

CDM Smith 3/21/2019 USER BANKSTONSE PATH C:\Users\bankstonse\Desktop\Figure_8-2a_Western_Pond_Turtle_Sightings_and_Habitat.mxd

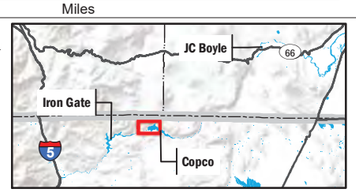


N

0 0.325 0.65

Miles

Data Source: CDM Smith
Basemap Source: Esri, USGS, NOAA



2018 Western Pond Turtle Observations

Historical Western Pond Turtle Observations (PacifiCorp 2004)

Historical Turtle Habitat (PacifiCorp 2004)

- Basking
- Basking & Nesting
- No Habitat
- Not Surveyed

- State
- County
- Stream
- Access Route
- 0.25 Mile Study Area Buffer

Klamath River Renewal Corporation
Klamath River Renewal Project

FIGURE 8-2A

Western Pond Turtle Sightings and Habitat
Copco Lake

CDM Smith 3/21/2019 USER BANKSTONSE PATH C:\Users\bankstonse\Desktop\Figure_8-2b_Western_Pond_Turtle_Sightings_and_Habitat.mxd



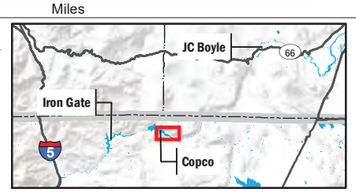
N

0 0.325 0.65

Miles

Data Source: CDM Smith
Basemap Source: Esri, USGS, NOAA

Klamath River Renewal Corporation
Klamath River Renewal Project



- 2018 Western Pond Turtle Observations
- Historical Western Pond Turtle Observations (PacifiCorp 2004)

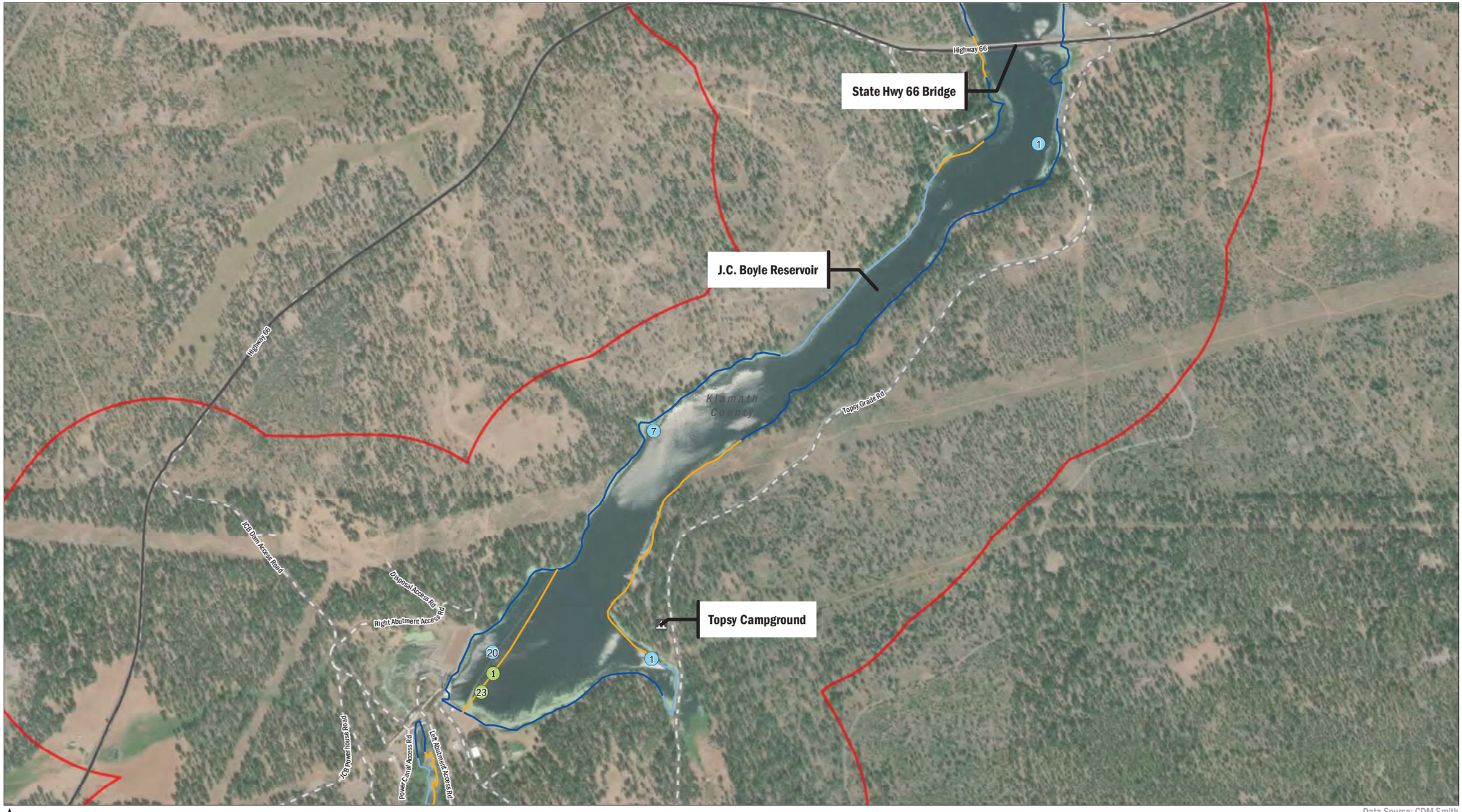
Historical Turtle Habitat (PacifiCorp 2004)
- Basking
- Basking & Nesting
- No Habitat
- Not Surveyed

- State
- County
- Stream
- Access Route
- 0.25 Mile Study Area Buffer

FIGURE 8-2B

Western Pond Turtle Sightings and Habitat
Copco Lake

CDM Smith 3/21/2019 USER BANKSTONSE PATH C:\Users\bankstonse\Desktop\Figure_8-3a_Western_Pond_Turtle_Sightings_and_Habitat.mxd



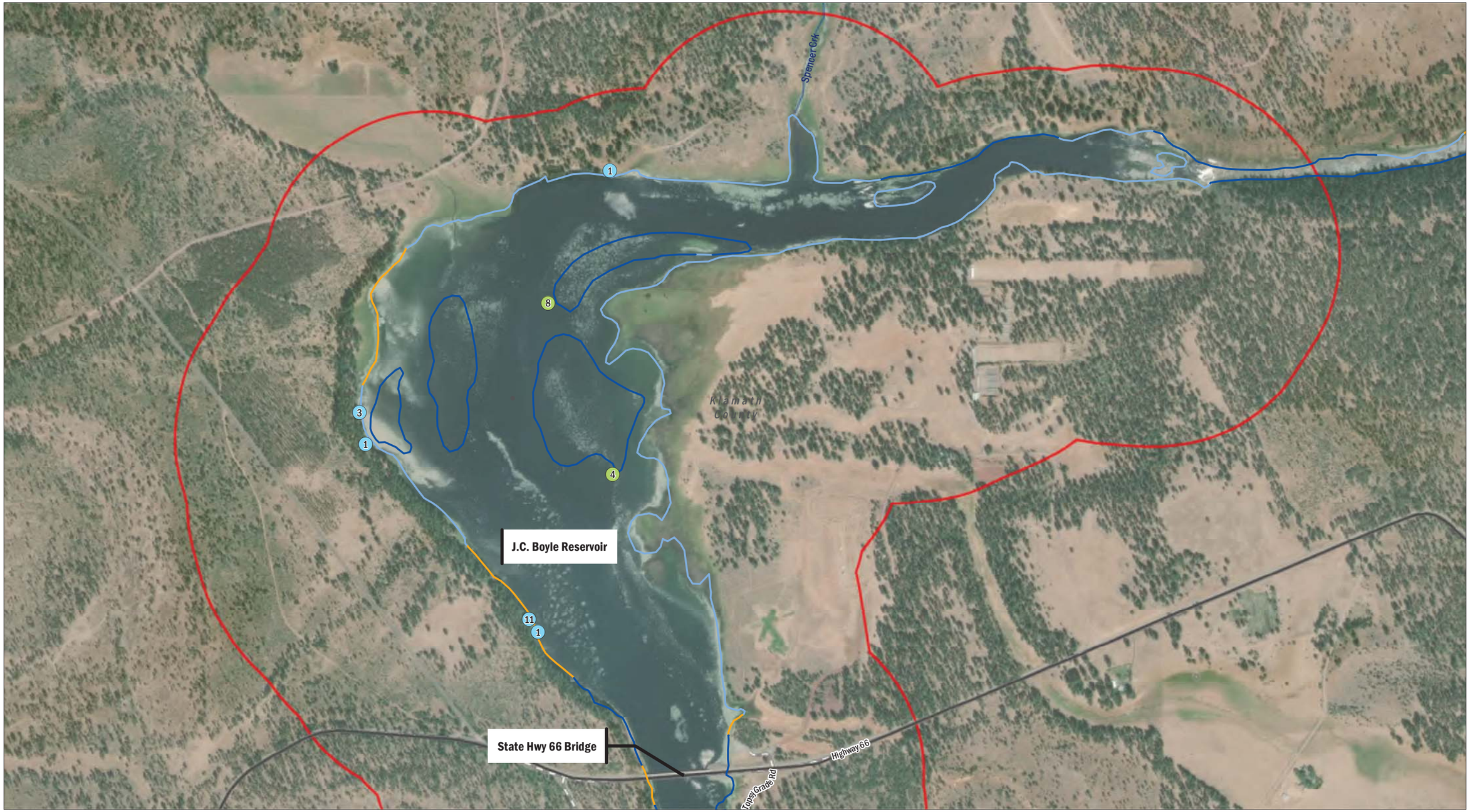
Data Source: CDM Smith
Basemap Source: Esri, USGS, NOAA

Klamath River Renewal Corporation
Klamath River Renewal Project

FIGURE 8-3A

Western Pond Turtle Sightings and Habitat
J.C. Boyle Reservoir

CDM Smith 3/21/2019 USER BANKSTONSE PATH C:\Users\bankstonse\Desktop\Figure_8-3b_Western_Pond_Turtle_Sightings_and_Habitat.mxd

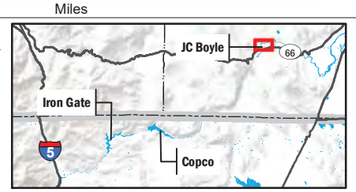


N

0 0.25 0.5
Miles

Data Source: CDM Smith
Basemap Source: Esri, USGS, NOAA

Klamath River Renewal Corporation
Klamath River Renewal Project



- 2018 Western Pond Turtle Observations
- Historical Western Pond Turtle Observations (PacifiCorp 2004)

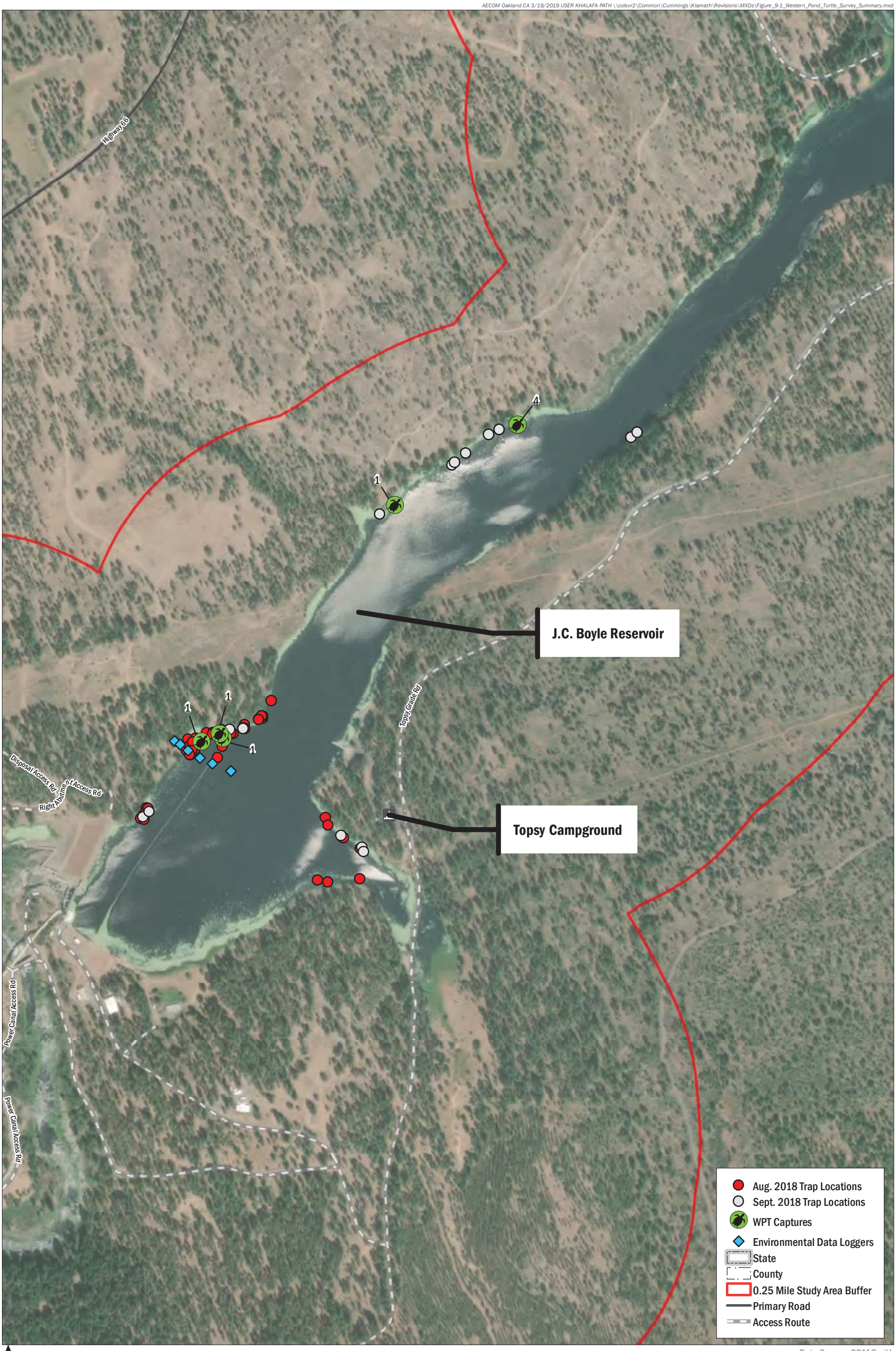
Historical Turtle Habitat (PacifiCorp 2004)
- Basking
- Basking & Nesting
- No Habitat
- Not Surveyed

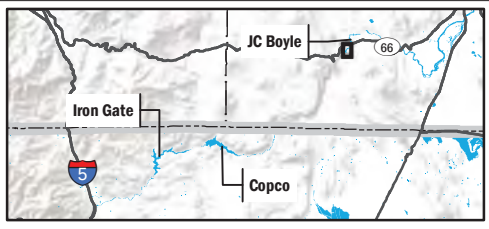
- State
- County
- Stream
- Primary Road
- Access Route
- 0.25 Mile Study Area Buffer

FIGURE 8-3B

Western Pond Turtle Sightings and Habitat
J.C. Boyle Reservoir

AECOM Oakland CA 3/19/2019 USER KHALAFA PATH \\colsvr2\Common\Cummings\Klamath\Revisions\MXDs\Figure_9-1_Western_Pond_Turtle_Survey_Summary.mxd



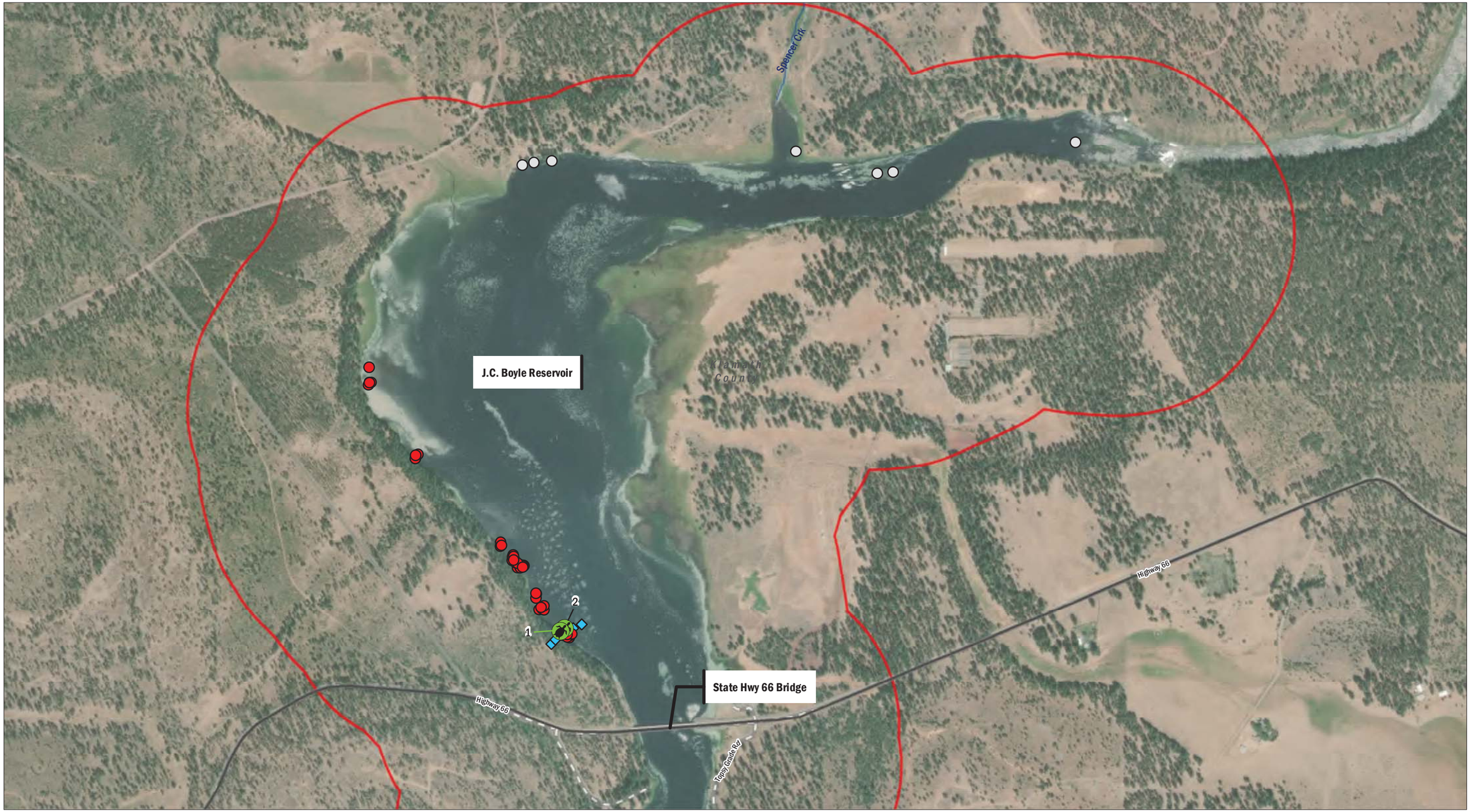


Klamath River Renewal Corporation
Klamath River Renewal Project

FIGURE 9-1

2018 Western Pond Turtle Survey Summary
J.C. Boyle Reservoir - South

CDM Smith 3/19/2019 USER KHALAFA PATH \\colsvr2\Common\Cummings\Klamath\Revisions\MXDs\Figure_9-2_Western_Pond_Turtle_Survey_Summary.mxd

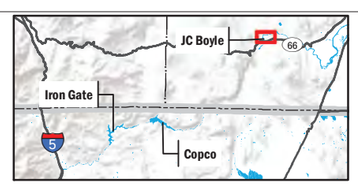


N

0 0.25 0.5
Miles

Data Source: CDM Smith
Basemap Source: Esri, USGS, NOAA

Klamath River Renewal Corporation
Klamath River Renewal Project



- Aug. 2018 Trap Locations
- Sept. 2018 Trap Locations
- WPT Captures
- Environmental Data Loggers
- State
- County
- Stream
- Primary Road
- Secondary Road
- Access Route
- 0.25 Mile Study Area Buffer

FIGURE 9-2

2018 Western Pond Turtle Survey Summary
J.C. Boyle Reservoir - North

CDMSmith 3/15/2019 USER:Bateska PATH: \\colsvr2\Common\Cummings\Klamath\Revisions\MXDs\Figure_10_1_Special_Status_Plants.mxd

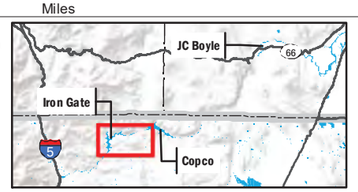
Horseshoe Ranch Wildlife Area
Slide Crk
Scotch Crk
Camp Creek
Dutch Crk
Dutch Creek
Dutch Crk
Jenny Crk
Jenny Creek
Fall Crk
Copco Rd
Fall Creek
Copco No. 2 Bypass
Copco No. 2 Penstock
Juniper Point
Mirror Cove
Iron Gate Reservoir
Long Gulch Cove
Brush Crk
Brush Creek
Iron Gate Fish Hatchery
Bogus Crk
Bullhead Crk
Siskiyou County
Ager Beswick Rd
Iron Crk
Cold Crk

N

0 0.75 1.5
Miles

Data Source: CDM Smith
Basemap Source: Esri, USGS, NOAA

Klamath River Renewal Corporation
Klamath River Renewal Project



2018 Special Status Plants Observations
- Greene's Mariposa Lily (Calochortus greenei)
- Washingotn Lily (Lilium washingtonianum ssp. purpurascens)
- Greene's Four O'Clock (Mirabilis greenei)
- Fleshy Sage (Salvia dorii)

- Primary Road
- Access Route
- Stream
- 0.25 Mile Study Area Buffer

FIGURE 10-1
2018 Special-Status Plant Surveys
Iron Gate Reservoir

CDMSmith 3/15/2019 USER Bateska PATH \\colsvr2\Common\Cummings\Klamath\Revisions\MXDs\Figure_10_2_Special_Status_Plants.mxd

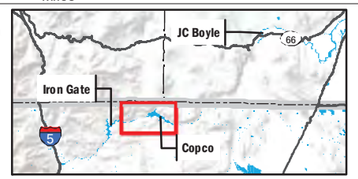
Scookum Crk
Fall Crk
Beaver Creek
Beaver Crk
E Fork Beaver Crk
Sloan Crk
Beaver Creek Cove
Dutch Crk
Jenny Crk
Copco Rd
Copco Lake
Raymond Gulch
Copco No. 2 Bypass
Fall Creek
Copco No. 2 Penstock
Jenny Creek
Keaton Cove
Bullhead Crk
Siskiyou County
Indian Crk
Deer Crk
Klamath National Forest
Shackenbing Crk
Milk Crk

N

0 0.75 1.5
Miles

Data Source: CDM Smith
Basemap Source: Esri, USGS, NOAA

Klamath River Renewal Corporation
Klamath River Renewal Project

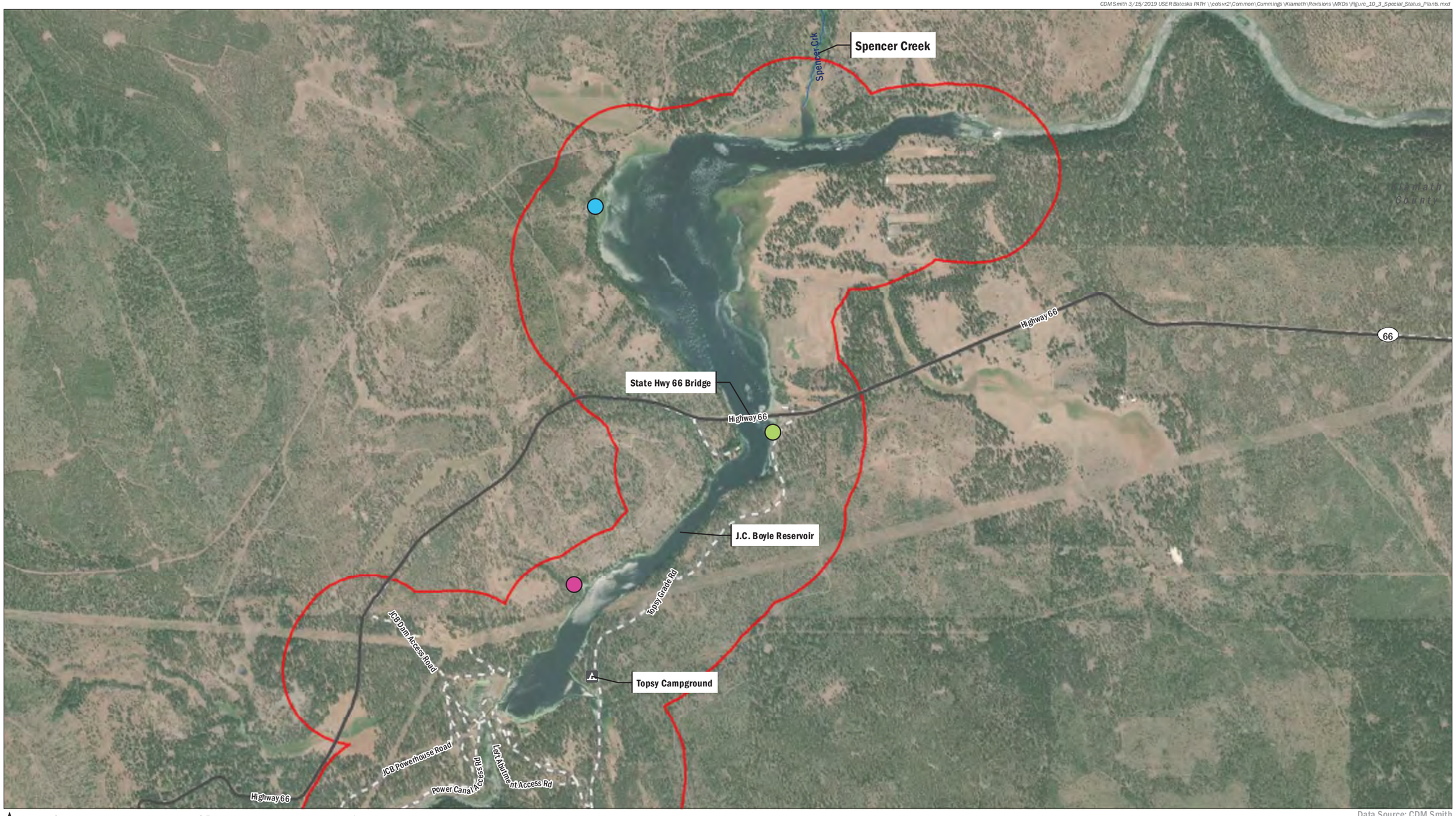


2018 Special Status Plants Observations
- Greene's Mariposa Lily (Calochortus greenei)
- Calochortus sp.
- Washingotn Lily (Lilium washingtonianum ssp. purpurascens)
- Greene's Four O'Clock (Mirabilis greenei)
- Fleshy Sage (Salvia dorii)

- 0.25 Mile Study Area Buffer
- State
- County
- Stream
- Access Route

FIGURE 10-2
2018 Special-Status Plant Surveys
Copco Lake

CDM Smith 3/15/2019 USER Bateska PATH \\colsvr2\Common\Cummings\Klamath\Revisions\MXDs\Figure_10_3_Special_Status_Plants.mxd

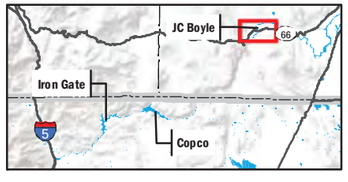


N

0 0.5 1
Miles

Data Source: CDM Smith
Basemap Source: Esri, USGS, NOAA

Klamath River Renewal Corporation
Klamath River Renewal Project



2018 Special Status Plants Observations
- Bristly Sedge (Carex comosa)
- Coast Irirs (Iris longipetala)
- Western Yampah

- Primary Road
- Access Route
- Stream
- 0.25 Mile Study Area Buffer

FIGURE 10-3

2018 Special-Status Plant Surveys
J.C. Boyle Reservoir

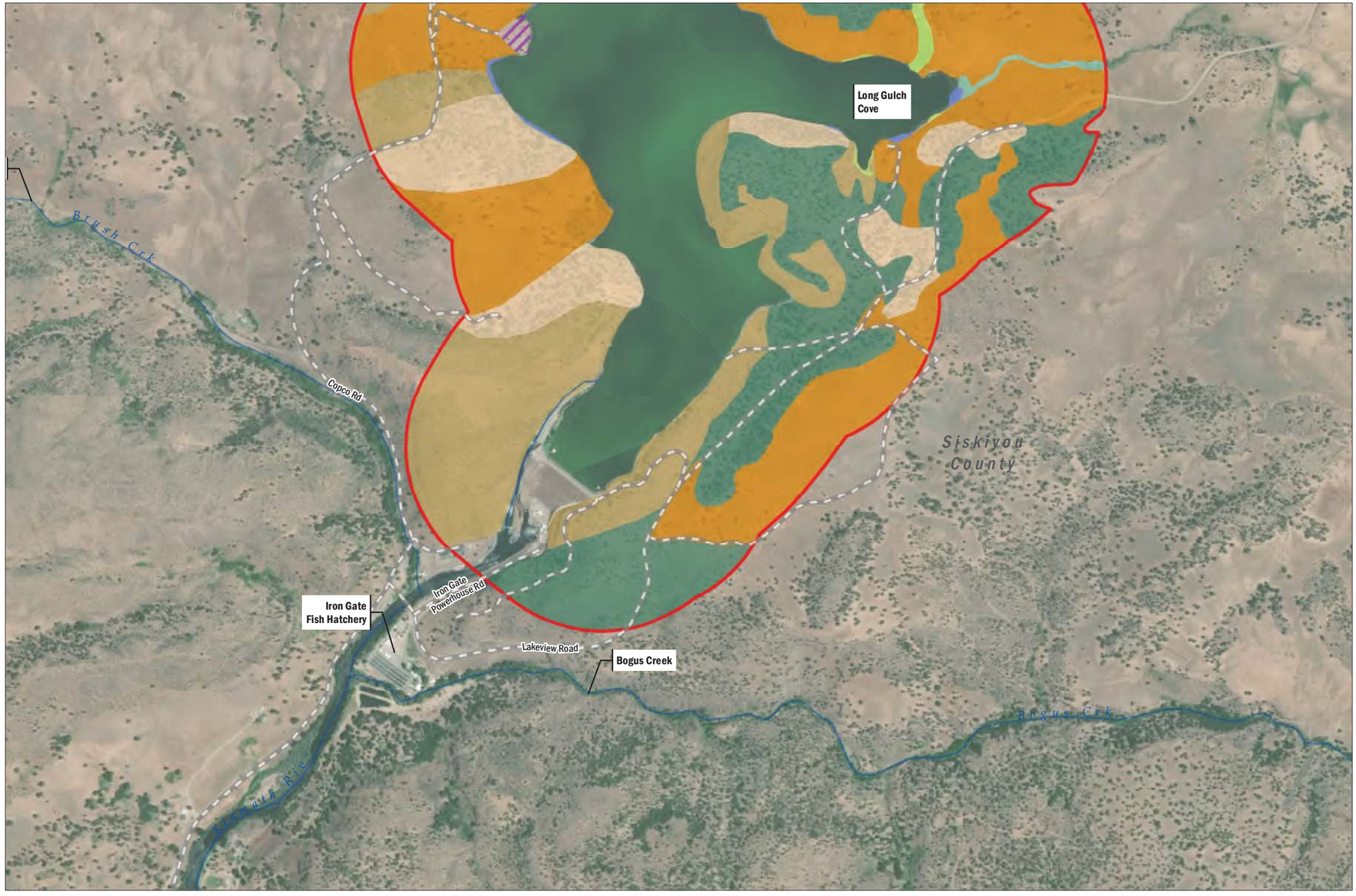
AECOM Oakland CA 3/20/2019 USER KHALAFA PATH \\colsvr2\Common\Cummings\Klamath\Revisions\MXDs\Figure_11_Iron_Gate_Vegetation_Communities.mxd

LEGEND

- Access Route
- State
- County
- Stream
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Geyer willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



N

0 0.5

Miles

Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

Klamath River Renewal Corporation

Klamath River Renewal Project

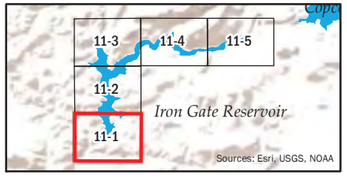


FIGURE 11-1

Vegetation Communities

Iron Gate Reservoir

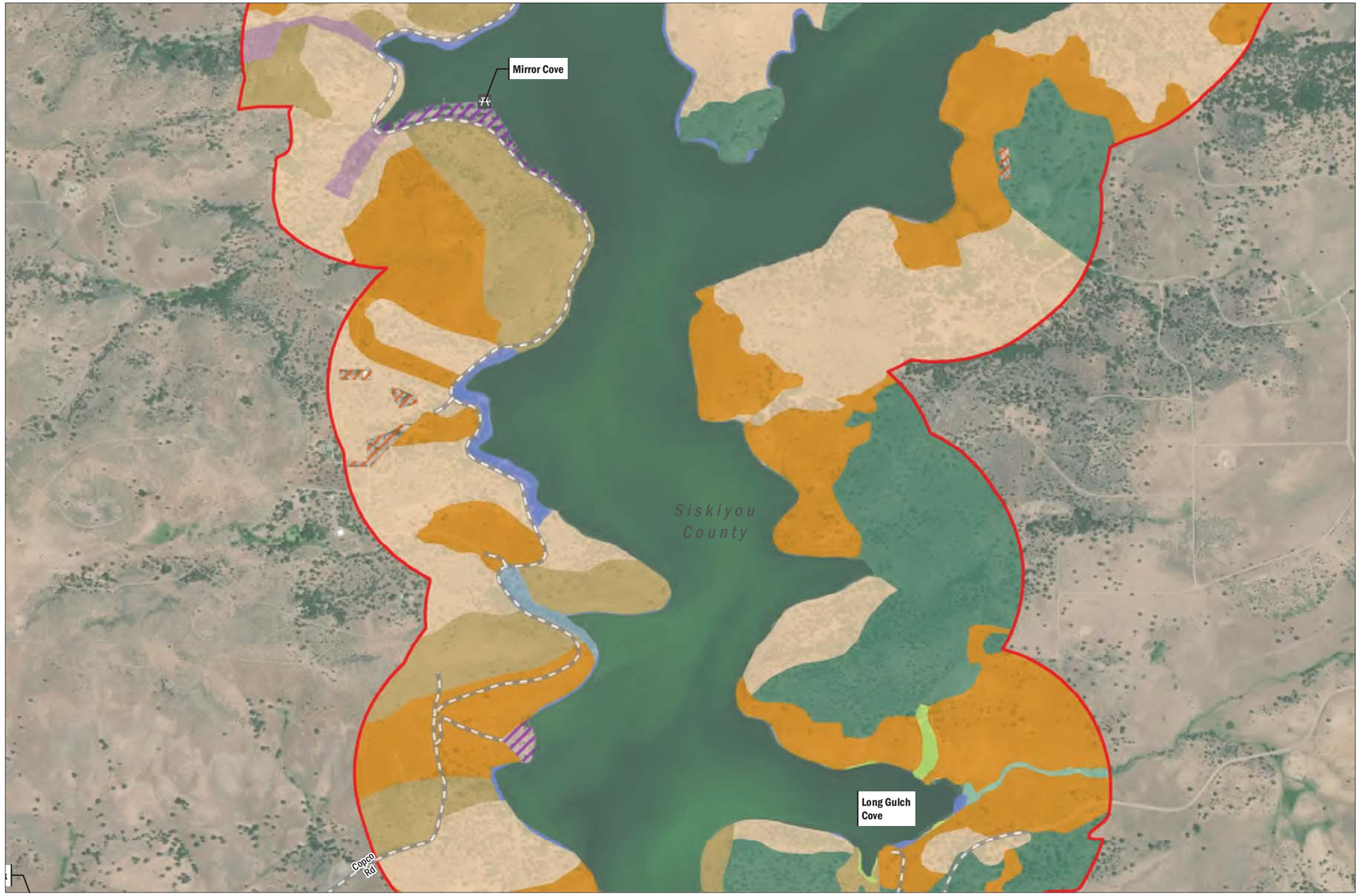
AECOM Oakland CA 3/20/2019 USER KHALAFA PATH \\colsvr2\Common\Cummings\Klamath\Revisions\MXDs\Figure_11_Iron_Gate_Vegetation_Communities.mxd

LEGEND

- Access Route
- State
- County
- Stream
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Geyer willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



N

0 0.5 Miles

Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

Klamath River Renewal Corporation
Klamath River Renewal Project

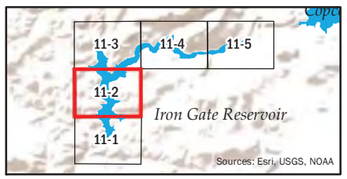


FIGURE 11-2

Vegetation Communities
Iron Gate Reservoir

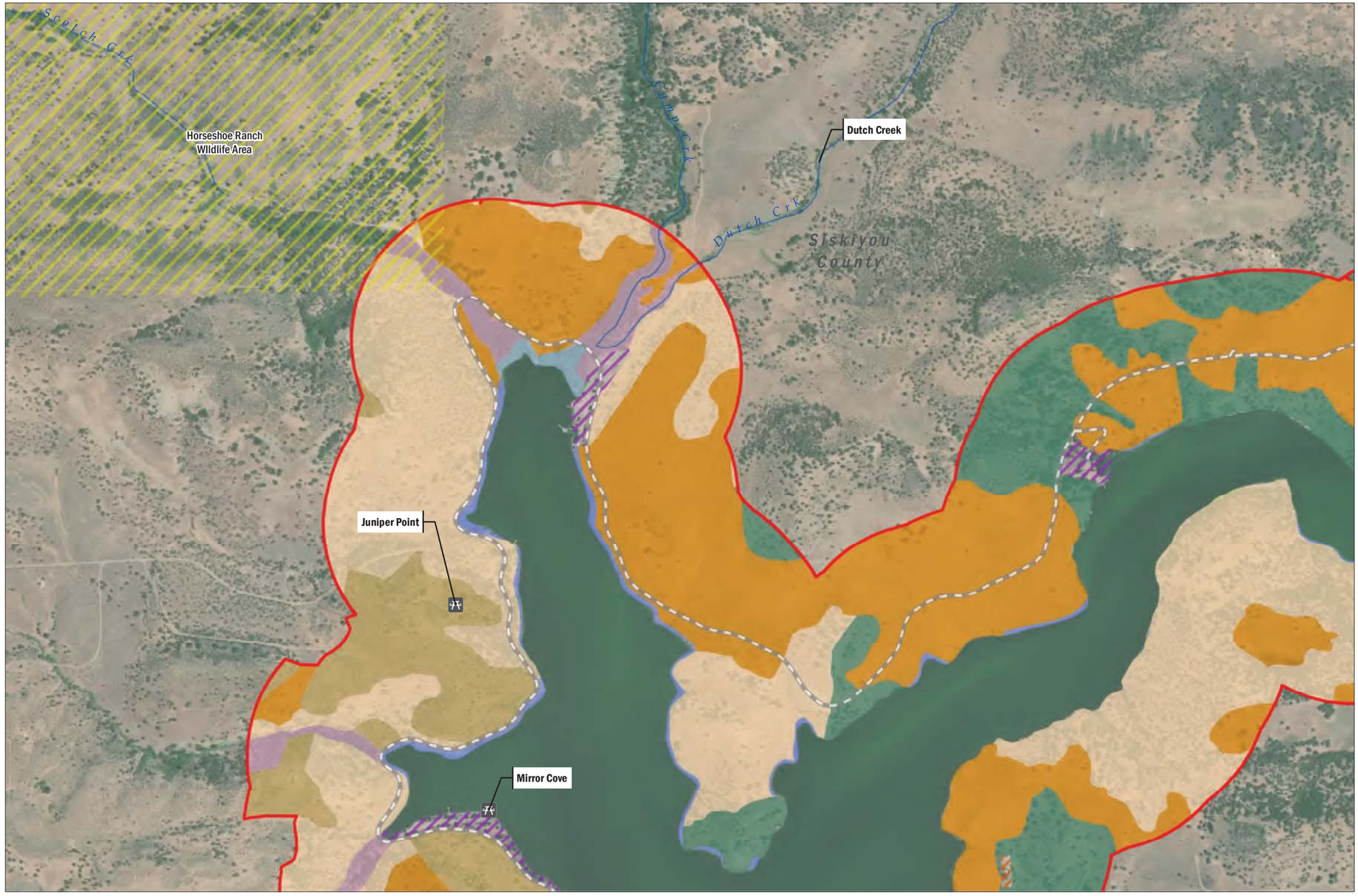
AECOM Oakland CA 3/20/2019 USER KHALAFA PATH \\colsvr2\Common\Cummings\Klamath\Revisions\MXDs\Figure_11_Iron_Gate_Vegetation_Communities.mxd

LEGEND

- Access Route
- State
- County
- Stream
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Geyer willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



N

0 0.5

Miles

Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

Klamath River Renewal Corporation

Klamath River Renewal Project

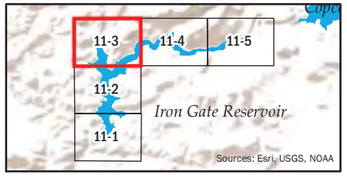


FIGURE 11-3

Vegetation Communities

Iron Gate Reservoir

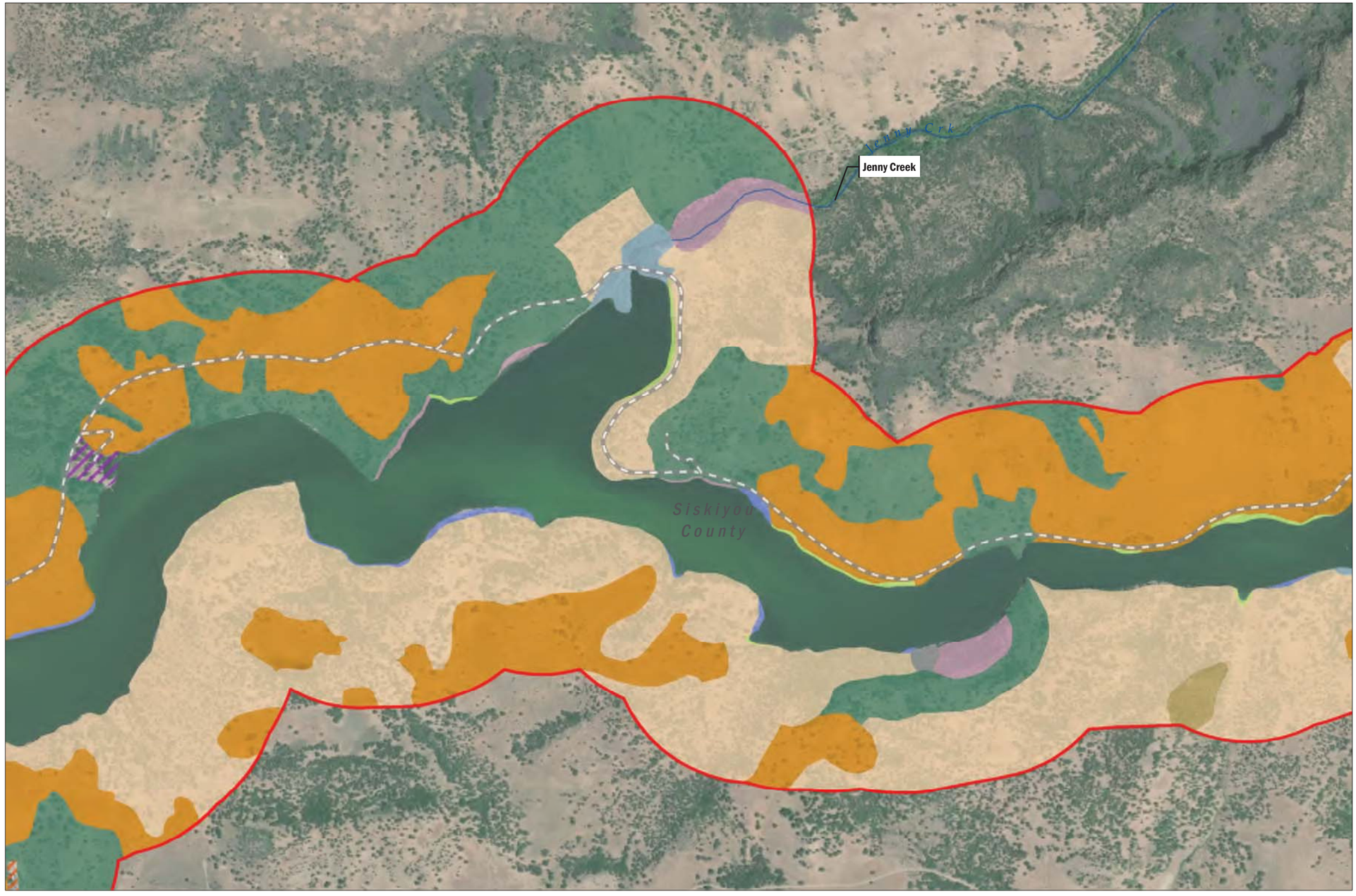
AECOM Oakland CA 3/20/2019 USER KHALAFA PATH \\colsvr2\Common\Cummings\Klamath\Revisions\MXDs\Figure_11_Iron_Gate_Vegetation_Communities.mxd

LEGEND

- Access Route
- State
- County
- Stream
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Geyer willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



N

0 0.5

Miles

Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

Klamath River Renewal Corporation

Klamath River Renewal Project

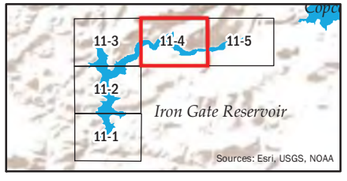


FIGURE 11-4

Vegetation Communities

Iron Gate Reservoir

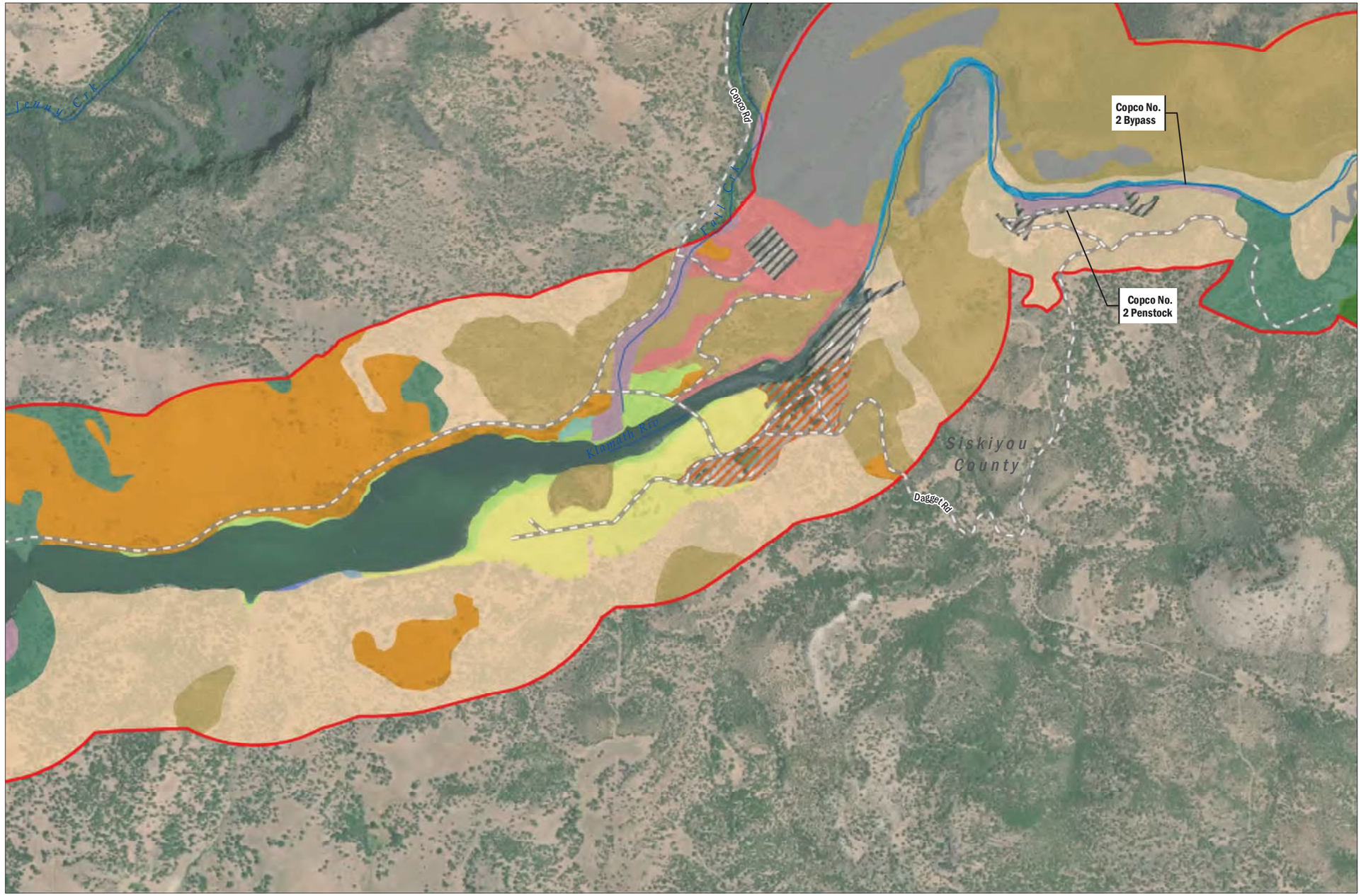
AECOM Oakland CA 3/20/2019 USER KHALAFA PATH \\colsvr2\Common\Cummings\Klamath\Revisions\MXDs\Figure_11_Iron_Gate_Vegetation_Communities.mxd

LEGEND

- Access Route
- State
- County
- Stream
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Geyer willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



N

0 0.5 Miles

Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

Klamath River Renewal Corporation
Klamath River Renewal Project

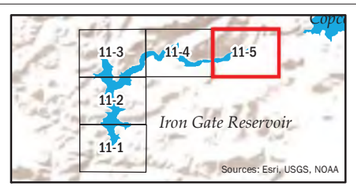


FIGURE 11-5

Vegetation Communities
Iron Gate Reservoir

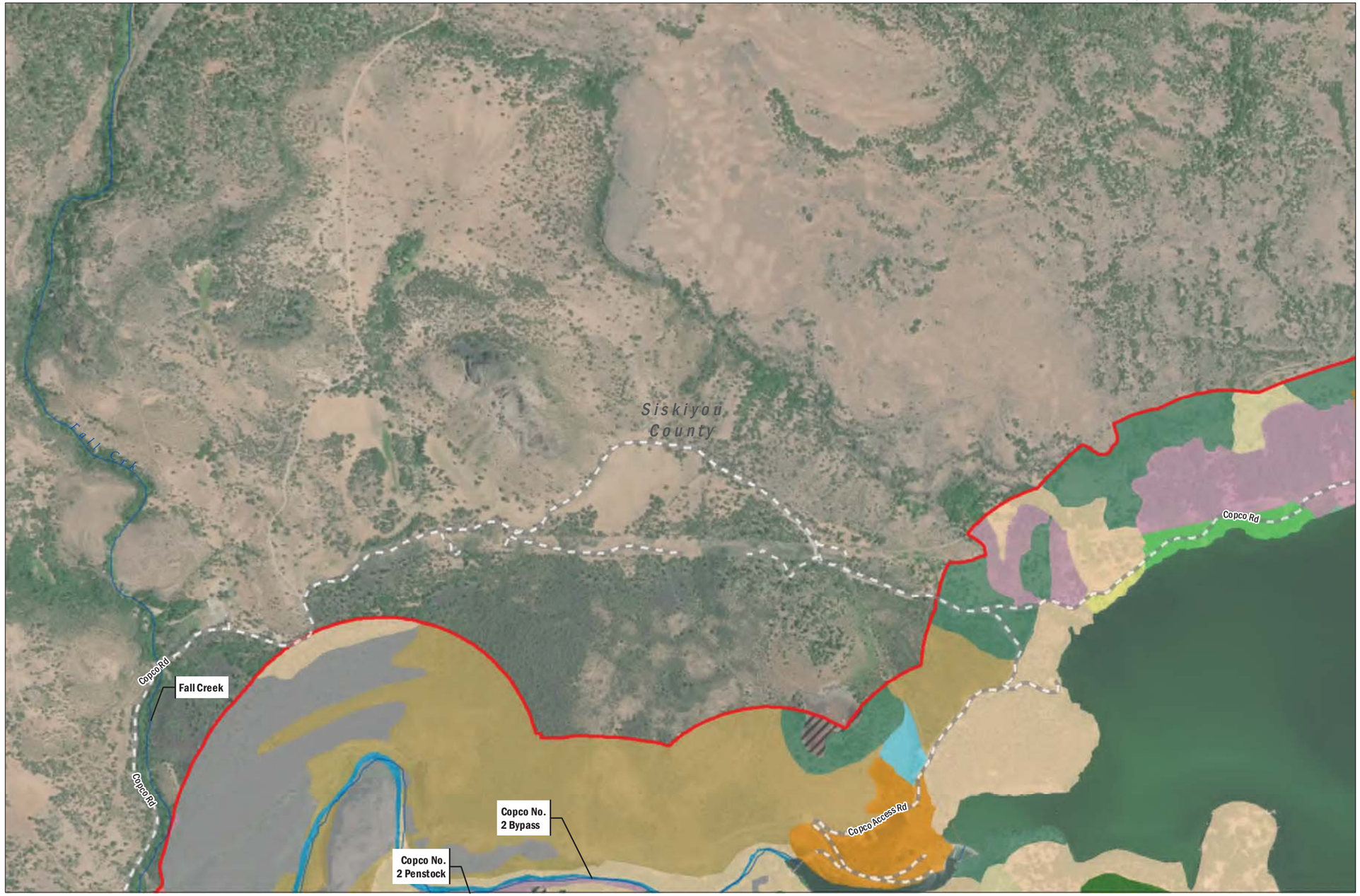
AECOM Oakland CA 3/19/2019 USER Bateska PATH \\cdsvr2\Common\Cummings\Klamath\Revisions\MXDs\Figure_11_Copco_Vegetation_Communities.mxd

LEGEND

- Access Route
- State
- County
- Stream
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Geyer willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

N

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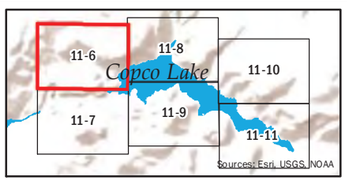


Klamath River Renewal Corporation
Klamath River Renewal Project

FIGURE 11-6

Vegetation Communities
Copco Lake

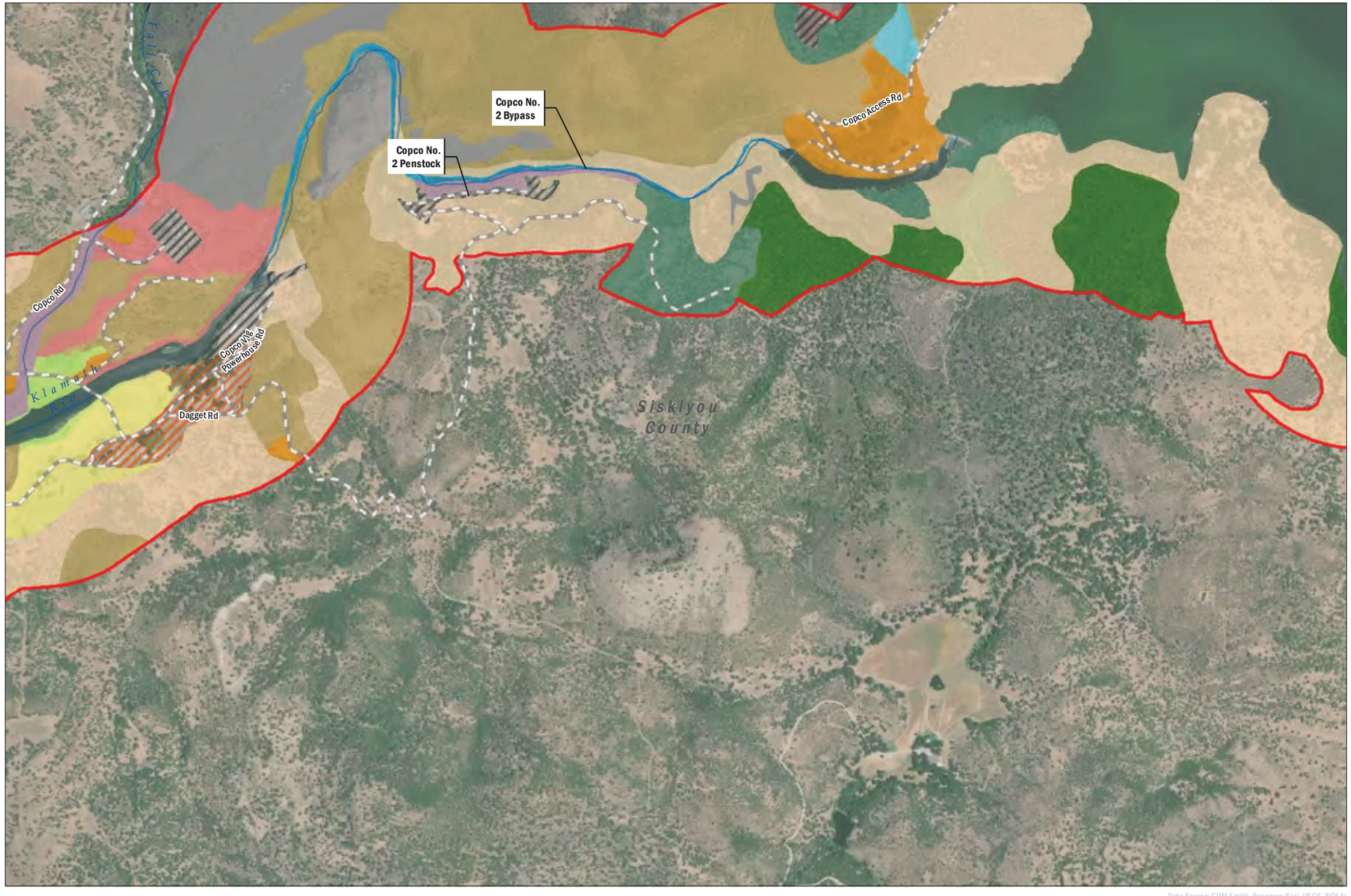
AECOM Oakland CA 3/19/2019 USER Bateska PATH \\cdsvr2\Common\Cummings\Klamath\Revisions\MXDs\Figure_11_Copco_Vegetation_Communities.mxd

LEGEND

- Access Route
- State
- County
- Stream
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Geyer willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



N

0 0.5 Miles

Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

Klamath River Renewal Corporation
Klamath River Renewal Project

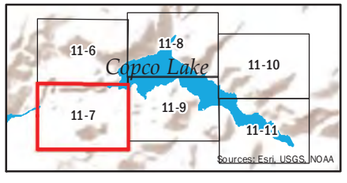


FIGURE 11-7

Vegetation Communities
Copco Lake

AECOM Oakland CA 3/19/2019 USER Bateska PATH \\cdsvr2\Common\Cummings\Klamath\Revisions\MXDs\Figure_11_Copco_Vegetation_Communities.mxd

LEGEND

- Access Route
- State
- County
- Stream
- 0.25 Mile Study Area Buffer

Alliance Name

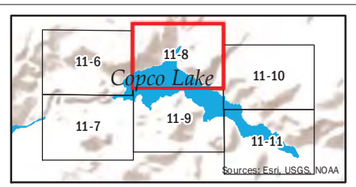
- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Geyer willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



N

0 0.5 Miles

Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)



Klamath River Renewal Corporation
Klamath River Renewal Project

FIGURE 11-8

Vegetation Communities
Copco Lake

AECOM Oakland CA 3/19/2019 USER Bateska PATH \\cdsvr2\Common\Cummings\Klamath\Revisions\MXDs\Figure_11_Copco_Vegetation_Communities.mxd

LEGEND

- Access Route
- State
- County
- Stream
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Geyer willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



N

0 0.5

Miles

Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

Klamath River Renewal Corporation

Klamath River Renewal Project

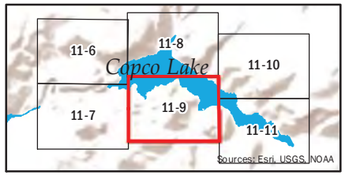


FIGURE 11-9

Vegetation Communities

Copco Lake

AECOM Oakland CA 3/19/2019 USER Bateska PATH \\cdsvr2\Common\Cummings\Klamath\Revisions\MXDs\Figure_11_Copco_Vegetation_Communities.mxd

LEGEND

- Access Route
- State
- County
- Stream
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Geyer willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



N

0 0.5 Miles

Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

Klamath River Renewal Corporation
Klamath River Renewal Project

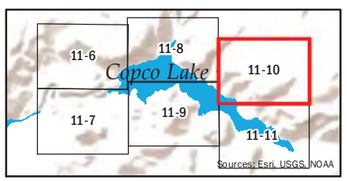


FIGURE 11-10

Vegetation Communities
Copco Lake

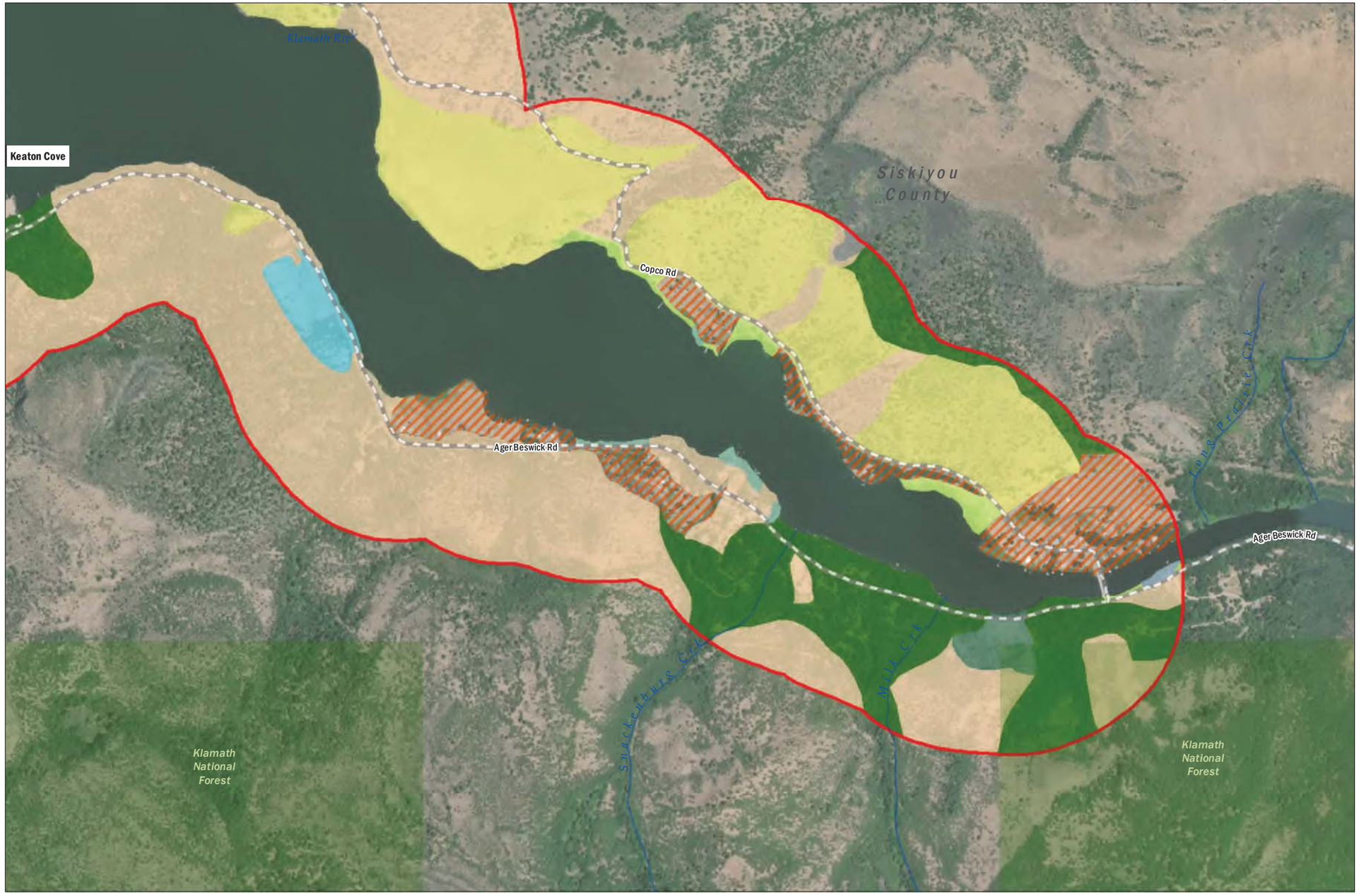
AECOM Oakland CA 3/19/2019 USER Bateska PATH \\colsvr2\Common\Cummings \Klamath\Revisions \MXDs \Figure_11_Copco_Vegetation_Communities.mxd

LEGEND

- Access Route
- State
- County
- Stream
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Geyer willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



N

0 0.5

Miles

Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

Klamath River Renewal Corporation

Klamath River Renewal Project

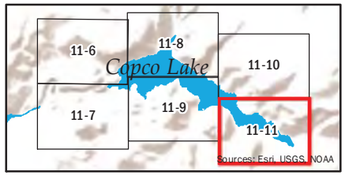


FIGURE 11-11

Vegetation Communities

Copco Lake

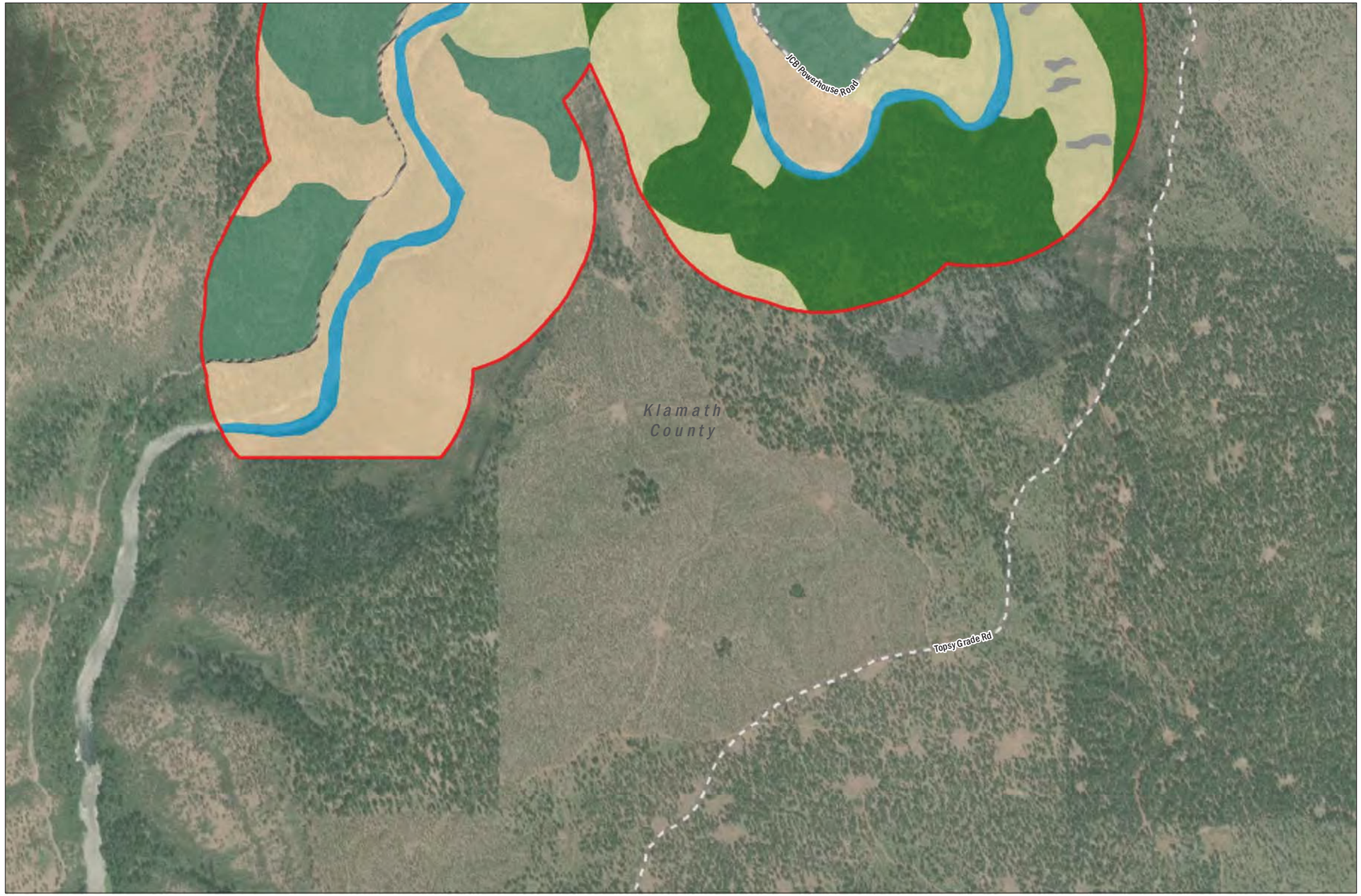
AECOM Oakland CA 3/19/2019 USER Bateska PATH \\colsvr2\Common\Cummings\Klamath\Revisions\MXDs\Figure_11_JC_Boyle_Vegetation_Communities.mxd

LEGEND

- Access Route
- State
- County
- Stream
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Geyer willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



N

0 0.5 Miles

Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

Klamath River Renewal Corporation
Klamath River Renewal Project

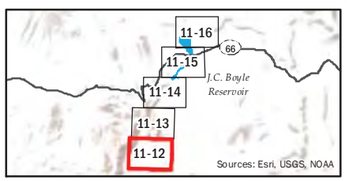


FIGURE 11-12

Vegetation Communities
JC Boyle Reservoir

AECOM Oakland CA 3/19/2019 USER Bateska PATH \\colsvr2\Common\Cummings\Klamath\Revisions\MXDs\Figure_11_JC_Boyle_Vegetation_Communities.mxd

LEGEND

- Access Route
- State
- County
- Stream
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Geyer willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



N

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Miles

Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

Klamath River Renewal Corporation

Klamath River Renewal Project

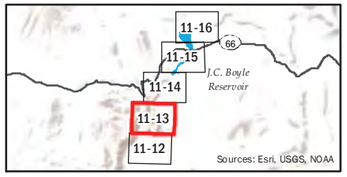


FIGURE 11-13

Vegetation Communities

JC Boyle Reservoir

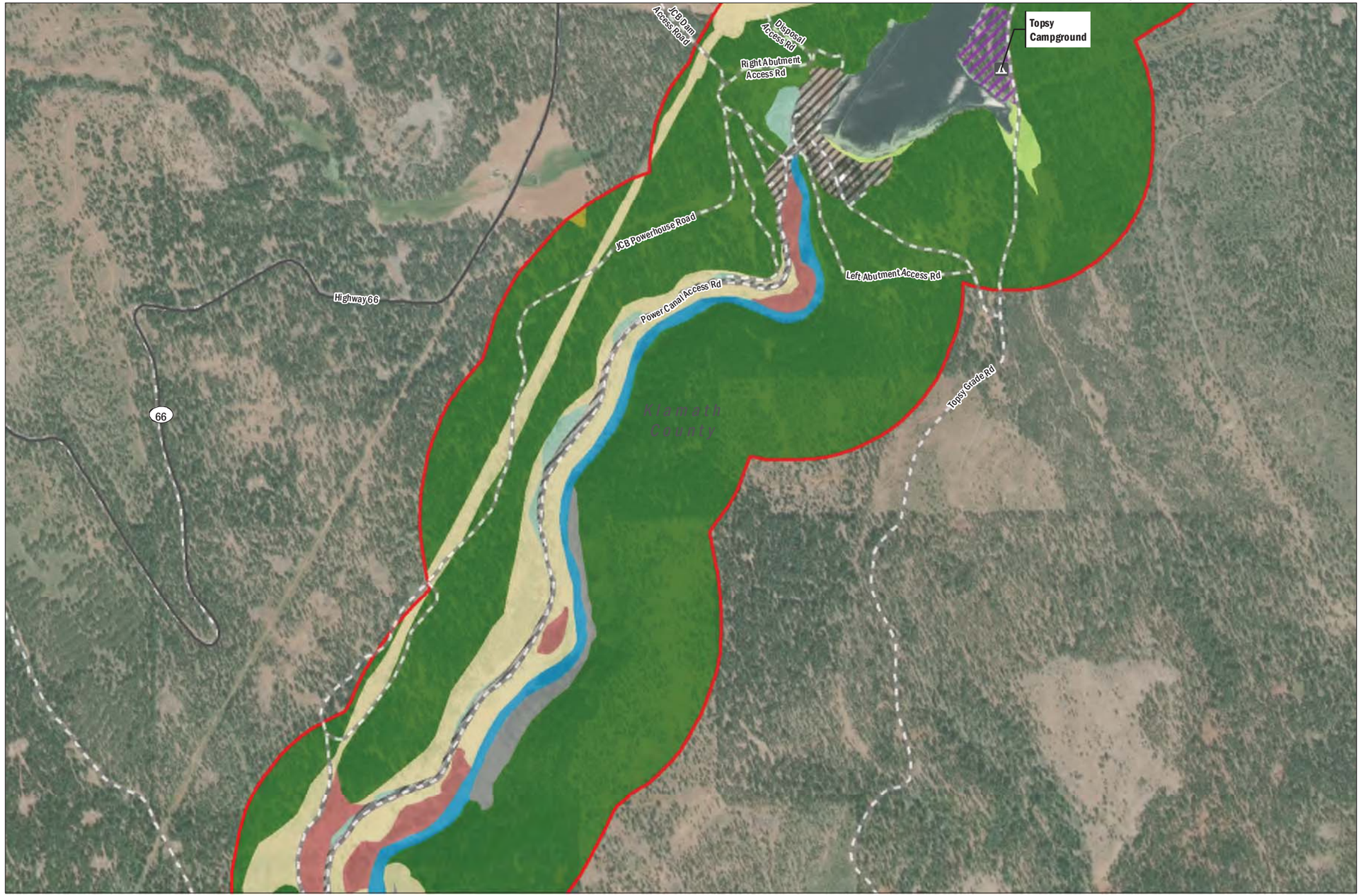
AECOM Oakland CA 3/19/2019 USER Bateska PATH \\colsvr2\Common\Cummings\Klamath\Revisions\MXDs\Figure_11_JC_Boyle_Vegetation_Communities.mxd

LEGEND

- Access Route
- State
- County
- Stream
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Geyer willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



N

0 0.5 Miles

Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

Klamath River Renewal Corporation
Klamath River Renewal Project

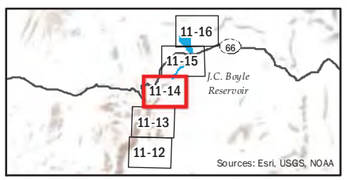


FIGURE 11-14

Vegetation Communities
JC Boyle Reservoir

AECOM Oakland CA 3/19/2019 USER Bateska PATH \\colsvr2\Common\Cummings\Klamath\Revisions\MXDs\Figure_11_JC_Boyle_Vegetation_Communities.mxd

LEGEND

- Access Route
- State
- County
- Stream
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Geyer willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



N

0 0.5 Miles

Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

Klamath River Renewal Corporation
Klamath River Renewal Project

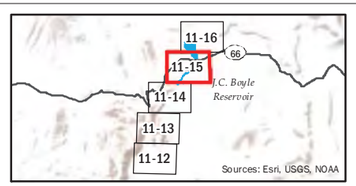


FIGURE 11-15

Vegetation Communities
JC Boyle Reservoir

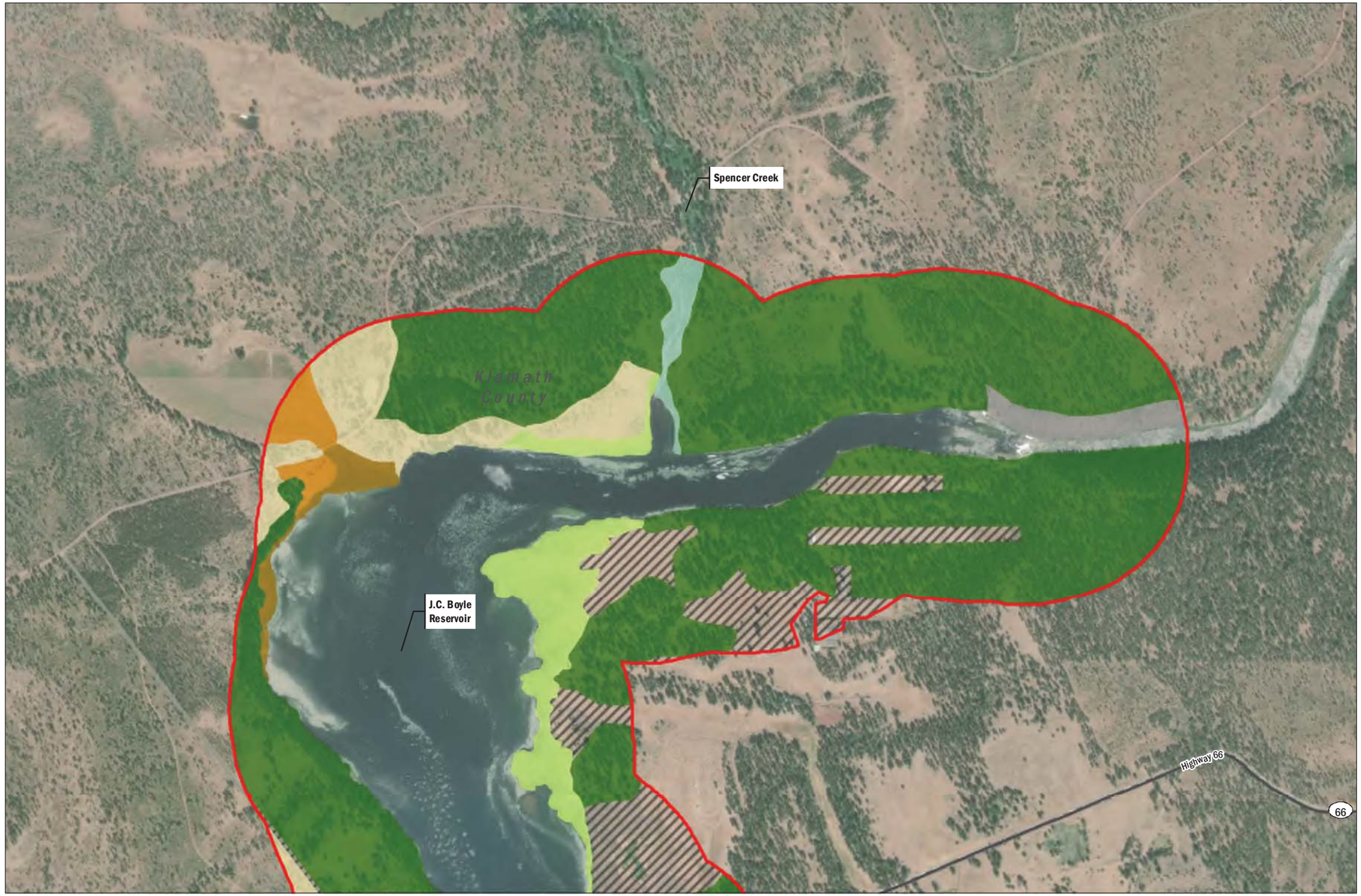
AECOM Oakland CA 3/19/2019 USER Bateska PATH \\colsvr2\Common\Cummings\Klamath\Revisions\MXDs\Figure_11_JC_Boyle_Vegetation_Communities.mxd

LEGEND

- Access Route
- State
- County
- Stream
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Geyer willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thicket
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



N

0 0.5 Miles

Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

Klamath River Renewal Corporation
Klamath River Renewal Project

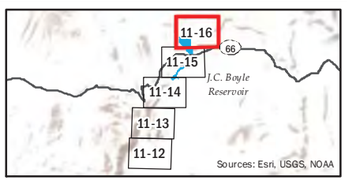


FIGURE 11-16

Vegetation Communities
JC Boyle Reservoir

AECOM Oakland CA 3/20/2019 USER jessica.parteno PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\SeedCollection_and_ReferenceSites\InvasiveVegetation_2018AnnualReport\Figure X EIV 2018 Annual Report Mapbook.mxd



N

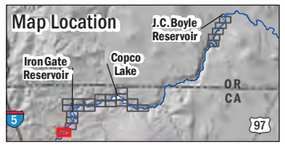
0 1,000
Feet

DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 3/20/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project



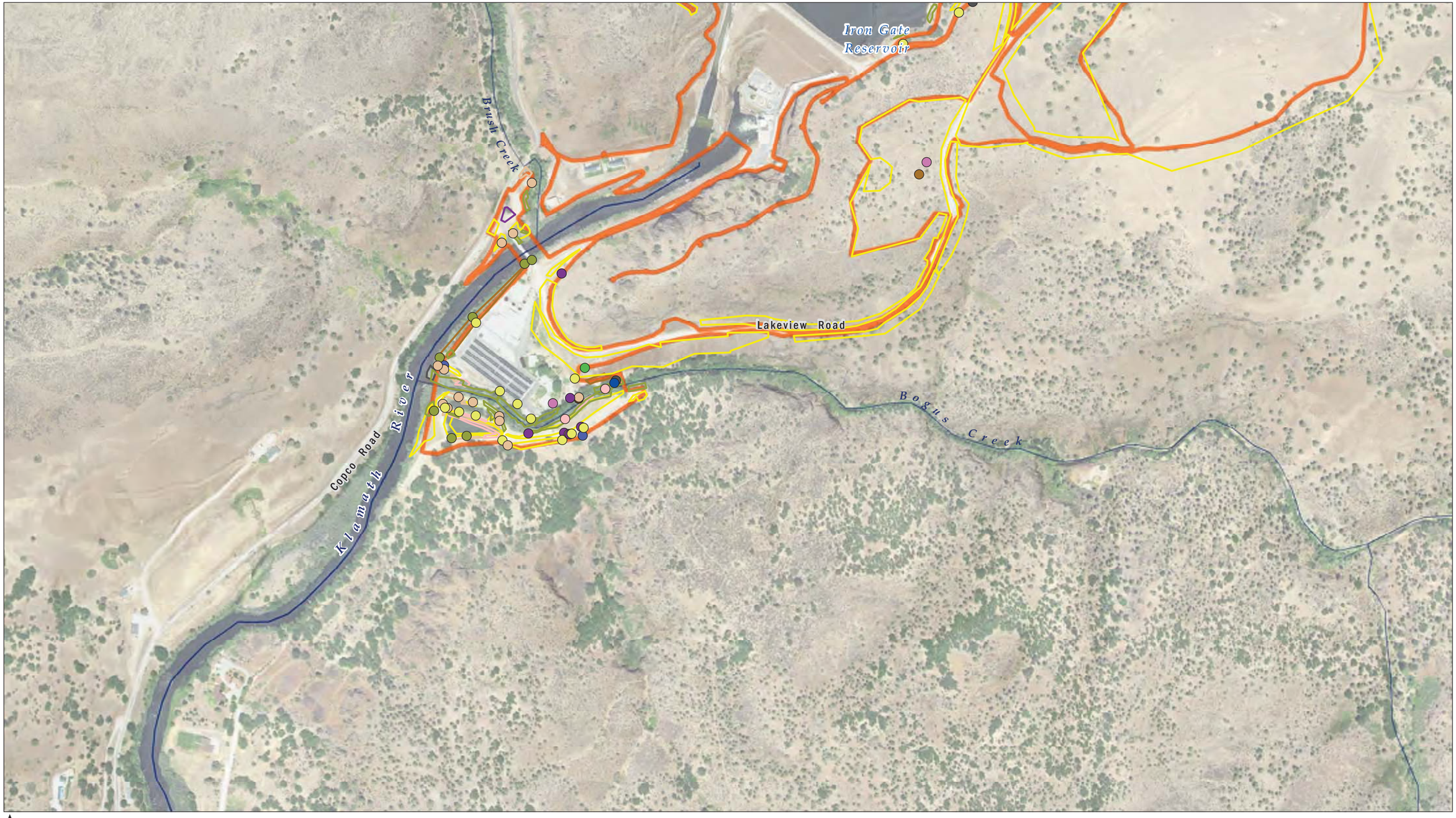
Klamath River
Streams
Limits of Work

Species - Surveyed Point
Convolvulus arvensis

Species - Surveyed Polygon
Centaurea solstitialis
Convolvulus arvensis
Dipsacus fullonum
Rubus armeniacus
Tribulus terrestris

FIGURE 12-1
Invasive Exotic Vegetation Observations

AECOM Oakland CA 3/20/2019 USER.jessica.parteno PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\SeedCollection_and_ReferenceSites\InvasiveVegetation_2018AnnualReport\Figure X EIV 2018 Annual Report Mapbook.mxd



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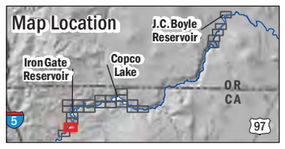
Feet

DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 3/20/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project

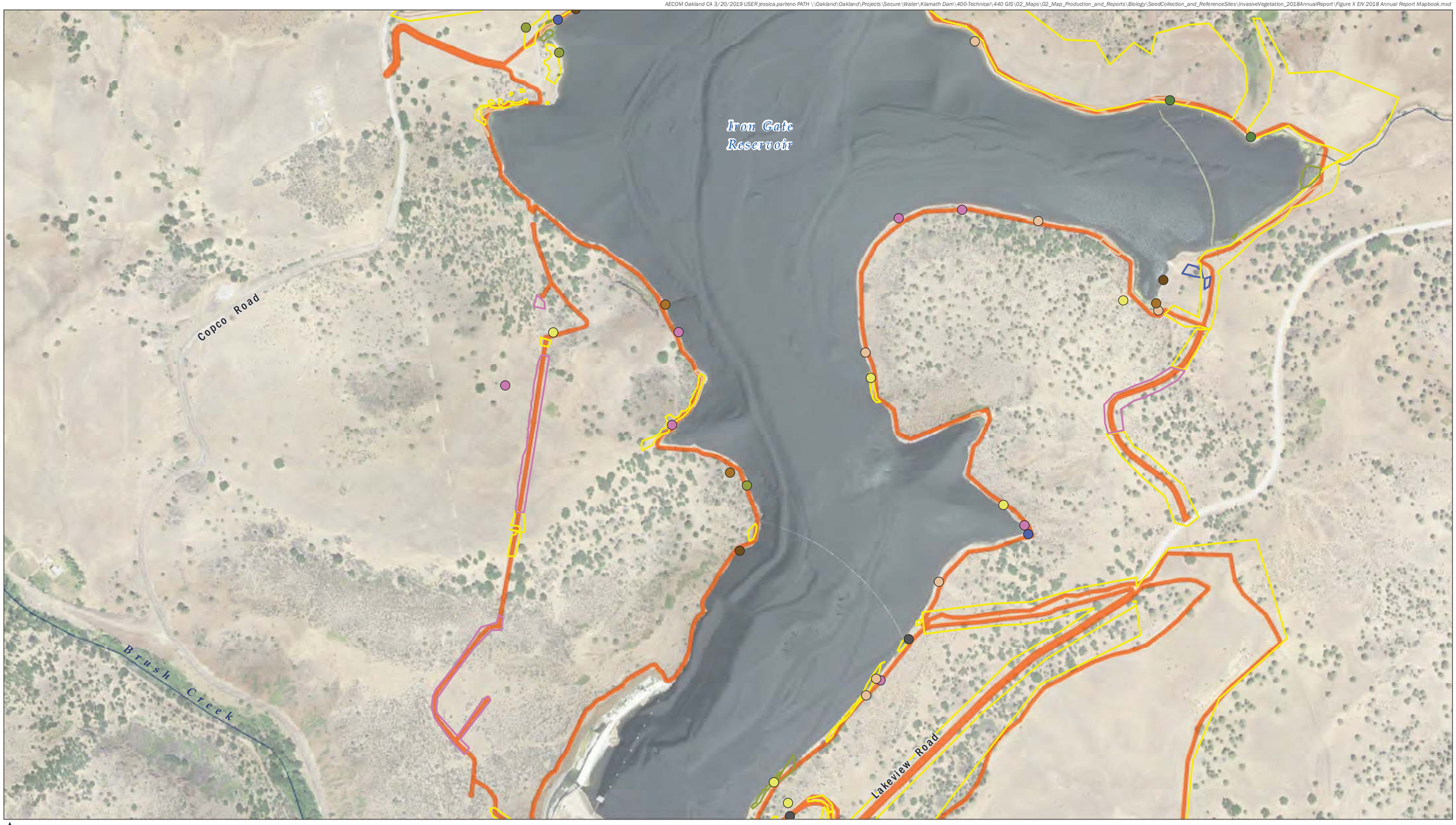
Map Location


- Klamath River
- Streams
- Limits of Work

Species - Surveyed Point
- Bromus tectorum
- Centaurea solstitialis
- Convolvulus arvensis
- Dipsacus fullonum
- Elymus caput-medusae
- Isatis tinctoria
- Phalaris arundinacea
- Rubus armeniacus
- Tribulus terrestris
- Cirsium vulgare
- Conium maculatum
- Lepidium draba

Species - Surveyed Polygon
- Bromus tectorum
- Centaurea solstitialis
- Dipsacus fullonum
- Rubus armeniacus
- Tribulus terrestris
- Conium maculatum
- Lepidium draba

FIGURE 12-2
Invasive Exotic Vegetation Observations

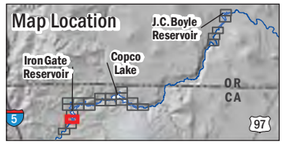


DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 3/20/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project

Map Location


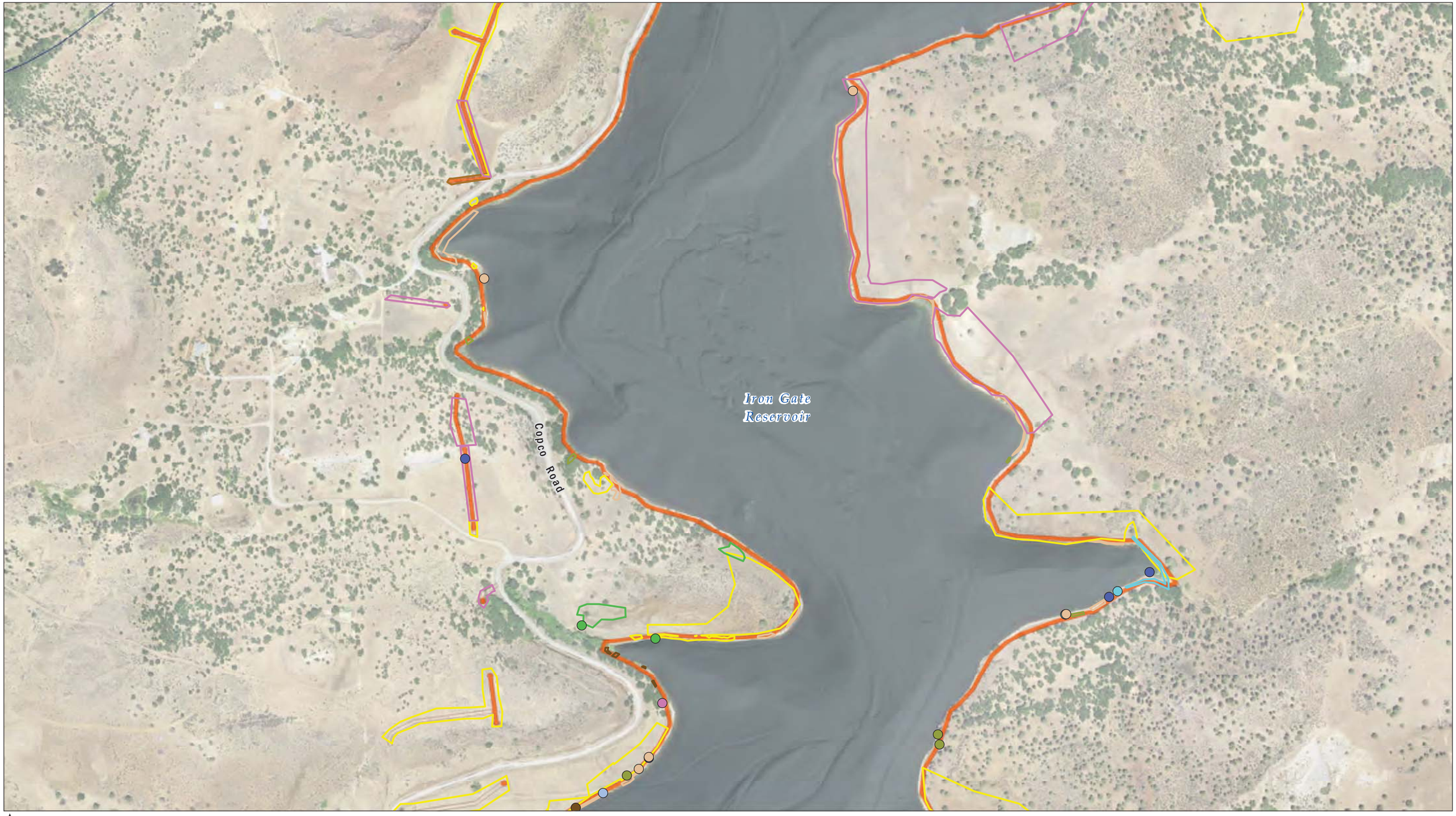
- Klamath River
- Streams
- Limits of Work

Species - Surveyed Point
- Bromus tectorum
- Centaurea solstitialis
- Convolvulus arvensis
- Dipsacus fullonum
- Elymus caput-medusae
- Phalaris arundinacea
- Rubus armeniacus
- Lepidium draba
- Mentha pulegium

Species - Surveyed Polygon
- Bromus tectorum
- Centaurea solstitialis
- Convolvulus arvensis
- Dipsacus fullonum
- Elymus caput-medusae
- Rubus armeniacus

FIGURE 12-3
Invasive Exotic Vegetation Observations

AECOM Oakland CA 3/20/2019 USER.jessica.parteno PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\SeedCollection_and_ReferenceSites\InvasiveVegetation_2018AnnualReport\Figure X EIV 2018 Annual Report Mapbook.mxd



N

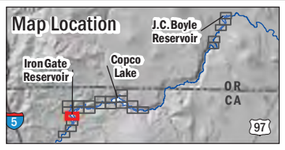
0 1,000
Feet

DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 3/20/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project



- Klamath River
- Streams
- Limits of Work

Species - Surveyed Point
- Convolvulus arvensis
- Dipsacus fullonum
- Elymus caput-medusae
- Isatis tinctoria
- Linaria vulgaris
- Phalaris arundinacea
- Rubus armeniacus
- Xanthium spinosum

Species - Surveyed Polygon
- Bromus tectorum
- Centaurea solstitialis
- Dipsacus fullonum
- Elymus caput-medusae
- Isatis tinctoria
- Phalaris arundinacea
- Rubus armeniacus
- Xanthium spinosum

FIGURE 12-4
Invasive Exotic Vegetation Observations

AECOM Oakland CA 3/20/2019 USER.jessica.parteno PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\SeedCollection_and_ReferenceSites\InvasiveVegetation_2018AnnualReport\Figure X EIV 2018 Annual Report Mapbook.mxd



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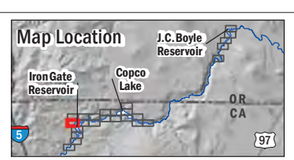
Feet

DATA SOURCE:
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 3/20/2019

PROJECTION:
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project



Klamath River
Streams
Limits of Work

Species - Surveyed Point
- Bromus tectorum
- Dipsacus fullonum
- Elymus caput-medusae
- Mentha pulegium

Species - Surveyed Polygon
- Centaurea solstitialis
- Dipsacus fullonum
- Rubus armeniacus

FIGURE 12-5
Invasive Exotic Vegetation Observations

AECOM Oakland CA 3/20/2019 USER jessica.parteno PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\SeedCollection_and_ReferenceSites\InvasiveVegetation_2018AnnualReport\Figure X EIV 2018 Annual Report Mapbook.mxd



N

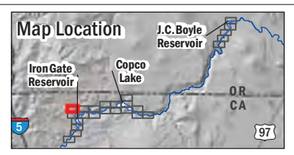
0 1,000
Feet

DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 3/20/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project



Klamath River
Streams
Limits of Work

Species - Surveyed Point
- Bromus tectorum
- Dipsacus fullonum
- Phalaris arundinacea
- Tribulus terrestris

Species - Surveyed Polygon
- Centaurea solstitialis
- Dipsacus fullonum
- Rubus armeniacus
- Tribulus terrestris
- Conium maculatum

FIGURE 12-6
Invasive Exotic Vegetation Observations

AECOM Oakland CA 3/20/2019 USER:jessica.parteno PATH: \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\SeedCollection_and_ReferenceSites\InvasiveVegetation_2018AnnualReport\Figure X EIV 2018 Annual Report Mapbook.mxd



N

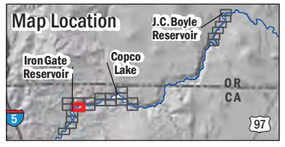
0 1,000
Feet

DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 3/20/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project



Klamath River
Streams
Limits of Work

Species - Surveyed Point
Centaurea solstitialis
Phalaris arundinacea
Rubus armeniacus

Species - Surveyed Polygon
Centaurea solstitialis

Dipsacus fullonum
Elymus caput-medusae
Phalaris arundinacea
Rubus armeniacus
Xanthium spinosum

FIGURE 12-7
Invasive Exotic Vegetation Observations

AECOM Oakland CA 3/20/2019 USER.jessica.parteno PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\SeedCollection_and_ReferenceSites\InvasiveVegetation_2018AnnualReport\Figure X EIV 2018 Annual Report Mapbook.mxd



N

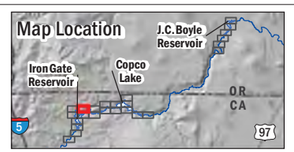
0 1,000
Feet

DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 3/20/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project



Klamath River
Streams
Limits of Work

Species - Surveyed Point
- Centaurea solstitialis
- Dipsacus fullonum
- Isatis tinctoria
- Phalaris arundinacea

Species - Surveyed Polygon
- Centaurea solstitialis
- Dipsacus fullonum
- Elymus caput-medusae
- Phalaris arundinacea

FIGURE 12-8
Invasive Exotic Vegetation Observations

AECOM Oakland CA 3/20/2019 USER.jessica.parteno PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\SeedCollection_and_ReferenceSites\InvasiveVegetation_2018AnnualReport\Figure X EIV 2018 Annual Report Mapbook.mxd

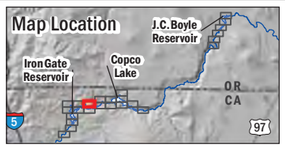


DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 3/20/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project



- Klamath River
- Streams
- Limits of Work

Species - Surveyed Point
- Dipsacus fullonum
- Phalaris arundinacea

Species - Surveyed Polygon
- Bromus tectorum
- Centaurea solstitialis
- Dipsacus fullonum
- Elymus caput-medusae
- Phalaris arundinacea
- Rubus armeniacus

FIGURE 12-9

Invasive Exotic Vegetation Observations

AECOM Oakland CA 3/20/2019 USER.jessica.parteno PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\SeedCollection_and_ReferenceSites\InvasiveVegetation_2018AnnualReport\Figure X EIV 2018 Annual Report Mapbook.mxd



N

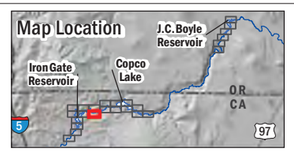
0 1,000
Feet

DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 3/20/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project



Klamath River
Streams
Limits of Work

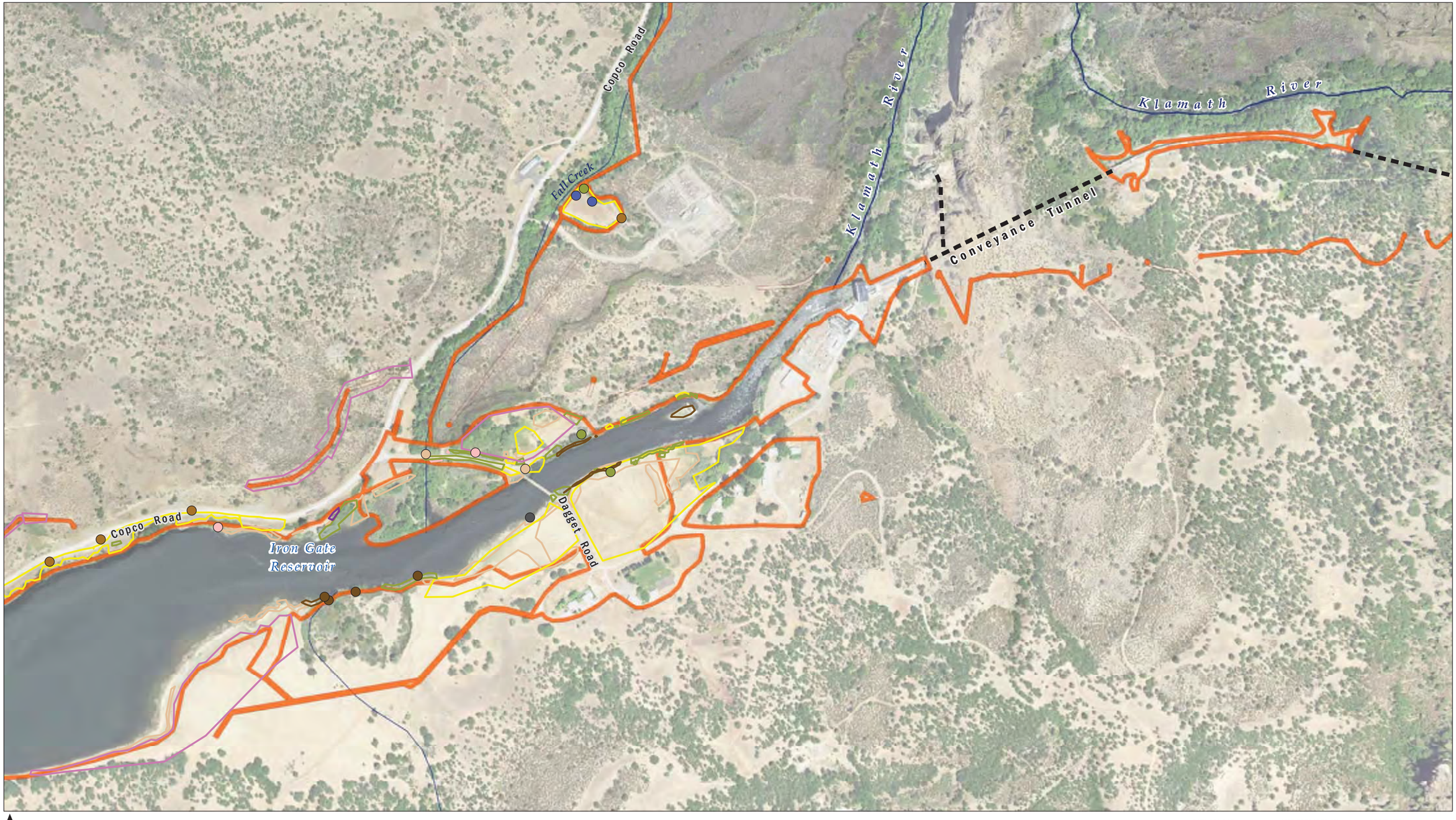
Species - Surveyed Point
- Dipsacus fullonum
- Elymus caput-medusae
- Phalaris arundinacea
- Lepidium draba

Species - Surveyed Polygon
- Centaurea solstitialis
- Dipsacus fullonum
- Elymus caput-medusae
- Phalaris arundinacea
- Rubus armeniacus

FIGURE 12-10

Invasive Exotic Vegetation Observations

AECOM Oakland CA 3/20/2019 USER.jessica.parteno PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\SeedCollection_and_ReferenceSites\InvasiveVegetation_2018AnnualReport\Figure X EIV 2018 Annual Report Mapbook.mxd



N

0 1,000
Feet

DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 3/20/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project

Map Location
J.C. Boyle Reservoir
Iron Gate Reservoir
Copco Lake
OR
CA
5
97

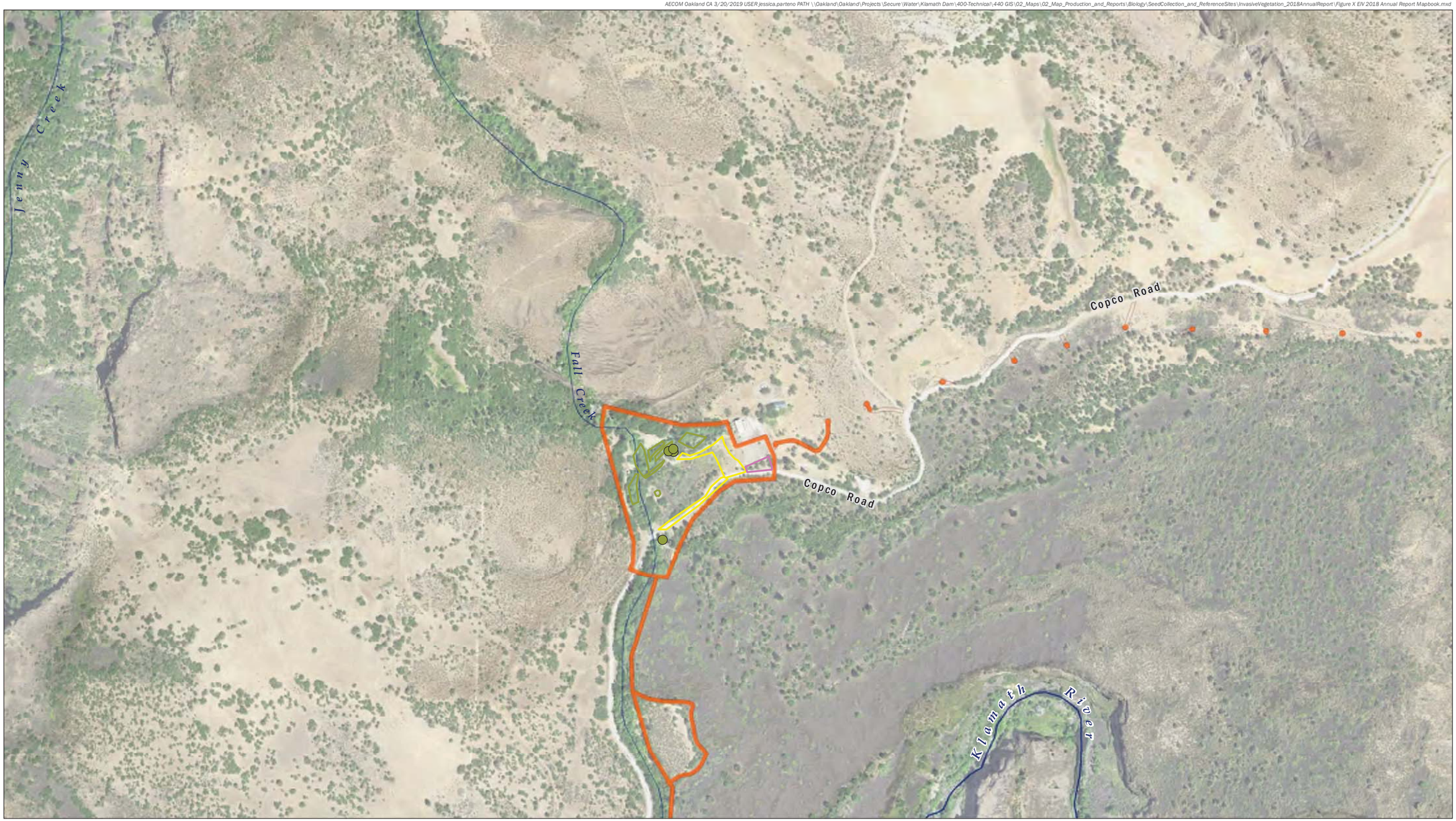
- Klamath River
- Streams
- Limits of Work

Species - Surveyed Point
- Bromus tectorum
- Convolvulus arvensis
- Dipsacus fullonum
- Phalaris arundinacea
- Rubus armeniacus
- Conium maculatum
- Lepidium draba

Species - Surveyed Polygon
- Centaurea solstitialis
- Dipsacus fullonum
- Elymus caput-medusae
- Phalaris arundinacea
- Rubus armeniacus
- Tribulus terrestris
- Conium maculatum

FIGURE 12-11
Invasive Exotic Vegetation Observations

AECOM Oakland CA 3/20/2019 USER.jessica.parteno PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\SeedCollection_and_ReferenceSites\InvasiveVegetation_2018AnnualReport\Figure X EIV 2018 Annual Report Mapbook.mxd



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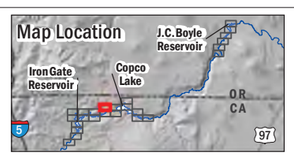
DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 3/20/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project



Klamath River
Streams
Limits of Work

Species - Surveyed Point
Rubus armeniacus

Species - Surveyed Polygon
Centaurea solstitialis
Elymus caput-medusae
Rubus armeniacus

FIGURE 12-12
Invasive Exotic Vegetation Observations

AECOM Oakland CA 3/20/2019 USER.jessica.parteno PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\SeedCollection_and_ReferenceSites\InvasiveVegetation_2018AnnualReport\Figure X EIV 2018 Annual Report Mapbook.mxd



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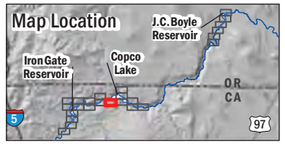
DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 3/20/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project



- Klamath River
- Streams
- Limits of Work

Species - Surveyed Point
- Bromus tectorum
- Dipsacus fullonum
- Elymus caput-medusae
- Phalaris arundinacea
- Rubus armeniacus
- Cirsium vulgare

Species - Surveyed Polygon
- Dipsacus fullonum
- Elymus caput-medusae
- Rubus armeniacus

FIGURE 12-13
Invasive Exotic Vegetation Observations

AECOM Oakland CA 3/20/2019 USER.jessica.parteno PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\SeedCollection_and_ReferenceSites\InvasiveVegetation_2018AnnualReport\Figure X EIV 2018 Annual Report Mapbook.mxd



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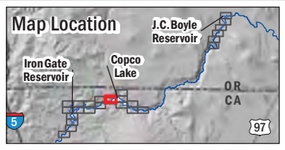
DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 3/20/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project



Klamath River
Streams
Limits of Work

Species - Surveyed Point
- Dipsacus fullonum
- Phalaris arundinacea
- Rubus armeniacus
- Cirsium vulgare

Species - Surveyed Polygon
- Bromus tectorum
- Centaurea solstitialis
- Dipsacus fullonum
- Rubus armeniacus

FIGURE 12-14

Invasive Exotic Vegetation Observations

AECOM Oakland CA 3/20/2019 USER jessica.parteno PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\SeedCollection_and_ReferenceSites\InvasiveVegetation_2018AnnualReport\Figure X EIV 2018 Annual Report Mapbook.mxd



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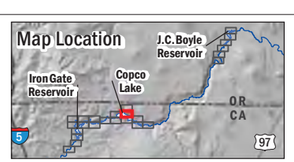
DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 3/20/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project

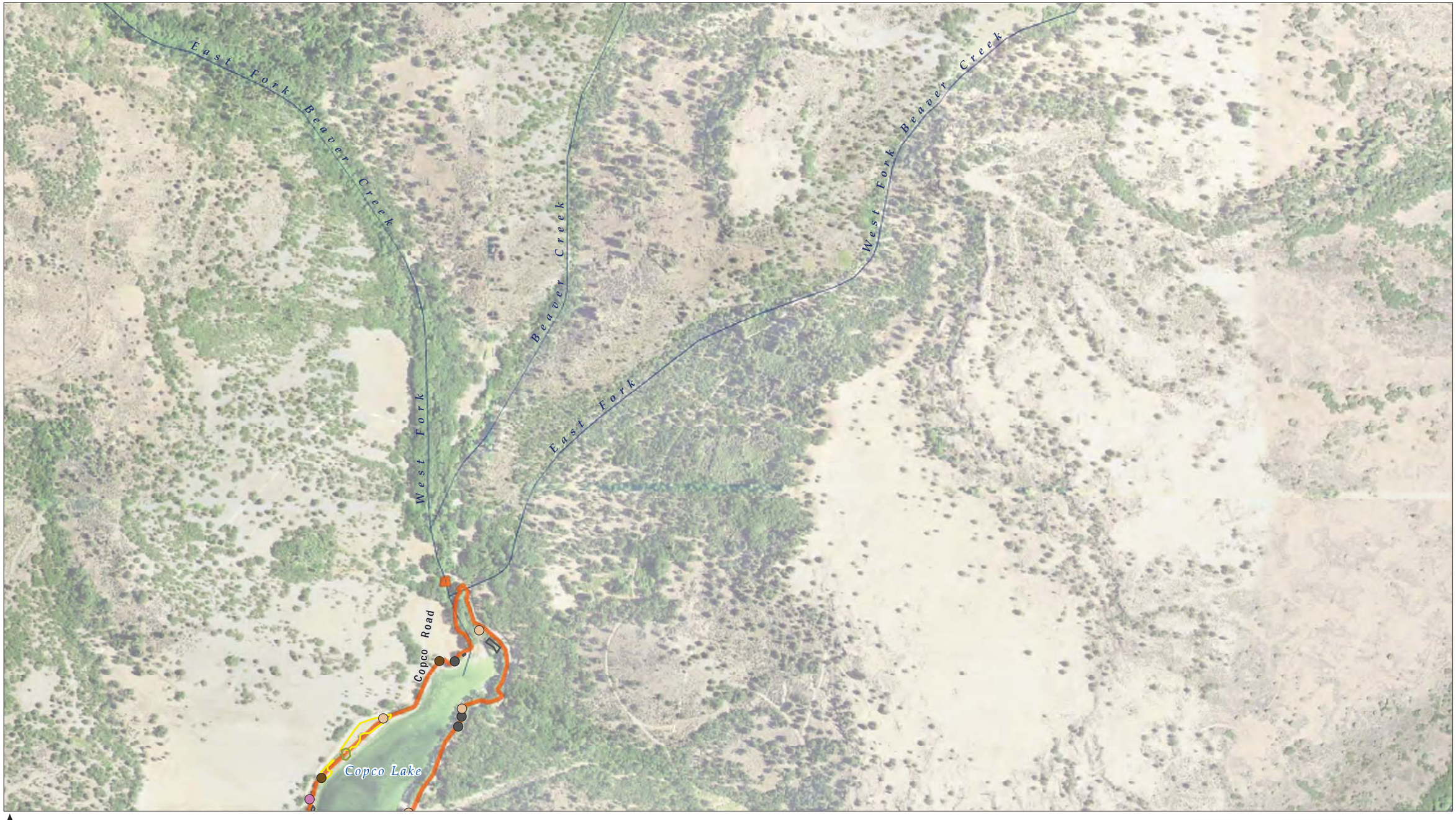


Klamath River
Streams
Limits of Work

Species - Surveyed Point
- Bromus tectorum
- Centaurea solstitialis
- Dipsacus fullonum
- Elymus caput-medusae
- Phalaris arundinacea
- Rubus armeniacus
- Lepidium draba

Species - Surveyed Polygon
- Bromus tectorum
- Centaurea solstitialis
- Dipsacus fullonum
- Elymus caput-medusae
- Phalaris arundinacea
- Rubus armeniacus
- Lepidium draba

FIGURE 12-15
Invasive Exotic Vegetation Observations



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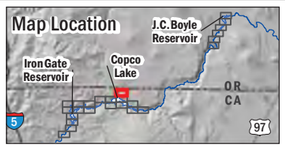
DATA SOURCE:
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 3/20/2019

PROJECTION:
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project



- Klamath River
- Streams
- Limits of Work

Species - Surveyed Point
- Dipsacus fullonum
- Elymus caput-medusae
- Phalaris arundinacea
- Lepidium draba

Species - Surveyed Polygon
- Centaurea solstitialis
- Dipsacus fullonum
- Rubus armeniacus
- Lepidium draba

FIGURE 12-16
Invasive Exotic Vegetation Observations

AECOM Oakland CA 3/20/2019 USER.jessica.parteno PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\SeedCollection_and_ReferenceSites\InvasiveVegetation_2018AnnualReport\Figure X EIV 2018 Annual Report Mapbook.mxd



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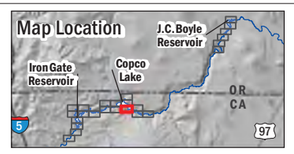
DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 3/20/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project



Klamath River
Streams
Limits of Work

Species - Surveyed Point
- Carduus nutans
- Bromus tectorum
- Centaurea solstitialis
- Dipsacus fullonum
- Elymus caput-medusae
- Phalaris arundinacea
- Rubus armeniacus
- Cirsium vulgare
- Lepidium draba

Species - Surveyed Polygon
- Bromus madritensis ssp. rubens
- Centaurea solstitialis
- Dipsacus fullonum
- Elymus caput-medusae
- Phalaris arundinacea
- Rubus armeniacus
- Lepidium draba

FIGURE 12-17
Invasive Exotic Vegetation Observations

AECOM Oakland CA 3/20/2019 USER.jessica.parteno PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\SeedCollection_and_ReferenceSites\InvasiveVegetation_2018AnnualReport\Figure X EIV 2018 Annual Report Mapbook.mxd



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DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 3/20/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project

Map Location
J.C. Boyle Reservoir
Iron Gate Reservoir
Copco Lake
OR
CA
5
97

Klamath River
Streams
Limits of Work

Species - Surveyed Point
Bromus madritensis ssp. rubens
Bromus tectorum
Centaurea solstitialis
Dipsacus fullonum
Elymus caput-medusae
Phalaris arundinacea
Rubus armeniacus
Conium maculatum

Species - Surveyed Polygon
Bromus madritensis ssp. rubens
Centaurea solstitialis
Dipsacus fullonum
Elymus caput-medusae
Phalaris arundinacea
Rubus armeniacus
Lepidium draba

FIGURE 12-18
Invasive Exotic Vegetation Observations

AECOM Oakland CA 3/20/2019 USER.jessica.parteno PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\SeedCollection_and_ReferenceSites\InvasiveVegetation_2018AnnualReport\Figure X EIV 2018 Annual Report Mapbook.mxd



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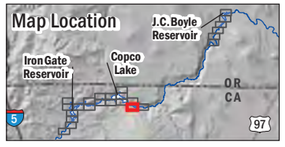
DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 3/20/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project

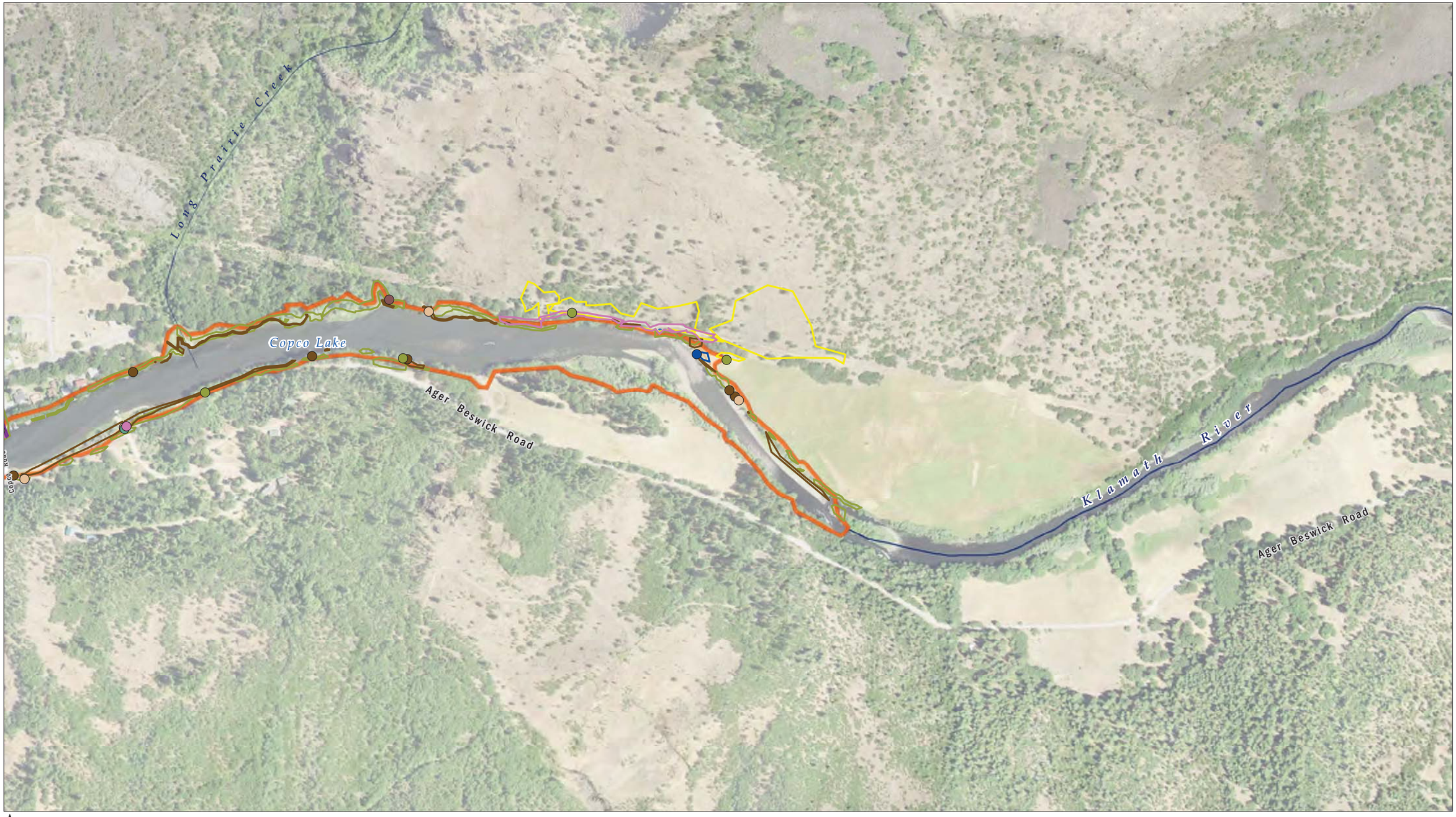


- Klamath River
- Streams
- Limits of Work

Species - Surveyed Point
- Centaurea solstitialis
- Dipsacus fullonum
- Elymus caput-medusae
- Phalaris arundinacea
- Rubus armeniacus
- Bromus diandrus
- Conium maculatum
- Marrubium vulgare

Species - Surveyed Polygon
- Centaurea solstitialis
- Dipsacus fullonum
- Elymus caput-medusae
- Phalaris arundinacea
- Rubus armeniacus
- Tribulus terrestris
- Conium maculatum

FIGURE 12-19
Invasive Exotic Vegetation Observations

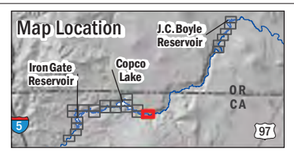


DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 3/20/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project



- Klamath River
- Streams
- Limits of Work

Species - Surveyed Point
- Carduus nutans
- Dipsacus fullonum
- Elymus caput-medusae
- Phalaris arundinacea
- Rubus armeniacus
- Bromus diandrus
- Cirsium vulgare
- Conium maculatum
- Marrubium vulgare

Species - Surveyed Polygon
- Centaurea solstitialis
- Dipsacus fullonum
- Elymus caput-medusae
- Phalaris arundinacea
- Rubus armeniacus
- Tribulus terrestris
- Aegilops cylindrica
- Cirsium vulgare

FIGURE 12-20
Invasive Exotic Vegetation Observations



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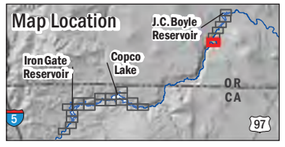
DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 3/20/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project



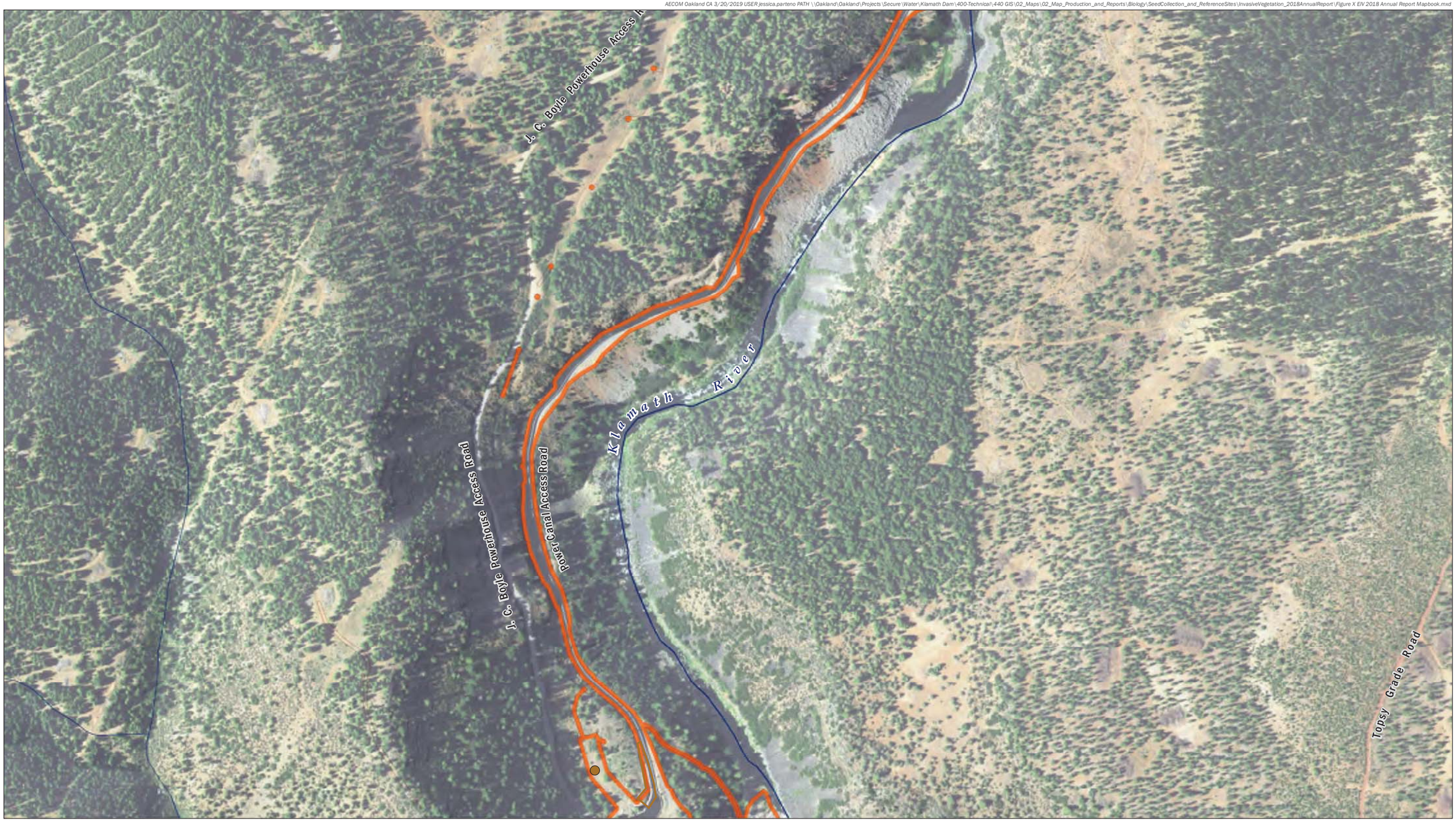
Klamath River
Streams
Limits of Work

Species - Surveyed Point
Centaurea solstitialis

Species - Surveyed Polygon
Bromus tectorum
Centaurea solstitialis
Elymus caput-medusae
Phalaris arundinacea

FIGURE 12-21
Invasive Exotic Vegetation Observations

AECOM Oakland CA 3/20/2019 USER.jessica.parteno PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\SeedCollection_and_ReferenceSites\InvasiveVegetation_2018AnnualReport\Figure X EIV 2018 Annual Report Mapbook.mxd



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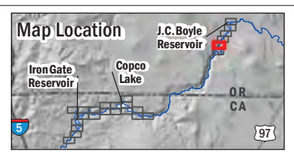
DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 3/20/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project



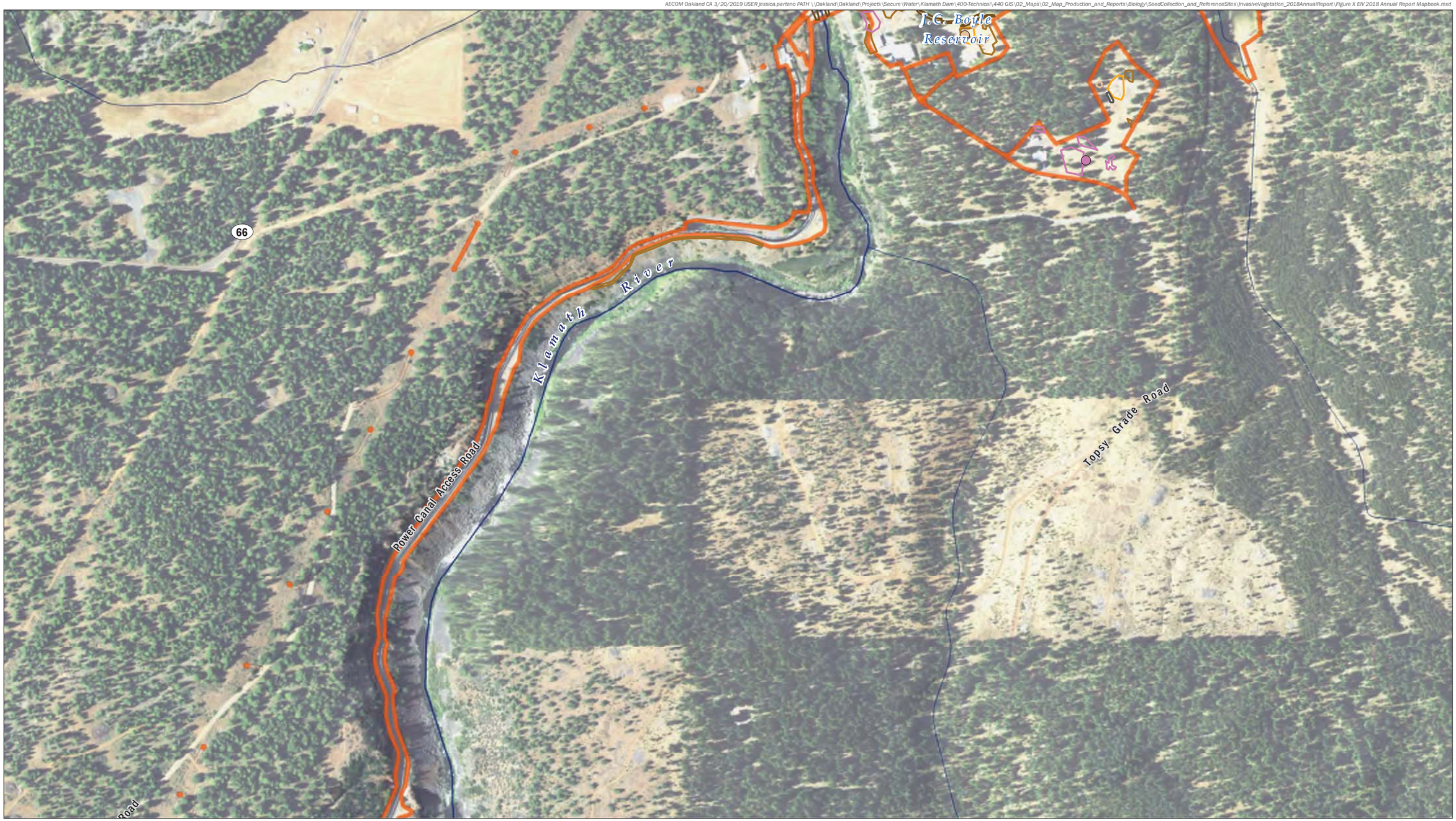
Klamath River
Streams
Limits of Work

Species - Surveyed Point
Bromus tectorum

Species - Surveyed Polygon
Bromus tectorum

FIGURE 12-22

Invasive Exotic Vegetation Observations



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DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 3/20/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project

Map Location
J.C. Boyle Reservoir
Iron Gate Reservoir
Copco Lake
OR
CA
5
97

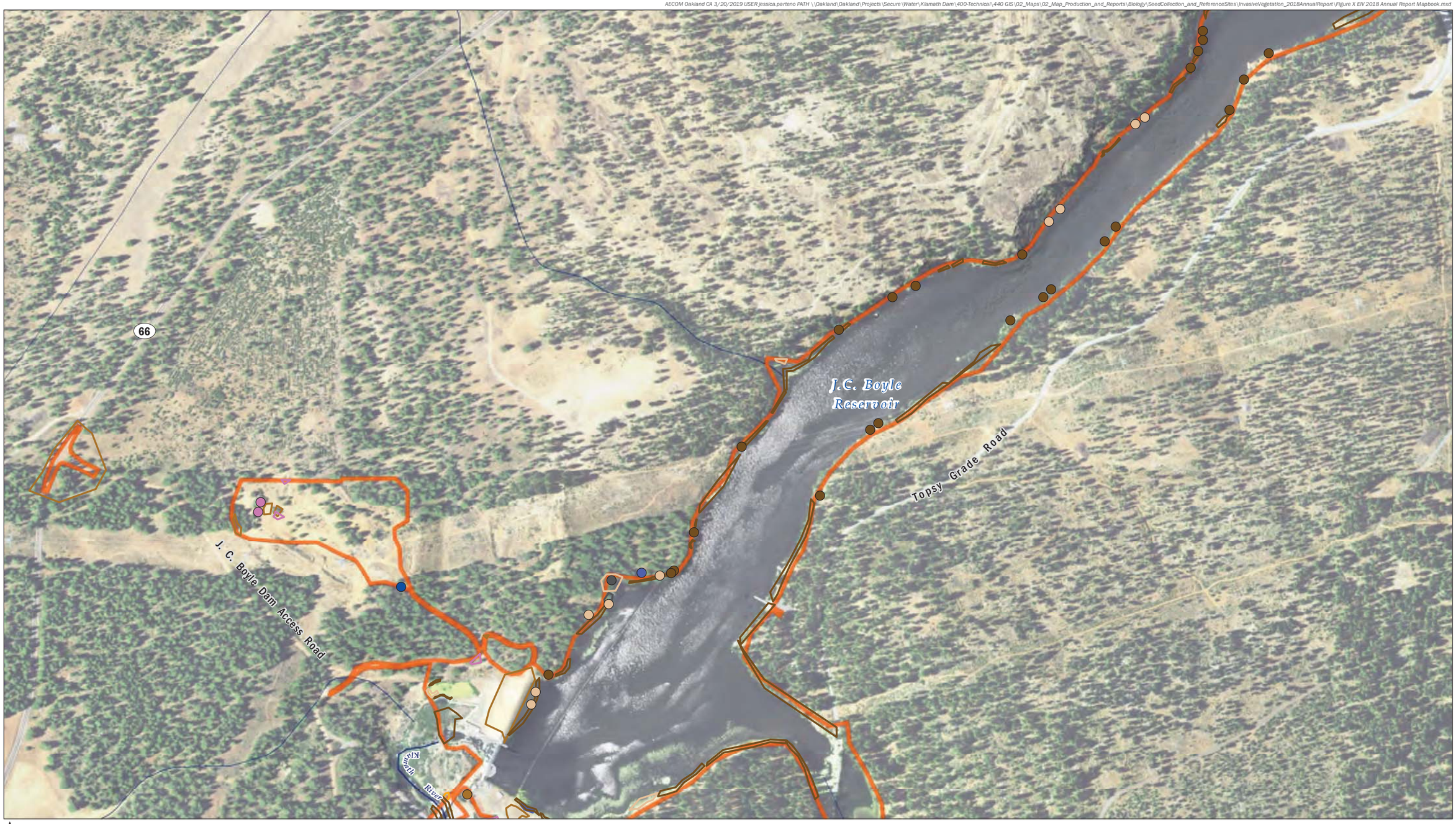
- Klamath River
- Streams
- Limits of Work

Species - Surveyed Point
- Dipsacus fullonum
- Elymus caput-medusae

Species - Surveyed Polygon
- Onopordum acanthium
- Bromus tectorum
- Convolvulus arvensis
- Dipsacus fullonum
- Elymus caput-medusae
- Phalaris arundinacea
- Lepidium draba

FIGURE 12-23
Invasive Exotic Vegetation Observations

AECOM Oakland CA 3/20/2019 USER.jessica.parteno PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\SeedCollection_and_ReferenceSites\InvasiveVegetation_2018AnnualReport\Figure X EIV 2018 Annual Report Mapbook.mxd



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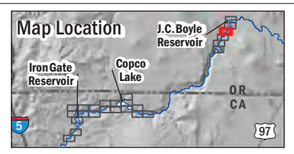
Feet

DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 3/20/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project



- Klamath River
- Streams
- Limits of Work

Species - Surveyed Point
- Bromus tectorum
- Convolvulus arvensis
- Dipsacus fullonum
- Elymus caput-medusae
- Phalaris arundinacea
- Cirsium vulgare
- Lepidium draba

Species - Surveyed Polygon
- Onopordum acanthium
- Bromus tectorum
- Convolvulus arvensis
- Dipsacus fullonum
- Elymus caput-medusae
- Phalaris arundinacea
- Lepidium draba

FIGURE 12-24
Invasive Exotic Vegetation Observations

AECOM Oakland CA 3/20/2019 USER jessica.parteno PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\SeedCollection_and_ReferenceSites\InvasiveVegetation_2018AnnualReport\Figure X EIV 2018 Annual Report Mapbook.mxd



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DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 3/20/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project

Map Location
J.C. Boyle Reservoir
Iron Gate Reservoir
Copco Lake
OR
CA
5
97

- Klamath River
- Streams
- Limits of Work

Species - Surveyed Point
- Bromus tectorum
- Dipsacus fullonum
- Phalaris arundinacea
- Cirsium vulgare
- Lepidium draba

Species - Surveyed Polygon
- Bromus tectorum
- Dipsacus fullonum
- Phalaris arundinacea
- Rubus armeniacus

FIGURE 12-25
Invasive Exotic Vegetation Observations

AECOM Oakland CA 3/20/2019 USER.jessica.parteno PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\SeedCollection_and_ReferenceSites\InvasiveVegetation_2018AnnualReport\Figure X EIV 2018 Annual Report Mapbook.mxd



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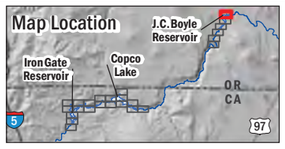
Feet

DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 3/20/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project



- Klamath River
- Streams
- Limits of Work

Species - Surveyed Point
- Dipsacus fullonum
- Elymus caput-medusae
- Phalaris arundinacea
- Cirsium vulgare
- Hypericum perforatum
- Lepidium draba

Species - Surveyed Polygon
- Dipsacus fullonum
- Elymus caput-medusae
- Phalaris arundinacea
- Cirsium vulgare
- Lepidium draba

FIGURE 12-26

Invasive Exotic Vegetation Observations

Appendix B Northern Spotted Owl Survey Data Sheets

Visit 1: April 24-25, 2018

Surveyor(s): Lidia D'Amico, AECOM; Jennifer Jones, CDM Smith

4/24/2018 Klamath Dam NSO Detection Surveys Weather: 68 F, partly cloudy, 0-5mph wind NE				
Station	Begin Time	End Time	NSO Detection	Notes
5	20:43	20:53	No	Canada Geese heard calling from reservoir
4	21:15	21:25	No	
7	21:40	21:50	No	
14	22:00	22:10	No	Bats heard
16	22:19	22:30	No	Heard frogs and bats
15	22:36	22:46	No	Bat species flyover
18	22:52	23:02	No	
17	23:10	23:20	No	Site adjacent to the Klamath River, ambient noise from river

4/25/2018 Klamath Dam NSO Detection Surveys Weather: 64 F, clear, 0-4 mph wind WNW				
Station	Begin Time	End Time	NSO Detection	Notes
8	20:35	20:45	No	Bat species flyover
12	21:00	21:10	No	Surveyed from edge of stand, walked into area approximately 260 feet from access road.
6	21:25	21:35	No	Site adjacent to off-site recreation area; bonfire pit.
10	21:40	21:50	No	Performed outside of Pacificorp Property; stood at edge of boundary. Saw raccoons
11	22:02	22:12	No	Great-horn owl detected
9	22:35	22:45	No	
13	22:55	23:05	No	

Note: Did not survey stations located on PacifiCorp property (Stations 1 and 3) due to lack of access agreement. Unable to access proposed Station 2 (west of dam); station is behind fence on private property.

NSO Survey Data Sheet

NSO Detection?	**Y**	**N**
BAOW Detection:	**Y**	**N**

Date: 5/29/2018 **Site Name:** J.C. Boyle Dam
Surveyor(s): Jennifer Jones, Kent Barnes **Visit #:** 2 **Outing #** 1
Weather *(circle one)*: Precipitation: *None* [*Trace*] *Drizzle* *Light* *Heavy* *Snow*
Cloud cover: *Clear* [*Partly/Cloudy*] *Overcast* *Fog*
Moon phase: [*Full*] *Half* *Quarter* *None*
Wind: [0] 1 2 3 4 5 Temp: 54 Rain In prior 24hrs: YES [NO]
Type of Survey: ACS [SC] CC FO RV AV OPP
ACS=*Activity Center Search*. SC=*Station calling*. CC=*Continuous Calling*. FO=*Follow Up Outing*. RV=*Reproductive Visit*. *AV=Additional Visit. OPP=Opportunistic Sitting*

Call Point	**Start Time**	**End Time**	**Results:** *spp., Sex, Direction from Surveyor, UTM's, waypoint name.*	Response
17	2107	2119	Chorus Frogs	NR
18	2128	2140	Quiet	NR
15	2150	2200		NR
16	2210	2221	Chorus Frogs	NR
14	2229	2241	Crickets	NR
7	2250	2303	Unidentified Raptor call	NR
11	2318	2334	Great Horned Owl very distant Coyote vocalizations toward reservoir	NR
10	2341	2358	Second group of coyote vocalizations off toward the East	NR
5	2410	2421		NR

NSO Survey Data Sheet

NSO Detection?	**Y**	**N**
BAOW Detection:	**Y**	**N**

Date: 5/30/2018 **Site Name:** J.C. Boyle Dam Site
Surveyor(s): Jennifer Jones, Kent Barnes **Visit #:** 2 **Outing #** 2
Weather *(circle one)*: Precipitation: *None* [*Trace*] *Drizzle* *Light* *Heavy* *Snow*
Cloud cover: *Clear* *Partly/Cloudy* [*Overcast*] *Fog*
Moon phase: [*Full*] *Half* *Quarter* *None*
Wind: 0 [1] 2 3 4 5 Temp: 55 Rain In prior 24hrs: [YES] NO
Type of Survey: ACS [SC] CC FO RV AV OPP
ACS=*Activity Center Search*. SC=*Station calling*. CC=*Continuous Calling*. FO=*Follow Up Outing*. RV=*Reproductive Visit*. *AV=Additional Visit. OPP=Opportunistic Sitting*

Call Point	Start Time	End Time	**Results:** *spp., Sex, Direction from Surveyor, UTM's, waypoint name.*	Response
12	2106	2127	Great horned owl call before survey started—Quiet during	NR
8	2133	2146		NR
6			Did not call teenagers having campfire at survey station	NR
1	2222	2236	Human noise from campground across reservoir	NR
4	2250	2302	Fighter jet noise from base in Kfalls,	NR
9	2312	2325		NR
13	2331	2341		NR
3	2352	2403		NR

NSO Survey Data Sheet

NSO Detection?	**Y**	**N**
BAOW Detection:	**Y**	**N**

Date: 6/11/2018 **Site Name: J. C. Boyle Dam**
Surveyor(s): Kent Barnes, Jennifer Jones **Visit #: 3** **Outing # 1**
Weather *(circle one)*: Precipitation: *None Trace Drizzle Light Heavy Snow*
Cloud cover: *Clear Partly/Cloudy Overcast Fog*
Moon phase: *Waning Crescent*
Wind: 0 1 2 3 4 5 Temp: 62 f Rain In prior 24hrs: YES NO
Type of Survey: ACS SC CC FO RV AV OPP
ACS=*Activity Center Search.* SC=*Station calling.* CC=*Continuous Calling.* FO=*Follow Up Outing.* RV=*Reproductive Visit.* AV=*Additional Visit.* OPP=*Opportunistic Sitting*

Call Point	Start Time	End Time	**Results:** *spp., Sex, Direction from Surveyor, UTM's, waypoint name.*	Response
17	2116	2128	River noise	NR
18	2138	2149	Crickets and River noise	NR
15	2201	2212		NR
19	2220	2232	This is new point added on this date. Chorus frogs below us by weir.	NR
13	2240	2250	Quiet	NR
9	2258	2309	Quiet	NR
4	2319	2329	Great horned owl very distant, from the north- no bearing taken	NR
3	2341	2351	Quiet	NR
1	2400	2412	Great horned owls calling still distant but closer than before, possible pair. No bearing taken	NR

NSO Survey Data Sheet

NSO Detection?	**Y**	**N**
BAOW Detection:	**Y**	**N**

Date: 6/12/2018 **Site Name:** J. C. Boyle Dam
Surveyor(s): Kent Barnes, Jennifer Jones **Visit #:** 3 **Outing #** 2
Weather *(circle one)*: Precipitation: *None* *Trace* *Drizzle* *Light* *Heavy* *Snow*
Cloud cover: *Clear* *Partly/Cloudy* *Overcast* *Fog*
Moon phase: *Waning Crescent*
Wind: 0 1 2 3 4 5 Temp: 60 f Rain In prior 24hrs: YES NO
Type of Survey: ACS SC CC FO RV AV OPP
ACS=*Activity Center Search.* SC=*Station calling.* CC=*Continuous Calling.* FO=*Follow Up Outing.* RV=*Reproductive Visit.* AV=*Additional Visit.* OPP=*Opportunistic Sitting*

Call Point	Start Time	End Time	**Results:** *spp., Sex, Direction from Surveyor, UTM's, waypoint name.*	Response
8	2115	2127	Nighthawks calling and diving prior to and throughout survey. Osprey call from cliffs over the Klamath River just after survey ended	NR
12	2142	2152	Quiet	NR
6	2205	2219	Quiet	NR
10	2227	2239	Unknown owl contact call (not *strix*) Possible great horned owl. Bearing 300°. Follow up survey should occur.	NR
11	2255	2306	Quiet	NR
7	2322	2333	River noise	NR
14	2342	2352	Crickets	NR
16	2402	2415	Chorus frogs	NR
5	2434	2446	Quiet	NR

NSO Survey Data Sheet

NSO Detection?	**Y**	**N**
BAOW Detection:	**Y**	**N**

Date: 6/13/2018 **Site Name: J. C. Boyle Dam**

Surveyor(s): Kent Barnes, Jennifer Jones **Visit #: 3** **Outing # 2**

Weather *(circle one)*: Precipitation: *None* *Trace* *Drizzle* *Light* *Heavy* *Snow*

Cloud cover: *Clear* *Partly/Cloudy* *Overcast* *Fog*

Moon phase: *New*

Wind: 0 1 2 3 4 5 Temp:_____ Rain In prior 24hrs: YES NO

Type of Survey: ACS SC CC FO RV AV OPP

ACS=*Activity Center Search*. SC=*Station calling*. CC=*Continuous Calling*. FO=*Follow Up Outing*. RV=*Reproductive Visit*. AV=*Additional Visit*. OPP=*Opportunistic Sitting*

Call Point	**Start Time**	**End Time**	**Results:** *spp., Sex, Direction from Surveyor, UTM's, waypoint name.*	**Response**
10	1015	1115	Research indicated that our detection the evening before most likely had been a female great horned owl protecting a nest. This follow up survey was conducted to search for this nest. We proceeded from call station 10 and headed Northwest in the general direction of the owl call from the previous night. We used NSO electronic calls in an attempt to solicit a response. We called with 2-3 minute duration approximately every 10 minutes. While conducting our stand search we found no structure, whitewash, feathers, or pellets indicative of nesting owls. While returning to our vehicles Jennifer visually located a fledgling great horned owl. Downy feathers were still visible but the fledgling appeared to have flight capabilities.	

NSO Survey Data Sheet

NSO Detection?	**Y**	**N**
BAOW Detection:	**Y**	**N**

Date: 7/13/18 **Site Name:** J. C. Boyle Dam

Surveyor(s): Mathew Petty, Kent Barnes **Visit #:** 4 **Outing #** 1

Weather *(circle one)*: Precipitation: *None* *T race* *Drizzle* *Light* *Heavy* *Snow*

Cloud cover: *Clear* *Partly/Cloudy* *Overcast* *Fog* Thunder Storms in Area

Moon phase: *Full* *Half* *Quarter* *None* New Moon

Wind: 0 2 3 4 5 Temp: 82 f Rain In prior 24hrs: YES NO

Type of Survey: ACS SC CC FO RV AV OPP

ACS=*Activity Center Search.* SC=*Station calling.* CC=*Continuous Calling.* FO=*Follow Up Outing.* RV=*Reproductive Visit. AV=Additional Visit. OPP=Opportunistic Sitting*

Call Point	Start Time	End Time	**Results:** *spp., Sex, Direction from Surveyor, UTM's, waypoint name.*	Response
10	2050	2102	Mourning doves in trees above station, great horned owl call	NR
6	2115	2128	Multiple bats	NR
12	2146	2156	Car noise on access road- no visual	NR
8	2215	2225	Osprey call very agitated by NSO calls, possible nest	NR
11	2243	2253		NR
5	2317	2329	Audible bat wing beats, truck noise	NR
3	2343	2354	Quiet	NR
1	2412	2423	Deer near call station, at least gave alarm call (snort)	NR
4	2444	2454	Quiet	NR

NSO Survey Data Sheet

NSO Detection? Y [N]
BAOW Detection: Y [N]

Date: 7/14/18 **Site Name:** J. C. Boyle Dam
Surveyor(s): Mathew Petty, Kent Barnes **Visit #:** 4 **Outing #** 2
Weather *(circle one)*: Precipitation: [*None*] *T race Drizzle Light Heavy Snow*
Cloud cover: *Clear* [*Partly/Cloudy*] *Overcast Fog*
Moon phase: *Full Half Quarter None* Waxing Crescent
Wind: [0 1 2] 3 4 5 Temp: 82 f Rain In prior 24hrs: YES [NO]
Type of Survey: ACS [SC] CC FO RV AV OPP
ACS=Activity Center Search. SC=Station calling. CC=Continuous Calling. FO=Follow Up Outing. RV=Reproductive Visit. AV=Additional Visit. OPP=Opportunistic Sitting

Call Point	Start Time	End Time	**Results:** *spp., Sex, Direction from Surveyor, UTM's, waypoint name.*	Response
17	2058	2110	Bats observed, river noise	NR
18	2122	2134	Quiet	NR
15	2146	2158	Quiet	NR
19	2212	2224	Matt heard movement in canopy, source unidentified	NR
13	2235	2247	Wood rat in bushes (visual)	NR
9	2254	2307	Motorcycles on Route 66, unidentified chirp after end of NSO calling (once)	NR
16	2316	2328	River noise	NR
14	2336	2347	Crickets	NR
17	2404	2415	Bull Frogs	NR

NSO Survey Data Sheet

NSO Detection? Y [N]
BAOW Detection: Y [N]

Date: 7/21/18 **Site Name:** J. C. Boyle Dam
Surveyor(s): Mathew Petty, Kent Barnes **Visit #:** 4 **Outing #** 2
Weather *(circle one)*: Precipitation: [*None*] *T race Drizzle Light Heavy Snow*
Cloud cover: *Clear Partly/Cloudy Overcast Fog* [Hazy Smoke]
Moon phase: *Full Half Quarter None* Saxing gibbous
Wind: [0 1] 2 3 4 5 Temp: 75 f Rain In prior 24hrs: YES [NO]
Type of Survey: ACS [SC] CC FO RV AV OPP
ACS=Activity Center Search. SC=Station calling. CC=Continuous Calling. FO=*Follow Up Outing.* RV=*Reproductive Visit. AV=Additional Visit. OPP=Opportunistic Sitting*

Call Point	Start Time	End Time	**Results:** *spp., Sex, Direction from Surveyor, UTM's, waypoint name.*	Response
17	2108	2119	One bat observation	NR
18	2127	2138	Quiet, night hawk call as finishing NSO calls	NR
15	2154	2206	Quiet	NR
19	2212	2223	Cricket Noise	NR
13	2229	2240	Electrical noise in overhead power lines	NR
9	2248	2259	Quiet	NR
4	2308	2319	Car stopped on Route 66, no visual	NR
3	2330	2340	Quiet	NR
1	2348	2358	Quiet	NR

NSO Survey Data Sheet

NSO Detection? Y [N]
BAOW Detection: Y [N]

Date: 7-22-18 **Site Name:** J. C. Boyle Dam
Surveyor(s): Jennifer Jones, Kent Barnes **Visit #:** 5 **Outing #** 2
Weather *(circle one)*: Precipitation: [*None*] *T race* *Drizzle* *Light* *Heavy* *Snow*
Cloud cover: *Clear* *Partly/Cloudy* [*Overcast*] *Fog* Thunder Storms in Area
Moon phase: *Full* *Half* *Quarter* *None* Waxing Gubbous
Wind: 0 [1 2] 3 4 5 Temp:_____ Rain In prior 24hrs: YES [NO]
Type of Survey: ACS [SC] CC FO RV AV OPP
ACS=Activity Center Search. SC=Station calling. CC=Continuous Calling. FO=Follow Up Outing. RV=Reproductive Visit. AV=Additional Visit. OPP=Opportunistic Sitting

Call Point	Start Time	End Time	**Results:** *spp., Sex, Direction from Surveyor, UTM's, waypoint name.*	Response
16	2101	2112	Bats observed, crickets	NR
14	2122	2133	Bats observed (one larger than others- big brown bat?)	NR
7	2145	2157	Quiet	NR
10	2208	2218	Quiet (No GHOW response)	NR
8	2235	2247	Osprey called back- less agitated than previous encounter at this location	NR
12	2304	2314	Quiet	NR
6	2330	2341	Quiet	NR
11	2354	2405	Quiet	NR
5	2421	2435	Coyotes, Bull Frogs, Unknown avian call- not strix	NR

NSO Survey Data Sheet

NSO Detection? Y [N]
BAOW Detection: Y [N]

Date: 8/8/2018 **Site Name:** J. C. Boyle Dam
Surveyor(s): Jennifer Jones, Kent Barnes **Visit #:** 6 **Outing #** 1
Weather *(circle one)*: Precipitation: [*None*] *T race* *Drizzle* *Light* *Heavy* *Snow*
Cloud cover: *Clear* *Partly/Cloudy* [*Overcast*] *Fog* Smokey conditions- low visibility
Moon phase: *Full* *Half* *Quarter* [*None*] Wanning Crescent
Wind: 0 [1 2] 3 4 5 Temp: 77 Rain In prior 24hrs: YES [NO]
Type of Survey: ACS [SC] CC FO RV AV OPP

ACS=Activity Center Search. SC=Station calling. CC=Continuous Calling. FO=*Follow Up Outing.* RV=*Reproductive Visit. AV=Additional Visit. OPP=Opportunistic Sitting*

Call Point	Start Time	End Time	**Results:** *spp., Sex, Direction from Surveyor, UTM's, waypoint name.*	Response
5	2026	2038	Cattle lowing, nighthawks overhead, motorcycles on road, mule deer at call station, unknown raptor call.	NR
			While in-route from station 5 to station 7, we made visual encounter of owl flying across the road. We stopped and used NSO call to try and solicit a response, I heard one call from GHOW very distant, this was not confirmed by Jennifer. Call duration was about 5 minutes.	NR
7	2109	2120	Crickets, Quiet	NR
14	1933	1951	Batteries in the digital caller died mid-way through survey. Extended survey to compensate. Quiet.	NR
16	2200	2211	Very dark, smoke blocking stars, low visibility.	NR
15	2217	2228	River noise	NR
18	2237	2248	Quiet, river noise	NR
17	2258	2309	Quiet	NR
19	2319	2330	Crickets	NR
13	2337	2347	Powerline buzz	NR
9	2355	245	Quiet	NR

NSO Survey Data Sheet

NSO Detection? Y [N]
BAOW Detection: Y [N]

Date: 8/9/2018 **Site Name:** J. C. Boyle Dam
Surveyor(s): Jennifer Jones, Kent Barnes **Visit #:** 6 **Outing #** 2
Weather *(circle one)*: Precipitation: [*None*] *T race Drizzle Light Heavy Snow*
Cloud cover: *Clear Partly/Cloudy Overcast Fog* Smoky, low visibility
Moon phase: *Full Half Quarter* [*None*] Wanning gibbour
Wind: [0 1 2] 3 4 5 Temp: 85 Rain In prior 24hrs: YES [NO]
Type of Survey: ACS [SC] CC FO RV AV OPP
ACS=Activity Center Search. SC=Station calling. CC=Continuous Calling. FO=*Follow Up Outing.* RV=*Reproductive Visit. AV=Additional Visit. OPP=Opportunistic Sitting*

Call Point	Start Time	End Time	**Results:** *spp., Sex, Direction from Surveyor, UTM's, waypoint name.*	Response
4	2030	2041	Cattle lowing to north, vehicles on HWY 66, Robin Call	NR
3	2050	2101	Quiet, one visual-small boat	NR
1	2113	2126	Cattle lowing, motorcycles on HWY 66, single hoot non-strix possible GHOW	NR
	2143	2150	Turtle crews notified us of an incidental owl detection they made north of the Topsy campground, possible strix. We stopped and used the digital caller, with both NSO and BDOW calls, we heard no response.	NR
11	2201	2213	Cattle lowing, visual detection of GHOW, flew in and sat on branch approximately 20 meters from the call station. It made no calls.	NR
8	2235	2247	Quiet, Crickets	NR
12	2305	2316	Crickets	NR
6	2333	2345	Quiet	NR
10	2355	2404	Quiet	NR

Appendix C Western Pond Turtle Trapping Study Summary Data and Photographs

Summary of 2018 J.C. Boyle Western Pond Turtle Trapping Events

Date	Night	Site	# of traps	# of traps that caught turtles	# turtles captured	# transmitters applied
8/6	1	S	12	1	1	1
8/7	2	W	20	2	3	2
8/8	3	S	20	1	1	1
8/9	4	W	20	0	0	0
8/10	5	S	20	0	0	0
8/11	6	W	20	0	0	0
9/4	7	W, S, O	10	0	0	0
9/5	8	W, S, O	37*	2	5	4
9/6	9	W, S, O	42*	0	1**	0
	TOTALS		**201**	**4**	**11**	**8**

S – South
W – West
O – Other
*includes day and night trapping
**turtle caught by hand capture



Photo 1. Commercial opera-style crab trap used for turtle trapping



Photo 2. Side view of trap



Photo 3. Deployment of trap near fallen tree, South site



Photo 4. Deployment of trap near rock face, South site



Photo 5. Deployment of trap near fallen tree, West site



Photo 6. Western pond turtle (WPT), male, captured 8/7 at South site.



Photo 7. Weight measurement using spring scale



Photo 8. Radio transmitter and temperature logger attached to WPT.



Photo 9. WPT, female, caught 8/8 at West site.



Photo 10. Checking female WPT for eggs



Photo 11. Vertebral scutes of female WPT detaching from carapace, indicating unknown shell disease



Photo 12. WPT, male, caught 8/8 at West site.



Photo 13. Morphometric measurements using calipers



Photo 12. WPT, male, caught 8/8 at West site.



Photo 13. Shell height measurement



Photo 14. Plastron of male WPT showing growth rings (used to estimate age) and unique plastron pattern

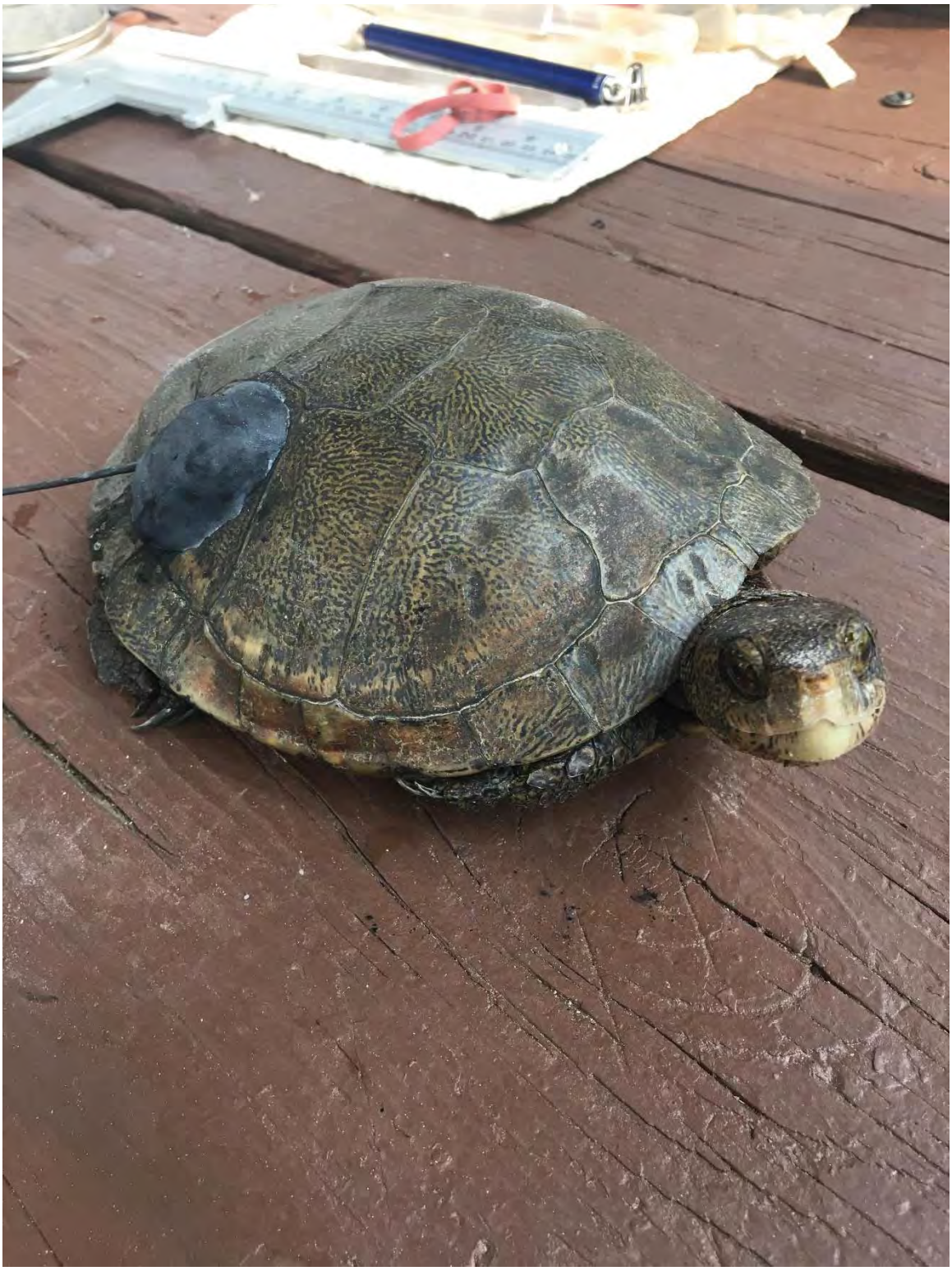


Photo 15. WPT, female, caught 8/9 at South site. With radio tracker and temperature logger attached.



Photo 16. Filing identification mark into marginal shields

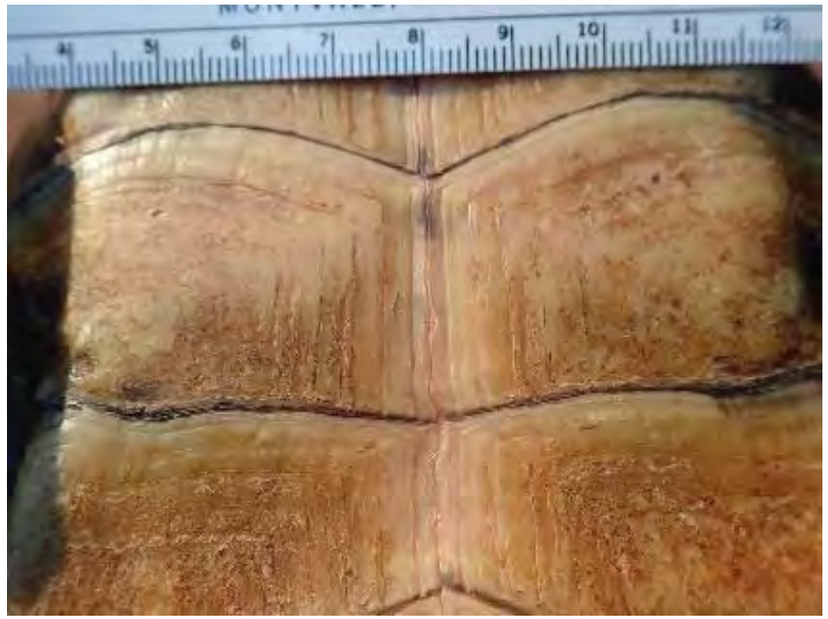


Photo 17. WPT with identification notches on marginal shields. Note notches at front and rear shields.











MARK	DATE	CapHist	SEX	AGE	AGE+	CL	cl	cw	PL	pl	pw	Ht	Wt
100	8/7/2018	1	M	>10	20+	163.0	159.5	117.7	149.4	143.5	82.9	53.4	552

100

Transmitter

Freq **151.790**



Photo 18. WPT morphology data









MARK	DATE	CapHist	SEX	AGE	AGE+	CL	cl	cw	PL	pl	pw	Ht	Wt
101	8/8/2018	1	F	13	20+	182.2	176.3	138.5	176.9	168.0	96.2	68.1	662



101

Peeling verbal shields,
No transmitter applied

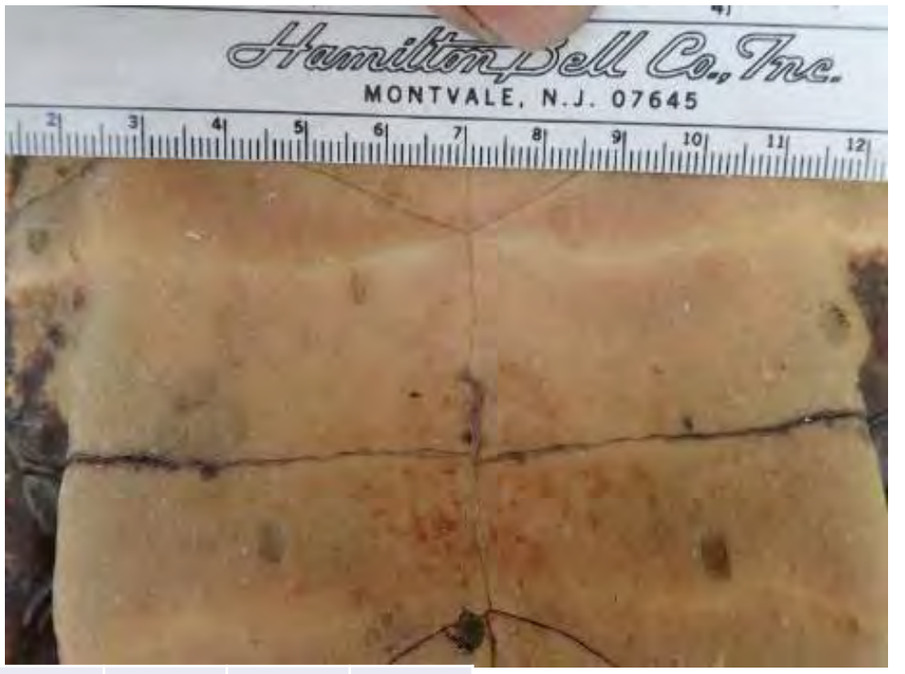


Photo 19. WPT morphology data











MARK	DATE	CapHist	SEX	AGE	AGE+	CL	cl	cw	PL	pl	pw	Ht	Wt
102	8/8/2018	1	M	99	99	187.7	186.1	140.1	166.1	159.5	97.3	64.8	905



102

- Transmitter
  Freq **151.701**

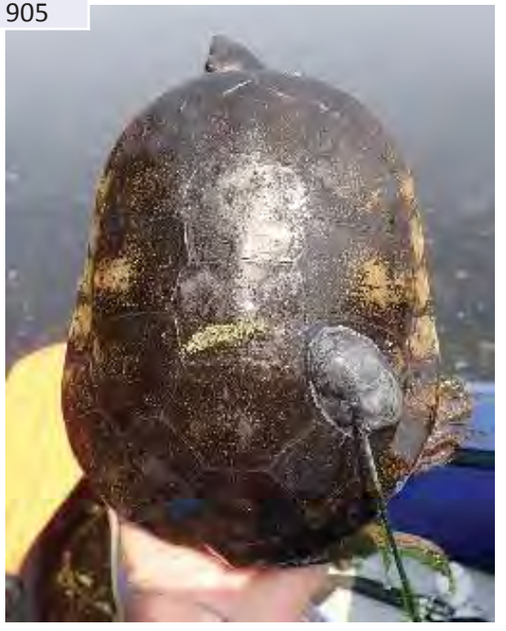


Photo 20. WPT morphology data









MARK	DATE	CapHist	SEX	AGE	AGE+	CL	cl	cw	PL	pl	pw	Ht	Wt
103	9/5/2018	1	F	3	4	121.3	117.0	97.3	112.2	110.2	63.4	44.0	258



103

- Juvenile
- No Transmitter



Photo 21. WPT morphology data









MARK	DATE	CapHist	SEX	AGE	AGE+	CL	cl	cw	PL	pl	pw	Ht	Wt
104	9/5/2018	1	M	99	99	180.9	175.1	131.8	165.0	153.5	89.6	60.0	782



104

- Transmitter

  Freq **151.750**



Photo 22. WPT morphology data









MARK	DATE	CapHist	SEX	AGE	AGE+	CL	cl	cw	PL	pl	pw	Ht	Wt
105	9/5/2018	1	F	20	20+	166.3	164.0	119.4	156.0	150.0	186.9	61.5	718



105

- Transmitter
  Freq **151.760**

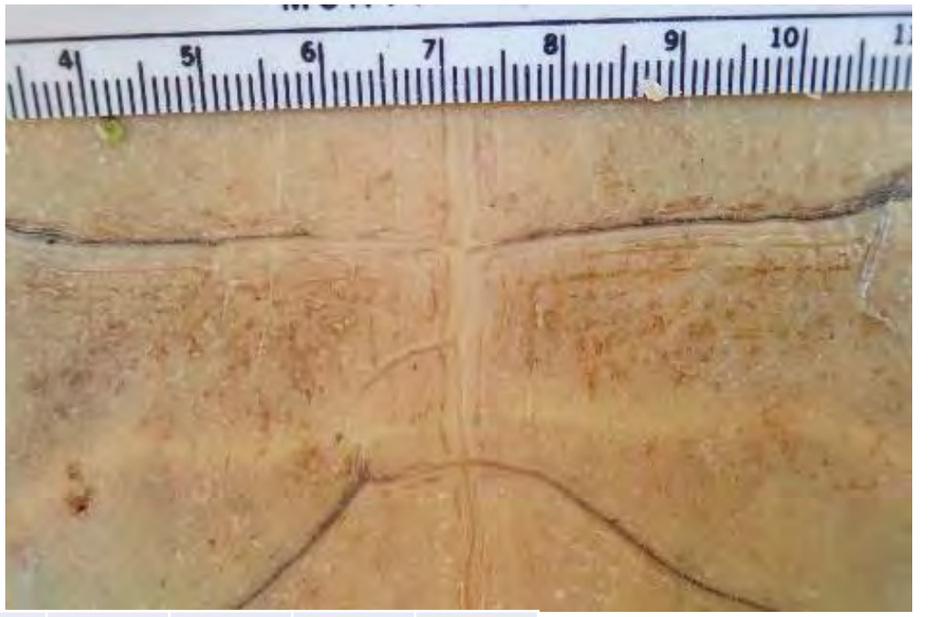


Photo 23. WPT morphology data









MARK	DATE	CapHist	SEX	AGE	AGE+	CL	cl	cw	PL	pl	pw	Ht	Wt
106	9/5/2018	1	F	20	20+	170.7	167.4	126.4	157.5	151.1	90.6	65.0	765



106

- Transmitter
  Freq **151.729**



Photo 24. WPT morphology data









MARK	DATE	CapHist	SEX	AGE	AGE+	CL	cl	cw	PL	pl	pw	Ht	Wt
107	9/5/2018	1	M	99	99	188.8	186.9	141.0	170.9	163.0	195.5	62.5	865



107

- Transmitter
  Freq **151.770**



Photo 25. WPT morphology data









MARK	DATE	CapHist	SEX	AGE	AGE+	CL	cl	cw	PL	pl	pw	Ht	Wt
108	9/6/2018	1	J	2	2	97.3	94.5	81.2	92.7	89.7	52.4	36.0	144







108

- No Transmitter



Photo 26. WPT morphology data









MARK	DATE	CapHist	SEX	AGE	AGE+	CL	cl	cw	PL	pl	pw	Ht	Wt
119	8/8/2018	1	M	9	10	163.0	160.1	123.6	151.8	148.2	87.7	54.3	600



119

- Transmitter
  Freq **151.919**



Photo 27. WPT morphology data









MARK	DATE	CapHist	SEX	AGE	AGE+	CL	cl	cw	PL	pl	pw	Ht	Wt
120	8/9/2018	1	F	99	99	178.8	176.4	143.0	171.7	164.2	100.5	71.5	975



120

- Transmitter
  Freq **151.820**



Photo 28. WPT morphology data

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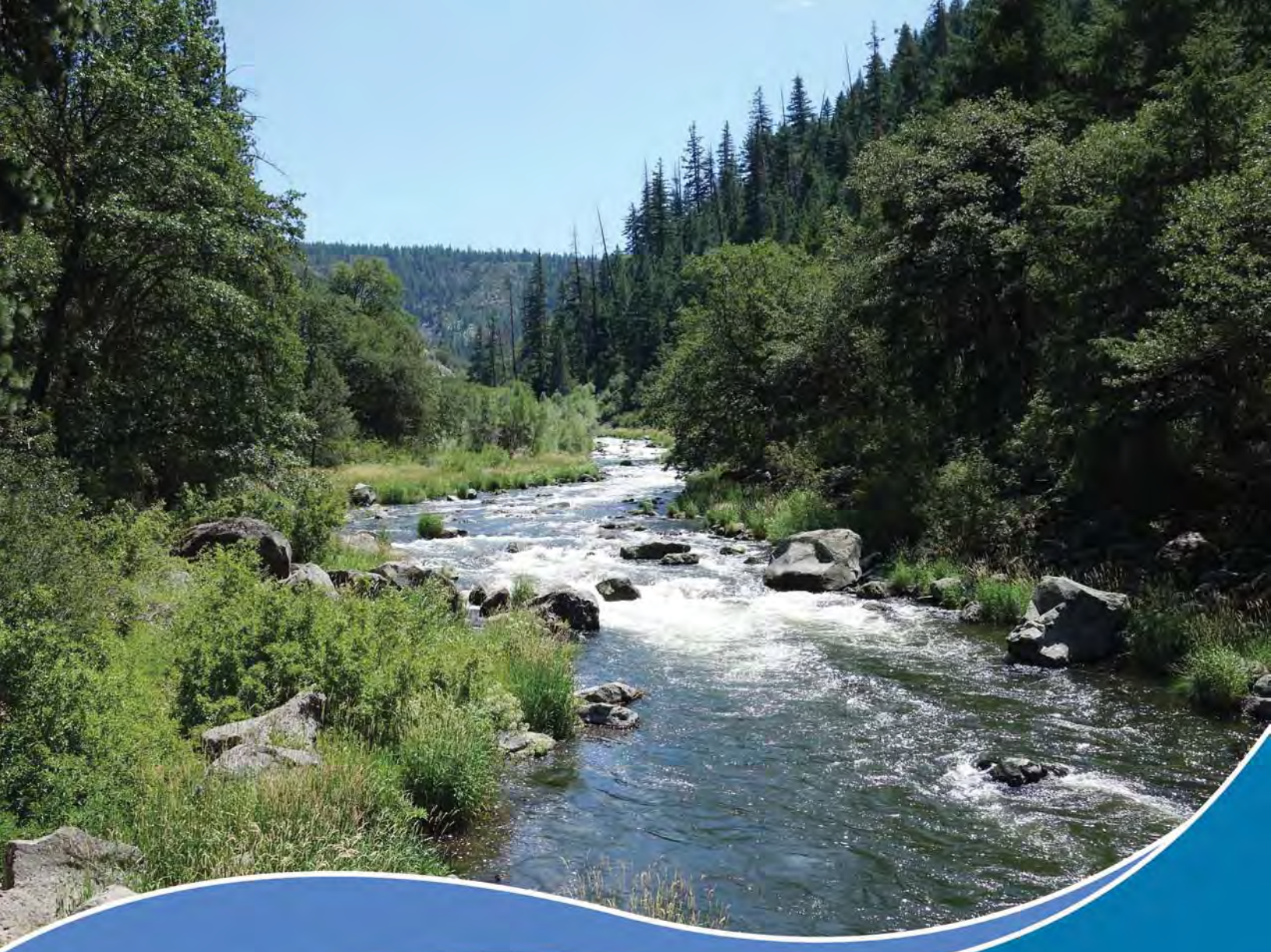

Klamath River Renewal Project

2019 Annual Terrestrial Resources Survey Report

March 2020

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RIVER RENEWAL
CORPORATION

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Acronyms and Abbreviations

BLM	Bureau of Land Management
CDFW	California Department of Fish and Wildlife
CE	California Endangered
CEQA	California Environmental Quality Act
CMR	capture-mark-recapture
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
COTO	*Corynorhinus townsendii* (Townsend's big-eared bat)
FE	Federal Endangered
FSC	Federal Species of Concern
GIS	Geographic Information System
GPS	Global Positioning System
IPaC	USFWS Information for Planning and Consultation Database
KRRC	Klamath River Renewal Corporation
MYYU	*Myotis yumanensis* (Yuma myotis)
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NRCS	Natural Resources Conservation Service
OC	Candidate listing by Oregon Department of Agriculture
ODFW	Oregon Department of Fish and Wildlife
ODSL	Oregon Department of State Lands
OHWM	ordinary high-water mark
ONHP	Oregon Natural Heritage Program
ORBIC	Oregon Biodiversity Information Center
ORWAP	Oregon Rapid Wetland Assessment Protocol
OSHA	Occupational Safety and Health Administration
Project	Klamath River Renewal Project
RCB	riparian corridor boundary
USACE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
WPT	western pond turtle

Chapter 1 Introduction

1. INTRODUCTION

This report summarizes the terrestrial resources surveys conducted in 2019 for the Klamath River Renewal Project (Project). The Klamath River Renewal Corporation (KRRC) and its consultants carried out field investigations to collect existing condition information on the following terrestrial resources:

- Bald and golden eagles
- Bats
- Western pond turtles (WPTs)
- Special-status plants
- Wetlands

KRRC initiated several of these surveys in 2018. This report provides a summary of both 2018 and 2019 findings for the resources listed above. KRRC completed surveys for other terrestrial resources in 2018, as described in the 2018 Annual Terrestrial Resource Survey Report (KRRC 2019a). Section 7 provides a correction to the willow community data previously reported in the 2018 Annual Terrestrial Resources Survey Report (KRRC 2019a).

1.1 Purpose of the Terrestrial Resources Surveys

Information on the existing condition of terrestrial resources in the Project area is needed to inform the ongoing Project design and regulatory permit processes. Early Project planning identified information gaps, as described in previous studies and regulatory compliance documents, including the 2012 Environmental Impact Statement/Environmental Impact Report (USBR and CDFW 2012) and the Joint Preliminary Biological Opinion (NMFS and USFWS 2012).

1.2 Study Area

For each resource listed above, this report describes the methods followed during field investigations. Methods were based on survey work plans developed in close coordination with federal and state resource agencies, including the United States Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife (CDFW), and Oregon Department of Fish and Wildlife (ODFW). The survey work plans are available in Appendix J of the Definite Plan (KRRC 2018).

Unless otherwise noted, surveys were conducted within 0.25 mile of dams and structures to be removed, disposal sites, and haul and access roads (collectively referred to as the study area). The 0.25-mile study area is shown in Figure 1-1 and was developed in cooperation with the resource agencies listed above during development of the survey work plans. Surveys for eagles and bats used different study areas, which are described in the respective sections of this report. This report summarizes the findings of the surveys. Figures cited in the text of this report are provided in Appendix A, and figures updated from the 2018 Annual

Terrestrial Resources Survey Report (KRRC 2019a) are provided in Appendix B. Appendix C provides a list of all plant and wildlife species observed during field investigations.

Chapter 2 Eagles

2. EAGLES

Bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) are protected under the Bald and Golden Eagle Protection Act (16 Code of Federal Regulations 668) and the Migratory Bird Treaty Act (16 United States Code §§ 701-12), and are fully protected under California law. Bald eagles are listed as endangered under the California Endangered Species Act, but do not have listing status in the State of Oregon. The upper Klamath Basin provides suitable habitat for and is known to support bald eagle and golden eagle populations. Existing information on bald and golden eagles in the Klamath Basin and results from the 2017-2018 eagle surveys can be found in the Klamath River Renewal Project 2018 Annual Terrestrial Resources Survey Report (KRRC 2019a).

2.1 Methods

KRRC developed the approach to the 2019 field surveys based on previous work, including a desktop review of historical and current nest data; a Geographic Information System (GIS) viewshed analysis conducted in 2017 and 2018 that helped define the study area; development of a survey plan in coordination with state and federal agencies; and results of previous eagle surveys (PacifiCorp 2004, KRRC 2018, KRRC 2019a).

2.1.1 Study Area

KRRC defined the study area by the viewshed analysis (KRRC 2019a) and the nature, timing, and location of proposed construction activities. The terms used to describe the study area are defined below.

- The limits of work are those defined in the Definite Plan for the Lower Klamath Project (KRRC 2018).
- High-impact areas include a 1-mile buffer surrounding the limits of work anticipated to have high-impact activities (excluding the extent of the reservoir where no work will occur). High-impact activities include proposed construction and demolition activities associated with the decommissioning of the dams and facilities, and creation of disposal sites.
- Low-impact areas include a 0.5-mile buffer surrounding the limits of work, as well as those access roads that are anticipated to have an increase in traffic and movement of heavy equipment.

The study area encompassed the extent of the viewshed in the high impact areas and low impact areas. The study area defined here is intended to represent the portion of habitat that may be affected by Project activities. In 2019, KRRC biologists surveyed beyond this defined area to account for potential future changes to the Project area and activities and to gain a general understanding of eagle use and occupancy surrounding the Project area.

2.1.2 Field Surveys

Qualified KRRC avian biologists conducted bald eagle and golden eagle surveys concurrently. The surveys focused on areas with suitable nesting, roosting, or foraging habitat for bald and golden eagles, as well as known nest locations. The goal of the surveys was to determine nest site locations in the study area and to determine baseline eagle use and other key habitat features. Additionally, by monitoring eagle behavior at nests prior to construction, it will be easier to identify changes in behavior that may occur during construction. Field surveys employed a variety of techniques and multiple temporal windows to capture seasonal activity. Biologists recorded all survey data digitally through Collector for ArcGIS, using iPads (Apple, Inc.) which preserve the location and time of the observation. Table 2-1 summarizes the 2019 survey date and type.

Table 2-1 Eagle Survey Types and Dates

Survey Type	Survey Date
Ground-based early breeding season survey	February 18 , 2019
Ground-based and helicopter mid-breeding season survey	May 21 through 23, 2019
Ground-based and helicopter late-breeding season survey	June 13 through 19, 2019

2019 Surveys

KRRC biologists used binoculars and spotting scopes when surveying for nest occupancy. Teams were able to view the entire study area using a combination of ground-based surveys on foot and in vehicles, and aerial surveys from a helicopter. In the field, biologists emphasized surveys on microhabitats that could support nesting eagles (e.g., rocky cliffs for golden eagles, large conifers for bald eagles). Biologists surveyed all nests that were historically active. Biologists recorded detailed data based on the guidelines and datasheets provided in the protocols (see field survey protocol in KRRC 2019a). The surveys included three breeding season surveys (February through June 2019), as follows:

1. To determine occupancy, biologists conducted an initial nest search early in the breeding season, from February 18 through 20, 2019, when eagles were most likely to be found near nest sites. The timing of this survey was informed by findings from the 2018 surveys. By estimating the age of chicks in May 2018, biologists were able to determine what winter survey timing would capture the most eagle activity at nests. In this survey, six biologists conducted ground-based observations from vehicles and on foot for 3 days, spending 1 day at each reservoir and corresponding dams. Biologists conducted this first inventory and monitoring survey during courtship, when the adults were mobile and conspicuous. Surveys included observing historical nests and recording all eagle detections in the study area. Biologists also documented courtship behavior and areas of high eagle activity to follow up on during the May and June 2019 surveys. For this early-breeding season survey, biologists extended the study area to include observations at all golden eagle nests within 10 miles of the limits of work, and bald eagle nests within 2 miles. Biologists established survey distances in coordination with wildlife agencies.

2. Biologists conducted a second survey from May 21 through 23, 2019, to observe eagle behavior and mid-season nesting activity, and to determine the number of active nests and nestlings in the study area. Biologists based the survey timing on the results of the 2018 surveys to observe nests when they contained nestlings and to avoid disturbing nests when they were most vulnerable. Three teams of two biologists conducted this survey. Two teams conducted ground-based surveys for 3 days, spending 1 day at each reservoir. The second team conducted aerial helicopter surveys for 2 days, covering all reservoirs; and a ground-based survey for 1 day. Biologists thoroughly surveyed locations where eagle pairs or territorial behavior were observed during previous surveys from the ground and during helicopter surveys. Additionally, biologists surveyed all historical and newly discovered nests from the helicopter and from the ground when accessible.

3. Biologists conducted a late breeding season survey from June 13 through 19, 2019, when the nestlings were near fledging age. One team of three biologists conducted ground-based surveys for 7 days at all reservoirs, and one team of two biologists conducted helicopter surveys for 1 day, covering all reservoirs.

2.2 Findings

2.2.1 Field Surveys

February 2019

Eagle Activity

Biologists observed approximately 117 eagles in the study area, of which 78 were bald eagles and 39 were golden eagles; however, many of these could have been resightings of the same individuals. Common bald eagle behavior observed included subadults and adults perching on trees and utility poles near and in sight of the reservoirs. Biologists observed several adult bald eagle pairs perched together, and exhibiting courtship behavior, acting territorial, vocalizing, performing undulating flight (breeding behavior), visiting nests, and nest-building. Biologists observed bald eagles soaring on thermals with other bald eagles and golden eagles, usually near the reservoirs but also over the Klamath River. Biologists also observed bald eagles foraging in the reservoirs. Biologists observed golden eagles perching on trees and cliffs that were not typically near the reservoirs. Biologists also observed golden eagles foraging on the ground, soaring on thermals with other eagles, flying in pairs, and performing undulating (breeding behavior) flight. Both species of eagles appeared to prefer certain perches and were observed using these same perches during different survey times and days.

At Iron Gate Reservoir and Copco Lake, biologists were able to discern areas of high eagle activity, which had the potential to include nest sites. Biologists observed thirteen potential bald and golden eagle territories surrounding Iron Gate Reservoir. In these areas, biologists observed high eagle activity, undulating flight, or pairs of adult eagles perching for long periods. Additionally, biologists identified five potential golden and

bald eagle territories around Copco Lake with high golden and bald eagle activity. Biologists thoroughly surveyed these areas during subsequent field surveys in May and June of 2019.

At J.C. Boyle Reservoir, there was significantly less eagle activity observed than at the other two sites, with only seven eagles observed. However, this may have been due to the lower visibility at J.C. Boyle, resulting from the high density of trees and limited road access surrounding the reservoir. Biologists noted three potential bald eagle territories where high eagle activity or courtship behavior was observed. Biologists thoroughly surveyed these areas during subsequent field surveys in May and June of 2019. Due to the presence of potential wintering and migratory birds in the area, it is difficult to determine how many of the observed birds represented resident birds. Table 2-2 presents the number, age, and species of eagles observed at each reservoir.

Table 2-2 Total Number of Eagle Observations by Site, Survey, Species, and Age

Iron Gate Reservoir[1]						
Survey Date	Golden Eagle Adults	Golden Eagle Subadults	Golden Eagle Young of the Year	Bald Eagle Adults	Bald Eagle Subadults	Bald Eagle Young of the Year
February 2019[2]	18	1	0	19	1	0
May 2019	2	0	0	12	6	2
June 2019	2	0	0	6	0	2
Total	**22**	**1**	**0**	**37**	**7**	**4**
Copco Lake[1]						
Survey Date	Golden Eagle Adults	Golden Eagle Subadults	Golden Eagle Young of the Year	Bald Eagle Adults	Bald Eagle Subadults	Bald Eagle Young of the Year
February 2019[2]	19	0	0	15	28	0
May 2019	17	0	3	13	10	3
June 2019	6	1	2	2	4	3
Total	**42**	**1**	**5**	**30**	**42**	**6**
J.C. Boyle Reservoir[1]						
Survey Date	Golden Eagle Adults	Golden Eagle Subadults	Golden Eagle Young of the Year	Bald Eagle Adults	Bald Eagle Subadults	Bald Eagle Young of the Year
February 2019[2]	0	1	0	13	2	0
May 2019	2	0	0	8	0	5
June 2019	0	0	0	3	0	7
Total	**2**	**1**	**0**	**24**	**2**	**12**

Notes:

[1] The number of eagles observed is influenced by the visibility at each site and should not be interpreted as relative abundance across sites. Visibility at J.C. Boyle Reservoir is poorer than at Copco and Iron Gate Reservoirs.
[2] The number of eagles detected during the winter survey period is likely to include wintering and migratory individuals.

Eagle Nests

Biologists were unable to access 26 historically active nests because of poor visibility, resulting from dense tree cover, limited access through private property, or poor road conditions. In the case of the 19 remaining nests where access was not limited, observers were able to survey the area and look for eagle activity. Biologists observed bald eagles visiting three historically active nests, and one new nest. Biologists also observed golden eagles visiting three historically active nests, and one new nest. Out of the 26 inaccessible historically active nests, biologists observed bald eagles in the vicinity of four bald eagle nests and golden eagles in the vicinity of five golden eagle nests. This suggested that the inaccessible nests could be active. The conditions of the accessible nests varied. Some nests appeared to be old and unused, while other nests appeared to have been recently active. Biologists also located several observation points that provided exceptional visibility, allowing survey of historically active areas for eagle activity and occupancy. Details of the nest observations are provided in the following paragraphs, and nest locations are shown on Figures 2-1 through 2-6. Historically active nests that were not observed in the 2017-2019 KRRC surveys are excluded from the figures. All nests that were active in 2019, active in 2018, or found to be inactive are depicted on the figures.

At Iron Gate Reservoir, biologists observed a bald eagle pair nest-building at one new bald eagle nest location that had not been historically documented (F19_BE1). No other nests at Iron Gate were accessible by car; however, biologists were able to observe adult bald and golden eagle pairs in the vicinity of each historically active nest (four golden eagle nests and one bald eagle nest: GE3-7, GE3-5, F_GE2, GE3-6, and F_BE1).

At Copco Lake, biologists observed a golden eagle pair perching near and landing in one new golden eagle nest location (F19_GE1) that had not been historically documented. Additionally, biologists observed nest building at one historically active golden eagle nest (GE3-3) within 0.5 mile of the limits of work. Biologists observed a golden eagle pair visiting an existing golden eagle nest (F_GE4) and a bald eagle pair visiting an existing bald eagle nest (BE1-43) outside of the 0.5-mile buffer, but within 0.5 mile of access roads between Copco and J.C. Boyle reservoirs. Several nests were not accessible from the ground (five golden eagle nests and four bald eagle nests); however, biologists observed an adult golden eagle in the vicinity of one historically active nest (GE3-8).

Biologists observed bald eagle adults visiting two existing bald eagle nests (BE1-31, BE1-32) at J.C. Boyle Reservoir. Additionally, biologists observed adult bald eagle activity in the vicinity of two other historically active bald eagle nests (BE1-34, BE1-35), but these nests were not accessible from the ground. Most existing nests at J.C. Boyle were inaccessible due to snowy and icy road conditions.

May 2019

Eagle Activity

Biologists observed several adult bald and golden eagles at all reservoirs, some subadults, and nestlings in active nests. Biologists observed an estimated 21 adult golden eagles, in addition to 3 nestlings described

below. Except for the nestlings, some of these observations may have been resightings of the same eagle. Golden eagle activity included perching near, flying around, and visiting active nests, often in pairs. Biologists also observed golden eagles foraging over land and flying over ridgelines and the reservoirs. Golden eagles exhibited territorial behavior toward bald eagles and other birds.



Photograph 2-1 Two Bald Eagle Nestlings at Nest F19_BE1

Biologists observed an estimated 33 bald eagle adults and 16 subadults, in addition to the 10 nestlings described below. Except for the nestlings, some of these may have been resightings of the same individual. Bald eagle activity included perching near, flying around, defending, and visiting active nests; and feeding chicks. Bald eagles exhibited territorial behavior toward other eagles and raptors and were observed perching and flying around the reservoirs. Bald eagles were also observed soaring on thermals, vocalizing, engaging in courtship behavior, foraging, and flying in pairs. Most bald eagle observations were close to the reservoirs; however, there were some observations near the Klamath River or over ridgelines. Table 2-2 presents the number, age, and species of eagles observed at each reservoir; nest locations are shown on Figures 2-1 through 2-6.

Eagle Nests

Biologists observed a total of seven active bald eagle nests, each with one or two nestlings present; and two golden eagle nests, each with one or two nestlings present. Biologists found one new active bald eagle nest within 0.5 mile of the limits of work (F19_BE5).

At Iron Gate Reservoir, biologists observed one active bald eagle nest (F19_BE1) immediately adjacent to Copco Road and the reservoir. There were two chicks about 6 to 8 weeks old in the nest, often with one or

both bald eagle adults perched nearby. Biologists observed one inactive bald eagle nest (F_BE1), which was also inactive in 2018, within 2 miles of the limits of work. Biologists observed two inactive golden eagle nests (GE3-6, F_GE2) within 2 miles of the limits of work, both of which were also inactive in 2018. Biologists observed one inactive golden eagle nest, which was also inactive in 2018, within 2 miles of the limits of work (GE3-7). Biologists were unable to locate the nest structure of one golden eagle nest that was active in 2018 (GE3-6), within 2 miles of the limits of work.

At Copco Lake, biologists observed two active bald eagle nests at Copco Lake. One of these nests (BE2-3) was within 0.5 mile of the limits of work and contained two nestlings about 8 weeks old, with an adult perched nearby. The other nest (BE1-43) was within 0.5 mile of an access road but more than 2 miles from the limits of work and contained one large chick about 9 weeks old, with an adult perching and flying nearby. The only active golden eagle nests for the 2019 surveys were at Copco Lake. Biologists observed one nest (F19_GE1) that was newly discovered in February 2019 and was within 0.5 mile of the limits of work; this nest contained two 1.5- to 2-week-old nestlings, with an adult perched and flying nearby. The other nest (F_GE3) was within 5 miles of the limits of work and contained one unattended nestling, about 4 to 5 weeks old. Biologists observed two inactive golden eagle nests at Copco Lake. Both nests (GE3-3, and F_GE4) were active in 2018, and biologists observed nest-building activity at these nests during the February 2019 surveys. Biologists observed three subadult bald eagles flying in the territory of nest GE3-3, with no golden eagles defending the nest territory, and therefore confirmed that this nest was inactive in 2019.

Biologists observed four active bald eagle nests around J.C. Boyle Reservoir, including one nest that had not been observed in previous surveys (F19_BE5). Three of these nests (F19_BE5, BE1-36, and BE1-32) were within 0.5 mile of the limits of work, and one of these nests (F_BE2) was within 5 miles of the limits of work. Nest F19_BE5 had a large nest structure in good condition, with 2 adults perched nearby, exhibiting territorial behavior. Based on the behavior of the adults, biologists assumed that this nest was active and that a chick was nearby; however, the nest was empty. Nests BE1-36 and BE1-32 both contained two nestlings approximately 8 weeks old. Nest F_BE2 contained one nestling approximately 9 weeks old. Biologists observed two inactive bald eagle nests. One of these nests (BE1-31) was within 0.5 mile of the limits of work; the other (BE1-15), which was active in 2018, was within 2 miles of the limits of work and within 0.5 mile of an access road. Biologists could not find the nest structure of one bald eagle nest that was inactive in 2018 (BE1-35). Biologists observed one inactive golden eagle nest (GE4-206), which had been active in 2018, within 2 miles of the limits of work.

June 2019

Eagle Activity

Biologists observed an estimated 11 adult bald eagles, four subadult bald eagles, and 12 nestlings. Except for the nestlings, some of these observations may have been resightings of the same eagle. Bald eagle adults were perching by reservoirs and in or near nests; foraging; feeding chicks; and flying over nests, reservoirs, and ridgelines. Subadult bald eagles were flying, perching by reservoirs, and foraging.

Biologists observed approximately eight adult golden eagles, one subadult golden eagle, and two nestlings during the June 2019 survey. Except for the nestlings, some of these observations may have been resightings of the same eagle. Biologists observed golden eagles flying over ridgelines and flying around, perching near, and visiting nests. Biologists also observed golden eagle adults flying in pairs and vocalizing near nests. Table 2-2 presents the number, age, and species of eagles observed at each reservoir.

Eagle Nests

Biologists observed ten active nests during the June 2019 survey: eight bald eagle nests, each with one or two nestlings present; and two golden eagle nests, each with one or two nestlings present. Biologists found one new active bald eagle nest (F19_BE7) containing two nestlings near the 0.5-mile buffer of the limits of work at J.C. Boyle Reservoir in proximity to a historical nest. Biologists found one new inactive bald eagle nest north of Iron Gate Reservoir, within 0.5 mile of the limits of work; one new inactive golden eagle nest that was in good condition, on a cliff face north of the Copco No. 2 Dam, within 0.5 mile of the limits of work (F19_GE2); and a cavity in a cliff face that could be suitable golden eagle nest habitat, at the northeastern edge of Copco Lake where it meets the Klamath River (F19_GE4).

At Iron Gate Reservoir, biologists observed one active bald eagle nest (F19_BE1) immediately adjacent to Copco Road at Iron Gate Reservoir, within 0.5 mile of the limits of work. This nest contained two large nestlings approximately 11 weeks old, and an adult was observed feeding these chicks. Biologists found one new inactive bald eagle nest, north of Iron Gate Reservoir within 0.5 mile of the limits of work (F19_BE6). Biologists observed one inactive golden eagle nest (GE3-7) within 2 miles of the limits of work, which was inactive in 2018. Additionally, three golden eagle nests (GE3-5, GE3-6, and F_GE2) observed to be active or inactive during 2018 surveys were not found during aerial surveys.

At Copco Lake, biologists observed two active bald eagle nests. Nest BE2-3 was within 0.5 mile of the limits of work and contained two large nestlings about 11 weeks old, with one adult perched nearby. Nest BE1-43 was within 0.5 mile of an access road, but more than 2 miles from the limits of work and contained one large nestling about 12 weeks old. Biologists observed two active golden eagle nests at Copco Lake. One of these nests (F19_GE1) was within 0.5 mile of the limits of work; the other (F_GE3) was within 5 miles of the limits of work. Due to the survey angle from the ground and the adult obscuring the view from the helicopter, biologists could only confirm one nestling in nest F19_GE1, which had two nestlings in May 2019. At nest F_GE3, biologists observed one chick approximately 7 weeks old in the cliff nest, and an adult visiting the nest. Biologists observed two inactive golden eagle nests at Copco Lake. One of these nests (F_GE4) was active in 2018, with breeding activity observed near nest F_GE4 during the February 2019 surveys, but was confirmed empty through both aerial surveys (May and June 2019). The second inactive golden eagle nest (GE3-3) was confirmed inactive during the May 2019 survey and was therefore not surveyed during the June 2019. Biologists found an empty cliff cavity that could be suitable golden eagle nest habitat (F19_GE4) and should be surveyed during future eagle surveys. This potential nest site is categorized as inactive on Figures 2-1 through 2-6, but is not included in Table 2-3.

Table 2-3 Active and Inactive Bald and Golden Eagle Nests Observed in 2019 Field Surveys

Nest Name	Golden Eagle		Bald Eagle	
Nest Status in 2019	Active	Inactive	Active	Inactive
Within 0.5 mile of Project footprint	1	2	5	2
Between 0.5 and 2 miles from Project footprint	0	4	1	2
Total Nests within 2 Miles	**1**	**6**	**6**	**4**
Outside of 2-mile buffer surrounding Project footprint, but within 0.5 mile of haul roads	0	0	2	1

At J.C. Boyle Reservoir, biologists observed five active bald eagle nests, one of which was a new nest (F19_BE7) observed during the June 2019 survey. Four of these nests (F19_BE5, BE1-36, BE1-32, and F19_BE7) were within 0.5 mile of the limits of work, and one of these nests (F_BE2) was within 5 miles of the limits of work. At nest F19_BE5, biologists were able to confirm one nestling in the nest, about 8 to 9 weeks old. This nest appeared empty in the May 2019 survey. Nest BE1-36 had one chick about 10 weeks old and one adult perched nearby. This nest contained two nestlings in May 2019. Nest F_BE2 contained one chick about 11 weeks old. Nests BE1-32 and F19_BE7 each contained two chicks approximately 10 to 11 weeks old. Biologists observed two inactive bald eagle nests. One of these nests (BE1-31) was within 0.5 mile of the limits of work; the other (BE1-15), which was active in 2018, was within 0.5 mile of an access road. One bald eagle nest found inactive in 2018 was not found in 2019 (BE1-35). One golden eagle nest (GE4-206) which had been active in 2018 was inactive in 2019, within 1 mile of the limits of work. Biologists searched the surrounding trees for alternate nests for GE4-206, because this nest is in a dead tree and is therefore less suitable for nesting; the search was unsuccessful.

2.3 Conclusions

Biologists observed a total of ten active nests at Copco, Iron Gate, and J.C. Boyle Reservoirs in 2019. Two are golden eagle nests and eight are bald eagle nests. Nine of these nests are within 2 miles of the limits of work or within 0.5 mile of haul roads (Table 2-3).

Additionally, biologists observed eleven inactive nests within 2 miles of the limits of work or within 0.5 mile of haul roads. Five of these are presumed bald eagle nests and six are presumed golden eagle nests, based on historical use data and 2018 surveys. Biologists also observed one potential golden eagle nest site within 0.5 mile of the limits of work. It is not uncommon for eagles to suspend breeding in some years or use alternative nest sites (USFWS 2004); therefore, these inactive nests will continue to be surveyed in the future.

The 2019 survey results showed a higher number of successful bald eagle nests than golden eagle nests in the study area (Table 2-4). However, in 2018, there were more successful golden eagle nests than bald eagle nests in the study area. Several nests that were active in 2018 were not active in 2019, demonstrating that eagles could be suspending breeding in some years in the study area. There are more bald eagle nests surrounding J.C. Boyle Reservoir than there are surrounding Copco and Iron Gate Reservoirs, and there are more golden eagle nests surrounding Copco and Iron Gate Reservoirs than surrounding J.C. Boyle Reservoir. Trends in eagle activity cannot be compared across reservoirs due to different levels of visibility and access.

Table 2-4 Summary of Active and Inactive Eagle Nests from 2017 through 2019 Surveys

Species	Nest Name	Nest Status	Number of Nestlings in 2018 or 2019
Bald Eagle	BE1-15	Active in 2018	1
Bald Eagle	BE1-31	Inactive	0
Bald Eagle	BE1-32	Active in 2019	2
Bald Eagle	BE1-35	Inactive	0
Bald Eagle	BE1-36[1]	Active in 2019	2
Bald Eagle	BE1-43	Active in 2019	1
Bald Eagle	BE2-3	Active in 2019	2
Bald Eagle	F_BE1	Inactive	0
Bald Eagle	F_BE2	Active in 2019	1
Bald Eagle	F19_BE1	Active in 2019	2
Bald Eagle	F19_BE5	Active in 2019	1
Bald Eagle	F19_BE6	Inactive	0
Bald Eagle	F19_BE7	Active in 2019	2
Golden Eagle	F_GE2	Inactive	0
Golden Eagle	F_GE3	Active in 2019	1
Golden Eagle	F_GE4	Active in 2018	2
Golden Eagle	F19_GE1[1]	Active in 2019	2
Golden Eagle	F19_GE2	Inactive	0
Golden Eagle	GE3-3	Active in 2018	1
Golden Eagle	GE3-5	Active in 2018	2
Golden Eagle	GE3-6	Inactive	0
Golden Eagle	GE3-7	Inactive	0
Golden Eagle	GE4-206	Active in 2018	1
Golden Eagle	F19_GE4	Potential Future Nest Site	0

Notes:
BE = Bald eagle nest
GE = Golden eagle nest
F19_GE = New golden eagle nest found during the 2019 surveys, not included in historically active data or the 2017-2018 surveys
F19_BE = New bald eagle nest found during the 2019 surveys, not included in historically active data or the 2017-2018 surveys
[1] For some nests, the number of nestlings decreased by one from May to June 2019. This table reflects the highest number of nestlings observed at each nest.

Chapter 3 Bats

3. BATS

In 2019, KRRC biologists conducted targeted surveys at structures where either 1) additional data were sought to supplement previous summer surveys (2017-2018) for bats; or 2) evidence of bat use had been found during previous inspections, but summer roosting had not been confirmed. The 2017-2018 survey methods and results are described in the 2018 Annual Terrestrial Resources Survey Report (KRRC 2019a).

3.1 Methods

A team of four KRRC biologists conducted evening emergence and acoustic surveys for bats from June 12 through 15, 2019, at structures at J.C. Boyle, Iron Gate, and Copco. KRRC biologists targeted the following structures where additional data were sought to supplement previous summer surveys (2017-2018); or where evidence of bat use had been found during previous inspections, but summer roosting had not been confirmed:

- J.C. Boyle red barn
- Iron Gate diversion tunnel outlet
- Iron Gate powerhouse
- Lakeview Road bridge (at Iron Gate entrance)
- Maintenance Building on Copco Access Road
- Copco No. 1 gatehouse C-12
- Copco No. 1 diversion tunnel outlet

KRRC biologists used night vision during all emergence surveys and documented points of egress. During all emergence surveys, KRRC biologist used iPads (Apple, Inc.) running Echo Meter Touch 2 Pro (Wildlife Acoustics) and a laptop running Sonobat software (Version 4) with a Binary Acoustics ultrasonic microphone (Binary Acoustic Technology, LLC). Field teams conducted emergence surveys when weather conditions were suitable for the evening emergence of bats (e.g., warm temperatures and minimal rain and wind).

3.2 Findings

All bat survey findings from 2017 through 2019 are summarized in Table 3-1; the structures surveyed in 2019 are indicated by green rows. A summary of the 2019 survey results follows the table.

Table 3-1 2017-2019 Bat Survey Findings

Building Name	Suitability[1]	Evidence of Bat Use?	Bat Roosting Confirmed?	Species Confirmed	Survey Dates (all years)	Additional Notes
Iron Gate						
Lakeview Road Bridge	High	Yes	Yes – 200 bats estimated during summer emergence.	MYYU	October 2018, June 2019	First emergence survey in June 2019.
Diversion Tunnel Outlet	High	Yes	Yes – 200 bats estimated during summer emergence. Absent in winter.	MYYU	February 2018 (interior), May-June 2018 (emergence only), June 2019 (emergence only)	None
Powerhouse	High	Yes	Yes – 400 bats estimated during summer emergence.	MYYU	July 2017, May and June 2018, October 2018, June 2019	None
Penstock Intake Structure	High	Yes	Yes – several hundred bats roosting inside at top of structure in summer.	MYYU	July 2017, June 2018, October 2018	None
Barn/Garage at Iron Gate Village	High	Yes	Yes – bats present in rafters/ceiling in summer.	MYYU	July 2017, May and June 2018, October 2018	None
Residence 1 (occupied) blue/gray	Mod-high (attic)	Unknown	Unknown	NA	June 2017 (exterior only)	No interior survey access to occupied residences.
Residence 2 (occupied) tan with green roof	Mod-high (attic)	Yes	Yes – 15 (estimated) bats found huddled behind clock on back porch in summer. Potential attic access through loose screen over vent.	MYYU	July 2017 (exterior only)	No interior survey access to occupied residences.
Fish Holding Facilities	Mod	No	No	NA	July 2017, June 2018, October 2018	None
Restrooms (near powerhouse)	Low - mod	No	No	NA	July 2017, June 2018	None
Emergency Spill Equipment shed	Low	No	No	NA	July 2018	None

Building Name	Suitability[1]	Evidence of Bat Use?	Bat Roosting Confirmed?	Species Confirmed	Survey Dates (all years)	Additional Notes
Copco No. 1 Diversion Tunnel Outlet	High	Yes	Yes – 100 bats estimated during summer emergence.	None	February 2018 inspection, June 2018 emergence	Access limitations prohibit safe, targeted placement of acoustic recording equipment at or near the mouth of the tunnel.
C-12 Gatehouse at Copco No. 1	High	Yes	Yes – 2,000 to 3,000 bats estimated during summer emergence. Several dozen present in late October.	MYYU	July 2017, June 2018, October-November 2018, June 2019	Maternity roost; largest roost found on Project site. Gatehouses C-11 and C-12 are the only Project structures found to have bats present in late October/early November.
C-11 Gatehouse at Copco No. 1	High	Yes	Yes – 100 bats estimated during summer emergence. Approximately 20 bats clustered in interior roof apex in late October.	MYYU	July 2017, June 2018, October-November 2018	Gatehouses C-11 and C-12 are the only Project structures found to have bats present in late October/early November.
Copco No. 1 powerhouse	High	Yes	Yes – several dozen bats clustered on walls in transformer bays and small numbers in lower level in summer.	MYYU	July 2017, February 2018, June 2018, October through November 2018	Abundant staining/guano on lower level but no large roosts found. Small number of COTO detected acoustically during summer emergence, but not confirmed to be present in the powerhouse.
Vacant House (light blue) on Copco Access Road	Mod	No	No	NA	July 2017	None
Maintenance Building (next to switchyard on Copco Access Road)	High	Yes	Yes – 30 bats estimated on summer emergence.	*Myotis* spp.	July 2017, June 2018, October-November 2018, June 2019	First emergence survey in June 2019. One COTO call detected on emergence.
Tin Pumphouse (across from light blue house on Copco Access Road)	Low	No	No	NA	July 2017	None
Groundwater Well House (at entrance to Copco Village)	Low - mod	No	No	NA	July 2017, October-November 2018	None
Vacant House 1 (tan)	High	Yes	Yes – small numbers of bats present under exterior side panels in summer.	MYYU	July 2017, February 2018, May and June 2018, October-November 2018	None

Building Name	Suitability[1]	Evidence of Bat Use?	Bat Roosting Confirmed?	Species Confirmed	Survey Dates (all years)	Additional Notes
Vacant House 2 (blue)	High	Yes	Yes – small numbers of bats present under exterior side panels in summer.	MYYU	July 2017, February 2018, May and June 2018, October-November 2018	None
Vacant House 3 (yellow-green)	High	Yes	Yes – large colony present in summer, in garage behind wood window framing and under rotting wood panels.	MYYU	July 2017, February 2018, May and June 2018, October-November 2018	None
Vacant House 4 (peach)	High	Yes	Yes – present between flashing and fascia board all around roof edge in summer.	MYYU	July 2017, February 2018, May and June 2018, October-November 2018	None
Vacant House #21601 (light yellow)	High	Yes	Yes – 300 bats estimated during summer emergence.	MYYU	July 2017, February 2018, May and June 2018, October-November 2018	Presumed maternity roost.
Occupied House next to Vacant House 4	Mod	Unknown	Unknown	NA	July 2017 exterior only.	No interior survey access to occupied residences. Resident stated he is not aware of any bats in the attic.
House 19038 (next to schoolhouse)	High	Yes	No	NA	July 2017, February 2018, June 2018, October November 2018	None
Bunkhouse	Mod	No	No	NA	July 2017, February 2018, June 2018, October-November 2018	None
Cookhouse	Mod	Yes	Yes – small number of bats present in awning over side door outside in summer.	MYYU	July 2017, February 2018, May and June 2018, October-November 2018	None
Equipment Shed (in front of bunkhouse/cookhouse)	Low	No	No	NA	July 2017, February 2018, June 2018	None
Schoolhouse	Low - mod	No	No	NA	July 2017	None
Hazardous Waste Storage/Wood Shop	Low - mod	No	No	NA	July 2017, February 2018, June 2018	None

Building Name	Suitability[1]	Evidence of Bat Use?	Bat Roosting Confirmed?	Species Confirmed	Survey Dates (all years)	Additional Notes
Copco No. 2 powerhouse	High	Yes	Yes – 50 bats estimated during summer emergence.	MYYU	July 2017, February 2018, June 2018, October-November 2018	Six dead Myotis adults and pups found on ground level and lower level in summer. Small number of COTO detected acoustically during summer emergence, but not confirmed to be present in the powerhouse.
Maintenance Building (next to Copco No. 2 powerhouse)	Low	No	No	NA	July 2017, June 2018	None
Copco No. 2 Dam (concrete dam and associated structures)	Low	No	No	NA	July 2017	None
Control Center at Copco No. 2 powerhouse	Low	No	No	NA	July 2017, February 2018, June 2018	None
J. C. Boyle						
Office/Red Barn	High	Yes	No	None	July 2017, May and June 2018, October 2018, June 2019	June 2019 survey conducted from outside of perimeter fence due to gate access constraint. Two desiccated dead MYYU found in attic in 2017. No live bats found to-date.
Spillway Control Center	High	Yes	Yes – several hundred bats present in summer.	MYYU	July 2017, May and June 2018, October 2018	Presumed maternity roost.
Fish Screen House	Mod-high	No	No	NA	July 2017, June 2018, October 2018	None
Fire Protection Building	Mod	Yes	Yes – outside only, a few bats day roosting in exterior crevices near roof edges (western side and eastern side) in summer.	MYYU	July 2017, June 2018, October 2018	None
Dam Communications	Mod	No	No	NA	July 2017, June 2018, October 2018	None

Building Name	Suitability[1]	Evidence of Bat Use?	Bat Roosting Confirmed?	Species Confirmed	Survey Dates (all years)	Additional Notes
J.C. Boyle powerhouse	Mod	No	No	NA	July 2017, June 2018, October 2018	None
Maintenance Building (next to powerhouse)	Low - mod	No	No	NA	July 2017, June 2018, October 2018	None
Truck Shop	Low - mod	No	No	NA	July 2017, May 2018 and June 2018, October 2018	None
Headgate Control	Low - mod	No	No	NA	July 2017, June 2018	None
Gate Control and Communications	Low - mod	No	No	NA	July 2017, October 2018	None
Power Canal/Spillway	Low	No	No	NA	July 2017, June 2018	None
HazMat Storage Shed	Low	No	No	NA	July 2017	None
Pump House	Low	No	No	NA	July 2017	None
Two occupied residences	Unknown	Unknown	Unknown	NA	NA	No interior survey access to occupied residences.

Notes:

[1] "High" suitability was assigned to structures with bats present and/or where signs of heavy bat use were found, or to structures that showed little or no sign of use or could not be accessed but contain external or internal features generally preferred by roosting bats, such as attics/roof spaces, soffits, fascias, weather boarding, spaces between roof felt/membrane and tiles/slates, window frames, cave/cavity walls, flashing, and the like. "Moderate" suitability was assigned to structures where no bats or very few bats were found, with little or no sign of bat use, that contain points of entry/exit and limited internal and external features preferred by roosting bats. "Low" suitability for roosting was assigned to well-sealed structures with no points of entry/exit, and generally lacking cavities, crevices, and other features generally preferred by roosting bats.

[2] Photograph included in report

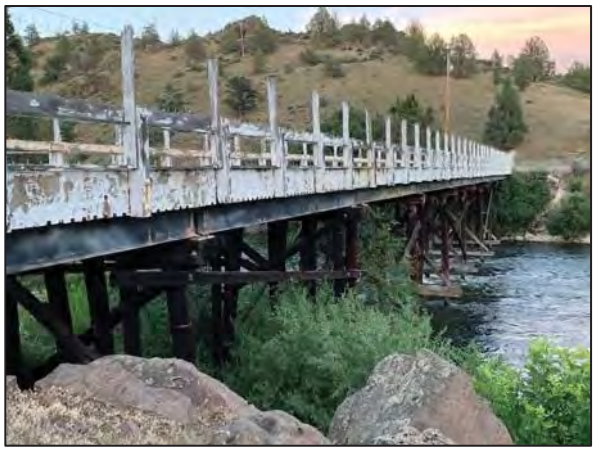
NA = Not Applicable

MYYU = *Myotis yumanensis* (Yuma myotis)

COTO = *Corynorhinus townsendii* (Townsend's big-eared bat)



Photograph 3-1 Maintenance Building on Copco Access Road, June 15, 2019



Photograph 3-2 Lakeview Road Bridge, June 12, 2019

During the June 2019 surveys, bat emergences occurred when the average evening outdoor temperature was 75 degrees Fahrenheit. KRRC biologist confirmed bat roosts in six of the seven structures surveyed. Figures 3-1 through 3-5 show all structures across the Project area where active bat roosts have been confirmed during surveys from 2017-2019. Photographs 3-1 and 3-2 depict the exterior view of the Maintenance Building and Lakeview Road Bridge prior to emergence surveys.

Biologists observed evening emergences of approximately 100 bats from the Copco diversion tunnel and approximately 200 bats from the Iron Gate diversion tunnel. More than 2,000 *Myotis* spp. emerged from the Copco No. 1 C-12 gatehouse. As before, more than 400 bats emerged from the below-grade draft pipe channels at the Iron Gate powerhouse. At the J.C. Boyle red barn, no bats were seen emerging from the structure. Big brown bat (*Eptesicus fuscus*) and hoary bat (*Lasiurus cinereus*) were identified acoustically in small numbers in flight nearby. The results of the June 2019 surveys at these five structures are consistent with the emergence and acoustic surveys conducted at these same locations in 2018.

Biologists surveyed the Lakeview Road Bridge and Maintenance Building for emergence and acoustic detections for the first time in June 2019. At the Lakeview Road bridge, biologists observed bats emerging from three discrete locations underneath the bridge. Most of the acoustic detections at this location were not definitively classified; however, a small number of Yuma myotis were confirmed. At the Maintenance Building, most of the calls showed characteristics of *Myotis* spp. These were primarily auto-classified as Yuma myotis and California myotis (*Myotis californicus*), with a small number of long-legged myotis (*Myotis volans*) and/or western small-footed myotis (*Myotis ciliolabrum*). Because these species are difficult to distinguish acoustically, the species detected at this structure are collectively reported as *Myotis* spp. One call at the Maintenance Building was auto-classified as Townsend's big-eared bat (*Corynorhinus townsendii*) and later confirmed by manual vetting. KRRC biologist observed many bats circling around the open area at the back of the building and foraging among the trees behind the building; therefore, the Townsend's big-

eared bat call confirmed the species presence in the vicinity but did not confirm the species to be roosting inside of the structure.

Additionally, during meetings with the design-build contractor in September 2019, KRRC biologists were informed that an engineering team observed one bat in a cavity in a historic concrete gate control structure on the upstream side of the Copco No. 1 dam (Figure 3-3) in March 2018. This structure has not been inspected by KRRC biologists to-date for potential bat roosting.

3.3 Conclusions

Surveys conducted from 2017-2019 confirmed that significant bat roosts are present in many structures across the Project area.

Chapter 4 Western Pond Turtle

4. WESTERN POND TURTLE

4.1 Introduction

KRRC biologists completed general wildlife surveys and noted observations of WPTs in the 0.25-mile study area in 2018, as described in the 2018 Annual Report (KRRC 2019a). In accordance with condition 4.c of the Clean Water Act Section 401 Certification issued by the Oregon Department of Environmental Quality, KRRC conducted a study of WPTs at J.C. Boyle Reservoir. This study was conducted by KRRC biologists in partnership with ODFW from August 2018 through April 2019. This study was implemented to inform key knowledge gaps about native turtles. This study had two primary objectives: 1) to estimate the WPT population size and 2) to determine the timing and locations of WPT overwintering behavior. The results of the study are summarized here. For more detail, figures, and data, please see the full report, Western Pond Turtle Study Report, J.C. Boyle Reservoir (KRRC 2019b).

To assess the population size, KRRC biologists conducted capture-mark-recapture (CMR) in areas known to be used by turtles. In addition, biologists conducted a springtime basking survey to provide a rough estimate of relative abundance. It should be noted that visual surveys do not provide rigorous estimates of population size or density.

Biologists used radio telemetry to track adult turtles through the winter and determine the overwinter timing and location of refugia for WPTs in J.C. Boyle Reservoir. Biologists used temperature data loggers, some attached to radio-tagged turtles and some installed along a transect from upland to deeper waters, to compare temperatures associated with turtle locations with the baseline environmental temperatures. This comparison required the recapture of radio-tagged animals in spring 2019 to retrieve transmitters and recover temperature data.

As described in the 2018 Annual Terrestrial Resources Survey Report (KRRC 2019a), KRRC biologists carried out trapping events and installed environmental temperature loggers in August and September of 2018. Radios and temperature loggers were affixed to eight turtles.

Additional field efforts completed by KRRC biologists in 2019 included:

- Monthly radio-telemetry surveys to identify overwintering habitat and characterize seasonal movement patterns
- Trapping for CMR and for recovery of telemetry equipment and temperature data loggers
- A springtime basking survey to provide a rough estimate of relative abundance
- Retrieval of environmental data loggers to collect baseline temperature data

The WPT Study Report, J.C. Boyle Reservoir (KRRC 2019b) provides additional details of the methods and findings of the study.

4.2 Methods

4.2.1 Fall 2018 – Winter 2019

Telemetry Surveys

Field teams completed telemetry surveys during monthly site visits from November 2018 through April 2019 to ascertain the overwintering habits (timing and location) of the eight radio-tagged WPT. KRRC tested all equipment and found that telemetry receiver accuracy was consistently under 6.5 feet (2 meters). The equipment typically provided locations that were within the margins of error for handheld Global Positioning System (GPS). Locations were recorded using a handheld GPS (Garmin Map78s), with error typically between 10 to 16 feet (3 and 5 meters).

4.2.2 Spring 2019

Trapping and Recovery of Data Loggers

KRRC biologists conducted trapping for CMR and for recovery of telemetry equipment and temperature data loggers in spring of 2019, with site visits on April 3 through 5 and April 23 through 29. Considering the low trap capture success in 2018, the team chose to focus the spring trapping on recapture of radio-tagged WPT to recover the transmitters and temperature data loggers. Trapping was therefore targeted in areas where radio-tagged WPT were found to be present based on telemetry. All eight turtles were successfully radio-located prior to trap deployment in April.



Photograph 4-1 Deployment of Turtle Trap near Large Woody Debris

Biologists placed twenty traps around the reservoir near large woody debris, rock crevices, and other refugia near where radio-tagged turtles were detected. Traps were left in place near radio-tagged turtles and were checked one or more times each day. Bait was replaced as necessary. If telemetry indicated that radio-tagged

turtles were no longer in the area, traps were repositioned near the radio-tagged turtle's new location and rebaited.

On April 27, 2019, KRRC retrieved the environmental data loggers that had been placed along land-to-water transects in the summer of 2018 to collect baseline environmental temperature data.

Basking Surveys

Biologists completed formal basking surveys from April 23 through 29, 2019. These surveys consisted of visually inspecting various basking habitats, such as rock faces, exposed stumps, and downed trees throughout the study area. Biologists recorded the locations of all basking turtles using a handheld GPS unit.

4.3 Findings

4.3.1 Telemetry Study

All eight radio-tagged animals were located via telemetry during each site visit, with the two exceptions noted below. KRRC biologists tracked the approximate travel paths based on monthly telemetry checks for each individual turtle. The telemetry results from the end of summer, through fall and winter and into early spring, are summarized below:

- On September 7, 2018, biologists successfully radio-located seven of the eight turtles. One turtle (#701) only had a faint signal that could not be accurately triangulated.
- On November 14, 2018, biologists located all eight turtles at the reservoir shoreline, apparently inside bank cavities or under large woody debris at the water's edge. Although no radio-tagged turtles were visible, cavities in the bank, crevices, and root wads were visible. Based on telemetry signals, some radio-tagged turtles appeared to be fewer than 3 feet into the bank. Some radio-tagged turtles were located under root wads of standing trees or stumps. Openings to these refugia were often just below the water surface but were completely exposed when the water level was low. Turtles were in the zone exposed to regular fluctuations of reservoir water levels.
- On December 10, 2018, seven of the eight turtles appeared to be in the same locations recorded on the previous visit in November. One turtle had moved, apparently to avoid ice pack.
- On January 29, 2019, there were no recorded movements for any of the turtles; all eight animals appeared to be in the same locations as in December.
- On February 22, 2019, four of the eight turtles had moved short distances (<5 meters) from their overwinter sites, while the other four appeared to be in the same locations reported in December and January.
- On March 5, 2019, most radio-tagged turtles exhibited short distance movements, and by March 13, 2019, telemetry information indicated that turtles were becoming more active.

- From April 3 through 5, 2019, radio-tagged turtles were actively moving throughout the reservoir. Biologists observed some turtles basking. By April 23 through 29, 2019, basking turtles were abundant, and radio-tagged turtles were frequently moving over long distances.

4.3.2 Spring Recapture Efforts

In early April (April 3 through 5), telemetry data indicated that turtles had left overwinter refugia and were actively moving throughout the J.C. Boyle Reservoir. No turtles were caught in baited traps, but two turtles were hand-captured with a dip net. Biologists observed turtles basking on the first day, but observations declined dramatically over the 3-day visit as a large winter storm advanced.

During a second visit in April (April 23 through 29, 2019), weather conditions were more favorable, and biologists regularly observed basking turtles. It appeared that most radio-tagged turtles were moving away from overwinter sites (i.e., shoreline refugia) to more typical spring/summer-use microhabitats during the day (i.e., areas with aerial basking perches, such as woody debris, emergent rocks, and the floating log boom near the dam).



Photograph 4-2 Releasing a Captured Western Pond Turtle

Biologists captured several turtles during the first few days of trapping, but the capture rate declined after the first day. Turtles, including radio-tagged individuals, were consistently observed near trap locations, but the capture rate remained low. Eleven new turtles were caught in traps in 2019, but no recaptures occurred. One radio transmitter (radio #919) was recovered from a trap, but it was no longer attached to the turtle, indicating that the radio-tagged turtle had entered the trap and later escaped. A few turtles were caught by dip net; however, seine netting, snorkeling, and a drift fence trap did not capture any turtles. Due to extremely low underwater visibility and high water levels, active methods of turtle capture were not effective.

Due to the lower-than-required number of captures and recaptures, the CMR data were insufficient to calculate a valid population estimate A larger sample size and higher proportion of recaptures would be required to produce a valid population estimate.

4.3.3 Basking Observations

During basking surveys, KRRC biologists observed a maximum of 35 turtles in 1 day. As observed in previous surveys, WPT used a variety of basking habitats, including exposed rock features and large woody debris. Biologists consistently observed the greatest numbers of basking turtles at the northern end of the floating log boom near the J.C. Boyle Dam; more than a dozen turtles were observed here at one time on several occasions.

4.3.4 Temperature Monitoring

Biologists successfully recovered environmental temperature data from 9 of the 16 environmental temperature loggers. Thermographs from a land-to-water transect reveal distinct signatures between land and water sensors. Based on the environmental thermographs, the greatest temperature fluctuations occurred at the shoreline sensor, which was nearest to where radio-tagged turtles in this study overwintered. However, temperatures in turtle refugia are unknown because no functional temperature loggers were recovered from the study animals. Only one data logger was recovered from a turtle, but the data were not recoverable due to water damage.

4.4 Conclusions

The study of WPTs occupying the J.C. Boyle Reservoir area had two primary objectives: to generate a population estimate for WPTs at the J.C. Boyle Reservoir and to gain information about their overwintering habits. The number of turtles captured and recaptured was insufficient to produce a statistically valid population estimate, but visual surveys confirmed that WPTs are common in the reservoir. Frequent observations of juveniles indicated that the reservoir supports a reproducing population of turtles.

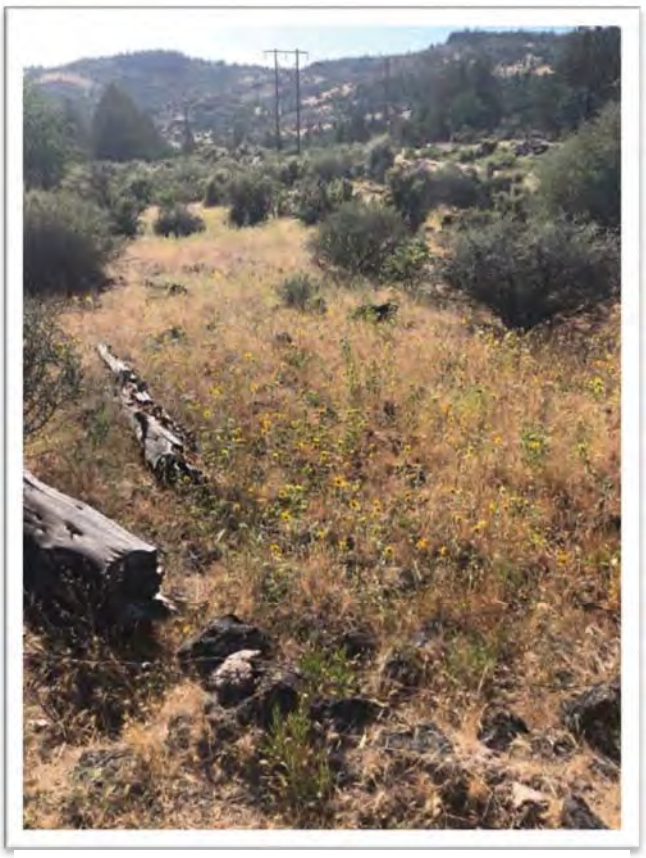
The telemetry study determined that all eight radio-tagged animals overwintered in refugia at the reservoir shoreline. It must be noted that this study was limited in scope and describes the behavior of a subset of turtles at J.C. Boyle Reservoir. Literature on WPT overwinter habits demonstrate that turtles in different systems often behave differently. The findings of this study should be cautiously applied to turtles in the other Project reservoirs. Additional information of WPT life cycle and habitat requirements can be found in previous Project documents (AECOM and CDM Smith 2017).

Chapter 5 Special-Status Plants

5. SPECIAL-STATUS PLANTS

5.1 Introduction

KRRC defined special-status plants to include those species with federal status (federally listed as threatened, endangered, or proposed for listing); state threatened or endangered species, and species on the Oregon Natural Heritage Program Lists 1 to 4 and California Rare Plant Rank 1 to 4. BLM and USFS Sensitive Species are also considered where BLM and USFS lands occur in the study area. The list of special status species in Oregon and California was refined to those with the potential to occur in the project area based on available habitat types and historical records. The species with potential to occur are listed in Table 5-1.



Photograph 5-1 Survey Transect near Copco No. 1 Dam

KRRC biologists identified special-status plant species with the potential to occur in the Project area, based on historical records and review of plant databases. PacifiCorp (2004) documented several special-status plant species during extensive surveys in 2002 and 2003. In addition, KRRC biologists identified documented occurrences of special-status plant species through reviews of state and federal databases, including the Oregon Biodiversity Information Center (ORBIC), the California Natural Diversity Database (CNDDB), and the USFWS Information for Planning and Consultation database (ORBIC 2017, IPaC 2018, CNDDB 2018). Other sources of information on special-status plant species in the Project area include the California Native Plant Society (CNPS) Inventory of Rare and Endangered Plants of California, USFWS – Yreka, the Bureau of Land Management (BLM) – Klamath Falls, and the United States Forest Service (USFS) – Klamath National Forest. Table 5-1 shows the documented occurrences for each species with the potential to occur in the project area. If a special status species was previously documented (e.g., on ORBIC, CNDDB) within the project area, it was included in the list of species with the potential to occur even if available habitat did not appear to be present.

Table 5-1 Preliminary List of Special-Status Plants with Potential to Occur

Species	Status	Habitat	Location of Documented Occurrence(s)	Bloom Time	Proposed Survey Effort
Western yellow cedar *(Callitropsis nootkatensis)*	Petitioned for federal listing, CNPS List 4.3	Wet to moist sites, from the coastal rainforests to rocky ridgetops near the timberline in the mountains	Not documented during PacifiCorp surveys or listed on CNDDB or ORBIC for the Project area; may occur based on information from USFWS Yreka office (May 23, 2017)	NA	In construction areas in suitable habitat
Greene's mariposa-lily *(Calochortus greenei)*	FSC, BLM, OC, ONHP List 1, CNPS List 1B	Occurs primarily in annual grassland, wedgeleaf ceanothus chaparral, and oak and oak-juniper woodlands	Several locations around Iron Gate Reservoir (PacifiCorp 2004; CNDDB 2018)	May through July	In construction areas in suitable habitat
Bristly Sedge *(Carex comosa)*	ONHP List 2	Marshes, lake shore, and wet meadows	East Shore of J.C. Boyle Reservoir in two locations (east of Dam and south of Highway 66); also, west of dam (ORBIC 2017)	May through September	Along reservoir margins and in construction areas in suitable habitat
Mountain Lady's Slipper *(Cypripedium montanum)*	ONHP List 4, CNPS List 4	Dry, open conifer forests, more often in moist riparian habitats	J.C. Boyle peaking reach (location details unknown) (PacifiCorp 2004)	March through August	In construction areas in suitable habitat
Gentner's fritillary *(Fritillaria gentneri)*	FE, CNPS List 1B	Cismontane woodland, chaparral and mixed hardwood-conifer vegetation dominated by Oregon oak	Habitat present in the reach along Copco and Iron Gate Reservoirs; no known locations	Late March to early April; April and May at higher elevations	In construction areas in suitable habitat
Bolander's sunflower *(Helianthus bolanderi)*	BLM, ONHP List 3	Occurs in yellow pine forest, foothill oak woodland, and chaparral, and occasionally in serpentine substrates or wet habitats	South of Iron Gate Reservoir near alternative disposal site, J.C. Boyle peaking reach (location details unknown) (PacifiCorp 2004)	June through October	In construction areas in suitable habitat
Washington lily *(Lilium washingtonianum* ssp. *purpurascens)*	CNPS List 4	Forest openings, chaparral, burned clearcuts, and roadsides	Several locations around Copco Lake, including near Copco Road along the seep area (KRRC 2019a)	June through August	Within the limits of work in suitable habitat
Bellinger's meadow-foam *(Limnanthes floccosa* ssp. *Bellingerana)*	FSC, BLM, OC, ONHP List 1, CNPS List 1B	High elevation vernal pools in shallow soiled rocky meadows in spots that are at least partially shaded in the spring	J.C. Boyle peaking reach (location details unknown) (PacifiCorp 2004)	April through June	In construction areas in suitable habitat

Species	Status	Habitat	Location of Documented Occurrence(s)	Bloom Time	Proposed Survey Effort
Detling's silverpuffs (*Microseris laciniata* ssp. *detlingii)*	CNPS List 2	Chaparral and grassy openings among Oregon white oak trees	One location on the western side of Iron Gate Reservoir (CNDDB 2018)	May and June	In construction areas in suitable habitat
Egg Lake monkeyflower *(Mimulus pygmaeus)*	FSC, CNPS List 4	Occurs in damp areas or vernally moist conditions in meadows and open woods	East of J.C. Boyle Reservoir in two locations (north of Highway 66 and southeast of Dam); west of Dam in two locations in damp mudflats; also west of canal near access road in one location (PacifiCorp 2004)	May through August	Along reservoir margins and in construction areas in suitable habitat
Greene's four o-clock *Mirabilis greenei*	CNPS List 4	Dry slopes and flats among juniper and foothill woodlands, and grasslands	Along the western side of the Iron Gate Reservoir (KRRC 2019a)	May and June	Within the limits of work in suitable habitat
Holzinger's orthotrichum moss *(Orthotrichum holzingeri)*	CNPS List 1B.3	Found on vertical calcareous rock surfaces and at the bases of Salix bushes just above rock that is frequently inundated by seasonally high water in dry coniferous forests	Just upstream of Iron Gate Reservoir on Jenny Creek (CNDDB 2018)	N/A	Where in-stream work could occur at Jenny Creek at bridge
Western yampah *(Perideridia erythrorhiza)*	FSC, BLM, OC, ONHP List 1	Occurs in moist prairies, pastureland, seasonally wet meadows, and oak or pine woodlands, often in dark wetland soils and clay depressions	Along three drainages into the western side of J.C. Boyle Reservoir, and in two locations west of the canal near the access road (PacifiCorp 2004)	Mid July and August	Along reservoir margins and in construction areas in suitable habitat
Howell's yampah (Howell's false caraway) *(Perideridia howelii)*	ONHP List 4	Moist meadows and stream banks	One location along the drainage southeast of J.C. Boyle Reservoir; one location along the northern side of Copco Lake north of the road (PacifiCorp 2004)	July and August	Along reservoir margins and in construction areas in suitable habitat
Yreka phlox *(Phlox hirsuta)*	FE, CE, CNPS List 1B	Open areas on dry serpentine soils and at elevations ranging from 2,500 to 4,400 feet	Not known to occur near construction areas; no suitable ultramafic soils occur within 0.5 mile of construction areas (NRCS 2017)	March and April	None – suitable soils not present in construction areas
Strapleaf willow *(Salix ligulifolia)*	ONHP List 3	Riverbanks, wetlands, and floodplains	One location west of J.C. Boyle Dam in a boulder flood channel in the dam release zone (ORBIC 2017)	March through June	Along reservoir margins and in construction areas in suitable habitat

Species	Status	Habitat	Location of Documented Occurrence(s)	Bloom Time	Proposed Survey Effort
Fleshy sage *(Salvia dorrii* var. *incana)*	CNPS List 3	Occurs in silty to rocky soils in great basin scrub, pinyon, and juniper woodland	Three locations around Iron Gate Reservoir (PacifiCorp 2004)	May through July	In construction areas in suitable habitat
Lemmon's silene *(Silene lemmonii)*	ONHP List 3	Open pine woodlands	J.C. Boyle peaking reach to J.C. Boyle Reservoir (location details unknown) (PacifiCorp 2004)	Spring and Summer	In construction areas in suitable habitat

Key:

BLM: Bureau of Land Management sensitive species -species that could easily become endangered or extinct.
CE: California Endangered
CNDDB: California Natural Diversity Database
CNPS List 1A: California Native Plant Society (CNPS)-Presumed extinct in California
CNPS List 1B: rare, threatened, or endangered in California and elsewhere
CNPS List 2: rare, threatened, or endangered in California, but more common elsewhere
CNPS List 3: on the review list – more information needed
CNPS List 4: on the watch list – limited distribution
FE: Federal Endangered
FSC: Federal Species of Concern
OC: Candidate listing by Oregon Department of Agriculture
ONHP List 1: Oregon Natural Heritage Program threatened with extinction or presumed to be extinct throughout their entire range
ONHP List 2: threatened with extirpation or presumed to be extirpated from the State of Oregon
ONHP List 3: more information is needed before status can be determined, but may be threatened or endangered in Oregon or throughout their range
ONHP List 4: of conservation concern but not currently threatened or endangered
ORBIC: Oregon Biodiversity Information Center
USFWS: United States Fish and Wildlife Service

As described in the 2018 Annual Terrestrial Resources Survey Report (KRRC 2019a), KRRC began conducting special-status plant surveys in 2018 to identify any special-status plants that are currently present 1) within a 0.25-mile buffer around the Project area, defined as the dams and structures to be removed, the disposal sites, the haul and access roads that may undergo improvements, and the reservoirs; and/or 2) in areas such as reservoir shorelines that may be affected by the Project. Findings of KRRC surveys in 2018 and 2019 are presented below.

5.2 Methods

KRRC biologists conducted surveys for special status plants with the potential to occur in the project area. Prior to the surveys, KRRC biologists compiled a list of special-status plant species with potential to occur within the limits of work based on documented occurrences and the presence of suitable habitat, as shown in Table 5-1. Surveys were timed to coincide with the bloom time for each species, and the surveys for each species were based on an understanding of the potential habitat suitability in the Project area. The entire limits of work were surveyed for special status plants; however, a focused floristic survey was conducted in areas where there would be construction disturbance. Focused floristic surveys were also conducted where habitat conditions are expected to change due to reservoir drawdown and there were also suitable habitat and locations of known and potential occurrences of special-status plants.

The focused surveys followed the CDFW "Protocols for Surveying and Evaluating Impacts to Special-Status Native Plant Populations and Sensitive Natural Communities" (CDFW 2018). In areas along reservoir shorelines, where changes in hydrology and geomorphology could occur due to the Project, surveys were focused on the locations of known and potential occurrences of special-status plants documented during surveys conducted by PacifiCorp (2004) and data obtained from a desktop review of existing databases (CNDDB, ORBIC, and CNPS).

Following the CDFW protocol, KRRC biologists conducted detailed floristic surveys that entailed identification of every plant taxon observed, to the taxonomic level necessary to determine rarity and listing status. The construction areas include proposed disposal sites (including those considered alternative disposal sites), staging areas, utility line corridors, facility removal areas, and locations where clearing could occur for road modifications such as road widening, turnouts, equipment/material storage, and bridge replacement. In these areas, biologists walked parallel transects generally spaced 5 to 10 meters apart and recorded plant species observed. Biologists also used a boat to survey reservoir shorelines, focusing on areas of suitable habitat and locations of known and potential occurrences of special-status plants. GPS coordinates were recorded for all observed special-status plants, along with descriptions of habitat conditions and proximity to proposed work activities or other notable features.

In consideration of the various peak bloom times of the focal species listed in Table 5-1, the KRRC biologists planned three surveys: early season (April), mid-season (May), and late season (July). The mid-season and part of the late season surveys were conducted in 2018, as described in the 2018 Annual Terrestrial Resources Survey Report (KRRC 2019a). The April early season survey was not conducted in 2018, due to lack of access to PacifiCorp lands. A July 2018 wildfire in the California portion of the study area restricted the late-season survey to the J.C. Boyle Reservoir study area. Therefore, KRRC planned follow-up surveys in 2019 to include the April early-season survey and the July late-season survey (California only). Additionally, any areas that were insufficiently surveyed during 2018 were surveyed in 2019. This included the proposed Fall Creek Hatchery area and river reach between Copco and Iron Gate Reservoirs. Lastly, biologists visited the locations of unconfirmed, historical sightings during the appropriate bloom times to confirm the occurrences of specific species.



Photograph 5-2 Bristly Sedge (*Carex comosa*)

The April 2019 special-status plant survey was specifically scheduled to coincide with the bloom time of Gentner's fritillary. During survey planning, KRRC biologists obtained information from CDFW and USFS botanists on the 2019 phenology at known reference populations to confirm the appropriate timing of the survey in the Project area. Biologists visited a reference population of Gentner's fritillary in Jacksonville, Oregon on April 21, 2019 to confirm that the species was blooming. Biologists took this opportunity to familiarize themselves with the morphological and habitat characteristics of the species to aid in differentiating it from the more common fritillary species, scarlet fritillary (*Fritillaria recurva*), which is very similar in appearance and occupies the same habitat.

The July 2019 special-status plant survey was scheduled to coincide with the late-blooming species shown in Table 5-1, including Greene's mariposa-lily, Bolander's sunflower, Howell's yampah, fleshy sage, and pendulous bulrush. KRRC biologists conducted the survey in the vicinity of Iron Gate Reservoir and Copco Lake from July 15 through July 19, 2019. In addition, during the week of July 22 through July 26, 2019, an AECOM biologist visited the locations of special-status plant observations from the July 2018 survey in the vicinity of J.C. Boyle Reservoir.

5.3 Findings

As shown on Figures 5-1 through 5-3 and presented in Table 5-2 below, biologists identified eight special-status plant species in the Project area during the 2018 and 2019 surveys, as follows:



Photograph 5-3 Greene's Mariposa-lily (*Calochortus greeni*)

- Greene's mariposa-lily (*Calochortus greenei*): KRRC biologists observed numerous *Calochortus* plants in construction areas in the Project area, including at the Iron Gate alternative upland disposal site and along utility corridors in the vicinity of Iron Gate Reservoir and Copco Lake during surveys completed in April 2019. Although plants were not in bloom when first observed in April 2019; the species designation was confirmed as *Calochortus greenei* when sites were revisited in July 2019.

- Detling's silverpuffs (*Microseris laciniata* ssp. *detlingi*). KRRC biologists confirmed a previously documented CNDDB occurrence at the Iron Gate alternative upland disposal site. New occurrences were also observed and mapped along utility corridors along the southeastern side of the Iron Gate Reservoir and south of the Copco No. 2 bypass reach.

- Bristly sedge (*Carex comosa*): In July 2019, KRRC biologists observed and mapped plants throughout the wetland complex along the eastern shore of the J.C. Boyle Reservoir. The location of a historical occurrence south of the Highway 66 bridge was visited during the field surveys and *Carex* was present, but because the plants were not in flower, the species is unconfirmed south of the bridge.

- Bolander's sunflower (*Helianthus bolanderi*): In July 2019, KRRC biologists observed and mapped plants in utility corridors along the northern side of Iron Gate Reservoir and between Iron Gate Reservoir and Copco Lake. Biologists also observed and mapped one occurrence along the eastern side of the J.C. Boyle Reservoir in July 2019.

Table 5-2 Special-Status Plant Observations by Reservoir

Species	Observation Location		
	Iron Gate Reservoir	Copco Lake	J.C. Boyle Reservoir
Greene's mariposa-lily (*Calochortus greenei*)	Several locations in the vicinity of the Iron Gate Reservoir, including within the footprint of the Iron Gate alternative upland disposal site	Along utility corridors between the Copco No. 1 and Copco No. 2 Dams, and between Copco No. 2 Dam and Daggett Road bridge	
Detling's silverpuffs (*Microseris laciniata* ssp. *detlingii)*	Present in the Iron Gate alternative upland disposal site; also along utility corridor on the southeastern side of the reservoir	Along the utility corridor between Copco No. 2 Dam and Daggett Road Bridge	
Bolander's sunflower (*Helianthus bolanderi*)	Present in the Iron Gate disposal area east of the dam; present in the transmission line corridor to west of Jenny Creek confluence	Observed in the transmission line corridor northwest of the reservoir	A large group was observed on the eastern shore in Klamath Sportsman's Park
Fleshy Sage (*Salvia dorrii* var. *incana*)	Two locations near Iron Gate Reservoir; both in proximity to but outside of the construction footprint for removal of utility poles		
Western Yampah (*Perideridia erythrorhiza*)			North of the J.C. Boyle Dam in a dry meadow; will likely be outside the area of impact from the drawdown of the reservoir
Bristly Sedge (*Carex comosa*)			Observed in three locations in Klamath Sportsman Park wetlands on the eastern shore north of the Highway 66 bridge
Greene's Four O'clock (*Mirabilis greenei*)	Observed in the utility corridor on the northeastern side of the reservoir	Observed in four locations along the northern side of the Klamath River, downstream of the Copco No. 2 Dam	
Purple-flowered Washington Lily (*Lilium washingtonianum* ssp. *Purpurascens*)	Near the Fall Creek diversion	Along the northern side of Copco Lake; several observations in mountain seep-associated wetlands along the northwestern shore of the reservoir	
Strapleaf willow (Salix ligulifolia)			Observed along the river just downstream of the J.C. Boyle Dam

- Purple-flowered Washington lily (*Lilium washingtonianum* ssp. *purpurascens*): Biologists recorded a potential observation at one location near the Fall Creek diversion in July 2019. The plant was not in bloom; however, the location is consistent with a confirmed observation of the species in 2018. In July 2019, KRRC biologists observed several plants in bloom, enabling a positive identification, along Copco Road on the northern side of Copco Lake and coinciding with a series of hillside seeps.
- Greene's four o'clock (*Mirabilis greenei*): In April and July 2019, KRRC biologists observed this species in two locations where disturbances resulting from utility pole removal may occur: 1) near the location of the fleshy sage described below, and 2) north of the Klamath River approximately 0.3 mile west of the intersection of Copco Road and Daggett Road.
- Western yampah (*Perideridia erythrorhiza*): In July 2019, KRRC biologists verified a previously documented population north of the J.C. Boyle Dam. The plants were in a dry meadow and would likely be outside of the area impacted by drawdown of the reservoir.
- Fleshy sage (*Salvia dorrii* var. *incana*): In July 2019, KRRC biologists confirmed a previously documented CNDDB occurrence and mapped a population near a culvert along the southeastern side of the Iron Gate Reservoir. Several plant locations along utility corridors on the northern side of Iron Gate Reservoir were also recorded.
- Strapleaf willow (*Salix ligulifolia*): In July 2019, KRRC biologists confirmed a previously documented ORBIC occurrence along the river just below the J.C. Boyle Dam.



Photograph 5-4 Fleshy Sage (*Salvia dorrii* var. *incana*)

5.4 Conclusions

In summary, the KRRC biologists documented special-status plants in the Project area, including at locations that will potentially be disturbed during construction. These findings are consistent with findings of previous surveys conducted in 2018.

Special-status plant surveys have been completed in accordance with the survey work plan (see Appendix J of the Definite Plan [KRRC 2018]). KRRC is not planning additional surveys.

Chapter 6 Wetlands

6. WETLANDS

6.1 Introduction

Wetland and riparian habitats occur throughout the Project area wherever persistent surface water features occur (e.g., streams, seeps, springs, Project reservoirs, or other sources of hydrology). Wetlands are regulated at both the state and federal levels by resource agencies including the United States Army Corps of Engineers (USACE), CDFW, and the Oregon Department of State Lands (ODSL); riparian habitats are only subject to jurisdiction by California agencies (i.e., CDFW and the State Water Resources Control Board). Restoration of the historical Klamath River channel following dam removal is expected to result in a net increase of wetland and riparian acreage; however, some areas may experience a reduction or a loss of associated water sources resulting from reservoir drawdown. This could result in the temporary or permanent loss of some wetlands or riparian areas that primarily depend on reservoir waters for hydrology. Consequently, KRRC developed wetland investigation methodologies in close coordination with USACE, ODSL, and CDFW to characterize existing conditions for wetlands and other waters (including riparian habitats in California). The methodology included determining the primary hydrology source maintaining each assessment area. The results of the wetland delineation work are provided in detail in the separate *2019 Wetland Investigation Summary Report* (KRRC 2020).



Photograph 6-1 Wetland along Shoreline of Copco Lake

To evaluate potential direct impacts on existing habitats, KRRC wetland scientists delineated wetlands in the portions of the Project area where ground-disturbing activities are anticipated to occur (e.g., disposal sites). KRRC wetland scientists also mapped wetlands along the reservoir margins, stream-associated wetlands, and non-wetland riparian vegetation outside of direct construction areas that may experience changes in hydrological conditions resulting from reservoir drawdown or the removal of other dam infrastructure.

6.2 Methods

Prior to the field investigations, KRRC scientists identified wetland investigation sites through a review of previous vegetation and wetland surveys and pertinent agency databases. This included PacifiCorp surveys conducted in 2002 (as reported in PacifiCorp 2004), 2018 KRRC vegetation community mapping (KRRC 2019a), high-resolution aerial imagery, the USFWS National Wetlands Inventory (USFWS 2019), and the United States Department of Agriculture Natural Resources Conservation Service Web Soil Survey (NRCS 2019).

KRRC wetland scientists conducted wetland delineation and mapping field surveys from May 6 through May 17, 2019, and from July 15 through July 25, 2019. KRRC wetland scientists delineated wetlands in accordance with the 1987 United States Army Corps of Engineers Wetland Delineation Manual and the Western Mountains, Valleys, and Coast Region Regional Supplement. In the Oregon portion of the Project, scientists applied the Oregon Rapid Wetland Assessment Protocol (ORWAP) to assess functional values of wetlands in construction areas, as described in Section 6.2.2.

The May 2019 investigations focused primarily on areas where ground-disturbing activities are planned to occur (e.g., disposal areas, staging areas, or bridge replacements) and where hydrology sources were identified to be independent of the Klamath River or Project reservoirs. The July 2019 investigations focused on mapping wetlands along and adjacent to reservoir shorelines and sections of the Klamath River within the limits of work, and on confirming preliminary findings by revisiting areas where problematic conditions were encountered in May 2019. Survey teams mapped non-wetland riparian areas on the California side of the Project in both May and July. Non-wetland riparian areas were not mapped in Oregon; however, the vegetation community mapping does identify willow-dominated communities that are often indicators of riparian conditions (see Section 7 for an update to willow vegetation community mapping provided in the 2018 annual report [KRRC 2019a]).

6.2.1 Wetland Delineation

In accordance with the USACE methodology, KRRC scientists first identified areas that exhibited potential wetland characteristics (e.g., hydrophytic vegetation) and then conducted evaluations of representative wetland determination plots to determine whether the area met the requirements for hydrophytic vegetation, hydric soils, and wetland hydrology. Field crews selected determination plots in areas with conditions that were representative of the entire wetland area. Figures 6-1, 6-2, and 6-3 depict the areas investigated for wetlands in the vicinity of Iron Gate Reservoir, Copco Lake, and J.C. Boyle Reservoir, respectively. In addition to the areas shown on the figures, the entire reservoir margin was also surveyed.

When the presence of a wetland was confirmed, field teams mapped the wetland boundary to submeter accuracy using a handheld GPS device (Trimble Geo 7X). For sites containing a defined stream channel, wetland scientists mapped the ordinary high-water mark (OHWM) and the riparian corridor boundary (RCB) to delineate the extent of federal (e.g., OHWM constitutes waters of the United States) and state jurisdictional boundaries (e.g., RCB constitutes waters of the State under CDFW jurisdiction). In areas where private property or safety concerns prevented access to wetlands or riparian vegetation, surveyors used an alternative mapping approach. This consisted of using ArcGIS Collector, a mobile data collection application that provides a map-driven interface that allows the user to capture spatial data from a distance. Collector

was only used to map study areas where line of sight was unimpeded and mapped points could be corroborated with visual observations and aerial imagery.

In several cases, multiple wetlands exhibited sufficiently similar soil, vegetation, and hydrological conditions that they could be appropriately characterized by a single set of paired wetland and upland USACE determination plots recorded for a single representative wetland. For example, wetlands dominated by hardstem bulrush (*Schoenoplectus acutus*) occurring intermittently along the shoreline of each reservoir consistently exhibited very similar characteristics in terms of vegetation, hydrology, and soils. Given their similarity, these wetlands were characterized by at least one representative determination plot at each reservoir. Using this approach, at least one representative set of paired wetland and upland determination plots was evaluated for each wetland type observed at each reservoir.

6.2.2 Oregon Rapid Wetland Assessment Protocol

Based on direction from ODSL, KRRC wetland scientists conducted an additional wetland functions and values assessment in the Oregon portion of the Project area using the ORWAP. ORWAP consists of a series of field and desktop evaluations that provide a standardized, regionally tailored, rapid procedure for estimating the functions and values of wetlands occurring in the state of Oregon (Adamus et al. 2016). ORWAP was conducted in areas where the hydrology is independent from the Klamath River or J.C. Boyle Reservoir (e.g., J.C. Boyle alternative upland disposal site).



Photograph 6-2 Wetland with Hydrology Independent of the Reservoirs

6.2.3 Riparian Vegetation Mapping



Photograph 6-3 Riparian Vegetation at Jenny Creek

CDFW jurisdiction includes ephemeral, intermittent, and perennial watercourses, and can extend to habitats adjacent to watercourses. Wetlands and riparian vegetation near watercourses would be considered "habitats adjacent to watercourses" and are thus subject to jurisdiction by the CDFW under Sections 1600 through 1616 of the California Fish and Game Code. To delineate CDFW jurisdictional boundaries, KRRC wetland scientists mapped riparian areas associated with relatively permanent (e.g., reservoir, river, perennial stream, spring, or pond) and semi-permanent (e.g., ephemeral channels) water bodies within the limits of work. Riparian areas generally had hydrophytic vegetation but failed to meet one or more of the remaining wetland parameters (i.e., hydrology and hydric soils), and thus were classified as non-wetland, riparian habitat. KRRC wetland scientists determined the upslope edge of riparian areas by mapping the line where vegetation transitioned from hydrophytic vegetation to vegetation more representative of dry, upland areas in terms of species composition and density. Upland habitat typically consisted of sparsely vegetated, rocky hillslopes. The riparian boundary was mapped to submeter accuracy using a handheld GPS device or ArcGIS Collector, as previously described for wetland delineations.

Riparian delineation methods were informed by definitions and procedures described in the California Riparian Habitat Joint Venture's 2006 Comparison of Methods to Map California Riparian Areas (Collins et al. 2006).

6.2.4 Determination of Hydrology Source

KRRC wetland scientists evaluated the primary source of hydrology for each wetland and riparian area to determine whether the hydrology was mainly dependent on reservoir waters or on other sources. Hydrology was characterized according to the following classifications:



Photograph 6-4 Wetlands along Spencer Creek

- Reservoir-dependent: the primary hydrology is associated with one of the Project reservoirs.
- Infrastructure-dependent: the primary hydrology is associated with infrastructure related to operation of the dams that will be removed as part of the Project (e.g., the Copco wood-stave penstock).
- Non-reservoir-dependent: the primary hydrology is associated with the Klamath River, a stream or seep, precipitation, or another source.

6.3 Findings

A summary of survey findings organized by reservoir area is provided in the following sections. Total wetland and riparian acreages by reservoir are presented in Table 6-1 and described below.

Table 6-1 Summary of 2018-2019 Wetland Investigation Findings

	Location		
	Iron Gate Reservoir	Copco Lake	J.C. Boyle Reservoir
Total Wetlands	**21.2 acres**	**12.9 acres**	**40.0 acres**
Reservoir-Dependent[1] Wetlands	9.6 acres	9.4 acres	38.1 acres
Non-Reservoir-Dependent Wetlands	11.6 acres	3.5 acres	1.9 acres
Total Riparian Vegetation[2]	**40.8 acres**	**32.2 acres**	**n/a**
Reservoir-Dependent Vegetation	10.2 acres	5.3 acres	n/a
Non-Reservoir-Dependent Riparian Vegetation	30.6 acres	26.9 acres	n/a

Notes:

1 This total also includes acreage for areas that are dependent on dam-related infrastructure to support wetland hydrology.
2 Riparian areas not mapped in Oregon.

6.3.1 Iron Gate Reservoir Area

KRRC wetland scientists characterized 134 individual wetlands and 122 riparian zones in the Iron Gate Reservoir area. This area comprised the following 17 general assessment areas between the proposed Fall Creek fish hatchery and the western extent of the proposed limits of work (Figure 6-1):

- Dry Creek Bridge
- Lakeview Road Bridge
- Iron Gate Disposal Area
- Long Gulch Cove
- Iron Gate Culvert 1
- Iron Gate Culverts 2 and 3
- Mirror Cove South Culvert
- Mirror Cove North Culvert
- Juniper Point Culvert
- Scotch Creek
- Camp Creek
- Wanaka Springs Recreation Site
- Jenny Creek Bridge and Cove
- Reservoir Margin
- Yreka Water Supply Pipeline Crossing Area
- Fall Creek Confluence, Daggett Road Bridge, and Staging Areas
- Fall Creek Bridge and Fish Hatchery

These assessment areas correspond to areas where direct impacts resulting from ground-disturbing activities may occur, such as culvert/bridge replacement and upgrades (e.g., Scotch Creek, Dutch Creek, Camp Creek, and Lakeview Road Bridge), recreation site restoration (e.g., Wanaka Springs Recreation Site), and infrastructure improvements (e.g., Fall Creek Hatchery and Yreka Water Supply Pipeline Crossing Area). In addition, these locations represent areas where hydrological changes are expected to affect existing wetlands (e.g., Jenny Creek and Reservoir Margin). Additional sites were evaluated along access routes to characterize existing conditions in the event that future plans require road modifications (e.g., Mirror Cove North and South and Iron Gate Culverts 1 through 3). As noted in Table 6-1, KRRC wetland scientists mapped 21.2 acres of wetlands and 40.8 acres of non-wetland riparian vegetation for areas associated with Iron Gate Reservoir. In all, 9.6 acres of wetland and 10.2 acres of riparian area were classified as dependent on reservoir hydrology.

6.3.2 Copco Lake Area

KRRC wetland scientists characterized 110 individual wetlands and 52 riparian zones in the Copco Lake area. This area comprised the following 14 general assessment areas between the Copco powerhouse and the eastern extent of the limits of work in California, east of the Copco Road Bridge (Figure 6-2):

- Copco No. 2 Wooden Penstock
- Transmission Corridor Pasture
- Copco Borrow Site, Staging Area, and Disposal Area
- Northern Shore Seeps
- Northern Shore Cove #1
- Beaver Creek Confluence and Culvert
- Patricia Road Culverts
- Raymond Gulch
- Northern Shore Cove #2
- Mallard Cove
- Northern Shore Cove #3
- Northern Shore Cove #4
- Shoreline East of Copco Road Bridge
- Reservoir Margin

These assessment areas can be broadly categorized as either areas where ground-disturbing work is anticipated to occur (e.g., Copco Borrow Site, Staging Area and Disposal Area, Copco No. 2 Wooden Penstock, Raymond Gulch, and Beaver Creek Confluence and Culvert) or areas where changes in hydrological conditions resulting from reservoir drawdown are anticipated (e.g., Mallard Cove and Reservoir Margin). As previously noted, some additional sites were evaluated in the event that future road modifications are required (e.g., North Shore Seeps, Northern Shore Cove 1 to 4, and Patricia Road Culverts). As noted in Table 6-1, wetland scientists mapped 12.9 acres of wetlands and 32.2 acres of riparian vegetation in the Copco Lake area. In all, 9.4 acres of wetland and 5.3 acres of riparian area were classified as reservoir-dependent or infrastructure-dependent.

6.3.3 J.C. Boyle Reservoir Area

KRRC wetland scientists characterized 46 individual wetlands in the J.C. Boyle Reservoir area. This area comprised the following 16 general assessment areas, encompassing the extent of the proposed limits of work in the state of Oregon (Figure 6-3):

- Powerhouse and Tailrace
- Access Road South of Scour Hole
- J.C. Boyle Power Canal and Access Road
- Power Canal Exit Ramp
- Rafter Access Point
- Base of J.C. Boyle Dam
- J.C. Boyle Alternative Upland Disposal Site
- Southwest Cove
- Topsy Campground Cove
- Ephemeral Stream – Western Shore
- Ephemeral Drainage – Eastern Shore
- Pioneer Park Day Use Area
- Klamath Sportsman's Park
- Northwestern Shore
- Spencer Creek Cove and Northern Shore
- Reservoir Margin

Several assessment areas correspond with areas where deconstruction activities will take place (e.g., Powerhouse and tailrace, J.C. Boyle Power Canal and access road, Power Canal exit ramp, and Access road south of scour hole) and areas where road improvements may occur (e.g., northwestern shore and ephemeral stream east), while others represent sites where wetland impacts associated with reservoir drawdown are anticipated (e.g., Klamath Sportsman's Park, Spencer Creek Cove and northern shore, and reservoir margins). As noted in Table 6-1, wetland scientists mapped 40.0 acres of wetlands in the J.C. Boyle Reservoir area. In all, 38.1 acres of wetland were classified as dependent on reservoir hydrology. Non-wetland riparian areas were not mapped at J.C. Boyle.

6.4 Conclusions

KRRC wetland scientists conducted field investigations in May and July of 2019 to characterize and delineate wetlands and riparian zones in the Project area. These efforts were carried out to describe existing environmental conditions and inform the ongoing Project design and regulatory permit processes. The wetland and riparian area delineations are described in detail in a Wetland Delineation Report.

Chapter 7 Errata: 2018 Vegetation Community Mapping

7. ERRATA: 2018 VEGETATION COMMUNITY MAPPING

This section outlines revisions made to the 2018 Annual Terrestrial Resources Survey Report (KRRC 2019a) subsequent to its distribution as a final report.

During vegetation community mapping in 2018, sandbar willow (*Salix exigua*) was misidentified as Geyer willow (*Salix geyeriana*) in wetlands around the margins of Iron Gate Reservoir and Copco Lake. In addition to correcting the species identification, these errata clarify that Geyer willow thickets, considered a sensitive natural community by CDFW, are not present in the California portion of the Project area. Similarly, bitterbrush scrub, a sensitive natural community in California, is not present in the California portion of the Project area.

The following tables list all revisions to the 2018 report. Table 7-1 lists the changes that apply to the text and Table 7-2 lists changes to the figures in Appendix A of the 2018 report (KRRC 2019a). The corrected figures (Figures 3 and 11) are included in Appendix B of this 2019 survey report.

Table 7-1 Text Errata from 2018 Annual Terrestrial Resources Survey Report (KRRC 2019a)

Previous Text	Revised Text	Page Number	Chapter or Section Number
Geyer	Sandbar	19	2.2.2 Willow Flycatcher
Bitterbrush scrub	Bitterbrush scrub (found only in Oregon portion of the study area)	64	Table 8-1: Vegetation Alliances Recorded in the Study Area
Not applicable (revised text indicates a new row in Table 8-1)	*Salix exigua*; Sandbar willow thicket; Shrub; S4.2; G5	64	Table 8-1: Vegetation Alliances Recorded in the Study Area
Geyer willow thicket	Geyer willow thicket (found only in Oregon portion of the study area)	64	Table 8-1: Vegetation Alliances Recorded in the Study Area
Biologists identified the following sensitive natural communities in the study area: • Oregon ash groves • Bigleaf maple forest • Oregon white oak woodland • Bitterbrush scrub • Chokecherry thicket • Shining willow grove • Geyer willow thicket	Biologists identified the following sensitive natural communities in the California portion of the study area: • Oregon ash groves • Bigleaf maple forest • Oregon white oak woodland • Chokecherry thicket • Shining willow grove	64 and 65	8.3 Conclusions

Table 7-2 Figure Errata from 2018 Annual Terrestrial Resources Survey Report (KRRC 2019a, Appendix A)

Previous Text	Revised Text	Figure Numbers
Geyer willow thicket	Sandbar willow thicket	Figures 3-1 through 3-3; 2018 Willow Flycatcher Habitat and Observations
Geyer willow thicket	Sandbar willow thicket	Figures 11-1 through 11-16 Vegetation Communities

Chapter 8 References

8. REFERENCES

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Chapter 9 List of Preparers

9. LIST OF PREPARERS

Table 8-1 List of Preparers

Name	Education	Qualifications
Emma Argiroff	Master of Urban Planning; B.A. Environmental Science; B.A. Art and Design	2.5 years of experience in regulatory compliance, NEPA/CEQA, land use, and transportation planning.
Don Ashton	M.A. Biodiversity; B.S. Biology	25 years of experience as a professional herpetologist (amphibians and reptiles) researching freshwater ecosystems and seeking multi-disciplinary ecosystem-based approaches to complex stakeholder issues regarding flow management and rehabilitation of regulated rivers in California and Oregon.
Sam Bankston	B.S. Aquatic Biology	7 years of experience in fisheries and wildlife science, stream assessment, threatened and endangered species surveys, biological/water quality sampling, wetland delineation, data analysis using R statistical software, and GIS support.
Kacey Bates	Master of Geospatial Information Science and Technology; B.S. Environmental Science	3 years of experience in GIS, geospatial analysis, task automation (Python), data management, cartographic design, water resources, watershed delineation, floodplain delineation, and development of field data collection forms (Collector for ArcGIS, Survey123).
Laura Burbage	M.S. Ecology; Master of Landscape Architecture; B.A. Biology	18 years of experience in wetland science, plant species identification, wetland soils, restoration design – wetland, stream, and upland habitats, nature park design, permitting, NEPA, aesthetic analysis – USACE methodology, and pre-remedial site assessment.
Joe Broberg	B.A. Environmental Studies	9 years of experience and training in botany with a focus on floristic surveys, special-status plants, ecological data collection, tree surveys, wetland delineations, wildlife surveys, and construction monitoring.
Wilson Fogler	B.A. Forestry (Wildlife Habitat Management and Conservation); B.A. Business Management	3.5 years of experience in wetland delineation, wetland monitoring, biological assessments, threatened and endangered species surveys, water resource planning, and GIS support.

Name	Education	Qualifications
Jennifer Jones	M.S. Environmental Science; B.A. Biology Certified Ecologist – Ecological Society of America	20 years of experience in wildlife and fisheries science, regulatory compliance and permitting, NEPA/CEQA, ecological restoration, wetland delineation, threatened and endangered species surveys, site assessment and remediation, and biological/water quality/soil and sediment sampling.
Christina Kelleher	M.S. Ecology; B.S. Biology; B.A. Sociology 40 Hour Hazwoper Training	5 years of experience in wildlife science, special-status species surveys and monitoring; holds USFWS Recovery Permit and CDFW Scientific Collecting Permit.
Adam Khalaf	M.S. Biological Engineering; B.S. Ecological Engineering	2 years of experience in stream and wetland restoration design, NEPA, and plant and wildlife surveys.
Kate Moran	M.En.- Master of Environmental Science; B.S. Biology; B.A. Sustainability	3 years of experience in wetland science, water resources management, fisheries management and sturgeon research, restoration monitoring, regulatory compliance, and GIS support.
Mandi McElroy	M.S. Wildlife Ecology and Conservation; B.S. Wildlife Biology 40 Hour Hazwoper Training	17 years of experience in wildlife biology with an emphasis on Northern California special status species, habitat assessments, construction monitoring, protocol-level surveys, and impact analyses for regulatory compliance.
Sean O'Hare	B.S. – Biological Science 40 Hour OSHA Hazwoper Training; Methodology of Wetland Delineation Certificate; 30-Hour OSHA Construction	12 years of experience in leading technical field investigations, ecological characterizations, wetland delineations, plant inspection and oversight of planting, stream assessments, water quality assessment, plant surveys, wildlife surveys, and biological assessments; extensive sampling experience.
Matt Petty, PWS, PMP	M.S. Environmental Studies; B.A. Zoology; Environmental Science Professional Wetland Scientist – Society of Wetland Scientists; Certified Ecologist – Ecological Society of America; Project Management Professional – Project Management Institute	14 years of experience in project management, wildlife and fisheries science, regulatory compliance and permitting, NEPA, ecological and stream restoration, wetland delineation, stream and lake assessment, threatened and endangered species surveys, biological/water quality/sediment sampling, and GIS support.
Jonathan Stead	M.S. Ecology, B.S. Biology (Ecology, Behavior, and Evolution)	More than 20 years of experience in ecology and biology, with expertise in environmental permitting and compliance, dam removal, fish passage, stream restoration, and water infrastructure projects.

Name	Education	Qualifications
Kate Stenberg	Ph.D. Wildlife and Fisheries Science and Regional Planning; Master of Administration in Land Use Planning; B.A. Biology-Environmental Studies	35 years of experience in wildlife and fisheries science, regulatory compliance, and NEPA/CEQA.
Conor Veeneman	Professional Science Master, Environmental Science; B.A. Environmental Science; Wetland Professional in Training – Society of Wetland Scientists	4.5 years of experience in wetland delineation, regulatory compliance and permitting, NEPA, stream and wetland restoration design and monitoring, habitat evaluations, threatened and endangered species surveys, biological/water quality/sediment sampling, and GIS support.
Suzanne Wilkins, AICP, ENV SP	B.S. Business Administration	30 years of experience in environmental planning, CEQA/NEPA; regulatory permitting and compliance, and sustainable infrastructure planning.

Notes:
CEQA = California Environmental Quality Act
GIS = Geographic Information System
NEPA = National Environmental Policy Act
OSHA – Occupational Safety and Health Administration
USACE = United States Army Corps of Engineers

Appendix A Figures

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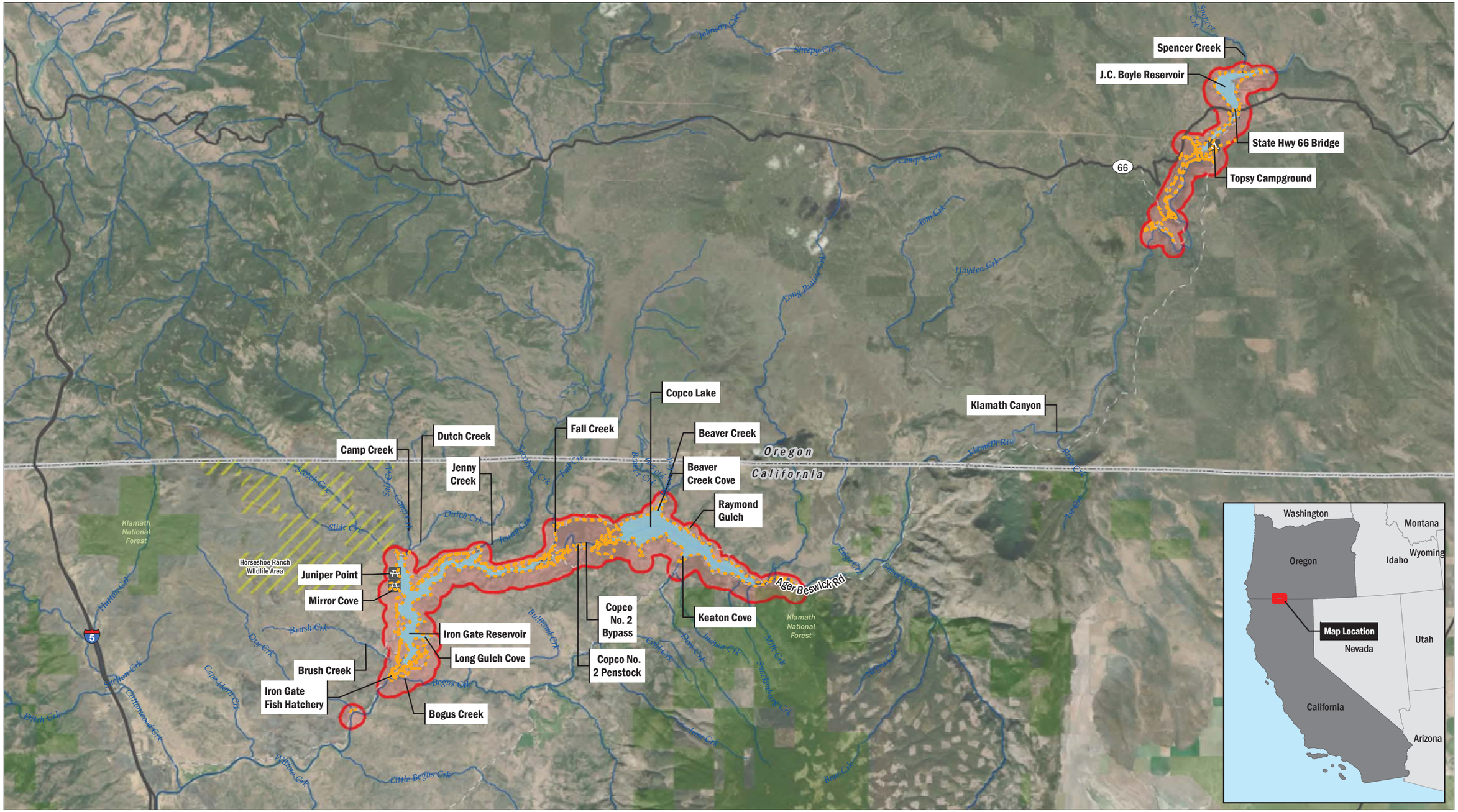


Data Source: 2018 TIGER/Line Shapefiles
Basemap Source: Esri, USGS, NOAA

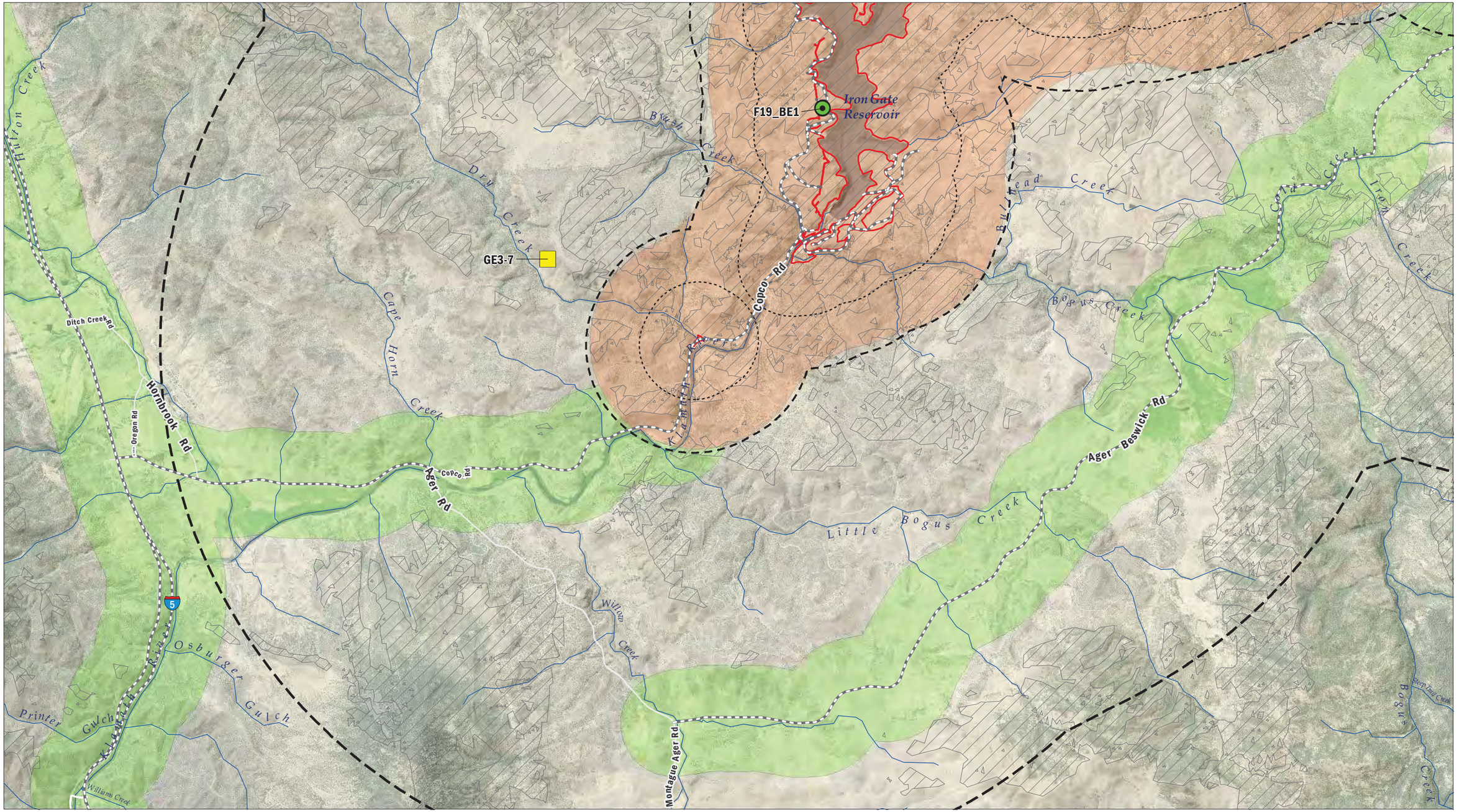
Klamath River Renewal Corporation
Klamath River Renewal Project

Legend
- Limits of Work
- Primary Road
- Access Route
- Stream
- Water Body
- State
- County
- 0.25 Mile Study Area Buffer
- National Forest
- Wildlife Area

FIGURE 1-1

Overall Project Map and Terrestrial Resources Study Area

AECOM Oakland CA 2/26/2020 USER sally.shatford PATH \\Oakland.na.aecomnet.com\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\Eagles\EagleSurveys_AECOM2017-2019_CDM.mxd



N

0 2

Miles

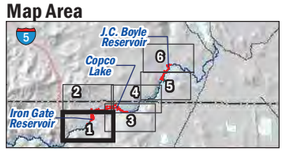
NAIP Imagery, 2014; AECOM, 2019

AECOM

Klamath River Renewal Corporation

Klamath River Renewal Project

Map Area



- Access Routes
- Limits of Work
- Viewshed from Limits of Work
- Low Impact Area
- High Impact Area

Project LOW Buffers

- 0.5 Miles
- 1 mile
- 5 miles
- 10 miles

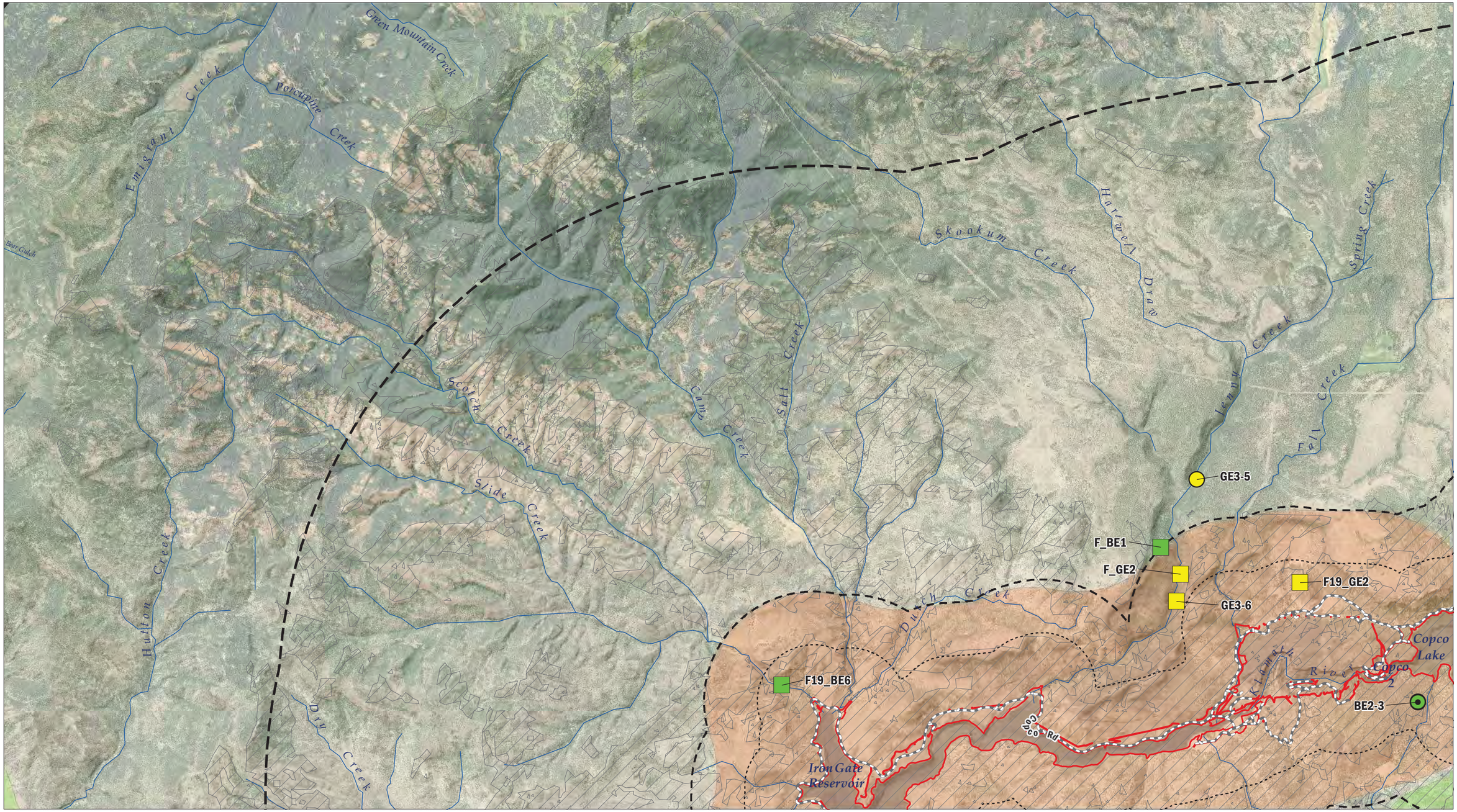
Eagle Survey Points

- Active in 2019, Bald Eagle
- Inactive, Golden Eagle

FIGURE 2 - 1

Eagle Nest Surveys 2019

AECOM Oakland CA 2/26/2020 USER sally.shatford PATH \\Oakland.na.aecomnet.com\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\Eagles\EagleSurveys_AECOM2017-2019_CDM.mxd



N

0 2

Miles

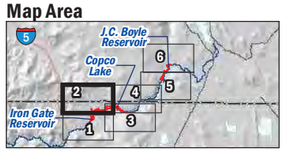
NAIP Imagery, 2014; AECOM, 2019

AECOM

Klamath River Renewal Corporation

Klamath River Renewal Project

Map Area



- Access Routes
- Limits of Work
- Viewshed from Limits of Work
- Low Impact Area
- High Impact Area

Project LOW Buffers

- 0.5 Miles
- 1 mile
- 5 miles
- 10 miles

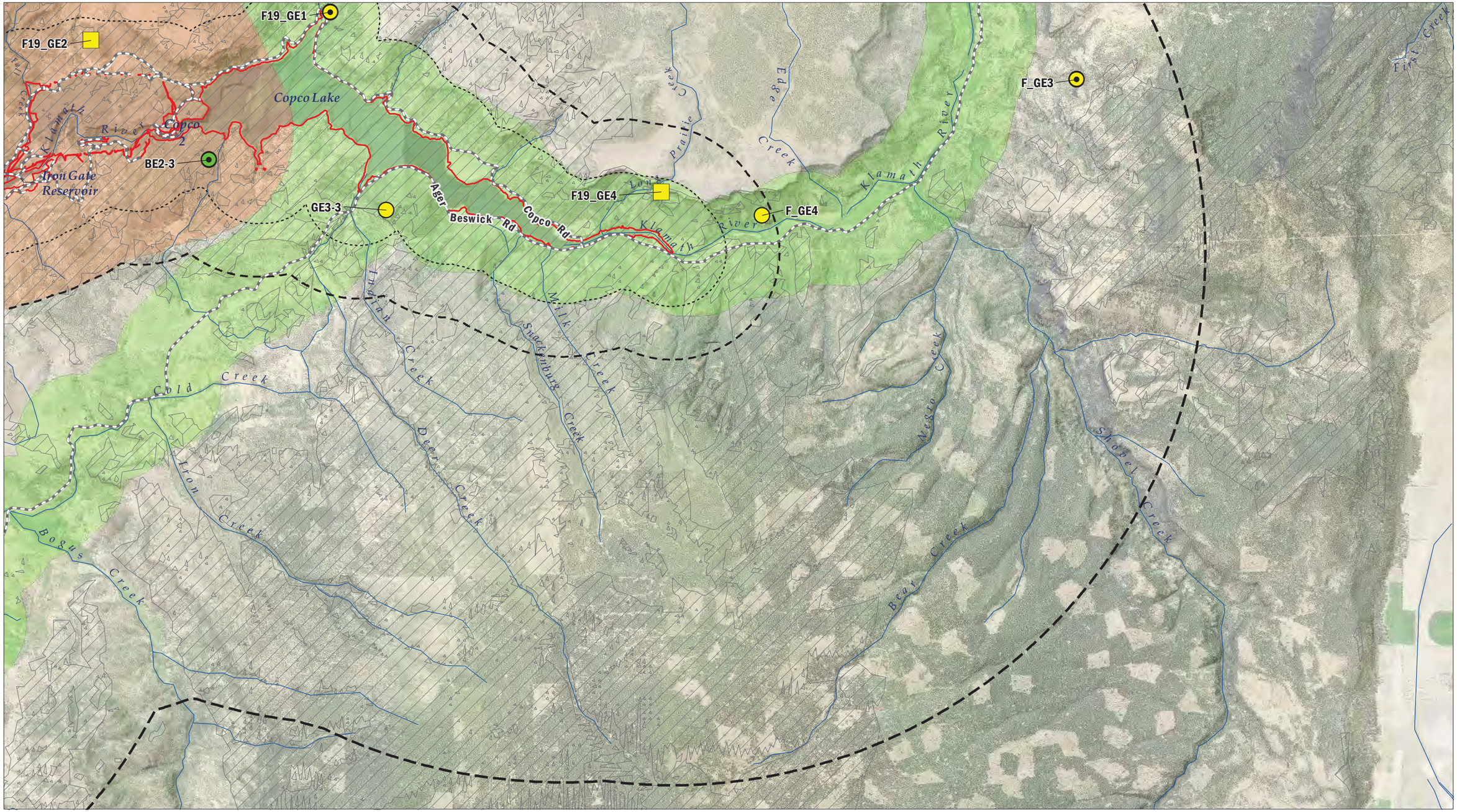
Eagle Survey Points

- Active in 2018, Golden Eagle
- Active in 2019, Bald Eagle
- Inactive, Bald Eagle
- Inactive, Golden Eagle

FIGURE 2 - 2

Eagle Nest Surveys 2019

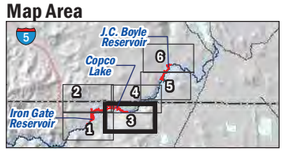
AECOM Oakland CA 2/26/2020 USER sally.shatford PATH \\Oakland.na.aecomnet.com\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\Eagles\EagleSurveys_AECOM2017-2019_CDM.mxd



NAIP Imagery, 2014; AECOM, 2019

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project

Map Area



- Access Routes
- Limits of Work
- Viewshed from Limits of Work
- Low Impact Area
- High Impact Area

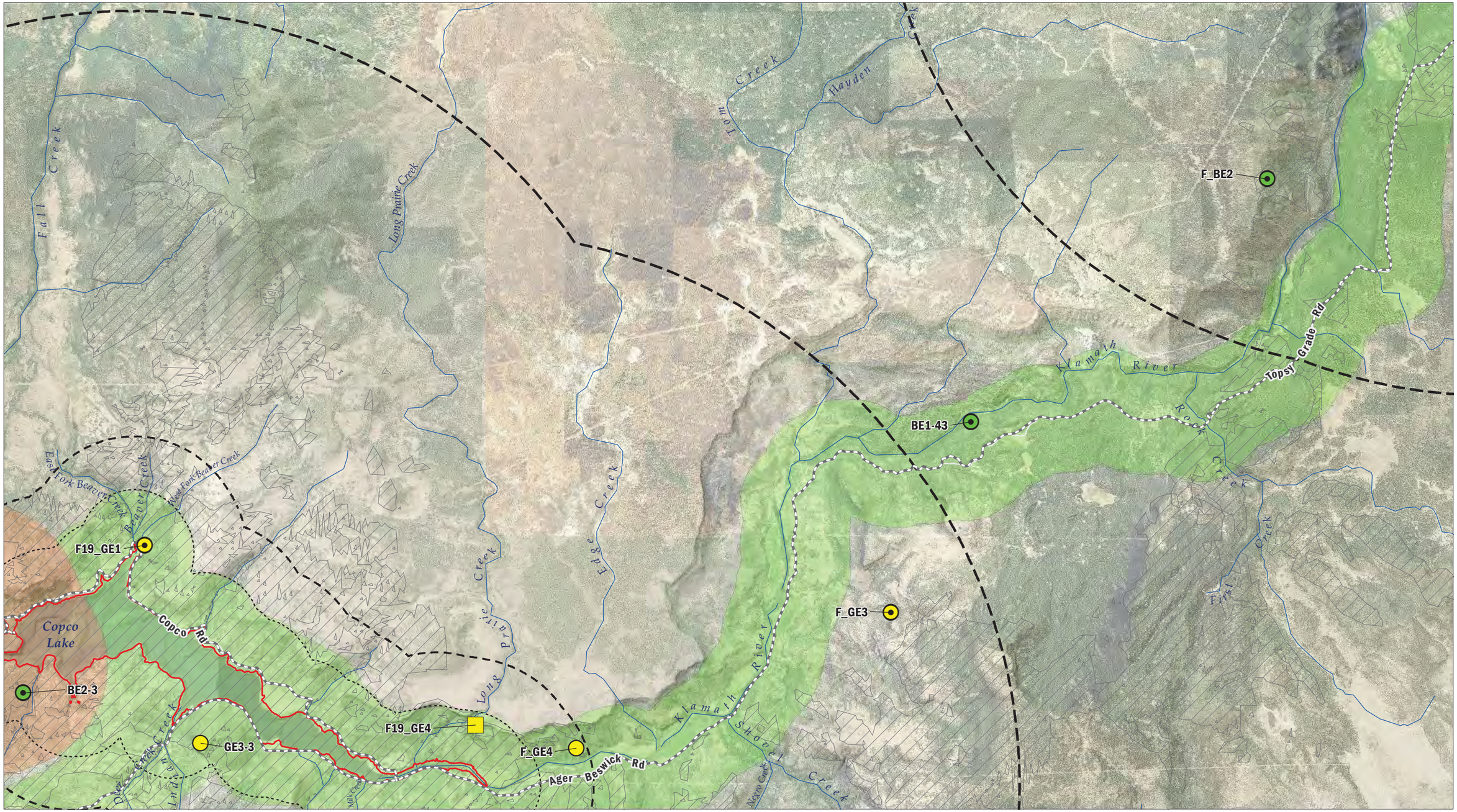
Project LOW Buffers
- 0.5 Miles
- 1 mile
- 5 miles
- 10 miles

Eagle Survey Points
- Active in 2018, Golden Eagle
- Active in 2019, Bald Eagle
- Active in 2019, Golden Eagle
- Inactive, Golden Eagle

FIGURE 2 - 3

Eagle Nest Surveys 2019

AECOM Oakland CA 2/26/2020 USER sally.shatford PATH \\Oakland.na.aecomnet.com\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\Eagles\EagleSurveys_AECOM2017-2019_CDM.mxd



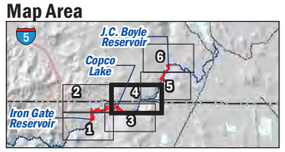
N

0 2
Miles

NAIP Imagery, 2014; AECOM, 2019

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project

Map Area



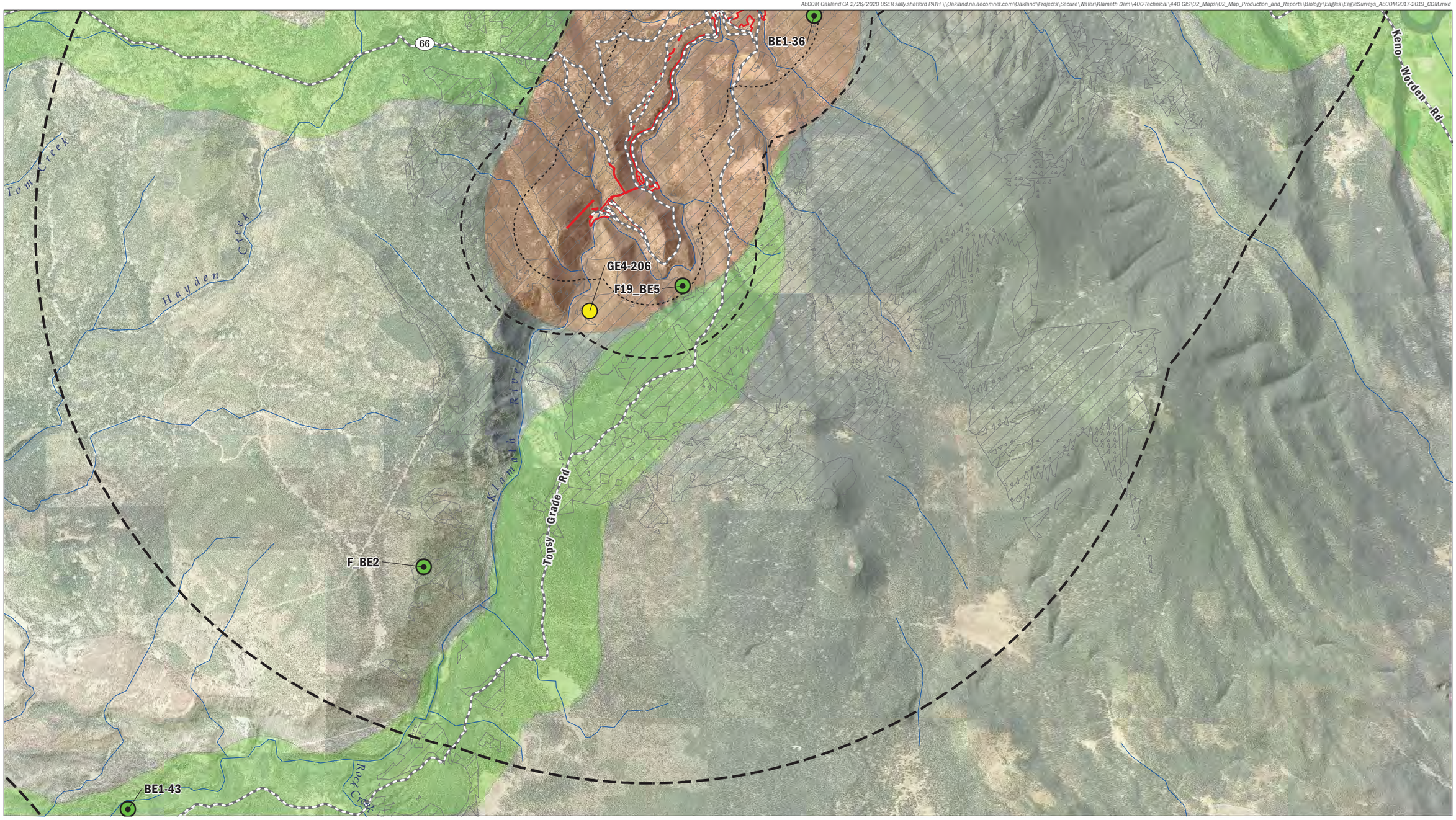
- Access Routes
- Limits of Work
- Viewshed from Limits of Work
- Low Impact Area
- High Impact Area

Project LOW Buffers
- 0.5 Miles
- 1 mile
- 5 miles
- 10 miles

Eagle Survey Points
- Active in 2018, Golden Eagle
- Active in 2019, Bald Eagle
- Active in 2019, Golden Eagle
- Inactive, Golden Eagle

FIGURE 2 - 4
Eagle Nest Surveys 2019

AECOM Oakland CA 2/26/2020 USER sally.shatford PATH \\Oakland.na.aecomnet.com\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\Eagles\EagleSurveys_AECOM2017-2019_CDM.mxd



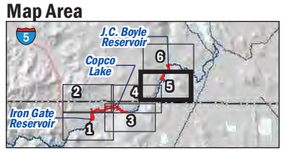
N

0 2
Miles

NAIP Imagery, 2014; AECOM, 2019

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project

Map Area



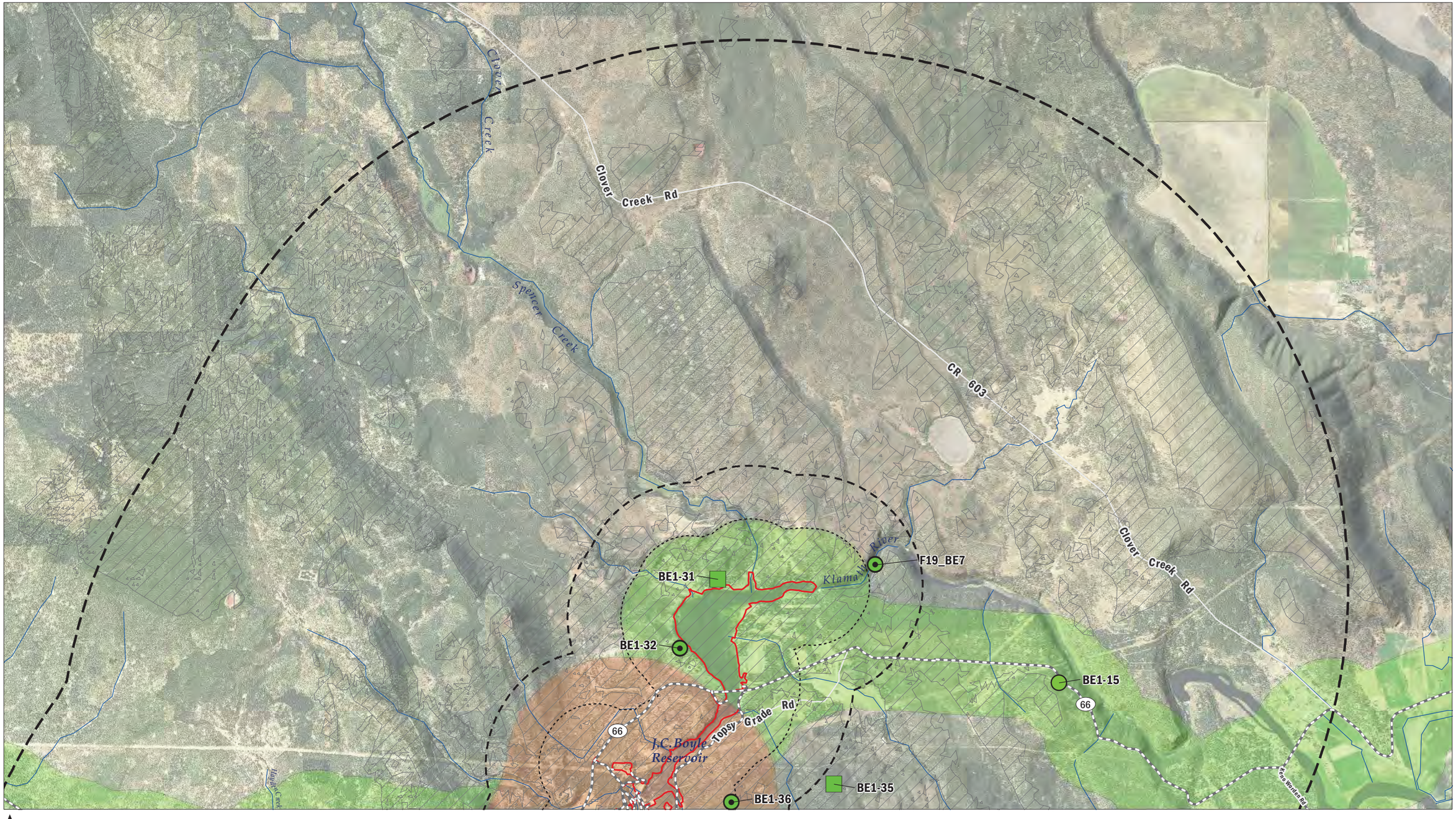
- Access Routes
- Limits of Work
- Viewshed from Limits of Work
- Low Impact Area
- High Impact Area

Project LOW Buffers
- 0.5 Miles
- 1 mile
- 5 miles
- 10 miles

Eagle Survey Points
- Active in 2018, Golden Eagle
- Active in 2019, Bald Eagle

FIGURE 2 - 5
Eagle Nest Surveys 2019

AECOM Oakland CA 2/26/2020 USER sally.shatford PATH \\Oakland.na.aecomnet.com\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\Eagles\EagleSurveys_AECOM2017-2019_CDM.mxd



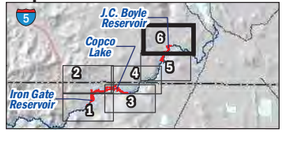
NAIP Imagery, 2014; AECOM, 2019

AECOM

Klamath River Renewal Corporation

Klamath River Renewal Project

Map Area



Access Routes
Limits of Work
Viewshed from Limits of Work

Low Impact Area
High Impact Area

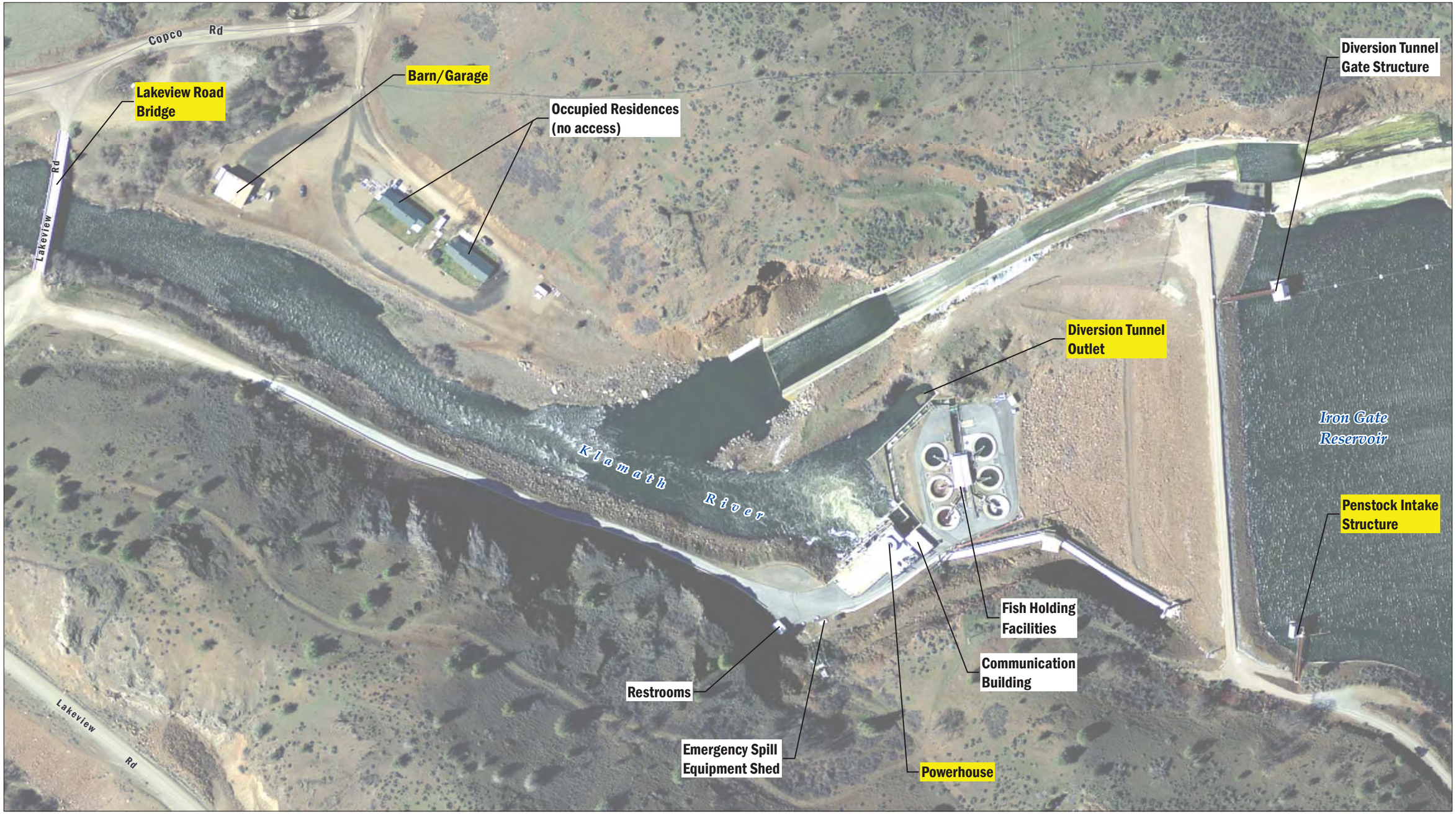
Project LOW Buffers
0.5 Miles
1 mile
5 miles
10 miles

Eagle Survey Points
Active in 2018, Bald Eagle
Active in 2019, Bald Eagle
Inactive, Bald Eagle

FIGURE 2 - 6

Eagle Nest Surveys 2019

AECOM Oakland CA 9/24/2019 USER sally.shatford PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\Bats\BatSurveys_2017-2019\Figure 7-1 Iron Gate.mxd



0 300
Feet

DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 9/24/2019

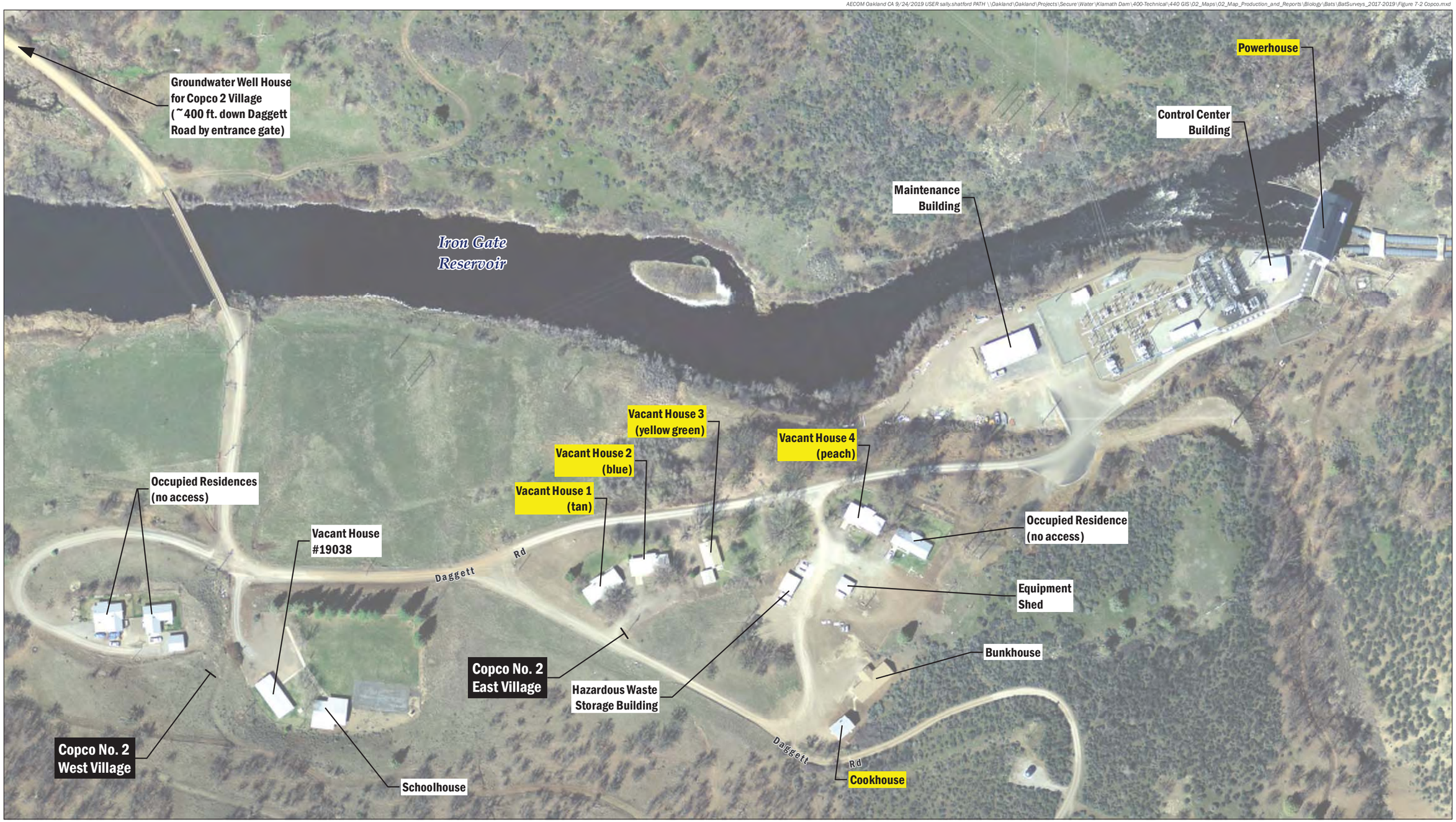
PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project

Map Location
Iron Gate Reservoir

Labels
- Active Bat Roost Confirmed
- Roosting Bats Not Found

FIGURE 3-1
2017-2019 Bat Surveys
Iron Gate Dam Area

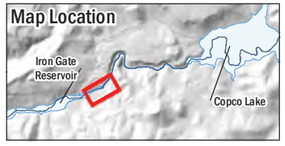


DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 9/24/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project



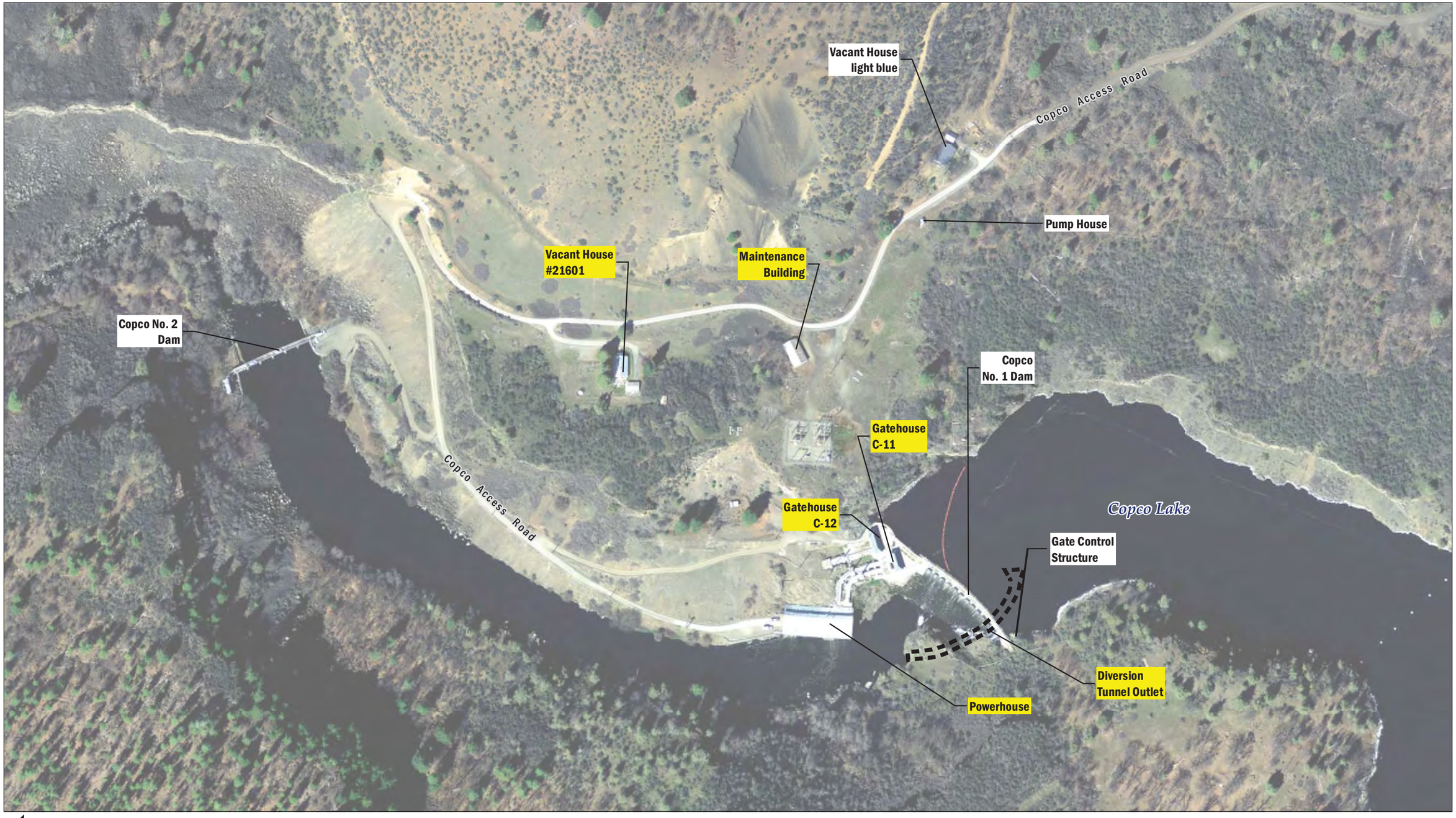
Labels

- Active Bat Roost Confirmed
- Roosting Bats Not Found

FIGURE 3-2

2017-2019 Bat Surveys
Copco No. 2 Powerhouse Area

AECOM Oakland CA 9/24/2019 USER sally.shatford PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\Bats\BatSurveys_2017-2019\Figure 7-3 Copco.mxd



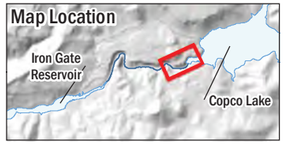
DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 9/24/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project

Map Location



Labels

- Active Bat Roost Confirmed
- Roosting Bats Not Found

FIGURE 3-3

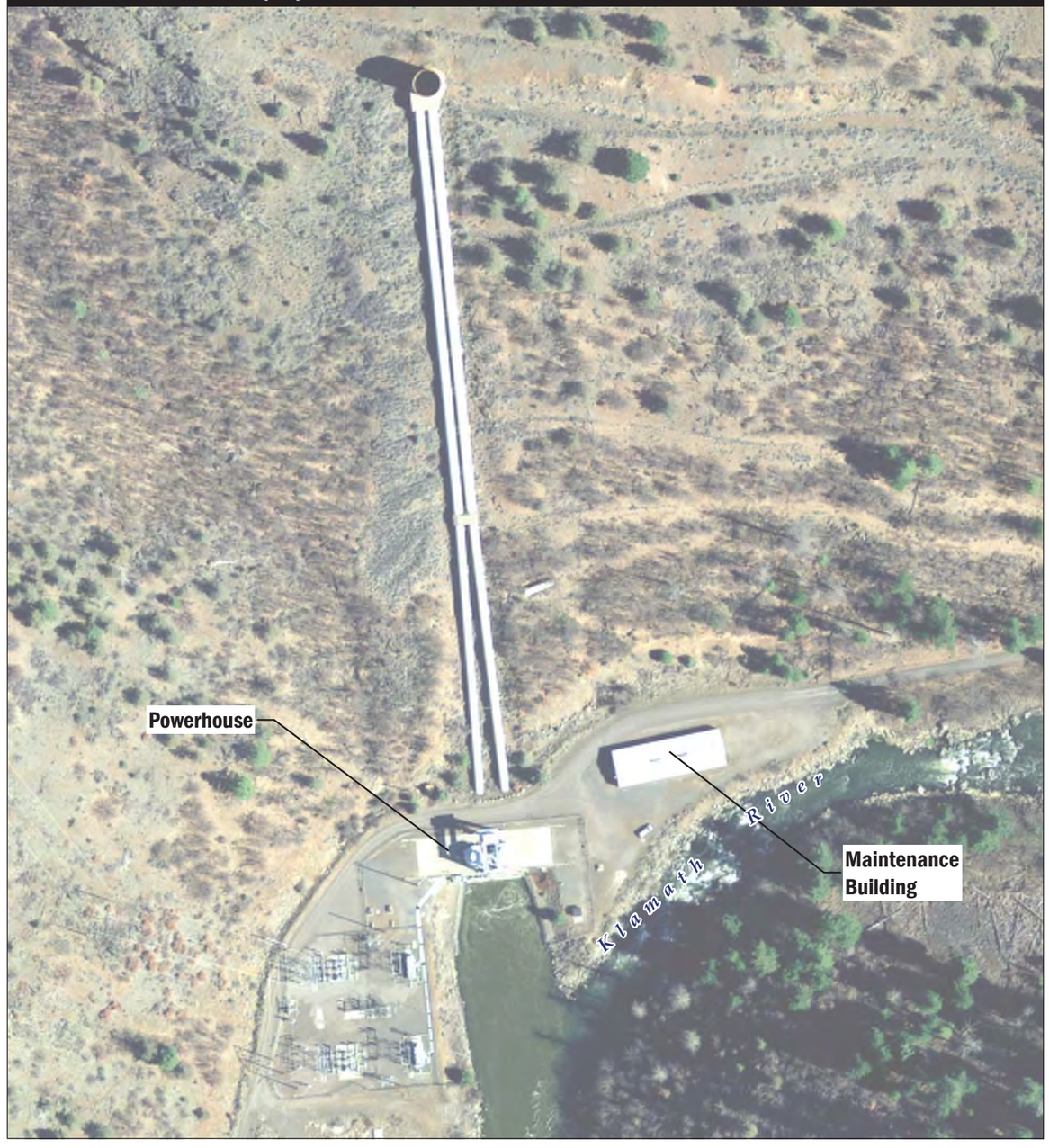
2017-2019 Bat Surveys
Copco No. 1 Dam Area and
Copco No. 2 Dam Area

AECOM Oakland CA 9/24/2019 USER sally.shatford PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\Bats\BatSurveys_2017-2019\Figure 7-4 JC Boyle.mxd

(I) FOREBAY AND SPILLWAY



(II) PENSTOCKS AND POWERHOUSE



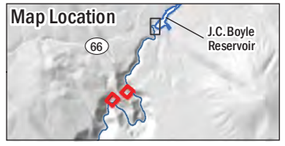
0 300
Feet

DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 9/24/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project

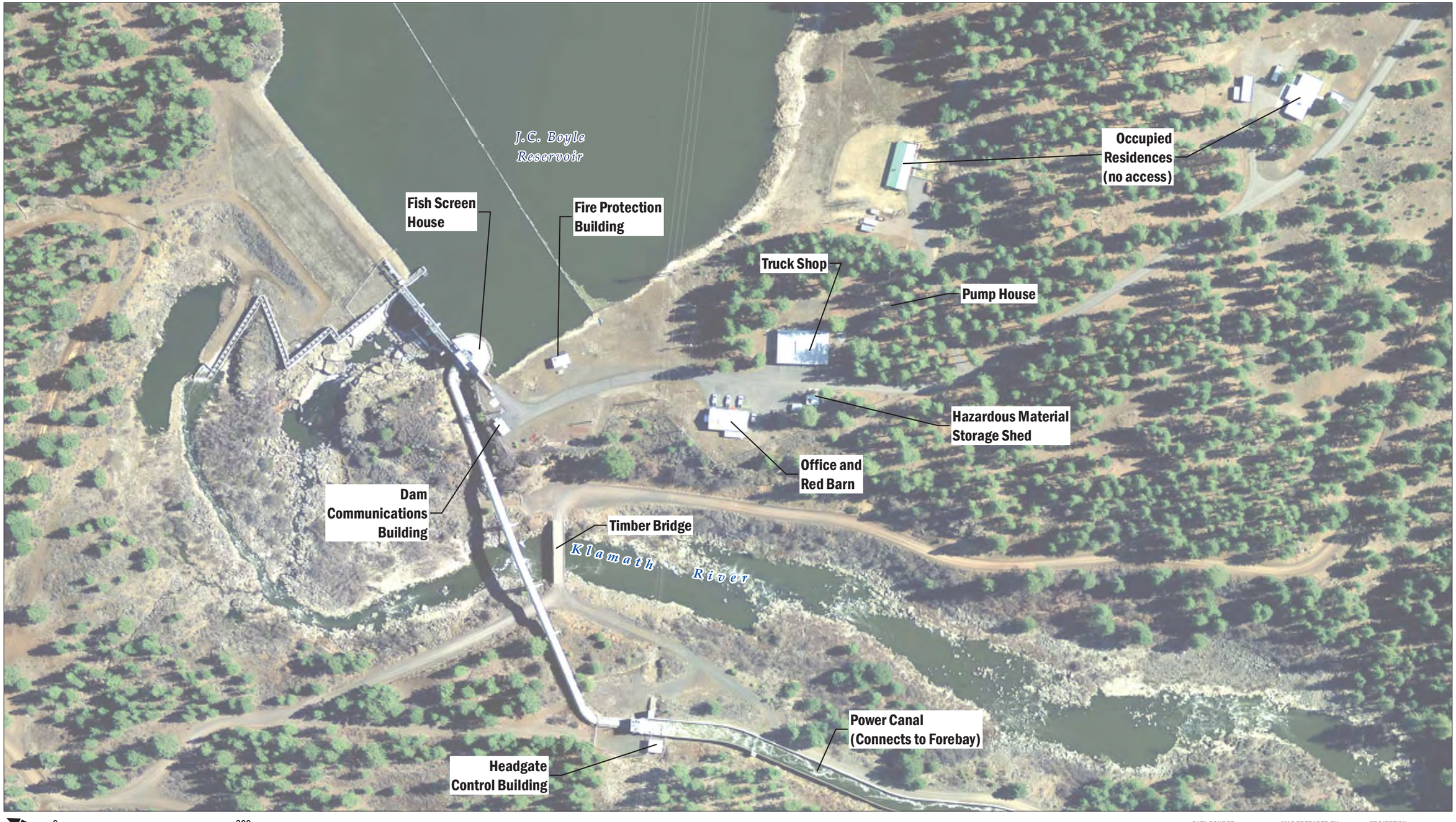
Map Location


Labels
- Active Bat Roost Confirmed
- Roosting Bats Not Found

FIGURE 3-4

2017-2019 Bat Surveys
J.C. Boyle Forebay and Spillway Area, Penstocks and Powerhouse Area

AECOM Oakland CA 9/24/2019 USER sally.shatford PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Biology\Bats\BatSurveys_2017-2019\Figure 7-5 JC Boyle.mxd



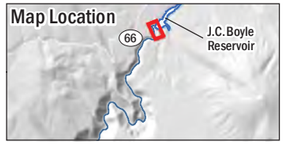
0 300
Feet

DATA SOURCE
NAIP, 2014; USGS (NED), 2015

MAP PREPARED BY:
AECOM Alex Remar, 9/24/2019

PROJECTION
NAD 1983 HARN StatePlane California I FIPS 0401 Feet

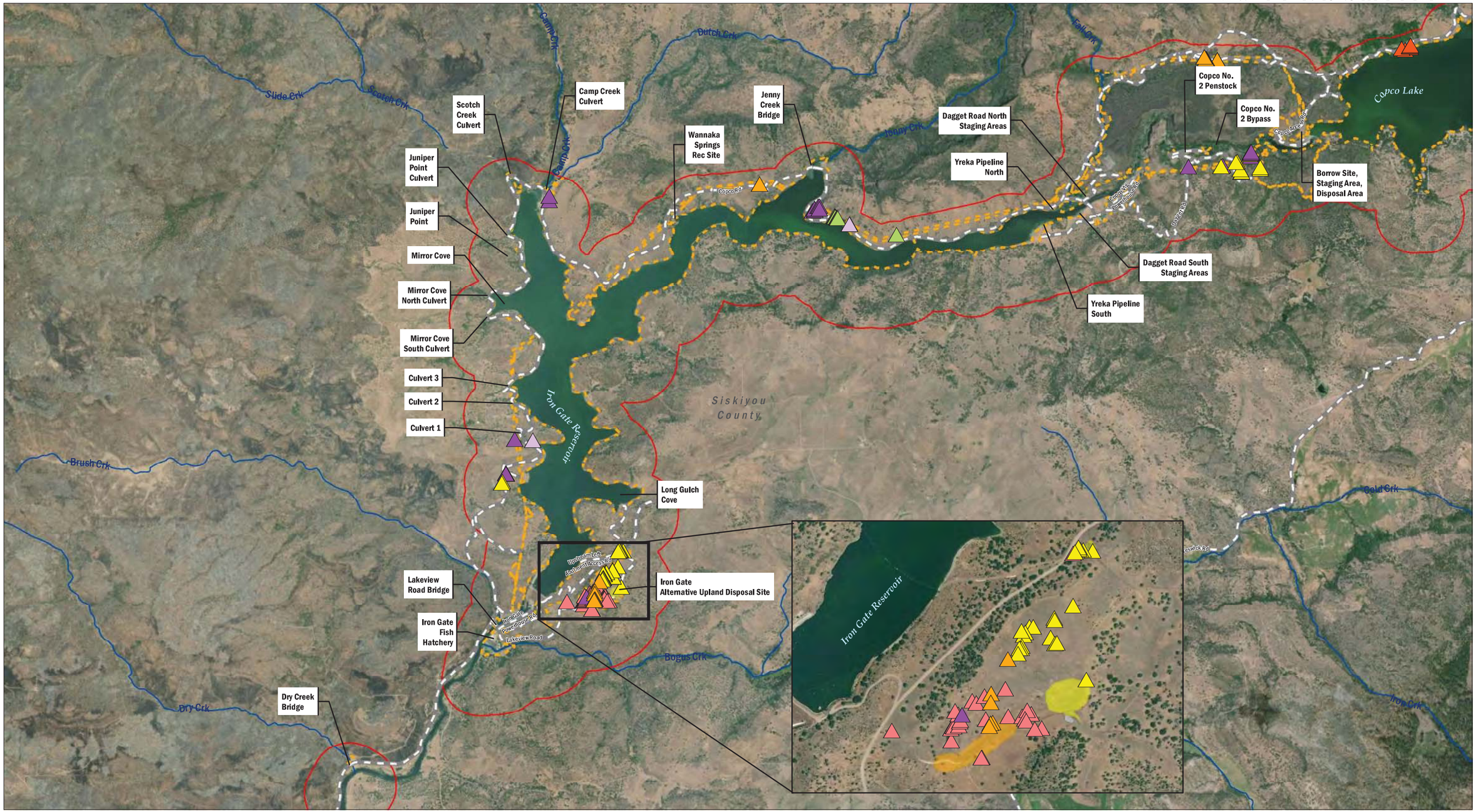
AECOM
Klamath River Renewal Corporation
Klamath River Renewal Project

Map Location


Labels
Roosting Bats Not Found

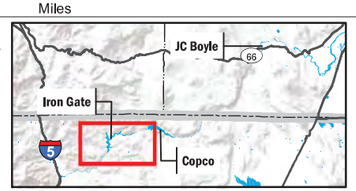
FIGURE 3-5
2017-2019 Bat Surveys
J.C. Boyle Dam Area

CDM Smith 2/19/2020 USER BANKSTONSE PATH C:\Users\bankstonse\Desktop\Klamath_2019_Annual_Report_Figures\Figure_5_1_Iron_Gate_SSP_2019_SB021920.mxd



Data Source: CDM Smith
Basemap Source: Esri, USGS, NOAA

Klamath River Renewal Corporation
Klamath River Renewal Project



Legend

- Limits of Work
- 0.25 Mile Study Area Buffer
- Access Route

Special Status Plants (Points)

- Bolander's sunflower
- Bristly sedge
- Calochortus sp.
- Detling's silverpuffs
- Fleshy sage
- Greene's four o'clock
- Greene's mariposa-lily
- Purple-flowered Washington lily

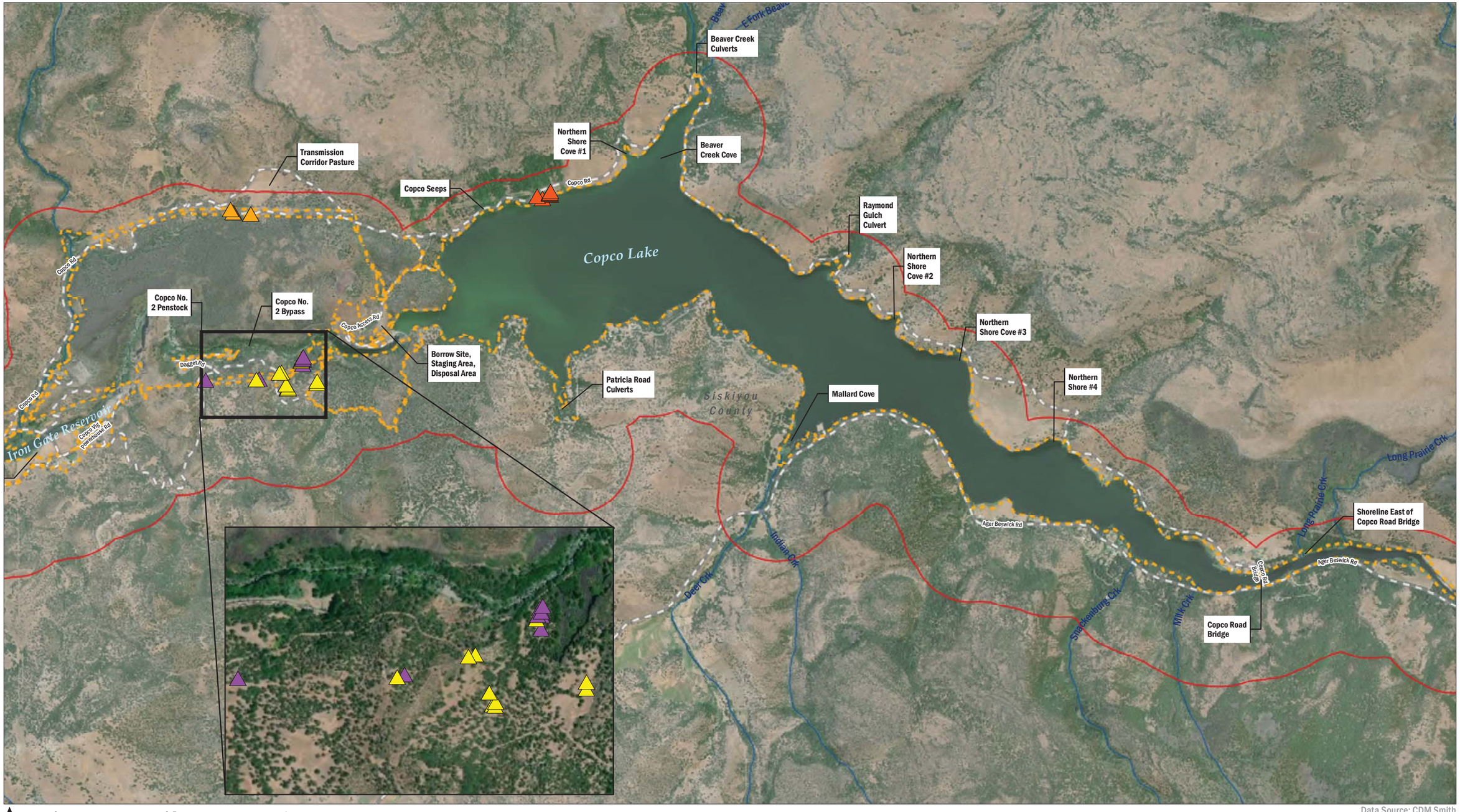
Special Status Plants (Polygons)

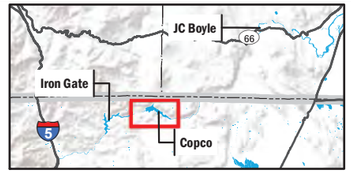
- Bolander's Sunflower
- Bristly Sedge
- Calochortus sp.
- Detling's Silverpuffs
- Fleshy Sage
- Greene's mariposa-lily
- Western Yampah

FIGURE 5-1

2019 Special Status Plants
Iron Gate Reservoir

CDM Smith 10/14/2019 USER Bateska PATH F:\Klamath_River\2019\MXDs\Klamath_2019_Annual_Report_Figures\Figure_5_2_Copco_SSP_2019.mxd





Legend

- Limits of Work
- Access Route
- 0.25 Mile Study Area Buffer

Special Status Plants (Points)

- Bolander's sunflower
- Bristly sedge
- Calochortus sp.
- Detling's silverpuffs
- Fleshy sage
- Greene's four o'clock
- Greene's mariposa-lily
- Purple-flowered Washington lily

Special Status Plants (Polygons)

- Bolander's Sunflower
- Bristly Sedge
- Calochortus sp.
- Detling's Silverpuffs
- Fleshy Sage
- Greene's mariposa-lily
- Western Yampah

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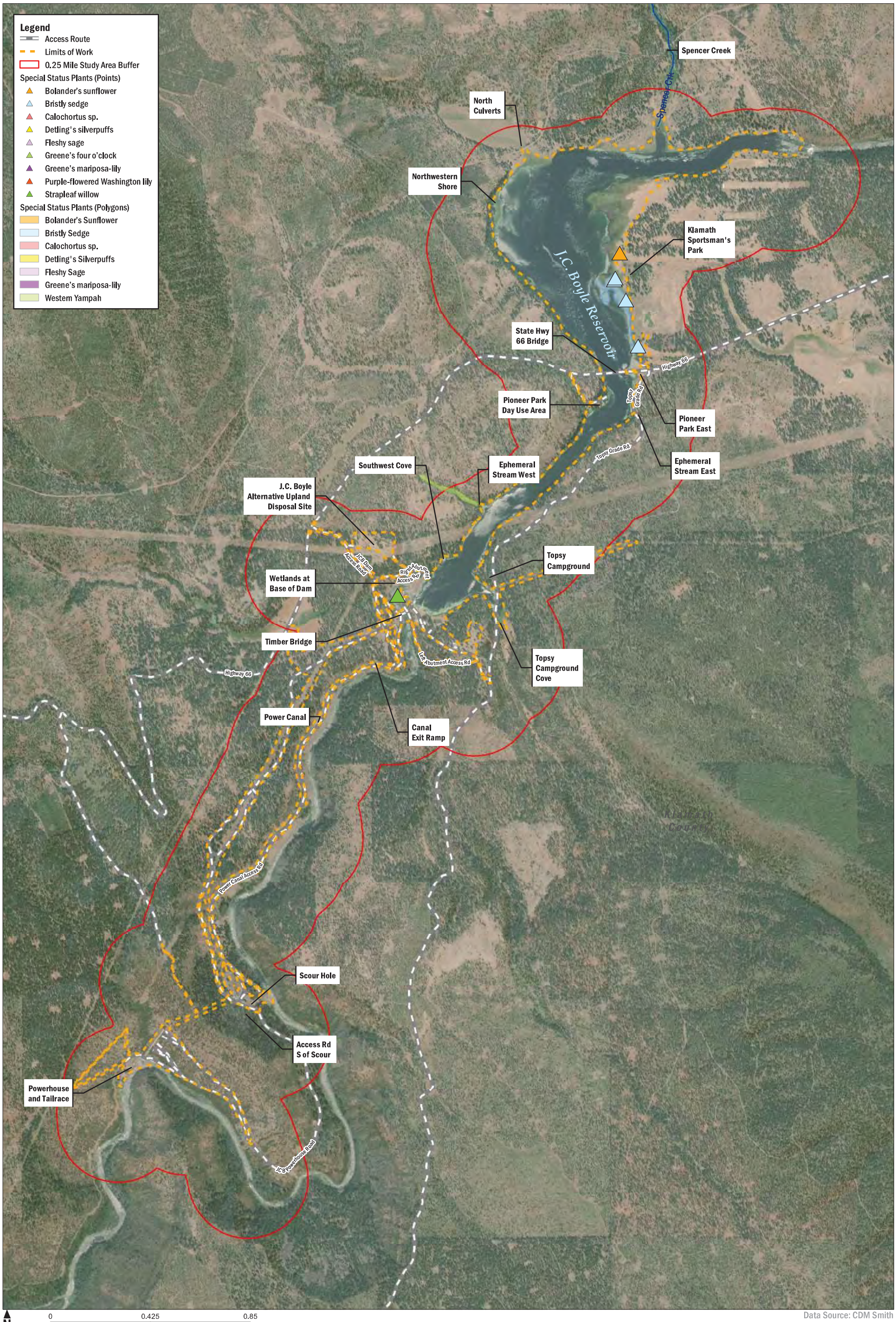
FIGURE 5-2

2019 Special Status Plants
Copco Lake

CDM Smith 2/19/2020 USER BANKSTONSE PATH C:\Users\bankstonse\Desktop\Klamath_2019_Annual_Report_Figures\Figure_5_3_SSP_2019_SB021920.mxd



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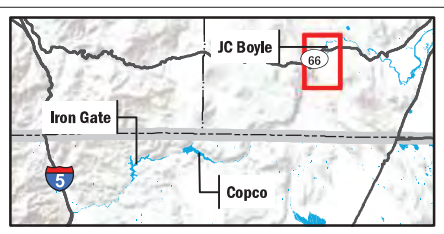


FIGURE 5-3

2019 Special Status Plants
J.C. Boyle Reservoir

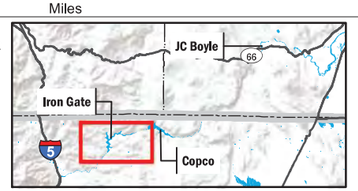
CDM Smith 2/19/2020 USER BANKSTONSE PATH C:\Users\bankstonse\Desktop\Klamath_2019_Annual_Report_Figures\Figure_6_1_Iron_Gate_Wetlands_2019_SB021920.mxd

Slide Crk
Scotch Crk
Camp Crk
Camp Crk
Dutch Crk
Fall Crk
Jenny Crk
Copco Lake
Brush Crk
Cold Crk
Bullhead Crk
Bogus Crk
Dry Crk
Iron Crk
Siskiyou County
Iron Gate Reservoir

Scotch Creek Culvert
Camp Creek Culvert
Jenny Creek Bridge
Wannaka Springs Rec Site
Dagget Road North Staging Areas
Yreka Pipeline North
Juniper Point Culvert
Juniper Point
Mirror Cove
Mirror Cove North Culvert
Mirror Cove South Culvert
Culvert 3
Culvert 2
Culvert 1
Dagget Road South Staging Areas
Yreka Pipeline South
Long Gulch Cove
Lakeview Road Bridge
Iron Gate Alternative Upland Disposal Site
Dry Creek Bridge

N
0 1 2
Miles

Data Source: CDM Smith
Basemap Source: Esri, USGS, NOAA



Legend

- Limits of Work
- Access Route
- Ephemeral Stream
- Intermittent Stream
- Stream Channel

Wetland Designation

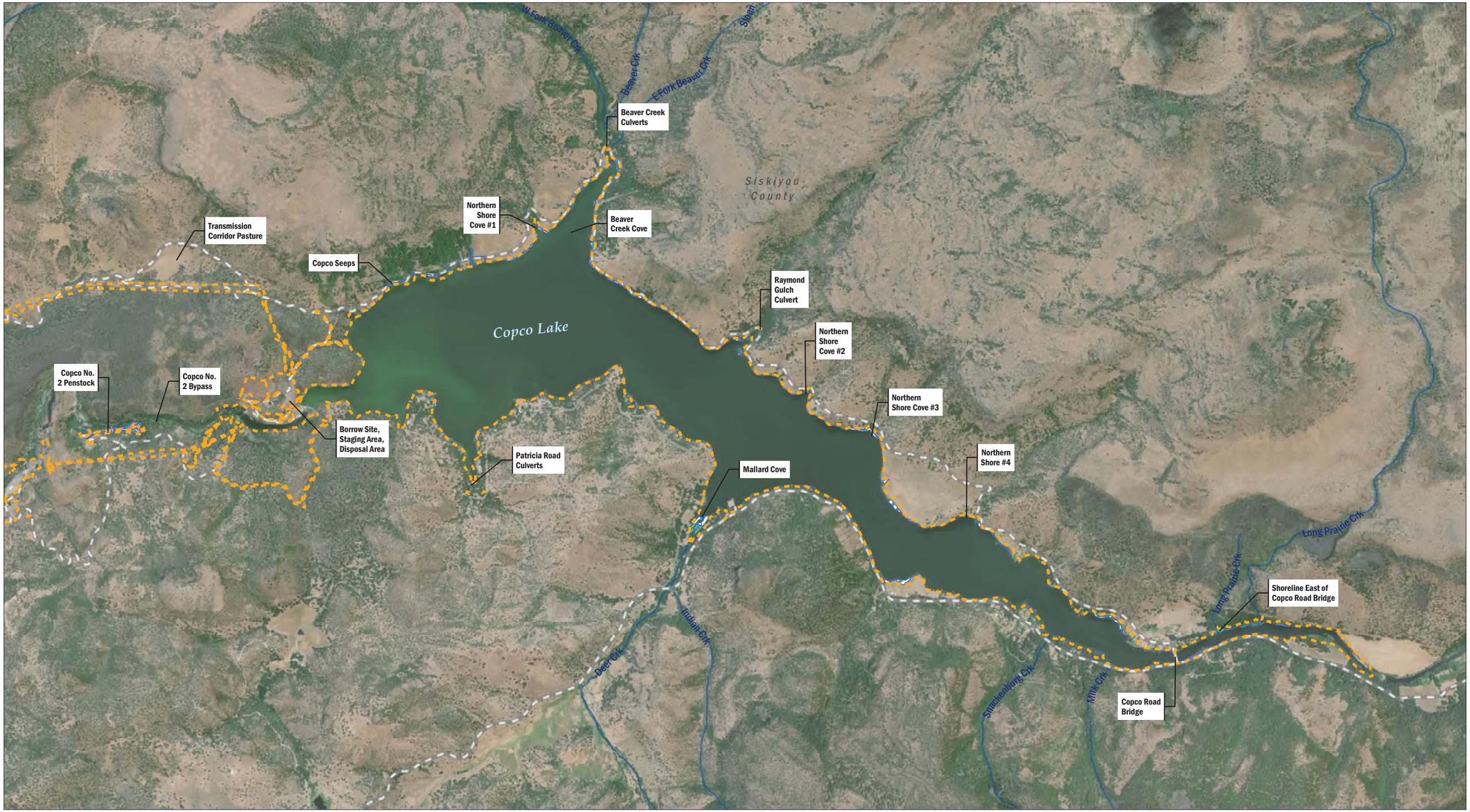
- Reservoir Dependent
- Non-Reservoir Dependent

Klamath River Renewal Corporation
Klamath River Renewal Project

FIGURE 6-1

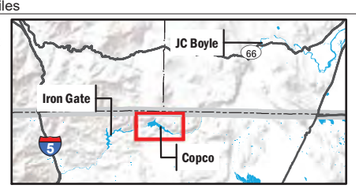
2019 Wetland Surveys
Iron Gate Reservoir

CDM Smith 10/14/2019 USER Bateska PATH F:\Klamath_River\2019\MXDs\Klamath_2019_Annual_Report_Figures\Figure_6_2_Copco_Wetlands_2019.mxd



Data Source: CDM Smith
Basemap Source: Esri, USGS, NOAA

Klamath River Renewal Corporation
Klamath River Renewal Project



Legend
- Access Route

Wetland Designation
- Reservoir Dependent
- Non-Reservoir Dependent
- Infrastructure Dependent

FIGURE 6-2
2019 Wetland Surveys
Copco Lake

CDM Smith 2/19/2020 USER BANKSTONSE PATH C:\Users\bankstonse\Desktop\Klamath_2019_Annual_Report_Figures\Figure_6_3_JC_Boyle_Wetlands_2019_SB021920.mxd

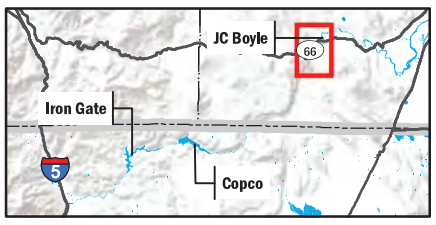
Spencer Creek
Spencer Creek
North Culverts
Northwestern Shore
J.C. Boyle Reservoir
Klamath Sportsman's Park
State Hwy 66 Bridge
Highway 66
Pioneer Park Day Use Area
Topsy Grade Rd
Pioneer Park East
Topsy Grade Rd
Ephemeral Stream East
Southwest Cove
Ephemeral Stream West
J.C. Boyle Alternative Upland Disposal Site
JCB Dam Access Road
Disposal Access Rd
Topsy Campground
Wetlands at Base of Dam
Timber Bridge
Topsy Campground Cove
Highway 66
Power Canal Access Rd
Power Canal
Canal Exit Ramp
Klamath County
Scour Hole
Access Rd S of Scour
Powerhouse and Tailrace
JCB Powerhouse Road

N

0 0.425 0.85
Miles

Data Source: CDM Smith
Basemap Source: Esri, USGS, NOAA

Klamath River Renewal Corporation
Klamath River Renewal Project



Legend

- Access Route
- Stream Channel
- Limits of Work

Wetland Designation

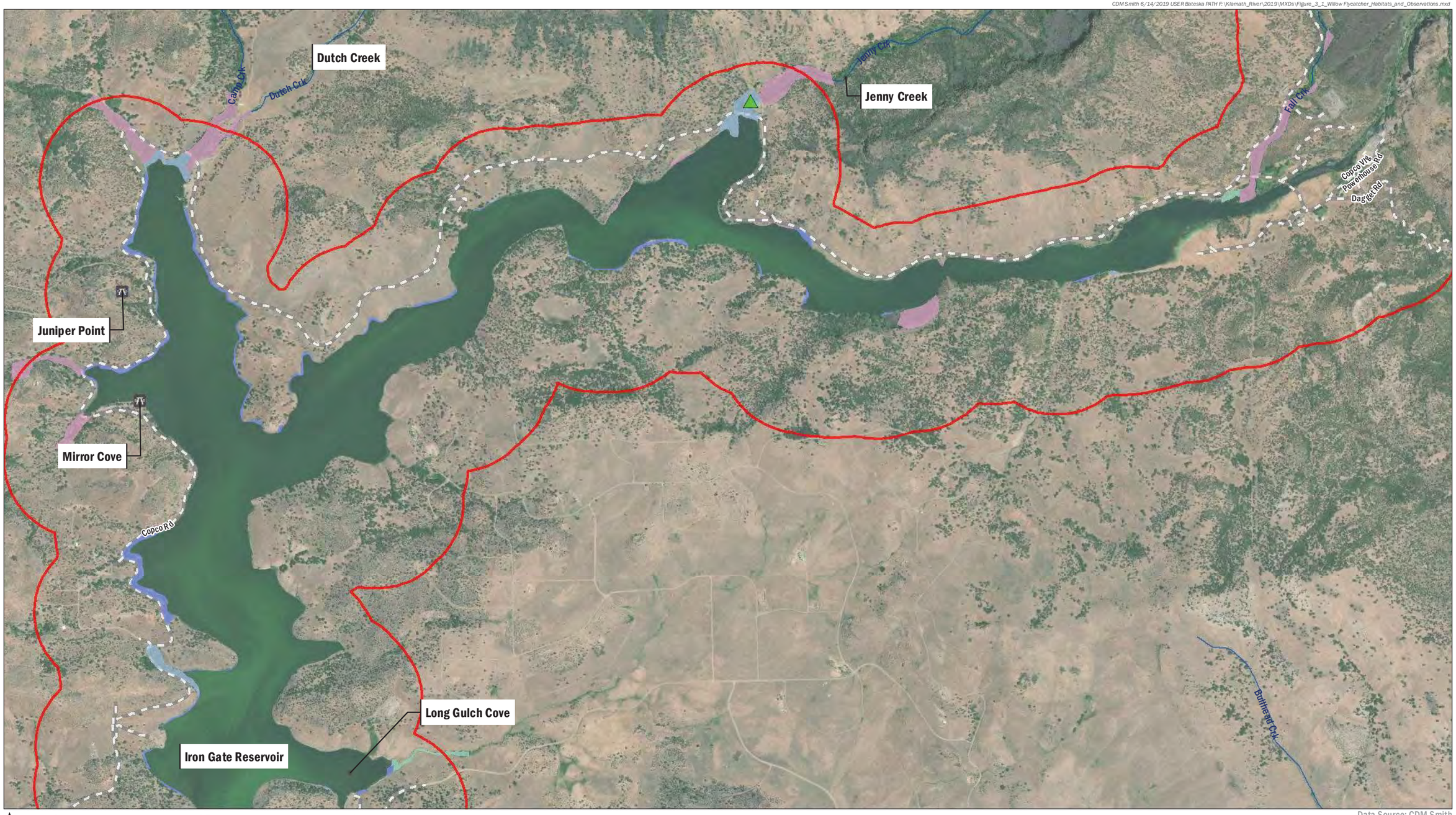
- Reservoir Dependent
- Non-Reservoir Dependent

FIGURE 6-3

2019 Wetland Surveys
J.C. Boyle Reservoir

Appendix B Revised Figures from 2018 Report

CDM Smith 6/14/2019 USER Bateska PATH F:\Klamath_River\2019\MXDs\Figure_3_1_Willow Flycatcher_Habitats_and_Observations.mxd



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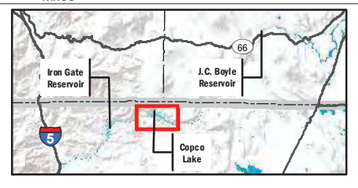
Basemap Source: Esri, USGS, NOAA



Willow Flycatcher Observation

Willow Flycatcher Habitat
- Bigleaf maple forest
- Sandbar willow thicket
- Oregon ash grove
- Shining willow grove
- Willow thickets

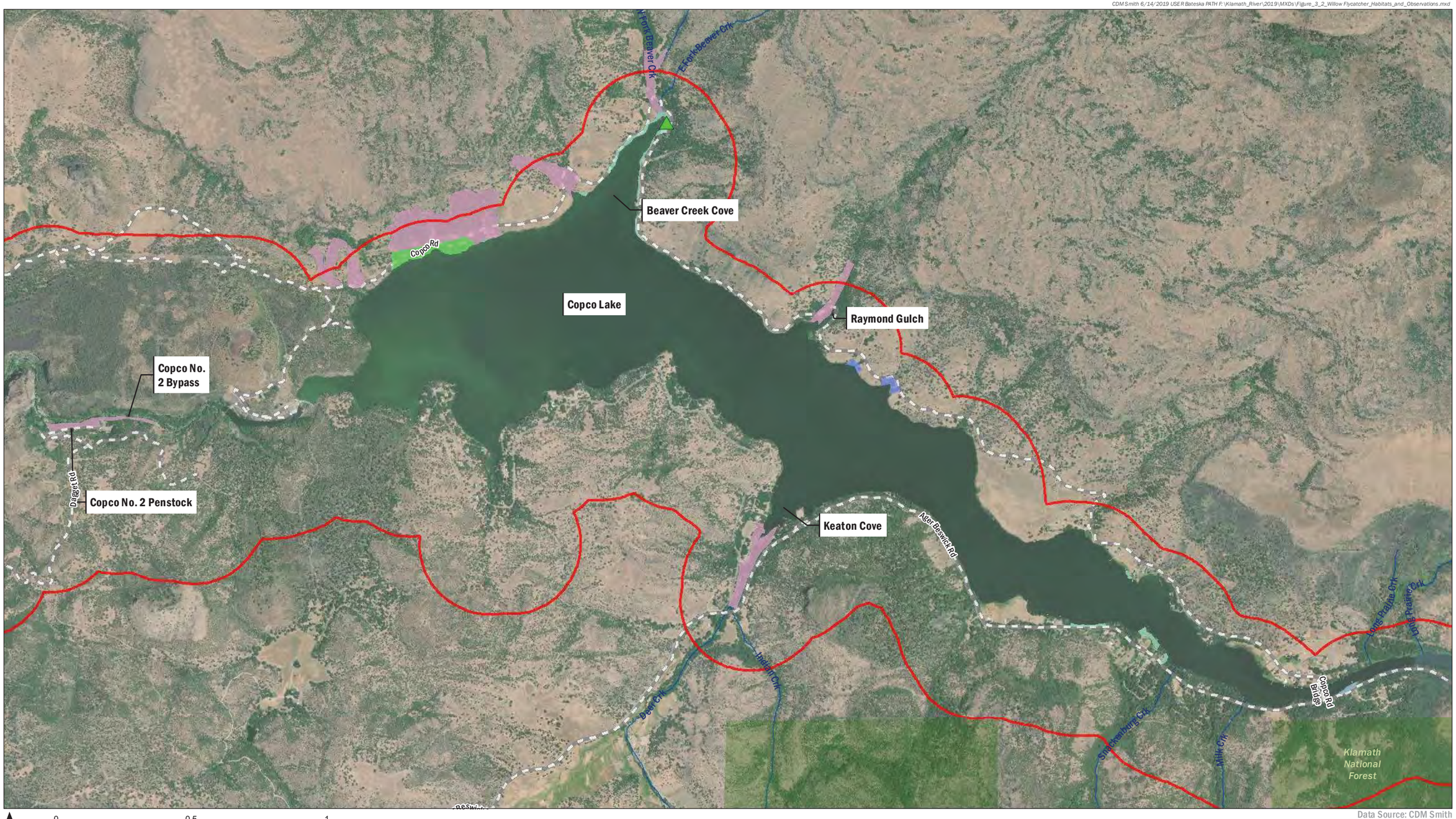
- State
- County
- Stream
- Access Route
- 0.25 Mile Study Area Buffer

Klamath River Renewal Corporation
Klamath River Renewal Project

FIGURE 3-1

2018 Willow Flycatcher Habitat and Observations
Iron Gate Reservoir

CDM Smith 6/14/2019 USER Bateska PATH F:\Klamath_River\2019\MXDs\Figure_3_2_Willow Flycatcher_Habitats_and_Observations.mxd



Data Source: CDM Smith
Basemap Source: Esri, USGS, NOAA

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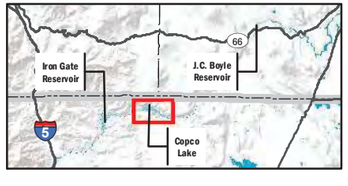


- Willow Flycatcher Observation

Willow Flycatcher Habitat
- Bigleaf maple forest
- Sandbar willow thicket
- Oregon ash grove
- Shining willow grove
- Willow thickets

- State
- County
- Stream
- Access Route
- 0.25 Mile Study Area Buffer

FIGURE 3-2

2018 Willow Flycatcher Habitat and Observations
Copco Lake

AECOM Oakland CA 6/13/2019 USER Bateska PATH F:\Klamath_River\2019\MXDs\Figure_3_3_Willow Flycatcher_Habitats_and_Observations.mxd



N

0 0.5

Miles

Data Source: CDM Smith
Basemap Source: Esri, USGS, NOAA

Klamath River Renewal Corporation
Klamath River Renewal Project

Willow Flycatcher Observation

Willow Flycatcher Habitat
- Bigleaf maple forest
- Sandbar willow thicket
- Oregon ash grove
- Shining willow grove
- Willow thickets

- State
- County
- Stream
- 0.25 Mile Study Area Buffer
- Access Route

FIGURE 3-3

2018 Willow Flycatcher Habitat and Observations
J.C. Boyle Reservoir and Canal

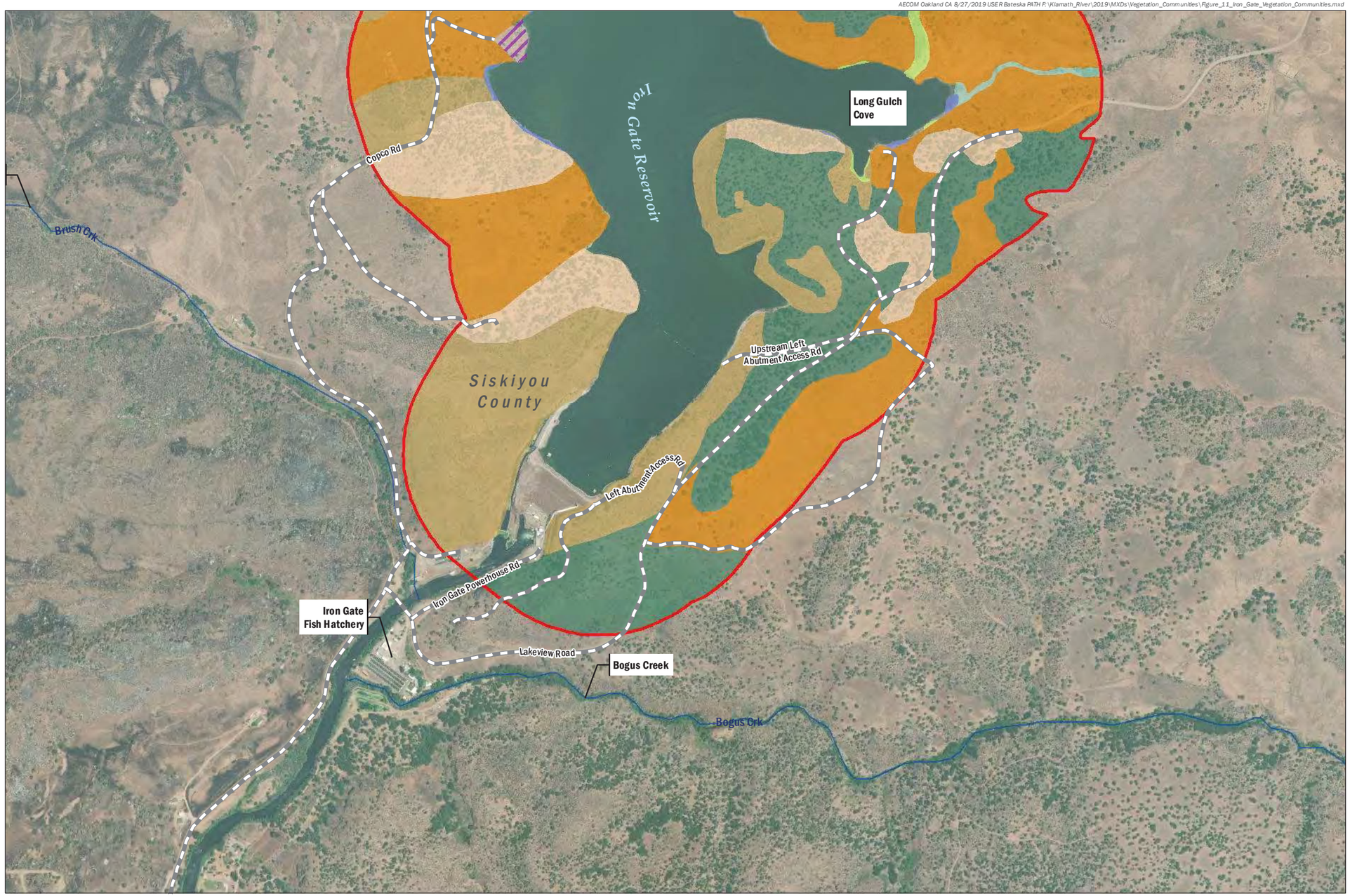
AECOM Oakland CA 8/27/2019 USER:Bateska PATH:F:\Klamath_River\2019\MXDs\Vegetation_Communities\Figure_11_Iron_Gate_Vegetation_Communities.mxd

LEGEND

- Access Route
- State
- County
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Sandbar willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thicket
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



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Miles

Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

Klamath River Renewal Corporation

Klamath River Renewal Project

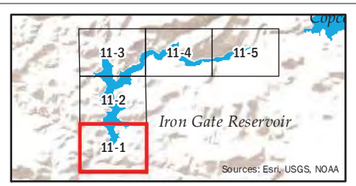


FIGURE 11-1

Vegetation Communities
Iron Gate Reservoir

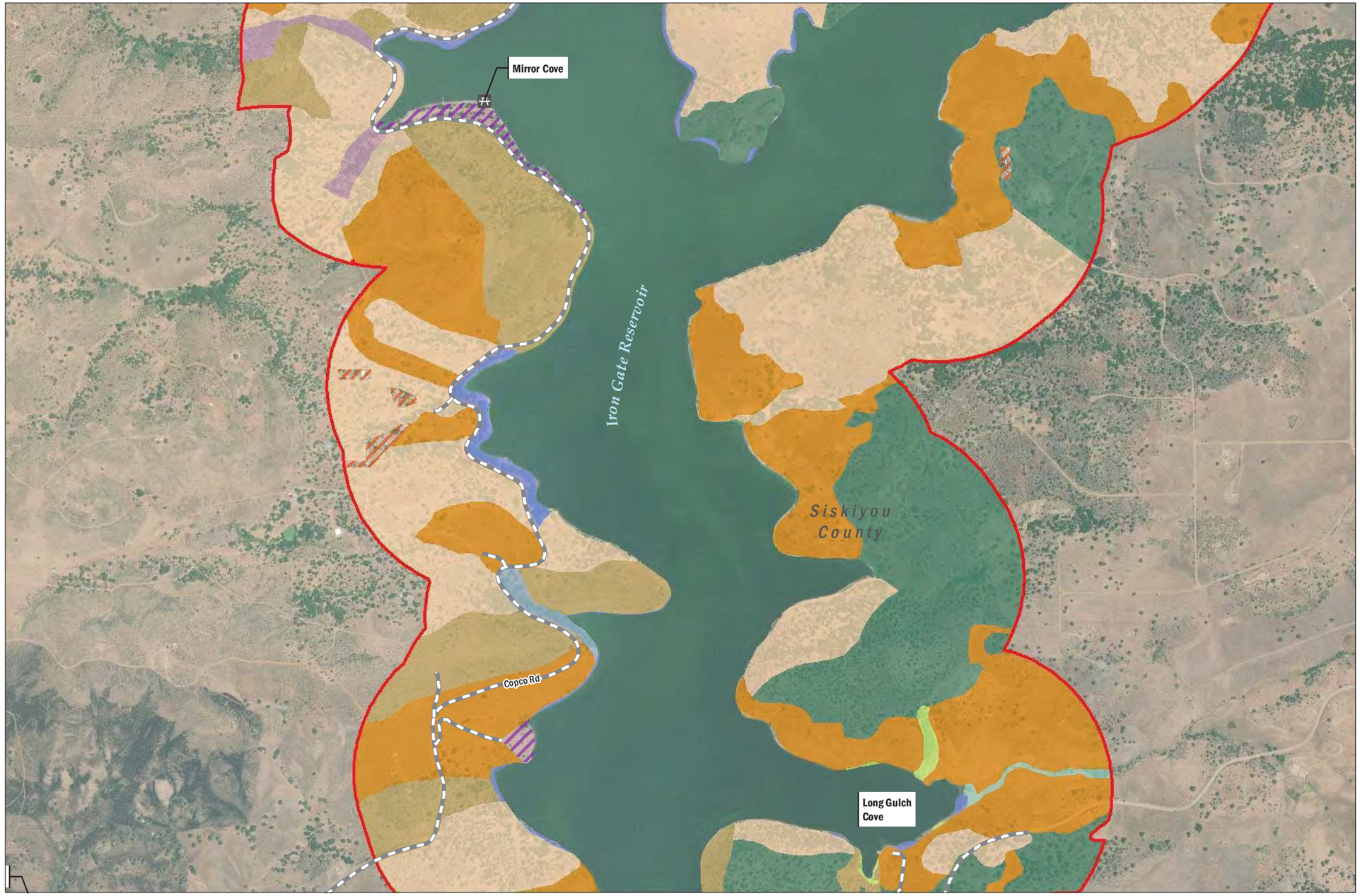
AECOM Oakland CA 8/27/2019 USER Bateska PATH F:\Klamath_River\2019\MXDs\Vegetation_Communities\Figure_11_Iron_Gate_Vegetation_Communities.mxd

LEGEND

- Access Route
- State
- County
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Sandbar willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



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Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

Klamath River Renewal Corporation
Klamath River Renewal Project

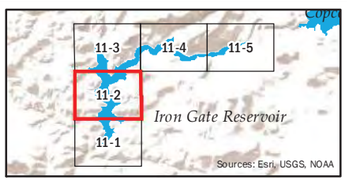


FIGURE 11-2

Vegetation Communities
Iron Gate Reservoir

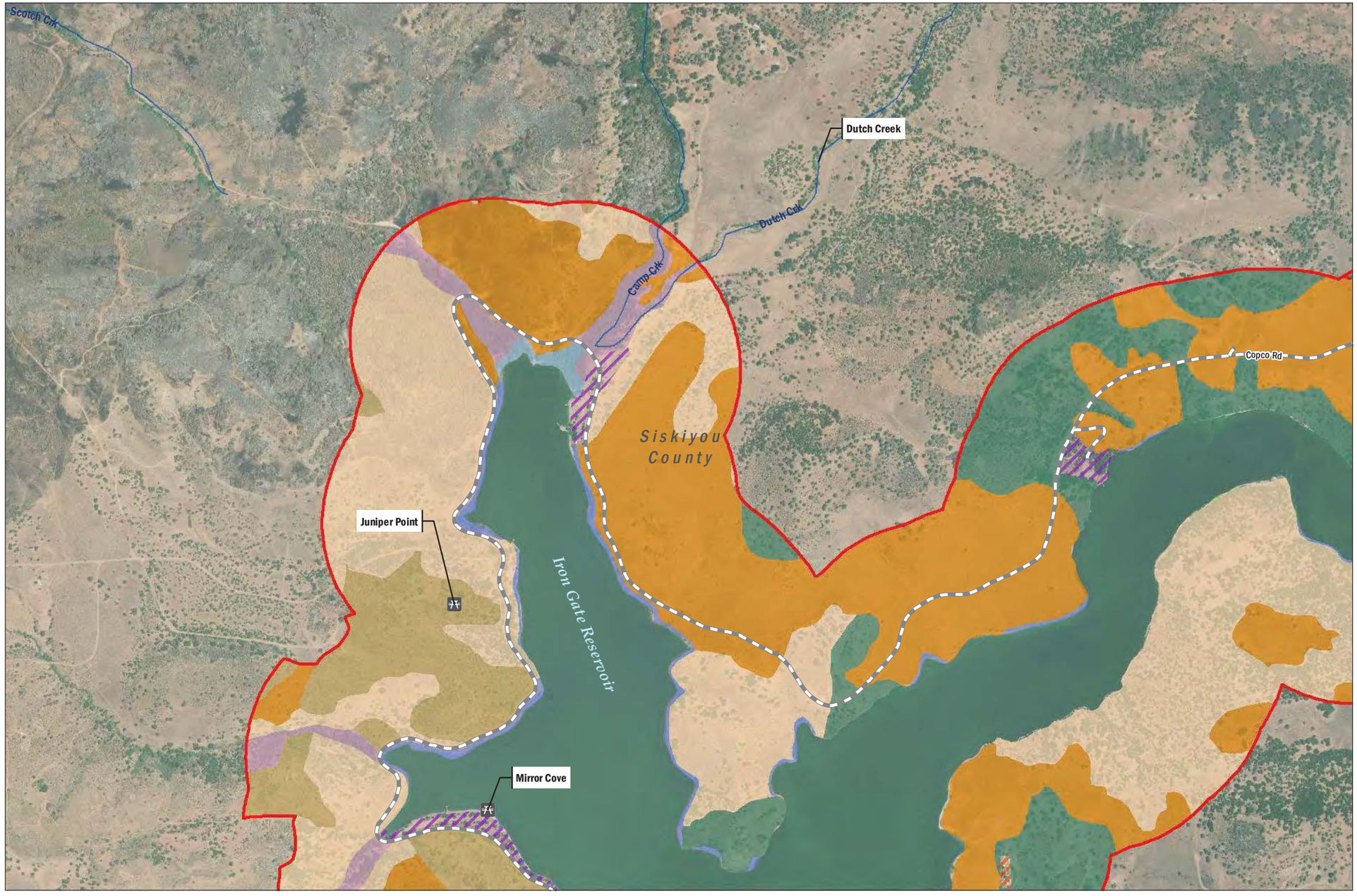
AECOM Oakland CA 8/27/2019 USER:Bateska PATH:F:\Klamath_River\2019\MXDs\Vegetation_Communities\Figure_11_Iron_Gate_Vegetation_Communities.mxd

LEGEND

- Access Route
- State
- County
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Sandbar willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



N

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Klamath River Renewal Corporation
Klamath River Renewal Project

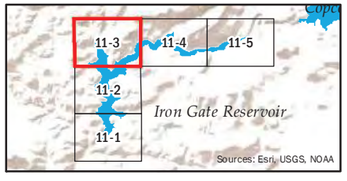


FIGURE 11-3

Vegetation Communities
Iron Gate Reservoir

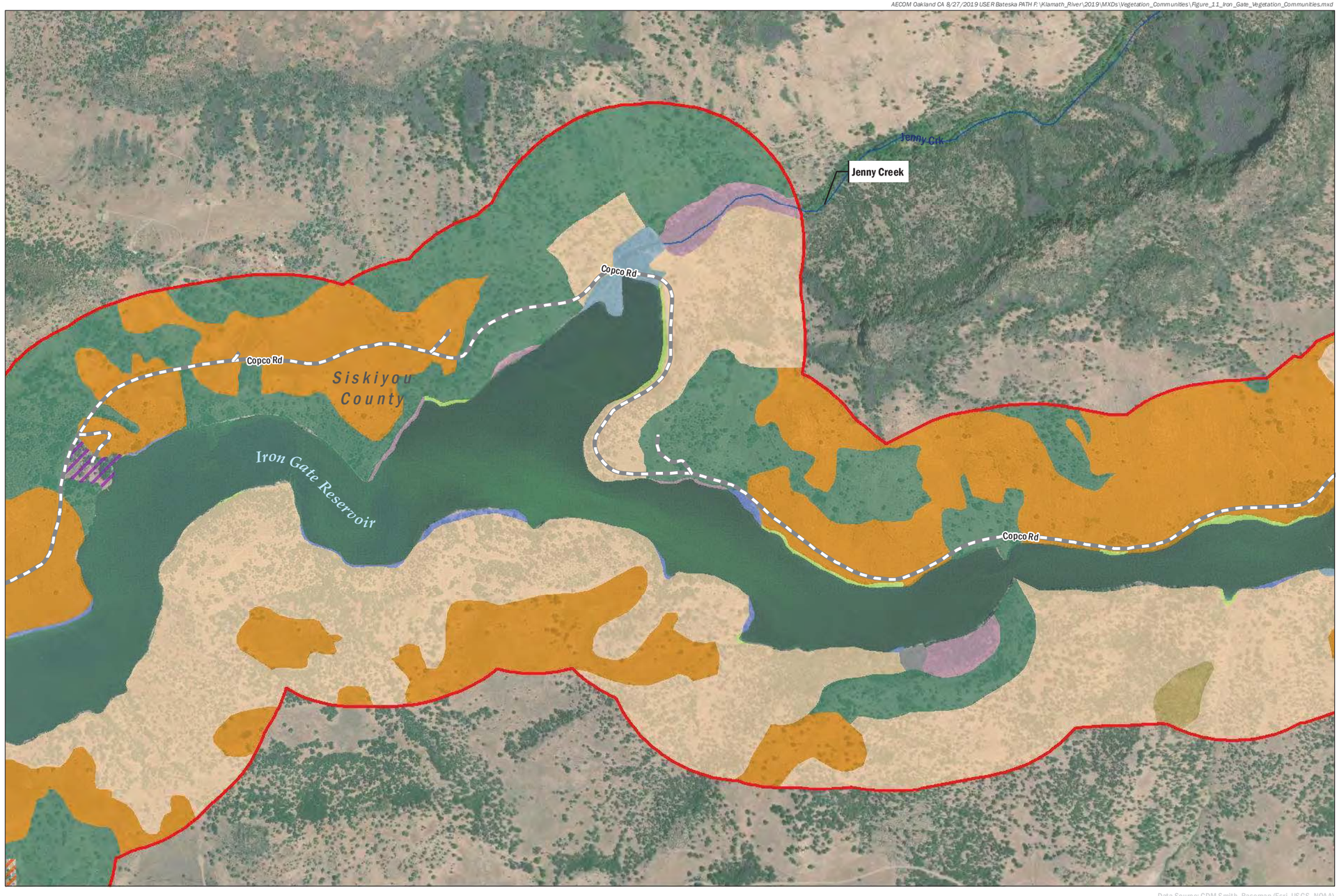
AECOM Oakland CA 8/27/2019 USER Bateska PATH F:\Klamath_River\2019\MXDs\Vegetation_Communities\Figure_11_Iron_Gate_Vegetation_Communities.mxd

LEGEND

- Access Route
- State
- County
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Sandbar willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



N

0 0.5

Miles

Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

Klamath River Renewal Corporation

Klamath River Renewal Project

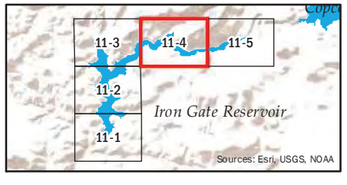


FIGURE 11-4

Vegetation Communities

Iron Gate Reservoir

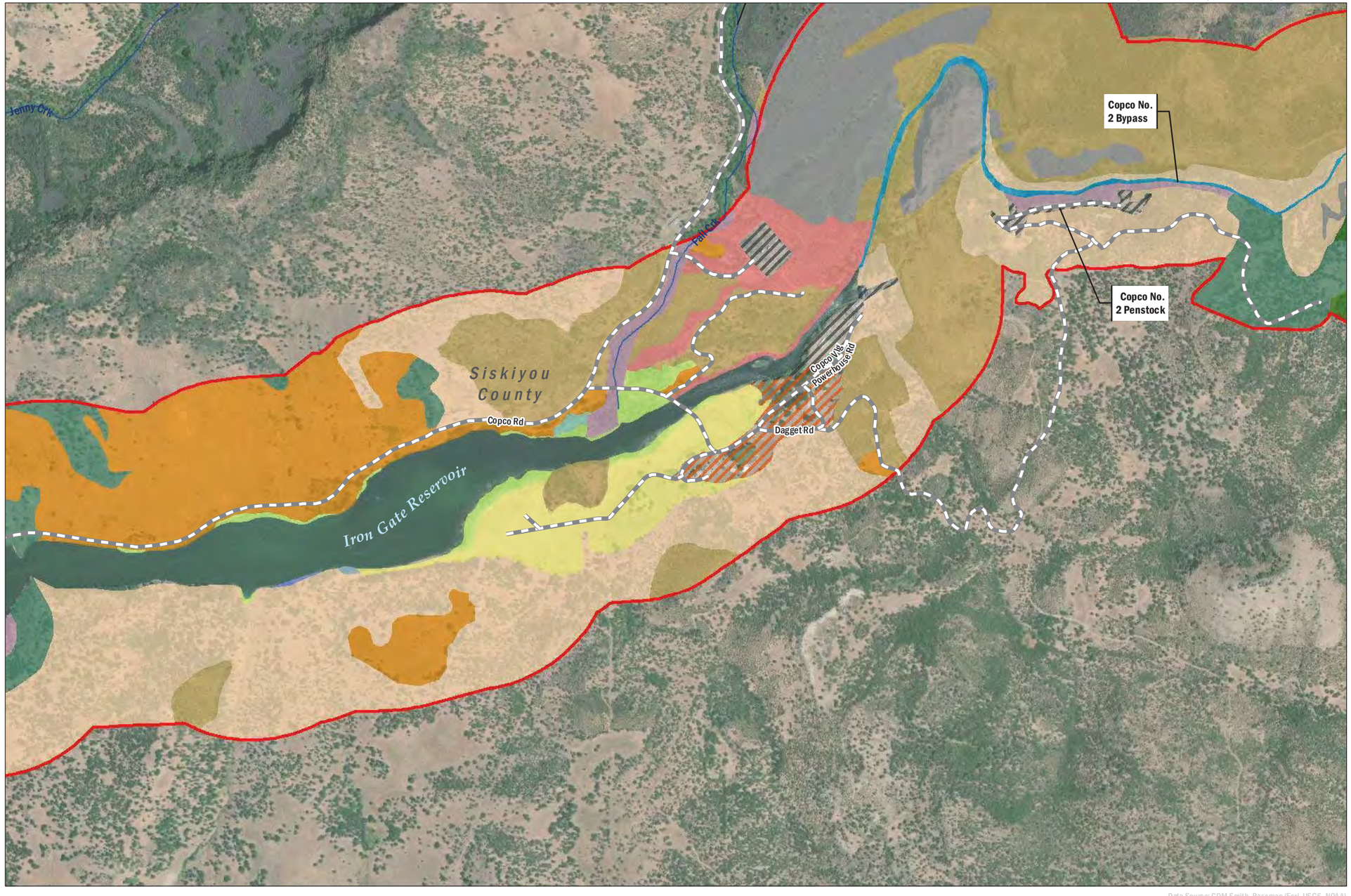
AECOM Oakland CA 8/27/2019 USER Bateska PATH F:\Klamath_River\2019\MXDs\Vegetation_Communities\Figure_11_Iron_Gate_Vegetation_Communities.mxd

LEGEND

- Access Route
- State
- County
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Sandbar willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



N

0 0.5 Miles

Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

Klamath River Renewal Corporation
Klamath River Renewal Project

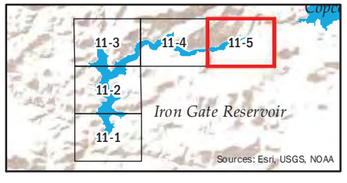


FIGURE 11-5

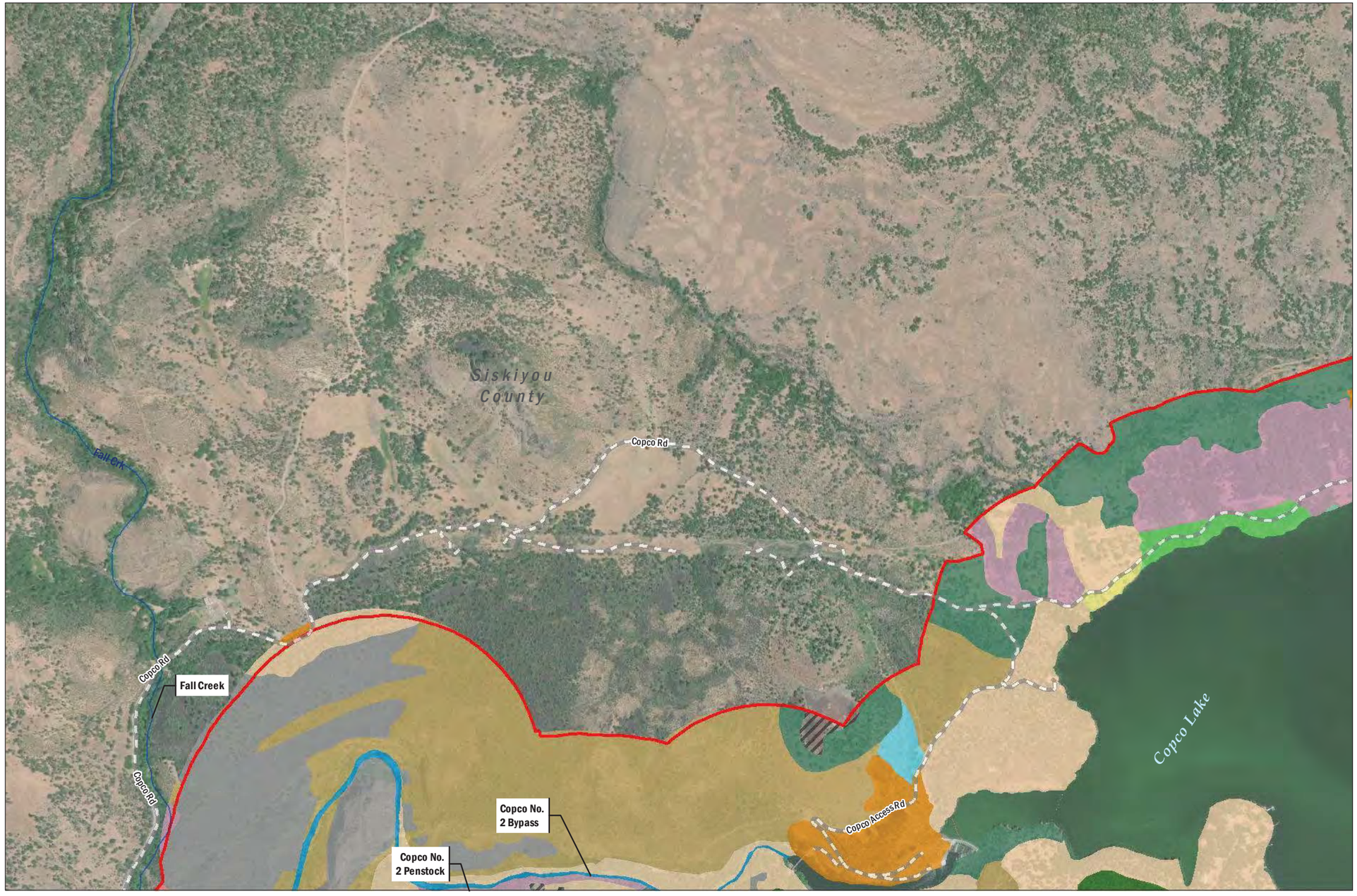
Vegetation Communities
Iron Gate Reservoir

LEGEND

- Access Route
- State
- County
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Sandbar willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



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Miles

Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

Klamath River Renewal Corporation

Klamath River Renewal Project

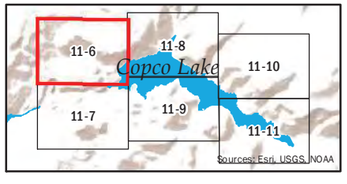


FIGURE 11-6

Vegetation Communities

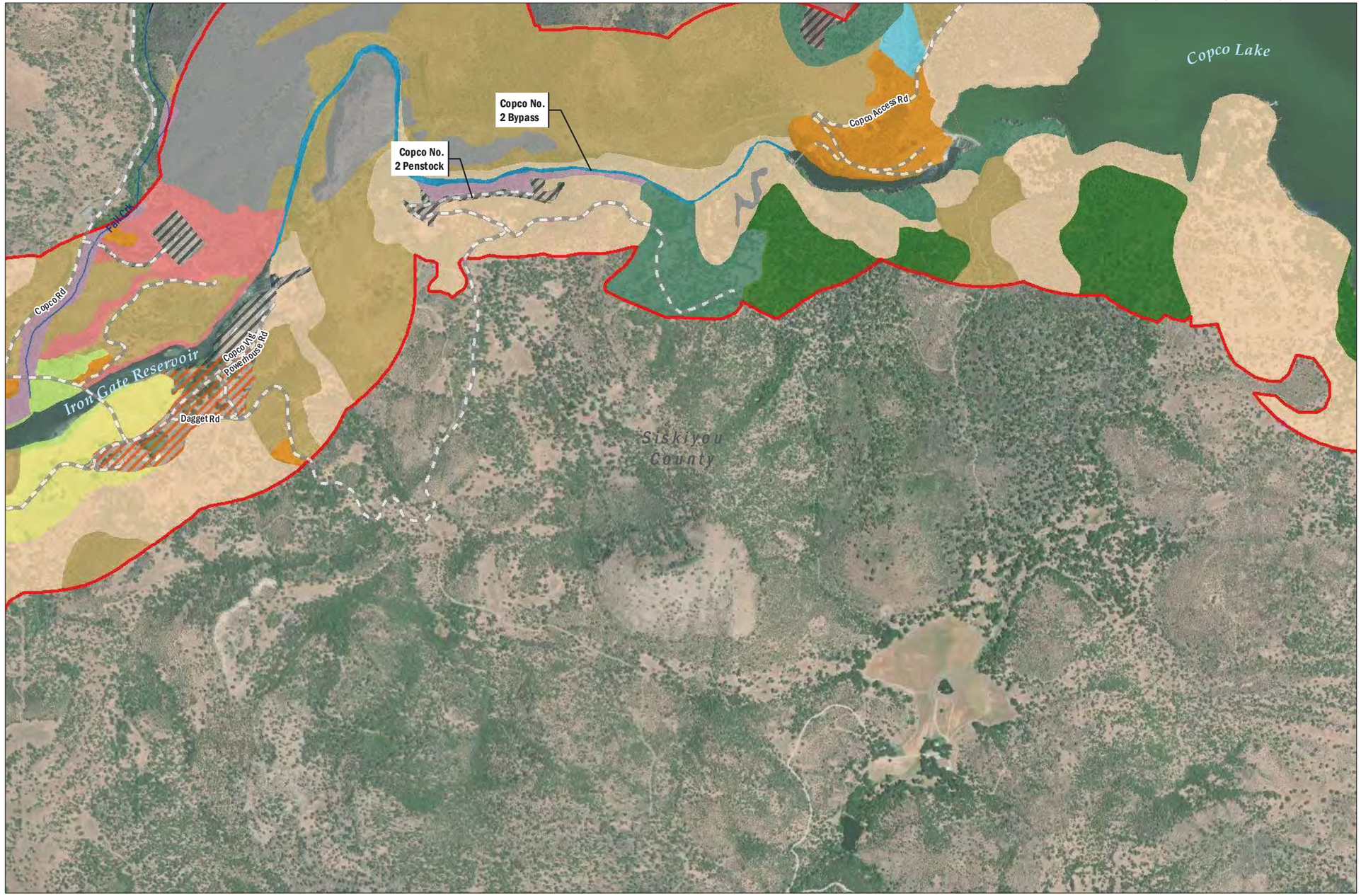
Copco Lake

LEGEND

- Access Route
- State
- County
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Sandbar willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



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Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

Klamath River Renewal Corporation
Klamath River Renewal Project

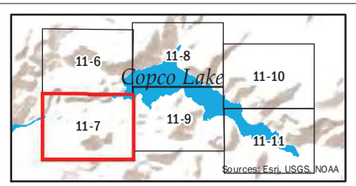


FIGURE 11-7

Vegetation Communities
Copco Lake

AECOM Oakland CA 8/27/2019 USER Bateska PATH P:\Klamath_River\2019\MXDs\Vegetation_Communities\Figure_11_Copco_Vegetation_Communities.mxd

LEGEND

- Access Route
- State
- County
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Sandbar willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



N

0 0.5 Miles

Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

Klamath River Renewal Corporation
Klamath River Renewal Project

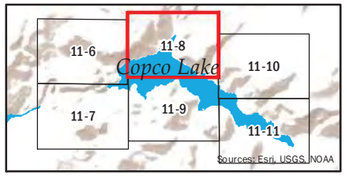


FIGURE 11-8

Vegetation Communities
Copco Lake

AECOM Oakland CA 8/27/2019 USER Bateska PATH F:\Klamath_River\2019\MXDs\Vegetation_Communities\Figure_11_Copco_Vegetation_Communities.mxd

LEGEND

- Access Route
- State
- County
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Sandbar willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



N

0 0.5

Miles

Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

Klamath River Renewal Corporation

Klamath River Renewal Project

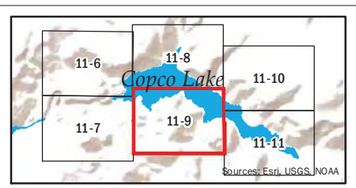


FIGURE 11-9

Vegetation Communities

Copco Lake

AECOM Oakland CA 8/27/2019 USER:Bateska PATH:F:\Klamath_River\2019\MXDs\Vegetation_Communities\Figure_11_Copco_Vegetation_Communities.mxd

LEGEND

- Access Route
- State
- County
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Sandbar willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



N

0 0.5

Miles

Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

Klamath River Renewal Corporation

Klamath River Renewal Project

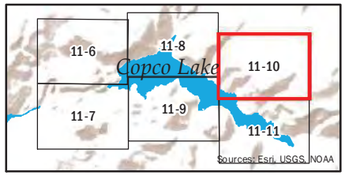


FIGURE 11-10

Vegetation Communities

Copco Lake

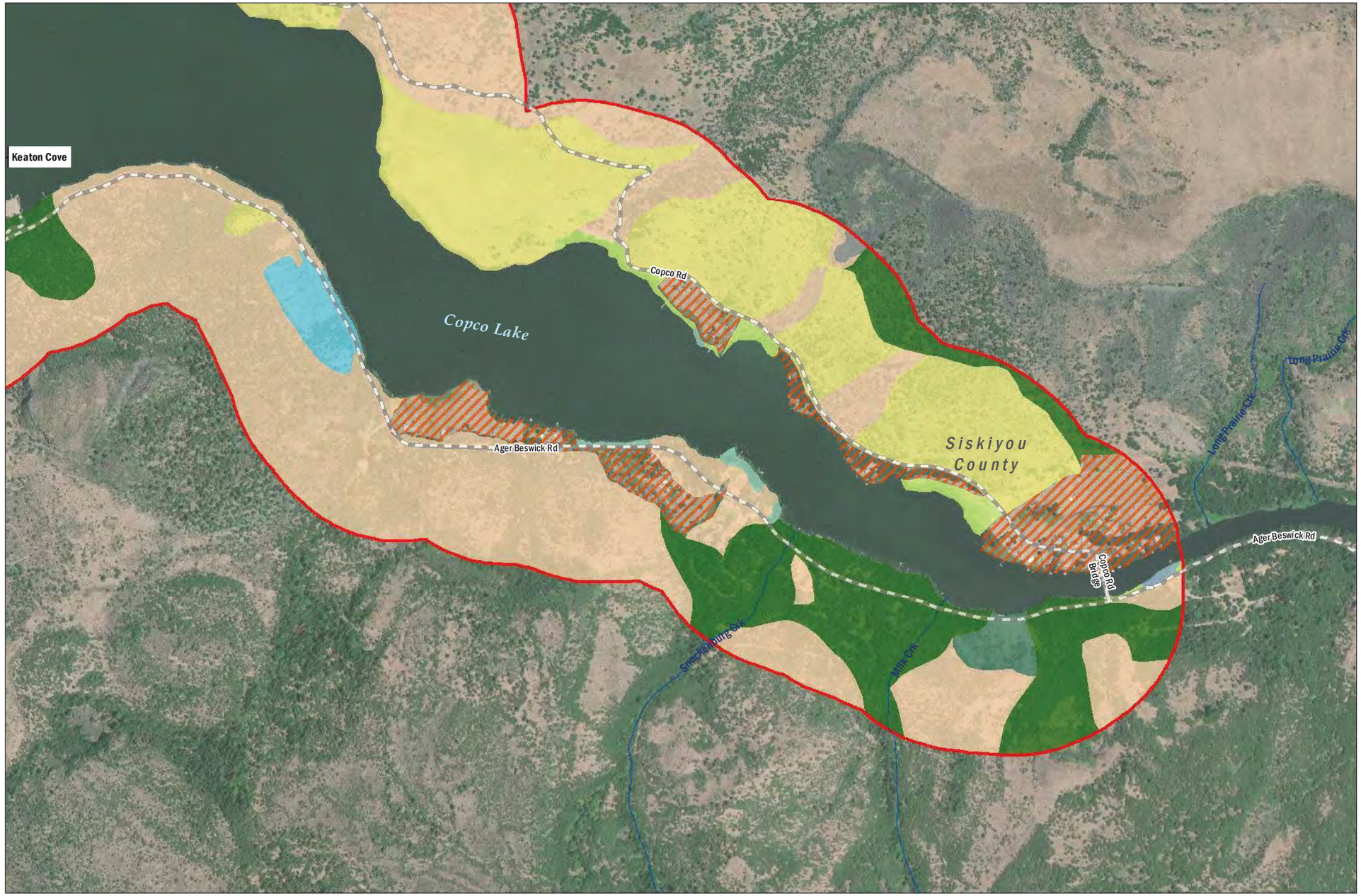
AECOM Oakland CA 8/27/2019 USER Bateska PATH P:\Klamath_River\2019\MXDs\Vegetation_Communities\Figure_11_Copco_Vegetation_Communities.mxd

LEGEND

- Access Route
- State
- County
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Sandbar willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

N

0 0.5

Miles

Klamath River Renewal Corporation

Klamath River Renewal Project

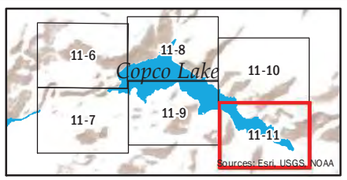


FIGURE 11-11

Vegetation Communities

Copco Lake

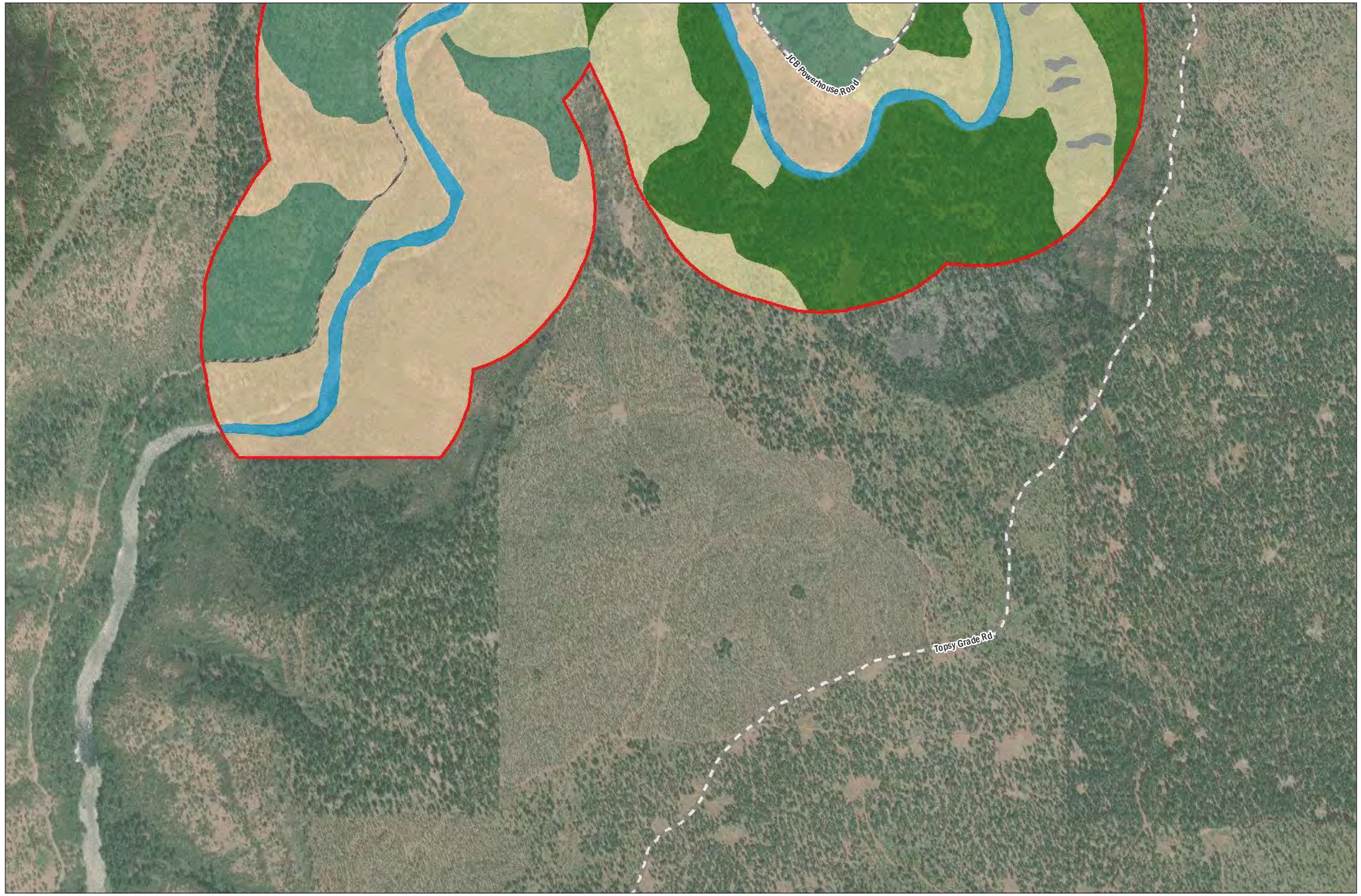
AECOM Oakland CA 8/27/2019 USER Bateska PATH F:\Klamath_River\2019\MXDs\Vegetation_Communities\Figure_11_JC_Boyle_Vegetation_Communities.mxd

LEGEND

- Access Route
- State
- County
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Geyer willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Lemmon's willow
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sandbar willow thicket
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



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Miles

Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

Klamath River Renewal Corporation

Klamath River Renewal Project

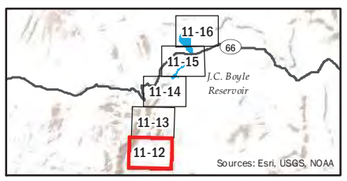

FIGURE 11-12

Vegetation Communities

JC Boyle Reservoir

AECOM Oakland CA 8/27/2019 USER Bateska PATH F:\Klamath_River\2019\MXDs\Vegetation_Communities\Figure_11_JC_Boyle_Vegetation_Communities.mxd

LEGEND

- Access Route
- State
- County
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Geyer willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Lemmon's willow
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sandbar willow thicket
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



N

0 0.5

Miles

Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

Klamath River Renewal Corporation

Klamath River Renewal Project

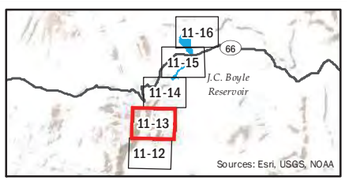

FIGURE 11-13

Vegetation Communities

JC Boyle Reservoir

AECOM Oakland CA 8/27/2019 USER Bateska PATH F:\Klamath_River\2019\MXDs\Vegetation_Communities\Figure_11_JC_Boyle_Vegetation_Communities.mxd

LEGEND

- Access Route
- State
- County
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Geyer willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
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- Oregon ash grove
- Oregon white oak woodland
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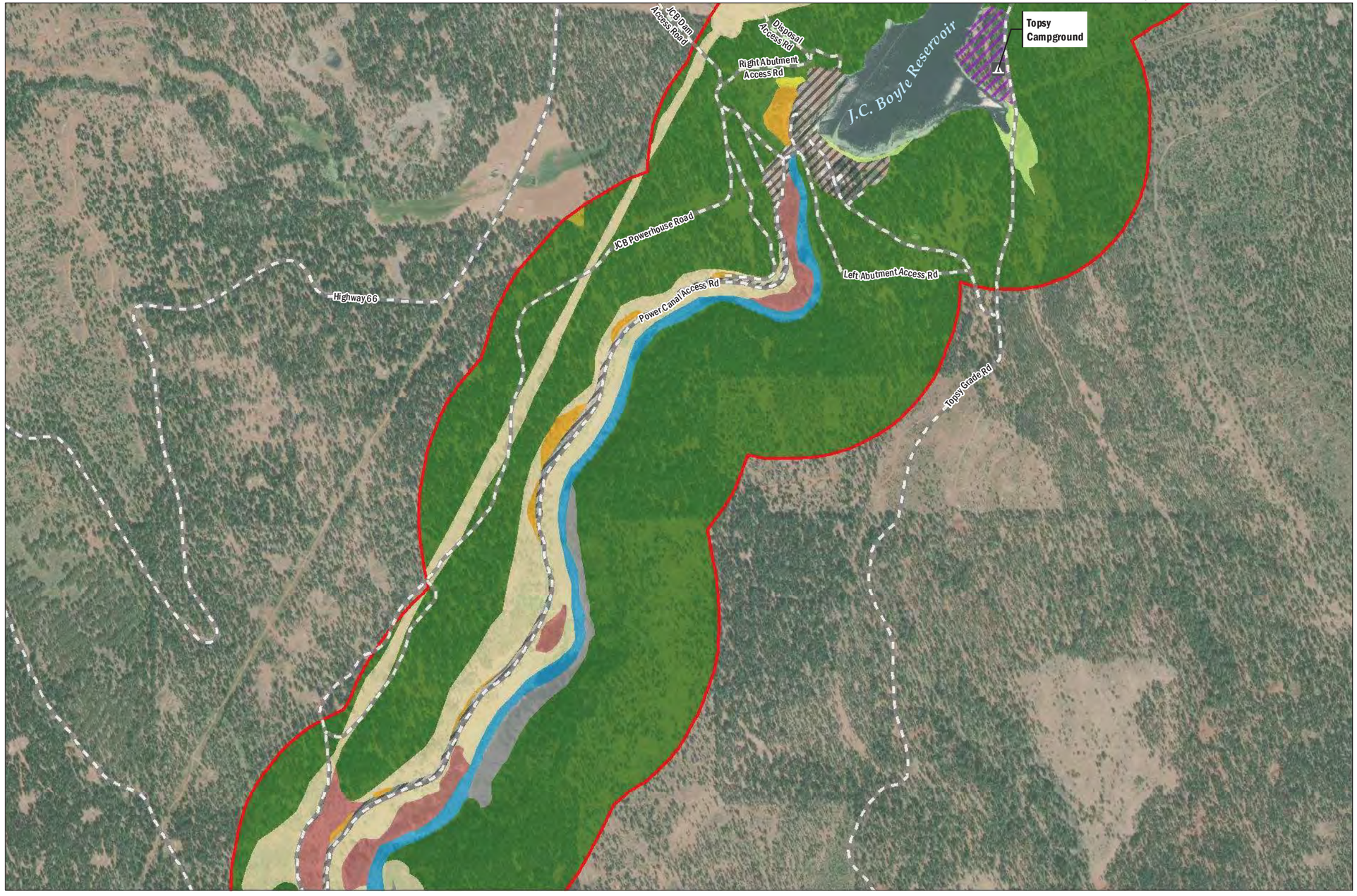
- Sandbar willow thicket
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



N

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Miles

Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

Klamath River Renewal Corporation

Klamath River Renewal Project

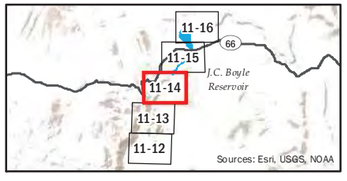


FIGURE 11-14

Vegetation Communities

JC Boyle Reservoir

LEGEND

- Access Route
- State
- County
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Geyer willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Lemmon's willow
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sandbar willow thicket
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



N

0 0.5

Miles

Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

Klamath River Renewal Corporation

Klamath River Renewal Project

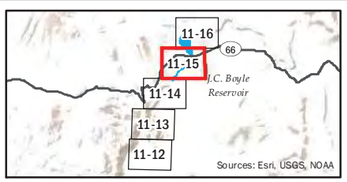


FIGURE 11-15

Vegetation Communities

JC Boyle Reservoir

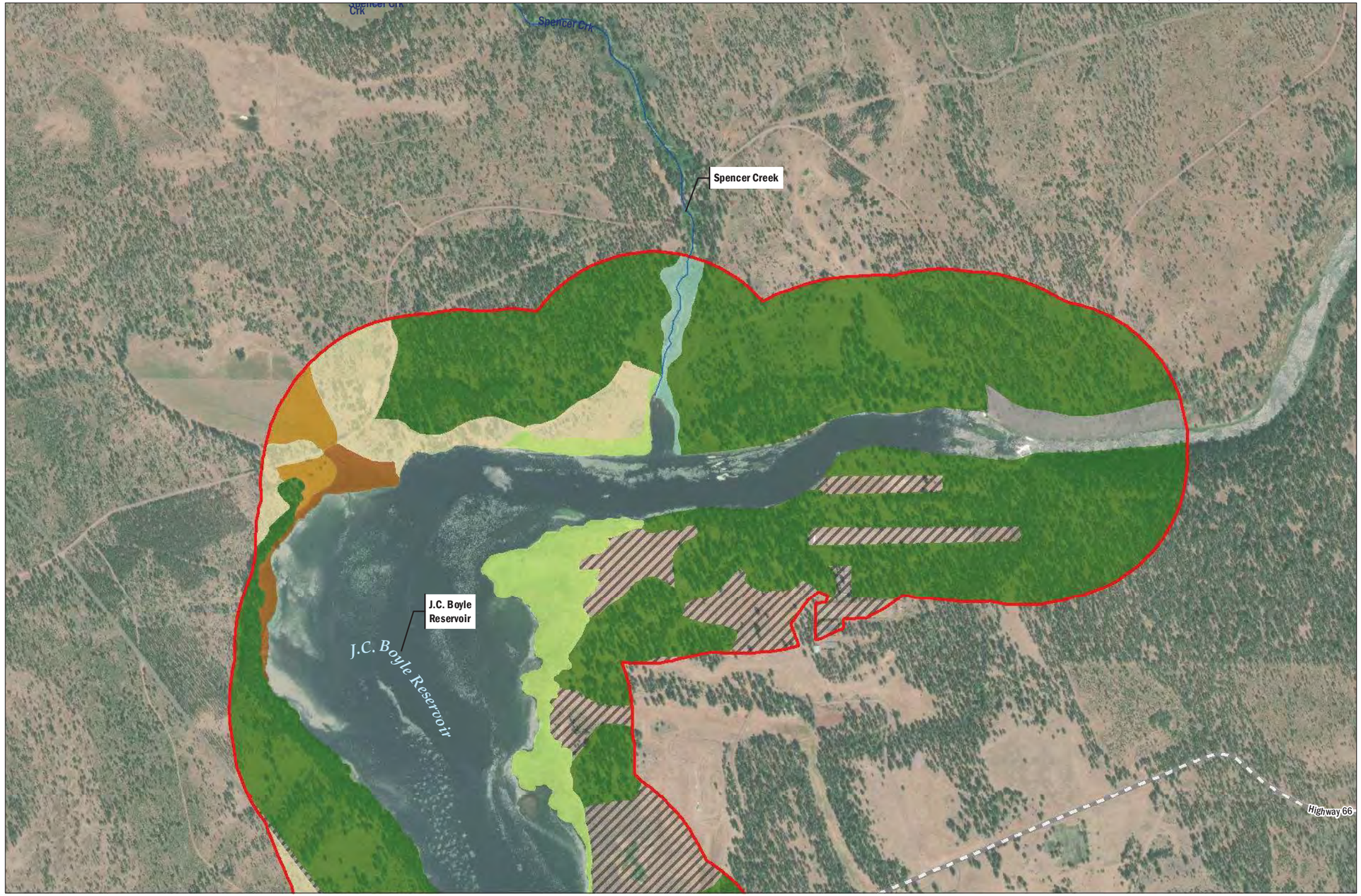
AECOM Oakland CA 8/27/2019 USER Bateska PATH F:\Klamath_River\2019\MXDs\Vegetation_Communities\Figure_11_JC_Boyle_Vegetation_Communities.mxd

LEGEND

- Access Route
- State
- County
- 0.25 Mile Study Area Buffer

Alliance Name

- Annual brome grasslands
- Bigleaf maple forest
- Birch leaf mountain mahogany
- Bitterbrush scrub
- Cheatgrass - medusahead grassland
- Chokecherry thicket
- Geyer willow thicket
- Hardstem bulrush marsh
- Klamath plum shrubland
- Lemmon's willow
- Oregon ash grove
- Oregon white oak woodland
- Ponderosa pine forest
- Sandbar willow thicket
- Sedge meadow
- Shining willow grove
- Wedgeleaf ceanothus chaparral
- Western juniper woodland
- Willow thickets
- Agricultural pasture
- Disturbed
- Recreational
- Residential
- Riverine
- Talus



N

0 0.5 Miles

Data Source: CDM Smith, Basemap (Esri, USGS, NOAA)

Klamath River Renewal Corporation
Klamath River Renewal Project

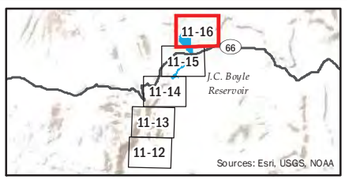


FIGURE 11-16

Vegetation Communities
JC Boyle Reservoir

Appendix C Species Observed during Field Studies

Appendix C
Species Observed During Field Studies

Plant Species Observed

J.C. Boyle Project Area

Scientific Name	Common Name
Achillea millefolium	yarrow
Acmispon americanus	american bird's foot trefoil
Agoseris grandiflora	giant mountain dandelion
Alnus rhombifolia	white alder
Amelanchier alnifolia	service berry
Angelica sp.	angelica
Antennaria argentea	silvery everlasting
Apocynum androsaemifolium	spreading dogbane
Artemesia tridentata	Big sagebrush
Artemisia douglasiana	mugwort
Artemisia tridentata	common sagebrush
Bromus tectorum	cheat grass, downy chess
Carex comosa	bristly sedge
Carex nebrascensis	nebraska sedge
Carex sp.	sedge
Castilleja applegatei	wavy leaf paintbrush
Castilleja miniata	great red paintbrush
Ceanothus prostratus	mahala mats
Cercocarpus betuloides	birch leaf mountain mahogany
Chrysothamnus viscidiflorus	green rabbitbrush
Cirsium vulgare	bullthistle
Clarkia rhomboidea	tongue clarkia
Collinsia parviflora	Maiden blue-eyed Mary
Collomia grandiflora	large flowered collomia
Collomia tinctoria	Yellow-staining Collomia
Convolvulus arvensis	bindweed, orchard morning-glory
Dieteria canescens	hoary aster
Dipsacus fullonum	wild teasel
Drymocallis glandulosa	sticky cinquefoil

Scientific Name	Common Name
Eleocharis sp.	spikerush
Elymus elymoides	squirreltail
Elymus glaucus	blue wildrye
Elymus repens	Common couch grass
Epilobium brachycarpum	willow herb
Epilobium ciliatum	slender willow herb
Ericameria bloomeri	Goldenbush
Ericameria nauseosa	rubber rabbitbrush
Erigeron inornatus	rayless fleabane
Erigeron philadelphicus	philadelphia fleabane
Eriogonum umbellatum	sulphur buckwheat
Eriophyllum lanatum	common woolly sunflower
Erodium cicutarium	Starksbill
Erythranthe guttata	yellow monkey flower
Festuca bromoides	brome fescue
Festuca myuros	rattail sixweeks grass
Fragaria sp.	wild strawberry
Galium boreale	Northern bedstraw
Grindelia sp.	gumweed
Helianthus bolanderi	bolander's sunflower
Holosteum umbellatum	jagged chickweed
Hordeum brachyantherum	meadow barley
Hordeum spp.	Barley
Hypericum perforatum	klamathweed
Iris chrysophylla	Yellow-leaf iris
Iris missouriensis	western blue flag
Juncus balticus	wire rush
Juncus occidentalis	slender juncus
Juncus sp.	rush
Juniperus occidentalis	western juniper
Lathyrus sp.	pea
Lemna sp.	duckweed
Lithospermum ruderale	western gromwell
Lonicera hispidula	pink honeysuckle
Lotus corniculatus	bird's-foot trefoil
Lupinus argenteus	silvery lupine
Madia glomerata	Mountain tarweed
Madia sp.	tarweed
Mahonia aquifolium	Hollyleaved barberry
Mentha pulegium	pennyroyal
Mimulus guttatus	Common monkeyflower
Monardella odoratissima	mountain monardella

Scientific Name	Common Name
Navarettia sp.	navarettia
Oemleria cerasiformis	oso berry
Osmorhiza berteroi	sweetcicely
Penstemon deustus	hot-rock penstemon
Perideridia erythrorhiza	Western yampah
Persicaria sp.	smartweed
Phalaris arundinacea	reed canary grass
Phleum pratense	cultivated timothy
Pinus ponderosa	Ponderosa pine
Plagiobothrys sp.	popcorn flower
Plagiobothyris mollis	Popcorn flower
Plantago lanceolata	english plantain
Poa bulbosa	bulbous blue grass
Poa pratensis	kentucky blue grass
Poa secunda	pine bluegrass
Polygonum aviculare	knotweed, knotgrass
Potentilla anserina ssp. anserina	silver weed cinquefoil
Potentilla glandulosa	Sticky cinquefoil
Potentilla gracilis	Five-finger cinquefoil
Prunella vulgaris var. lanceolata	mountain selfheal
Prunus emarginata	Bittercherry
Prunus subcordata	pacific plum, sierra plum
Prunus virginiana	Chokecherry
Pseudotsuga menziesii	douglas fir
Purshia tridentata	antelope bush
Quercus garryana	oregon oak
Ranunculus occidentalis	Western buttercup
Ribes aureum	Golden currant
Ribes velutinum	Desert gooseberry
Rosa sp.	rose
Rosa woodsii	Woods rose
Rubus parviflorus	thimbleberry
Rumex acetosella	sheep sorrel
Rumex crispus	curly dock
Salix exigua	narrowleaf willow
Salix geyeriana	geyer's willow
Salix lasiandra	pacific willow
Salix lemmonii	lemmon's willow
Salix ligulifolia	strapleaf willow
Scirpus microcarpus	mountain bog bulrush
Senecio hydrophilus	alkali marsh ragwort
Sidalcea sp.	checker mallow

Scientific Name	Common Name
Sisymbrium altissimum	tumble mustard
Sparganium eurycarpum	broadfruit bur reed
Spheonoplectus acutus	Tule bulrush
Spiraea douglasii	douglas spiraea
Stellaria longipes	Long-stalked Starwort
Stipa sp.	needlegrass
Symphiotrichum sp.	aster
Symphoricarpos albus	snowberry
Taraxacum officinale	common dandelion
Tragopogon dubius	yellow salsify
Trifolium repens	white clover
Triteleia hyacinthina	wild hyacinth
Typha latifolia	Broad-leaved cattail
Verbascum blattaria	moth mullein
Verbascum thapsus	woolly mullein
Veronica anagallis-aquatica	water speedwell

Copco Project Area

Scientific Name	Common Name
Acer macrophyllum	big leaf maple
Achillea millefolium	yarrow
Achnatherum occidentale	Western needleglass
Agoseris grandiflora	giant mountain dandelion
Agoseris heterophylla	Mountain dandelion
Alnus rhombifolia	white alder
Alyssum desertorum	desert madwort
Amelanchier alnifolia	service berry
Amsinckia menziesii	common fiddleneck, small-flowered fiddleneck
Amsinckia retrorsa	rigid fiddleneck
Angelica californica	California angelica
Angelica sp.	angelica
Antennaria dimorpha	gray cushion pussytoes
Anthemis cotula	dog fennel
Antirrhinum vexillocalyculatum	wiry snapdragon
Apocynum androsaemifolium	spreading dogbane
Arctium minus	common burdock
Arctostaphylos patula	greenleaf manzanita
Artemesia tridentata	Big sagebrush
Asclepias cordifolia	purple milkweed
Asclepias fascicularis	narrow leaf milkweed

Scientific Name	Common Name
Asclepias speciosa	showy milkweed
Astragalus filipes	basalt milkvetch
Astragalus lentiginosus	Freckled milkvetch
Balsamorhiza sagittata	arrow leaved balsamroot
Berberis aquifolium	mountain grape
Bidens frondosa	sticktight
Bidens spp.	
Blepharipappus scaber	blepharipappus
Boechera sp.	rockcress
Bromus diandrus	ripgut grass
Bromus hordeaceus	Soft brome
Bromus tectorum	cheat grass, downy chess
Calocedrus decurrens	incense cedar
Calochortus greenei	Greene's mariposa lily
Calochortus greenei	Greene's mariposa lily
Calochortus tolmiei	hairy star tulip
Cardamine oligosperma	idaho bittercress
Carex multicaulis	stick sedge
Carex sp.	sedge
Castilleja attenuata	valley tassels
Castilleja tenuis	Indian paintbrush
Ceanothus cuneatus	buck brush
Ceanothus integerrimus	deer brush
Centaurea cyanus	batchelor's button
Centaurea solstitialis	yellow star-thistle
Cerastium glomeratum	sticky mouse-ear chickweed
Cercocarpus betuloides	birch leaf mountain mahogany
Chenopodium sp.	lamb's quarters
Chrysothamnus viscidiflorus	Yellow rabbitbrush
Cichorium intybus	chicory
Cirsium arvense	canada thistle
Cirsium occidentale var. candidissimum	snowy thistle
Cirsium vulgare	bullthistle
Clarkia rhomboidea	tongue clarkia
Clarkia sp.	clarkia
Claytonia perfoliata	miner's lettuce
Claytonia rubra	red stemmed spring beauty
Collinsia parviflora	blue-eyed mary
Collomia grandiflora	large flowered collomia
Conium maculatum	poison hemlock
Convolvulus arvensis	bindweed, orchard morning-glory

Scientific Name	Common Name
Crepis occidentalis	western hawk's beard
Crocidium multicaule	spring gold
Cryptantha	cryptantha
Descurainia sophia	herb sophia
Dichelostemma capitatum	blue dicks
Dipsacus fullonum	wild teasel
Draba verna	whitlow grass
Dysphania botrys	jerusalem oak goosefoot
Echinochloa crus-galli	barnyard grass
Elymus caput-medusae	medusa head
Elymus elymoides	squirreltail
Elymus ponticus	tall wheat grass
Epilobium brachycarpum	willow herb
Epilobium ciliatum	slender willow herb
Epilobium densiflorum	willow herb
Equisetum arvense	common horsetail
Equisetum hyemale	scouringrush horsetail
Ericameria nauseosa	rubber rabbitbrush
Erigeron inornatus	rayless fleabane
Eriogonum nudum var. pubiflorum	hairy flowered buckwheat
Eriogonum vimineum	wicker-stem wild buckwheat
Eriophyllum lanatum	common woolly sunflower
Erodium cicutarium	redstem filaree
Eryngium cf. articulatum	coyote thistle
Erythranthe guttata	yellow monkey flower
Eschscholzia californica	california poppy
Eschsholzia californica	California poppy
Festuca idahoensis	idaho fescue, blue bunchgrass
Fraxinus latifolia	oregon ash
Fritillaria recurva	scarlet fritillary
Galium aparine	cleavers
Garrya fremontii	fremont's silk tassel
Grindelia camporum	gumweed
Helianthus bolanderi	bolander's sunflower
Heracleum maximum	common cowparsnip
Holosteum umbellatum	jagged chickweed
Hordeum jubatum	fox tail barley
Hordeum murinum	wall barley
Hosackia crassifolia	broad leaved lotus
Juncus balticus	wire rush
Juncus occidentalis	slender juncus
Juniperus occidentalis	western juniper

Scientific Name	Common Name
Kickxia elatine	sharp point fluellin
Lactuca serriola	prickly lettuce
Lactuca virosa	poison wild lettuce
Lagophylla ramosissima	common hareleaf
Lamium amplexicaule	henbit
Lathyrus nevadensis	purple peavine
Lemna minor	duckweed
Lemna sp.	duckweed
Lilium pardalinum	california tiger lily
Lilium washingtonianum ssp. purpurascens	purple flowered washington lily
Lilium washingtonianum ssp. purpurascens	purple flowered Washington lily
Lithophragma sp.	woodland stars
Lomatium californicum	celery weed
Lomatium cf. utriculatum	hog fennel
Lomatium dissectum	fern leaved lomatium
Lomatium nudicaule	pestle lomatium
Lomatium triternatum	lewis's lomatium
Lonicera ciliosa	Orange honeysuckle
Lonicera hispidula	pink honeysuckle
Lotus corniculatus	bird's-foot trefoil
Lupinus argenteus	silvery lupine
Lupinus bicolor	miniature lupine
Luzula comosa	Wood rush
Lythrum hyssopifolia	hyssop loosestrife
Madia glomerata	Mountain tarweed
Malva parviflora	cheeseweed, little mallow
Matricaria discoidea	Pineapple weed
Melilotus albus	white sweetclover
Mentzelia laevicaulis	giant blazingstar
Microseris laciniata ssp. detlingii	detling's silverpuffs
Microsteris gracilis	slender phlox
Mimulus guttatus	yellow monkey flower
Muscari botryoides	common grape hyacinth
Nasturtium officinale	watercress
Penstemon deustus	hot-rock penstemon
Penstemon humilis	Low beardtongue
Perideridia	yampah
Persicaria sp.	smartweed
Phacelia heterophylla	varileaf phacelia
Phacelia ramosissima	branching phacelia

Scientific Name	Common Name
Phalaris arundinacea	reed canary grass
Philadelphus lewisii	wild mock orange
Phleum pratense	cultivated timothy
Phlox speciosa	showy phlox
Phoradendron sp.	mistletoe
Pinus ponderosa	ponderosa pine, western yellow pine
Plagiobothrys hispidus	Cascade popcorn flower
Plagiobothrys sp.	popcorn flower
Plantago lanceolata	english plantain
Plantago major	Common plantain
Plectritis macrocera	plectritis
Poa bulbosa	bulbous blue grass
Poa pratensis	kentucky blue grass
Poa secunda	Sandberg bluegrass
Prunus emarginata	bitter cherry
Prunus subcordata	pacific plum, sierra plum
Prunus virginiana	chokecherry
Pseudotsuga menziesii	douglas fir
Quercus garryana	oregon oak
Quercus kelloggii	california black oak
Ranunculus occidentalis	western buttercup
Ranunculus testiculatus	Curveseed butterwort
Rhus aromatica	fragrant sumac
Rhus trilobata	Skunkbush
Ribes sp.	gooseberry
Ribes velutinum	desert gooseberry
Rubus armeniacus	himalayan blackberry
Rubus ursinus	california blackberry
Rumex crispus	curly dock
Rumex salicifolius	willow leaved dock
Salix exigua	narrowleaf willow
Salix lasiandra	pacific willow
Salix scouleriana	scouler's willow
Sambucus nigra ssp. caerulea	blue elderberry
Schoenoplectus acutus var. occidentalis	tule
Sequoiadendron giganteum	redwood
Sisymbrium altissimum	tumble mustard
Sisymbrium altiussimum	Tall tumblemustard
Solidago velutina	threenerve goldenrod
Stellaria media	common chickweed

Scientific Name	Common Name
Symphoricarpos albus	snowberry
Symphoricarpos mollis	Creeping snowberry
Taraxacum officinale	common dandelion
Torilis arvensis	tall sock-destroyer
Toxicodendron diversilobum	western poison oak
Tragopogon dubius	yellow salsify
Tribulus terrestris	puncture vine
Trifolium dubium	Suckling clover
Trifolium hirtum	Rose clover
Urtica dioica	stinging nettle
Verbascum blattaria	moth mullein
Verbascum thapsus	woolly mullein
Verbascum Thapsus	Woolly mullein
Veronica americana	American speedwell
Veronica anagallis-aquatica	water speedwell
Veronica persica	persian speedwell
Vitis californica	california wild grape
Wyethia angustifolia	narrow leaved mule ears

Iron Gate Project Area

Scientific Name	Common Name
Achillea millefolium	yarrow
Acmispon americanus	american bird's foot trefoil
Agoseris grandiflora	giant mountain dandelion
Alnus rhombifolia	white alder
Alyssum desertorum	desert alyssum
Amaranthus blitoides	prostrate pigweed
Amsinckia menziesii	common fiddleneck, small-flowered fiddleneck
Anthemis cotula	dog fennel
Apocynum androsaemifolium	spreading dogbane
Asclepias fascicularis	narrow leaf milkweed
Astragalus filipes	basalt milkvetch
Blepharipappus scaber	blepharipappus
Bromus carinatus	california bromegrass
Bromus laevipes	narrow flowered brome
Bromus tectorum	cheat grass, downy chess
Calochortus greenei	Greene's mariposa lily
Capsella bursa-pastoris	shepherd's purse
Castilleja attenuata	valley tassels
Ceanothus cuneatus	buck brush

Scientific Name	Common Name
Centaurea solstitialis	yellow star-thistle
Cichorium intybus	chicory
Cirsium cymosum var. canovirens	gray-green thistle
Cirsium occidentale var. candidissimum	snowy thistle
Cirsium vulgare	bullthistle
Claytonia perfoliata	miner's lettuce
Collinsia parviflora	blue-eyed mary
Collomia grandiflora	large flowered collomia
Convolvulus arvensis	bindweed, orchard morning-glory
Cornus sericea	american dogwood
Crepis occidentalis	western hawk's beard
Croton setiger	turkey-mullein
Cryptantha	cryptantha
Cuscuta sp.	Dodder
Descurainia sophia	herb sophia
Dichelostemma capitatum	blue dicks
Dieteria canescens	hoary aster
Draba verna	whitlow grass
Eleocharis sp.	spikerush
Elymus caput-medusae	medusa head
Elymus spicatus	blue bunch wheat grass
Epilobium brachycarpum	willow herb
Equisetum hyemale	scouringrush horsetail
Ericameria nauseosa	rubber rabbitbrush
Erigeron sp.	horseweed
Eriodictyon californicum	yerba santa
Eriogonum luteolum var. luteolum	golden buckwheat
Eriogonum nudum var. pubiflorum	hairy flowered buckwheat
Eriogonum umbellatum	sulphur buckwheat
Erodium cicutarium	redstem filaree
Festuca myuros	rattail sixweeks grass
Frasera albicaulis	whitestem frasera
Galium aparine	cleavers
Geum triflorum	old man's beard
Helianthus bolanderi	bolander's sunflower
Hirschfeldia incana	mustard
Holosteum umbellatum	jagged chickweed
Hordeum murinum	wall barley
Hypericum perforatum	klamathweed
Juniperus occidentalis	western juniper
Lagophylla ramosissima	common hareleaf

Scientific Name	Common Name
Leptosiphon sp.	babystars
Lomatium cf. utriculatum	hog fennel
Lomatium triternatum	lewis's lomatium
Lupinus argenteus	silvery lupine
Lupinus microcarpus var. microcarpus	chick lupine
Matricaria discoidea	pineapple weed
Melilotus albus	white sweetclover
Mentha pulegium	pennyroyal
Mentzelia laevicaulis	giant blazingstar
Microseris laciniata ssp. detlingii	detling's silverpuffs
Microsteris gracilis	slender phlox
Mirabilis greenei	Greene's four o'clock
Monardella odoratissima	mountain monardella
Penstemon sp.	penstemon
Perideridia	yampah
Persicaria sp.	smartweed
Phalaris arundinacea	reed canary grass
Phlox speciosa	showy phlox
Phoradendron sp.	mistletoe
Plagiobothrys sp.	popcorn flower
Poa bulbosa	bulbous blue grass
Polygonum aviculare	knotweed, knotgrass
Portulaca oleracea	common purslane
Quercus garryana	oregon oak
Ranunculus testiculatus	tubercled crowfoot
Rhus aromatica	fragrant sumac
Ribes sp.	gooseberry
Salvia dorrii var. incana	fleshy sage
Scutellaria antirrhinoides	snapdragon skullcap
Sisymbrium altissimum	tumble mustard
Symphiotrichum sp.	aster
Symphoricarpos albus	snowberry
Tragopogon dubius	yellow salsify
Trichostema lanceolatum	vinegarweed
Verbascum thapsus	woolly mullein
Veronica persica	persian speedwell
Vitis californica	california wild grape
Xanthium strumarium	cocklebur

Wildlife Species Observed

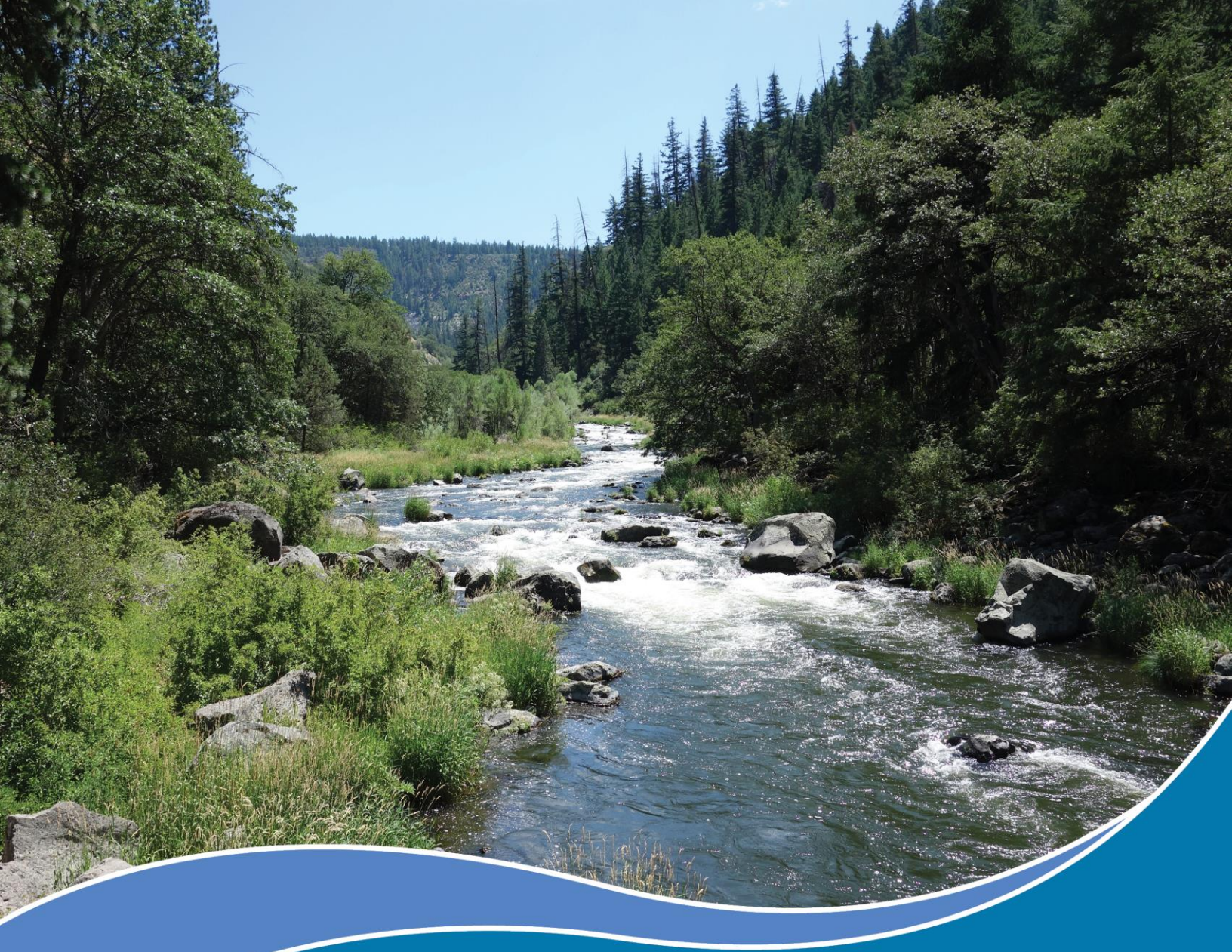
Common Name	Scientific Name
Birds	
Canada Goose	*Branta canadensis*
Wood Duck	*Aix sponsa*
Gadwall	*Mareca strepera*
Mallard	*Anas platyrhynchos*
Ring-necked Duck	*Aythya collaris*
Lesser Scaup	*Aythya affinis*
Bufflehead	*Bucephala albeola*
Common Merganser	*Mergus merganser*
Red-breasted Merganser	*Mergus serrator*
Ruddy Duck	*Oxyura jamaicensis*
Mountain Quail	*Oreortyx pictus*
California Quail	*Callipepla californica*
Sooty Grouse	*Dendragapus fuliginosus*
Wild Turkey	*Meleagris gallopavo*
Pied-billed Grebe	*Podilymbus podiceps*
Western Grebe	*Aechmophorus occidentalis*
Clark's Grebe	*Aechmophorus clarkii*
Common loon	*Gavia immer*
Rock Pigeon	*Columba livia*
Eurasian Collared-Dove	*Streptopelia decaocto*
Mourning Dove	*Zenaida macroura*
Common Nighthawk	*Chordeiles minor*
Common Poorwill	*Phalaenoptilus nuttallii*
White-throated Swift	*Aeronautes saxatalis*
Vaux's Swift	*Chaetura vauxi*
Anna's Hummingbird	*Calypte anna*
Allen's Hummingbird	*Selasphorus sasin*
Common Gallinule	*Gallinula galeata*
American Coot	*Fulica americana*
Sandhill Crane	*Antigone canadensis*
Killdeer	*Charadrius vociferus*
Least Sandpiper	*Calidris minutilla*
Spotted Sandpiper	*Actitis macularius*
Greater Yellowlegs	*Tringa melanoleuca*
Western Gull	*Larus occidentalis*
California Gull	*Larus californicus*
Franklin's Gull	*Leucophaeus pipixcan*
Caspian Tern	*Hydroprogne caspia*

Common Name	Scientific Name
Forster's Tern	*Sterna forsteri*
Double-crested Cormorant	*Phalacrocorax auritus*
American White Pelican	*Pelecanus erythrorhynchos*
Great Blue Heron	*Ardea herodias*
Great Egret	*Ardea alba*
Snowy Egret	*Egretta thula*
Green Heron	*Butorides virescens*
Turkey Vulture	*Cathartes aura*
Osprey	*Pandion haliaetus*
Bald Eagle	*Haliaeetus leucocephalus*
Golden Eagle	*Aquila chrysaetos*
Northern Harrier	*Circus hudsonius*
Sharp-shinned Hawk	*Accipiter striatus*
Cooper's Hawk	*Accipiter cooperii*
Red-shouldered Hawk	*Buteo lineatus*
Red-tailed Hawk	*Buteo jamaicensis*
Ferruginous Hawk	*Buteo regalis*
Great Horned Owl	*Bubo virginianus*
Belted Kingfisher	*Megaceryle alcyon*
Lewis's Woodpecker	*Melanerpes lewis*
Acorn Woodpecker	*Melanerpes formicivorus*
Red-breasted Sapsucker	*Sphyrapicus ruber*
Pileated woodpecker	*Drycopus pileatus*
Downy Woodpecker	*Picoides pubescens*
Hairy Woodpecker	*Picoides villosus*
Northern Flicker	*Colaptes auratus*
American Kestrel	*Falco sparverius*
Merlin	*Falco columbarius*
Peregrine Falcon	*Falco peregrinus*
Olive-sided Flycatcher	*Contopus cooperi*
Willow Flycatcher	*Empidonax traillii*
Western Wood-Pewee	*Contopus sordidulus*
Dusky Flycatcher	*Empidonax oberholseri*
Pacific-slope Flycatcher	*Empidonax difficilis*
Black Phoebe	*Sayornis nigricans*
Say's Phoebe	*Sayornis saya*
Ash-throated Flycatcher	*Myiarchus cinerascens*
Western Kingbird	*Tyrannus verticalis*
Hutton's Vireo	*Vireo huttoni*
Cassin's Vireo	*Vireo cassinii*

Common Name	Scientific Name
Warbling Vireo	*Vireo gilvus*
Steller's Jay	*Cyanocitta stelleri*
California Scrub-Jay	*Aphelocoma californica*
Clark's Nutcracker	*Nucifraga columbiana*
Black-billed Magpie	*Pica hudsonia*
American Crow	*Corvus brachyrhynchos*
Common Raven	*Corvus corax*
Tree Swallow	*Tachycineta bicolor*
Violet-green Swallow	*Tachycineta thalassina*
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*
Bank Swallow	*Riparia riparia*
Cliff Swallow	*Petrochelidon pyrrhonota*
Barn Swallow	*Hirundo rustica*
Purple martin	*Progne subis*
Black-capped Chickadee	*Poecile atricapillus*
Mountain Chickadee	*Poecile gambeli*
Chestnut-backed Chickadee	*Poecile rufescens*
Oak Titmouse	*Baeolophus inornatus*
Bushtit	*Psaltriparus minimus*
Red-breasted Nuthatch	*Sitta canadensis*
White-breasted Nuthatch	*Sitta carolinensis*
Pygmy Nuthatch	*Sitta pygmaea*
Brown Creeper	*Certhia americana*
Rock Wren	*Salpinctes obsoletus*
Canyon Wren	*Catherpes mexicanus*
House Wren	*Troglodytes aedon*
Bewick's Wren	*Thryomanes bewickii*
American Dipper	*Cinclus mexicanus*
Ruby-crowned Kinglet	*Regulus calendula*
Western Bluebird	*Sialia mexicana*
Mountain Bluebird	*Sialia currucoides*
Townsend's Solitaire	*Myadestes townsendi*
Swainson's Thrush	*Catharus ustulatus*
Hermit Thrush	*Catharus guttatus*
American Robin	*Turdus migratorius*
Varied Thrush	*Ixoreus naevius*
Northern Mockingbird	*Mimus polyglottos*
European Starling	*Sturnus vulgaris*
Cedar Waxwing	*Bombycilla cedrorum*
Pine Siskin	*Spinus pinus*

Common Name	Scientific Name
House Finch	*Haemorhous mexicanus*
Purple Finch	*Haemorhous purpureus*
Lesser Goldfinch	*Spinus psaltria*
American Goldfinch	*Spinus tristis*
Spotted Towhee	*Pipilo maculatus*
California Towhee	*Melozone crissalis*
Green-tailed Towhee	*Pipilo chlorurus*
Chipping Sparrow	*Spizella passerina*
Lark Sparrow	*Chondestes grammacus*
Savannah Sparrow	*Passerculus sandwichensis*
Fox Sparrow	*Passerella iliaca*
Song Sparrow	*Melospiza melodia*
Lincoln's Sparrow	*Melospiza lincolnii*
Vesper Sparrow	*Pooecetes gramineus*
Dark-eyed Junco	*Junco hyemalis*
Slate-colored Junco	*Junco h. hyemalis*
Western Meadowlark	*Sturnella neglecta*
Bullock's Oriole	*Icterus bullockii*
Red-winged Blackbird	*Agelaius phoeniceus*
Tricolored Blackbird	*Agelaius tricolor*
Brown-headed Cowbird	*Molothrus ater*
Brewer's Blackbird	*Euphagus cyanocephalus*
Great-tailed Grackle	*Quiscalus mexicanus*
Orange-crowned Warbler	*Oreothlypis celata*
Nashville Warbler	*Oreothlypis ruficapilla*
Common Yellowthroat	*Geothlypis trichas*
Yellow Warbler	*Setophaga petechia*
Yellow-breasted Chat	*Icteria virens*
Black-throated Blue Warbler	*Setophaga caerulescens*
Yellow-rumped Warbler	*Setophaga coronata*
Wilson's Warbler	*Cardellina pusilla*
Western Tanager	*Piranga ludoviciana*
Black-headed Grosbeak	*Pheucticus melanocephalus*
Lazuli Bunting	*Passerina amoena*
Mammals	
California kangaroo rat	*Dipodomys californicus*
California ground squirrel	*Otospermophilus beecheyi*
Golden-mantled ground squirrel	*Callospermophilus lateralis*
Yellow-pine chipmunk	*Tamias amoenus*
Allen's chipmunk	*Neotamias senex*

Common Name	Scientific Name
Antelope squirrel	*Ammospermophilus* sp.
Douglas' squirrel	*Tamiasciurus douglasii*
Western gray squirrel	*Sciurus griseus*
Black-tailed jackrabbit	*Lepus californicus*
Opossum	*Didelphimorphia* sp.
Raccoon	*Procyon lotor*
Yuma myotis	*Myotis yumanensis*
Myotis sp.	*Myotis* sp.
Townsend's western big-eared bat	*Corynorhinus townsendii townsendii*
Coyote	*Canis latrans*
Black-tailed deer	*Odocoileus hemionus*
big-horned sheep	*Ovis canadensis*
Black bear	*Ursus americanus*
Bobcat	*linx rufus*
Mountain lion	*Puma concolor*
American mink	*Neovison vison*
North American beaver	*Castor canadensis*
River otter	*Lontra canadensis*
Feral horse	*Equus ferus*
Cow	*Bos taurus*
Reptiles	
Western pond turtle	*Actinemys marmorata*
Western fence lizard	*Sceloporus occidentalis*
Sagebrush lizard	*Sceloporus graciousus*
California alligator lizard	*Elgaria multicarinata*
California red-sided garter snake	*Thamnophis sirtalis infernalis*
Garter snake	*Thamnophis* sp.
Western yellow-bellied racer	*Coluber constrictor mormon*
Western rattlesnake	*Crotalus oreganus*
California mountain kingsnake	*Lampropeltis zonata*
California kingsnake	*Lampropeltis getula californiae*
Amphibians	
Northern tree frog	*Hyla versicolor*
Sierran treefrog	*Pseudacris sierra*
Western toad	*Anaxyrus boreas*
American bullfrog	*Lithobates catesbeianus*



Klamath River Renewal Project

2019 Annual Aquatic Resources Survey Report

December 2019

KLAMATH
RIVER RENEWAL
CORPORATION

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Acronyms and Abbreviations

AISP	aquatic invasive species protocol
CDFW	California Department of Fish and Wildlife
cfs	cubic feet per second
CPUE	catch per unit effort
°F	degrees Fahrenheit
FM	floater mussel
GPS	Global Positioning System
KRRC	Klamath River Renewal Corporation
mm	millimeter
NMFS	National Marine Fisheries Service
ODFW	Oregon Department of Fish and Wildlife
PIT	Passive Integrated Transponder
Project	Klamath River Renewal Project
RM	river mile
USBR	United States Bureau of Reclamation
USDI	United States Department of the Interior
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WEPE	western pearlshell mussel
WRM	western ridged mussel

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Chapter 1: Introduction

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1. INTRODUCTION

This report summarizes the data collected during aquatic resources surveys conducted in 2019 in the Klamath River downstream of Iron Gate Dam and in the three reservoirs in the hydroelectric reach. The Klamath River Renewal Corporation (KRRC) and its consultants carried out field investigations in Oregon and California to determine the presence or absence of and the existing condition information on the following aquatic resources:

- Freshwater mussels, including floater mussels (*Anodonta oregonensis*, *A. californiensis*), western ridged mussels (*Gonidea angulata*), and western pearlshell mussels (*Margaritifera falcata*)
- Lost River (*Deltistes luxatus*) and Shortnose (*Chasmistes brevirostris*) suckers

Sampling objectives for freshwater mussels included the following:

1. Determine the taxa, presence, location, and approximate abundance of freshwater mussels in the 8-mile-long reach of the Klamath River between Iron Gate Dam and Cottonwood Creek (salvage reach), and in the Klamath River between J.C. Boyle Reservoir and Copco Reservoir (translocation reach).
2. Determine appropriate locations for translocating freshwater mussels from the salvage reach and prepare a salvage plan that will guide the freshwater mussel translocation in advance of the Project.

Sampling objectives for Lost River and Shortnose Suckers included the following;

1. Determine the presence or absence of Lost River and Shortnose Suckers in the hydroelectric reach reservoirs,
2. Passive Integrated Transponder (PIT)-tag captured Lost River and Shortnose Suckers to assign a unique identifier to individual fish. Uniquely identifying fish will allow for estimating growth rates and assigning discrete genetic results, and will improve understanding of the relative abundance of suckers in the reservoirs during future sampling events.
3. Collect tissue samples from all captured Lost River and Shortnose Suckers for inclusion in a United States Fish and Wildlife Service (USFWS) study being conducted on sucker species in the Upper Klamath Basin.

KRRC is in need of updated information regarding the existing condition of aquatic resources in the Klamath River Renewal Project (Project) area to inform the ongoing Project design and regulatory permit processes, as described in previous studies and regulatory compliance documents, including the 2012 Environmental Impact Statement/Environmental Impact Report (USDI et al. 2012) and the Joint Preliminary Biological Opinion (NMFS and USFWS 2012). KRRC incorporated aquatic resources surveys and avoidance and

minimization measures into the Project as Aquatic Resources Measures (see Appendix I of the Definite Plan [KRRC 2018]). The 2019 surveys follow the Aquatic Resources Measures.

For the resources listed above, this report describes the methods followed during the field investigations. Work plans were developed in close coordination with federal and state resource agencies, including USFWS, California Department of Fish and Wildlife (CDFW), and Oregon Department of Fish and Wildlife (ODFW). Coordination between CDFW, ODFW, USFWS, and KRRC ensured that survey protocols implemented by the field teams were consistent with standard sampling methods that minimize impacts to freshwater mussels, and to Lost River and Shortnose Suckers.

Chapter 2: Freshwater Mussels

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2. FRESHWATER MUSSELS

In 2019, as a component of the KRRC's proposed Aquatic Resource measure 7 (AR-7), KRRC conducted a freshwater mussel reconnaissance survey in two reaches: one where the Project may affect mussels, and a second that may be used for mussel translocation prior to construction. The first reach is between Iron Gate Dam (river mile [RM] 193.1) and Cottonwood Creek (RM 185.1) in Siskiyou County, California. Mussels in this reach are expected to experience moderate to high mortality due to bedload burial associated with the sediment release during removal of the Klamath River dams. Prior to dam removal, KRRC plans to move as many as 20,000 mussels to locations in the Klamath River between J.C. Boyle Reservoir (RM 230.6) and Copco Reservoir (RM 208.4). KRRC anticipates that this reach will experience lesser sediment impacts due to the minimal sedimentation that is expected to occur downstream of J.C. Boyle Dam. The primary objectives of the survey were to locate, identify, and enumerate freshwater mussels in the salvage reach, and to determine appropriate locations for translocating salvaged mussels. KRRC's secondary objectives included identifying potential access locations, documenting logistical constraints, and evaluating existing freshwater mussel habitat availability and use in the translocation reach.

2.1 Field Investigation

Freshwater mussels inhabit the Klamath River, including the river reach from Iron Gate Dam downstream to the Cottonwood Creek confluence (also referred to as the Salvage Reach). The Western Freshwater Mussel Database (Xerces and CTUIR 2019) includes a compilation of specific freshwater mussel locations based on observations completed by past investigators. Database records are thought to constitute only a subset of occupied sites in the river. KRRC completed a database search as a planning task in advance of the field investigation. The database search yielded 218 freshwater mussel records for the three hydrologic unit codes encompassing the Project area and adjacent reaches.

2.1.1 Methods

KRRC biologists completed pre-fieldwork planning and the field investigation from June 24 through 28, 2019. Pre-field planning included reviewing the Western Freshwater Mussel Database (Xerces and CTUIR 2019) to identify freshwater mussel locations based on past investigations. KRRC mapped the freshwater mussel record locations on digital base maps to assist in locating potential mussel beds during the field investigation.

KRRC selected timed visual surveys as the most appropriate method for evaluating salvage and translocation sites. The method is relatively easy to employ under a wide range of conditions, while also enabling general comparisons among mussel beds and sites if minimum standards are implemented. Time-based visual snorkel sampling was conducted in the vicinity of (upstream, downstream, and across from) existing records for freshwater mussels and also opportunistically, where habitat appeared to be appropriate and accessible. KRRC accessed sites by cataraft and navigated using hand-held Global Positioning System (GPS) units and base maps. Each of the two cataraft field teams included an oarsman and two surveyors.

Surveyors were deployed from the cataraft to conduct surveys with a snorkel and mask along the bank and in flow refugia. The two surveyors commenced a preliminary timed survey to scout the site (up to 5 minutes) and determine whether mussels were present. During the preliminary survey, crew members on the cataraft completed the following tasks: timekeeping, measuring water flow and depth at a representative location in the site, and recording survey data. Surveyors also typically took at least three photographs—one each oriented upstream, downstream, and inland—that depicted the surveyed location. The data collection at some sites was limited when habitat was not present and/or no mussels were observed.

When fewer than 50 mussels were observed by the field team during the preliminary search, the location was documented but no further effort was applied. When more than 50 mussels were observed by the field teams during the preliminary search, a timed search was commenced. The surveyors visually delineated the search area based on similarity of flow and underwater habitat as well as the outer extent of the mussel bed (if easily observed), thus ensuring reasonable coverage of the mussel bed while minimizing survey time in unsuitable habitat. The surveyors measured the length and placed pin flags underwater in the substrate at the upstream and downstream ends. The length was used to determine the total survey time (two simultaneous surveyors) based on the following categories:

- 1 to 15 meters in length = 10 minutes (20 total person-minutes)
- 16 to 30 meters in length = 15 minutes (30 total person-minutes)
- >30 meters in length = 20 minutes (40 total person-minutes)

The surveyors then divided the survey area approximately evenly, placing pin flags underwater in the substrate as a visual aid to avoid overlapping counts (Figure 2-1). During the search period, surveyors used a tally counter to document each mussel viewed from the surface. If more than one species was observed in a bed, a separate counter was used for each species. Numbers were then reported to the data recorder at the surface following completion of the timed count. The surveyors also took several representative photographs of mussels and underwater habitat at each site, including an object of known size in photos for scale. Relevant basic observations regarding the mussel bed—including impressions of embeddedness, density, orientation—were documented. The data recorder also completed a brief site sketch indicating the general distribution of mussels in the site and relevant habitat features.

Where water depths and flow allowed, surveyors selected a representative location in each bed to sample mussels below the surface. Surveyors placed a quadrat and mussels were carefully excavated by hand from within the plot (Figure 2-2). Collected mussels were placed temporarily in bags. Excavation continued until no further mussels were detected or substrate limited further digging. After the total number of mussels of each species was determined, mussels were gently placed back on the substrate in approximately the same area from which they were excavated and allowed to rebury.

The field teams discussed relevant characteristics of the site and other survey notes, including macrohabitat type, substrate characteristics, and visibility. At the end of each day, the data recorders reviewed data sheets and worked with crews to fill in any remaining gaps. The teams documented relevant information for each site during a general discussion at the end of the day.



Figure 2-1 Surveyors Working in Tandem to Conduct Timed Surveys Along a Parallel Transect



Figure 2-2 Quadrat Excavations are Performed at Sites with Timed Surveys

2.1.2 Findings

The freshwater mussel reconnaissance was conducted June 24 through 28, 2019, by staff of the Xerces Society, River Design Group, Karuk Tribe, and CDFW. Weather and flow conditions during the week were sufficient for conducting visual snorkel surveys, including low-flow conditions (e.g., 1,080 cubic feet per second [cfs]) at United States Geological Survey (USGS) Gage 11516530 downstream of Iron Gate Dam on June 24); and adequate visibility of the river bottom, with the exception of the site downstream of Keno Dam, where suspended algae limited visibility of mussels. The following section includes a brief summary of the field survey.

Iron Gate Dam to Cottonwood Creek – Salvage Reach

KRRC field teams conducted preliminary surveys at 15 locations in the reach on June 24, 25, and 27, 2019 (Figure 2-3). Eight sites were locations with previously documented mussels. During this study, the field teams detected mussels at five of the eight sites, and documented seven new sites. The field teams located all three freshwater mussel taxa, although they documented western pearlshell (*Margaritifera falcata*) at only one site. The species most commonly observed by the field teams was western ridged mussel (*Gonidea angulata*) (11 of 12 beds); it was also the most abundant species when found. The field teams observed floater mussels (*Anodonta* spp.) in eight beds, but often at far lower abundance than western ridged mussel. On average, there was one floater mussel for every 10 western ridged mussels.

Quadrat excavations performed by the field teams revealed that a large proportion of both western ridged mussels and floaters were buried below the substrate and were not visible during visual surveys. For example, in six excavated quadrats, the field teams encountered 10 percent more mussels in the substrate than on the channel bed surface; for floaters, for each mussel the field teams encountered at the surface, nearly six mussels were encountered in the subsurface. In two of five quadrats, the field teams observed floaters only during excavation. Because the field teams detected floaters in low numbers during the timed visual surveys, the quadrat excavations suggest that floaters may be more common in the subsurface than on the channel bed.

Copco Lower – Translocation Reach

The field teams conducted preliminary surveys at four locations in the reach from RM 213.8 to RM 208.4 on June 26 and 27, 2019 (Figure 2-4). The field teams observed mussels at three locations, all of which contained western ridged mussels. The field teams observed floater mussels only at a single site (#19016, at approximately RM 213). At this site, western ridged mussels outnumbered floater mussels ~19 to 1. Site #19016 also had the greatest number of mussels observed at any site during this study (1,984). The field teams observed a single western pearlshell shell while surveying the lower reach of the site; they did not observe any live western pearlshell mussels.

Copco Upper – Translocation Reach

Field teams did not visit this potential translocation reach in the Klamath River between RM 222.5 and RM 220.0, due to the extensive travel that would be required to translocate mussels. KRRC determined that the distance and poor road conditions could lead to high mortality rates for transported mussels.

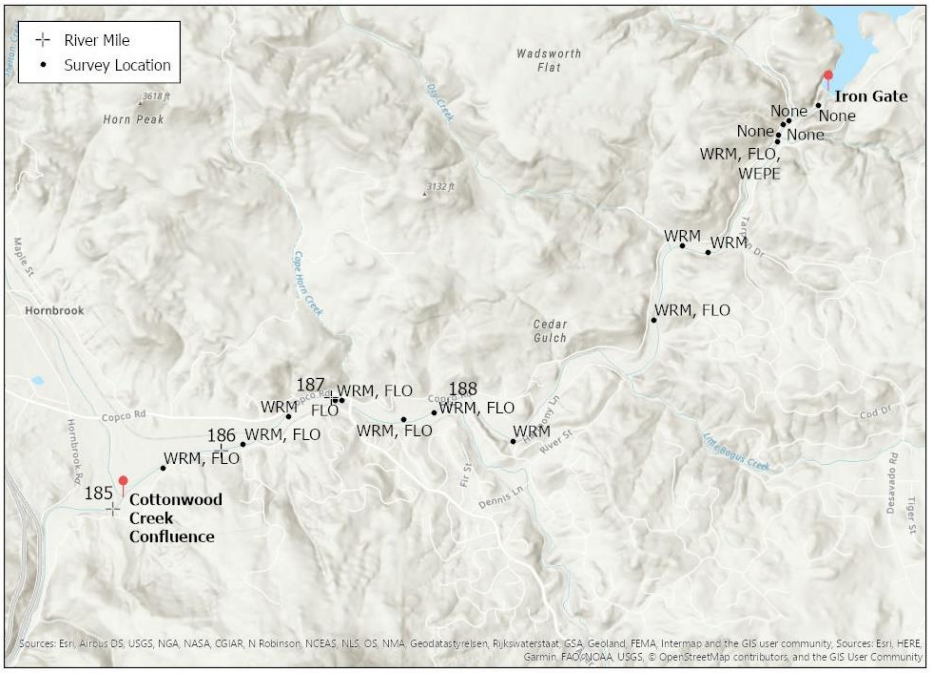

Figure 2-3 Freshwater Mussel Field Investigation Locations Downstream from Iron Gate Dam
Key: WRM = western ridged mussel, FLO = floater mussel, WEPE = western pearlshell mussel

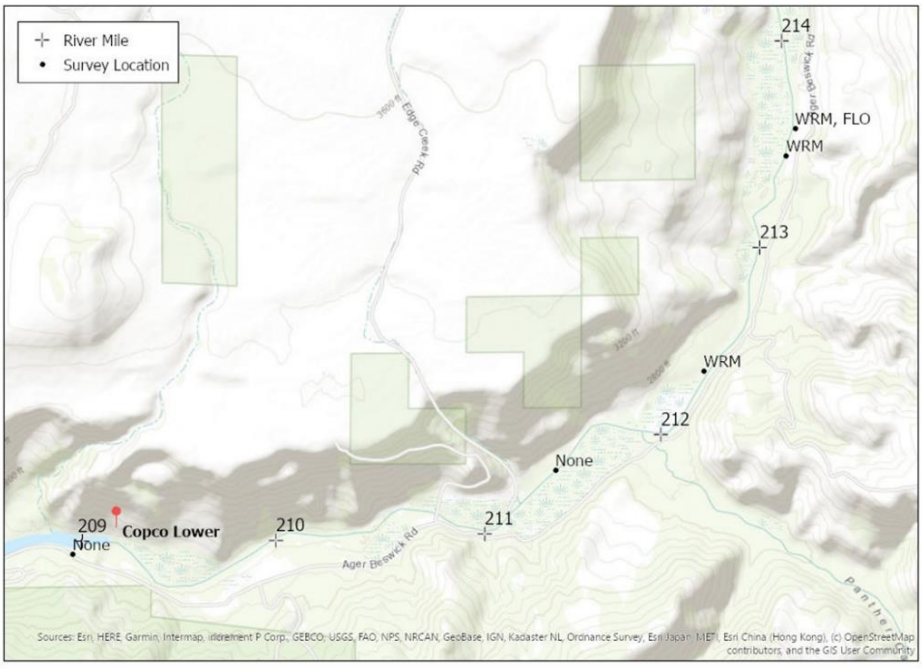

Figure 2-4 Freshwater Mussel Field Investigation Locations for the Translocation Reach Upstream from Copco Reservoir
Key: WRM = western ridged mussel, FLO = floater mussel, WEPE = western pearlshell mussel

Downstream of Keno Dam – Translocation Reach

A single field team visited this potential translocation reach on June 28, 2019. The team conducted preliminary surveys at three sites. Although the team detected floater mussels at each site, habitat and water quality conditions were poor, and the team observed few mussels at the most easily accessible locations. Mussel predation was also prevalent, based on empty shells on the channel margin. This reach was previously assessed during KRRC's 2018 reconnaissance survey, which found little evidence of freshwater mussel use and small amounts of suitable habitat (KRRC 2019).

2.1.3 Summary

Mussels appear to occur nearly continuously throughout the Klamath River from Iron Gate Dam downstream to Cottonwood Creek. KRRC found mussels in low densities along either bank, but in areas of calmer water, mussel beds extended further into the channel toward the thalweg.

In the Salvage Reach and the Copco Lower – Translocation Reach, KRRC observed the greatest mussel densities near rooted submerged aquatic and emergent vegetation (Figure 2-5). This association may indicate freshwater mussel habitats influenced by lower water velocities; the stabilizing nature of roots; and burrowing substrates such as sand, silt, or muck. These areas are difficult to survey either through visual counts or tactile searches necessary, due to reduced visibility, more deeply burrowed mussels, or challenges with encountering mussels among dense root networks. As a result, mussel counts based on visual surveys likely greatly underestimate the number of mussels in a given area containing this habitat.



Figure 2-5 Floater Mussel (circled, top right) and Western Ridged Mussel (right of center) in Typical Habitat Where Mussels Occurred in High Abundance and Density

2.2 Salvage Plan

Freshwater mussels in the 8-mile-long Salvage Reach from Iron Gate Dam downstream to the Cottonwood Creek confluence are anticipated to experience high mortality due to high suspended sediment concentrations and bedload deposition during reservoir drawdown and dam removal. KRRC has prepared the following draft salvage plan to reduce the anticipated Project effects to freshwater mussels downstream from Iron Gate Dam. KRRC's salvage plan focuses on a portion of the freshwater mussel community, and not all mussels will be translocated.

The following sections provide additional detail regarding the objectives of the salvage and translocation, the reaches included in the plan, and the methods for executing the effort. In brief, the salvage will include moving up to 20,000 mussels from up to five sites in the reach from RM 187.6 to RM 185.5, approximately 3.5 miles downstream from Iron Gate Dam. KRRC recommends translocation to three sites in the Copco Lower – Translocation Reach upstream of Copco Lake between approximate RM 213.6 and RM 212.4. KRRC will salvage mussels by boat and wading, and mussels will be trucked in coolers using Ager-Beswick Road on the southern side of the Klamath River. Translocated mussels will be placed by boat and wading in appropriate habitats in the Copco Lower – Translocation Reach.

2.2.1 Methods

KRRC used the field investigation results to determine appropriate freshwater mussel salvage and translocation sites. The following sections present information on the priority salvage and translocation sites.

Salvage Sites

KRRC identified five salvage sites during the 2019 field investigation. The sites are in an approximately 2.5-mile-long reach beginning just upstream of the Klamathon Bridge and extending downstream toward Cottonwood Creek. Mussels appear to be numerous enough at these five sites (Table 2-1; Figure 2-6) that most of the salvage effort may be focused here. For example, visual surveys and subsurface excavations suggest that 3,380 mussels (western ridged mussel and floater combined) were present within ~705 feet of river snorkeled during the field investigation. There are likely substantially more mussels in this reach because the field investigation was a rapid assessment with limited subsurface excavation. However, if the 20,000 mussels planned for salvage are not available in the five sites, the salvage will extend to the longer reach, which includes more dispersed mussel aggregations (Table 2-2). KRRC anticipates completing the salvage-translocation effort in approximately 4 days, KRRC will evaluate the completed effort at priority sites before mussels are salvaged from dispersed locations.

Translocation Sites

KRRC identified three translocation sites in the Lower Copco – Translocation Reach during the 2019 field investigation. The sites between RM 213.6 and RM 212.4 (Table 2-3; Figure 2-7) are approximately 40 minutes of drive time upriver from the salvage sites and are easily accessed from a fishing access. KRRC identified sites with existing freshwater mussels, stable habitat, and low to moderate water velocities under low flow conditions. One site is preferred (TS1; 19016) because it has a large existing freshwater mussel community (an estimated 3,095 mussels), including both western ridged mussels and floaters. Because

both taxa inhabit the site, salvaged western ridged mussels and floaters could be translocated to the site. The site also has large amounts of additional unoccupied habitat.

Table 2-1 Priority Freshwater Mussel Salvage Sites Downstream from Iron Gate Dam

Site ID #	Species	Latitude Longitude	Location	Approximate Count Based on Field Survey	Access
SS1, 19010	WRM, FM	41.89746, -122.500	River-right	1,200	Boat, wading
SS2, 19011	FM	41.89964, -122.510	River-right	N/A	Boat, wading
SS3, 19012	WRM, FM	41.89965, -122.511	River-left	800	Boat, wading
SS4, 19014	WRM, FM	41.89471, -122.525	River-right	700	Boat, wading
SS5, 19015	WRM, FM	41.89200, -122.537	River-left	700	Wading

Notes:

FM = floater mussel
WRM = western ridged mussel

Table 2-2 Secondary Freshwater Mussel Salvage Sites Downstream from Iron Gate Dam

Site ID #	Species[1]	Latitude Longitude	Location	Approximate Count Based on Field Survey	Access
19004	WRM, FM, WEPE	41.928815, -122.443621	River-left	<50	Boat, wading
19005	FM	41.916403, -122.454146	River-right	<50	Boat, wading
19006	FM	41.917117, -122.458086	River-right	<50	Boat, wading
19007	WRM, FM	41.908750, -122.462406	River-right	>50	Boat, wading
19008	WRM	41.895060, -122.483900	River-left	<50	Boat, wading
19009	WRM, FM	41.898302, -122.495856	River-left	>150	Boat, wading

Notes:

FM = floater mussel
WEPE: western pearlshell mussel
WRM = western ridged mussel

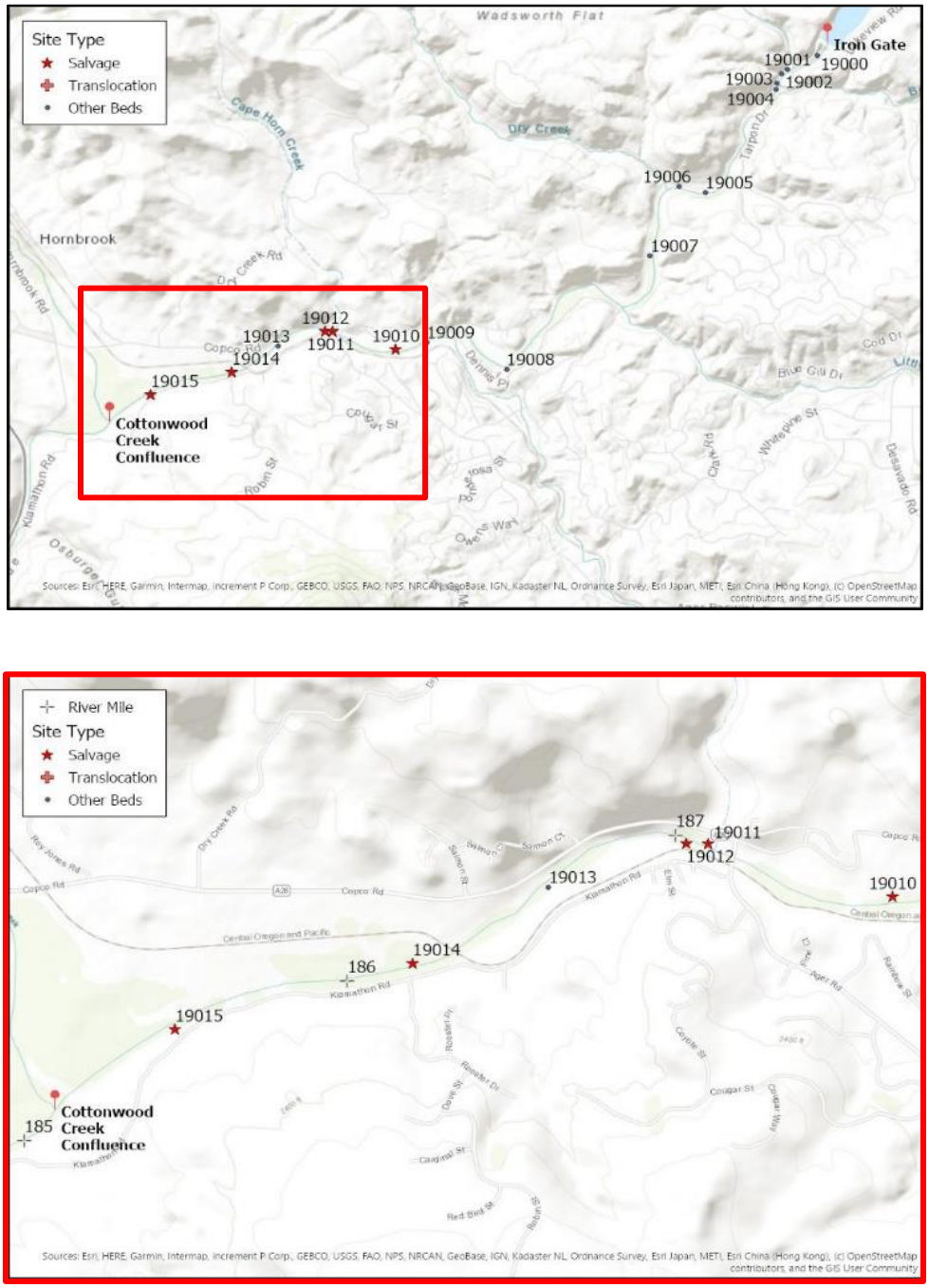

Figure 2-6 Top: Overview of Priority Mussel Salvage Sites; Bottom: Focused View of Sites Referenced in Table 2-1

Table 2-3 Priority Freshwater Mussel Translocation Sites Upstream from Copco Reservoir

Site ID #	Species	Latitude Longitude	Location	Approximate Count Based on Field Survey	Access
TS1, 19016	WRM, FM	41.99211, -122.19	River-right, River-left	3,100	Boat, wading
TS2, 19017	WRM	41.99039, -122.191	River-left	N/A	Boat, wading
TS3, 19018	WRM	41.97655, -122.198	River-right	N/A	Boat, wading

Notes:

FM = floater mussel
WRM = western ridged mussel

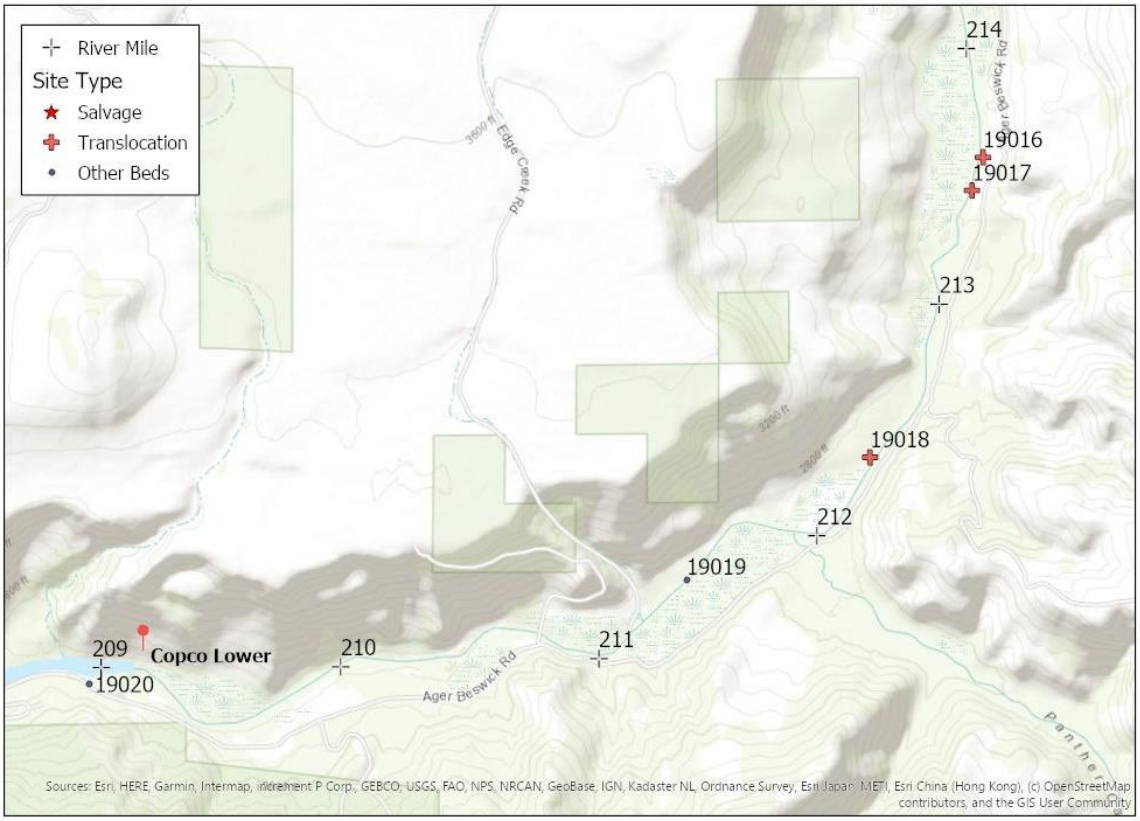

Figure 2-7 Translocation Sites Identified in Table 2-3

Additional translocation sites downstream of site 19016 could be used to place mussels exceeding the capacity of site 19016. Sites TS2 (19017) and TS2 (19018) were not surveyed in as much detail during the field investigation, but habitat conditions resembled conditions at site 19016 (Table 2-4).

Table 2-4 Secondary Freshwater Mussel Translocation Sites Upstream from Copco Reservoir

Site ID #	Species	Latitude Longitude	Location	Approximate Count Based on Field Survey	Access
19019	None	41.970205, -122.210916	River-right	N/A	Boat, wading
19020	None	41.964790, -122.252600	River-right, River-left	N/A	Boat, wading

Salvage and Translocation Implementation

KRRC will complete the translocation in early summer prior to reservoir drawdown in advance of dam removal. The salvage will be completed during safe water quality conditions (e.g., low microsystin concentrations), moderate air temperatures of less than 80 degrees Fahrenheit, and stable river flows less than 1,200 cfs. These conditions will ensure worker safety and reduce stress on mussels during transport.

KRRC biologists will mark salvage and translocation sites at least one day in advance of the start of the salvage. To focus the salvage effort, the biologists will mark sites with buoys, pin flags, or painted stones, or by some other method , and will mark and record the coordinates of the upstream and downstream reach extents using GPS. Salvage and translocation teams will use recorded data to navigate to sites once the salvage and translocation effort commences. KRRC anticipates that the salvage will be completed by two teams over approximately 4 days. Each team will include up to 10 people, with at least one biologist experienced with freshwater mussel salvage leading each team.

All team members will complete the KRRC aquatic invasive species protocol (AISP) prior to arriving on site. Team members will meet at the Klamathon Bridge boat access for orientation. KRRC will review the AISP, complete safety training, and then provide a mussel salvage orientation. Each team will include two rafts and four personnel per raft. It is anticipated that the four personnel will include an oarsman, data recorder, and mussel salvagers.

Following the orientation, both teams will begin salvaging mussels at site 19015 near the CDFW boat access above Cottonwood Creek. This site, which can be accessed by wading, will provide an opportunity for team members to work together for the first salvage site. Once mussels have been placed in half of the transport coolers, the salvage team will continue to salvage mussels and the translocation team will depart with the mussel coolers for the translocation site. The translocation team will arrive at translocation site 19016 and begin to place mussels by boating across the river from the fishing access. Salvage team members will continue to salvage mussels in the vicinity of site 19015. A driver will transport mussels once the next set of transport coolers is filled. The driver will pick up empty coolers from the translocation team and return the coolers to the salvage team. KRRC anticipates that three mussel transports will be completed per day,

depending on the number of coolers and on salvage and translocation efficiency. The team leaders will be in communication and will adjust techniques as necessary.

Mussel Salvage Handling

Team members will navigate to each salvage site by boat or by wading. Salvagers will begin at the downstream extent of marked mussel aggregations and snorkel in an upstream direction. Mussels will be removed from the channel bed surface and subsurface. Rooted vegetation will be investigated as mussels were often found associated with rooted vegetation during the field investigation. Mussels will be carefully removed from the substrate and placed in mesh bags. Salvagers will periodically hand off mesh bags to the oarman or the data recorder to place mussels in water-filled buckets, preferably harnessed to the side of the raft in such a way that the buckets remain partially submerged in the river to maintain the ambient water temperature. Each data recorder will have a GPS-enabled field tablet containing gridded aerial base maps of the salvage reach. The data recorder will note the salvage site location and the approximate number and taxa of mussels removed from each site. Sites may be visited in successive days to remove as many mussels as possible.

The boat will periodically navigate to shore to hand off the mussel buckets to team members on the shore. The team will identify and enumerate the mussels as they are transferred into the transport coolers. Coolers will contain ice blocks or frozen water bottles and damp towels. Mussels will be tightly packed between damp towels to limit mussel movement within the coolers. Once the coolers are full, the driver will transport them to the translocation site.

Mussel Translocation Handling

At the Lower Copco – Translocation Reach, coolers will be loaded onto the translocation rafts. Two or three coolers will be secured to each raft and team members will prepare to place mussels on the channel bed. The oarsmen will also be outfitted with GPS-enabled field tablets with gridded images of the translocation sites. The oarsmen will record the approximate number of mussels placed in each grid cell as team members place the mussels on the channel bed. Mussels will be placed in direct contact with finer sediments (e.g., gravel or smaller particles), which will allow the placed mussel to burrow into the channel bed substrate. KRRC will place mussels near rooted vegetation and lower velocity habitats where available. Mussels will not be piled or otherwise placed on top of each other.

KRRC will coordinate the mussel salvage with the Karuk, Yurok, and Klamath Tribes; state and federal fish and wildlife agencies; and conservation organizations. A portion of the mussels may be marked with shellfish tags if Project partners plan to monitor the mussel response to the translocation. KRRC will not be completing post-translocation monitoring. A mussel translocation report will be completed.

Chapter 3: Lost River and Shortnose Suckers

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3. LOST RIVER AND SHORTNOSE SUCKERS

Lost River and Shortnose Suckers are federally listed endangered species (USFWS 1988), and are similarly listed as endangered in Oregon and in California. The species also have Fully Protected status in California. Both are primarily lake-dwelling sucker species that spawn in riverine habitats; Lost River Suckers also spawn in spring complexes in Upper Klamath Lake. Lost River and Shortnose Suckers are endemic to the Upper Klamath Basin (Moyle 2002). The Lost River Sucker historically occurred in Upper Klamath Lake (Williams et al. 1985) and its tributaries; and in the Lost River watershed, Tule Lake, Lower Klamath Lake, and Sheepy Lake (Moyle 1976). Shortnose Sucker historically occurred in Upper Klamath Lake (Miller and Smith 1981; Williams et al. 1985; USFWS 2019c). The current distribution of both species includes Upper Klamath Lake and its tributaries (Buettner and Scoppettone 1990); Clear Lake Reservoir and its tributaries (USFWS 1993); Tule Lake; Lost River up to Anderson-Rose Dam (USFWS 1993); and the Klamath River downstream to Copco Reservoir and probably to Iron Gate Reservoir (USFWS 1993; KRRC 2018). Shortnose Suckers also occur in Gerber Reservoir and its tributaries, but Lost River Sucker do not.

The Project will eliminate existing reservoir habitat used by Lost River and Shortnose Suckers. The Lost River and Shortnose Suckers that have been observed in the hydroelectric reach reservoirs are believed to be fish that originated in Upper Klamath Lake and moved down through Lake Euwana and the hydroelectric reach (Buettner and Scoppettone 1991; Markle et al. 1999; Desjardins and Markle 2000). However, some Shortnose Sucker in the reservoirs may be derived from reproduction in the hydroelectric reach (Beak Consultants, Inc. 1987). Suckers in the hydroelectric reach may not represent viable, self-sustaining populations (Buettner et al. 2006; USFWS 2012). Due to the lack of suitable upstream fish passage at hydroelectric reach dams and a higher gradient channel segment downstream from Keno Dam, which is believed to have historically excluded suckers from returning to Upper Klamath Lake, the suckers inhabiting the hydroelectric reach no longer interact with Upper Klamath Lake populations.

The hydroelectric reach habitat is not designated critical habitat for either species, and hydroelectric reach populations are not part of the species' recovery units (USFWS 2012; 2019a; 2019b). Although Shortnose Sucker are known to spawn upstream of the hydroelectric reach reservoirs (Beak Consultants, Inc. 1987), there does not appear to be recruitment into the adult populations in Copco and Iron Gate reservoirs (Desjardins and Markle 2000). However, multiple age classes of suckers were sampled by Desjardins and Markle (2000) and during the sampling reported in this document. Poor sucker recruitment may be due to limited spawning habitat, a lack of rearing habitats, poor water quality, and large predator populations residing in the hydroelectric reach reservoirs. Poor understanding of sucker demographics and recruitment into the hydroelectric reach reservoirs is in part due to limited sampling over the past 20 years.

KRRC's field surveys conducted in fall 2018, spring 2019, and fall 2019 are intended to inform and support the KRRC's proposed Aquatic Resource Measure 6 (AR-6), which includes a stepwise adaptive process for sampling and salvaging a portion of the Lost River and Shortnose Suckers residing in the Project Area reservoirs, and relocating salvaged suckers into designated water bodies that are isolated from sucker recovery populations in Upper Klamath Lake. Appendix I of the Definite Plan (KRRC 2018) includes a

description of the proposed measure. This report describes the field activities that were completed during the spring and fall of 2019 and summarizes how those activities compare to the sampling effort undertaken during the fall of 2018. For a more detailed description of the fall 2018 sampling, see KRRC 2019.

3.1 Methods

KRRC conducted reservoir sampling in J.C. Boyle, Copco, and Iron Gate reservoirs during night-time hours in spring and fall 2019. KRRC sampled the reservoirs in late March and early April, and again in early November (Table 3-1).

Table 3-1 Reservoir Sampling Dates for Spring and Fall 2019 Surveys

Location	Spring 2019	Fall 2019
J.C. Boyle Reservoir	March 28 through 30	November 2 and 3
Copco Reservoir	March 31 and April 1	November 4 and 5
Iron Gate Reservoir	April 2 and 3	November 6 and 7

3.1.1 Trammel Netting

Two field teams, each consisting of a three-person crew in a motorized boat with two to three trammel nets, completed the sampling. The field teams consisted of staff from River Design Group, Inc., AECOM, Meridian Environmental, Resource Environmental Solutions, LLC, ODFW, CDFW, and USFWS. The teams used two jet boats to set the 300-foot-long by 6-foot-tall trammel nets. Nets were typically set in relatively shallow areas, including bays and coves in the three reservoirs. KRRC typically positioned nets in a perpendicular orientation relative to the reservoir shoreline. The teams set nets initially in areas where listed suckers were captured during previous sampling efforts (Desjardins and Markle 2000; KRRC fall 2018 sampling); and secondarily in areas with reservoir bottom surfaces that were less than 20 feet deep on average, and extended at least 200 feet waterward from the shoreline as measured using recently acquired bathymetric data. To deploy the trammel nets, the teams attached the lead line of the net to a 15-pound mushroom-type anchor that was lowered to the bottom of the reservoir. They attached the topline of the net to 50 feet of floating rope, and attached a buoy at the water surface to mark the net's location. The team used handheld GPS units to record coordinates for the ends of each net (landward and waterward), and recorded the time of net-set and retrieval for each net-set. The teams measured water temperature during each net-set by attaching an Onset HOBO Pendant thermograph to one end of the trammel net near the lead line. Thermographs recorded water temperature at 5-minute intervals.

The field teams typically soaked the nets for 1 to 3 hours before retrieving them. Fish were removed from the net and placed in aerated live wells. Once all fish were removed from the net, the field teams sampled fish on the boat. The field teams identified fish other than the targeted sucker species by species and disposition (live or dead) and recorded this information before releasing each fish. The field teams identified Lost River Sucker, Shortnose Sucker, and potential Shortnose Sucker hybrids (likely Shortnose Sucker-Klamath Smallscale Sucker hybrids); noted overall condition; and determined sex, when possible. The field teams measured fork length to the nearest millimeter (mm) and then scanned these suckers for the presence of a PIT tag. If no tag was found, a

Biomark APT12 PIT tag was inserted into the ventral abdominal musculature anterior to the pelvic girdle, as recommended by the USGS and described in Hewitt et al. (2014). The teams took a small fin clip from the lower or upper caudal fin for genetic analysis, placed the clip in an envelope, and wrote the PIT tag code on the envelope. The field teams then allowed sampled suckers to recover in the aerated livewell before release, or released the fish following processing. KRRC also completed the sampling methodology for a limited number of Klamath Smallscale Suckers during the fall 2019 sampling. Klamath Smallscale Suckers were sampled to provide USFWS with additional genetic material and metrics associated with the sampled fish.

3.1.2 Electrofishing

KRRC also conducted boat electrofishing during the fall 2019 sampling event. KRRC completed boat electrofishing for one night on each of the three reservoirs to determine the efficacy of capturing Lost River and Shortnose Suckers using electrofishing techniques. The boat electrofishing unit included a modular electrofisher array mounted to a 17-foot jet boat (Figure 3-1). The electrofishing setup consisted of dual bow-mounted anode/cathode arrays (each with a terminal four-wire umbrella). The dual cathode arrays were hung from each side of the boat, each with 14 terminal wires. The anode/cathode arrays were operated by a Smith-Root electrofisher control module (Model 1.5 kilovolt-ampere) with electricity provided by a gas-powered generator (Generac GP 3250). Two fish netters were stationed in the bow of the boat during electrofishing operations. The netters controlled electrofisher operation via a foot switch. To minimize fish mortality, the netters set the electrofisher controller to AC current and the voltage/amperage to the lowest setting. Netters then conducted test electrofishing with the amperage/voltage increased until the desired level of electrotaxis to facilitate capture is exhibited by the target species, while also minimizing injury and mortality of nontarget species.



Figure 3-1 Boat Electrofishing Unit Used During the Fall 2019 Reservoir Sampling

To effectively use the electrofishing equipment, the field teams targeted areas of the reservoirs where suckers had previously been captured and where water depths were typically less than 8 feet deep. All captured fish were held in an onboard aerated and freshwater flow-through water tank. The teams followed the previously described fish sampling and tagging procedures for fish sampled through electrofishing.

3.2 Findings

3.2.1 Trammel Netting

The field teams captured 2,920 total fish across the three reservoirs during the spring and fall 2019 trammel net efforts (Table 3-2). Table 3-3 summarizes sampling efforts and select metrics for each sampling event. Figures 3-2 through 3-4 include net-set locations in each reservoir. Ten Lost River Sucker, 36 Shortnose Sucker, and 1 potential hybrid (Shortnose X Smallscale) sucker were captured, PIT-tagged, and released over the 7-night spring 2019 effort. Four Lost River Sucker, 40 Shortnose Sucker, and 1 potential hybrid (Shortnose X Smallscale) sucker were captured, PIT-tagged, and released over the 6-night fall 2019 effort (Table 3-2).

During the spring 2019 sampling, the field teams recaptured one Shortnose Sucker in Iron Gate Reservoir. The Shortnose Sucker was previously PIT-tagged on November 6, 2018, in Iron Gate Reservoir. The second capture occurred in the same cove, approximately 300 feet away from the initial fall capture location. The recaptured Shortnose Sucker was the only listed or potential hybrid sucker sampled during the spring 2019 sampling event at Iron Gate Reservoir. Additionally, two Lost River Suckers in J.C. Boyle Reservoir and one Shortnose Sucker in Copco Reservoir tagged during the spring 2019 sampling were recaptured during the same sampling.

During the fall 2019 sampling, the field teams recaptured one Lost River Sucker in J.C. Boyle Reservoir that had been initially tagged during the spring 2019 sampling effort. The field teams also recaptured one Shortnose Sucker in Copco Reservoir and one Shortnose Sucker in Iron Gate Reservoir; both fish were initially tagged during the fall 2018 sampling effort. The Shortnose Sucker that was recaptured in Iron Gate Reservoir was also the same fish that had been recaptured during the spring 2019 effort. Two Shortnose Suckers in J.C. Boyle Reservoir and one Shortnose Sucker in Iron Gate Reservoir were initially tagged and then subsequently recaptured during the fall 2019 sampling effort. Table 3-4 contains recapture information for previously tagged listed or potential hybrid suckers. The table does not include suckers that were recaptured during the same sampling effort as they were tagged, because KRRC did not use these fish to develop abundance estimates (see Section 3.3.3).

KRRC calculated the catch per unit effort (CPUE) based on the number of specified suckers captured per hour of net deployment. Listed and potential hybrid sucker CPUE was highest in J.C. Boyle Reservoir in the spring (0.54) and in Copco Reservoir in the fall (0.42). CPUE for listed and potential hybrid suckers was lowest in Iron Gate Reservoir for both the spring and fall sampling events (0.02 and 0.16, respectively). There were no observed target sucker species (or potential hybrid sucker) mortalities (Table 3-5). Observed mortality rates for other species ranged from 0 percent to 65 percent, with the highest mortality rates observed on nonnative Yellow Perch, Crappie, and Largemouth Bass.

Table 3-2 Total Catch by Reservoir during Trammel Net Sampling (Spring and Fall 2019 Surveys)

Species Captured	J.C. Boyle		Copco		Iron Gate		Total	
	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
Shortnose Sucker *Chasmistes brevirostris*	19	9	16	21	1	10	36	40
Lost River Sucker *Deltistes luxatus*	10	4	0	0	0	0	10	4
Potential hybrid sucker *Chasmistes* sp. or *Deltistes* sp.	1	1	0	0	0	0	1	1
Klamath Smallscale Sucker *Catostomus rimiculus*	42	47	55	34	2	5	99	86
Klamath Largescale Sucker *Catostomus snyderi*	0	1	0	1	3	1	3	3
Klamath Chub and Blue Chub *Gila sp.*	398	570	2	26	0	1	400	597
Goldfish *Carassius auratus*	78	31	0	0	1	0	79	31
Crappie *Pomoxis* spp.	58	3	9	5	154	65	221	73
Yellow Bullhead and Brown Bullhead *Ameiurus* spp.	46	6	1	5	11	27	58	38
Yellow Perch *Perca flavescens*	110	37	75	3	673	13	863	53
Bass *Micropterus* spp.	7	0	0	3	2	3	9	6
Other sunfish *Lepomis* spp.	5	3	0	0	34	18	39	21
Redband Trout *Oncorhynchus mykiss* ssp.	55	4	17	26	45	2	117	32
Lamprey *Entosphenus* spp.	0	0	1	0	1	1	2	1
Redside Shiner *Richardsonius balteatus*	0	0	0	0	1	0	1	0

Table 3-3 Trammel Net Sampling Summary Table by Reservoir Spring and Fall 2019 Surveys

Metric	J.C. Boyle		Copco		Iron Gate		Total	
	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
Total net-sets	40	19	31	30	25	36	96	85
Total nets with listed suckers	19 (48%)	10 (53%)	9 (29%)	13 (43%)	1 (4%)	8 (22%)	29 (30%)	31 (36%)
Total listed or potential hybrid suckers	30	14	16	21	1	10	47	45
Total listed or potential hybrid suckers catch per unit effort (fish/net-hour)	0.54	0.39	0.38	0.42	0.02	0.16	0.34	0.31
Total net hours	55.1	36.0	42.4	50.3	42.6	61.0	140.1	147.4
Minimum net soak time (hours)	0.8	1.2	1.0	1.0	1.2	1.0	0.8	1.0
Mean net soak time (hours)	1.4	1.9	1.4	1.7	1.7	1.7	1.5	1.7
Maximum net soak time (hours)	2.3	4.0	1.9	2.8	2.5	2.3	2.5	4.0
Minimum depth set (feet)	3	2	2	2.5	4	3.3	2	2
Maximum depth set (feet)	18	21.2	43	46.2	42	41.7	43	46.2
Minimum water temperature (°F)	45.4	42.2	47.4	44.7	47.4	49.1	45.4	42.2
Mean water temperature (°F)	47.3	44.4	49.5	47.7	50.7	50.8	49.2	47.6
Maximum water temperature (°F)	51.2	47.3	52.7	50.4	55.9	54.8	55.9	54.8

Note:

°F = degrees Fahrenheit

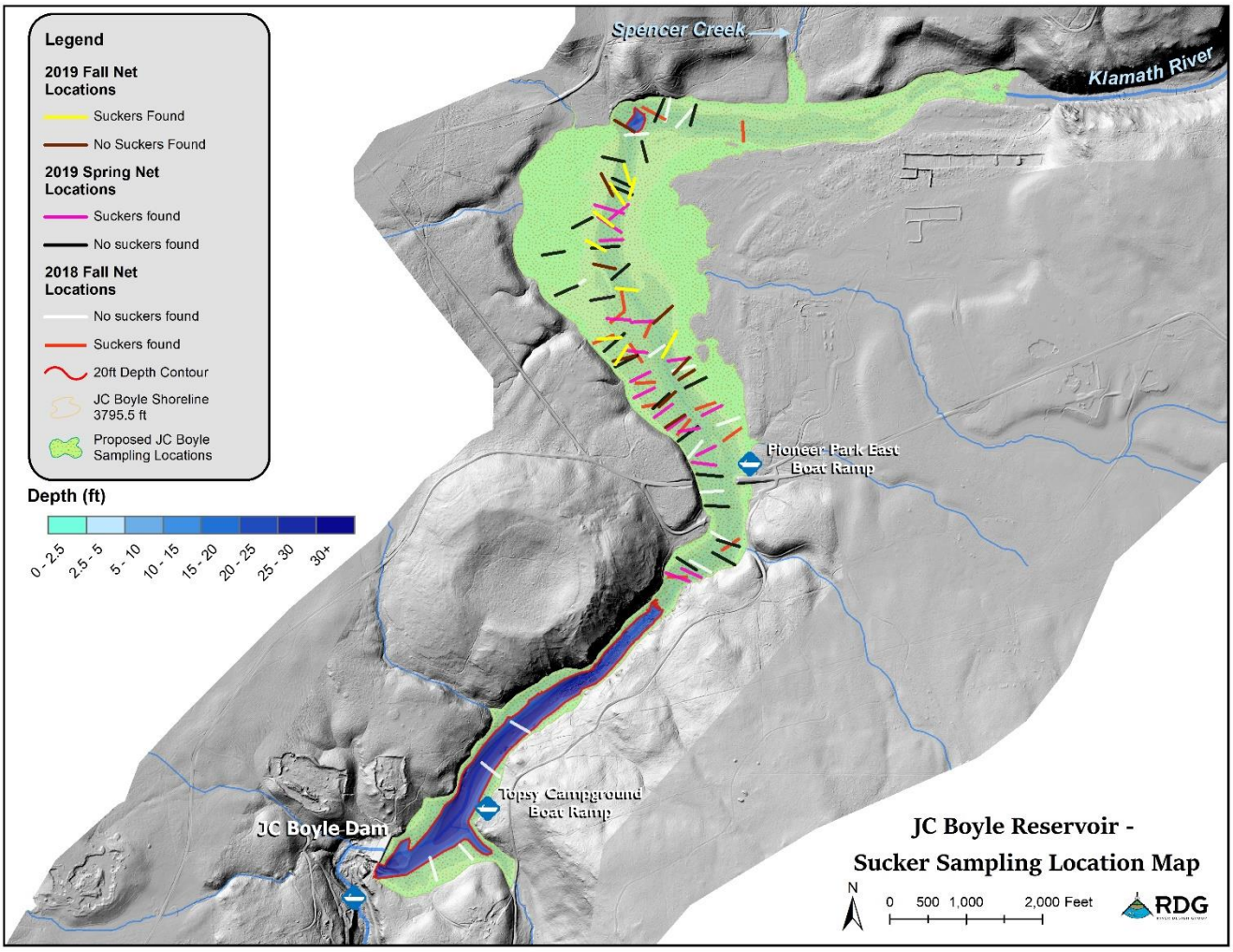

Figure 3-2 Fall 2018 and Spring and Fall 2019 Net-Set Locations and Sucker Sampling Results – J.C. Boyle Reservoir

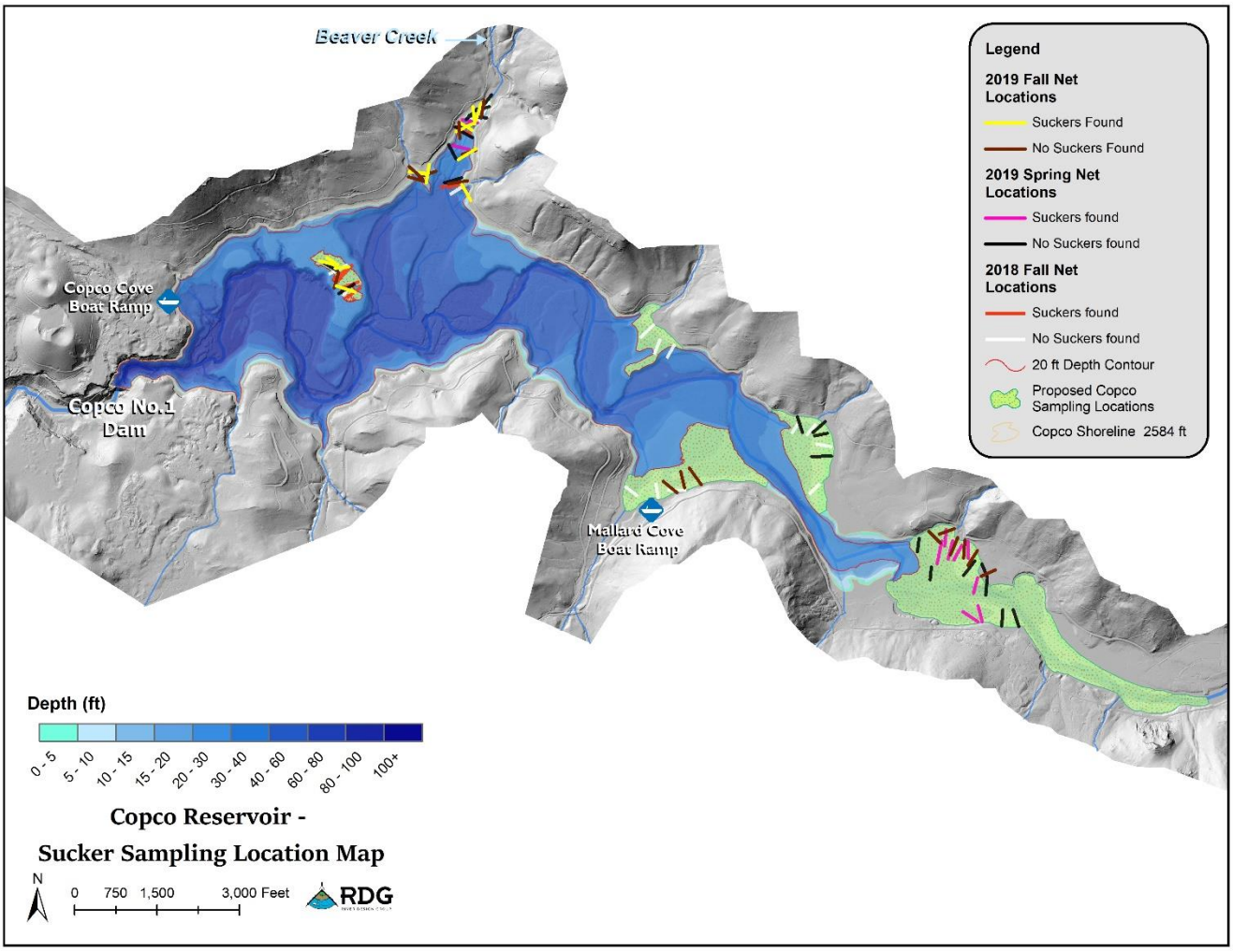

Figure 3-3 Fall 2018 and Spring and Fall 2019 Net-Set Locations and Sucker Sampling Results – Copco Reservoir

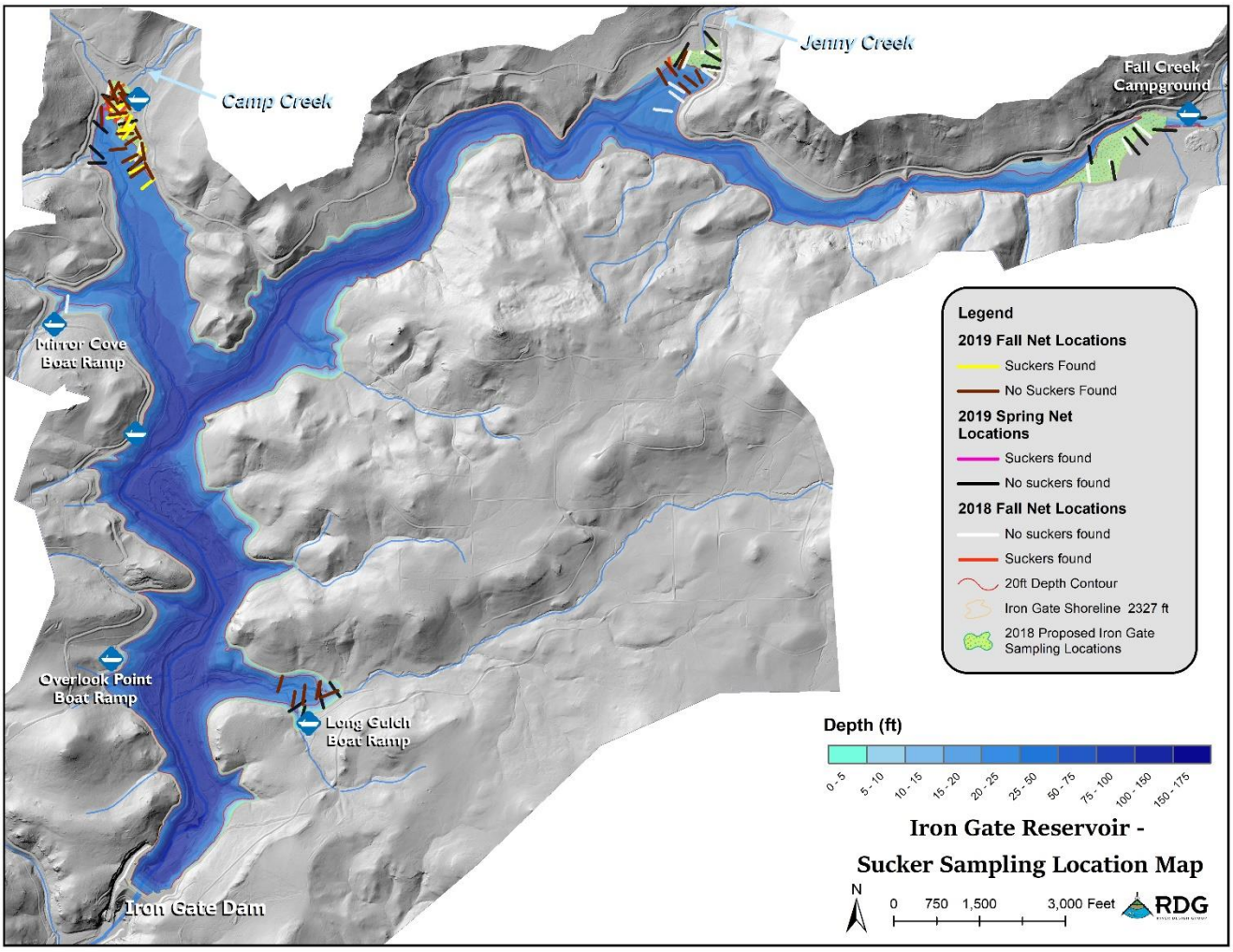

Figure 3-4 Fall 2018 and Spring and Fall 2019 Net-Set Locations and Sucker Sampling Results – Iron Gate Reservoir

Table 3-4 Target Sucker Recapture Data (Spring and Fall 2019 Surveys)

PIT Tag Number	Species	Reservoir	Initial Capture Date	Recapture Date (s)	Approximate Distance (s) from Previous Capture (feet)
989001028381595	Shortnose Sucker	Iron Gate	11/6/2018	4/3/2019, 11/6/2019	300, 900
989001028381463	Lost River Sucker	J.C. Boyle	3/28/2019	11/3/2019	3,100
989001028381798	Shortnose Sucker	Copco	11/8/2018	11/4/2019	100

Note:

PIT = Passive Integrated Transponder

Table 3-5 Total Capture and Handling Mortality during Trammel Net Surveys (Spring and Fall 2019 Surveys)

Species	Estimated % Mortality	
	Spring	Fall
Shortnose Sucker (*Chasmistes brevirostris*)	0%	0%
Lost River Sucker (*Deltistes luxatus*)	0%	0%
Potential hybrid sucker (*Chasmistes* sp. or *Deltistes* sp.)	0%	0%
Klamath Smallscale Sucker (*Catostomus rimiculus*)	0%	0%
Klamath Tui Chub and Blue Chub (*Gila* spp.)	4%	3%
Goldfish (*Carassius auratus*)	0%	0%
Crappie (*Pomoxis* spp.)	65%	38%
Bullhead (*Ameiurus* spp.)	0%	0%
Yellow Perch (*Perca flavescens*)	15%	2%
Bass (*Micropterus* spp.)	22%	0%
Other sunfish (*Lepomis* spp.)	15%	14%
Redband Trout (*Oncorhynchus mykiss* ssp.)	9%	3%
Lamprey (*Entosphenus* spp.)	0%	0%
Redside Shiner (*Richardsonius balteatus*)	0%	-

3.2.2 Electrofishing

Field teams conducted boat electrofishing on November 2, 2019, in J.C. Boyle Reservoir, November 4 in Copco Reservoir, and November 6 in Iron Gate Reservoir. The field teams completed 2,999, 1,271, and 1,000 seconds of electrofishing effort in J.C. Boyle, Copco, and Iron Gate reservoirs, respectively. Although no suckers were captured, the field teams captured 174 total fish via boat electrofishing (Table 3-6). Based on the typical water depth range where suckers were captured by the field teams during the trammel net surveys, suckers likely occupied depths that were greater than the effective range of the boat electrofishing equipment.

Table 3-6 Total Catch and Capture and Handling Mortality during Electrofishing Surveys by Reservoir (Fall 2019 Survey)

Species	J.C. Boyle	Copco	Iron Gate	Total	Estimated % Mortality
Klamath Tui Chub and Blue Chub (*Gila* spp.)	12	29	17	58	2%
Goldfish (*Carassius auratus*)	44	0	0	44	0%
Yellow Bullhead and Brown Bullhead (*Ameiurus* spp.)	1	0	0	1	0%
Yellow Perch (*Perca flavescens*)	0	11	26	37	0%
Bass (*Micropterus* spp.)	5	1	7	13	0%
Redband Trout (*Oncorhynchus mykiss*)	12	9	0	21	0%

3.3 Discussion

3.3.1 Size, Condition, and Composition

In 2019, the field teams captured Shortnose Sucker in all three reservoirs, but captured Lost River Sucker only in J.C. Boyle Reservoir (Figure 3-5), which is consistent with surveys conducted by KRRC field teams in November 2018 (see Figure 3-2). The field teams noted the occurrence of wounds, deformities, and growths/tumors on target sucker species in all three reservoirs (Figure 3-6), with the frequency of those afflictions seemingly increasing in a downstream direction. Ten percent of sampled fish in J.C. Boyle Reservoir, 22 percent in Copco Reservoir, and 46 percent in Iron Gate Reservoir were inflicted by tumors, wounds, or other deformities. Deformities were similar to those observed by KRRC during the November 2018 reservoir surveys.



Figure 3-5 A Lost River Sucker Captured in J.C. Boyle Reservoir (left) and a Shortnose Sucker (right) Captured in Copco Reservoir (right) During the Fall 2019 Survey



Figure 3-6 Example of Tumors and Growths (left) and Wounds (right) Found on Suckers Residing in the Hydroelectric Reach Reservoirs

The field teams captured Shortnose Sucker in each of the three reservoirs sampled. Fork lengths measured for Shortnose Sucker captured during the 2019 sampling events ranged from 317 to 555 mm. Both the smallest and largest Shortnose Sucker were captured in Copco Reservoir. Table 3-7 summarizes the metrics for fork lengths of Shortnose Suckers captured in each of the reservoirs during the 2018 and 2019 reservoir surveys. Although there is overlap in the fork lengths of the sampled fish, there is an apparent trend of increasing Shortnose Sucker size in a downstream direction (Figure 3-7). Based on length-age relationships for Shortnose Sucker in Upper Klamath Lake, Shortnose Sucker sampled in the hydroelectric reach are likely older fish. Based on the measured fork lengths, the sampled Shortnose Sucker may have been spawned in the early 1990s, the last successful spawning period for suckers in Upper Klamath Lake (Hewitt et al. 2017). Although the sizes of Shortnose Sucker suggest that suckers in Copco and Iron Gate reservoirs may be older than those found in J.C. Boyle Reservoir, other studies have found a wide range of sucker lengths at a given age, especially for older fish. Therefore, it is possible that Shortnose Suckers inhabiting the three reservoirs may be of similar age, although there is a downstream trend of increasing fork length.

Table 3-7 Minimum, Maximum, Mean, and Median Fork Lengths for Shortnose Suckers Captured in the Hydroelectric Reach Reservoirs during the Fall 2018 and Spring and Fall 2019 Surveys

Location	Shortnose Sucker Fork Length (mm)			
	Minimum	Maximum	Mean	Median
J.C. Boyle Reservoir	313	520	427	426
Copco Reservoir	317	555	475	481
Iron Gate Reservoir	390	549	484	484

Note:

mm = millimeter

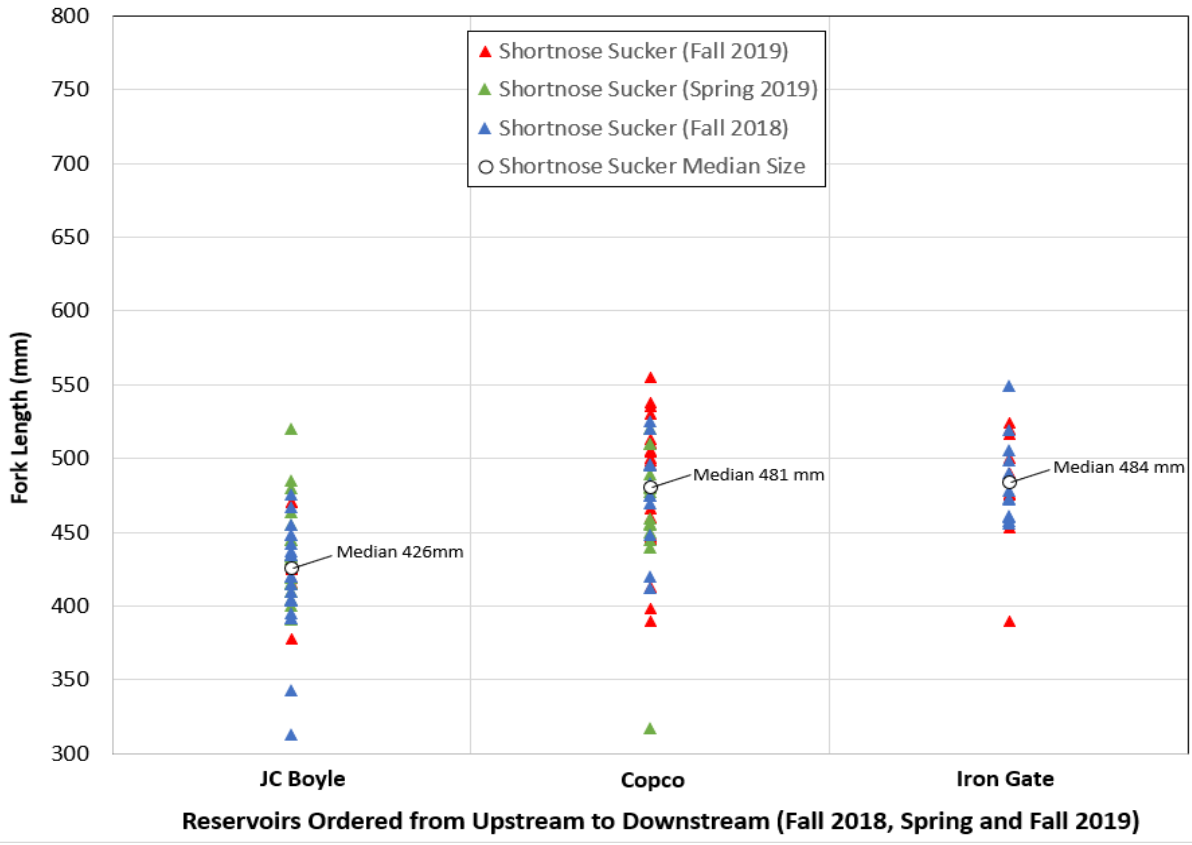

Figure 3-7 Shortnose Sucker Fork Length Trend – Upstream to Downstream

During the 2019 reservoir surveys, the field teams captured fourteen maiden (not previously tagged) Lost River Suckers, ranging in fork length from 440 to 720 mm.

3.3.2 Comparison with Previous Surveys

Table 3-8 provides a comparison of CPUE for Shortnose Sucker between the three completed KRRC sampling efforts and previous sampling completed by Desjardin and Markle in 1998 and 1999 (Desjardins and Markle 2000). Table 3-9 and Figures 3-8 and 3-9 provide a comparison of CPUE and select trammel net metrics for the fall 2018, spring 2019, and fall 2019 KRRC reservoir surveys.

Table 3-8 Comparison of Shortnose Sucker Trammel Net CPUE for Desjardins and Markle (2000) Effort and KRRC Effort (Fall 2018, Fall and Spring 2019 Surveys)

Location	Desjardins and Markle CPUE	KRRC Fall 2018 CPUE	KRRC Spring 2019 CPUE	KRRC Fall 2019 CPUE
J.C. Boyle Reservoir	0.06	0.47	0.54	0.39
Copco Reservoir	0.49	0.39	0.38	0.42
Iron Gate Reservoir	0.04	0.32	0.02	0.16
Reservoirs Combined	0.20	0.34	0.26	0.31

Note:

CPUE catch per unit effort

Table 3-9 Sampling Summary Comparison (Fall 2018, Spring 2019, Fall 2019 Surveys)

Metric	Sampling Event	J.C. Boyle	Copco	Iron Gate	Total	Grand Total
Total net-sets	Fall 2018	30	22	24	76	257
	Spring 2019	40	31	25	96	
	Fall 2019	19	30	36	85	
Total net hours	Fall 2018	57.9	33.6	37.3	128.8	416.2
	Spring 2019	55.1	42.4	42.6	140.1	
	Fall 2019	36.0	50.3	61.0	147.4	
Total nets with listed suckers	Fall 2018	13 (43%)	13 (59%)	8 (33%)	34 (45%)	94 (37%)
	Spring 2019	19 (48%)	9 (29%)	1 (4%)	29 (30%)	
	Fall 2019	10 (53%)	13 (43%)	8 (22%)	31 (36%)	
Total Lost River Suckers	Fall 2018	3	0	0	3	17
	Spring 2019	10	0	0	10	
	Fall 2019	4	0	0	4	
Total Shortnose Suckers	Fall 2018	21	11	12	44	120
	Spring 2019	19	16	1	36	
	Fall 2019	9	21	10	40	
Total listed or potential hybrid suckers	Fall 2018	27	13	17	57	149
	Spring 2019	30	16	1	47	
	Fall 2019	14	21	10	45	
Total listed or potential hybrid suckers catch per unit effort (fish/net-hour)	Fall 2018	0.47	0.39	0.46	0.44	0.36
	Spring 2019	0.54	0.38	0.02	0.34	
	Fall 2019	0.39	0.42	0.16	0.31	
Total recaptures from same sampling event	Fall 2018	0	0	1	1	7
	Spring 2019	2	1	0	3	
	Fall 2019	2	0	1	3	
Total recaptures from previous sampling event	Fall 2018	NA	NA	NA	NA	4
	Spring 2019	0	0	1	0	
	Fall 2019	1	1	1	3	

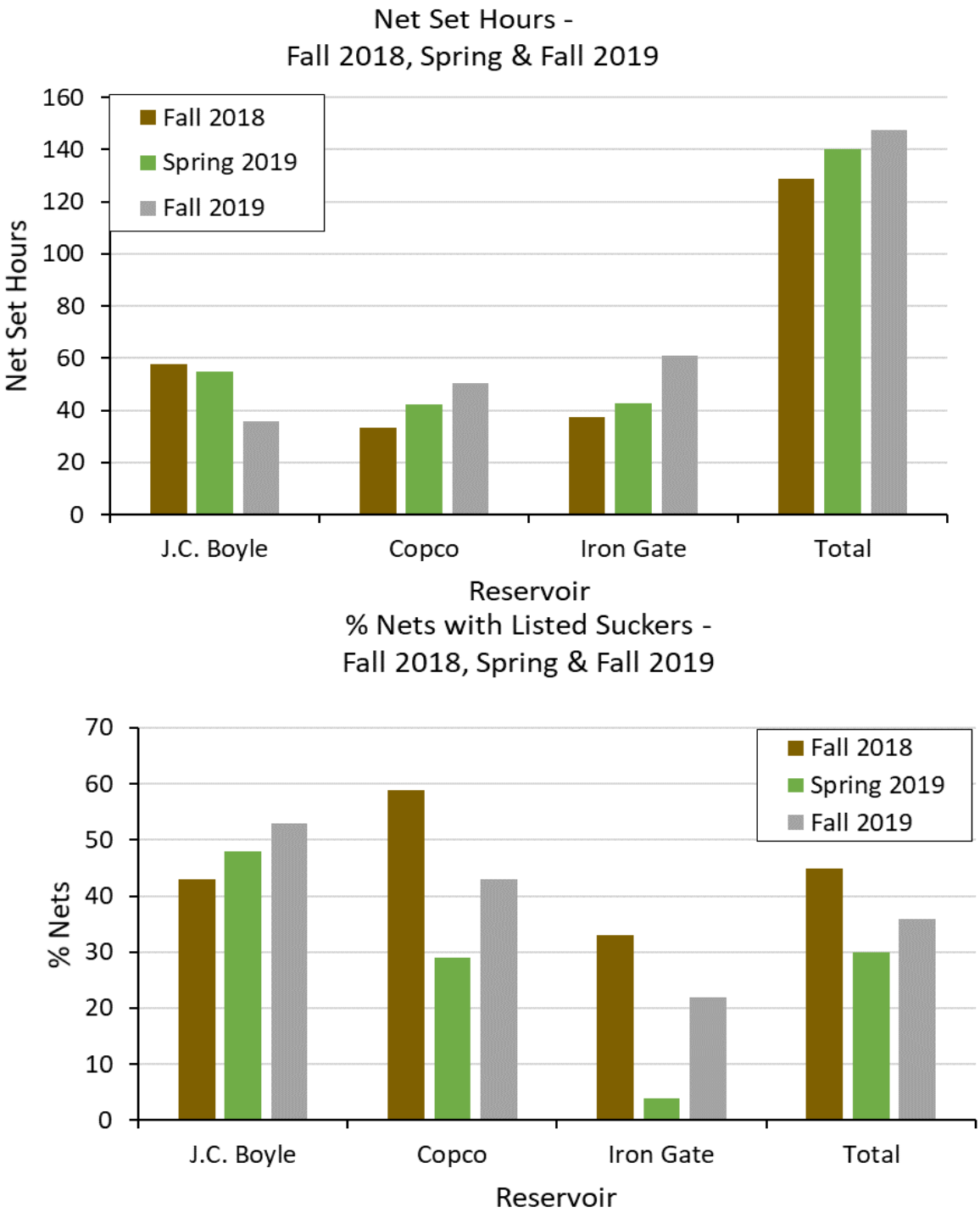

Figure 3-8 Trammel Net Set Hours by Reservoir and Sampling Effort (top), and Percentage of Trammel Net Sets that Captured Listed or Potential Hybrid Suckers by Reservoir and Sampling Effort (bottom)

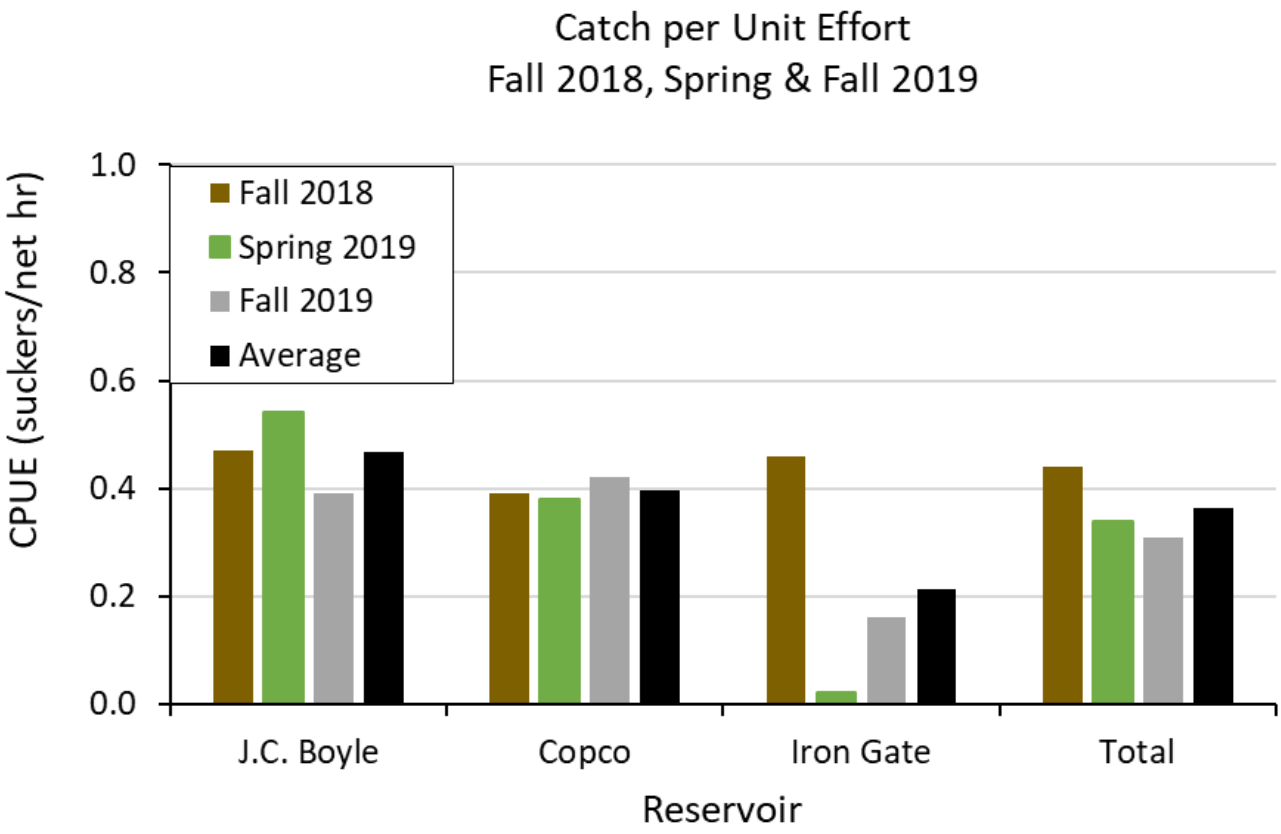

Figure 3-9 Catch Per Unit Effort for Listed or Potential Hybrid Suckers by Reservoir and Sampling Effort

3.3.3 Preliminary Abundance Estimate

KRRC biologists used the PIT tag mark-recapture data to produce preliminary abundance estimates for target suckers inhabiting each reservoir, and for the three reservoirs combined. Due to the relatively low recapture rates to date, mark-recapture data for Shortnose, Lost River, and potential hybrid suckers were combined. Target suckers tagged by the field teams during the fall 2018 and spring 2019 survey efforts were aggregated and treated as the initial marking event. KRRC biologists then treated the fall 2019 survey as the recapture event because it represents the first survey where suckers tagged during prior survey efforts were recaptured by the field teams in all three reservoirs. Abundance estimates were calculated using the following methods.

The Chapman method (Chapman 1951; Johnson et al. 2007) reduces small sample size bias and estimates the total population as:

$$\hat{N} = \frac{(M)(n+1)}{(m+1)}$$

Where:

$\hat{N}$ = Estimated size of the population

n = Number of fish initially marked and released

M = Number of unmarked fish captured during subsequent survey

m = Number of recaptured fish that were marked

Meridian Environmental, Inc. (KRRC subcontractor) used a nonparametric bootstrap method (Efron and Tibshirani 1986; Manly 2007) to calculate mean population estimates and estimate variance to produce 95 percent confidence intervals. The bootstrap was run 10 times for each estimate, with 1,000 iterations per run. Population and variance estimates represent the mean of each 10-run set. KRRC calculated the 95 percent confidence interval as the square root of the mean bootstrap variance multiplied by 1.96.

The mark-recapture estimates include the following assumptions: 100 percent PIT tag retention (i.e., no tag loss); mortality of tagged target suckers is the same as untagged target suckers; no emigration of tagged target suckers occurs from the reservoirs between the first and last survey; and trammel net-set locations are representative of habitats used by suckers in the three reservoirs. Combining Shortnose Sucker, Lost River Sucker, and potential hybrid sucker mark-recapture data also assumes that the trammel net catchability of these three categories of fish is the same.

An additional assumption is that each sucker species identification is correct. The field teams have collected genetic samples from all Shortnose Sucker, Lost River Sucker, and potential hybrid suckers captured during the three survey efforts, and all target suckers were PIT-tagged. Once these samples are processed, reservoir mark-recapture population estimates can be further refined based on species genetic assignment of each fish in the dataset.

The fall 2019 mark-recapture survey-based population estimates suggest that the total number of adult target suckers is highest in J.C. Boyle Reservoir and lowest in Iron Gate Reservoir (Table 3-10). The 95 percent confidence intervals suggest that there are several hundred to about 1,000 adult target suckers in J.C. Boyle Reservoir, but less than 300 in Iron Gate Reservoir. The adult target sucker population in Copco Reservoir is likely at some intermediate value to these ranges (Table 3-11). Due to the low number of recaptured suckers to date, the 95 percent confidence intervals for the population estimates are large compared to the magnitude of the population estimate (i.e., confidence interval widths substantially greater than ±100 percent of the population estimate. To refine the abundance estimate for each hydroelectric reach reservoir, and to reduce the confidence interval widths of those estimates, KRRC intends to complete an additional sampling effort in the spring of 2020 and is strategizing on methods to increase target sucker recapture efficiency during that effort.

Table 3-10 Population Estimate Attributes and Preliminary Estimates for Listed and Potential Hybrid Suckers in Each Reservoir and in All Reservoirs Combined

Population Estimate Attributes	J.C. Boyle	Copco	Iron Gate	All Reservoirs Combined
Total suckers PIT-tagged (fall 2018 and spring 2019)	57	29	17	103
Total maiden suckers captured (fall 2019)	14	21	10	45
Total tagged suckers recaptured (fall 2019)	1	1	1	3
Recapture efficiency (# recaptured/# Tagged)	0.018	0.034	0.059	0.029
Population estimate (Chapman estimator)	434	329	98	1,195
Mean population estimate (bootstrap estimator)	402	298	85	1,913
95% confidence interval (bootstrap estimator)	±739	±540	±160	±2,610
95% confidence interval width as % of bootstrap population estimate	±184%	±182%	±189%	±136%

Note:

PIT = Passive Integrated Transponder

3.4 Next Steps and Recommendations

KRRC is coordinating the sucker analysis and future sampling with USFWS. KRRC has provided sucker genetic samples from the fall 2018 and spring 2019 sampling efforts to USFWS, and KRRC will provide the fall 2019 fin clips to USFWS in January 2020. The USFWS – Klamath Falls Field Office is also coordinating a Klamath sucker genetics study with the USFWS – Abernathy Laboratory. The Abernathy Laboratory is currently producing a paper describing the development of a genetic library of Klamath suckers; this paper is in review. The Abernathy Laboratory has also provided a proposal to the Klamath Falls Field Office to develop

genetic testing assays that would be used to determine the genetic composition of the samples collected by KRRC in the hydroelectric reach reservoirs.

KRRC is planning to complete a fourth and final sampling effort in spring 2020. The spring sampling will be targeted to coincide with Lost River and Shortnose Sucker spawning. KRRC intends to use trammel nets in the reservoirs and boat electrofishing in the sucker spawning reaches upstream of the reservoirs. Recapturing tagged target suckers is the primary goal of the spring sampling effort.

KRRC anticipates an increase in recapture efficiency (the number of net hours necessary per recapture) during the spring 2020 survey due to the increased number of PIT-tagged target suckers available for recapture. Three PIT-tagged target suckers were recaptured, with 103 PIT-tagged suckers available for recapture during the fall 2019 survey. Following the fall 2019 survey, there are currently 148 total PIT-tagged target suckers available for recapture; therefore, given the same level of netting effort, it is reasonable to expect an increase in recapture efficiency. To increase recapture efficiency, the field teams are also exploring the use of additional trammel nets and completing longer net soak times in areas where suckers have been previously captured. Furthermore, the spring sampling effort will employ boat electrofishing in the river reaches, a methodology that KRRC has yet to attempt. If the sampling is more effective at capturing suckers, this method could be employed during the future sucker salvage to be completed in advance of reservoir drawdown and dam removal.

KRRC will continue to coordinate with state and federal agencies and other stakeholders to draft a salvage and relocation plan for Lost River Sucker and Shortnose Sucker prior to dam removal, if this effort is deemed necessary. Depending on the results of the genetic analysis and the findings of the spring 2020 reservoir and river survey, KRRC may conduct initial salvage and relocation efforts as early as spring of 2021.

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Appendix E: Wildlife Resources

Table 7A-1. Habitats and Project sections associated with wildlife detected during terrestrial studies in the Klamath Hydroelectric Project study area.

	DST	GL	J	KMC	LP	LUB	MHO	MHOC	MHOJ	MXC	PA	PEM	PP	R/PFO	R/PSS	RG	RM	RT	RUB	SB
BIRDS (174)																				
Pelagic Birds and Herons (12)																				
Common Loon*						I														
Eared Grebe						K														
Western Grebe						C,K													B,N	
Clark's Grebe						K													N	
American White Pelican*			N			C,I,J,K								K		C,K			B,R,Y,N	
Double-Crested Cormorant	N		N	Y		C,I,J,K								K	K	C,Y			Y,N,L	
Black-Crowned Night Heron*	N					K								K	Y,N,L				Y,N	
Green Heron															F,I,L	L			N	
Snowy Egret*						K													N	
Great Egret*	N					K						N			B,N				Y,N	
Great Blue Heron						C,I,K	C			C				R,L	I,L	L	L		B,L,N	J
White-Faced Ibis*		N											J						N	
Waterfowl (20)																				
Greater White-Fronted Goose						K														
Canada Goose						I,C,J,K	F,I			C,I	R			I	I,N	J			N,F,R,L	
Snow Goose						K,N														
Mallard	K	I				I,C,J,K					K	I,K		C	I	K			K,B,Y,L	J
Gadwall						J,K														
American Wigeon						C,I,K,J														
Northern Pintail						J														
Blue-Winged Teal						J														
Cinnamon Teal	K					K						K								
Ruddy Duck						C,J,K													L	
Wood Duck						I,C						C,I							L,N,Y	
Canvasback						J,K														
Redhead						K														
Ring-Necked Duck						I,C													L	
Lesser Scaup						I,C,J,K														
Barrow's Goldeneye*						I,C,K														
Common Goldeneye						I,K														
Bufflehead*						I,C,J,K													N	
Common Merganser						I,C,J,K								L		L			Y,N,L,R	
Hooded Merganser						C														
Raptors, Gamebirds (16)																				
Turkey Vulture		C,I,N,L						R					J	C,I		K				
Osprey*		C,I		B		B,I,J			F,I,R			F	J		C,I,B	L			R,L	
Northern Harrier*		L														K				
Sharp-Shinned Hawk*															L					
Cooper's Hawk*				B				R												
Northern Goshawk*								R												
Golden Eagle*		I,C		R,B				R									R			
Bald Eagle*						C,I,J	C						J	I,K	J					J
Red-tailed Hawk	K		N						F	C	K		B		Y					
American Kestrel		N												R						
Merlin*															R					
Prairie Falcon*		C,R		B		K						K								
Wild Turkey																				
Blue Grouse								R				R								
California Quail		I,L,N	N				C,I,L		I	L				C	C,I,L		F			
Mountain Quail*				B				F		R					L					
Rails, Cranes, Shorebirds, Gulls, Terns, and Doves (18)																				
Virginia Rail															F					
American Coot						I,K,N													N	
Sandhill Crane*		K,J				J						J								
Killdeer	B,I,J,K,L,N	C,I,N				C,J	I				K	I,K	J	C,L	I,Y,L	R,K			B,Y	J
American Avocet						K														
Black-Necked Stilt	K					K														
Greater Yellowlegs																			N	
Spotted Sandpiper						C,J,K						K		K	L	L			Y,L,N	J
Least Sandpiper						J														
Common Snipe		I																		
Bonaparte's Gull						C														
Ring-Billed Gull						C,F,I,J,K					K			C					C,F,L	
California Gull						I													R	
Caspian Tern*						C,I,J,K,N			I				J		J				B,Y,N	J
Forster's Tern*						C,I,J,K,N					K		J			K			R,N	
Black Tern*						J,K														
Rock Dove						K														
Mourning Dove	C,K	C,I,K	I,K	R			C,I,R,L	2,F,J,C	F,I	C,I,R,Y		C,I,R	J,Y,K	C,K,N,L	C,I,N,L					J

Habitat: DST=Disturbed; GL=Grassland; J=Juniper; KMC=Klamath Mixed Conifer; LP=Lodgepole Pine; LUB=Lacustrine Unconsolidated Bottom; MHO=Montane Hardwood Oak; MHOC=Montane Hardwood Oak Conifer; MHOJ=Montane Hardwood Oak Juniper; MXC=Mixed Conifer; PA=Pasture; PEM=Palustrine Emergent Wetland;PP=Ponderosa Pine; R/PFO=Riparian/Palustrine Forested Wetland; R/PSS=Riparian/Palustrine Scrub-Shrub Wetland; RG=Riparian Grassland; RM=Riparian Mixed; RT=Rock Talus; RUB=Riverine Unconsolidated Bottom; SB=Sagebrush.

***TES Species.**

Project Section: B=J.C. Boyle bypass; C=Copco reservoir; F=Fall Creek; I=Iron Gate reservoir; J=J.C. Boyle reservoir; K=Keno reservoir; L=Lower River; N=Link River; R=J.C. Boyle peaking reach; Y=Keno Canyon; 2=Copco No.2 bypass.

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Table 7A-1 (cont.). Habitats and Project sections associated with wildlife detected during terrestrial studies in the Klamath Hydroelectric Project study area.

	DST	GL	J	KMC	LP	LUB	MHO	MHOC	MHOJ	MXC	PA	PEM	PP	R/PFO	R/PSS	RG	RM	RT	RUB	SB
BIRDS (cont.)																				
Owls, Goatsuckers, Swifts, Hummingsbirds, and Kingfishers (13)																				
Barn Owl	N																			
Great-Horned Owl									L				B,J	J						
Great Gray Owl*				B				F												
Northern Spotted Owl*				R,B																
Western Screech Owl									I											
Flammulated Owl*				B,R				R												
Northern Pygmy Owl								R												
Common Poorwill		I																		
Vaux's Swift*						C	C	R			R		J	C,R	F,B	C,R			R	
Anna's Hummingbird									C					C	C					
Calliope Hummingbird							R			C				I,R	R	R	F,R			
Rufus Hummingbird								F						C	B,C		F			
Belted Kingfisher			K			C,J,K		R						C,I,K,L	F,I,B,Y,L				B,R,Y,L	J
Woodpeckers and Flycatchers (17)																				
Acorn Woodpecker*		C,L	I				C,I,R	2,C,I,R,B	C,F,I	C,R		R	J	C,I,R	C,I,L		R			
White-Headed Woodpecker*															B					
Lewis' Woodpecker*							I,R			L				L	I,L	L				
Red-Shafted Flicker		B	I,K	B,J	B	N	C,I,R	2,I,R	R	L		R	B,R,J,Y,K	C,R,N	I,B,J		R			J
Red-Breasted Sapsucker								R									F			
Downy Woodpecker							R			R			B	R	C		R			
Hairy Woodpecker		B		J									Y				F			
Pileated Woodpecker*				B,J			R	R	R				B,F,Y		R		F			
Olive-Sided Flycatcher*			N										R,J,Y,K							
Western Wood Peewee		C,I,R	C,K	R,Y	B	K	C,I,R,L	B,C,F,R	B,F,I,R	C,Y		F	B,F,R,J,Y,K	2,C,I,R,N,L	C,F,I,B,R,J,Y,L	L	F,R			
Willow Flycatcher*												R		N	C,I,R,J,L	L				
Hammond's Flycatcher													Y							
Dusky Flycatcher							R	R									R			
Pacific Slope Flycatcher				B				R							B					
Black Phoebe*													B	R	L					
Ash-Throated Flycatcher		C,I	I				C,I,R,L	R	I	C,L				C,I,L	I					
Western Kingbird		C					C,L	R		C		F		L		L				
Vireos, Corvids, and Swallows (13)																				
Cassin's Vireo				B,R			R		R	C			F	C,N,B	L		F,R			
Warbling Vireo		R		R			R	R	R				J		R		F			
Stellar's Jay	B		N	B	B		R	B,R	R	Y		R	B,F,R,J,Y,K	R	F,B,R,J,Y		F			
Scrub Jay			I,N				C,I		F,I	C				C,I,L		L				
Black-Billed Magpie		C					I					K			I					J
American Crow		R,L	I			C	R,L	I,R	I	C	R			I,L	I,L	L	R			
Common Raven		N		R			R						R,J,Y		R					
Tree Swallow	K	C,R	K			C,I,J,K	I,R		R		R	C	J,K	C,I,R	C,B,I,R,J,N	C,R,L			F,B,R,L	
Violet-Green Swallow	I	I				C,I,N	I		R	C	R	I,K	J	C,I,R	B,R,J,L	C,K			R,N	
Purple Martin*										F										
Cliff Swallow	B,J,F,K					C,I,J,K,N			C	C,I	R,K	I	J	K	I,B,Y,L	K,L			B,Y,N,L	J
Northern Rough-Winged Swallow			C,N			C						B,I		K	B,K					
Barn Swallow										R	R,K	I		K	B,K,L	K			L	J
Wrentits, Titmice, Chickadees, and Nuthatches (9)																				
Wrentit									R					I						
Oak/Juniper Titmouse		C					C,I	R	C				Y	2,C,	C,I,B					
Black-Capped Chickadee*		C													I	N				
Mountain Chickadee		B,C	R,K	B,R,J	B		I,R			C,R,Y			B,R,J,Y		R,J					
Bushtit		R	K				C,I	2,R	C,F,I	C,Y				C,I	F,I,B,R,J,Y,N		F			
Brown Creeper								R					B,J							
White-Breasted Nuthatch				R			C,I,R		I,R				J				R			
Red-Breasted Nuthatch				B,J			R	R					B,R							
Pygmy Nuthatch*													J,K							

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Table 7A-1 (cont.). Habitats and Project sections associated with wildlife detected during terrestrial studies in the Klamath Hydroelectric Project study area.

	DST	GL	J	KMC	LP	LUB	MHO	MHOC	MHOJ	MXC	PA	PEM	PP	R/PFO	R/PSS	RG	RM	RT	RUB	SB
BIRDS (cont.)																				
Wrens, Dippers, Kinglets, and Gnatcatchers (8)																				
House Wren	I,J	C	I,N				C,R	R	F,R	C,I,L	R		B,R,J,Y,K	C,I,R,L	C,F,I,Y,L	L	F			
Bewick's Wren			I,N				C,I	I,R	I	C,I				2,R,L	I,C		F	F		
Rock Wren		I,L							I											
Canyon Wren										C					C			2		
Marsh Wren												K				K				
American Dipper														2,R	B				R,2	
Golden-Crowned Kinglet				B									B	I						
Blue-Gray Gnatcatcher*														I						
Thrushes, Starlings, and Waxwings (7)																				
Western Bluebird*							I	2	F											
Swainson's Thrush				B				F,R					R	I	I					
Hermit Thrush							R		F			F	J							
American Pipit															L					
European Starling	K	C	K			K	C,R	R	R	C	K	C	J	C,K,L	J,L	K,L			B,L	J
American Robin	B,2,K	R,J	K,N	B,R,J	B		I,R	I,R	R	C,R,Y	R	I,R	B,R,J,Y	C,I,R,N,L	B,C,R,J,Y,K,N	C,J,Y,N	R	R		J
Cedar Waxwing															K					
Warblers and Tanagers (13)																				
Orange-Crowned Warbler							C,I,R			C,R				C,R,N,L	F,N					
Nashville Warbler		B					R	F,R	F	R		R	B,J		B,R,L,N		F			
Chestnut-Sided Warbler															I					
Yellow-Rumped Warbler		B,R	C	B,R,J	B		C,R	C,F,R	R	R,Y			B,F,R,J,Y	C,R	B,R,J	R,K	F,R			
Black-Throated Gray Warbler							I	R	I				R		L,I		F			
Townsend's Warbler								R					Y							
Hermit Warbler							R	R												
Yellow Warbler*					B		C,I,R	B,2,C,R	F,I,R	Y	R	C,F,R	B,J,Y	2,C,I,R,K,N,L	C,F,I,B,R,J,Y,K,N,L	R,Y,N,L	F,R		Y	
MacGillivrays's Warbler				J			R	R	R	C				C,I,L,R,2	C,R,N,L,I					
Wilson's Warbler			K				C,F,I,R	I,R	F,I	R,Y		F		C,I,R,K,L	C,F,I,B,R,J,Y,N,L	L	F,R	R		
Common Yellowthroat												K		R	B,C,L					
Yellow-Breasted Chat*		R											R	R,L	C,F,R,L	L				
Western Tanager		C,R	R	B,R,J	B		C,R,L	C,F,R	F,R	C,R	R	R	B,F,R,J,Y,K	2,C,I,R	C,F,B,R,J,L	Y,L	F,R		R	
Sparrows, Icterids, and Finches (28)																				
Green-Tailed Towhee									I											
Spotted Towhee		I	R,K,N	J	B		I,R	F,R	F,I,R	R,Y			B,F,R,J,Y,K	C,I	B,R,Y,N					
Chipping Sparrow	B	B,I,R,L	C,R,N	B,R,J	B		F,I,R	C,F,R	F,I,R	C,F,R,J	R		B,R,J,Y,K		R,Y					J
Brewer's Sparrow									I						N					
Lark Sparrow		C	C						C,I											
Fox Sparrow	Y	B																		
Savannah Sparrow											K	K				K				J
Lincoln's Sparrow								R												
Song Sparrow		F,R	N	B			C,R	I,R	F,R	C,Y	R	F,R,Y,K	J,Y,K	B,2,I,R,K,N,L	F,I,B,C,R,J,Y,K,N,L	R,Y,K,L	F,R		2	J
Vesper Sparrow													J							J
White-Crowned Sparrow												F								
Golden-Crowned Sparrow																	R			
Dark-Eyed Junco		B	R	B,R,J	B		C,R	2,C,I	R	C,F			B,R,J,Y	C,R	B					J
Black-Headed Grosbeak	N		R,K,N	B,R,J			B,C,F,I,R	B,2,C,I,R	I,R	C,R,Y,L		R	F,R,Y,K	B,2,C,I,R,K,N,L	B,I,R,Y,N,L	R,L	F,R		R,Y	
Lazuli Bunting			I				C,I,R	R	I,R	R,Y	R	F	F	C,I,R	I,B,R	R,N	F,R			
Western Meadowlark		C,I,K,L	I			K			I	C	K				I	K				
Yellow-Headed Blackbird											K	B,K		K	K					
Red-Winged Blackbird	K,N	I,R	I,K,N			K	I,R		R	C,Y	R,K	J,C,F,I,R,Y,K	J	I,R,K,N,L	F,I,B,R,Y,K,N,L	C,R,J,Y,K,N,L				J
Brewer's Blackbird	2,C,L	C,I,R	I,K,N				C	R		C,L	K	C,F,I	J	2,C,I,R,N,L	C,I,B,I,J,Y,K,N,L	C,Y,K,L				J
Brown-Headed Cowbird	B,K	C,K	K,N		B		C,I,R	2,R	F,I	C,Y,L	R,K	B,R,K	B,F,J,Y	2,C,I,R,K,N,L	F,I,B,R,J,Y,K,N,L	Y,K,N,L	F		Y	
Bullock's Oriole		C,R	C,N	B			C,I,R	C,I,R	F,I,R	C,R,L		C,F,I	R	2,C,I,R,N,L	C,F,I,N,L	R,N,L	F,R	R		
Purple Finch							I	R	I				F,J,Y	I,N,L	R	R	F			
Cassin's Finch					B			R		Y			J							
House Finch	C	C	I,K				I					K		C,K,L	L	L				
Red Crossbill													Y							
American Goldfinch		C,I,K,J					R		R	R	R,K			C,R	C,Y	K	F,R			
Lesser Goldfinch		C	C,I				C,I	F,R	I		R			C,I,L		L	F			
House Sparrow	K														N					

Habitat: DST=Disturbed; GL=Grassland; J=Juniper; KMC=Klamath Mixed Conifer; LP=Lodgepole Pine; LUB=Lacustrine Unconsolidated Bottom; MHO=Montane Hardwood Oak; MHOC=Montane Hardwood Oak Conifer; MHOJ=Montane Hardwood Oak Juniper; MXC=Mixed Conifer; PA=Pasture; PEM=Palustrine Emergent Wetland;PP=Ponderosa Pine; R/PFO=Riparian/Palustrine Forested Wetland; R/PSS=Riparian/Palustrine Scrub-Shrub Wetland; RG=Riparian Grassland; RM=Riparian Mixed; RT=Rock Talus; RUB=Riverine Unconsolidated Bottom; SB=Sagebrush.

***TES Species.**

Project Section: B=J.C. Boyle bypass; C=Copco reservoir; F=Fall Creek; I=Iron Gate reservoir; J=J.C. Boyle reservoir; K=Keno reservoir; L=Lower River; N=Link River; R=JC Boyle peaking reach; Y=Keno Canyon; 2=Copco No. 2 bypass.

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Table 7A-1 (cont.). Habitats and Project sections associated with wildlife detected during terrestrial studies in the Klamath Hydroelectric Project study area.

	DST	GL	J	KMC	LP	LUB	MHO	MHOC	MHOJ	MXC	PA	PEM	PP	R/PFO	R/PSS	RG	RM	RT	RUB	SB
AMPHIBIANS (5)																				
Pacific Giant Salamander																	F		F,B	
Western Toad*								I						I	R				R	
Treefrog	C	R										F,I,R,J,N		R					R	
Long-toed Salamander												R								
Bullfrog						I,K,J						L,K,J		I	I,L					
REPTILES (15)																				
Western Pond Turtle*	K	L				C,F,I,J,K						F,K	K		I	K			R	
Southern Alligator Lizard	Y							R				R,Y			C,Y					
Northern Sagebrush Lizard*		F											Y	I	Y					
Western Fence Lizard	B,K,L	B,R	C,R	B,R,Y	B		C,R	I,R	I,B,R	C,R		I,R,Y	R,J,K	2,C,R	F,I,B,R,Y,L	R,Y,L	F	R	R	
Yellow-Bellied Racer	B									B	R		Y		R					
Western Skink																B				
Sharptail Snake*				R																
Ringneck Snake										B										
Common Kingsnake*	F,I						F													
California Mountain Kingsnake*	2			B																
Striped Whipsnake	2																			
Gopher Snake	L											R		K	L	R,Y				
Western Terrestrial Garter Snake	F													R	R					
Rubber Boa (no habitat information available)																				
Common Garter Snake	Y											R			B,N	R,Y				
Western Rattlesnake	I									B		R			I					
MAMMALS (30)																				
Black Bear														N						
Raccoon	L,K								R			C			L				I	
Long-Tailed Weasel								2												
Mink	N											C			N,R,Y	R,N			Y	
River Otter															L				R,L	
Striped Skunk	B								I											
Badger														I						
Coyote								R												
Gray Fox	I																			
Mountain Lion	R			R			R		2											
Bobcat			N	B			R	C,F,R	R,2											N
Yellow-Pine Chipmunk										N										
Least Chipmunk								B		B										
Yellow-Bellied Marmot	N	K																		
California Ground Squirrel		C	C,R				R	2	I						L					N
Western Gray Squirrel*				B			R,C						J,C							
Beaver						I,R						I,F		I,N,K	L				F,R,L	
Kangaroo Rat (sp.)	I																			
Western Harvest Mouse	N													F	N	N				
Deer Mouse	B,F,N							B,F,N							B,F,N	N		B		
Canyon Mouse	B, F									F								B		
Pinyon Mouse	B																	B		
Dusky-Footed Woodrat			2,R				I							C,F,I,R			F			
Bushy-Tailed Woodrat	B							B,R						R				B		
Montane Vole	B,N							B		B,N					N					
Muskrat						K						C,F,K								
Black-Tailed Jackrabbit				B				2		C,Y,N					Y,N					N
Roosevelt Elk								R												
Yuma Bat*	2,B,N,R																			
Black-Tailed Deer	L	K	N	B				F	C,I	K		C,I,R,Y		I	I,L				F	N

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