Draft Evaluation and Findings Report

Section 401 Water Quality Certification for the Removal of the Lower Klamath Project (FERC Project Number 14803)

By: Chris Stine

May 2018

Section 401 Hydropower
700 NE Multnomah St.
Suite 600
Portland, OR 97232
Phone: 503-229-5696
800-452-4011
Fax: 503-229-5850
Contact: Chris Stine
www.oregon.gov/DEQ

DEQ is a leader in restoring, maintaining and enhancing the quality of Oregon's air, land and water.

DEQ
State of Oregon
Department of Environmental Quality

This report prepared by:

Oregon Department of Environmental Quality
700 NE Multnomah Street, Suite 600
Portland, OR 97232
1-800-452-4011
www.oregon.gov/deq

Contact:
Chris Stine
541-686-7810

Table of Contents

Tables

Figures

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.

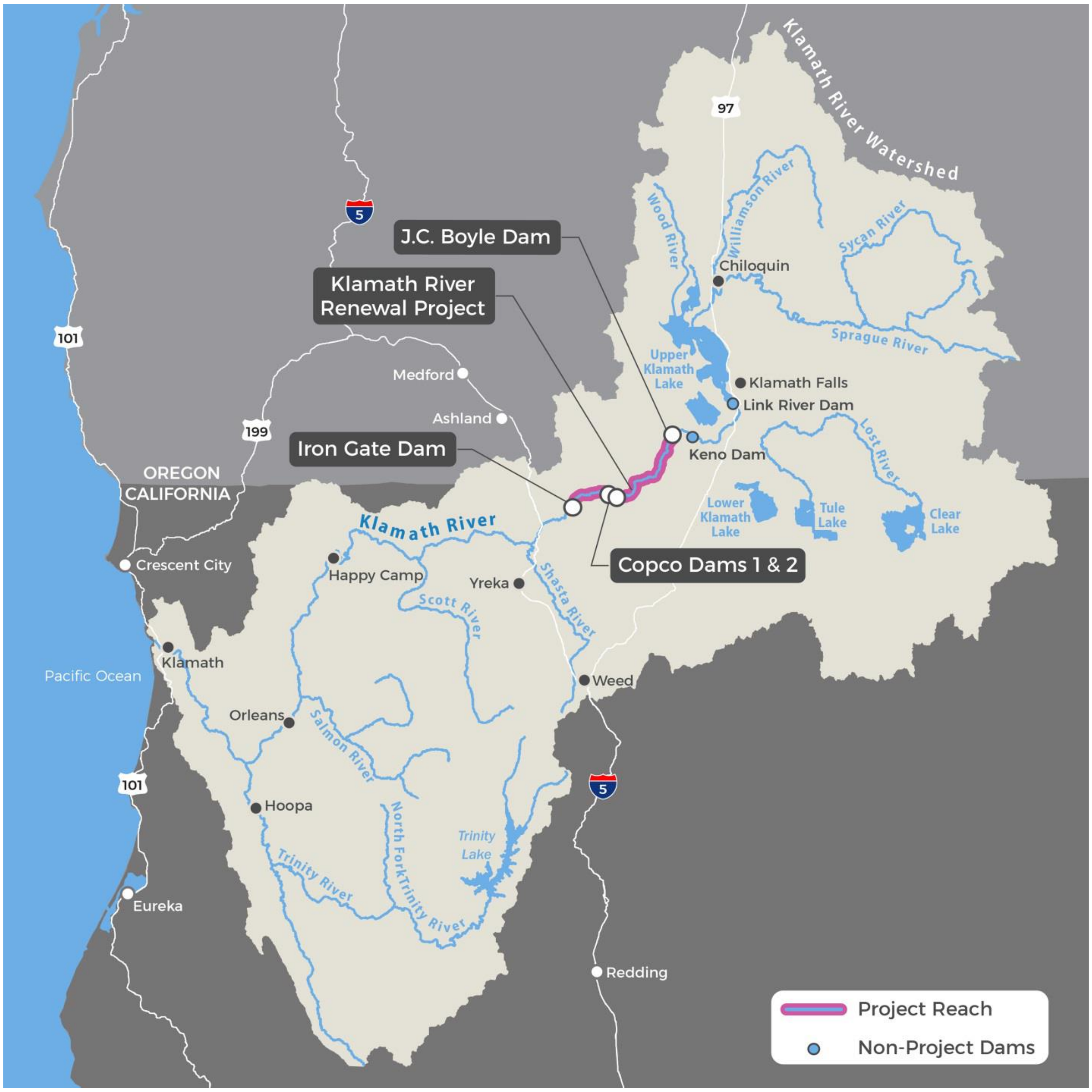

Figure 1 - Lower Klamath Project in the Klamath Watershed

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 section303(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	Project Applicant
PacifiCorp Energy	Michael Carrier, President KRRC
825 NE Multnomah Blvd. Suite 1500	Klamath River Renewal Corporation
Portland, OR 97232	423 Washington Street, 3rd Floor
	San Francisco, CA 94111

Name and Address of Owner's Official Representative

Peter Okurowski, KRRC
423 Washington Street, 3rd Floor
San Francisco, CA 94111
Phone: (415) 820-4422

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. 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. 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.

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 (approx. elev. 7,000 feet) 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.

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.

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.

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. 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. 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.

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.

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.

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.

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.

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.

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.

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. The volume of sediment trapped behind J.C. Boyle dam is estimated to be between 990,000 and 600,000 cubic yards.

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. 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).

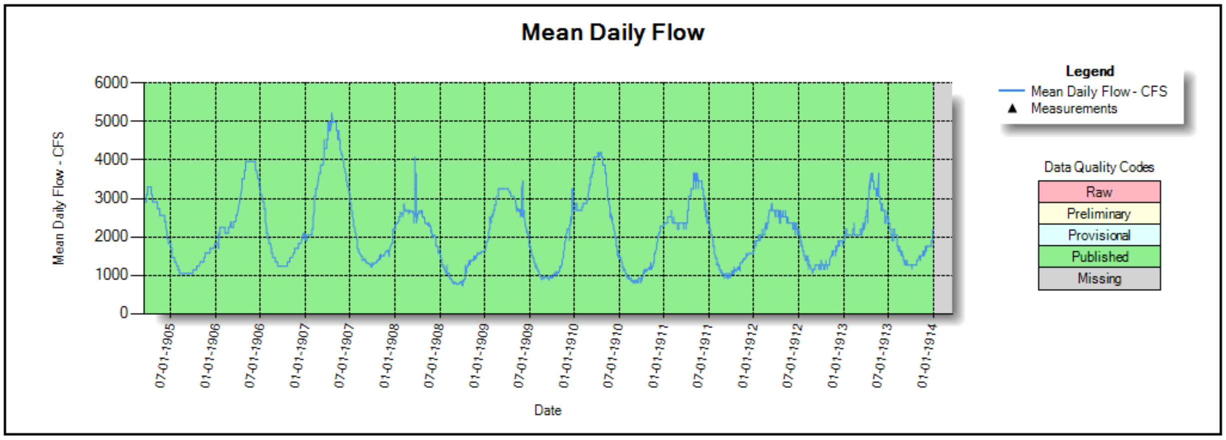

Figure 2 USGS Stream Gage below Keno

Median streamflow at Keno, J.C. Boyle powerhouse and Copco No.1 for the years 1960 to 20090 are shown in Figure 3. 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.

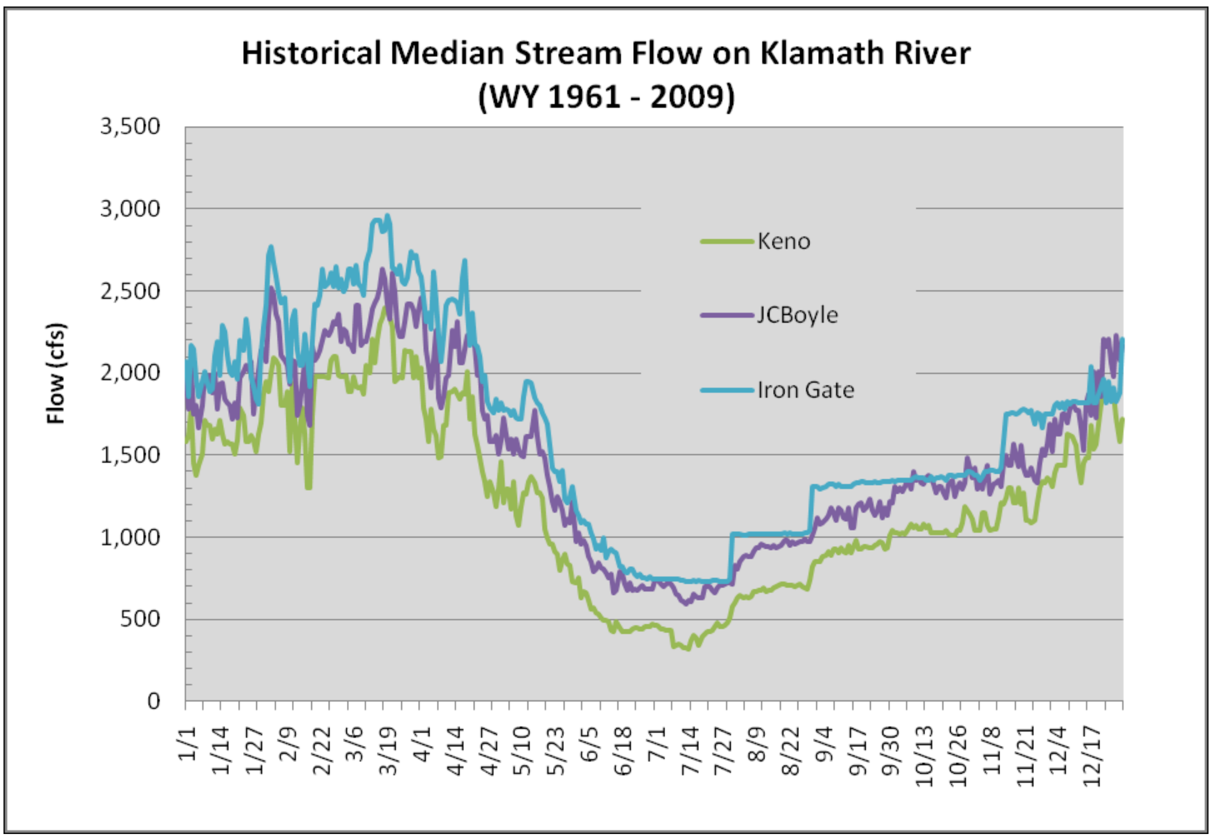

Figure 3 Median Flows at Keno, J.C. Boyle, and Iron Gate 1960-2009

Figure 4 shows the average daily flow statistics below J.C. Boyle Power Plant. The median monthly flows are greatest in March, during spring runoff.

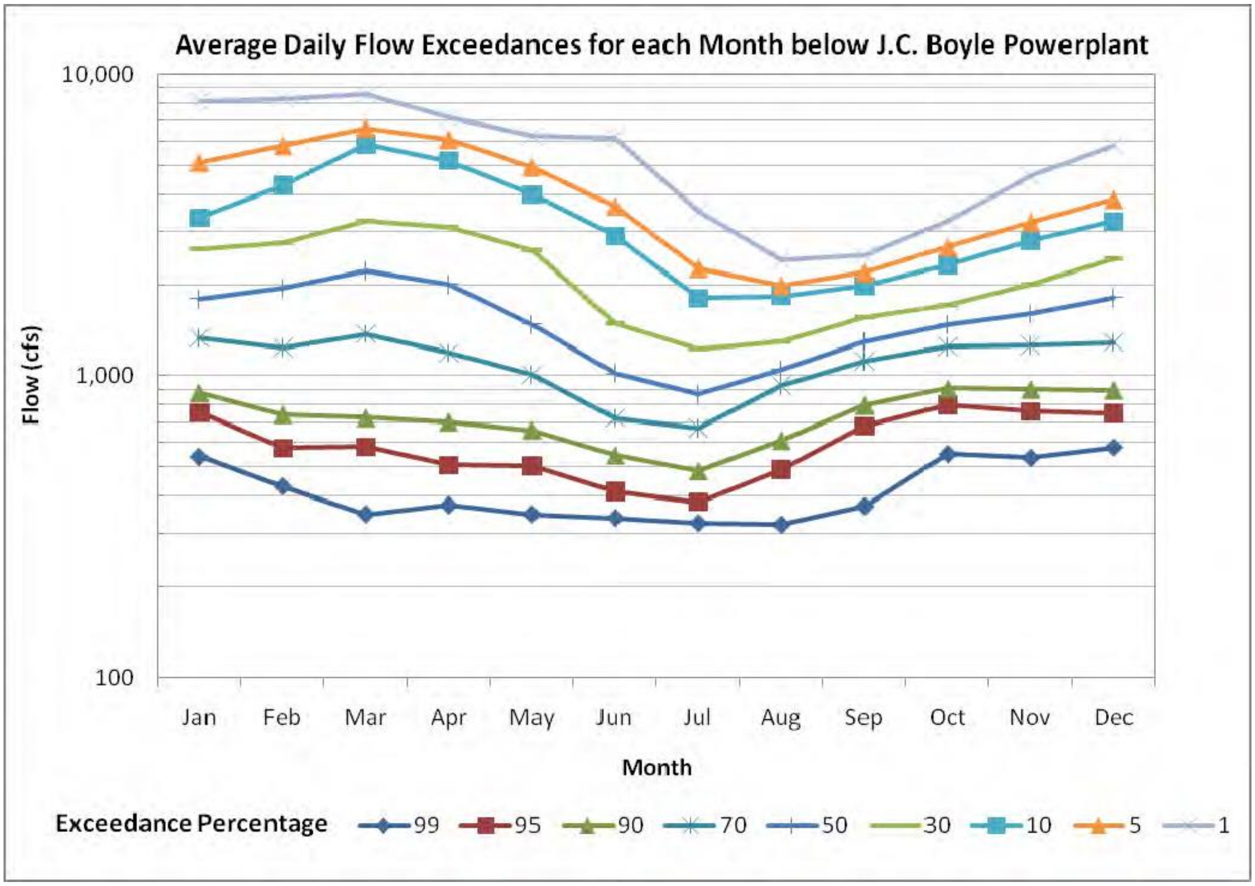

Figure 4 Flow at J.C. Boyle Power Plant (1960-2009)

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[2], the September 23, 2016 application to Oregon DEQ for water quality certification, and the Technical Support Document (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 water quality certification evaluation administered by the California State Water Resources Control Board. The dam is shown in Figure 5.

[2] DEQ expects KRRC will update the proposed action in a Definite Plan by July 1, 2018. DEQ will consider the proposed actions as presented in the Definite Plan prior to issuing a final section 401 water quality certification decision.

KRRC proposes to permanently 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. 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	Retain
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.

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 6 identifies the locations of proposed restoration actions in J.C. Boyle Reservoir.

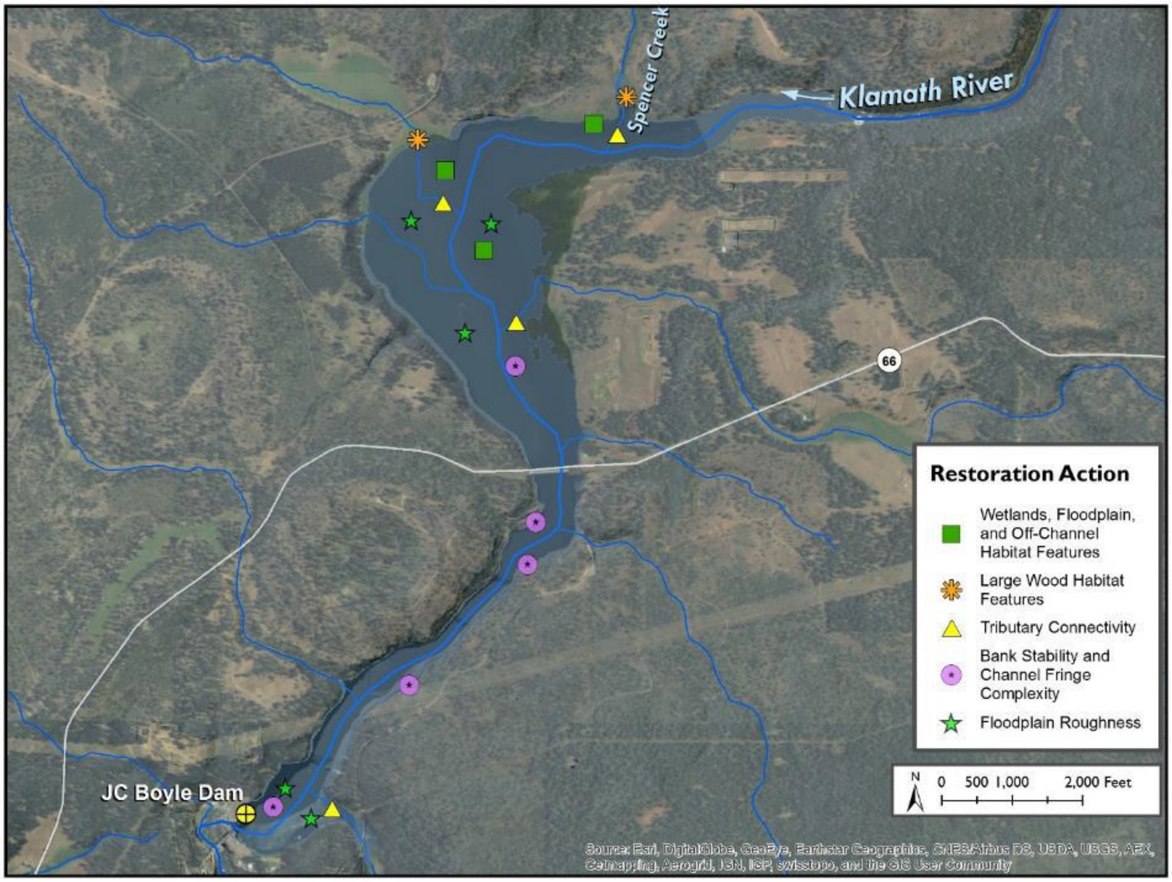

Figure 6: J.C. Boyle Proposed Restoration Area

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, collect seeds and grow-out of trees and shrubs by local nurseries;

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 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.

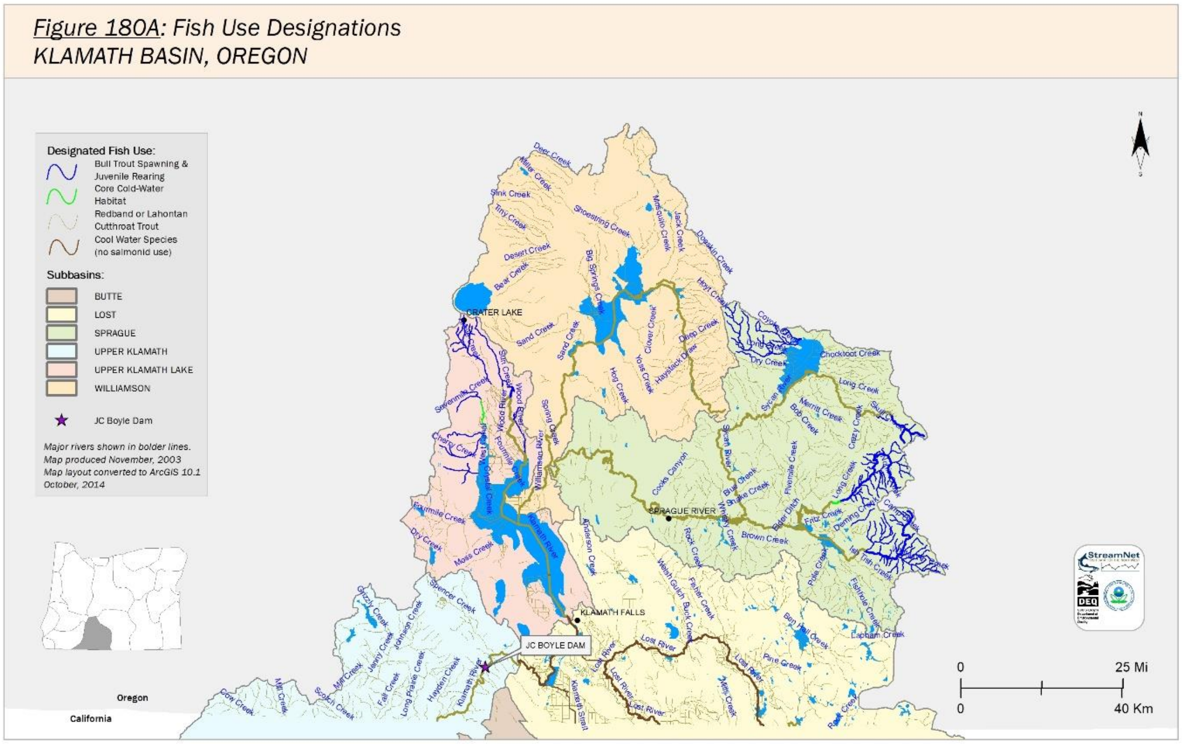

Figure 7 Fish Use in the Klamath Basin, OAR 340, Division 041 - Figure 180A

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 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

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.*

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 numeric criteria for open waters and the Statewide Narrative Criteria for aesthetic sensory 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 10 μg/L.

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'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 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.

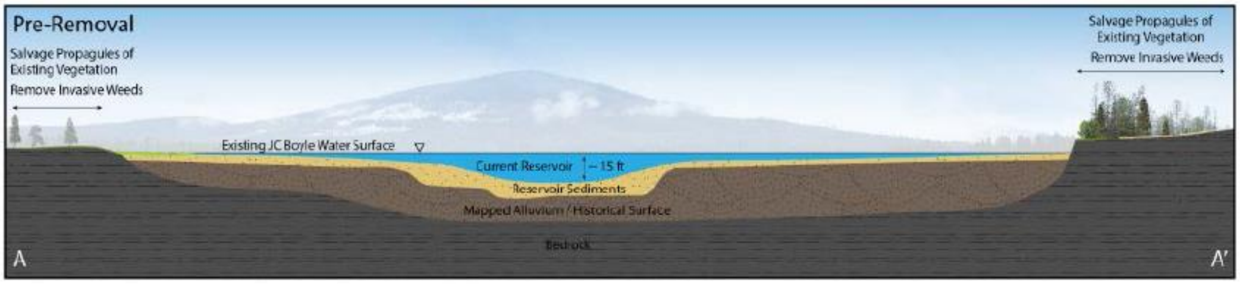

Figure 8: Cross Section of J.C. Boyle Reservoir Sediments

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 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]. 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.

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.

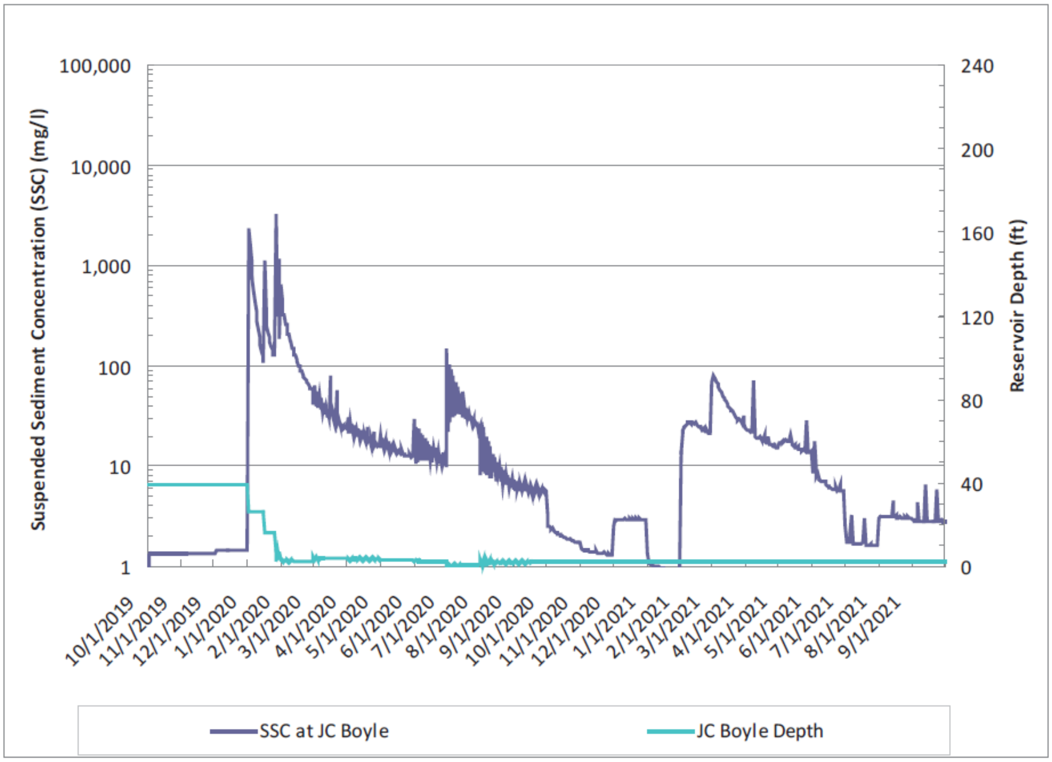

Figure 9 Modeled Suspended Sediment Concentrations Below JC Boyle - Dry Hydrology

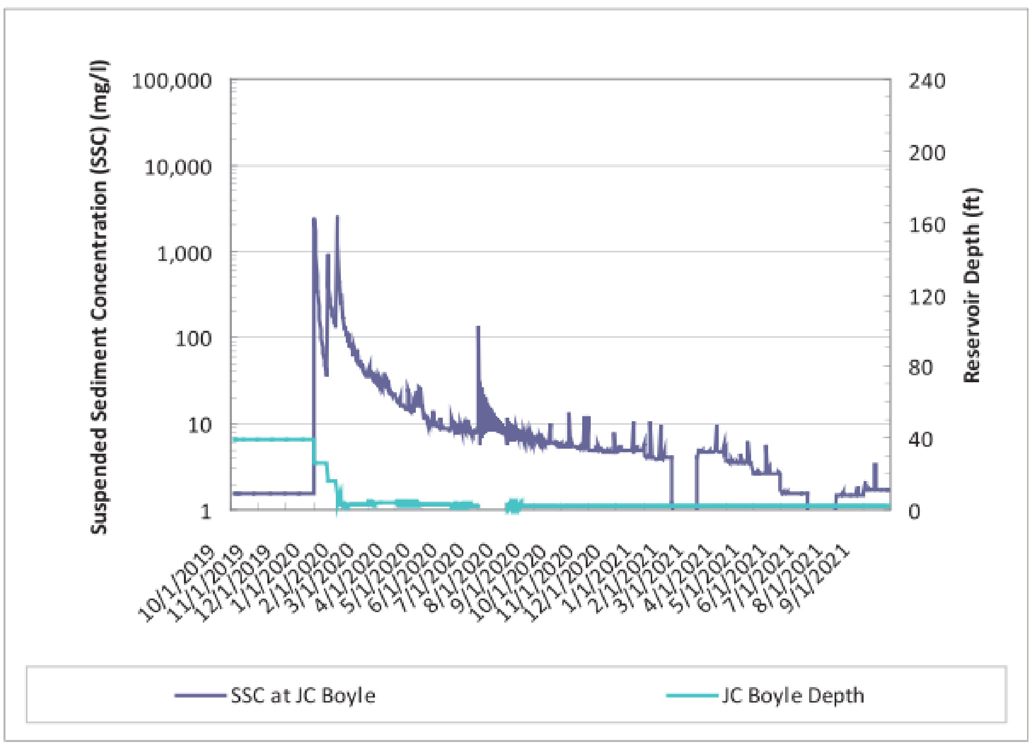

Figure 10 Modeled Suspended Sediment Concentrations Below JC Boyle - Median Hydrology

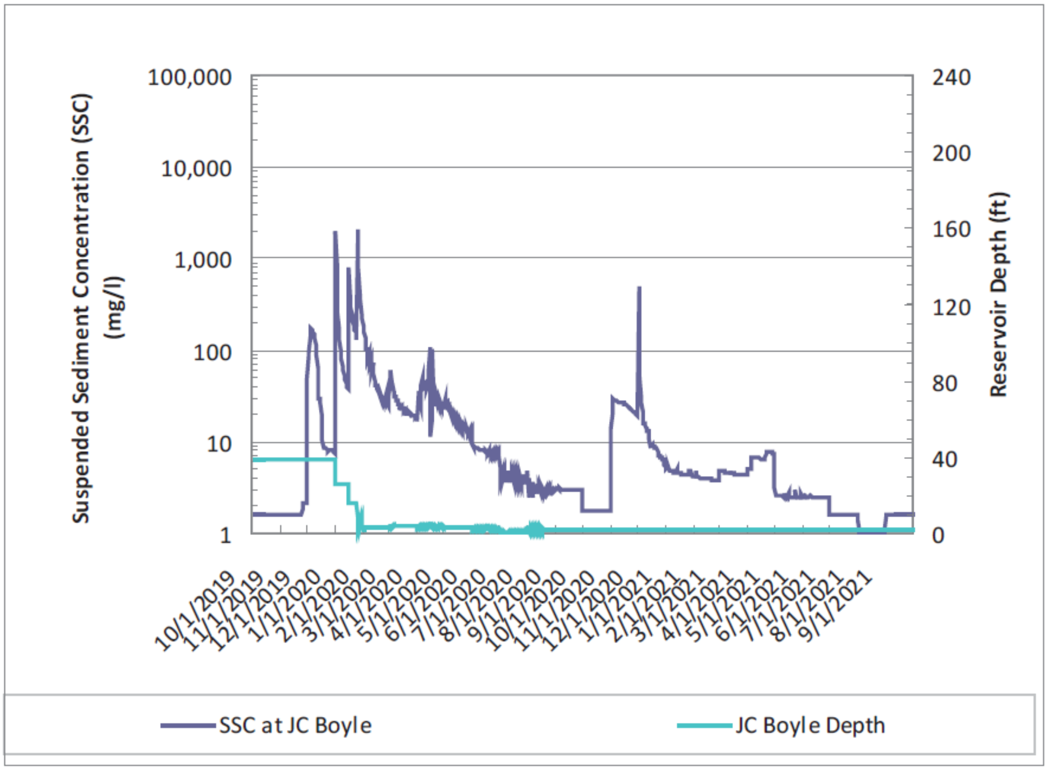

Figure 11 Modeled Suspended Sediment Concentrations Below JC Boyle - Wet Hydrology

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

<u>Short-Term Effects: pH</u>

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.

<u>Long-Term Effects: pH</u>

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

<u>Short-Term Effects: Temperature</u>

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.

<u>Long-Term Effects: Temperature</u>

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. 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.

7.1.1.8 Biocriteria

<u>Short-Term Effects: Biocriteria</u>

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.

<u>Long-Term Effects: Biocriteria</u>

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

<u>Short-Term Effects: Turbidity</u>

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.

To reduce the effects of turbidity during removal of the powerhouse DEQ will require placement of a turbidity curtain across the tailrace during in-water work including backfilling of the tailrace channel.

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 Plan

KRRC must prepare and implement a Remaining Facilities Plan in accordance with the conditions in Section 7 of the section 401 water quality certification. The Remaining Facilities 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. Also, 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, DQE considers it possible that diel pH variation may occur as a result 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. <u>Miscellaneous Measures Protective of Beneficial Uses</u>

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. <u>Reservoir Area Management Plan</u>

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 Clean Water Act 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 some construction and de-construction activities that may require a removal-fill permit from DSL which is 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. To ensure compliance with this requirement of state law, as well as for the protection of designated beneficial uses, the section 401 Certificate will require KRRC to obtain all necessary state permits and authorizations 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 permanently decommission any on-site sanitary systems 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. Comments must be received by 5:00 p.m. July 2, 2018. DEQ will consider and respond to all comments received and may modify the proposed water quality certification based on comments. DEQ intends to take final state action on the water quality certification by September 2018.

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.

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.