EXHIBIT E – ENVIRONMENTAL REPORT

Klamath Hydroelectric Project
(FERC Project No. 2082)

PacifiCorp
Portland, Oregon

Version: February 2004

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E1.0 INTRODUCTION

E1.1 APPROACH TO RELICENSING THE KLAMATH HYDROELECTRIC PROJECT

PacifiCorp has chosen to pursue a Traditional Licensing Process (TLP) in relicensing its Klamath Hydroelectric Project (Project). The Traditional Licensing Process is a three-stage consultation process that involves the public in developing a license application for an existing hydroelectric project. First stage includes initial review of the project and any proposed modifications, and the determination of studies. The Traditional Licensing Process for the Project was initiated in December 2000 by the distribution of the Notice of Intent and First Stage Consultation Document (FSCD). The formal comments of stakeholders to the FSCD produced over 175 letters and conveyed broad ranging concerns with (1) the adequacy of the study plans, (2) PacifiCorp's decision not to study dam decommissioning, and (3) the level of collaboration in developing study plans. In response to these comments, PacifiCorp revised its proposed study plans and redistributed them in the form of a draft Second Stage Consultation document. Stakeholder response was again vigorous and reiterated the concerns expressed in the first round of comments. Appendix E-1A of this Exhibit includes a matrix of combined comments and responses to the above referenced documents.

Second stage consultation involves completing the studies agreed to during the first stage, deciding on appropriate protection, mitigation, and enhancement (PM&E) measures, and preparing and reviewing a draft application. PacifiCorp's approach to this stage has been to conduct a "Traditional Plus" process. Given the complexity and controversy of fish and water resources issues within the Klamath basin, PacifiCorp initially established two technical work groups to provide input on the development and execution of aquatic studies. In response to strong stakeholder interest and concerns, in March 2002 PacifiCorp elected to expand the collaboration concept beyond aquatic resources to all resources to be addressed in Exhibit E. Since that time, PacifiCorp has engaged in a robust collaborative effort with over 40 stakeholders participating monthly in week-long facilitated meetings to develop study plans, review study results, and develop reasonable and defensible PM&E measures.

Collaboration with stakeholders has followed an agreed upon Process Protocol and included monthly meetings of a Plenary Group, various resource working groups, and on occasion, working subgroups that meet regarding specific issues. Resource work groups include Water Quality, Aquatics, Fish Passage, Terrestrial, Recreation (includes land use and visual issues), Cultural, and Socioeconomics. With the exception of the Cultural Work Group, all stakeholders were invited to participate in any meeting. Due to the sensitive nature of cultural information, participation in the Cultural Working Group was limited to Tribal representatives, PacifiCorp, and appropriate federal and state agencies. Appendix E-1A of this exhibit includes a comprehensive report on the collaborative effort to date entitled *PacifiCorp Consultation Record for Relicensing the Klamath Hydroelectric Project*.

The change in the level of collaboration during the second stage extended the timeline on adopting and executing study plans; therefore, many studies were not yet completed and documented in Exhibit E of the Draft License Application (DLA), and a few (including fish passage modeling) are outstanding in this final license application. Given the outstanding status of some studies in the DLA and the need to address Project impacts and PM&E measures more collectively, the draft Exhibit E did not address PM&Es or continuing Project impacts as is usual

in the second stage of the licensing process. Outstanding study results, Project impacts, and probable PM&E measures continued to be discussed with stakeholders on a monthly basis while the draft Exhibit E was being reviewed by FERC and stakeholders and while this final Exhibit E was being developed.

Over the course of the 90-day comment period (which was extended by several days to accommodate a few stakeholders), PacifiCorp received 60 letters totaling 1539 individual comments. Public comments and PacifiCorp responses are documented in Appendix E-1A.

As of December 2003, 38 study plans were approved. Nine study plans did not receive approval and remained outstanding:

- Study Plan 1.7: Evaluation of Ramping Effects on Fish Downstream of Link Dam, Keno Dam, J.C. Boyle Dam, J.C. Boyle Powerhouse, Copco No. 2 Dam, and Iron Gate Dam.
- Study Plan 1.9: Fisheries Investigations.
- Study Plan 1.10: Fish Passage Planning and Evaluation.
- Study Plan 1.12: Instream Flow Analysis Study Plan.
- Study Plan 1.16: Evaluation of Effects of Flow Fluctuations on Aquatic Resources within the J.C. Boyle Peaking Reach.
- Study Plan 1.17: Investigation of Trout and Anadromous Fish Genetics in the Klamath Hydroelectric Project Area.
- Study Plan 1.18: Description of Migratory Behavior of Juvenile Salmon Smolts and Estimation of Success through Reservoirs using Radio-Telemetry Techniques in the Klamath Basin, 2004- Initial Study.
- Study Plan 1.23: Sampling of Fisheries in Project Riverine and Reservoir Areas.
- Study Plan 7.2: High Level Socioeconomic Analysis of the Landscape Options – Phase 2.
- Study Plan 7.3: Analysis of Effects of Differences Between the Proposed Project and the Current Project on the Socioeconomic Environment – Phase 3.

Key agreements and outstanding issues are summarized by resource area and study in Appendix E1-A, Consultation Record.

The third stage is initiated with this final license application, which incorporates information from the first and second stages, and is being submitted to FERC. The submittal of this final license application triggers FERC to conduct an independent environmental review of the Project and the involved stakeholders to provide comments and mandatory terms and conditions through the NEPA process.

E1.2 PROPOSED PROJECT

In the course of study and in the interim between the draft license application and this final application, PacifiCorp has made a few changes in the proposed Project. The newly proposed Project includes removing from service the East Side and West Side developments and removing FERC boundaries associated with these developments. The Keno Development and associated FERC boundary have also been removed since this facility does not have installed generation or substantially benefit generation at PacifiCorp's downstream hydroelectric developments. The existing Spring Creek diversion is proposed for inclusion with the Fall Creek Development. In some areas, Project FERC boundaries have been expanded to incorporate additional recreation areas and recreational access and terrestrial areas.

While this section of Exhibit E may include some information on facilities and lands no longer proposed as part of the Project, it should be noted that this information is included for context only. The impact assessment relates only to the Project currently proposed. The impact assessment includes a cursory review of the Spring Creek diversion and associated FERC boundaries. PacifiCorp will collaborate with stakeholders to identify an appropriate scope of study for this newly proposed Project modification.

For a more detailed description of the proposed Project, including proposed FERC boundaries, please refer to Exhibits A and G of this final license application.

E1.3 ORGANIZATION AND CONTENTS OF EXHIBIT E

Exhibit E is organized into nine sections as generally cited and sequenced in Title 18 Section 4.51(f). Exceptions to federal code organization include the addition of this introduction (Section E1) and a section on socioeconomics (Section E9). Section E2 of Exhibit E provides a general description of the Project setting. Sections E3 through E9, including Water Use and Quality, Fish Resources, Wildlife and Botanical Resources, Cultural Resources, Recreation Resources, Land Management and Aesthetics, and Socioeconomics, generally outline the following information for each resource category: existing setting and factors affecting the setting; regulatory management framework; consultation with stakeholders; study status (previously conducted studies, studies currently underway, proposed studies, and outstanding study issues); proposed PM&E measures; and continuing Project impacts (excluding socioeconomics).

E2.0 GENERAL DESCRIPTION OF THE ENVIRONMENT

This section of the Klamath Hydroelectric Project (FERC Project No. 2082) (Project) Exhibit E describes the locale of the Project as stipulated in Title 18 Section 4.51 (f) (1) of the U.S. Code of Federal Regulations:

> The applicant must provide a general description of the environment of the project and its immediate vicinity. The description must include general information concerning climate, topography, wetlands, vegetative cover, land development, population size and density, the presence of any floodplain and the occurrence of flood events in the vicinity of the project, and any other factors important to an understanding of the setting.

E2.1 PROJECT OVERVIEW AND LOCATION

In the course of study and in the interim between the draft license application and this final application, PacifiCorp has made a few changes in the proposed Project. The newly proposed Project includes removing from service the East Side and West Side developments and removing FERC boundaries associated with these developments. The Keno Development and associated FERC boundary have also been removed since this facility does not have installed generation or substantially benefit generation at PacifiCorp's downstream hydroelectric developments. The existing Spring Creek diversion is proposed for inclusion with the Fall Creek Development. In some areas, Project FERC boundaries have been expanded to incorporate additional recreation areas and recreational access and terrestrial areas.

While this section of Exhibit E may include some information on facilities and lands no longer proposed as part of the Project, it should be noted that this information is included for context only. The impact assessment relates only to the Project currently proposed.

For a more detailed description of the proposed Project, including proposed FERC boundaries, please refer to Exhibits A and G of this final license application.

E2.1.1 Existing Facilities

The Klamath Hydroelectric Project area is located on the Upper Klamath River in Klamath County (south-central Oregon) and Siskiyou County (north-central California). The nearest principal cities are Klamath Falls, Oregon, located at the northern end of the Project area; Medford, Oregon, 45 miles northwest of the downstream end of the Project; and Yreka, California, 20 miles southwest of the downstream end. Figure A2.1-1 of Exhibit A provides a map of the Project area.

The current Project consists of six generating developments on the Klamath River between river mile (RM) 190 and RM 254. It also includes a re-regulation dam with no generation facilities along the mainstem of the upper Klamath River and a generating facility on Fall Creek, which is a tributary to the Klamath River at about RM 196. The major Project developments are as follows:

- The East Side (3.2 megawatt [MW]) and West Side (0.6 MW) powerhouses are the most upstream facilities, located near RM 254 within the city limits of Klamath Falls, Oregon. They are associated with Link River dam, which is owned by the U.S. Bureau of

Reclamation (USBR) and currently operated by PacifiCorp under USBR's directives. The power plants and water conveyance system are owned and operated by PacifiCorp. PacifiCorp proposes to exclude these facilities under the new license application.

- Keno dam is a diversion and re-regulating facility with no generation capability. At RM 233, it is 20 miles downstream of Link River dam. The Keno dam and reservoir buffer flows downstream from the effects of USBR project inflow and outflow changes. Since there is no generation capability with this facility, PacifiCorp proposes eliminating it from FERC jurisdiction.

- J.C. Boyle dam, reservoir, and powerhouse (80 MW) are in Oregon. The dam is at RM 224.7 and the powerhouse is several miles downstream at RM 220.4.

- The Copco hydroelectric facilities are in California. Copco reservoir supplies the Copco No. 1 powerhouse (20 MW) at RM 198.6 and Copco No. 2 powerhouse (27 MW) at RM 196.8. The Copco No. 2 reservoir is small, located immediately downstream of the Copco No. 1 dam. Because it has no active storage, the Copco No. 2 powerhouse operates as a "slave" to Copco No. 1.

- The Fall Creek powerhouse (2.2 MW) is located on a small Klamath River tributary that flows into the upper end of Iron Gate reservoir.

- Iron Gate dam, reservoir, and powerhouse (18 MW) comprise the farthest downstream (RM 190) development. The dam is operated to meet monthly river flow needs for the Klamath River downstream of the Project.

E2.2 CLIMATE

Temperatures in the Project area range from below freezing during the winter to 100 degrees Fahrenheit (^{o}F) during the summer. The higher elevation, upstream part of the Project area is generally cooler than the downstream Iron Gate and Copco areas. Average annual precipitation is 18.2 inches at Copco reservoir, although higher elevation areas in the surrounding mountains can receive more than 50 inches on average. Annual precipitation in Klamath Falls is 13.3 inches.

Precipitation in the Project area occurs primarily as rain, mostly during the fall and winter, with occasional afternoon thunderstorms occurring in the summer. During the winter, snow is common, particularly in the higher elevations (i.e., above the canyon rim and east to Klamath Falls). Historically, annual precipitation patterns define distinct dry and wet cycles that are closely related to runoff on the river. The most recent climatic trends include wet periods from 1885 to 1915 and 1940 to 1975, and dry periods from 1915 to 1940 and 1975 to 1994. Gauged runoff and flow patterns on the river closely reflect these climatic cycles. General decreases in runoff and discharge during the last 20 years also coincide with a generally decreasing trend in precipitation amounts. The peak of the natural annual hydrograph in the area is dominated by spring snowmelt.

E2.3 TOPOGRAPHY

The Klamath River is one of only three rivers that bisect the Cascade Mountain Range, flowing from the high desert interior of Oregon through California's coastal rain forest to the Pacific

Ocean. The Klamath River begins at the outlet of Upper Klamath Lake in Oregon at elevation 4,139 feet mean sea level (msl) and flows southwest approximately 260 miles to the Pacific Ocean at Requa, California. Most of the inflow to the upper Klamath River Basin enters Upper Klamath Lake via the Sprague, Williamson, and Wood Rivers. Upper Klamath Lake is a shallow, regulated natural lake, which serves as a storage reservoir for extensive, irrigated lands (approximately 250,000 acres) in the basin.

From Upper Klamath Lake, water flows into the head of the upper Klamath River, called Link River, at the City of Klamath Falls. Downstream of Link River, the river flows through Keno reservoir (the upper area is known as Lake Ewauna), which is the diked channel of what was once part of Lower Klamath Lake. Keno dam controls water level in the reservoir. Much of the former Lower Klamath Lake has been diked and reclaimed for farming. An extensive array of canals feeds water to and from the river and the farmland. The Lost River diversion and other major irrigation drains enter Keno reservoir.

At Keno, Oregon, the river enters the area often referred to as "the Klamath River canyon" at elevation 4,000 feet. The river in the Keno reach is free flowing for 3 miles of canyon down-stream from Keno dam, at which point it enters the J.C. Boyle reservoir (elevation 3,800 feet). Spencer Creek is a small but important trout-producing tributary that enters the J.C. Boyle reservoir. From the J.C. Boyle dam, the river is free flowing for the remaining 22 miles of canyon before entering Copco reservoir in northern California (elevation 2,600 feet). Copco reservoir is about 4.3 miles long and averages about 0.5 mile wide. Shovel Creek is another small, but important trout-producing tributary that enters the river near the downstream end of the canyon.

Downstream of the Copco area, the Klamath River flows through a short section of canyon before entering Iron Gate reservoir (elevation 2,330 feet msl). Iron Gate reservoir is about 4.5 miles long and averages about 0.3 mile wide. The outflow from Iron Gate then flows unimpounded over the remaining 190 miles to the ocean. Fall Creek is a relatively small tributary that enters the Klamath River near the upstream end of Iron Gate reservoir. PacifiCorp's Fall Creek powerhouse facility (elevation 2,500 feet msl) is located on the tributary about 0.8 mile upstream from the reservoir. Jenny Creek is another small tributary that enters Iron Gate reservoir about 2 miles downstream of the mouth of Fall Creek. Additional flows to the Fall Creek diversion dam are provided from Spring Creek, a tributary of Jenny Creek.

E2.4 GEOLOGY AND SOILS

E2.4.1 Geology and Physiology

Thick volcanic deposits underlie the Project area. Slopes are generally stable, except for talus slopes and landslide prone areas along steeper hillslopes and canyon walls. Three basic rock formations crop out in the Project area and consist predominantly of two volcanic rock types: andesitic tuff and basaltic lavas. Two main soil types occur in the Project area: a gravelly clay loam about 17-40 inches deep on steeper slopes and a well-drained colluvium gravelly loam about 15-60 inches deep on floodplain and terrace surfaces.

Physiography in the Project area varies considerably. The Klamath Basin lies (from east to west and north to south) within the Modoc Plateau, Cascade Range, Klamath Mountains, and

Northern Coast Range physiographic provinces. Most of the basin lies within the Klamath Mountains and the Southern Cascades provinces. The Klamath Hydroelectric Project area and its immediate vicinity lie within the Modoc Plateau and Southern Cascade provinces.

Climatic changes, highly permeable rocks, regional faulting, and volcanism have disrupted drainage patterns in this province. The poorly developed modern drainage has resulted in the formation of lakes and large, closed, sediment-filled basins. Regional faulting is causing subsidence of the valley floor and perhaps influencing sediment transport characteristics of the rivers and streams in this area. These factors are currently causing subsidence of the valley floor that contains Upper Klamath Lake. Therefore, this area is sensitive to the effects of recent deformation on regional groundwater conditions, and on surface and subsurface flow.

The Klamath River crosses several faults between the Upper Klamath Lake and Copco reservoir that were active during the last 10,000 years. Numerous earthquakes with magnitudes of greater than 4.0 have been recorded around the southern end of Upper Klamath Lake since 1964. The most recent significant event in the area had a magnitude of 5.9. It occurred in 1993 near Klamath Falls and was the largest felt in Oregon since 1872.

The Klamath River has maintained its antecedent course across the rising Cascade chain and has cut a well-defined deep canyon through volcanic rocks from near Klamathon (RM 184) upstream to the California-Oregon border. The well-rounded topography of the region and the deeply incised canyons are indicative of the erodibility of the volcanic rocks associated with the Cascades.

The presence of two Pleistocene cinder cones and associated lava flows at the downstream end of Copco reservoir, as well as extensive Holocene lake deposit along the margins of Copco reservoir suggest damming of the Klamath River at that site. The extensive valley-fill alluvium upstream of Copco reservoir probably is also a result of volcanic damming of the river that induced upstream backwater, and a subsequent reduction in channel slope. The Klamath River has incised through this lava dam and the upstream Holocene alluvial deposits over time.

E2.4.2 Klamath River Geomorphology

The Klamath River in the Project area has a bedrock (canyon) dominated channel composed predominantly of a step pool or riffle pool morphology, with minor alluvial reaches. The river is considered non-alluvial and sediment supply limited, with a steep, high-energy, coarse bedded channel that follows a course of convenience (Ayres Associates, 1999). The planform of the river has changed little over time. Pools, riffles, rapids, bars, flows, splits, and side channels have not changed location, nor significantly increased or decreased in size and shape (Ayres Associates, 1999). Most of the limited change that has occurred is attributed to localized sedimentation zones in proximity to tributary inflow points that provide a source of coarse sediment contribution.

The Klamath River's channel shape and physical character is determined by local geologic characteristics and by infrequent, high magnitude flow events. The river has always undergone extreme droughts and floods. Changes in the river's flow regime resulting from basin-wide water projects have produced no significant channel geomorphic impacts (Ayres Associates 1999).

E2.5 DRAINAGE BASIN HYDROLOGY

While the Project proposed in this license application extends from J.C. Boyle Reservoir to Iron Gate dam, hydrology descriptions are provided above J.C. Boyle Reservoir to Upper Klamath Lake to provide a context for basin hydrology.

E2.5.1 Klamath River from Link River Dam to Keno Dam

The upstream-most section of the river in the Project vicinity extends from Link River dam to Keno dam (approximately RM 254 to RM 233). It is generally characterized as a relatively low-gradient, wide, and slow-moving section of the river. The Link River channel is mostly bedrock, and at lower flows it breaks into smaller braided channels. It is the site of the former natural Klamath Falls, which was not a typical waterfall, but rather a high-gradient cascade. Habitat in Keno reservoir (Lake Ewauna), from just downstream of Link River to Keno dam, more closely resembles a widened section of the river than a lake, due to its channelization for agricultural reclamation. The Lost River and ADY Canals, operated and maintained by the USBR, discharge to the river in Lake Ewauna.

E2.5.2 Klamath River from Keno Dam to J.C. Boyle Reservoir

From Keno dam to J.C. Boyle reservoir (approximately RM 233 to RM 228), the river runs through a canyon area with a relatively high gradient of 50 feet per mile. The channel is generally broad with rapids, riffles, and pocket water among rubble and boulders (ODFW, 1997).

E2.5.3 J.C. Boyle Reservoir

The J.C. Boyle reservoir (approximately RM 228 to RM 225) is a shallow impoundment behind J.C. Boyle dam. The upstream part of the reservoir is surrounded by a low-gradient, gently sloping shoreline; downstream from the Highway 66 bridge, the reservoir begins to deepen as the canyon narrows again. The upper end of the reservoir contains a large amount of macrophytes during the summer and several fairly large shoreline wetland areas.

E2.5.4 Klamath River from J.C. Boyle Dam to Copco Reservoir

The section of the Klamath River from J.C. Boyle dam to Copco reservoir extends about 20 miles (RM 225 to RM 204) in a deep, undeveloped canyon and is characterized by relatively steep gradient (35 feet per mile). The J.C. Boyle powerhouse location at approximately RM 220 represents a point at which this section can be divided into two reaches with different hydrologic conditions due to Project operations.

E2.5.4.1 J.C. Boyle Bypass Reach

In the approximately 5-mile-long river reach between the J.C. Boyle dam and powerhouse, flows are affected both by diversions to the powerhouse and by input of about 220 cubic feet per second (cfs) to the channel from large springs. This bypass reach has a steep gradient of approximately 100 feet per mile and is made up of a series of rapids, runs, and pools among large boulders. Compared to the reach downstream from the powerhouse, flows here are relatively stable. Beginning about 0.5 mile downstream of the dam, cool, clear groundwater from the

springs begins to augment flow from the dam. With the springs' contribution, summer flows are a relatively constant 320 cfs at the downstream end of this reach.

E2.5.4.2 J.C. Boyle Peaking Reach

In the river reach downstream of the J.C. Boyle powerhouse, full flows are reintroduced to the river by powerhouse outflows. In contrast to the upstream bypass reach, flows vary and fluctuate over short periods in this full flow reach, due to load-factoring operations at the powerhouse. Flows may range from approximately 320 cfs to as much as 3,170 cfs daily during the summer and fall, depending on Project inflow. These daily peak flows are extensively utilized by the local whitewater rafting industry. In the winter and spring and during high flow events, when flows are in excess of the turbines' capacity, the powerhouse generates continuously and water spills at the dam. This full flow reach is also characterized by an overall more moderate gradient than the bypass reach (35 feet per mile), but is nonetheless steep in several areas in comparison with other sections of the Project area.

E2.5.5 Copco No. 1 and No. 2 Reservoir Area

Copco reservoir is located in a canyon area between approximately RM 204 and RM 199. The reservoir is quite large and deep compared to the Keno and J.C. Boyle reservoirs. It contains several coves with more gradual slopes. Large areas of thick aquatic vegetation are common in shallow areas. Nearshore riparian habitat is generally lacking, due to the cliff-like nature of shorelines, and only very small isolated pockets of wetland vegetation exist. Water quality in the reservoir during the summer is generally degraded, as large blooms of *Aphanizomenon flos aquae* occur annually and surface water temperatures are warm.

Copco No. 2 reservoir (forebay), and a roughly 1.3-mile-long bypass reach, extends from approximately RM 197 to RM 199 in a narrow canyon area. The impoundment is small and water quality is generally the same as in Copco No. 1 reservoir. The bypass reach has a steep gradient similar to the river reaches upstream, and the channel is comprised of boulder, large rock, and pool habitat. The riparian area in this reach is well developed.

E2.5.6 Iron Gate Reservoir

Iron Gate reservoir is located in a relatively steep canyon area between approximately RM 190 and RM 197. Similar to Copco reservoir, Iron Gate reservoir is large and deep compared to the Keno and J.C. Boyle reservoirs. Iron Gate reservoir has a few coves with more gradual slopes. Large areas of thick aquatic vegetation are common in shallow areas. Nearshore riparian habitat is generally lacking, except at the mouths of Jenny Creek and Camp Creek, where well-developed riparian habitat occurs. Due to the cliff-like nature of shorelines, only very small isolated pockets of wetland vegetation exist around the perimeter of the reservoir. Water quality in the reservoir during the summer is generally quite poor, as large blooms of *Aphanizomenon flos aquae* occur annually and surface water temperatures are warm.

E2.5.7 Klamath River Downstream of Iron Gate Dam

Iron Gate dam at RM 190 is the facility farthest downstream in the Klamath Hydroelectric Project system. Downstream of Iron Gate dam, the Klamath River has variable channel

morphology shaped by local geologic characteristics and infrequent, high-magnitude flow events. The river has always undergone extreme droughts and floods.

E2.5.7.1 Fall Creek

Fall Creek is a relatively small tributary that enters the Klamath River near the upstream end of Iron Gate reservoir. PacifiCorp's Fall Creek powerhouse facility is located on the tributary about 0.8 miles upstream from the reservoir. Fall Creek is spring fed, and water quality is consistently better than in the Klamath River and reservoirs. In fact, Fall Creek provides a municipal water supply to the City of Yreka. The bypass reach between the diversion and the powerhouse is about 1.2 miles long. A falls is located less than 0.2 mile upstream of the powerhouse. Upstream of the falls, the bypass reach is relatively low in gradient, and contains cobble/silt substrate and a healthy riparian fringe of oak shrub. Downstream of the falls, the bypass reach consists of a boulder-dominated channel in a steep canyon section. Downstream from the Fall Creek power-house to Iron Gate reservoir, the channel again is fairly low in gradient and is well shaded with trees. The creek enters a wetland area at its confluence with the reservoir.

E2.6 BASIN WATER QUALITY

In general, results from both past and current water quality sampling efforts indicate that water quality conditions in the upper Klamath River are often degraded with respect to several parameters. The principal factors that influence regional water quality conditions include climate, run-off, and irrigation return from surrounding agricultural, range, and marsh lands, and the effects of impoundment by existing lakes and reservoirs (i.e., Upper Klamath Lake, Keno, J.C. Boyle, Copco, and Iron Gate reservoirs) (City of Klamath Falls, 1990; Kann and Walker, 1999; Campbell, 1999; Deas, 2000). Such factors affect water temperature, DO, dissolved solids, sediments, turbidity, nutrients (primarily nitrogen and phosphorus), and bacteria.

E2.6.1 Upper Klamath Lake

Upper Klamath Lake is hypereutrophic: both its water and its sediment are extremely rich in nutrients. Rivers to the lake carry large quantities of dissolved and particulate organic matter from the many marshes in the drainage basin. High levels of phosphorus are derived from natural springs, as well as from runoff from agricultural areas. Resuspension of bottom sediment may be another major source of phosphorus loading to Upper Klamath Lake. In fact, it has been estimated that this "internal" loading might contribute as much as 80 to 85 percent of the total phosphorus load (Kann and Walker, 1999).

The lake can experience large phytoplankton blooms, particularly of the cyanobacterium *Aphanizomenon flos aquae* from May through September. Diatoms also bloom at several times during the year and lake sediments are diatom rich. The lake's hypereutrophic nutrient enrichment is the primary cause of the massive algae blooms. The blooms and subsequent die-offs result in elevated pH and cycles of supersaturated and low dissolved oxygen concentrations. Fish die-offs have occurred in recent years and have been attributed in part to poor water quality conditions.

Summertime pH values typically exceed 9.5 and periodically exceed 10.0 (Kann et al., 1999). Water temperatures in the lake can approach 30^{o}C near the surface, and temperatures of 22^{o}C to 24^{o}C are common in the upper 1 to 2 meters of water. At the same time, DO concentrations are

often supersaturated in the upper part of the water column, but concentrations of less than 2.0 mg/L can occur near the bottom (Martin and Saiki, 1999).

E2.6.2 Klamath River and Reservoirs

The water that discharges downstream from Upper Klamath Lake contains high nutrient concentrations and high organic matter, and therefore has a high oxygen demand. The ODEQ characterizes the water of the upper Klamath River as being of poor quality from high water temperature, low DO, high ammonia, high pH, and high levels of algae and nutrients (Cude, 1996). As the primary source of inflow to the Klamath Hydroelectric Project, this enriched water can exacerbate water quality conditions within and downstream of Project reservoirs and powerhouses.

In general, water temperatures in the Klamath River in the Project area during winter are near 1°C, begin increasing in March and April, and are above 15°C from late May through September. Water temperatures are typically above 20°C in July and August; DO concentrations typically range from 6 to 9 mg/L; pH values usually vary from 7 to 8.5.

Water temperatures in the Klamath River in the Project area generally respond to climatological changes. Seasonal temperature changes are prominent in the Klamath River. Water temperatures during winter are near 1°C. Water temperatures exceed 15°C (60°F) in early May and 20°C (68°F) from late May through October. Water temperature may approach 27°C (80°F) for up to 10 days per year in mid-July through early August, concurrent with the annual peak in regional air temperatures. Although the Klamath River supports coldwater biota, water temperatures can exceed stress thresholds for extended periods during the summer.

Isolation of the upper basin from the moderating coastal weather and the somewhat lower elevation of the middle basin, compared to the surrounding terrain, combine to contribute to unusually high water temperatures in the Klamath River. For example, the 7-day mean of the maximum daily water temperature can reach 25°C in the Keno reach just above the Project area. The 7-day mean of the maximum daily water temperature is slightly less at river sites downstream from J.C. Boyle dam, at the Oregon-California border, and downstream from Iron Gate dam. The lower temperatures downstream are probably due to a combination of factors, including greater shading and faster water transport in the canyon, moderating effects of the reservoirs, and significant spring inflow downstream of J.C. Boyle dam.

Large diel fluctuations in water temperatures have been observed in the river segment between J.C. Boyle dam and Copco reservoir. The City of Klamath Falls (1990) measured diel water temperatures that fluctuated by as much as 7°F during August in the river near the Oregon-California border. These fluctuations were attributed to a combination of factors, including daytime solar warming, mid-day load-factoring operations at the J.C. Boyle Project, and substantial accretion (approximately 220 cfs) of cool groundwater inflow directly to the river channel between the J.C. Boyle dam and powerhouse. Thus, these springs provide for significant cooling of downstream waters during summertime low flow periods. By comparison, relatively little diel fluctuation in water temperatures has occurred during other sampling periods (e.g., fall, winter, and spring). During these times, temperatures are naturally cooler, and continuous operation of the J.C. Boyle powerhouse and/or spill at the dam maintains consistent downstream river flows.

J.C. Boyle, Copco, and Iron Gate reservoirs show differences in the occurrence of thermal stratification with depth. The degree of stratification is greatest, and period of stratification longest, in Iron Gate reservoir. Conversely, the degree of stratification is least, and period of stratification shortest, in the J.C. Boyle reservoir. Iron Gate reservoir stratifies as early as April and continues through late October. The thermocline typically occurs at a depth of 50-60 feet by the end of summer. Water temperature differences between the surface and the bottom during peak stratification can range from 18 to 19^{o}C. By comparison, the temperature differentials in Copco and J.C. Boyle reservoirs range from 9 to 12^{o}C and from 3 to 6^{o}C, respectively. Stratification appears to be rather consistent from year to year.

During stratification, there is an inverse relationship between DO and depth. Surface DO can be 9-14 mg/L and bottom values can be less than 5 mg/L. Both Copco and Iron Gate reservoirs are consistently anoxic in the hypolimnion during the summer. The pH values typically range from 6 to 9 in the Project reservoirs. However, pH values greater than 9 have been recorded during algal blooms.

The Klamath River is listed as water quality limited by both Oregon and California under Section 303(d) of the federal Clean Water Act. Specific constituents and locations included on the 303(d) list are summarized in Table E2.6-1. The Clean Water Act requires that Total Maximum Daily Load (TMDL) limits and implementation plans be developed to control pollutant loading sources and achieve compliance with water quality standards and objectives in water bodies on the 303(d) list. TMDLs and waste load allocations are currently being developed for the Klamath River in Oregon. ODEQ is preparing information as part of a TMDL study that addresses water quality in the Klamath River between Upper Klamath Lake and Keno dam. TMDLs for temperature, nutrients, and dissolved oxygen are scheduled to be established for the Klamath River in California by December 31, 2007.

E2.7 FISH RESOURCES

The fisheries resources in the Project vicinity are diverse, consisting of a mixture of warmwater and coldwater species, anadromous and resident fish, and some federally listed threatened and endangered species. At least 28 fish species are known to occur upstream of Iron Gate dam, and 44 fish species are known to occur downstream of Iron Gate dam. Many of these species are non-native. As would be expected, the reservoirs contain most of the warmwater and introduced species and the river sections support most of the coldwater native species, although this varies somewhat by Project reach.

The anadromous fishery consists of coho salmon, chinook salmon, steelhead trout, and Pacific lamprey. Coho salmon are part of the northern California/southern Oregon stock that is listed as a federally threatened species under the Endangered Species Act (ESA). Chinook salmon are part of the Klamath/Trinity River stock, which has spring run and fall run fish, although only the fall-run chinook migrate up to Iron Gate dam. Steelhead trout are part of the Klamath Mountain Province stock, which is a candidate species under the ESA. The Pacific lamprey is also a federal candidate species.

Table E2.6-1. A summary of Oregon and California water quality criteria for key water quality constituents for the Klamath Basin in the vicinity of the Klamath Hydroelectric Project. Refer to OAR 340-041-0001 through –0061 and –0180 through -0185 (Oregon) and to the Water Quality Control Plan For The North Coast Region (California) for details on water quality criteria.

Constituent	Oregon Criteria	California Criteria	Included in Final 2002 303(d) List?[1]						
			UKL	EWA	KEO	BOY	KRA	KRB	KRC
Dissolved oxygen	At DEQ discretion, for waters designated for cool-water aquatic life, 30-day (D) mean min 6.5 mg/L, 7-D min mean 5.0 mg/L, and absolute min 4.0 mg/L At DEQ discretion, for waters designated for cold-water aquatic life, 30-D mean min 8.0 mg/L, 7-D min mean 6.5 mg/L, and absolute min 6.0 mg/L. Not less than 11.0 mg/L in active spawning areas used by resident trout species unless the minimum spatial median intergravel dissolved oxygen is 8.0 mg/L or more, in which case the criterion is 9.0 mg/L.	Minimum of 7.0 mg/L above Iron Gate dam and 8.0 mg/L below Iron Gate dam 50% lower limit[2] of 10.0 mg/L above and below Iron Gate dam	Yes		Yes			Yes	Yes

Table E2.6-1. A summary of Oregon and California water quality criteria for key water quality constituents for the Klamath Basin in the vicinity of the Klamath Hydroelectric Project. Refer to OAR 340-041-0001 through –0061 and –0180 through -0185 (Oregon) and to the Water Quality Control Plan For The North Coast Region (California) for details on water quality criteria.

Constituent	Oregon Criteria	California Criteria	Included in Final 2002 303(d) List?[1]						
			UKL	EWA	KEO	BOY	KRA	KRB	KRC
Temperature	7-day average maximum (max) not to exceed 20ºC in waters designated for redband trout.[3] Designated cool water habitat may not be warmed more than 0.3ºC above ambient temperatures unless a greater increase would not reasonably be expected to adversely affect fish or other aquatic life. If the natural thermal potential of a waterbody is determined to exceed the applicable criterion, the natural thermal potential becomes the applicable criterion. A cumulative temperature increase of 0.3ºC above the applicable criterion is allowed in all waters.	Shall not be altered unless demonstrated that such alteration does not adversely affect beneficial uses. At no time shall temperature be increased by more than 5°F above natural receiving water temperature.		Yes	Yes	Yes	Yes	Yes	Yes
Nuisance phytoplankton growth (Oregon) and nutrients (California)	If chlorophyll-*a* exceeds an action level of 0.015 mg/L[4], ODEQ may conduct studies to determine impacts, causes, and control strategies. Where natural conditions exceed the action level, the action level may be modified to an appropriate value.	Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths sufficient to cause nuisance or adverse effects.	Yes	Yes	Yes			Yes	Yes
pH	Values shall not fall outside the range of 6.5-9.0.[5]	Values shall not fall outside the range of 7.0-8.5.	Yes	Yes	Yes				

Table E2.6-1. A summary of Oregon and California water quality criteria for key water quality constituents for the Klamath Basin in the vicinity of the Klamath Hydroelectric Project. Refer to OAR 340-041-0001 through –0061 and –0180 through -0185 (Oregon) and to the Water Quality Control Plan For The North Coast Region (California) for details on water quality criteria.

Constituent	Oregon Criteria	California Criteria	Included in Final 2002 303(d) List?[1]						
			UKL	EWA	KEO	BOY	KRA	KRB	KRC
Toxic substances (including ammonia)	Shall not exceed criteria listed in OAR 340-041-0033, Table 20.	All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life.			Yes (ammonia)				
Turbidity (NTU)	Except for certain limited duration activities, no more than a 10% increase above natural background levels, as measured relative to a control point immediately upstream of the turbidity causing activity.	No more than 20% increase above natural background levels (except as otherwise allowed by permit or waiver)							
Total dissolved gas	Shall not exceed 110% saturation[6] Shall not exceed 105% saturation in water < 2-ft in depth.								
Total dissolved solids or specific conductance	Unless otherwise authorized by ODEQ, specific conductance shall not exceed a guideline value of 400 micromhos (measured at 77°F) at the Oregon-California border (RM 208.5).	90% and 50% upper limits of 425 and 275 micromhos, respectively, above Iron Gate dam. 90% and 50% upper limits of 350 and 275 micromhos, respectively, below Iron Gate dam.							
Taste and odor	The creation of tastes or odors deleterious to aquatic life, the potability of drinking water or the palatability of fish or shellfish may not be allowed	Shall not contain taste or odor producing substances that impart undesirable taste of odors to fish flesh or adversely affect beneficial uses.							
Color	Objectionable discoloration may not be allowed	Waters free of coloration that adversely affects beneficial use							

Table E2.6-1. A summary of Oregon and California water quality criteria for key water quality constituents for the Klamath Basin in the vicinity of the Klamath Hydroelectric Project. Refer to OAR 340-041-0001 through –0061 and –0180 through -0185 (Oregon) and to the Water Quality Control Plan For The North Coast Region (California) for details on water quality criteria.

Constituent	Oregon Criteria	California Criteria	Included in Final 2002 303(d) List?[1]						
			UKL	EWA	KEO	BOY	KRA	KRB	KRC
Floating material	Objectionable floating solids are not allowed	Shall not contain floating solids, liquids, foams or scum that adversely affect beneficial uses							
Naturally occurring conditions	Less stringent natural conditions that exceed a numeric criterion become the standard.								

[1] UKL: Upper Klamath Lake; EWA: Klamath Lake to Lake Ewauna; KEO: Link River to Keno dam; BOY: J.C. Boyle reservoir; KRA: Keno dam to the California border; KRB: Oregon border to Iron Gate dam; KRC: Iron Gate dam to Scott River. Oregon's current (2002) Section 303(d) list is based on Oregon's water quality standards as they existed before the December 2003 revision and renumbering of the standards.

[2] 50% and 90% upper and lower limits represent the 50th and 90th percentile values, respectively, of monthly means for a calendar year.

[3] Exceedances of temperature criteria are not violations if they occur during the warmest 7-day period of the year that exceeds the 90th percentile of the 7-day average daily max air temperature calculated in a yearly series over the historic record.

[4] Calculated from a minimum of three depth-integrated samples collected over three consecutive months at a minimum of one representative site.

[5] Exceedance of this criterion is not a violation if it occurs in waters impounded by dams existing on January 1, 1996, provided all practicable measures have been taken to bring pH into compliance.

[6] Exceedances of total dissolved gas criteria are not violations if they occur when stream flow exceeds the 10-year, 7-day average flood.

These anadromous species occur only in the Klamath River downstream from Iron Gate dam, because there are no facilities at the dam to pass fish to the upper river. However, there are land-locked populations of lamprey upstream from the dam. A fish hatchery located at Iron Gate dam, operated by California Department of Fish and Game (CDFG), collects and supplements all three anadromous salmonids to the river system (only the fall run of chinook). At least one life stage of at least one of the anadromous species is present in the river at any given time of year.

The resident salmonids include rainbow/redband and brown trout, although rainbows are much more prevalent and brown trout are rarely observed. In the upper areas of the Project, rainbow trout have been identified to be a subspecies of rainbows called redband trout. Redband rainbow trout are listed as a state species of concern in Oregon (ODFW, 1997). Brown trout are an introduced species, but were present in the upper Klamath River before the dams were built and were stocked in Copco reservoir as recently as 1973.

A large warmwater fishery also exists in the basin. A vast majority of these fish consists of non-natives and includes many game species, such as largemouth bass, crappie, yellow perch, and various panfish. There are also several non-game species, such as Tui and blue chubs, which are native and very abundant throughout the Project area. The introduced species occur mostly, but not entirely, in the reservoirs. All of the gamefish provide excellent recreational opportunities, particularly bass, for which yearly fishing tournaments are held. None of these species has special state or federal status.

Another important subset of the Project fishery comprises the four sucker species found in the reservoirs and river reaches. These species are the Klamath largescale and smallscale suckers and the shortnose and Lost River suckers. All four species are native to the basin, and the shortnose and Lost River suckers are listed as federally endangered species under the ESA. The largescale and smallscale suckers are considered riverine species, whereas the shortnose and Lost River suckers are obligatory lake or reservoir dwellers (Desjardins and Markle, 1999). However, the shortnose and Lost River suckers do use streams and rivers for spawning.

E2.8 VEGETATION AND WILDLIFE

The Klamath Hydroelectric Project is located near the confluence of several mountain ranges (Siskiyou/Klamath and Cascade) and within several different ecoregions or physiographic provinces, resulting in a diverse mix of flora and fauna. In Oregon, the Oregon Diversity Plan (ODFW, 1993) refers to these ecoregions as the East Slope Cascades (the Basin and Range physiographic province in Franklin and Dyrness [1973]) and the West Slope Cascades (the High Cascades physiographic province in Franklin and Dyrness [1973]). In California, the Project is within the Southern Cascades and the Modoc Plateau physiographic provinces (Ayres Associates 1999). It is also within the Cascade-North Sierra floristic region of the California floristic province (Barbour and Major, 1988).

Vegetation in the general Klamath Project area varies widely from east to west, but transitions are gradual because of the influences of altitude, aspect, and topography. Overall, the western end of the area, which includes Iron Gate and Copco reservoirs, is relatively dryer than the eastern portion, which is higher in elevation and somewhat cooler. Vegetation within the Project area is relatively distinctive within the following two Project segments: (1) the canyon area

between J.C. Boyle dam and the eastern end of Copco reservoir, and (2) Copco and Iron Gate reservoirs.

J.C. Boyle reservoir has relatively flat, open topography, with wetlands along some edges. From J.C. Boyle dam to the eastern end of Copco reservoir, the Klamath River cuts through several vegetation zones as it bisects the Cascade Range, forming a steep canyon. Montane vegetation typical of the Cascades is mixed with high desert and interior valley plant communities. The dominant plant communities include a mosaic of pine, oak, and mixed conifer. Ponderosa pine and Oregon white oak are the dominant tree species. The upper canyon is more mesic and densely forested than the lower canyon, which widens and becomes drier.

As in other areas in the West, plant communities in the Project vicinity have been adversely affected by a number of anthropogenic activities. Factors contributing to degraded conditions and a decline of the original vegetation mosaic include cattle grazing, exclusion of fire, and the introduction of exotic plants and noxious weeds. Recent studies identified a total of 14 noxious weed species and 112 infestations in the Project vicinity. Significant changes to vegetation have included replacement of native perennial grasses by introduced annual or biennial grasses and forbs and development of over-mature shrub fields. These conditions typify the Copco and Iron Gate areas of the Project.

Table E2.8-1 summarizes the major cover types found within the Project area and identifies their general locations.

Table E2.8-1. Major plant community types along the Klamath River in the Project area.

Plant Community Type	Key Characteristics	General Location
Mixed conifer forest	Mesic wooded communities with a significant oak component and an annual and/or perennial grassland understory.	Northeastern part of study area where it occupied narrow river bottomland, mesic drainages, and north-facing slopes.
Pine/juniper community	Xeric communities located in rocky generally steep inaccessible areas dominated by a variety of species including a significant shrub component.	Several sites located near eastern part of study area and a narrow band on the southern part on the north canyon rim.
Pine/oak forest community	Coniferous forests with little shrub and grass component. Understory is typically a sterile bed of needles.	Southwestern part of study area on dry slopes and benches above the river and below the north canyon wall.
Oak forest community	Oak woodlands commonly associated with ponderosa pine and either annual or perennial grass understories.	Throughout the study area on dry, steep slopes and adjacent to the mixed conifer forest community.
Oak/shrub communities	Mixed shrub communities including wedgeleaf ceanothus, mountain mahogany and bitterbrush communities generally with an annual grass understory and an oak component.	Throughout the study area on terrain varying from steep canyon walls to gentle slopes and benchlands.
Oak grassland community	An open oak savannah without significant shrub or tree cover with the exception of juniper and oak in some areas.	Southwestern portion of the study area adjacent to oak/shrub communities.
Meadow community	Irrigated or subirrigated meadows created for cattle grazing by clearing shrub species.	Southwestern part of study area on benches above the river.

Table E2.8-1. Major plant community types along the Klamath River in the Project area.

Plant Community Type	Key Characteristics	General Location
Riparian community	Areas adjacent to perennial streams or on river islands with moist-site species.	Narrow band along most of the river and some portions of reservoir shorelines.
Steppe	Scattered grasses, forbs, and ponderosa pine in shallow, rocky soils.	Only occurs on basalt flat above the canyon rim.
Rock outcrops and talus	Large outcrops and cliffs with little or no vegetation.	Scattered throughout the upper and lower portions of the study area. Most prominent in the canyon section.

Approximately 54 percent of the Project study area is forested, with other common cover types including upland shrub (10 percent), upland herbaceous (9 percent), agricultural (11 percent), and aquatic habitat (10 percent). Riparian communities (about 1 percent), wetlands (over 4 percent), and barren habitats (less than 2 percent) are the least abundant cover types in the study area.

Wildlife diversity in the Project area is high, reflecting the variety of habitats that occur. Because the area crosses the Cascade Range, species occurring on both the east and west slopes are found. Wildlife diversity has been adversely affected by a number of human-related activities, including timber harvest, fire and fire suppression, small-scale water development, roads, livestock grazing, infestations of exotic plants and noxious weeds, hydroelectric development on the Klamath River, and general human development activities (BLM, 1996a).

Approximately 30 mammal species are known to occur in the Project area. Some of the most common species include: furbearers such as muskrat, gray fox, beaver, and river otter; big game such as mule deer, black-tailed deer, elk, black bear, and cougar; and other non-game mammals such as spotted skunk, Belding ground squirrel, yellow-bellied marmot, deer mouse, house mouse, harvest mouse, montane vole, pacific shrew, little brown bat, and northern pocket gopher.

Approximately 174 bird species are known to occur within the Project area. The Klamath Basin contains extensive marshes that support large numbers of water birds. ODFW considers this area to be one of the most important water bird areas in the state (Puchy and Marshall, 1993). Thompson et al. (1970) estimated that about 80 percent of the waterfowl in the Pacific Flyway migrate through or breed in the Klamath basin. Puchy and Marshall (1993) identified Upper Klamath Lake and the marshes along the Klamath River south of the lake as major areas of water bird use. Peak numbers of water birds, mostly ducks, geese, and swans, occur from late October to early November. Areas that receive the highest levels of waterfowl use include Upper Klamath Lake and the nearby state and federal wildlife refuges. Just upstream of the Project area is Link River and Keno reservoir (Lake Ewauna), which are located immediately downstream of Upper Klamath Lake. The ODFW Klamath Wildlife Area (north and west of Midland, Oregon) is adjacent to Keno reservoir. The USFWS Lower Klamath National Wildlife Refuge (NWR) and Bear Valley NWR are in the vicinity of the Project. Because of its location, the Project area undoubtedly also receives a good deal of waterfowl use. However, marshes adjacent to the river provide more favorable habitat during most periods and are probably used more heavily by waterfowl than the river. Waterfowl may use sections of the Klamath River near ODFW's Miller

Island Wildlife Management Area later into the winter than they use the refuges, because the river stays open after the refuge waters freeze. When the river does freeze, most of the waterfowl move south to the California refuges. The river usually thaws by mid-January and waterfowl start showing up in the refuge area again (R. Anglin, ODFW, pers. comm.). During the summer, common species on the Klamath River include various species of ducks and geese, double-crested cormorant, American white pelican, American coot, several terns (Forster's, Caspian, and black), great egret, grebes (western, pied-billed, and eared), and black-crowned night-heron (Puchy and Marshall, 1993).

Raptor species common in the upper reach of the canyon are those species that prefer open country and that are relatively tolerant of human presence. One of the largest concentrations of bald eagles in the lower 48 states occurs in the Klamath Basin area. Upland game birds include ring-necked pheasants and California quail.

Of the 107 TES species of wildlife potentially occurring within the Project area, only 5 species—the bald eagle *(Haliaeetus leucocephalus)*, western snowy plover *(Charadrius alexandrinus nivosus)*, northern spotted owl *(Strix occidentalis caurina)*, Canada lynx *(Lynx canadenis)*, and gray wolf *(Canis lupus)*—are federally listed as threatened or endangered.

E2.9 CULTURAL RESOURCES

The Klamath Hydroelectric Project area is rich in Native American history and archaeological sites as well as Euroamerican historic sites. Identified site types within the Project area include, but are not limited to, hydroelectric facilities, historic ranch sites, prehistoric/ historic house-pit villages, lithic scatters, campsites, and ceremonial areas.

Cultural resources in the Project area include Native American traditional cultural properties. Traditional cultural properties are places often associated with cultural traditions of Native American groups and may or may not be associated with visible remains or deposits. Examples might include traditional resources gathering locations, places associated with significant events in mythology, cemeteries, and ethnohistoric habitation sites.

The hydroelectric dams and powerhouses in the Project area are enduring, tangible products of the historical development and technological refinement of water-generated power. Early hydro-electric projects played an instrumental role in the process by which homes, businesses, and industries were modernized with the now ubiquitous commodity of electric energy.

Project facilities were constructed from the early 1900s to 1962, thereby making most facilities older than 50 years, one of the criteria for historic status.

The Fall Creek development was built in 1903, making it one of PacifiCorp's oldest hydroelectric developments. Project structures old enough (≥50 years) to be considered for the NRHP include Copco Nos. 1 and 2, and Fall Creek.

Today the Klamath-Modoc and Shasta Tribes (Mack, 1993) claim the area of the Upper Klamath River Canyon as former territory. The canyon stretches approximately 25 miles from the western edge of the Klamath Basin, near Keno, Oregon, into California and is the result of the river's entrenchment through the southern Cascades (Mack, 1993). Ethnographic accounts differ in their placement of tribal boundaries at the time of Euro-American contact; however, the Project area is

near traditional territorial borders of the Klamath and Shasta tribes. It has been suggested that the Shasta occupied the lower half of the Project area in protohistoric times. The evidence includes early explorer accounts, as well as the fact that several of the pioneering European American settlers married Shasta women (FERC, 1990b; Gehr, 1986, 1988). The Shasta Tribe continued using Project area sites for ceremonial purposes into the early twentieth century.

The modern day Klamath tribal territory includes land along the Klamath River from Upper Klamath Lake, extending southwest near the town of Keno. The Klamath Tribes traditionally were made up of Klamath, Modoc, and Yahooskin Snake Paiute people. Together they controlled 22 million acres of land in south central Oregon and northern California, providing abundantly for their needs and respective cultures. However, in the mid-nineteenth century, contact with invading Europeans decimated the populations through disease and war and resulted in a treaty reserving to the tribes a diminished land base of 2.2 million acres (O'Connell, 1999). In the 1950s, Congress adopted a termination policy over the objections of almost all the tribes and Indian organizations of the day. The Klamath tribes were terminated from federal status in 1954. The primary emphasis of the policy was to remove most of the federal responsibilities guaranteed to the tribes by treaty. The treaty guarantees had been bought and paid for with tribal cessions that surrendered over 18 million acres of prime timber and farmlands plus social services. Once terminated, the tribes were cut off, not only from the land, but also from valuable social services (O'Connell, 1999). The federal government took control of the Klamath Indian Reservation and it was converted into the Winema National Forest. In August of 1986, after years of struggle and court battles, the Klamath tribes were restored to federal status when President Reagan signed the Klamath Restoration Act into law (Haynal, 1994).

The native people known as the Shasta historically were living in numerous villages along the Klamath Canyon and in the upper part of the Bear Creek Valley at the time of contact with Euro-Americans (Winthrop, 1999). Early travelers came through this territory on their way to other places, living off the land, spreading disease, and pillaging the resources of native peoples. The resulting ill will culminated in a series of battles that ended in the relocation of the survivors to distant reservations, and ultimately, changed their way of life forever (Winthrop, 1999).

The Shasta subsequently managed to maintain a presence in the Shasta Valley and the Klamath-Iron Gate area. Like other native people in the region, the Shasta developed a highly sophisticated understanding of the environment and its resources. Today, Shasta descendants continue to use the area to gather various traditional materials, such as basketry supplies and medicinal plants.

Lastly, the Karuk, Hoopa, and Yurok tribes are located well downstream of the Project (both geographically and traditionally), and are primarily interested in Project-related fisheries issues. However, they also have an interest in cultural resources management relicensing issues.

E2.10 LAND USE

Primary land uses in the area of the Klamath Hydroelectric Project include agriculture/grazing, timber production, residential development, and recreation.

Development near the J.C. Boyle dam and powerhouse, is limited to an occasional residence, recreational facilities, powerline corridors, and unimproved access roads. Land use is primarily timber production, with some ranching/grazing activities, and recreation.

Crossing the border from Oregon to California, Copco Nos. 1 and 2 are the next developments along the river. The area is rural, with limited residential development along the shoreline of the reservoir. Powerline corridors, paved access roads, and recreation facilities, in addition to the powerhouses and dams, are present in the landscape. The Fall Creek Fish Hatchery, northwest of the Copco No. 2 diversion dam, is near Copco Village.

The most downstream Project development includes Iron Gate dam and powerhouse. Paved access roads, recreational facilities, limited recreation development, and a fish hatchery are the predominant features at this location. Ancillary structures in the area include a penstock, wood pole transmission lines, and railroad tracks/right-of-way. The area is rural, with limited forested land and ranching/grazing activities.

E2.11 AESTHETICS

The upper Klamath River canyon downstream of the J.C. Boyle powerhouse has been classified by the BLM as Scenic Quality A, the highest scenic classification on BLM-managed lands. The scenic value is due to a combination of unique landform, diverse vegetation, water, and lack of negative cultural modifications.

The steep-walled, layered basalt canyon is the predominant visual element in the region. Its steep slopes with large rock outcroppings form vertical cliffs, talus slopes, and rockslides. The Klamath River itself enhances the visual variety within the canyon; as it flows through the deep gorge, it changes from slack, slow-flowing water in the wider areas of the canyon to a rushing torrent of cascading whitewater in narrower sections. This variety of flow greatly enhances the Klamath River's scenic value.

The area's remoteness and steep topography provide visitors with an uncrowded and natural aesthetic experience not usually available at the more popular and famous national parks, monuments and rivers in the region.

E2.12 RECREATION RESOURCES

Popular recreation activities in the Project area include flatwater and whitewater boating, hiking, bird watching, camping, picnicking, lake and bank fishing, rafting and swimming. Recreation sites in the Project vicinity include the Link River Bird Sanctuary and Small Game Refuge, Pioneer Park, Sportsman's Park, Topsy Recreation Site, Frain Ranch, Mallard Cove, Copco Cove, Fall Creek Park, Jenny Creek Recreation Site, Wanaka Springs, Camp Creek, Juniper Point, Mirror Cove and Iron Gate Hatchery. Iron Gate reservoir has the highest concentration of recreation sites of all the developments associated with the Klamath Hydroelectric Project. PacifiCorp also provides six fishing access points along the lower portion of the Klamath River reach between J.C. Boyle dam and Copco reservoir. Also provided is one river access site and interpretive opportunities at Iron Gate Fish Hatchery.

Immediately downstream of J.C. Boyle dam, the Klamath River enters a series of rugged deep gorges and narrow canyons. In 1994, the section of river between the powerhouse and the

California State line was designated a National Wild and Scenic River by the U.S. Secretary of the Interior. The designation request was made by the Governor of Oregon under Section 2(a)(ii) of the National Wild and Scenic Rivers Act (NWSRA); under this designation, BLM, the current landowner, manages the river in cooperation with the State of Oregon. The primary purpose of the designation was to identify and "preserve free-flowing rivers in their natural condition for the use and enjoyment of the public" (NPS, 1994).

E2.13 SOCIOECONOMIC SETTING

The Project area is located within Klamath County and Jackson County, Oregon, and Siskiyou County, California. Other counties within the Project vicinity that comprise the socioeconomic setting include Curry County, Oregon, and Humboldt and Del Norte Counties, California. Within the six-county study area, the total population is 464,507. The three counties that comprise the upstream (generally above Iron Gate dam) region (Klamath, Siskiyou, and Jackson) have a combined population of 289,345. The combined population of the downstream region (Curry, Del Norte, and Humboldt) is 175,162. The upstream region contains more than 60 percent of the socioeconomic study area population, with Jackson County, Oregon comprising almost 40 percent of the total study area population. The 5-mile buffer study area for the upstream counties has a population of 57,869, representing about 20 percent of the upstream county population total.

The largest racial group in the study area is white, representing over three-fourths of the population in the study area. The American Indian population constitutes the second largest racial group in all but Jackson County.

The study area has adequate housing as indicated by high vacancy rates. Vacancy rates above 5 percent are generally thought to indicate surplus of housing units available for rent.

For the communities within the 5-mile buffer study area, the Services and Retail trade sectors account for about two-thirds of the industry employment.

Most of the communities in the 5-mile buffer study area have unemployment rates that are higher than those reported at the county or state level. Tribal authorities report unemployment rates as high as 40 percent within the tribal community (Waddell, 2002)

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