

## SUMMARY

This final environmental impact statement (EIS) for relicensing the Klamath Hydroelectric Project has been prepared by the staff of the Federal Energy Regulatory Commission (Commission or FERC) to fulfill the requirements of the National Environmental Policy Act (NEPA); the Commission's implementing regulations under Title 18, Code of Federal Regulations (CFR), Part 380; and the Council on Environmental Quality regulations for implementing NEPA (40 CFR Parts 1500-1508). The purpose of this document is to inform the Commission, the public, and the various federal and state agencies, tribes, and non-governmental organizations about the potential adverse and beneficial environmental effects of the proposed project and reasonable alternatives.

The Commission must decide whether to relicense the Klamath Hydroelectric Project and, if so, what conditions to place on any license issued. In deciding whether to authorize the continued operation of the hydroelectric project, the Commission must determine that the project will be best adapted to a comprehensive plan for improving or developing a waterway. In addition to the power and developmental purposes for which licenses are issued (e.g., flood control, irrigation, and water supply), the Commission must give equal consideration to the purposes of energy conservation; the protection and enhancement of fish and wildlife (including related spawning grounds and habitat); the protection and enhancement of recreational opportunities; and the preservation of other aspects of environmental quality.

The principal issues that we address in the EIS include the influence of project operations on water quality, including downstream of Iron Gate dam; approaches to facilitate the restoration of native anadromous fish within and upstream of the project; the influence of peaking operations at J.C. Boyle development on downstream biota and whitewater boating opportunities; the effect of project operations on archaeological and historic sites and resources of concern to various tribes; the effects of decommissioning East Side and West Side developments and removing Keno development from the project; and decommissioning other project developments.

### **PacifiCorp's Proposal**

On February 25, 2004, PacifiCorp filed an application with the Commission for a new license for the Klamath Hydroelectric Project, located principally on the Klamath River in Klamath County, Oregon and Siskiyou County, California, between Klamath Falls, Oregon, and Yreka, California. The existing project occupies 219 acres of lands of the United States, which are administered by the U.S. Bureau of Land Management or the U.S. Bureau of Reclamation. The current license expired on March 1, 2006, and the project is operating under an annual license.

The existing Klamath Hydroelectric Project consists of eight developments, seven of which are located on the Klamath River. One of the seven developments, Keno, currently regulates water levels of Keno reservoir to facilitate irrigation withdrawals. It has no generation capabilities and PacifiCorp states that it no longer serves project purposes and should be deleted from the project. PacifiCorp also proposes to decommission East Side and West Side developments because the cost of installing screens that would be protective of federally listed suckers that reside in Upper Klamath Lake would be prohibitive. The remaining project developments on the mainstem of the Klamath River include J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate. The Iron Gate Fish Hatchery produces anadromous fish to compensate for lost spawning and rearing habitat between Iron Gate and Copco No. 2 dams. The eighth project development, Fall Creek, is on a Klamath River tributary that flows into Iron Gate reservoir. The installed capacity of the entire project is 169 megawatts (MW) and, on average, the project annually generates 716,800 megawatt-hours (MWh) of electricity.

PacifiCorp proposes to operate the five remaining developments in a manner similar to past operations with a set of 41 environmental measures (described in detail in section 2.2.3), the purposes of which include the following:

- Enhancement of the quality of project-influenced waters by installing a hypolimnetic oxygenation system at Iron Gate reservoir and evaluating other methods to increase dissolved oxygenation, decrease temperature, and decrease nutrient loading and associated problems.
- Enhancement of aquatic habitat in the J.C. Boyle bypassed and peaking reaches by increasing the minimum flows and controlling ramping rates.
- Elimination of the source of major slope failures downgradient of the J.C. Boyle emergency overflow spillway by installation of bypass valves at the powerhouse.
- Facilitation of fish passage at J.C. Boyle dam by installation of a surface collection system upstream of the dam and making improvements to the existing fish ladder.
- Enhancement of spawning habitat in the J.C. Boyle bypassed reach and downstream of Iron Gate dam by gravel placement.
- Enhancement of aquatic habitat downstream of the Fall Creek diversion by increasing the minimum flow to 5 cubic feet per second (cfs).
- Protection of habitat downstream of the Spring Creek diversion dam by not diverting flow during July and August and releasing a minimum flow of 1 cfs for the remainder of the year.
- Facilitation of fish passage at the Fall and Spring Creek diversion dams by installing fish screens and ladders at both sites.
- Enhancement of Iron Gate Hatchery stock management by purchasing and operating a facility capable of marking 25 percent of all Chinook salmon released.
- Management of vegetation resources by implementation of a vegetation resources management plan.
- Management of wildlife resources by implementation of a wildlife habitat management plan.
- Enhancement of recreational opportunities by improving existing and construction of additional recreation sites and facilities and implementation of a recreation resources management plan.
- Enhancement of the appearance of project facilities by reducing their visibility and contrast through vegetative screening at recreation sites and at J.C. Boyle and Iron Gate developments via implementation of a visual resources management plan.
- Coordination of the management of project roads via implementation of a Project Roadway Management Plan.
- Protection of archaeological and historic resources via implementation of a Historic Properties Management Plan.

### **Staff Alternative**

After evaluating PacifiCorp’s proposal, along with the terms and conditions, prescriptions, and recommendations from resource agencies, tribes, and other interested parties, we compiled a set of environmental measures to address the resource issues raised in the proceeding. We call this the “Staff Alternative” (described in detail in section 2.3.2). The Staff Alternative incorporates most of PacifiCorp’s proposed environmental measures, but in some instances, with modifications. Key modifications include:

- Implementation of turbine venting as an initial dissolved oxygen enhancement measure, rather than hypolimnetic oxygenation, and further evaluation of other measures to enhance

water quality with identification of time frames during which specific actions identified during the evaluation would be implemented.

- Implementation of an integrated fish passage and disease management program, including the installation of a downstream passage and fish collection facility at J.C. Boyle dam, modifying adult collection facilities at Iron Gate dam to facilitate trapping and hauling of adult anadromous fish, evaluation of survival of outmigrating wild smolts at project reservoirs, spillways, and powerhouses, an experimental drawdown of Copco and Iron Gate reservoirs to assess effects on smolt outmigration and water quality, water quality monitoring in project reservoirs and to the mouth of the Klamath River, including major tributaries, to assess project contributions to factors that may cause fish diseases in the lower river, and evaluation of the most feasible and effective means to pass fish to and from project waters and minimize the risks associated with fish diseases that are project related.
- Implementation of an adaptive sediment augmentation program in the J.C. Boyle bypassed reach and downstream of Iron Gate dam based on habitat mapping.
- Implementation of a maximum downramping rate of 2 inches per hour during the first peaking cycle after extended periods of run-of-river operation, which would gradually be increased during each subsequent day until PacifiCorp's proposed ramping rates are achieved.
- Increasing the minimum flow in the Copco No. 2 bypassed reach to 70 cfs.
- Increased funding responsibilities for Iron Gate Hatchery operation and maintenance, tagging operations, and full funding of Fall Creek rearing facility operations.
- Implementation of a hatchery and genetics management plan.
- Addition of operation and maintenance responsibilities for Topsy Campground and Day Use area at J.C. Boyle development.
- Inclusion of Fall Creek and Copco No. 2 powerhouses and Copco No. 2 substation in the visual resources management plan.
- Expansion of the geographic scope of PacifiCorp's proposed area of potential effects pertaining to the protection of cultural resources.

The Staff Alternative includes 25 environmental measures in addition to those proposed by PacifiCorp.

### **Staff Alternative with Mandatory Conditions**

Section 18 of the Federal Power Act, 16 U.S.C §811, states that the Commission shall require construction, maintenance, and operation by a licensee of such fishways as the Secretaries of the U.S. Department of Commerce (Commerce) and U.S. Department of Interior (Interior) may prescribe. In March 29, 2006, filings with the Commission, Commerce and Interior submitted joint preliminary fishway prescriptions for anadromous and resident fish consisting of 7 general prescriptions and 31 development-specific prescriptions, summarized in section 2.3.1.2. PacifiCorp filed alternative fishway prescriptions by letter dated April 28, 2006, in accordance with section 241 of the Energy Policy Act of 2005, that take an adaptive approach for restoring anadromous fish to historically accessible habitat. On January 29, 2007, Commerce and Interior submitted joint modified fishway prescriptions that take into consideration the results of the Energy Policy Act of 2005 proceeding.

Section 4(e) of the Federal Power Act gives the Secretary of Interior authority to impose conditions on a license issued by the Commission for hydropower projects located on "reservations"

under the Secretary's supervision (16 U.S.C §§796[2], 797[e]). In a March 29, 2006, filing with the Commission, Interior submitted nine preliminary section 4(e) conditions (seven with multiple components) on behalf of the Bureau of Land Management and 7 preliminary section 4(e) conditions (one with multiple components) on behalf of Reclamation (see section 2.3.13). PacifiCorp filed alternative section 4(e) conditions to most of the measures specified by Interior by letter dated April 28, 2006, in accordance with section 241 of the Energy Policy Act of 2005. The alternative conditions, in general, either eliminated the 4(e) condition or reduced the scope of the measure described in the 4(e) condition. On January 29, 2007, Interior, on behalf of the Bureau of Land Management submitted revised section 4(e) conditions that take into consideration the results of the Energy Policy Act of 2005 proceeding.

When finalized, the fishway prescriptions and 4(e) conditions may need to be included in a new license for this project. Incorporation of these mandatory conditions into a new license would cause us to modify or eliminate some of the environmental measures that we include in the Staff Alternative. Because the Staff Alternative does not include East Side, West Side, and Keno developments, we do not include any mandatory conditions associated with these developments in this alternative. Key differences in this alternative compared to the Staff Alternative include the following:

- The minimum flow in the J.C. Boyle bypassed reach would be increased from 200 to 470 cfs or more.
- The ramping rates in the J.C. Boyle peaking reach would be considerably more restrictive.
- J.C. Boyle powerhouse would only be able to operate in a peaking mode once per week.
- The integrated fish passage and disease management program would be replaced by the installation of fishways at each development.
- PacifiCorp would be responsible for operating, maintaining, and monitoring the Spring Island Boaters access, Klamath River Campground, scouting trails at major rapids along the J.C. Boyle peaking reach, and dispersed day-use sites on Bureau of Land Management administered lands.

### **Retirement of Copco No. 1 and Iron Gate Developments**

We have identified for analysis two dam removal and development retirement alternatives, one consists of the removal of Copco No. 1 and Iron Gate developments from the project. This alternative is intended to address water quality issues that originate in the reservoirs associated with both developments, facilitate restoration of anadromous fish to habitat upstream of Iron Gate dam, and retain a substantial portion of the generation capability of the project. In this alternative, we modify or eliminate some of the environmental measures that we include in the Staff Alternative. Key differences in this alternative compared to the Staff Alternative include the following:

- Potential corrective actions to enhance water quality would no longer be necessary, and the water quality management plan would be replaced with a water quality monitoring plan.
- J.C. Boyle and Copco No. 2 developments would operate in a run-of-river mode.
- Sediment augmentation downstream of Iron Gate dam would be eliminated.
- The integrated fish passage and disease management program would be replaced by the installation of upstream and downstream fishways at Copco No. 2 dam, and the spillway of Copco No. 2 dam would be modified to protect downstream migrating smolts.
- Anadromous fish collected at the existing fish ladders at Iron Gate Hatchery and the base of Iron Gate dam not needed for hatchery brood stock would be transported by truck to the upper end of Copco reservoir during the first year from license issuance to establish naturally

reproducing populations prior to the elimination of salmonid stock from Iron Gate Hatchery. When Copco No. 1 dam is removed and upstream and downstream fishways are constructed at Copco No. 2 dam, all fish collected in excess of brood stock would be transported by truck to Iron Gate reservoir until the beginning of deconstruction of Iron Gate dam, which would occur about 5 years from license issuance.

- Funding obligations for Iron Gate Hatchery would increase to provide 100 percent of the cost of operating the hatchery until Iron Gate dam is removed, after which the disposition of the hatchery would be determined. The Fall Creek rearing facility would not be funded.
- Operation and maintenance requirements for existing recreational facilities at Copco No. 1 and Iron Gate developments would be eliminated, as would proposed new facilities at both developments.
- A new day use area would be constructed near Copco No. 2 dam that would also serve as a whitewater boater take-out point for boaters putting in downstream of J.C. Boyle dam. PacifiCorp would no longer be responsible for maintaining Fishing Access sites 1-6 and the State Line Take-out facility.
- Proposed visual enhancements at Iron Gate development would be eliminated.
- Consultation with the California Historic Preservation Officer regarding measures to protect or mitigate for historic properties associated with both developments would be necessary.

### **Retirement of J.C. Boyle, Copco No. 1, Copco No. 2 and Iron Gate Developments**

The second dam removal and development retirement alternative would entail removal of the four lowermost project dams on the mainstem of the Klamath River. The Fall Creek development, with an authorized capacity of 2.2 MW, would be the only remaining project development in a new license for this project, assuming East Side, West Side, and Keno developments are removed from the project, as PacifiCorp proposes. As with the previously discussed two dam removal alternative, this alternative is intended to address water quality issues that originate in the reservoirs associated with Iron Gate and Copco No. 1 developments, and facilitate restoration of anadromous fish to habitat upstream of Iron Gate dam. In this alternative, we modify or eliminate most of the environmental measures that we include in the Staff Alternative. Key differences in this alternative compared to the two dam removal alternative include the following:

- All sediment augmentation would be eliminated.
- Upstream and downstream fishways would not be constructed at Copco No. 2 dam, but anadromous fish would still be trapped at Iron Gate dam and trucked to the upper portion of Copco reservoir until Copco No. 1 and Copco No. 2 dams are removed. Anadromous fish then would be placed in Iron Gate reservoir until the beginning of Iron Gate dam deconstruction, about 5 years following license issuance.
- Operation and maintenance requirements for existing recreational facilities at J.C. Boyle development would no longer be implemented, as would proposed new facilities at this development. The only recreational facility remaining in the project would be the proposed Fall Creek trail, and the recreation resources management plan would be modified to only account for construction, operation, and maintenance of this trail.
- Our recommended visual enhancements at Copco No. 2 development would be eliminated.
- Consultation with the Oregon and California Historic Preservation Officers regarding measures to protect or mitigate for project-related historic structures associated with all four developments would be necessary.

## **Other Alternatives Considered**

Under the No-action Alternative, the project would continue to operate under the terms and conditions of the existing license and existing agreements. No new environmental measures would be implemented. We use this alternative to establish baseline conditions for comparison with PacifiCorp's Proposal, the Staff Alternative, the Staff Alternative with Mandatory Conditions, the Retirement of Copco No. 1 and Iron Gate Developments, and the Retirement of J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate Developments, and to judge the benefits and costs of any measures that might be required under a new license. We also considered federal takeover, issuance of a nonpower license, project decommissioning with dams in place, and decommissioning Fall Creek development, but concluded that none of these alternatives are reasonable in the context of this proceeding.

## **Project Effects**

We summarize the more substantial differences between PacifiCorp's Proposal, the Staff Alternative, the Staff Alternative with Mandatory Conditions, Retirement of Copco No. 1 and Iron Gate Developments, and Retirement of J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate Developments in table ES-1. Based on our detailed analysis of the environmental benefits and costs associated with the four alternatives considered in detail in this EIS, we conclude that the best alternative for the Klamath Hydroelectric Project would be to issue a new license consistent with the environmental measures specified in the Staff Alternative.

Table ES-1. Summary of effects of PacifiCorp’s Proposal, the Staff Alternative, the Staff Alternative with Mandatory Conditions, Retirement of Copco No. 1 and Iron Gate Developments, and Retirement of J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate developments. (Source: Staff)

Resource	PacifiCorp’s Proposal	Staff Alternative	Staff Alternative with Mandatory Conditions	Retirement of Copco No. 1 and Iron Gate Developments	Retirement of J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate Developments
<b>Power Benefits</b>					
Annual generation (MWh)	675,738	663,381	533,879	443,694	12,817
Net annual power benefits	\$17,031,370	\$2,076,740	-\$20,244,360	-\$6,571,040	-\$13,186,870
<b>Geology and Soils</b>					
Sediment Supply and Transport	Relatively minor enhancement of spawning gravel supply from recurring placement in J.C. Boyle bypassed reach and downstream of Iron Gate dam.	Deposition of sediment downstream of J.C. Boyle dam would provide a moderate enhancement of spawning gravel supply and could increase channel complexity and enhance riparian habitat in the bypassed reach. Diverting all flow to the J.C. Boyle bypassed reach for 7 days during the spring, when inflows to the reservoir exceed 3,300 cfs could serve to transport deposited, and naturally occurring sediment from the bypassed reach into the peaking reach, where it could also enhance habitat. Amount and frequency of sediment	Same as Staff Alternative	Similar to Staff Alternative for J.C. Boyle bypassed reach. During and immediately after removal of Copco No. 1 and Iron Gate dams, about 84 percent of the eroded sediment would remain in suspension until it reached the ocean (GEC, 2006). If Copco No. 1 dam is removed before Iron Gate dam, about 40 percent of the resuspended sediment would pass through Iron Gate reservoir, and remain in suspension in the lower Klamath River. Copco No. 2 dam may trap some sediments released from Copco reservoir, but would	Similar to Retirement of Copco No. 1 and Iron Gate dam alternative. Most sediment released from J.C. Boyle is expected to be sand, which would settle out relatively quickly. Sediments would no longer be prevented from moving downstream by project dams, which would enable more natural fluvial geomorphic processes to occur, thus enhancing

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<b>Resource</b>	<b>PacifiCorp's Proposal</b>	<b>Staff Alternative</b>	<b>Staff Alternative with Mandatory Conditions</b>	<b>Retirement of Copco No. 1 and Iron Gate Developments</b>	<b>Retirement of J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate Developments</b>
		placement in both the J.C. Boyle bypassed reach and downstream of Iron Gate dam to the Shasta River would be based on habitat mapping, monitoring, and identified habitat needs.		likely fill and require dredging to maintain powerhouse operations. Sediment stored in Iron Gate reservoir would likely be released to downstream reaches which would have short-term adverse effects on aquatic habitat but eventually stabilize, and spawning gravel released from the reservoir could enhance salmon spawning habitat. Following removal of both dams, downstream fluvial geomorphological processes would be aberrant, as material that is not transported to the ocean is redistributed and sorted, but would eventually reach equilibrium. The time frame for equilibrium would be dependent on water year time (wetter years would reduce the time frame).	spawning gravel distribution, channel complexity, and riparian habitat.
Slope stabilization	Installation of bypass valve at J.C. Boyle powerhouse would reduce use of emergency spillway, the source of a major slope failure.	In addition to PacifiCorp's measure, would address stabilization and restoration of this and other slope failures along the J.C. Boyle bypassed reach.	Similar to Staff Alternative. Removal of sidecast material from bypassed reach channel could enhance access of salmonids to thermal refugium under low flow conditions in	Similar to Staff Alternative, provisions for stabilizing exposed banks following dam removal would be addressed in development decommissioning plan.	Slope stabilization along the J.C. Boyle bypassed reach would be addressed in a decommissioning plan; provisions for stabilizing exposed

**Retirement of J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate Developments**

<b>Resource</b>	<b>PacifiCorp's Proposal</b>	<b>Staff Alternative</b>	<b>Staff Alternative with Mandatory Conditions</b>	<b>Retirement of Copco No. 1 and Iron Gate Developments</b>	<b>Retirement of J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate Developments</b>
			<p>the J.C. Boyle bypassed reach, but access would likely be possible under the flows specified by Bureau of Land Management. Removal of the sidecast material would enhance recreational boating opportunities in the J.C. Boyle bypassed reach when suitable flows are present.</p>		<p>banks following dam removal would be addressed in the decommissioning plans for each development.</p>
<p><b>Water Quality</b></p>	<p>Hypolimnetic oxygenation at Iron Gate reservoir would enhance DO downstream of Iron Gate compared to No-action but would still likely not meet applicable standards for much of the summer. Implementation could have unintended adverse effects in the reservoir. Reservoir management plans could identify measures to further address DO, as well as temperature and nutrient-related problems.</p>	<p>Turbine venting at Iron Gate would offer immediate downstream DO enhancement, while other options would be evaluated in response to monitoring results. DO would meet applicable standards at a level comparable to PacifiCorp's Proposal, but without potential for water quality degradation that could occur with hypolimnetic oxygenation. DO and TDG would be monitored to document the level of DO enhancement and to ensure that TDG levels to not reach unacceptable levels.</p>	<p>Similar to Staff Alternative.</p>	<p>The major sources of project-related water quality problems would be eliminated. Temperature regime downstream of Iron Gate generally would be more suitable for salmon, DO would usually meet applicable objectives, nutrient load would likely be reduced downstream of Iron Gate, which may reduce abundance of algae that form habitat for the intermediate host for at least two salmon pathogens, as well as <i>Microcystis</i> and its toxin. The current degree of ammonia and pH fluctuation that occur</p>	<p>Similar to Retirement of Copco No. 1 and Iron Gate Developments alternative. Temperature in the upper end of the J.C. Boyle bypassed reach and the entire Copco No. 2 bypassed reach would be slightly cooler during the summer, compared to current conditions, and therefore more suitable for salmonids.</p>

Resource	PacifiCorp's Proposal	Staff Alternative	Staff Alternative with Mandatory Conditions	Retirement of Copco No. 1 and Iron Gate Developments	Retirement of J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate Developments
<b>Aquatic Resources</b>					
Instream flows	Additional 100 cfs released from J.C. Boyle dam would enhance physical habitat and	Similar to PacifiCorp's proposal, although increased minimum flow in	Release of at least 470 cfs to the bypassed reach would diminish	Limiting releases from the Copco No. 2 development, as needed to be consistent	<p>Temperature in the lower portion of the J.C. Boyle bypassed reach would be warmer than under current conditions. DO in project waters expected to increase because of reaeration associated with turbulence, as water passed through higher gradient reaches that were formerly bypassed or inundated. Sediment in J.C. Boyle reservoir is predominantly sand, and the small size of Copco No. 2 reservoir would result in minimal incremental water quality effects during and after removal of either dam.</p> <p>downstream of Iron Gate dam would likely be reduced. Concentrations of TSS would increase during removal of both dams and much of the material would remain in suspension until it reaches the ocean. Downstream consumptive water users may need to treat or filter water withdrawn directly from the Klamath River. However, the duration of elevated TSS would likely be less than a year, based on modeling reported in GEC (2006).</p> <p>Similar to the Retirement of Copco No. 1 and</p>

<b>Resource</b>	<b>PacifiCorp's Proposal</b>	<b>Staff Alternative</b>	<b>Staff Alternative with Mandatory Conditions</b>	<b>Retirement of Copco No. 1 and Iron Gate Developments</b>	<b>Retirement of J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate Developments</b>
	<p>retain important thermal refugium in the bypassed reach; proposed peaking operation restriction and ramping rates in the peaking reach would reduce the potential for fish stranding. Minor enhancement of habitat in Fall and Spring creeks.</p>	<p>Copco No. 2 bypassed reach would substantially increase physical habitat. Warm water would likely continue to limit the suitability of the reach for salmonids during the summer. Our initial downramping rate restriction during the first peaking cycle following run-of-river operation at J.C. Boyle, followed graduated less restrictive ramping rates, should address identified stranding issues in the peaking reach. Monitoring of stranding under this operating mode would enable further adjustments to the ramping rates to be made based on site specific data. Implementing a 4 cfs minimum flow at Spring Creek and ceasing operation during the summer would enhance downstream habitat and water quality conditions in Spring and Jenny creeks.</p>	<p>the size of the thermal refugium in J.C. Boyle bypassed reach, but would provide additional physical habitat; limiting peaking operations to once a week would reduce likelihood of stranding, and provide a more stable aquatic environment, but could conflict with Outstanding Remarkable Value for this Wild and Scenic River reach by eliminating most whitewater boating opportunities and reducing the availability of optimal flows for angling.</p>	<p>with flows and ramping rates specified in the Klamath Irrigation Project Operations Plans would eliminate the ability to operate J.C. Boyle in a peaking mode, which would result in less downstream fluctuation, reducing stranding potential more than the Staff Alternative, but also curtailing whitewater boating opportunities in the J.C. Boyle peaking reach. Water temperatures in the Copco No. 2 bypassed reach would be cooler than other alternatives with all project dams in place, and more suitable for salmonids.</p>	<p>Iron Gate Developments alternative. Flows in the former J.C. Boyle bypassed reach would likely be cooler upstream of the substantial areas of spring accretion, but would likely be warmer downstream of springs. The value of the springs as a thermal refugia would be reduced because the increased flow would decrease the area cooled by the springs; this could affect adult summer steelhead and spring Chinook salmon. However, additional thermal refugia may become accessible at springs that are currently inundated by project reservoirs, and at the mouths of spring-fed</p>

Resource	PacifiCorp's Proposal	Staff Alternative	Staff Alternative with Mandatory Conditions	Retirement of Copco No. 1 and Iron Gate Developments	Retirement of J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate Developments
Anadromous fish restoration and fish passage	Improvements to the existing fish ladder at J.C. Boyle dam, and use of a "fish gulper" would improve passage for resident fish, however, effectiveness of the proposed downstream passage system is uncertain. New fish ladders and screens at Spring and Fall creek diversion dams would improve passage for resident trout. No specific provisions for restoration of anadromous fish.	Adaptive approach to restoring anadromous fish via an integrated fish passage and disease management program would provide immediate passage of anadromous fish to habitat upstream of J.C. Boyle dam. Construction of a downstream passage and collection facility at J.C. Boyle dam would provide downstream passage and a source of wild smolts for fish migration studies. These studies would be designed to address critical uncertainties about reservoir	Volitional upstream and downstream passage, with tailrace barriers and spillway modification at most project dams (unless studies show they are not needed). Completion of fish passage facilities at all project developments would require up to 6 years. No provisions are made for passing adult fish or smolts around Iron Gate and Copco reservoirs when water quality is poor or	The two most problematic dams (based on height, reservoir size, and landscape constraints) for effective upstream and downstream passage would be removed. Upstream and downstream volitional fishways would be installed at Copco No. 2 dam and enhancements made to the existing fish ladder at J.C. Boyle dam. This would provide access to 40.4 miles of mainstem habitat and more than 20.2 miles of tributary habitat within the project area, and potentially	tributaries. All river flows passing through the Copco No. 2 bypassed reach would likely eventually reduce the current vegetation encroachment into the channel, restore a more natural riparian community, and result in potential spawning gravel deposition at suitable locations. Similar to Retirement of Copco No. 1 and Iron Gate Dam Developments alternative. Expected relatively minor upstream and downstream passage inefficiencies at Copco No. 1 and J.C. Boyle dams would be eliminated. Potential spawning and rearing habitat that is currently

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		<p>passage before additional passage facilities are constructed. This alternative provides a higher level of assurance that passage facilities would be effective than the section 18 and alternative prescriptions. New fish ladders and screens at Spring and Fall creek diversion dams would improve passage for resident trout.</p>	<p>to minimize fish predation, which may result in substantial mortality and limited benefits. At Spring and Fall creeks, resident fish passage would be similar to Staff Alternative.</p>	<p>about 355 miles of habitat upstream of Upper Klamath Lake. Water quality barrier to upstream and downstream passage of fish caused by both reservoirs would be eliminated and the risk of predation during downstream passage substantially reduced. Migration corridor downstream of the project would be enhanced because conditions that foster disease outbreaks would be reduced. Potential spawning and rearing habitat that is currently inundated by Copco and Iron Gate reservoirs would again be accessible to anadromous fish</p>	<p>inundated by J.C. Boyle, Copco, and Iron Gate reservoirs would again be accessible to anadromous fish (an incremental increase of 3.9 miles of mainstem habitat and less than 0.25 mile of the lower end of Spencer Creek compared to the two dam removal alternative). Direct access by all anadromous fish that historically had access to the Keno reach prior to downstream dam construction would be restored. Existing fish ladders at Keno and Link River dam would enable passage to available suitable habitat upstream of Upper Klamath Lake to potentially occur. Similar to Retirement of</p>
Fish disease management	Reservoir management plan development could result in	Implementation of a disease monitoring and	Similar to Staff Alternative.	Removal of the two dams would enhance downstream	

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	implementation of measures that would reduce nutrient load in project reservoirs, which could reduce downstream occurrence of algal populations that form habitat for fish pathogen host.	management plan as part of an integrated fish passage and disease management program would entail monitoring water quality and disease prevalence to identify project-related factors that contribute to fish diseases and to evaluate the effects of operational changes including spills and reservoir drawdowns. Subsequently, measures would be implemented to address project-related causes, which could reduce smolt mortality in the lower Klamath River migratory corridor and provide basin-wide benefits to anadromous fish populations.		water quality and reduce cumulative effects that contribute to downstream fish kills caused by disease and poor water quality (low DO, high water temperature, variable pH and ammonia levels, crowding, nutrients and armored substrate favorable for algal populations that form habitat for fish pathogen host). Our recommended integrated fish passage and disease management plan would not be implemented, because the likely project-related causes of downstream fish diseases would be eliminated.	Copco No. 1 and Iron Gate Developments alternative.
Iron Gate Hatchery operations	Same level of funding (80%) for general operation and maintenance; unspecified minor improvements would be made to the hatchery; would purchase and operate facilities for tagging 25% of released Chinook salmon.	Increase level of hatchery funding to cover 100% of general operation and maintenance, purchase and operate facilities for tagging 100% of released Chinook and coho salmon. Marking all fish would reduce the need for restrictions on ocean fisheries to protect weak stocks. Refurbish and fund 100% of the operation of the Fall Creek rearing	Same as Staff Alternative.	Iron Gate Hatchery would either be dismantled or operated by others. Primary cold water supply, Iron Gate reservoir, would be eliminated. Fate of hatchery would be addressed in a decommissioning plan for the Iron Gate dam, in consultation with a fishery advisory committee that would include resource	Iron Gate Hatchery would either be dismantled or operated by others. Primary cold water supply, Iron Gate reservoir, would be eliminated. Fate of hatchery would be addressed in a decommissioning plan for the Iron Gate dam, in

<b>Resource</b>	<b>PacifiCorp's Proposal</b>	<b>Staff Alternative</b>	<b>Staff Alternative with Mandatory Conditions</b>	<b>Retirement of Copco No. 1 and Iron Gate Developments</b>	<b>Retirement of J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate Developments</b>
		<p>facility to enable shifting a greater portion of the released fish to yearlings rather than subyearlings, to reduce crowding effects with wild salmon.</p>		<p>agency representatives. However, our approach to this alternative would be to retain Iron Gate dam and the hatchery to enable production to continue until natural reproduction upstream of Iron Gate dam is established (a period of about 5 years from license issuance).</p>	<p>consultation with a fishery advisory committee that would include resource agency representatives. However, our approach to this alternative would be to retain Iron Gate dam and the hatchery to enable production to continue until natural reproduction upstream of Iron Gate dam is established.</p>
<b>Terrestrial Resources</b>	<p>Development of vegetation and wildlife management plans would provide for protection of sensitive plants, control of noxious weeds, consideration of plant of importance to Native Americans for revegetation projects, and implementation of measures to protect and enhance wildlife and associated habitat.</p>	<p>Similar to PacifiCorp's proposed measures</p>	<p>Similar to PacifiCorp's proposed measures.</p>	<p>Similar to PacifiCorp's proposed measures at remaining developments; exposed reservoir substrate would likely offer ideal conditions for re-establishment of vegetation. Eventually would reach equilibrium, but successional plant communities would likely diversify wildlife habitat; absence of fluctuating flows associated with peaking</p>	<p>Vegetation and wildlife management activities would be limited to the Fall Creek development; exposed reservoir substrate would likely offer ideal conditions for re-establishment of vegetation; eventually would</p>

Resource	PacifiCorp's Proposal	Staff Alternative	Staff Alternative with Mandatory Conditions	Retirement of Copco No. 1 and Iron Gate Developments	Retirement of J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate Developments
<b>Recreational Resources</b>	<p>Propose to implement substantial recreational enhancements in accordance with its Recreation Resources Management Plan. Major new and modifications to existing facilities would be constructed at J.C. Boyle and Iron Gate developments, and moderate facilities at Copco and Fall Creek developments. Programmatic elements of the plan would also be implemented, including provisions for plan updates, coordination with agencies regarding shared operation and maintenance responsibilities, monitoring, project patrol, and</p>	<p>Similar to PacifiCorp's proposal, although we would include Topsy Campground as a project facility for which PacifiCorp should have a share of the operation and maintenance costs</p>	<p>Similar to Staff Alternative, but would also include Spring Island Boater Access Site, Klamath Campground, dispersed day-use sites, and scouting trails at major rapids along the peaking reach among the facilities for which PacifiCorp was responsible. Provisions for peaking operations once a week during the recreation season would substantially reduce whitewater boating opportunities in the</p>	<p>would foster establishment of a more typical riparian vegetation community along the peaking reach.</p> <p>Generally the same as Staff Alternative for remaining developments. However, because peaking at J. C. Boyle would no longer be feasible, the nexus to project purposes of proposed river access sites along the peaking reach would no longer have a nexus to project purposes; we would replace this with a day-use area near Copco No. 2 dam, which would also serve as a boater take-out site. Existing recreational sites at Copco and Iron Gate developments would be either transferred</p>	<p>reach equilibrium, but successional plant communities would likely diversify wildlife habitat; absence of fluctuating flows associated with peaking would foster establishment of a more typical riparian vegetation community along the peaking reach.</p> <p>Nearly all existing recreational facilities would be either transferred to another entity or abandoned after appropriate decommissioning processes, with the exception of the proposed enhancements to the Fall Creek Trail. Proposed new recreational facilities at J.C. Boyle, Copco No. 1, and Iron Gate developments</p>

<b>Resource</b>	<b>PacifiCorp's Proposal</b>	<b>Staff Alternative</b>	<b>Staff Alternative with Mandatory Conditions</b>	<b>Retirement of Copco No. 1 and Iron Gate Developments</b>	<b>Retirement of J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate Developments</b>
	an interpretation and education program.		peaking reach compared to PacifiCorp's proposal and the Staff Alternative. Because of this, commercial outfitters may attempt to crowd trips into the limited window that would be created, and create public safety hazards. Eventually, some commercial outfitters could go out of business because of lack of access to this Wild and Scenic River segment. Such diminishment of boating opportunities could be inconsistent with the designated Outstanding Remarkable Value of whitewater boating.	to another entity or abandoned after appropriate decommissioning processes followed to secure the sites. Major new or enhanced facilities proposed at Iron Gate development would not be constructed. Some sites could serve as public access sites for the newly created riverine reaches. The length of the peaking reach would be increased by several miles, and additional riverine boating opportunities would be created at the Iron Gate reservoir site, potentially enhancing whitewater boating opportunities; however, boatable days compared to the proposed project, Staff Alternative, or Staff Alternative with Mandatory Conditions would be reduced.	would not be implemented. A continuous whitewater boating reach would be created from Keno dam to the mouth of the Klamath River, creating additional riverine boating opportunities; however boatable days would be comparable to the Retirement of Copco No. 1 and Iron Gate Developments, alternative
<b>Cultural Resources</b>	Implementation of its revised HPMP would provide reasonable monitoring, inspection, and protective measures for cultural resources within PacifiCorp's defined APE.	The APE for management of cultural resources under a new license would need to be determined on the basis of provisions of a new license. The HPMP would be revised to address	Similar to Staff Alternative, but may require expansion of the APE to accommodate mandated recreational enhancements.	Similar to Staff Alternative for developments that remain in the project. However, major site monitoring, inspection, and treatments were proposed for areas at Copco and Iron	Similar to Staff Alternative for development that remain in the project. However, major site monitoring,

<b>Resource</b>	<b>PacifiCorp's Proposal</b>	<b>Staff Alternative</b>	<b>Staff Alternative with Mandatory Conditions</b>	<b>Retirement of Copco No. 1 and Iron Gate Developments</b>	<b>Retirement of J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate Developments</b>
		management of cultural resources in the APE determined by the license.		Gate reservoirs. These sites would need to be addressed as part of a decommissioning plan that would include consultation with the CA SHPO and appropriate tribal and agency representatives.	inspection, and treatments were proposed for areas at J.C. Boyle, Copco, and Iron Gate reservoirs. These sites would need to be addressed as part of a decommissioning plan that would include consultation with the Oregon and CA SHPO and appropriate tribal and agency representatives