

## 5.0 STAFF'S CONCLUSIONS

### 5.1 SUMMARY COMPARISON OF APPLICANT'S PROPOSAL AND STAFF ALTERNATIVE

When the Commission considers license proposals, besides looking at power and other developmental purposes, such as irrigation and water supply, it must also give equal consideration to the purposes of energy conservation; the protection and enhancement of fish and wildlife habitat; the protection of recreational opportunities; and the preservation of other aspects of environmental quality. So far in this EIS, we have described the environmental effects and our estimated cost of proposed and alternative environmental measures. In this section, we examine the environmental effects and project costs and explain how we decided on the key environmental measures we include in a Staff Alternative.

#### 5.1.1 Description of Alternatives

##### 5.1.1.1 PacifiCorp's Proposal

PacifiCorp's proposal consists of a proposed operating regime and 41 environmental measures summarized previously in section 2.2, *PacifiCorp's Proposal*.

##### 5.1.1.2 Staff Alternative

After evaluating PacifiCorp's proposal and recommendations from resource agencies, tribes and other interested parties, we compiled a set of environmental measures that we consider appropriate for addressing the resource issues raised in this proceeding. We call this the Staff Alternative. The Staff Alternative includes some measures included in PacifiCorp's proposal as well as some of the section 18 and alternative section 18 fishway prescriptions, section 4(e) and alternative section 4(e) conditions, section 10(j) recommendations, section 10(a) recommendations, and measures developed by the staff.

In the Staff Alternative, we also include the following environmental measures proposed by PacifiCorp, based on our analyses included in sections 3 and 4. In some cases (*italicized*), we have deleted, modified, or supplemented PacifiCorp's proposed measures.

#### Water Resources

- 1P. Implement instream flow and ramping rate measures in project reaches to protect and/or enhance various flow-dependent resources, including water quality.
- 2P. Implement a low-level release of cooler hypolimnetic water from Iron Gate reservoir during summer to provide some cooling of the Klamath River downstream of the project. *PacifiCorp's proposed measure is modified to include development of a temperature management plan that would include: (1) a feasibility study to assess modifications of existing structures at Iron Gate dam to enable release of the maximum volume of cool, hypolimnetic water during emergency circumstances to be completed within 1 year of license issuance; (2) an assessment of methods to increase the DO of waters that may be released on an emergency basis to be completed within 1 year of license issuance; and (3) development of protocols that would be implemented to trigger the release of hypolimnetic water by using existing, unmodified structures at Iron Gate development or, if determined to be feasible, modified structures, when conditions for downstream salmonid survival approach critical levels to be completed within 2 years of license issuance.*
- 3P. Install a reservoir oxygenation diffuser system at the Iron Gate development as needed to prevent adverse downstream effects caused by seasonally low levels of DO in hypolimnetic generation flows. *PacifiCorp's proposed measure is modified to delay implementation of*

*reservoir oxygen diffuser until potential adverse effects are evaluated as part of 4 (below), but implement turbine venting at Iron Gate development, as described in Mobley (2005), and monitor and evaluate the response of the downstream DO and total dissolved gas regime.*

- 4P. Implement reservoir management plans for improving water quality in J.C. Boyle, Copco, and Iron Gate reservoirs that include evaluating the effectiveness and feasibility of hypolimnetic oxygenation, epilimnetic or surface aeration or circulation, and copper algacide treatment, for controlling water conditions.<sup>162</sup> *This proposed measure is modified to include development of a single, comprehensive water quality management plan for all project-affected waters within 1 year of license issuance, rather than three separate reservoir management plans, and expanded to include: (1) consideration of spillage of warm water at Iron Gate dam during late spring; (2) consideration of spillage at Copco No. 1, Copco No. 2, and Iron Gate dams during the summer to enhance DO downstream of Iron Gate development; (3) consideration of turbine venting at Copco No. 1 and No.2 powerhouses to increase DO in the epilimnion of Iron Gate reservoir and, potentially, downstream of Iron Gate development; (4) consideration of nutrient controls in project reservoirs including but not limited to using biological measures, aquatic vegetation, harvesting and treatment wetlands to limit algae blooms; (5) specification of water quality monitoring that would be used to evaluate the effectiveness of any implemented water quality management measures; (6) specification of long-term water quality monitoring programs (e.g., temperature and DO) that would enable adaptive management decisions to occur; (7) provisions for periodically updating the water quality management plan, and (8) provisions for annual consultation with the integrated fish passage and disease management work group as part of our recommended fish passage and disease management adaptive management approach (see measure 8S). Specific measures to enhance temperature and DO and reduce project-related nutrient loading, identified during development of this plan and any studies needed to assess whether specific techniques are feasible, would be implemented within 3 years of license issuance.*
- 5P. Consult and coordinate with appropriate agencies on the annual scheduled outages for project maintenance events where flows in project reaches are required to be outside the normal operations.

### **Aquatic Resources**

- 6P. Develop a decommissioning plan for the East Side and West Side facilities in consultation with NMFS, Interior, and Reclamation. *PacifiCorp's revised proposed measure is modified to include Oregon Fish & Wildlife and Oregon SHPO among the entities consulted during development of the decommissioning plan and to include provisions in the plan to ensure that PacifiCorp's actions to safely secure the developments and restore the landscape in proximity to both developments would not forestall the future installation of a smolt collection facility at this site.*
- 7P. Release a minimum flow of 100 cfs from J.C. Boyle dam at all times to enhance usable fish habitat while maintaining high water quality in the J.C. Boyle bypassed reach and install a gage to measure the flow.

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<sup>162</sup>Not included in PacifiCorp's license application, but proposed in PacifiCorp's water quality certification application, submitted by letter dated March 29, 2006, and confirmed in PacifiCorp's responses to terms and conditions, dated May 12, 2006.

- 8P. Release an additional minimum flow of 100 cfs at J.C. Boyle powerhouse or dam. *This proposed measure is modified to specify that the extra 100 cfs, or 200 cfs in total, would be released from J.C. Boyle dam.*
- 9P. Limit flow downramp rates to 150 cfs per hour in the J.C. Boyle bypassed reach, except for flow conditions beyond the project's control.
- 10P. Limit flow upramp rates to 9 inches (in water level) per hour in the J.C. Boyle peaking reach (the reach of the Klamath River from the J.C. Boyle powerhouse to Copco reservoir). Flow downramp rates would not exceed 9 inches per hour for flows exceeding 1,000 cfs, and would not exceed 4 inches per hour for flows less than 1,000 cfs. *PacifiCorp's proposed measure is modified to specify that, when peaking operation of the J.C. Boyle powerhouse commences in the spring, or after 7 or more days of non-peaking operation (as defined by the consistent operation of only 0, 1, or 2 units), downramping would be limited to a maximum rate of 2 inches per hour in the first 24 hours, 4 inches per hour in the second 24 hours, 6 inches per hour in the third 24 hours, and 9 inches per hour thereafter. During the periods when 6 or 9 inch downramping rates are in effect, downramping would also be limited to 4 inches per hour whenever flows are 1,000 cfs or less.*
- 11P. Install synchronized bypass valves on each of the two J.C. Boyle powerhouse units to ensure ramping rates could be met if a unit trips off-line and to reduce frequency of usage of canal emergency spillway.
- 12P. Install a surface collection system (gulper) for the J.C. Boyle reservoir to exclude fish from the power intake and to facilitate downstream fish passage. *PacifiCorp's proposed measure is not recommended, and is replaced by #8S.*
- 13P. Make minor improvements (i.e., increasing the existing bar spacing on the exit pool trashrack and adding an additional weir) to the J.C. Boyle fish ladder to facilitate the passage of adult fish.
- 14P. Eliminate the gravity-fed water diversions from Shovel Creek and its tributary, Negro Creek (located adjacent to the Klamath River in the California segment of the J.C. Boyle peaking reach), to prevent trout fry from being entrained and lost in the various ditches on PacifiCorp's Copco Ranch (a non-hydro related property).
- 15P. Place approximately 100 to 200 cubic yards of spawning gravel in the upper end of the J.C. Boyle bypassed reach on an as-needed basis. *This measure is not recommended, and is replaced by #1S.*
- 16P. Maintain a minimum flow of 10 cfs in the Copco No. 2 bypassed reach and make improvements to the gate and flow conduit to the bypassed reach. *This measure is not recommended, and is replaced by #7S.*
- 17P. Limit flow downramp rates to 125 cfs per hour (equivalent to less than 2 inches per hour in most of the expected flow ranges) in the Copco No. 2 bypassed reach, except for flow conditions beyond the project's control.
- 18P. Release a minimum flow of 5 cfs into the Fall Creek bypassed reach, and release a minimum flow of 15 cfs downstream of the bypass confluence.
- 19P. Divert no flow from Spring Creek during July and August and release 1 cfs, or inflow, downstream of the Spring Creek diversion dam for the remainder of the year; install a Parshall flume to measure the minimum flow. *PacifiCorp's proposed measure is modified so that the period during which no flow would be diverted would extend from June 1 to September 15 and a minimum flow of 4 cfs, or inflow, would be provided for the remainder of the year.*

- 20P. Install canal screens and fish ladders for both the Fall Creek and Spring Creek diversions.
- 21P. Maintain the instream flow schedule and ramp rates downstream of Iron Gate dam according to Reclamation's Klamath Project Operations Plans consistent with BiOps issued by FWS and NMFS. *PacifiCorp's proposed measure is modified as follows: If inflow to the project drops below the specified minimum release from the Iron Gate development, PacifiCorp would operate Iron Gate development in a run-of-river mode, defined as the 3-day running average of inflow to the Klamath Hydroelectric Project. In the event that project facilities are not included in any future Klamath Project Operations Plans (e.g., if coho salmon should be delisted), PacifiCorp would develop an Iron Gate flow release plan within 6 months of issuance of such a plan. Flows specified in the Operations Plans at the time of new plan issuance would remain in effect until the Commission approves the new flow release plan. Any such flow schedule and ramp rate would be developed in coordination with Reclamation and be consistent with Klamath Irrigation Project operations. PacifiCorp would also develop the plan in consultation with Cal Fish & Game, Oregon Fish & Wildlife, NMFS, FWS, and the tribes.*
- 22P. Place approximately 1,800 to 3,500 cubic yards of spawning gravel downstream of Iron Gate dam between the dam and the Shasta River confluence on an as-needed basis. *This measure is not recommended, and is replaced by #1S.*
- 23P. Maintain current obligation of funding for production and operation of Iron Gate Hatchery. *This measure is modified to increase PacifiCorp's obligation from 80 to 100 percent of the cost of operation of the Iron Gate Hatchery.*
- 24P. Purchase, construct, and operate a mass-marking facility for use at the Iron Gate Hatchery that provides for marking 25 percent of all Chinook salmon released. *PacifiCorp's proposed measure is modified to provide for marking 100 percent of Chinook and coho salmon released from the Iron Gate Hatchery and implementation of a hatchery and genetics management plan.*

### **Terrestrial Resources**

- 25P. Implement a vegetation resource management plan to include the following environmental measures: (1) project facility (including roads and transmission line right-of-way) vegetation management activities; (2) noxious weed control; (3) restoration of project-disturbed sites; (4) protection of threatened, endangered, and sensitive plant populations; (5) riparian habitat restoration; and (6) long term monitoring. *PacifiCorp's proposed measure for a vegetation management plan is expanded to include consultation with affected tribes regarding opportunities for re-establishment of plants of tribal significance in project-affected areas, and include in the upland vegetation management program measures to reduce fire fuels, such as controlled fires, to reduce the risk of wildfires and enhance wildlife habitat.*
- 26P. Implement a wildlife resource management plan to include the following environmental measures: (1) installation of wildlife crossing structures on the J.C. Boyle canal; (2) deer winter range management; (3) monitoring powerlines and retrofitting poles to decrease electrocution risk to raptors; (4) development of amphibian breeding habitat along Iron Gate reservoir; (5) support of aerial bald eagle surveys and protection of bald eagle and osprey habitat; (6) selective road closures; (7) installation of turtle basking structures; (8) installation of bat roosting structures; (9) surveys for threatened, endangered, and sensitive wildlife species in areas to be affected by new recreation development; and (10) long-term monitoring of environmental measures. *This measure is modified to address deer winter*

*range management in the vegetation management plan, rather than the wildlife resource management plan, because it would entail primarily vegetation management measures.*

## **Recreational Resources**

- 27P. Work with the Bureau of Land Management and others to resolve current effects of recreational use on sensitive resources and provide increased resource protection and visitor management controls throughout the proposed project area.
- 28P. Increase the supply of camping and day use facilities to help meet current and future demand, principally at Iron Gate reservoir, by adding approximately 85 new campsites and 30-day use picnic sites by 2040, or when needed, based on the results of monitoring. *The schedule for construction of a potable water supply and restroom facilities at the proposed J.C. Boyle Bluffs campground and day-use area is modified to correspond with the initial construction phase at this site (rather than 20 years after license issuance). The site design for J.C. Boyle Bluffs is modified to include a host site with full RV hookups, including a pressurized water system to be included in the initial site development phase. Although PacifiCorp's site design does not specify providing a pressurized water system, this level of development is consistent with providing RV sites, as PacifiCorp ultimately proposes. This proposed measure is also modified to include fencing at the city of Yreka's domestic water supply diversion at Fall Creek to protect public safety.*
- 29P. Provide increased management presence at developed and undeveloped recreation sites. *This proposed measure is modified to exclude provisions for funding law enforcement agencies to patrol the project area as a condition of a new license.*
- 30P. Address Americans with Disabilities Act (ADA) compliance at all existing and new recreational facilities, including providing ADA-accessible fishing access sites.
- 31P. Provide improved maintenance and repair or replace site-specific facilities at existing developed recreation sites, including boat launches, picnic sites, and campsites. Facility replacement would be addressed, as needed, in the final Recreation Resources Management Plan.
- 32P. Finalize the draft Recreational Resource Management Plan (dated September 2004) in consultation with the Bureau of Land Management, the Forest Service, National Park Service, Oregon Parks and Rec, Cal Fish & Game, Siskiyou County Sheriff's Office, Klamath County Sheriff's Office, Oregon Fish & Wildlife, and the tribes. The plan would include a multi-resource interpretation and education program with new signs, kiosks, brochures, and/or services. *This proposed measure is modified to expand the flow-related information available to the public on PacifiCorp's website and addressed in the Whitewater Boating and River-based Fishing Program component of PacifiCorp's Recreation Resources Management Plan to include real-time and projected flow information, generation times, and scheduled outages at all telemetry-gaged project-reaches and provisions for prompt posting of any changes to scheduled flow releases on the website.*
- 33P. Provide new and/or enhanced multi-use, non-motorized trail opportunities. *PacifiCorp's proposed measure is modified to ensure acquisition of appropriate easements for the final alignment of the proposed J.C. Boyle loop trail that avoids environmentally sensitive areas and includes the final alignment in the project boundary. The proposed trail from the J.C. Boyle powerhouse to the Spring Island boater access site is excluded because it would not serve project purposes.*
- 34P. Provide designated wildlife viewing areas, such as watchable wildlife stations.

- 35P. Maintain current undeveloped open space lands on PacifiCorp-owned property for activities such as wildlife viewing, sightseeing, nature appreciation, photography, and other recreational activities that rely on adequate natural open space.
- 36P. Work with the Bureau of Land Management and Oregon Parks and Recreation Department to implement portions of the Upper Klamath River Management Plan, when adopted, from Stateline Take-out on the Klamath River to Fishing Access Site No. 1 on Copco reservoir. *This proposed measure is modified to expand the proposed project boundary at the State-line Takeout Area to include the access road from Ager-Beswick Road to the existing site on PacifiCorp land and provisions to repair an adjacent leaking irrigation canal that adversely affects this road, as appropriate.*
- 37P. Provide whitewater boating and fishing opportunities in the upper Klamath River/Hell's Corner reach by conducting daily peaking operations at J.C. Boyle powerhouse and providing boating and fishing access above the powerhouse and downstream of the Oregon-California state line.

### **Land Use and Aesthetic Resources**

- 38P. Reduce visibility and contrast of powerhouse facilities through vegetative screening or painting at J.C. Boyle and Iron Gate developments. *PacifiCorp's proposed measure is modified to include vegetative screening measures for the Fall Creek and Copco No. 2 powerhouses and the Copco No. 2 substation in the visual resources management plan component of the final Recreation Resources Management Plan.*
- 39P. Finalize and implement the Study Area Roadway Inventory Analysis and Project Roadway management Plan.

### **Cultural Resources**

- 40P. Complete the project's HPMP providing direction and guidelines for the management of historic properties within the new project boundary as proposed by PacifiCorp. *This measure is modified to specify revision and finalization of the project's HPMP within the geographic area of historic property management for the project, as determined by Commission staff and reflected in a new license.*
- 41P. Through the final HPMP, implement measures to protect historic buildings and structures, archaeological sites, and traditional cultural properties.

In addition, the Staff Alternative also includes the following additional measures identified by staff based on agency, tribal, and non-governmental organization recommendations and our analysis.

### **Geology and Soils**

- 1S. Develop and implement a sediment resource management plan that includes mapping and evaluating gravel and other sediment distribution in the J.C. Boyle bypassed reach and in the Klamath River from Iron Gate dam to the confluence of the Shasta River, determining specific amounts and locations for sediment augmentation based on the mapping; monitoring gravel and spawning use after placement; and supplementing sediment placement based on monitoring results.
- 2S. Develop and implement a plan to restore slope failures and the affected channel, including the slope below the emergency spillway and removal of sidecast material, along the J. C. Boyle bypassed reach. Retain the right bank slope that is within the existing project boundary in the project boundary of a new license to ensure Commission oversight of

restoration and protection measures and to ensure continued stability of the intake canal and project access road.

- 3S. Develop protocols for contacting agencies that would be followed in the event of a water conveyance system failure. In addition, promptly notify resource agencies in the event of all unanticipated or emergency project-related situations that may result in harm to fish or wildlife to obtain guidance on appropriate remedial measures that should be implemented. Develop thresholds of harm that would trigger such notification, in consultation with the resource agencies, and provide the thresholds to the Commission as well as reports following each event that triggers agency notification, indicating the nature of the event, the actions taken in response to the event, and any follow-up monitoring to ensure that the response is effective.
- 4S. If a proposed project-related activity entails ground-disturbing activities, develop a site specific erosion and sedimentation control plan to address erosion and dust control and measures that would be taken to restore such areas following the activity. If the activity would generate spoils, include in the plan measures to (1) characterize the spoils; (2) identify where the spoil would be disposed in an environmentally responsible manner; and (3) restore, stabilize, and monitor the spoil disposal site following its use. As appropriate, include this plan in the broader plan for this activity (e.g., the final plan for development of a specific recreational site, or in annual road maintenance plans developed pursuant to a road management plan).

### **Water Quantity and Quality**

- 5S. Develop and implement a project operation management plan that includes provisions for installing gages to appropriately monitor the flow regime specified in a new license, coordinating operation of the Klamath Hydroelectric Project with the Klamath Irrigation Project, reporting project-related flows to appropriate entities, minimizing water level fluctuations at Iron Gate reservoir from March through July to protect breeding wildlife, establishing an appropriate range of water level elevations that would enable implementation of concurrent measures to enhance aquatic habitat, and periodically updating the plan.
- 6S. Develop and implement a monitoring plan for *Microcystis aeruginosa* and its toxin in project reservoirs and immediately downstream of Iron Gate dam. The plan would include protocols for providing Oregon Environmental Quality, the Water Board, and other appropriate public health agencies with monitoring results for their review and appropriate action. Such protocols would include potential locations for posting any public health warnings at project-related public access sites, and procedures for cooperation in providing agency access to those sites for posting any health advisories that may be issued. The plan would include provisions for extending the monitoring program to locations further downstream, pending completion and evaluation of the first 4 years of *Microcystis* and microcystin monitoring that would be implemented under the fish passage and disease management program (measure 8S).

### **Aquatic Resources**

- 7S. Release 70 cfs or inflow, whichever is less, to the Copco No. 2 bypassed reach.
- 8S. Develop and implement the integrated fish passage and disease management program as described in section 3.3.3.2.5, *Anadromous Fish Restoration*. The program would include the following components:

Year 1: (1) develop a Phase I implementation plan to initiate the restoration of anadromous fish passage to habitat upstream of Copco No. 1 and J.C. Boyle dams and conduct studies to address the feasibility of volitional passage through Copco and Iron Gate reservoirs; (2) design a downstream fish passage and collection facility at J.C. Boyle dam; (3) modify adult collection facilities at Iron Gate dam to facilitate fish handling for trap and haul operations; (4) initiate monitoring of key water quality parameters to determine the extent of downstream project effects on water quality and to evaluate the relationship between water quality and fish disease; and (5) initiate field and laboratory studies to evaluate approaches for reducing the prevalence of disease pathogens downstream of Iron Gate dam.

Year 2: (1) initiate trap and haul of adult anadromous fish above Copco No. 1 and J.C. Boyle dams; (2) initiate adult telemetry studies to determine effectiveness of the J.C. Boyle ladder and trap and haul survival rates; and (3) construct the downstream fish passage and collection facility at J.C. Boyle dam using design developed in year 1.

Year 3: (1) conduct radio telemetry studies to evaluate reservoir passage and spillway survival and the effects of different spill levels on spill passage rates, using Chinook salmon and steelhead smolts collected at the J.C. Boyle downstream passage and fish collection facility and at screw traps deployed at the head of Copco reservoir; (2) monitor the effects of spill at Copco No. 1 and Iron Gate dams on water quality conditions and disease incidence downstream of Iron Gate dam; and (3) conduct radio telemetry and mark-recapture studies to determine the transport and migration survival of smolts transported to and released at one or more locations downstream of Iron Gate dam to compare survival rates associated with different transport distances and release locations to the existing FWS smolt monitoring site at Big Bar.

Year 4: (1) Monitor the effects of a pulse flow, created by drawing down Copco No. 1 and Iron Gate reservoirs as rapidly as feasible to minimum operating pool, on attached algae, pathogen density, and disease incidence downstream of Iron Gate dam; and (2) evaluate the effects of holding Iron Gate and Copco reservoirs at minimum operating pool on passage conditions and downstream water quality and disease incidence.

Year 5: Develop a Phase II implementation plan that: (1) evaluates alternative approaches for providing upstream and downstream fish passage at each project dam; (2) evaluates the potential effects of each alternative approach on water quality conditions and disease incidence downstream of Iron Gate dam; and (3) describes a proposed schedule and approach for implementing fish passage and disease management measures, study efforts and monitoring to be continued into the future, and provisions for adaptive management based on study and monitoring results. Development of the Phase II implementation plan could be deferred for up to two years if additional studies are determined to be necessary.

During Phase I, PacifiCorp would be required to file for Commission approval annual Phase I implementation plans and reports that describe: (1) measures implemented, monitoring, and studies conducted in the past year; and (2) measures, monitoring, and studies for implementation in the coming year.

The Phase I and Phase II implementation plans would be developed in consultation with the fisheries management agencies, tribes, and a representative to be selected by the NGOs. The consulted parties would be provided at least 30 days to comment on a draft of each plan, and the plans filed with the Commission would include copies of comments received and describe how the comments were addressed. PacifiCorp would be responsible for implementing the plans following Commission approval.

- 9S. Develop a fish passage resource management plan in consultation with resource agencies that includes designs for any fishways included in a new license, provisions for developing fishway operation and maintenance plans, provisions for evaluating and monitoring fish passage at the fishways, and provisions for modifying the fishways in response to evaluation and monitoring.
- 10S. Allow state and federal resource agency personnel access to project developments to inspect fishways and records to monitor compliance with license conditions.
- 11S. Rehabilitate the Fall Creek rearing facility, and fund 100 percent of the operation and maintenance costs to resume the production of yearling fall Chinook salmon, as previously funded by Cal Fish & Game.
- 12S. Sponsor a fishery technical advisory committee that would provide input to guide project-related fish passage, hatchery, and anadromous fish restoration activities.
- 13S. Develop and implement an aquatic resources monitoring and management plan that includes specific resource goals and provisions for recommending project operations and facility modifications in response to monitoring results. Fish populations in project-affected reaches, including reservoirs, would be monitored every third year for the first 9 years, after which the frequency of monitoring in subsequent years would be re-evaluated.

### **Terrestrial and Threatened and Endangered Resources**

- 14S. Within 2 years of license issuance develop a bald eagle management plan for the project in consultation with FWS, the Bureau of Land Management, Cal Fish & Game, and Oregon Fish & Wildlife that includes provisions for (1) conducting annual aerial bald eagle surveys to document new nests and productivity of territories, (2) monitoring and protecting bald eagle nest sites, roost sites, and regular foraging areas from human disturbance within the project boundary, including seasonal restrictions for active nest sites, and (3) evaluating changes in prey base relationships. The bald eagle management plan should be prepared in coordination with the wildlife habitat management plan, which includes provisions for monitoring transmission lines and retrofitting poles on lines where birds have died to improve avian protection.

### **Recreational Resources**

- 15S. Include provisions for retaining the existing day-use area at Pioneer Park East (adjacent to the Highway 66 bridge across J.C. Boyle reservoir) in the final Recreation Resources Management Plan.
- 16S. Acquire necessary easements to include the access road to the upper J.C. Boyle reservoir boating access site in the project boundary.
- 17S. Retain Topsy Campground in the project boundary, develop a potable water system for this facility, address this facility in the Operations and Maintenance Program of PacifiCorp's Recreation Resources Management Plan, and develop a Memorandum of Agreement with the Bureau of Land Management that defines PacifiCorp's and the Bureau's responsibilities at this site.
- 18S. Develop an off-highway vehicle management plan as a component of the final Recreation Resources Management Plan.
- 19S. Conduct a feasibility study for enhancing communications between the J.C. Boyle powerhouse and the Stateline Take-out and, if feasible, develop a plan and cooperative

agreement with appropriate entities to implement reasonable measures that may be identified in the feasibility study.

### **Land Use and Aesthetic Resources**

- 20S. Consult with the Bureau of Land Management, Oregon Fish & Wildlife, and Cal Fish & Game in the finalization of the Recreation Resources Management Plan and Road Management Plan, as appropriate.
- 21S. Include the portion of Topsy Grade Road from Highway 66 to the intersection of the road that provides access to J.C. Boyle dam (designated 300000116 on PacifiCorp's road inventory map) in the project boundary because this road provides, or would provide, access for the public and PacifiCorp staff to Topsy Campground, the proposed Boyle Bluffs Campground and day-use area, proposed recreational areas along the J.C. Boyle bypassed reach, and all J.C. Boyle development features.

### **Cultural Resources**

- 22S. Consult with state and appropriate federal land management agencies in addition to the local law enforcement agencies, Oregon SHPO, California SHPO, and tribes specified in the revised HPMP in the finalization of the plan and subsequent plans.
- 23S. Conduct archaeological identification surveys in Bureau of Land Management units I through P on the J.C. Boyle peaking reach within the limits of project capacity, and in Units A through H in the J.C. Boyle bypassed reach at Big Bend and treat any sites determined eligible or potentially eligible for the National Register in accordance with the provisions of the HPMP.
- 24S. Include the Oregon State Commission on Indian Services in notifications of discoveries of human remains in Oregon.
- 25S. Develop a plan for providing tribes with access to areas within the project boundary where plants of traditional cultural importance occur, and permit use of such plants for traditional practices.

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

NMFS and Interior have made modified fishway prescriptions for the project (described in section 2.3.1.2, *Section 18 Fishway Prescriptions*) which, when finalized, the Commission may need to include in a new license for this project. Similarly, the Bureau of Land Management and Reclamation have specified preliminary 4(e) conditions (described in section 2.3.1.4, *Section 4(e) Federal Land Management Conditions*) which, when finalized, may also 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. When the Staff Alternative entails removing a development from the project, we do not include any mandatory conditions associated with that development in this alternative. PacifiCorp's proposed measures that we either accepted or modified for inclusion in the Staff Alternative that would be adjusted by mandatory conditions would include the following (see section 5.1.1.2 for the numerical designation and description of PacifiCorp's measures that would be adjusted):

- Measures 7P and 8P would be replaced by Bureau of Land Management's condition 4A1(a)(b), which pertains to the minimum flow in the J.C. Boyle bypassed reach.
- Measure 9P would be replaced by Bureau of Land Management's condition 4A2, which pertains to ramping rates in the J.C. Boyle bypassed reach.

- Measure 10P would be replaced by Bureau of Land Management’s condition 4B2, which pertains to ramping rates in the J.C. Boyle peaking reach. In addition, J.C. Boyle powerhouse would only be able to operate in a peaking mode once per week, in accordance with conditions 4B.1.
- Measures 12P and 13P would be replaced by NMFS and Interior’s fishway prescription for J.C. Boyle development.
- Measure 32P would be modified to include provisions for operating, maintaining, and monitoring the Spring Island Boaters access, Klamath River Campground, scouting trails at major rapids, and dispersed day-use sites on Bureau of Land Management administered lands in the final RRMP, in accordance with condition 6A.
- Our modification to measure 33P to exclude from the project the proposed trail from the old foundations day-use area to the Spring Island boater access site would be eliminated (i.e., this trail would be included in the project boundary and PacifiCorp ultimately would be responsible for maintenance of this trail).

Additional measures identified by staff based on our analysis that would be replaced by mandatory conditions include the following (see section 5.1.1.2 for the numerical designation and description of staff’s additional measures):

- Measure 8S would be replaced by NMFS and Interior’s fishway prescriptions.

#### **5.1.1.4 Retirement of Copco No. 1 and Iron Gate Developments with Staff Measures**

We analyze a dam removal and development retirement alternative consisting of removal of Iron Gate and Copco No. 1 dams from the project. This alternative would 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. Copco No. 1 dam would be removed within about 3 years of license issuance, following a year of studies designed to fine tune engineering approaches to dam removal beyond those which have already been completed (e.g., GEC, 2006), a year for development and Commission approval of a Copco No. 1 development decommissioning plan, and up to a year of actual deconstruction. During the year following removal of Copco No. 1 dam, any additional supplemental studies determined to be needed at Iron Gate reservoir would occur along with development and Commission approval of an Iron Gate decommissioning plan, which would be followed by deconstruction of the dam. We expect Iron Gate deconstruction to begin about 5 years from license issuance, which would enable anadromous fish reintroduced upstream of Iron Gate dam to become established to the point salmonid production at Iron Gate Hatchery would have less adverse effect on the number of anadromous fish available for harvest.

If removal of these two dams should be incorporated into a new license for this project, it would cause us to modify or eliminate some of the environmental measures that we include in the Staff Alternative. PacifiCorp’s proposed measures that we either accept or modify for inclusion in the Staff Alternative that would be adjusted under a two dam removal scenario would include the following (see section 5.1.1.2 for the numerical designation and description of PacifiCorp’s measures that would be adjusted):

- Measure 2P would be eliminated.
- Measure 3P would be eliminated.
- Measure 4P would be modified to reflect primarily a water quality monitoring plan that would serve as a basis to verify the environmental response to the altered conditions,

including during and after removal of each project dam, and serve as a basis for potential remedial actions.

- Measure 10P would be eliminated, as operations at J.C. Boyle development would be determined by operational measures at Copco No. 2 development, as specified in Measure 21P, below (peaking at J.C. Boyle would no longer be possible).
- Measure 15P would be replaced with aspects of staff measure 1S that pertain to sediment augmentation at the J.C. Boyle bypassed reach.
- Measure 21P would be modified to provide for flows released from Copco No. 2 development that are consistent with Reclamation's Klamath Operations Plans and the BiOps issued by FWS and NMFS for the Klamath Irrigation Project. In the event that project facilities are not included in any future Klamath Project Operations Plans (e.g., if coho salmon should be delisted), PacifiCorp would develop a Copco No. 2 flow release plan within 6 months of issuance of such a plan. Flows specified in the Operations Plans at the time of new plan issuance would remain in effect until the Commission approves the new flow release plan. Any such flow schedule and ramp rate would be developed in coordination with Reclamation and be consistent with Klamath Irrigation Project operations. PacifiCorp would also develop the plan in consultation with Cal Fish & Game, Oregon Fish & Wildlife, NMFS, FWS, and the tribes.
- Measure 22P would be eliminated.
- Measure 23P would be modified to provide 100 percent of the cost of operation of the Iron Gate Hatchery until Iron Gate dam is removed; after which the disposition of the hatchery (i.e., decommissioning or operation by another entity) would be determined.
- Measure 24P would be eliminated.
- Measure 26P would be modified to eliminate proposed wildlife enhancement measures at Copco and Iron Gate reservoirs.
- Measure 28P would be modified to eliminate proposed recreational facility enhancements at Copco and Iron Gate developments.
- Measure 31P would be modified to eliminate proposed improved maintenance provisions at recreational facilities at Copco and Iron Gate developments.
- Measure 32P would be modified to eliminate aspects of the interpretation and education program that pertain to Copco and Iron Gate developments.
- Measure 36P would be modified to eliminate PacifiCorp's responsibility for river access points from Stateline Take-out to Fishing Access Site No. 1 under a new license for this project, to be replaced by a Copco No. 2 day-use area near Copco No. 2 dam that would also serve as a take-out point for boaters putting in near J.C. Boyle powerhouse. The site would include picnicking facilities, car-top boat access, rest room, potable water, and parking. Enhanced security measures (fencing) would be needed to protect the dam from unauthorized public access.
- Measure 37P would be eliminated, as peaking would no longer provide whitewater or angling opportunities that would not exist without the project.
- Measure 38P would be modified to eliminate aspects of proposed vegetative screening or painting at Iron Gate development.

- Measure 41P would be modified to replace proposed measures to protect historic buildings and structures, archaeological sites, and traditional cultural properties associated with Copco and Iron Gate developments, with measures that would be established during consultation with California SHPO and tribes in a decommissioning plan for both developments.

Additional measures identified by staff based on our analysis that would be eliminated, replaced, or modified under the two dam removal scenario would include the following (see section 5.1.1.2 for the numerical designation and description of staff's additional measures):

- Measure 1S would be modified to include only aspects of sediment augmentation that pertain to the J.C. Boyle bypassed reach.
- Measure 6S would be eliminated.
- Measures 8S would be replaced with the fishway described in NMFS and Interior's prescription for the Copco No. 2 dam fish ladder, intake screening with fish bypass system, and spillway modifications at Copco No. 2 dam and the natural bedrock sill removal at the Copco No. 2 bypassed reach. Construction of a facility to provide downstream passage of anadromous fish at J.C. Boyle dam, in accordance with the fishway described in NMFS and Interior's prescription for intake screening and fish bypass system, would also be implemented. Anadromous fish collected at the existing fish ladders at Iron Gate Hatchery and the base of Iron Gate dam that are not needed for hatchery brood stock would be transported via truck to the upper end of Copco reservoir beginning during the first year from license issuance to begin establishing naturally reproducing salmonid populations. Once Copco No. 1 dam is removed and upstream and downstream fishways constructed at Copco No. 2 dam, all fish collected in excess of brood stock would be transported by truck to Iron Gate reservoir, instead of the upper portion of Copco reservoir, until the beginning of deconstruction of Iron Gate dam.
- Measure 11S would be eliminated.
- Measure 12S would be modified to have the fishery technical advisory committee address the disposition of the Iron Gate Hatchery once it is removed from the project.
- Measure 13S would be eliminated.
- Measure 19S would be eliminated, because peaking would no longer serve as a project-related enhancement of riverine whitewater boating.

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

In this EIS, we have analyzed an additional dam removal and development retirement alternative consisting of removal of J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate dams from the project. This alternative would address water quality issues that originate in the reservoirs associated with Copco and Iron Gate developments, facilitate restoration of anadromous fish to habitat upstream of Iron Gate dam, and enhance habitat connectivity for resident fish, but would retain a minimal amount of the generation capability of the project. J.C. Boyle, Copco No. 1, and Copco No. 2 dams would be removed within about 3 years of license issuance, following a year of studies to fine tune engineering approaches to dam removal beyond those which have already been completed (e.g., GEC, 2006); a year for development and Commission approval of J.C. Boyle, Copco No. 1 and Copco No. 2 development decommissioning plans; and about a year of actual deconstruction. During the year following removal of J.C. Boyle, Copco No. 1, and Copco No. 2 dams, supplemental sediment characterization in Iron Gate reservoir would occur along with development and Commission approval of an Iron Gate development decommissioning plan, which would be followed by deconstruction of Iron Gate dam. We expect Iron

Gate deconstruction to begin about 5 years from license issuance, which would enable anadromous fish reintroduced upstream of Iron Gate dam to become established to the point where eliminating salmonid production at Iron Gate Hatchery would have less adverse effect on the number of anadromous fish available for harvest. The Fall Creek development would be the only generation facility that would remain in the project.

If removal of these four dams should be incorporated into a new license for this project, it would cause us to modify or eliminate most of the environmental measures that we include in the Staff Alternative. PacifiCorp's proposed measures that we either accept or modify for inclusion in the Staff Alternative that would be adjusted under a four-dam removal scenario would include the following (see section 5.1.1.2 for the numerical designation and the full description of PacifiCorp's measures that would be adjusted):

- Measures 1P through 5P would be eliminated.
- Measures 7P through 17P would be eliminated.
- Measures 21P and 22P would be eliminated.
- Measure 23P would be modified to provide 100 percent of the cost of operation of the Iron Gate Hatchery until Iron Gate dam is removed; after which the disposition of the hatchery (i.e., decommissioning or operation by another entity) would be determined.
- Measure 24P would be eliminated.
- Measure 26P would be modified to eliminate proposed wildlife enhancement measures at the J.C. Boyle canal and Copco and Iron Gate reservoirs.
- Measures 27P and 28P would be eliminated.
- Measure 32P would be modified to only address recreation resources at the Fall Creek development at a scale commensurate with the size of the development (2.2 MW).
- Measure 33P would be modified to pertain only to the proposed Fall Creek Trail.
- Measures 34P through 37P would be eliminated.
- Measure 38P would be modified to only address measures to reduce visibility and contrast of project features at the Fall Creek development by use of vegetative screening.
- Measure 39P would be modified to only include roads necessary for the operation and maintenance of the Fall Creek development in the roadway management plan.

Additional measures identified by staff based on our analysis that would be eliminated, replaced, or modified under the four-dam removal scenario would include the following (see section 5.1.1.2 for the numerical designation and description of staff's additional measures):

- Measure 1S would be eliminated.
- Measure 2S would be incorporated into the decommissioning plan for J.C. Boyle development, rather than a stand-alone slope and channel restoration plan.
- Measure 5S would be modified to only include provisions for installing gages to appropriately monitor flows at Fall and Spring creeks specified in a new license. Coordination with the Klamath Irrigation Project would no longer be necessary, thus Reclamation would not need to be consulted during the development of the project operation management plan.
- Measures 6S and 7S would be eliminated.

- Measures 8S would be replaced with provisions to trap and haul anadromous fish from downstream of Iron Gate dam to appropriate locations upstream of this dam up to the time when Iron Gate dam is removed. Anadromous fish collected at the existing fish ladders at Iron Gate Hatchery and the base of Iron Gate dam that are not needed for hatchery brood stock would be transported via truck to the upper end of Copco reservoir beginning during the first year from license issuance to begin establishing naturally reproducing salmonid populations. Once Copco No. 1 and Copco No. 2 dams are removed, all fish collected in excess of brood stock would be transported by truck to Iron Gate reservoir, instead of the upper portion of Copco reservoir, until the beginning of deconstruction of Iron Gate dam.
- Measures 10S through 13S would be eliminated.
- Measures 15S through 20S would be eliminated.
- Measure 21S would be eliminated.
- Measure 23S would be eliminated.

### **5.1.2 Summary of Effects**

We summarize distinguishable differences between PacifiCorp's Proposal, the Staff Alternative, the Staff Alternative with mandatory conditions, the two-dam removal scenario, and the four-dam removal scenario in table 5-1. PacifiCorp's proposed operation is similar to current operations. Therefore, unless otherwise noted, the ongoing effects of project operations under PacifiCorp's Proposal are similar to current conditions.

Table 5-1. 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 placement in both the J.C.	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 likely fill and require	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 spawning gravel

<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>
Slope stabilization	Installation of bypass valve at J.C. Boyle powerhouse would reduce use of emergency spillway, the source of a major slope failure.	Boyle bypassed reach and downstream of Iron Gate dam to the Shasta River would be based on habitat mapping, monitoring, and identified habitat needs.	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 the J.C. Boyle bypassed	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). Similar to Staff Alternative, provisions for stabilizing exposed banks following dam removal would be addressed in development decommissioning plan.	distribution, channel complexity, and riparian habitat.  Slope stabilization along the J.C. Boyle bypassed reach would be addressed in a decommissioning plan; provisions for stabilizing exposed banks following

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>Water Quality</b>	<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. <i>Microcystis</i> monitoring</p>	<p>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>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 downstream of Iron Gate</p>	<p>dam removal would be addressed in the decommissioning plans for each development.</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. Temperature in the</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>
		would enable public notification of potential health risks from contact recreation at project reservoirs. Other effects similar to PacifiCorp's, except we provide specific time lines for studies and consultation to occur, and for implementation of feasible measures based on the study results (generally within 3 years or less). See fish disease management, below.		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).	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.
<b>Aquatic Resources</b>					
Instream flows	Additional 100 cfs released from J.C. Boyle dam would enhance physical habitat and retain important thermal	Similar to PacifiCorp's proposal, although increased minimum flow in Copco No. 2 bypassed reach	Release of at least 470 cfs to the bypassed reach would diminish the size of the thermal	Limiting releases from the Copco No. 2 development, as needed to be consistent with flows and ramping	Similar to the Retirement of Copco No. 1 and Iron Gate

<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>
	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.	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 Jenny Creek.	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.	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.	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 tributaries. All

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 passage before additional	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 to minimize fish	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 about 355 miles of habitat	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 inundated by J.C.

<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>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>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>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>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 Copco No. 1 and</p>
Fish disease management	Reservoir management plan development could result in implementation of measures	Implementation of a disease monitoring and management plan as part of	Similar to Staff Alternative.	Removal of the two dams would enhance downstream water quality and reduce	

<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>
	that would reduce nutrient load in project reservoirs, which could reduce downstream occurrence of algal populations that form habitat for fish pathogen host.	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.		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.	Iron Gate Developments alternative.
Iron Gate Hatchery operations	Same level of funding (80 percent) for general operation and maintenance; unspecified minor improvements would be made to the hatchery; would purchase and operate facilities for tagging 25 percent of released Chinook salmon.	Increase level of hatchery funding to cover 100percent of general operation and maintenance, purchase and operate facilities for tagging 100 percent 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 percent 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 agency representatives.	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

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
		<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>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>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 would foster establishment</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 reach equilibrium,</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. 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 an interpretation and education program.</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 peaking reach</p>	<p>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 to another entity or</p>	<p>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 would not be</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>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 be determined based on provisions of a new license. The HPMP would be revised to address management of cultural	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 Gate reservoirs. These sites	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.
			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.	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.	

<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>
		resources in the APE determined by the license.		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.	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.

## 5.2 DISCUSSION OF KEY ISSUES

The measures proposed by PacifiCorp and those included in the Staff Alternative would help protect and enhance water quality, fisheries, terrestrial, recreational, aesthetic, and cultural resources in the project area, but would reduce the net power benefits of the project. In this section, we discuss our rationale for including some measures in our Staff Alternative and not including others. We also summarize the effects of an alternative that includes all mandatory conditions and selected measures from the staff alternative and another that includes the removal of Iron Gate and Copco No. 1 dams and fish passage at Copco No. 2 dam with other selected measures.

### 5.2.1 Seasonal High Flows and Sediment Management

#### Seasonal High Flows

FWS and Oregon Fish & Wildlife recommend that, at least once a year between February 1 and April 15, no water be diverted to the J.C. Boyle and Copco No. 2 powerhouses when inflow to J.C. Boyle reservoir (including Spencer Creek) exceeds 3,300 cfs, and that this diversion cessation be maintained for at least 7 full days. Oregon Fish & Wildlife recommends the downramp rate for this seasonal high flow not exceed 2 inches per hour or 300 cfs per 24-hour period. FWS and Cal Fish & Game make the same recommendation, except they do not specify an hourly ramp rate. NMFS recommends and the Bureau of Land Management specifies the same seasonal high flow and ramping rate as Oregon Fish & Wildlife, but only for the J.C. Boyle bypassed reach.

Provision of seasonal high flows as recommended by the agencies could help to ensure that spawning areas used by trout remain sufficiently free of silt to support egg incubation and trout recruitment. However, our review of the average spill duration and quantity under existing conditions suggests that spillage to the J.C. Boyle bypassed reach may have been sufficient to flush fine-grained sediment during many years. Based on this initial conclusion, and because the trout population in the J.C. Boyle bypassed and peaking reaches does not show any evidence that recruitment has been impeded by poor spawning conditions, and in light of the associated high cost of this measure, our draft EIS Staff Alternative does not include the seasonal high flow recommended and prescribed by the agencies.

During the 10(j) meeting, the agencies clarified that this measure would only be implemented during about 50 percent of the years (we had previously understood that it would occur annually).<sup>163</sup> The agencies also emphasized that the seasonal high flow releases, in combination with the sediment augmentation measures discussed in the next section, are intended to meet multiple objectives in addition to improving trout spawning habitat. These objectives include control of reed canarygrass, creation of long-term riparian maintenance flows, alluvial feature formation, and creation of channel complexity. In addition, PacifiCorp indicated that it may be possible to schedule planned maintenance outages at J.C. Boyle to provide these high flows during the appropriate season, in some years, which would reduce the cost of this measure.

During the preparation of this EIS, we reconsidered seasonal high flows in light of this information. We also considered that seasonal high flow releases would assist with distributing augmented sediment, which would likely be added in only one or two locations where reasonable access is available. Both the recommended seasonal high flows and sediment augmentation would improve the recruitment of trout fry from primary locations where most of the spawning between J.C. Boyle and Copco No. 1 dams is thought to occur, and would enhance habitat for anadromous salmonids, if and when they are reintroduced to project waters upstream of Copco reservoir. Maintaining and enhancing channel

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<sup>163</sup>This seasonal high flow would be triggered by an inflow to the J.C. Boyle reservoir of more than 3,300 cfs. Flow of this magnitude occur about once every 2 years, on average.

complexity may be especially valuable in the vicinity of the large thermal refugia in the J.C. Boyle bypassed reach, which would provide important holding habitat for summer steelhead and spring Chinook salmon. If PacifiCorp's annual maintenance outages at J.C. Boyle development are coordinated with the specified timing of the seasonal high flow release, lost generation and associated revenues could be minimized. Based on these considerations, we now conclude that implementing seasonal high flows in the J.C. Boyle bypassed reach, as recommended by FWS, NMFS, Cal Fish & Game, and Oregon Fish & Wildlife, and as specified by the Bureau of Land Management, would be worth the estimated annualized cost of \$210,710, including 4,367 MWh of lost generation, and we include this measure as part of the Staff Alternative.

For the Copco No. 2 bypassed reach, we conclude that this reach is unlikely to support a quality trout fishery given the seasonal poor water quality conditions of flows released into the bypassed reach from Copco reservoir, and the lack of any tributaries that could provide suitable temperature refugia.<sup>164</sup> Furthermore, our review of the average spill duration and quantity indicates that spillage to the Copco No. 2 bypassed reach is sufficient to flush fine-grained sediment in many years. Because we do not include sediment augmentation to the Copco No. 2 bypassed reach in the Staff Alternative, there would be no need to enhance the downstream distribution of any such augmentation, as there would be in the J.C. Boyle bypassed reach. Regarding the cost of this measure, PacifiCorp stated at the 10(j) meeting that it does not schedule annual maintenance shutdowns at the Copco No. 2 powerhouse, so there is limited potential for reducing the cost of the measure through scheduling, as is possible at J.C. Boyle.

Because of the limited capacity of the reach to support a trout fishery and our conclusion that sediment augmentation and subsequent downstream dispersal by high flow releases would be unlikely to provide a meaningful habitat enhancement in this reach, we conclude that implementing seasonal high flows in the Copco No. 2 bypassed reach as recommended by FWS, Cal Fish & Game, and Oregon Fish & Wildlife would not be worth the estimated annualized cost of \$177,760, including 3,684 MWh of lost generation, and we do not include this measure in the Staff Alternative.

If passage of anadromous fish smolts through Iron Gate reservoir is determined to be feasible during Phase I of the integrated fish passage and disease management program, anadromous fish would be restored to this reach in Phase II. Augmentation of spawning gravel and monitoring of the condition of spawning gravel would likely be implemented in Phase II, and the need for a seasonal high flow at the Copco No. 2 bypassed reach to maintain the condition of spawning gravel could be determined based on monitoring results.

### **Sediment Management**

Several parties put forward sediment augmentation measures intended to increase spawning habitat for resident trout or anadromous salmonids downstream of PacifiCorp's dams, which trap sediment and cause a deficit of gravel and finer sediments in downstream reaches. PacifiCorp proposes to place about 100 to 200 cubic yards of spawning gravel in the upper end of the J.C. Boyle bypassed reach and 1,800 to 3,500 cubic yards between Iron Gate dam and the Shasta River confluence on an as-needed basis, and to monitor the sediment augmentation efforts. PacifiCorp's proposal would enhance spawning habitat that has been adversely influenced by the interruption of sediment transport by project dams and enable evaluations of whether sediment remains in place and available for salmonid spawning. We estimate the annualized cost of PacifiCorp's proposed measure to be \$152,360.

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<sup>164</sup>Although it is possible that some trout could use Fall Creek, only the lowermost 1 mile of the stream is accessible from Iron Gate reservoir, and the amount of habitat in this stream may provide a thermal refugium of sufficient size to accommodate resident trout from Fall Creek and migratory trout from Iron Gate reservoir and from the Copco No. 2 bypassed reach. Jenny Creek also has some potential as a temperature refugia, but summer water temperatures in this stream are only marginally suitable for trout.

Oregon Fish & Wildlife, Cal Fish & Game, and the Hoopa Valley Tribe recommend that PacifiCorp develop a sediment and gravel resource management plan, identify measures that would be implemented to provide for the restoration of spawning habitat below each project dam, map the character and distribution of sediments within project reaches, develop and implement recommendations for sediment management for each project-affected reach, and develop and implement a monitoring program to assess how introduced gravels and sediment are distributed and used under project operations. If monitoring indicates that the plan does not achieve the plan objectives, PacifiCorp would revise the plan in consultation with the resource agencies.

The Bureau of Land Management specifies that PacifiCorp develop a comprehensive sediment management plan for the J.C. Boyle bypassed reach designed to increase channel complexity and availability of spawning habitat for resident and anadromous fish. The Bureau of Land Management's plan would be developed to address the Bureau of Land Management's objectives for channel complexity and to support meeting the objectives outlined in the condition. This measure also would include the filing of a comprehensive monitoring report in year 7, adaptive management in years 7 through 9, and revision of the plan in year 10. The Bureau's specified program would include placing an unspecified amount of sediment into the J.C. Boyle bypassed reach (first in a large augmentation, then in smaller volumes). Placing a larger quantity of sediment than proposed by PacifiCorp (including multiple grain sizes) into the reach likely would benefit channel complexity, native riparian function, and rainbow trout spawning and rearing habitat. The sediment would also be transported downstream to the peaking reach where it would provide additional benefit.

NMFS and FWS recommend that PacifiCorp develop a sediment augmentation plan for project reaches and the Klamath River downstream of Iron Gate dam to include (1) identification of priority spawning and holding reaches; (2) assessment of flows needed to transport sediment and maintain holding habitat (pools); (3) identification of areas for removal of deposits of large debris; and (4) identification of priority areas for sediment augmentation, volumes of sediment, and flows to implement deposition of sediment in target areas and schedule for periodic replenishment. The plan would be implemented within 3 years of license issuance, results monitored in consultation with agencies, and reviewed at least every 5 years for the term of the license to facilitate adaptive management. Regarding flows necessary to redistribute sediment downstream to the J.C. Boyle peaking reach and the Klamath River below Iron Gate dam, we conclude the seasonal high flow releases to the J.C. Boyle bypassed reach would provide flows of the magnitude needed to initiate transport of spawning-sized gravel, sort sediment and build bar forms, and create holding pools both within the bypassed reach and the downstream peaking reach. Flows released from Iron Gate dam are currently specified in Reclamation's operating plans for the Klamath Irrigation Project, which are guided by BiOps from NMFS and FWS. Annual monitoring of gravel deposits, as included in the Staff Alternative, would help to assess the effects of flow on the movement and distribution of spawning gravels in different water year types, which would assist with guiding future augmentation efforts. Regarding the removal of large debris, it appears that this part of the NMFS and FWS recommendation is related to sidecast material that was introduced into the J.C. Boyle bypassed reach when the road to the powerhouse was constructed and material washed into the bypassed reach during slope failures. We address this issue in the next section.

We concur that it is likely that additional sediment augmentation would be required to replenish the supply of sediment after high flow events occur. We also conclude that mapping of sediment before and after placement would be useful to help quantify the measure's benefits and to guide further sediment augmentation efforts. Accordingly, we include in the Staff Alternative elements of the approach to sediment augmentation recommended by Oregon Fish & Wildlife, Cal Fish & Game, and the Hoopa Valley Tribe, and specified by the Bureau of Land Management, which would begin with developing a resource management plan; mapping existing spawning gravel deposits and alluvial surfaces suitable for riparian recruitment; and, based on the results of that mapping, developing sediment augmentation volumes, locations, and sizes that meet plan goals. Augmentation would include a range of sediment

sizes to support channel complexity and recruitment of riparian vegetation. During some years it may not be necessary to provide any augmentation if previous sediment has remained at locations that would provide appropriate spawning habitat (e.g., during relatively dry years). During wet years, larger quantities of sediment may be needed to replace sediment that washed downstream. The reporting elements specified by the resource and land management agencies and the Hoopa Valley Tribe for sediment augmentation would provide for coordination and review of the program by the Commission and stakeholders, and allow for consultation regarding any proposed changes to implementation and monitoring. This approach would facilitate any future augmentation necessary to meet habitat objectives in these reaches. We recommend that PacifiCorp develop a draft of the sediment and gravel resource management plan in consultation with NMFS, Oregon Fish & Wildlife, Cal Fish & Game, and the Klamath Basin Tribal Water Quality Work Group within 1 year after license issuance and file the plan for Commission approval. The plan should identify the source of the sediment, the quantity, location, and frequency of sediment placement, and describe sediment mapping and monitoring studies to be conducted before and after placement.

To estimate the cost of implementing the approach recommended by Oregon Fish & Wildlife, Cal Fish & Game, and the Hoopa Valley Tribe, we assume an initial placement of 4,131 cubic yards of sediment in the J.C. Boyle bypassed reach, followed by an annual placement of 826 cubic yards. We assume 3,500 cubic yards of sediment (likely to be primarily gravel) would be placed downstream of Iron Gate dam at 3-year intervals (actual amounts would depend on gravel mapping and assessment prior to augmentation). We estimate that this amount of sediment would provide sufficient spawning habitat to support about 6,200 rainbow trout redds in the J.C. Boyle bypassed reach and about 4,300 fall Chinook redds downstream of Iron Gate dam. We estimate that the annualized cost of this approach, including gravel mapping, monitoring, and reporting, would be \$181,600. We conclude that the sediment augmentation program would provide substantial benefits to populations of rainbow trout and fall Chinook salmon, and we include the measure in the Staff Alternative. We expect the cost for implementing the agencies' measures pertaining to sediment augmentation would be similar to our recommended measure. As noted previously, if passage of anadromous fish smolts through Iron Gate reservoir is determined to be feasible during Phase I of the integrated fish passage and disease management program, the restoration of anadromous fish into the Copco No. 2 bypassed reach would occur during Phase II. Augmentation of spawning gravel and monitoring of the condition of spawning gravel in the Copco would likely be implemented during Phase II, and is not included in the cost estimate given above.

### **5.2.2 Restoration of Slopes and Channel at the J.C. Boyle Bypassed Reach**

Construction and maintenance of the canal and roadway along the J.C. Boyle bypassed reach has resulted in the introduction of sidecast and eroded material to the river, which has narrowed the channel, exacerbating erosion on the opposite bank and, at one location, completely filling the channel. At this latter location, the sidecast material currently may form a barrier to fish migration, especially during summer low flow conditions when only the minimum flow of 100 cfs is released into the bypassed reach. There is substantial inflow from springs upstream of this sidecast blockage, and by preventing salmonid access to this area during the warm months of the year, the full benefits of this thermal refugium are diminished. The sidecast material also creates a barrier to recreational boaters who use the bypassed reach when flow conditions are suitable. Also, use of the emergency spillway to pass flows in the canal to the bypassed reach when the powerhouse units trip offline has created massive hillslope erosion of the adjacent slope, contributing large amounts of sediment to the Klamath River. Left unchecked, the eroding hillslope could threaten the integrity of the intake canal and adjacent road.

PacifiCorp proposes to install a synchronized bypass valve on each of the two powerhouse units to minimize or eliminate the use of the emergency spillway. Oregon Fish & Wildlife, Interior, and the Hoopa Valley Tribe recommend that PacifiCorp implement measures that would maintain flows at the

J.C. Boyle powerhouse during a powerhouse failure, which would be achieved with the installation of PacifiCorp's proposed bypass valves. However, PacifiCorp proposes no measures to restore the eroding slope downgradient of the emergency spillway or provisions to remove sidecast and eroded material from the bypassed reach channel.

NMFS and Interior, as part of the fishway prescription for the project, prescribe that PacifiCorp remove the sidecast rock barrier within the bypassed reach to allow upstream passage for resident and anadromous fish. Interior also recommends that PacifiCorp prepare site-specific remediation plans for the J.C. Boyle emergency spillway and other canal and slope failures, including (1) a map depicting the location of the proposed activity; (2) designs for site stabilization, channel restoration, location of disposal sites, and erosion control plan; (3) implementation and effectiveness monitoring; (4) survey data, biological evaluations, or results from consultation for ground- or habitat-disturbing activities; and (5) an environmental analysis of the proposed action that meets NEPA requirements. Oregon Fish & Wildlife makes a similar recommendation, and indicates that the plan should include provisions for revegetation of affected hillslope and riparian areas and structural, vegetative, and flow strategy methods to halt erosion, restore the damaged hillslope, and repair visual degradation. In addition, Oregon Fish & Wildlife recommends that PacifiCorp restore the J.C. Boyle bypassed reach channel from damage caused by use of the emergency spillway. In the event of future canal or spillway overflow events, both Oregon Fish & Wildlife and the Bureau of Land Management recommend that PacifiCorp develop an action plan that defines protocols for assessing and documenting environmental damage, notification of agencies, developing restoration plans, securing appropriate permits to implement restoration measures, and corrective actions taken in response to the emergency events.

Agency documentation and our observations of the severe erosion downslope of the emergency spillway and resultant degradation of the bypassed reach channel are strong reasons to eliminate the future use of the emergency spillway, as we discuss in section 3.3.1.2.2, *Project Effects on Sediment Supply*. PacifiCorp's proposed bypass valves at the J.C. Boyle powerhouse would achieve this objective. The estimated total annualized cost to install a valve at each of the two units is \$898,760. Although this is a substantial cost, the resultant benefit of a substantial reduction in this source of erosion, including protecting the structural integrity of the intake canal and the project access road that parallels this canal, would be worth the cost, and we include this measure in the Staff Alternative.

Although a major source of erosion would be eliminated with implementation of bypass valves at the powerhouse, the existing substantial erosion downslope of the emergency spillway cannot be left in its current unstable state without resulting in further damage to the bypassed reach channel, intake canal, and adjacent access road. We consider restoration of this slope to be imperative. The steep slope associated with the intake canal and access road is prone to damage by landslides, and during December 2005 a landslide caused the intake canal to rupture, with the release of large quantities of water and rock to downslope areas. Restoration of slopes and bypassed reach channel associated with this canal failure would minimize continued erosion into the reach and reduce the potential for more severe slope failures. When project-related erosion from slope failures and sidecast debris enters the bypassed reach, it can adversely influence aquatic habitat.

As we discuss in section 3.3.3, *Aquatic Resources*, the J.C. Boyle bypassed reach is particularly important to resident rainbow trout because it is one of two primary spawning areas between J.C. Boyle dam and Copco reservoir (the other is Shovel Creek, about 18 miles downstream of the dam). The bypassed reach is also the most substantial thermal refugium in the project area because of spring accretion of more than 200 cfs which remains relatively undiluted during the summer because most of the river flows are diverted through the powerhouse. Consequently, this reach has a disproportionately high value in maintaining the existing quality rainbow trout fishery and could serve an equally important function in the restoration of anadromous fish upstream of Iron Gate dam. Sidecast material in the channel causes an obstruction that forms a large pool that may impede the downstream movement of spawning gravel, and the sidecast material forms a small cascade that could block fish passage under the

existing minimum flow conditions. Removal of the sidecast material from the channel would reduce the potential that the sidecast material could obstruct fish passage or gravel movement, but it also may reduce the suitability of the pool as holding habitat for adult summer steelhead and spring Chinook salmon, if they are restored to the reach. However, we consider it unlikely that the sidecast material would block fish passage under the higher flow releases that we include in the Staff Alternative or that are prescribed by the Bureau of Land Management. We also consider it likely that some gravel would be transported through the pool when large spills occur. We estimate that the annualized cost for removing sidecast material from the stream channel would be \$286,930. Considering the high cost of the measure and the uncertainty of potential benefits to aquatic resources, we recommend that removal of sidecast material be considered an adaptive measure that could be implemented based on monitoring results. Monitoring the usage of gravel deposits for spawning would provide information on whether gravel is being transported through the pool, and whether a sufficient number of redds are being constructed to support trout populations in the J.C. Boyle bypassed and peaking reaches. Telemetry monitoring of adult anadromous fish would help to assess whether the sidecast material impedes migration and access to spawning habitat and to the portion of the temperature refugium upstream of the potential sidecast barrier. These monitoring efforts are included in the sediment management plan and the fish passage and disease management plan, which we include in the Staff Alternative.

Stabilization and restoration of the slopes along the J.C. Boyle bypassed reach that have failed because of canal breaches or use of the overflow spillway is essential to ensuring the future integrity of the intake canal and associated access road. Restoration would also address aesthetic effects associated with project-induced slope failures and reduce the introduction of uncontrolled amounts of sediment into the bypassed reach, which potentially could adversely influence spawning, incubation, and rearing of salmonids. We recognize that the steepness of the slope and difficult access would make restoring the eroded slope below the emergency spillway and at other locations where slope stabilization is needed a costly endeavor. We estimate the annualized cost for such remedial measures would be about \$409,000. However, considering that not stabilizing these slopes could eventually threaten the safety of key project features and also adversely affect habitat in the bypassed reach and the aesthetic resources of the area, we view the benefits of this measure to be worth the cost and include it in the Staff Alternative. Prior to performing the work, we recommend that PacifiCorp be required to develop a site-specific remediation plan as prescribed by NMFS/Interior, in consultation with Oregon Fish & Wildlife, Oregon Parks & Rec, Interior, NMFS, American Rivers, California Trout, Trout Unlimited, and the Klamath Basin Tribal Water Quality Work Group.<sup>165</sup> We recommend that the remediation plan include a map showing the location of material to be removed and planned disposal sites, and that opportunities for using spoils to improve aquatic and riparian habitat, and the potential effects of channel modifications on whitewater safety and recreation, be considered during plan development.

It is evident that because of the steepness of the slope above and below the J.C. Boyle intake canal, it is vulnerable to unforeseen natural and project operational events that can cause sudden releases of large quantities of water, resulting in erosion of material in the bypassed reach. This vulnerability is a valid reason to establish protocols that would be followed by PacifiCorp as soon as a breach in the canal or major uncontrolled spill event is discovered, as Oregon Fish & Wildlife and the Bureau of Land management recommend. The protocols would not only define the procedures that would be followed after such an event, but the threshold of flow conduit spill events that would trigger implementation of the specific procedures. We estimate that the annualized cost to develop such protocols would be relatively minor, about \$1,350. The establishment of proactive procedures that would be implemented following future flow conduit failures or major spill events should expedite stabilization and follow-up restoration work, and we include development of this plan in the Staff Alternative. We consider the cost of

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<sup>165</sup>The Work Group comprises the heads of the environmental departments of the Yurok, Hoopa Valley, and Karuk tribes, the Quartz Valley Indian Community, and the Resighini Rancheria.

implementing the actions defined in the protocols following any flow conduit failure or major spill event to be a cost of operation and maintenance that would be necessary regardless of this relicensing proceeding, and we therefore do not assign an incremental cost to such follow-up actions.

### **5.2.3 Project Operation Management**

PacifiCorp proposes to install new flow gaging stations at two project reaches to provide a basis for documenting that project operations are in compliance with the flow regime that may be specified in a new license, specifically the J.C. Boyle bypassed reach and downstream of the Spring Creek diversion. Existing USGS gaging stations downstream of the J.C. Boyle and Iron Gate powerhouses also provide a basis for documenting project operations and compliance with applicable flow regimes.

PacifiCorp proposes minimum flows in project reaches that are based on a set flow release, often during a specified period of the year. Consequently, documentation of such flow regimes focuses on measuring the flow downstream of the project dam (e.g., J.C. Boyle), diversion point (e.g., Spring Creek), or powerhouse (e.g., J.C. Boyle and Iron Gate). In some instances, we assume PacifiCorp intends to rely on fixed weir or orifice devices to document compliance with the specified flow regime (e.g., below Copco No. 2 dam and the Fall Creek diversion dam). The flow regimes specified by various entities (see section 3.3.3.2.1, *Instream Flows*) entail the use of proportional flows, where the minimum flow would be either a specified value or a proportion of inflow to the reservoir or diversion dam of each development, whichever is the larger flow. Therefore, both establishing the minimum flow at any particular time, and documentation of compliance with that minimum flow would require gages that accurately measure inflow to each development on a real-time basis and outflow below each project dam or powerhouse where a minimum flow specification has been established.

Another key aspect of Klamath Hydroelectric Project operation management pertains to interactions with the Klamath Irrigation Project, operated by Reclamation. Reclamation is required, as a condition of its BiOp for the protection of federally listed coho salmon, to release sufficient flows to the Klamath Hydroelectric Project to enable specified minimum flow releases from the Iron Gate development. In the past, this coordination was achieved through a contract between Reclamation and PacifiCorp, but this contract expired in April 2006. Reclamation specifies that PacifiCorp develop operational criteria to coordinate operation of Link River and Keno dams with operation of Iron Gate dam to ensure that Reclamation can meet its obligations under the BiOp for the Klamath Irrigation Project.

Oregon Fish & Wildlife and the Hoopa Valley Tribe recommend that PacifiCorp develop a project operations and resource management plan that would include provisions for documenting and annual reporting of appropriate minimum flows and ramping rates as measured at project gaging stations, non-compliance events pertaining to project operations, and an annual work plan for the upcoming year. The plan also would include provisions for updating the plan at 5 year intervals to reflect new information and management needs, and updated implementation strategies. Oregon Fish & Wildlife and the Hoopa Valley Tribe also recommend that PacifiCorp develop a coordinated gage installation and reporting plan. Because their flow recommendations are based on proportional inflow to each project reservoir or diversion dam, they recommend installing gages, equipped with telemetry capabilities and hourly recording intervals, above all project reservoirs and diversions and outflow from each project dam at the head of the dewatered reach.

We agree with Oregon Fish & Wildlife and the Hoopa Valley Tribe that developing a project operations and resource management plan would be an appropriate means to develop reporting formats in consultation with appropriate resource agencies. However, much of the information contained in the reports would be developed through flow and water level gages that would be necessary to ensure documentation with the flow regimes that may be specified in a new license. We see no reason why development of the project operations and resource management plan should not be consolidated with the gage installation and reporting plan. Developing such a plan, in consultation with resource agencies

including USGS, would ensure that gages are installed and maintained in a manner that provides accurate documentation of the project flow regime that may be required in a new license. This consolidated plan would also be the ideal forum for establishing the mechanism for coordinating flows into the project with Reclamation's BiOp responsibilities downstream of Iron Gate dam. Developing a separate agreement for operating Link River and Keno dam, as Reclamation specifies, would be problematic if the Commission removes East Side, West Side, and Keno developments from the project, as PacifiCorp proposes. Including coordination provisions for the Klamath Irrigation Project and the Klamath Hydroelectric Project in a project operations and resource management plan, which would be periodically updated, would enable this important function to occur regardless of the disposition of East Side, West Side, and Keno developments, as well as if any of the downstream developments should also be removed from the project. We therefore include the development of a project operations and resources management plan that includes provisions for gage installation appropriate to any flow regime specified in a new license in the Staff Alternative. We estimate that the annualized cost for developing this plan and implementing the reporting and plan update provisions would be about \$14,720.

As we discuss in more detail in section 5.2.5, *Instream Flows*, the Staff Alternative does not take the approach that minimum flows should be a proportion of the inflow to the reservoir or diversion dam of each development. As a result, the new gage placement that we include in the Staff Alternative is considerably less than that recommended by other entities. Specifically, we include the following new gages with hourly reporting intervals, equipped with telemetry to enable conveyance of real time information at the following locations: J.C. Boyle bypassed reach (as proposed by PacifiCorp and recommended by other entities) and Copco No. 2 bypassed reach (as recommended by other entities). The flow regimes that we include in the Staff Alternative include set flows on a seasonal basis downstream of Spring Creek diversion dam and a year-round basis downstream of Fall Creek diversion dam. Consequently, a Parshall flume should be sufficient to measure compliance with the designated flows in each reach, and we include such flow gages in our Staff Alternative. PacifiCorp currently provides financial support for USGS to operate the gage downstream of the J.C. Boyle and Iron Gate powerhouses, and there would be no incremental costs associated with this continued practice. We estimate that the annualized cost for installation of the four new gages that we include in the Staff Alternative would be about \$57,080.

In contrast, gages needed to measure inflow to each reservoir and outflow from each dam would not only include the two new real-time gages that we recommend, but refurbishment or replacement of the Spencer Creek gage, and new real-time gages at Shovel Creek and upstream and downstream of Spring Creek and Fall Creek diversion dams. PacifiCorp currently provides financial support for USGS to operate the gage in the Keno reach. We estimate that the annualized cost for installation of the additional gages needed to establish and document project-related flows recommended by the agencies would be about \$58,270. In response to our draft EIS, the agencies agreed with our approach to measuring flows in Spring and Fall creeks, but the incremental cost over our recommended gaging approach would still be \$38,880. We do not view this additional cost to be warranted because the gages, at Spencer and Shovel creeks, recommended by the agencies and others are unnecessary to document the flow regime that we include in the Staff Alternative.

#### **5.2.4 Water Quality Management**

Water quality within the Klamath River and throughout the mainstem portion of the project is compromised for a number of parameters, including temperature, DO, parameters related to nutrient enrichment, and toxic algae. PacifiCorp proposes to develop comprehensive reservoir management plans aimed at improving DO, reducing algae blooms, and improving pH in J.C. Boyle, Copco, and Iron Gate reservoirs. In response to our AIR, PacifiCorp stated that it would install a hypolimnetic oxygenation system at Iron Gate reservoir to enhance the DO concentration of water released from the Iron Gate development. However, in response to agency concerns (expressed in comments, terms, and conditions)

that hypolimnetic oxygenation could result in resuspension of nutrients and other unwanted effects, PacifiCorp indicated in its response to those comments that it would evaluate its proposed hypolimnetic oxygenation system further, as well as other means to improve the DO regime within and downstream of Iron Gate reservoir. PacifiCorp also stated that it would continue to evaluate potential means to provide short-term temperature relief downstream of Iron Gate dam by releasing cool, hypolimnetic water from Iron Gate reservoir.

Oregon Fish & Wildlife, the Forest Service, and the Hoopa Valley Tribe all recommend that PacifiCorp develop a water quality management plan that includes assessments and implementation of methods to improve water quality and water quality monitoring. NMFS, FWS, and the Klamath Tribes recommend that PacifiCorp develop a plan to address Keno reservoir water quality problems and fund implementation of remedial measures.

Water quality issues associated with the Klamath Hydroelectric Project are part of a systemic problem whereby high levels of nutrients that originate from upstream sources enter project waters, and processes associated with project reservoirs, primarily Copco and Iron Gate, exacerbate the problems during the warmer months of the year. Consequently, we conclude that developing a single, comprehensive water quality management plan for the project, in consultation with Reclamation, Bureau of Land Management, Oregon Environmental Quality, NMFS, FWS, Oregon Fish & Wildlife, the Water Board, Cal Fish & Game, and the Klamath Basin Tribal Water Quality Work Group would be the most effective way to achieve positive results in a cooperative manner that meshes with ongoing efforts by other entities to address water quality issues unrelated to operation of the hydroelectric project. The plan would include provisions for (1) assessing alternative techniques to address project-related water quality issues (temperature, DO, nutrient enrichment, and toxic algae); (2) considering a range of measures and implementing the feasible ones; (3) monitoring to determine the effectiveness of measures that are implemented, or to determine when specific triggers are met that signal implementation of seasonal or emergency measures (such as emergency cool water releases, spillage of warm water during late spring to enhance juvenile salmon growth, or implementation of DO enhancement measures); and (4) periodically updating the plan to be responsive to new scientific developments and evolving water quality initiatives by other entities (e.g., TMDLs and implementation of the Klamath Irrigation Project's CIP). We include development and implementation of a comprehensive water quality management plan as part of the Staff Alternative.

We agree with the resource agencies that caution against implementing measures, such as hypolimnetic oxygenation, without fully evaluating the ramifications on other water quality parameters. We also acknowledge that most chemical treatment of algal blooms when *Microcystis* is present could result in the release of unacceptably high concentrations of microcystin toxin, and therefore, this treatment method is not likely to be viable for this project. However, because water quality problems currently exist, we conclude that waiting while PacifiCorp evaluates numerous alternative measures to address these problems is not an acceptable response, if methods to address these issues have already been identified. For example, although we agree that as a component of a water quality management plan, PacifiCorp should continue to evaluate the potential use of a hypolimnetic oxygenation system at Iron Gate dam, PacifiCorp's response to our AIR regarding techniques to improve the DO content of releases from Iron Gate indicates that turbine venting could be implemented with relative minor modifications at the powerhouse. PacifiCorp's modeling indicates that turbine venting would be effective in achieving almost immediate increases in DO in the Klamath River downstream of Iron Gate dam. It is not clear whether turbine venting at Iron Gate development would enable releases to meet applicable water quality standards, but it is expected to improve conditions over existing conditions, and monitoring would enable documentation of the effect of this measure and the level of additional enhancement that should be targeted during future, supplemental efforts. Therefore, we include turbine venting and follow-up DO monitoring in the Staff Alternative.

The cost of developing and implementing a water quality management plan would be high. We estimate the identifiable annualized cost to be about \$240,330, and implementation of specific measures not yet identified, but that may surface during the consultation and evaluation of measures to address water quality issues, could increase this cost substantially (i.e., hypolimnetic oxygenation, if implemented, could have an annualized cost of about \$563,030). However, project operations are causing or exacerbating the following water quality effects: (1) currently limited recreational use at project reservoirs because of toxic algal blooms that occur during the latter half of the summer; (2) nutrient enrichment caused, in part, by nitrogen-fixing algae in project reservoirs fosters downstream growth of algae that creates habitat for the secondary host of at least two fish pathogens that have a major adverse effect on Klamath River salmon stocks; (3) increased duration of time when the DO downstream of Iron Gate dam does not meet applicable standards from less than 2 months (without the project) to most of the summer and early fall; and (4) modification of the temperature regime downstream of Iron Gate dam in a manner that at times adversely influences salmon. For these reasons, we consider the relatively high cost of the water quality management plan to be warranted.

## **5.2.5 Instream Flows**

### **J.C. Boyle Bypassed Reach**

Minimum flow releases from J.C. Boyle dam affect habitat conditions in the 4.3-mile-long bypassed reach, which supports a productive trout fishery and provides spawning habitat for trout in the downstream peaking reach. PacifiCorp currently releases 100 cfs into the bypassed reach, and this flow is augmented by the inflow of about 220 to 250 cfs from springs, most of which enters the reach about 1 mile below the dam. PacifiCorp proposes to release an additional 100 cfs either from the dam or from the powerhouse to increase base flows in the peaking reach. If the additional 100 cfs was released at the powerhouse, total flow in the lower portion of the bypassed reach would remain between 320 to 350 cfs, including the existing 100 cfs release and 220 to 250 cfs of accretion flows. Flows in the lower portion of the bypassed reach would increase to 420 to 450 cfs if the additional 100 cfs was released at the dam.

Oregon Fish & Wildlife, NMFS, and Cal Fish & Game recommend that PacifiCorp release a minimum flow of 640 cfs or 40 percent of inflow, whichever is more, from the dam into the J.C. Boyle bypassed reach. Bureau of Land Management specifies a similar flow, except that the minimum flow threshold would be 470 cfs rather than 640 cfs. The Hoopa Valley Tribe recommends that PacifiCorp discharge a continuous minimum flow of 500 cfs or 70 percent of inflow to the project, whichever is greater. Each of these recommendations include a provision for minimum flows to be reduced to inflows when inflows drop below the recommended minimum flow.

PacifiCorp conducted an instream flow study, which indicated that higher instream flow releases would increase the amount of physical habitat that is available to rainbow trout in the bypassed reach. However, these higher release flows would also increase water temperatures during the summer. To evaluate the effect of increased dam releases on water temperatures, we calculated the water temperature that would result from mixing different volumes of release flows at 22°C with an assumed accretion flow of 235 cfs at 11°C, based on longitudinal water temperatures measured in the reach during an aerial infrared imaging survey conducted in August. Using this method, we estimated that the temperature below the primary area of groundwater accretion would be increased from 14.3°C at the 100 cfs release flow to 16.1°C at a 200 cfs release flow, which is still very close to the optimal range of 13 to 16°C for salmonid growth. Further increases in dam releases would raise water temperatures below the accretion area to 18.3°C with the 470 cfs release specified by Bureau of Land Management to 19.0°C for the 640 cfs release recommended by Oregon Fish & Wildlife, NMFS, and Cal Fish & Game. We conclude that a release of 200 cfs at the dam would strike a reasonable balance between temperature and physical habitat needs for trout, because it would increase the amount of physical habitat for all three life stages of trout without causing water temperatures to greatly exceed the optimal growth range for salmonids. Accordingly, we include a minimum flow release of 200 cfs released from J.C. Boyle dam in the Staff

Alternative, which is consistent with the minimum flow release proposed by PacifiCorp, except that the Staff Alternative would require that the entire minimum flow of 200 cfs be released at J.C. Boyle dam.

Downramping in the J.C. Boyle bypassed reach does not occur for power production purposes, but occurs primarily when coming off of spill mode or during maintenance events, both of which are infrequent. The existing license includes a ramp rate restriction of 9 inches per hour, which is equivalent to about 700 cfs per hour when river flows are between 400 and 3,000 cfs. PacifiCorp proposes to limit downramping in the bypassed reach to 150 cfs per hour, except for flow conditions beyond the project's control.

Oregon Fish & Wildlife recommends that controllable upramp and downramp rates not exceed 1 inch per hour or 300 cfs per day. Bureau of Land Management specifies that upramp and downramp rates not exceed 2 inches per hour during controlled flow events, except during implementation of the seasonal flushing flow (see section 5.2.1, *Seasonal High Flows and Sediment Management*). The Hoopa Valley Tribe recommends that when native salmonid fry and federally listed sucker juveniles are present (about May 1- September 30), ramp rates not exceed 1.2 inches per hour, and ramp rates not exceed 2.4 inches per hour for the rest of the year.

Flow downramping has the potential to strand fish in areas of the channel that are relatively low-gradient, or where pockets or side channels exist in the river channel. PacifiCorp's proposed down ramp rate of 150 cfs reflects a substantial reduction from the current licensed rate of 9 inches (about 700 cfs) per hour. We estimate that the proposed rate of flow change would equate to a stage change of about 1.9 inches per hour, which is similar to the 2 inch per hour ramping rate specified by the Bureau of Land Management. Compared to current operations, the proposed ramping rate would reduce the risk of stranding fry and juvenile fish, and would provide a more gradual transition time for adult trout to relocate as river levels change.

Oregon Fish & Wildlife and the Hoopa Valley Tribe's recommended ramping rate of 1 inch per hour is more restrictive than PacifiCorp's proposed ramping rate of 1.9 inches per hour. However, stranding has not been identified as a problem in this reach, ramping in this reach is an infrequent event, and a downramp rate of 2 inches per hour is generally regarded as a conservative rate for the protection of salmon and trout fry under most conditions. Accordingly, we include PacifiCorp's proposed downramp rate of 150 cfs per hour in the Staff Alternative.

We estimate that our recommended minimum flow release of 200 cfs with a 150 cfs per hour ramp rate would reduce the annual generation from the project by 23,968 MWh and reduce the annualized benefit of the project by \$1,194,650. We estimate that the Bureau of Land Management's specified minimum flow of 470 cfs or 40 percent of inflow, combined with a 2 inch per hour ramping rate, would reduce the annual generation from the project by 135,077 MWh and reduce the annualized benefit of the project by \$6,590,960. We estimate that the Hoopa Valley Tribe's recommended minimum flow of 500 cfs or 70 percent of inflow, combined with 1.2 to 2.4 inch per hour ramp rate, would reduce the annual generation from the project by 227,536 MWh and reduce the annualized benefit of the project by \$11,052,100. Finally, we estimate that the Oregon Fish & Wildlife, NMFS, Cal Fish & Game, and Conservation Group's recommended flow of 640 cfs or 40 percent of inflow combined with a 1 inch per hour and 300 cfs per 24 hrs ramping rate would reduce the annual generation from the project by 151,062 MWh and reduce the annualized benefit of the project by \$7,362,230. We conclude that PacifiCorp's proposed minimum flow and ramp rates would serve to enhance the existing high quality fishery in the bypassed reach, that higher minimum flows could adversely affect water temperatures, and that more restrictive ramp rates would provide minimal additional benefit. Accordingly, we conclude that the environmental benefits of PacifiCorp's proposed minimum flows and ramp rates are worth the cost, and we include them in the Staff Alternative.

## **J.C. Boyle Peaking Reach**

Flows passing from the J.C. Boyle bypassed reach combine with those released from the J.C. Boyle powerhouse to affect aquatic habitat in the 17.3-mile-long reach between the powerhouse and Copco reservoir, referred to as the J.C. Boyle peaking reach. The upstream 11.1 miles of this reach are in Oregon, and this segment has been federally designated as a Wild and Scenic River. The downstream 6.2 miles are in California, and this segment has been designated by Cal Fish & Game as a Wild Trout Area. Both sections are managed for wild trout.

PacifiCorp proposes to increase its minimum flow release at the development from 100 to 200 cfs, which would provide a minimum flow of approximately 420 to 450 cfs in the peaking reach including the 220 to 250 cfs of spring flow accretion that occurs in the bypassed reach. Furthermore, it proposes to limit the maximum daily flow change to 1,400 cfs. This would eliminate full two-unit peaking (420 to 3,420 cfs at the gage), but one-unit peaking still would occur. PacifiCorp also proposes to limit flow upramp rates to 9 inches per hour and downramp rates to 9 inches per hour for flows exceeding 1,000 cfs, and 4 inches per hour for flows less than 1,000 cfs in the J.C. Boyle peaking reach.

NMFS and Cal Fish & Game recommend that PacifiCorp operate the J.C. Boyle development in run-of-river mode, with no peaking operations. Cal Fish & Game, as well as Oregon Fish & Wildlife, also recommends a minimum flow of 720 cfs, and the Hoopa Valley Tribe recommends a minimum flow of 500 cfs or 70 percent of inflow to the project, whichever is greater. The Bureau of Land Management states that the flows that it specifies for the bypassed reach (minimum flow of 470 cfs or 40 percent of inflow, whichever is more), combined with accretion flows, would provide the minimum flow to the peaking reach. Oregon Fish & Wildlife and Cal Fish & Game recommend ramp rates of 1 inch per hour, Bureau of Land Management specifies a ramp rate of 2 inches per hour, and the Hoopa Valley Tribe recommends a ramping rate that ranges from 1.2 when salmonid fry and sucker juveniles are present to 2.4 inches per hour for the rest of the year.

The J.C. Boyle powerhouse is typically operated as a peaking facility, with water stored at night and then flows are ramped up during the day to either one unit operation (up to 1,500 cfs) or two unit operation (typically 2,750 cfs). PacifiCorp conducted several different studies to evaluate the effect of peaking operations on aquatic resources in the J.C. Boyle peaking reach, including an instream flow analysis to evaluate effects on habitat for trout and suckers, a wetted perimeter analysis to evaluate potential effects on invertebrate production, a bioenergetics study, and stranding surveys.

Results of the instream flow study indicate that the habitat versus flow relationship for trout adult and juvenile habitat in the J.C. Boyle peaking reach follow the same general pattern – a gradual increase before leveling off in the 400 to 600 cfs range then declining over the upper range of flows. The study results indicate that the proposed base flow of 420 to 450 cfs would provide 64 percent, 100 percent, and 97 percent of the maximum modeled habitat for fry, juvenile, and adult trout, respectively, and that increasing minimum flows up to 720 cfs would provide only minimal changes in habitat compared to the proposed minimum flow. However, agency comments on the instream flow study indicate that there was a considerable amount of disagreement on the approach that was used to model rainbow trout habitat, and none of the stakeholders relied on the results of the instream flow study to support their flow recommendations. Accordingly, we focused most of our analysis of the effects of flow fluctuations on food (invertebrate) production and on stranding potential.

PacifiCorp used two modeling approaches to assess the effects of proposed operations on trout growth. One approach used a model that examined food and water temperature effects of growth rates for trout under different flow scenarios, while the second approach involved a detailed bioenergetics model that evaluated growth rates based on food availability and ingestion rates, compared to energy losses from basic and active metabolism and excretion. The results of both modeling approaches indicate that food availability is more important than water temperature and physical habitat as a factor in trout growth in the J.C. Boyle peaking reach. This suggests that current flow fluctuations may account for the smaller

size of trout in the peaking reach when compared with the Keno reach as a result of decreased benthic macroinvertebrate production. However, trout sampled from this reach had above average condition factors, indicating that they have an adequate supply of food to meet their metabolic needs. PacifiCorp's proposed base flow would serve to enhance food production by increasing the permanently wetted area by about 5 percent. Increasing the minimum flow to 500 cfs would provide a 6 percent increase compared to current base flow, and a flow of 720 cfs would provide an 11 percent increase over existing conditions.

Although we would expect some improvement in the fishery under the higher minimum flows recommended by the agencies and tribes and under run-of-river operations, available information indicates that the rainbow trout population in this river reach is highly productive, and we expect that this fishery would be sustained and improved under PacifiCorp's proposed flow regime, which would increase base flows and reduce the total flow change that would occur under peaking operations. In 1984, there were estimated to be 890 trout per mile exceeding 7.8 inches in length in the upper 6 miles of the peaking reach, and there were estimated to be 1,911 trout per mile of this size in the next 5 miles of the river. This population estimate and angler catch rates in the Oregon section reported by PacifiCorp are comparable to or exceed those reported for other high quality trout streams in Oregon including the lower Deschutes and Metolius rivers. Cal Fish & Game (2000) reports that annual angler catch rates in the California section of the peaking reach are among the highest of the wild trout rivers that they monitor.

Our analysis of the effect of alternative flow regimes on angling opportunities in section 3.3.6.2.2, *River Recreation*, shows that, under PacifiCorp's proposed flow regime, the total number of days with flows that create acceptable angling opportunities would be comparable to those that would be available under run-of-river operations, recommended by NMFS and Cal Fish & Game. However, PacifiCorp's Proposal would provide from 20 to 31 days of optimal angling flows during nearly all months from June through October for all water year types analyzed, and operating in a run-of-river mode would not provide any days with optimal angling flows during the same time frame.

PacifiCorp's proposed flow regime would also provide appropriate flows for whitewater boaters during the daytime over most of the summer season, while the higher minimum flows recommended by others would substantially reduce opportunities for whitewater recreation by reducing the magnitude of daytime peak flows. The cost of implementing PacifiCorp's proposed flow regime and of the agency recommendations are included in the costs that we provided above for flows in the bypassed reach, because minimum flow releases in the bypassed reach would generally meet the flows that would be necessary in the peaking reach. Implementing run-of-river operations at J.C. Boyle development, as recommended by some agencies, would provide some additional benefit to aquatic resources by increasing habitat stability, but would substantially reduce whitewater boating opportunities and would reduce project benefits by \$725,200 annually due to reduced generation during peak demand periods. We conclude that PacifiCorp's proposed flow regime provides a suitable balance between providing improved flows for aquatic resources while continuing to provide flows that are suitable for angling and whitewater recreation, and we include their proposed flow regime in the Staff Alternative.

Stranding surveys conducted in 2006, which we discuss in section 3.3.3.2.1, *Instream Flows*, indicate that ramping during the first several peaking cycles of the year caused substantial mortality of small fish, crayfish, and invertebrates. Such stranding losses have the potential to reduce the forage base available to trout and may adversely affect trout growth and survival. PacifiCorp's proposal to limit downramping to 4 inches per hour when flows are less than 1,000 cfs in the J.C. Boyle peaking reach would reduce the potential for stranding; and the more restrictive rates recommended by other stakeholders would further reduce the risk of stranding. However, implementing more restrictive ramping rates or run-of-river operations year-round would have a substantial effect on PacifiCorp's ability to use the project to meet peaks in electrical demand. As an alternative to the more restrictive agency recommendations, we recommend that PacifiCorp implement its proposed reduced ramping rate at flows below 1,000 cfs year-round, with the addition of a graduated ramping rate restriction over the first 4 days of ramping, after any sustained period of stable operations. The maximum ramping rate in the first,

second, and third days of peaking would be limited to 2, 4 and 6 inches per hour, respectively, after which PacifiCorp's proposed maximum ramping rate of 9 inches would apply. The effectiveness of this regime would be evaluated through monitoring, and adjusted as warranted, based on monitoring results. We conclude that this approach would ensure that adverse effects of ramping on trout populations and their forage based are minimized, and we include the graduated ramping restriction with monitoring and adaptive management in the Staff Alternative.

### **Copco No. 1 and Copco No. 2 Developments**

Currently, PacifiCorp voluntarily releases about 10 cfs of flow into the Copco No. 2 bypassed reach via leakage from the spill gates and from a small sluiceway. PacifiCorp proposes to maintain a minimum flow of 10 cfs in the Copco No. 2 bypassed reach, and to limit flow downramp rates to 125 cfs per hour (equivalent to less than 2 inches per hour) in the Copco No. 2 bypassed reach, except for flow conditions that are beyond the project's control.

Oregon Fish & Wildlife, Cal Fish & Game, NMFS and FWS all recommend that PacifiCorp release a minimum instantaneous minimum flow into the bypassed reach of 730 cfs or 40 percent of the inflow, whichever is greater. The Hoopa Valley Tribe recommends that PacifiCorp release a continuous minimum flow of 500 cfs or 70 percent of inflow to the project, whichever is greater, or total project inflow when inflow is less than 500 cfs. However, in its alternative section 18 prescription, the Hoopa Valley Tribe recommends the same flow regime as Oregon Fish & Wildlife, Cal Fish & Game, NMFS, and FWS.

Oregon Fish & Wildlife, Cal Fish & Game, and FWS recommend that ramp rates at Copco No. 2 dam not exceed 1 inch per hour at any time, and not exceed 300 cfs in any one 24 hour period. Cal Fish & Game also recommends that PacifiCorp operate the J.C. Boyle, Copco No. 1 and Copco No. 2 developments as run-of-river facilities in conjunction with meeting minimum target flows. As previously described, the Hoopa Valley Tribe recommends a ramping rate at all developments that ranges from 1.2 to 2.4 inches per hour.

An instream flow study conducted by PacifiCorp in the Copco No. 2 bypassed reach indicates that there is little instream habitat for the adult and juvenile life stages of rainbow trout and suckers at the current minimum flow of 10 cfs. Modeling results indicate that available habitat for juvenile and adult trout increases rapidly at flows of up to 75 cfs. Habitat at 10 cfs is only 55 and 33 percent of maximum WUA for juvenile and adult trout, but the available habitat increases to 80 and 63 percent of maximum WUA for juvenile and adult trout, respectively, at a flow of 75 cfs. Habitat for trout fry increases gradually from 46 percent of maximum at 10 cfs to 53 percent, 87 percent, and 95 percent of maximum WUA at flows of 75, 500, and 730 cfs, respectively. Although flows in excess of 500 cfs increase the available habitat for juvenile and adult trout, other physical constraints such as water quality conditions, especially water temperature, would continue to be a limiting factor for trout productivity in the reach. For example, the monthly average temperature of outflows from Copco reservoir exceeds 21°C in both July and August, and because of the small size of Copco No. 2 reservoir, it is likely that the temperature of water released into the bypassed reach would be similar, and would be too high to support a substantial trout fishery at any minimum flow. In addition, there are no known temperature refugia within the Copco No. 2 bypassed reach. The nearest coldwater refugia is in Fall Creek, and the amount of habitat that is accessible, is limited to the lower mile of the stream by an impassible falls. Summer water temperatures in lower Jenny Creek are only marginally suitable for supporting salmonids. We estimate that increasing the minimum flows to 70, 500 and 730 cfs would reduce the annual generation from the project by 4,280, 63,190, and 95,586 MWh, respectively, and reduce the annualized benefit of the project by \$217,380, \$3,122,410, and \$4,685,520. Because of the substantial gain in habitat area that would occur under a 70 cfs minimum flow and due to the high costs and limited improvement in fish habitat at higher minimum flows, we include a minimum flow of 70 cfs in the Staff Alternative. We conclude that this flow would

provide a substantial improvement in the condition of aquatic habitat and fish populations, and could be made from existing release gates without the need for extensive civil or structural modifications.

Downramping in this reach is rare and occurs primarily when Copco No.1 is coming off of a spill event or during scheduled maintenance shutdown of the Copco No. 2 powerhouse. Such events may strand some fish in the bypassed reach. PacifiCorp's proposed ramp rate of 125 cfs per hour is equivalent to less than 2 inches per hour in most flow ranges. A ramp rate of 1 inch per hour as recommended by Oregon Fish & Wildlife, Cal Fish & Game, and the Forest Service would also be protective of smaller fish and reduce the incidence of stranding, but may be more restrictive than is needed to protect fish in the reach given the limited nature of the fishery and the infrequent need for ramping. Because we consider the ramp rate sufficient to minimize stranding potential and due to its lower cost, we include in the Staff Alternative the 125 cfs per hour ramping rate.

Implementing run-of-river operations at Copco No. 1 and Copco No. 2 developments would reduce project benefits by \$231,590 and \$261,670, respectively, due to reduced generation during peak demand periods. Because both powerhouses discharge into reservoirs and outflows are reregulated in Iron Gate reservoir, peaking operations at these developments do not affect flows in any riverine areas, and no adverse effects from peaking operations in reservoirs have been reported. Accordingly, we do not include run-of-river operation at these developments in the Staff Alternative.

### **Fall Creek**

PacifiCorp proposes to increase the minimum flow that is released into the Fall Creek bypassed reach from 0.5 cfs to 5 cfs. Cal Fish & Game, Oregon Fish & Wildlife, and FWS recommend that a minimum of 40 percent of inflows be released into the Fall Creek bypassed reach, which would provide minimum flows between 14 and 22 cfs under typical flow conditions. Oregon Fish & Wildlife, Cal Fish & Game and FWS also recommend that ramp rates at Fall Creek diversion not exceed 1 inch per hour.

Fall Creek supports a population of rainbow trout, nearly all of which are smaller than 6 inches. Fish sampling conducted by PacifiCorp in July 2005 resulted in the capture of 15 trout in the bypassed reach, ranging in size from 2 to 8 inches, with an average size of 4 inches. Above the diversion, 9 trout were sampled ranging in size from 2 to 6 inches, with an average size of 4.5 inches. PacifiCorp reported that the catch per unit effort between the Fall Creek bypassed reach and above the Fall Creek diversion exhibited a fairly wide range (81.8 to 187.5 fish per hour), however the catch per 100 feet of stream was less variable, at 3.1 and 3.6, respectively. These results indicate that the trout populations in the two reaches are similar, despite the reduced flows in the bypassed reach. Public access to Fall Creek in the vicinity of the diversion dam is difficult, requiring four-wheel drive vehicles, and it is unlikely that this stream supports much angler use, given the relatively nearby peaking reach, which in California, is much more readily accessible.

PacifiCorp's instream flow analysis indicates that its proposed 5 cfs minimum flow would increase the available habitat in the bypassed reach by about 16 percent for fry, by 32 percent for trout juveniles (less than 6 inches), and by 28 percent for adult trout. Increasing minimum flows to 14 cfs as recommended by the agencies would increase the available habitat over current conditions by 21 percent for trout fry, by 52 percent for juveniles, and by 66 percent for adults. Increasing available habitat would potentially result in an increase in populations in the bypassed reach. However, given the similarity of trout populations upstream and downstream of the diversion, we expect that the higher flows recommended by the agencies would provide only a limited benefit to the fishery compared to PacifiCorp's proposed 5 cfs minimum flow. In addition, given the small size of the stream, the infrequent nature of ramping events and the remoteness of the facility, we conclude that imposing a 1-inch per hour ramping rate as recommended by the agencies would be a substantial burden to impose for a minimal benefit. We estimate that the annualized cost of implementing PacifiCorp's proposed 5 cfs minimum flow would reduce the annual generation from the project by 593 MWh, at an estimated annual cost of \$28,610, and that the agency-recommended flow of 14 to 22 cfs would reduce the annual generation from

the project by 5,061 MWh, and reduce the annualized benefit of the project by \$257,690. We conclude that PacifiCorp's proposed flow regime would improve fish habitat at a reasonable cost, and we include it in the Staff Alternative. We do not include the agency-recommended flow due to its high cost, limited additional benefit, and the limited nature of the fishery.

### **Spring Creek**

The Spring Creek diversion is located 0.5 mile upstream from the stream's confluence with Jenny Creek, and diverted flow is carried through a 1.7 mile-long canal before it enters Fall Creek about 1.7 miles upstream of the Fall Creek power canal diversion. In order to limit adverse effects on water temperatures in Jenny Creek during the summer months, PacifiCorp proposes to shut the Spring Creek diversion dam canal headgate so that no flow is diverted during July and August. For the remainder of the year they propose to position the slide gate to release 1 cfs of flow into the bypassed reach, if available. In their response to the REA notice, Oregon Fish & Wildlife, Cal Fish & Game, and FWS recommend that no flow diversion occur from June 1 through September 15, that 50 percent of inflows be released to the reach downstream of the diversion dam during the remainder of the year, and that ramp rates not exceed 1 inch per hour. However, in response to our draft EIS, all three agencies modified their recommendation, retaining the shutdown from June 1 through September 15, but recommending a 4 cfs minimum flow for the rest of the year.

Closing off the Spring Creek diversion in the summer months, as proposed by PacifiCorp and recommended by the agencies, would alleviate dewatering of the Spring Creek bypassed reach and increase the volume of cool water that Spring Creek contributes into lower Jenny Creek. Temperature monitoring conducted in three years when PacifiCorp was not operating the Spring Creek diversion (1995, 1996, and 1997), which we present in section 3.3.3.2.1, *Instream Flows*, indicate that inflows from Spring Creek reduce water temperatures in lower Jenny Creek during the summer months. In 1995 and 1996, the cooling effect was most pronounced during July and August, but in 1997 the cooling effect extended from June through mid-September. Although temperatures in lower Jenny Creek would still be above optimal during mid-summer in most years, closing off the diversion from Spring Creek during the warm season would limit the duration of highly stressful temperatures, and would likely provide a temperature refugium in Jenny Creek at its confluence with Spring Creek. We estimate that the annualized cost of shutting down the Spring Creek diversion from July 1 through August 31, as proposed by PacifiCorp, would reduce the annual generation from the project by 1,000 MWh, at an estimated annual cost of \$48,250, and shutting down the diversion from June 1 to September 15, and releasing 50 percent of the inflow to the diversion dam, as originally recommended by the agencies, would reduce the annual generation from the project by 2,020 MWh, at an estimated annual cost of \$97,330.

PacifiCorp's proposal of releasing a 1 cfs minimum flow (or inflow, if inflow is less than 1 cfs) at all other times would help to prevent dewatering in Spring Creek and help to maintain some aquatic habitat downstream of the diversion, although there are other diversions on Spring Creek that are not under PacifiCorp's control. The Oregon Fish & Wildlife, Cal Fish & Game, and FWS initial recommendation that 50 percent of the flow above the diversion be released to the reach downstream of the diversion dam from September 16 through May 31 regardless of flow volume would likely increase available habitat over current conditions. However, releasing 50 percent of the inflow would require some type of monitoring facility to determine the instantaneous release requirement as well as installation of facilities to accommodate changing release flows. In our draft EIS, we recommend PacifiCorp's minimum flow (1 cfs) because of the incremental cost of releasing the agencies' recommended higher flow, but we recommend the agencies' proposed period when no flow would be diverted because of additional habitat benefits that would be achieved. As indicated above, in response to our draft EIS, all three agencies modified their recommendation, retaining the shutdown from June 1 through September 15, but recommending a 4 cfs minimum flow for the rest of the year, as a compromise during the section 10(j) process. The agencies also provided additional information regarding the importance of protecting and enhancing habitat in Spring Creek and Jenny Creek, into which Spring Creek flows. We estimate that

the agencies' revised minimum flow recommendation (seasonal flow of 4 cfs), including shutdown of the diversion from June 1 through September 15, would reduce the annual generation from the project by 1,889 MWh, and reduce the annualized power benefit of the project by \$91,140. We conclude that the agencies revised 4 cfs flow recommendation would reduce trout and invertebrate mortality due to freezing in Spring Creek downstream of PacifiCorp's diversion, increase recruitment of trout and invertebrate drift into Jenny Creek, and provide a warm winter refugia for trout and suckers in Jenny Creek. Given the sensitive and unique populations of trout and suckers in Jenny Creek, we conclude that the benefit of providing the 4 cfs seasonal minimum flow from September 16 through May 31 would warrant the cost. However, given limited amount of habitat downstream of PacifiCorp's diversion, we expect that any additional benefit to the fishery from the higher flows initially recommended by the agencies would be minimal. We conclude that the 4 cfs revised minimum flow proposed by the agencies would provide an appropriate level of protection for trout habitat downstream of the diversion, and we include this minimum flow in the Staff Alternative.

### **Iron Gate**

The flow regime downstream of Iron Gate dam affects aquatic resources through its influence on physical habitat (depth, velocity, substrate and cover), water quality (especially water temperature), sediment transport processes (including effects on spawning habitat), and conditions that may influence the prevalence of disease pathogens and the spread of fish diseases. Iron Gate development is operated as a reregulating facility, and serves to eliminate daily flow fluctuations caused by peaking operation of the upstream J.C. Boyle and Copco developments. Since 1997, PacifiCorp has operated the project to provide instream flow releases that are established in Bureau of Reclamation's annual operating plans. PacifiCorp proposes to maintain the instream flow schedule and ramp rates below Iron Gate dam according to Reclamation's operating plans, which comply with Upper Klamath Lake water levels specified in a 2002 FWS BiOp to protect listed suckers and monthly Klamath River flow levels below Iron Gate dam specified in a 2002 NMFS BiOp to protect coho salmon. As described in section 3.3.2.1.1, *Water Quantity*, flow releases at Iron Gate dam were recently increased based on a ruling by the U.S. Ninth Circuit Court of Appeals that requires Reclamation to implement Phase III flows specified in the 2002 NMFS BiOp. These flows range between 1,000 and 1,300 cfs from July through February, increasing up to a maximum of 1,500 cfs in April and May of dry years and up to 3,025 cfs in May of above average and average water years. Ramp rates specified in the 2002 NMFS BiOp below Iron Gate dam are 50 cfs per 2 hours not to exceed 150 cfs in 24 hours when flows are 1,750 cfs or less, and 125 cfs per 4 hours or less, and 135 cfs per hour not to exceed 300 cfs in 24 hours when flows exceed 1,750 cfs.

The Hoopa Valley Tribe, Oregon Fish & Wildlife, Cal Fish & Game, and Forest Service recommend monthly flows that are based on the Hardy Phase II flow study conducted by Interior (Hardy and Addley, 2001). Monthly flows recommended by the Hoopa Valley Tribe match the Hardy Phase II flow recommendations for each water year type, which are based on annual flow exceedance values of 10, 30, 50, 70, and 90 percent. To minimize disease risk associated with low flows, Cal Fish & Game recommend that an absolute minimum flow of 1,200 cfs be released in all months and water year types. Oregon Fish & Wildlife applies the same minimum flow of 1,200 cfs in dry years, but not in below average water years. The Forest Service recommended that the 1,200 cfs minimum flow apply to all year types, but only for the months of August and September.

Although Oregon Fish & Wildlife and Cal Fish & Game indicate that application of the 1,200 cfs absolute minimum flow was their only change from the Hardy Phase II flows, the monthly flows that they provided in tabular form deviate substantially from the Hardy Phase II flows in dry water years. This may be a typographical error, however, because their dry year flow recommendations appear to correspond with the Hardy Phase II flows, with the exception of the 1,200 cfs absolute minimum flow, if they are shifted by 3 months.

Oregon Fish & Wildlife states that its flow recommendations are target flows, and that if the target flows are not available, PacifiCorp should pass inflows to Iron Gate reservoir downstream of Iron Gate dam. Cal Fish & Game recommends that, if inflows drop below the recommended minimum flows, PacifiCorp should draft Iron Gate reservoir to elevation 2,322 feet, using the available active storage to maintain the minimum flow. After the reservoir elevation drops to below 2,322 feet, Cal Fish & Game recommends that operations at Iron Gate dam convert to run-of-river, with outflow equal to the 3 day running average of inflow. The Forest Service recommends that, when the recommended flows are not available, Iron Gate dam be operated as a run-of-river facility. NMFS and FWS recommend that, with the exception of biologically based pulse releases, the project be operated as a run-of-river facility. Releases from Iron Gate dam would equal the combined instantaneous inflow to the project including tributary inflow, spring accretion flow, irrigation return flows, and releases made by Reclamation from its Klamath Irrigation Project. Oregon Fish & Wildlife recommends that Iron Gate dam be generally operated as a run-of-river facility.

NMFS recommends the ramping rates specified in the 2002 NMFS BiOp, and Oregon Fish & Wildlife and FWS recommends the same ramp rates, except that when flows are above 1,750 cfs, downramping would be limited to 125 cfs per hour (this may be another typographical error) instead of 125 cfs per 4 hours. Cal Fish & Game and Forest Service recommend that controllable ramp rates not exceed 1 inch per hour at any time.

Based on our estimate of the current storage capacity of the project reservoirs (see table 3-12), PacifiCorp controls a total of 12,244 acre-feet of storage in the five mainstem reservoirs that are part of the current project. This represents only 2.5 percent of the storage that is controlled by Reclamation in Upper Klamath Lake, or enough water to augment river flows by about 2,000 cfs for 3 days. This volume of water may be useful for contributing flow during short-term events, but is not sufficient to allow substantial, long-term augmentation over inflows.

Based on our analysis in section 3.3.3.2.3, *Disease Management*, we conclude that development of an effective disease management plan may be essential to prevent the further decline of populations of fall Chinook salmon in the Klamath River Basin, and the potential spread of disease to other salmonid species. Two components that could be included in such a plan would be evaluating the use of high flow releases prior to the juvenile fall Chinook outmigration to reduce pathogen densities, and increasing flows during the migration season to reduce the density of pathogens, expedite fish movement, and reduce water temperatures during the juvenile fall Chinook outmigration season. In section 3.3.3.2.1, *Instream Flows*, we compared flows that occurred during the 2006 outmigration, when few fish were infected (based on currently available results from sampling conducted through June 7, 2006), with five recent years when substantial mortalities were observed (1997, 2000, 2002, 2004, and 2005). We concluded from this analysis that flows in the range of 3,000 cfs during the outmigration season (May through July) have the potential to alleviate disease-related mortality and to protect the run of fall Chinook salmon from further decline. We also conclude that maintaining flows on the order of 3,000 cfs for an extended period is clearly beyond the range of flow volumes that can be provided using the active storage that is available in the project reservoirs. Accordingly, in section 3.3.3.2.3, *Disease Management*, we discuss the potential for PacifiCorp to develop a disease management plan in consultation with Reclamation and other stakeholders to consider opportunities for coordinating the use of available storage in the most effective manner possible.

Because of the limited storage capacity that is under PacifiCorp's control, we conclude that PacifiCorp's proposal to maintain the instream flow schedule below Iron Gate dam according to Reclamation's Klamath Irrigation Project Operations Plans is reasonable and appropriate. We see little benefit in Cal Fish & Game's recommendation that PacifiCorp use the active storage in Iron Gate reservoir to maintain target flows when inflows drop below their recommended monthly flow regime. The limited storage that is available in PacifiCorp's reservoirs would be most valuable for use during short-term emergencies when immediate flow increases are needed to avert impending fish losses based

on observed increases in fish losses or adverse water quality conditions. Because of Iron Gate reservoir's proximity to the lower Klamath River, it could be used to augment flows more quickly in emergency situations than flows released from Upper Klamath Lake. These could include releases of cool water from the hypolimnion to provide some short-term cooling of flows below Iron Gate dam. The potential for using releases from the hypolimnion, including potential adverse effects on the supply of cool water for Iron Gate Hatchery, could be evaluated under the temperature management plan that we discuss in section 3.3.2.1.2, *Water Quality*.

We also see little benefit in the Forest Service's recommendation that Iron Gate dam be operated as a run-of-river facility when inflows drop below their recommended flows or Oregon Fish & Wildlife's recommendation that Iron Gate dam should be generally operated as run-of-river. Iron Gate dam serves an important re-regulating function to smooth out flow fluctuations from peaking operations at the upstream J.C. Boyle and Copco developments. Implementing run-of-river operations at Iron Gate dam while continuing peaking operations at the upstream developments would result in substantial flow fluctuations downstream of Iron Gate dam and would violate ramping rates specified in the 2002 NMFS BiOp. It also could adversely affect aquatic resources through fish stranding, reduced invertebrate production, disruption of spawning activity, and dewatering of salmon redds.

In addition, we see little benefit in the recommendation made by NMFS and FWS that, with the exception of biologically based pulse releases, the project should be operated run-of-river with releases from Iron Gate dam equal to the combined instantaneous inflow to the project including tributary inflow, spring accretion flow, irrigation return flows, and releases made from the Klamath Irrigation Project. Because irrigation return flows to Keno reservoir can vary by up to 775 cfs over a 24 hour period, this could result in substantial flow variations downstream of Iron Gate dam and violation of ramping rates specified in the NMFS 2002 BiOp.

PacifiCorp reports that the ramp rates stipulated in the 2002 NMFS BiOp equate to about 0.4 inch per hour 0.5 mile below the dam. Based on 10 available cross sections between Iron Gate dam and Interstate 5 from Hardy and Addley (2001), PacifiCorp estimates that 0.4 inch per hour at the USGS gage equates to about 0.25 inch per hour in wider areas of the river where stranding potential would be the greatest, and that ramping rates become further attenuated downstream.

Because fish stranding is rarely observed at current ramping rates (PacifiCorp reports only one incident, which occurred at a flow level higher than those that can be controlled by the project), we conclude that the current rates specified in the 2002 NMFS BiOp appear to be protective of salmonids rearing and emigrating through the lower Klamath River. PacifiCorp reports that the current ramp rates equate to a stage change of less than 0.4 inch per hour 0.5 mile downstream of Iron Gate dam, which is equal to or more conservative than the ramping rates recommended by the agencies for this development. Although it is possible that less conservative ramping rates may be nearly as protective, given that PacifiCorp has not reported any substantial operational difficulties or adverse economic effects related to compliance with these ramping rates, we include them in the Staff Alternative because they would minimize any potential for adverse effects on federally listed coho salmon and because of the importance of the fall Chinook salmon fishery in the mainstem of the Klamath River.

If Copco No. 1 and Iron Gate dams were removed, imposing the BiOp ramp rates on flows released from the project would essentially require run-of-river operation at the remaining developments, since Copco No. 2 reservoir has very limited storage capacity that could be used to reregulate flows. This would cause an annual reduction in benefits of \$725,200 at J.C. Boyle and \$261,670 at Copco No. 2, due to reduced generation during peak demand periods.

If coho salmon are delisted in the future, we conclude, in our draft EIS, that a year-round ramping rate of 2 inches per hour as measured at the Iron Gate gage with an additional maximum daily limit of 12 inches during the Chinook salmon spawning and incubation period would likely be sufficiently protective, in conjunction with monitoring and provisions for adaptive management. A ramping rate of 2

inches per hour is generally accepted as being sufficient to protect rearing salmonids from stranding in most cases, and the 12 inch daily limit during the spawning and incubation season should prevent redds from being dewatered, but monitoring would be necessary to confirm that these restrictions are sufficiently protective. In response to our draft EIS, FWS provided an alternative approach to establishing an appropriate flow regime downstream of Iron Gate dam, if flows and ramping rates are not specified in any future Reclamation project Operations Plan. PacifiCorp would develop an Iron Gate flow release plan within 6 months of issuance of the Operations Plan. Flows specified in the Operations Plans in effect at the time of new plan issuance would remain in effect until the Commission approves the new flow release plan. Any such flow schedule and ramp rate would be developed in coordination with Reclamation and be consistent with Klamath Irrigation Project operations. PacifiCorp would also develop the plan in consultation with Cal Fish & Game, Oregon Fish & Wildlife, NMFS, FWS, and the tribes. We consider this to be a reasonable measure that would not have any identifiable incremental cost to PacifiCorp and include this measure in the Staff Alternative.

### **5.2.6 Anadromous Fish Restoration**

Numerous stakeholders have expressed strong interest in restoring anadromous fish to habitat within and upstream of the project area, either through implementing fish passage measures at project facilities or through dam removal. A successful anadromous fish restoration program would increase fish production by allowing anadromous fish to use historical production areas within and upstream of the project and would provide access to important thermal refugia, most notably in the J.C. Boyle bypassed reach and in tributaries upstream of Upper Klamath Lake. Restoration of anadromous fish upstream of Iron Gate dam could restore tribal and recreational fisheries over a very large geographical area (extending over more than 350 miles of riverine habitat), and could contribute to recovery of the SONCC coho salmon ESU. Increasing the abundance and geographic distribution of anadromous fish would increase the genetic diversity and resiliency of populations, and would help to restore and protect tribal, commercial and recreational fisheries both upstream and downstream of Iron Gate dam. Anadromous fisheries were recognized as an outstandingly remarkable value when the 189-mile-long lower Klamath River (extending from 3600 feet downstream of Iron Gate dam to the Pacific Ocean) was designated by Congress as a Wild and Scenic River in 1981.

In the draft EIS, we evaluated three distinct approaches to restore anadromous fish to areas upstream of Iron Gate dam. NMFS/Interior's preliminary fishway prescription, filed on March 27, 2006, involves the installation of volitional passage facilities at all project dams, but includes a trap-and-truck option for transporting juvenile and adult fish past Keno reservoir when water quality conditions are adverse. We also evaluate a PacifiCorp alternative to NMFS/Interior's preliminary prescription filed on April 25, 2006, which involves initiating feasibility studies to be followed by a trap-and-truck approach to provide passage between Iron Gate dam and J.C. Boyle reservoir, if studies indicate that establishing self-sustaining runs of anadromous fish is possible. The third approach involves the removal of some or all of the mainstem dams, and our analysis in the draft EIS focuses on removing Copco No. 1 and Iron Gate dams, which present the greatest challenges to fish passage and addressing water quality concerns.

NMFS/Interior filed a modified joint fishway prescription on January 26, 2007. The modified prescription retains the same overall approach as the preliminary prescription, with several modifications: (1) it includes provisions that would allow the need for and design of spillway modifications and tailrace barriers to be determined based on site-specific studies; (2) it would allow the need for measures to improve passage in the Copco No. 2 bypassed reach (by modifying the rock ledge or bypassed flows) to be determined based on an evaluation of fish passage under normal operating flows in the new license; and (3) the existing ladder and holding tanks at Iron Gate dam would be modified to allow the collection and handling of resident trout and lamprey.

PacifiCorp filed a second alternative fishway prescription on December 1, 2006, which would include the construction of volitional downstream fishways at each dam consistent with NMFS/Interior's

prescription, implementing an adult trap and haul program, initially using the existing collection facilities at Iron Gate dam, and constructing a second adult trap below Copco No. 2 dam. Construction of downstream passage facilities would be deferred for 4 years during which PacifiCorp would conduct juvenile reservoir and spillway survival studies, and PacifiCorp could recommend modifying the prescription for downstream fishways based on study results. This alternative prescription also would commit PacifiCorp to fund, sponsor and participate in a technical committee to provide input to project-related fish passage, hatchery, anadromous fish restoration, and enhancement measures consistent with articles included in the new license. PacifiCorp also would commit to the construction of tailrace barriers and spillway modifications and a new upstream fishway at J.C. Boyle if these facilities are determined to be needed based on the results of monitoring studies, and to provide additional hatchery compensation if an upstream passage survival rate of less than 95 percent is observed. This alternative prescription also includes a commitment to fund 100 percent of the marking of fish produced at Iron Gate Hatchery, and a mechanism for reducing hatchery production over time according to the number of juvenile fish produced upstream of Iron Gate dam.

In the draft EIS, we recommend a 3-year study program intended to determine which of the project reaches showed the greatest potential for the restoration of anadromous fish. This would be followed by the development and implementation of appropriate fish passage and habitat restoration measures for one or more reaches that would be targeted for initial restoration efforts. Many of the entities commenting on the draft EIS object to delaying the implementation of fish passage while the 3-year study was conducted, and they express some uncertainty regarding the number of reaches targeted for restoration.

In response to these comments, we re-evaluated our proposed approach, taking into consideration a substantial amount of relevant information that was filed with the Commission since the draft EIS was issued, mostly from the record of the EAct trial-type hearing. We agree with the commenters that the draft EIS is not clear about the number of reaches where passage would be restored. We also agree that it would be beneficial if the passage of anadromous fish to upstream habitat commenced earlier, and was not delayed by a multi-year study program.

We revised our recommended approach in a manner that would allow the recolonization of several key upstream habitats to occur within 2 years after license issuance, including J.C. Boyle peaking reach, J.C. Boyle bypassed reach, and Spencer Creek. To accomplish this, the adult collection facility at Iron Gate dam would be upgraded to facilitate fish collection; handling and improvements to the J.C. Boyle fish ladder would be implemented within 2 years. We note that recolonization of these key habitats would not occur until 6 years after license issuance under NMFS/Interior's modified fishway prescription.

Our revised approach includes the construction of a downstream passage and collection facility at J.C. Boyle dam within 2 years. The facility would be designed to meet NMFS screening criteria and would be used to provide initial downstream passage via trap and haul. The facility also would be used to collect naturally reared smolts for use in fish passage studies designed to address two critical uncertainties, which we discuss below. Using naturally reared smolts in these studies would provide a more reliable assessment of smolt passage behavior and migration success than PacifiCorp's earlier radio telemetry studies, which used hatchery smolts. Hatchery smolts are typically less physiologically fit and lack the predator avoidance responses that naturally reared fish develop in a river environment.

The first critical uncertainty is whether substantial losses of outmigrating salmon smolts would occur during passage through project reservoirs under the NMFS/Interior prescriptions and under PacifiCorp's December 1, 2006, alternative prescription, and whether these losses could be reduced using a trap-and-truck approach for downstream passage, or by implementing a seasonal drawdown of Copco and Iron Gate reservoirs down to the minimum level that allows power production to continue. In section 3.3.3.2.5, *Anadromous Fish Restoration*, we discuss three areas in which our conclusions relating to reservoir passage differ from the conclusions that were drawn by the ALJ on this issue, in the EAct 2005

proceeding. First, the ALJ concluded that all anadromous species would outmigrate before the onset of high water temperatures, based in part on the assumption the migration of fall Chinook salmon smolts would be complete by the beginning of April. Our analysis indicates that most hatchery and natural fall Chinook salmon outmigrate during July and August, when water quality conditions are highly stressful for salmonids. Second, the ALJ concluded that predation on outmigrating juvenile anadromous salmonids is a slight problem that could be minimized through use of unspecified remedial measures, and that few predacious fish exist in the project reservoirs. Our analysis indicates that yellow perch are abundant in project reservoirs, and that this species had been found to be a major predator on fall Chinook salmon smolts in slackwater environments. Third, the ALJ concluded that because anadromous salmonids currently complete their life cycles through eight dams and reservoirs on the Columbia and Snake rivers, they should be able to migrate through the five project reservoirs on the Klamath. Our analysis reveals four factors relevant to this conclusion that need to be considered: (1) that all of the salmon and steelhead ESUs in the Snake River are subject to heavy rates of hatchery supplementation; (2) that adult return rates to the Snake River are very low despite extensive measures that are undertaken each year to improve migration survival including extensive spill, smolt transportation, and predator control programs; (3) that critical water quality parameters are considerable more adverse in the Klamath River; and (4) that lower water velocities in the Klamath reservoirs are likely to result in slower rates of migration and increased exposure to predation. Considering these four factors, we are not convinced that observed successes with volitional passage on the Snake River would be necessarily transferable to the Klamath River.

The second critical uncertainty is whether substantial losses of outmigrating salmon smolts from infection with *C. shasta* and *P. minibicornis* would continue and perhaps escalate in the future, and whether measures can be implemented that would reduce these losses. We conclude that substantial disease losses are likely to continue and have the potential to become more severe given the current basin-wide trend of increasing water temperatures, unless substantive measures are implemented to reverse disease occurrence downstream of Iron Gate dam. As discussed in section 3.3.3.1.4, *Diseases Affecting Salmon and Steelhead*, *C. shasta* infection rates among sampled fall Chinook smolts averaged about 40, 19, 70, and 45 percent in 2001, 2002, 2004 and 2005, and Foott et al. (2004) concluded that most smolts with detectable levels of *C. shasta* infection were likely to die from the disease. Based on these data, we conclude that even a slight increase in average water temperatures, or other factors that may increase susceptibility to disease, could continue a long-term decline in the fall Chinook salmon fishery in the very near future.<sup>166</sup> We also conclude that increased prevalence of infection among fall Chinook salmon would increase the potential for losses of coho salmon due to infection with *C. shasta*.

Under the Staff Alternative, these critical uncertainties would be addressed as part of an integrated program to identify the most effective methods for addressing important project effects on fish passage, water quality, and fish disease. This integrated approach, which we describe in detail in section 3.3.3.2.5, would be refined and implemented in close consultation with a technical advisory committee that would include representatives from Oregon Fish & Wildlife, Oregon Environmental Quality, California Fish & Game, the Water Board, Interior, NMFS, and the Klamath Inter-tribal Work Group. This committee would also coordinate anadromous fish restoration activities with Iron Gate Hatchery operations. We estimate that the annual administrative costs of this committee would be approximately \$10,000, and the benefits of input from committee members would warrant this relatively minor cost.

In the first year of our proposed integrated approach, PacifiCorp would begin work with the committee to develop a Phase I implementation plan for Commission approval that would identify proposed restoration efforts and studies that would be conducted over the first 4 to 6 years of the program. These studies would be designed to determine the most beneficial approaches for providing fish passage

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<sup>166</sup>Due to a number of factors, including large variations in ocean survival, short-term trends in the fishery are highly variable, as reflected in the high adult returns currently predicted for 2007.

and for addressing project effects on water quality and fish diseases. PacifiCorp would work with the advisory committee to develop annual monitoring and implementation reports that summarize the results of monitoring studies conducted to date, describe actions that have been implemented in the previous year, and actions that are proposed to be implemented in the coming year following Commission approval. After critical uncertainties related to fish passage and disease management have been fully addressed, PacifiCorp would work with the advisory committee to develop a Phase II implementation plan for Commission approval that would describe the schedule and approach for implementing fish passage measures, as well as disease management, monitoring, and study efforts to be continued into the future. The Phase II implementation plan would also include provisions for implementing adaptive management based on monitoring and study results. Each of the implementation plans and annual reports would be developed in consultation with the technical advisory committee. A draft of each plan and report would be provided to the consulted parties for comment, and final reports and plans would be filed with the Commission, for approval, as appropriate, and would include a discussion of comments received on the drafts, and describing how the comments were addressed in the final report.

During Phase I of our recommended approach, the restoration of anadromous fish to historic habitat would be initiated in the first year following license issuance by modifying the adult collection facility at Iron Gate dam to facilitate holding and loading of anadromous fish into trucks, and within 2 years after license issuance, initiating the trucking of adult fall Chinook salmon to habitat upstream of Copco No.1 and J.C. Boyle dams. In addition, surplus coho salmon that return to Iron Gate Hatchery would be transported to habitat in Spencer Creek. A downstream fish passage and collection facility meeting NMFS criteria would be designed and constructed at the J.C. Boyle development within 2 years after license issuance. The facility would be used to collect downstream migrating smolts for use in passage studies, and additional smolts would be collected using screw traps at the head of Copco reservoir. Collected smolts would be used in radio telemetry studies to determine the survival rate of naturally produced smolts during passage through project reservoirs, over project spillways, through project powerhouse turbines, during transport over different distances, and during passage through different sections of the lower Klamath River. Adult telemetry studies would be used to evaluate transport mortality, migration survival, effectiveness of existing fish ladders, and to monitor spawning activity. The juvenile and adult telemetry studies would be conducted over a 2 to 4 year period.

Phase I studies also would include an evaluation of the effects of decreased reservoir volume on reservoir passage survival, downstream water quality conditions, pathogen densities and microcystin concentrations. Reservoir drawdown could improve migration survival by increasing water velocities and migration speed, which may reduce mortality caused by predation or adverse water quality conditions in the reservoirs. Drawdown may also reduce the severity of algal blooms and resultant adverse effects on downstream water quality. This evaluation would involve an experimental drawdown of Copco and Iron Gate reservoirs to minimum operating pool, from May through November.<sup>167</sup>

In the fifth year after license issuance, PacifiCorp would develop a Phase II implementation plan that evaluates alternative approaches for providing upstream and downstream fish passage at each project dam and the potential effects of each alternative approach on water quality conditions and disease incidence downstream of Iron Gate dam. The plan would also describe a proposed schedule and approach for implementing fish passage and disease management measures, study efforts and monitoring to be continued into the future, and provisions for adaptive management based on study and monitoring results. Development of the Phase II implementation plan could be deferred for up to 2 years if additional studies

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<sup>167</sup>We estimate that the volume and area of Copco and Iron Gate reservoirs would be reduced by about 40 percent and surface area would be reduced by 25 to 30 percent if the reservoirs were drawn down to minimum operating pool, which we estimate to be about 22 feet below the normal pool level at both reservoirs.

are determined to be necessary. The plan could include provisions for experimental passage of other anadromous species, if desired, including spring Chinook salmon, steelhead, and Pacific lamprey.

The recommended two-phased integrated approach would address critical uncertainties related to fish disease by collecting additional baseline data on water quality conditions and pathogen density downstream of Iron Gate dam, evaluating the effect of a high pulse flow implemented during the reservoir drawdown study on the abundance of fish pathogens and the incidence of fish disease, evaluating infection rates in different reaches of the river after the pulse flow, and studying other potentially viable approaches for controlling fish diseases. Water quality monitoring would be conducted to document the effect of pulse flows, spills, and reservoir drawdown on water quality conditions, focusing on conditions that may contribute to disease susceptibility and mortality, including concentrations of the microcystin toxin. We included costs for installing continuous water temperature, DO, and pH monitoring equipment at six locations on the Klamath River downstream from Iron Gate dam and at four major tributaries, and for spot-checks at each site every 2 weeks from March through December of the following parameters: (1) un-ionized ammonia; (2) microcystin concentration; (3) attached algae species composition and biomass; (4) *M. speciosa* (*C. shasta*'s polychaete alternate host) density; and (5) infection rate of *M. speciosa* with *C. shasta* and/or measurement of pathogen spore density using quantitative polymerase chain reaction (QPCR) assays.

The recommended integrated approach would also include monitoring studies to assess fish stranding in the J.C. Boyle peaking reach and spawning of anadromous fish in all reaches that are affected by project operations (J.C. Boyle bypassed and peaking reaches, Copco No. 2 bypassed reach, and the accessible portions of Fall and Jenny creeks), starting in the first year following license issuance. Based on the results of the monitoring studies, refinement of the graduated ramping rates and minimum flows and of sediment augmentation measures that we include in the Staff Alternative may be considered and implemented during Phase II, if warranted.

We estimate that implementing fish passage components of the integrated fish passage and disease management program described above would have an annualized cost of \$4,515,440, and would reduce annual generation from the project by an average of 1,151 MWh.<sup>168</sup> We estimate that water quality and disease monitoring components would have an annualized cost of \$393,570. If drawdown of Copco or Iron Gate reservoirs is required for more than 1 year to resolve critical uncertainties or to address adverse project effects on fish passage or disease incidence, this would result in an additional annual cost in lost energy of \$286,800 for a seasonal drawdown of Copco reservoir (5,944 MWh) and \$384,260 for a seasonal drawdown of Iron Gate reservoir (7,964 MWh), and would cause additional adverse effects on reservoir recreation during the drawdown period. In section 3.3.3.2.5, *Anadromous Fish Restoration*, we estimate that provision of passage over Iron Gate, Copco No. 1 and J.C. Boyle dams<sup>169</sup> would provide access to approximately 3.4, 25.6, and 19.4 miles of riverine habitat, respectively,

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<sup>168</sup>For cost estimating purposes, we assumed that the passage approach that is ultimately implemented would include modifications of the existing ladders at Iron Gate dam and Iron Gate hatchery to facilitate the loading of adult anadromous fish onto trucks, modification of the J.C. Boyle fish ladder, installation of fish screening facilities meeting NMFS juvenile fish screening criteria at J.C. Boyle dam and at the head of Copco No. 1 reservoir, and downstream trap and haul of smolts from the head of Copco No. 1 reservoir to below Iron Gate dam. We also assumed that the drawdown of Copco and Iron Gate reservoirs would occur in only one year.

<sup>169</sup>The miles of habitat and fish production estimates presented here do not include 350 miles of habitat in the upper basin that would be made available if anadromous fish are able to migrate successfully through Upper Klamath Lake and Keno reservoir. Both of these water bodies present potential impediments (but not necessarily insurmountable) to migration due to adverse water quality conditions during parts of the year. Successful restoration of anadromous fish to this habitat would be dependent on the timing of smolt outmigration and on future changes in water quality conditions.

and that this habitat could support about 1,200, 5,800, and 4,200 adult fall Chinook salmon spawners, respectively. Restoring passage to one or more of these reaches would alleviate fish crowding downstream of Iron Gate dam, which could reduce disease incidence, and could provide a substantial increase in anadromous fish production. This increase in fish production would benefit commercial, recreational, and tribal fisheries, and these benefits could amount to tens of millions of dollars annually if the harvest restrictions that have been imposed to protect the escapement of naturally spawning fall Chinook salmon to the Klamath were relaxed or eliminated. Providing passage to any of these three reaches would also provide access to substantial tributary habitat that is suitable for spawning and rearing of steelhead and coho salmon, and may contribute to the restoration of spring Chinook salmon. Providing passage upstream of Iron Gate dam would allow access to Jenny and Fall creeks; passage over Copco No. 1 dam would provide access to Long Pine and Shovel Creeks; and passage over J.C. Boyle would provide access to Spencer Creek. Based on the potential substantial benefit to commercial, recreational and tribal fisheries, federally listed coho salmon, tribal cultures, and the economy of coastal communities, we include implementation of the integrated fish passage and disease management program as part of the Staff Alternative, despite its substantial cost.

We estimate that implementing Interior/NMFS's modified fishway prescription at proposed mainstem project dams (excluding facilities at Spring and Fall creeks, which we address in the next section) would reduce the annual benefit of the project by \$25,987,150<sup>170</sup> and would reduce annual generation from the project by 17,772 MWh. We estimate that PacifiCorp's April 25, 2006 alternative fishway prescription would have an annualized cost of \$3,884,200, and would reduce annual generation by 228 MWh. We estimate that PacifiCorp's December 1, 2006 alternative prescription, excluding facilities at Spring and Fall creeks, would have an annualized cost of \$16,331,560,<sup>171</sup> and would reduce annual generation by 1,006 MWh. Because of the critical uncertainties relating to passage through project reservoirs and future disease effects (discussed above), we cannot predict, with any degree of certainty, the benefits associated with implementing the preliminary and modified prescriptions or PacifiCorp's April 25, 2006, or December 1, 2006, alternative prescriptions and, given this high degree of uncertainty, we conclude there is a reasonable chance that very little benefit would be provided, despite the high cost of these measures.

Interior recommends that PacifiCorp be required to develop a Pacific lamprey management plan, which would include monitoring lamprey outmigrating through the project and the effects of reservoir fluctuations on rearing habitat, to be followed by developing and implementing plans to modify or replace existing structures and operations to achieve upstream and downstream passage levels commensurate with the best levels achieved elsewhere in the basin. As we discuss in section 3.3.3.2.5, *Anadromous Fish Restoration*, we consider it unlikely that the migration studies recommended by FWS would identify structural or operational changes that would allow juvenile lamprey to migrate successfully through the project. Our analysis indicates that the Pacific lamprey is a weak-swimming species and very vulnerable to predation, and we found no evidence that this species can migrate successfully through large reservoirs such as Copco and Iron Gate. We also found that the species is vulnerable to impingement on fish screens, that there is no conclusive evidence that the species occurred historically upstream of Iron Gate dam, and that no Pacific lamprey have been observed entering the fish ladders at Iron Gate hatchery. Because we were not able to identify potential changes in project structures and operations that would

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<sup>170</sup>The tailrace barriers, spillway modifications, and removal of the bedrock sill in the Copco No. 2 bypassed reach prescribed by Interior and NMFS would not be implemented if PacifiCorp can demonstrate that they are not needed, based on site-specific studies. To estimate the cost of the modified prescription, we have assumed that spillway modifications would be required at Copco No. 1 and Iron Gate dams, but that the other measures would not be implemented.

<sup>171</sup>Our estimated cost for PacifiCorp's December 1, 2006 alternative assumes that all downstream passage facilities would be constructed.

provide effective passage for this species, we were not able to estimate the cost of plan implementation. We conclude that developing and implementing the study portion of the plan, which we estimate would have an annualized cost of \$111,930, would be unlikely to lead to the development of effective passage for this species, and as a result we conclude that the potential benefits of the measure do not warrant its cost. We note, however, that our integrated fish passage and disease management plan would allow for experimental passage to be provided by trapping and trucking lamprey around the project reservoirs, if adult lamprey are available and passage of this species is determined to be warranted by the fisheries technical committee.

Removal of Iron Gate and Copco No. 1 dams would restore a substantial amount of spawning and rearing habitat for fall Chinook salmon that is currently inundated by the reservoirs associated with these dams and facilitate passage of anadromous fish to habitat upstream of these dams; it also could play an important role in reducing the incidence of fish disease in the Klamath River downstream of Iron Gate dam. Removal of Iron Gate dam, however, would also eliminate the cool water supply to Iron Gate Hatchery, and ceasing hatchery operations would likely necessitate fishery restrictions for at least several years while anadromous fish stocks become established in newly accessible habitat. The removal of Copco No. 2 and J.C. Boyle dams and reservoirs would provide a more limited benefit to anadromous fish restoration efforts because of the smaller amount of inundated habitat, the less substantial obstacle that these reservoirs pose to implementing fish passage, and their more limited effects on downstream water quality. Because dam removal has the potential to influence sediment transport, water quality, severity of fish diseases, and other resources, we discuss the effects of dam removal on all affected resources later in section 5.2.21, *Dam Removal*.

### **5.2.7 Fish Disease Management**

In section 3.3.3.2.3, *Disease Management*, we conclude that the project likely contributes to the incidence of fish disease downstream of the project by (1) increasing the density of spawning adult fall Chinook salmon downstream of Iron Gate dam; (2) promoting the development of attached algae beds that provide favorable habitat for the polychaete alternate host for *C. shasta* and *P. minibicornis*; and (3) contributing to water quality conditions that increase the stress level of juvenile and adult migrants and increase their susceptibility to disease. High infection rates of *C. shasta* and *P. minibicornis* observed in juvenile fall Chinook migrants in 2004 and 2005, and mortality rates observed during juvenile migration monitoring, indicate that losses of juvenile migrants may be having a substantial effect on fall Chinook salmon populations in the Klamath basin. Out-migrant sampling conducted by FWS in 2004 indicated that high infection rates were associated with immediate mortality rates of juvenile fall Chinook salmon that exceeded 70 percent during June and July, when the majority of fall Chinook smolts outmigrate. Monitoring results from 2005 indicate that infection rates with *C. shasta* increased to levels of 70 percent or more by late April. Because most fish infected with *C. shasta* are expected to die, it is likely that the percentage of the smolt population that is lost from disease may exceed 70 percent in some years. Monitoring data from both years indicate that both infection and mortality rates tend to increase rapidly with increasing water temperatures. Given the general trend of increasing water temperatures in the basin over the last several decades reported by Bartholow (2005), there is strong potential that disease-related mortality of both juvenile and adult migrants could increase in the future and contribute to a continued decline in the fishery for fall Chinook salmon. We note that toxins produced by blooms of *Microcystis* algae are also likely to increase fish stress and disease. In this section we evaluate approaches for evaluating and implementing measures to control the incidence of fish disease in the lower Klamath River.

In section 3.3.3.2.4, *Dam Removal or Decommissioning*, we conclude that the elimination of Iron Gate and Copco reservoirs would likely reduce fish stress and disease susceptibility by moderating fluctuations in DO and pH associated with algae blooms, increasing DO levels through natural aeration from turbulent passage of water in areas of higher gradient that are inundated by the reservoirs, and

reducing levels of ammonia in downstream areas. In addition, expanding the length of river that is accessible to anadromous fish would reduce the crowding of adult fall Chinook salmon that currently occurs on the spawning grounds downstream of Iron Gate dam, which would reduce pathogen density and the transmission of disease. However, because of the substantial costs of dam removal, and due to the urgency of the disease situation in the lower Klamath River, we also evaluate measures in the draft EIS that involve developing and implementing approaches for reducing the incidence of fish diseases downstream of Iron Gate dam through a disease monitoring and management plan. We concluded that if disease issues are not addressed effectively within the next several years, there is a risk that the fall Chinook salmon fishery could suffer a further, dramatic decline, and that an increased prevalence of disease pathogens may affect other salmonid species including the federally listed coho salmon ESU.

Therefore, in the draft EIS, we recommend that PacifiCorp develop a disease management program, and we suggest 12 measures that should be considered. However, commenters stated that the plan was not specific enough, and that the proposed approach provided little assurance that the plan would be effective. We agree with the commenters regarding the lack of specificity, and have developed a more specific plan in this EIS that integrates the assessment of potential disease control measures with an aggressive approach to determining the factors that contribute to losses of juvenile fall Chinook salmon associated with *C. shasta* infection, and their relationship to project effects on water quality conditions downstream of Iron Gate dam. As we describe in the preceding section, the program would be developed and refined in close consultation with a technical advisory committee, and would be fully integrated with experiments and monitoring studies designed to address critical uncertainties related to the restoration of anadromous fish to habitat upstream of Iron Gate dam. We estimate that the water quality and disease monitoring components of the integrated plan would have an annualized cost of \$393,570, and that implementing these components would assist with identifying and implementing effective approaches to reduce project-related losses of juvenile migrating fall Chinook and coho salmon from infection with *C. shasta* infection. We conclude that this plan would be more effective than the approach recommended in the draft EIS. Because developing effective approaches to control fish disease in the Klamath River has the potential to provide substantial benefits to the important fall Chinook salmon fishery and the federally listed SONCC coho salmon, we conclude that the benefits of the water quality and disease components of the integrated plan warrant their costs, and we have included them as part of the Staff Alternative.

### **5.2.8 Resident Fish Passage**

FWS, NMFS, Cal Fish & Game, Oregon Fish & Wildlife, and the Hoopa Valley Tribe recommend installing upstream passage facilities designed to meet current agency criteria at all dams. Although in most cases the primary intent of these facilities would be to provide passage for anadromous fish, these ladders also would provide opportunities for resident fish passage. Oregon Fish & Wildlife and the Hoopa Valley Tribe recommend constructing a ladder at Keno dam with a maximum gradient of 4 percent to accommodate passage of federally listed suckers. FWS specifies that PacifiCorp monitor usage of their prescribed Keno fish ladder to determine whether a lower gradient ladder that meets sucker criteria should also be constructed.

The existing ladders at Keno and J.C. Boyle dams were constructed to provide passage for rainbow trout, but they do not meet current agency design criteria and were not designed to pass suckers. We estimate that the annualized cost of constructing a low gradient ladder at Keno dam that is designed to pass suckers would be approximately \$1,983,340. However, our review of the gradient profile of the Klamath River indicates that suckers that pass over Keno dam and move downstream into the higher gradient sections of the reach would probably be unable to move back upstream to access the fish ladder. Furthermore, any suckers that were to ascend a ladder at Keno dam would be subject to sometimes lethal DO conditions if they remained in the reservoir during the summer months, while downstream reservoirs provide suitable rearing habitat for these species. Because they are a very long-lived species, adult fish

that take up residence in the project reservoirs could contribute to species conservation as a reserve population of broodstock. This reserve population could be used to rebuild upstream populations if they were to decline substantially, as they have in the past, due to water quality-related fish kills. The specifics of how any such upstream sucker supplementation would occur, including a conservation hatchery program, would be the responsibility of resource agencies, should they determine the need for this type of program. We conclude that construction of a fish ladder designed to meet sucker criteria at Keno dam would provide little, if any, conservation benefit to the population of federally listed shortnose or Lost River suckers. We, therefore, have not included this measure in the Staff Alternative due to its high cost and limited benefit.

Upgrading the ladder at Keno dam and replacing the ladder at J.C. Boyle dam to meet current agency criteria for passing trout could increase their effectiveness, but these measures would have relatively high annualized costs of \$1,112,950 and \$1,926,210, respectively. Monitoring conducted by Oregon Fish & Wildlife at the J.C. Boyle ladder in the first few years after it was constructed indicated that several thousand trout migrated through the ladder each year. PacifiCorp suggests that these initial high rates of ladder usage may have been related to intensive hatchery stocking or due to fish attempting to return to historic spawning areas near the mouth of Spencer Creek that were inundated by J.C. Boyle reservoir. Once the spawning area was inundated, the advantage of moving upstream to spawn was lost, and monitoring studies conducted from 1988 through 1991 indicated that the number of trout using the ladder decreased about 10-fold.

Another possible reason for the decline in ladder usage is an observed change in the river gradient downstream of the ladder entrance, which may preclude trout from gaining access to the ladder entrance. PacifiCorp is in the process of regrading the river channel in this section to provide a resting pool to eliminate the potential migration barrier. PacifiCorp also has proposed to make several minor modifications to improve passage conditions within the ladder. These modifications would have annualized costs of \$261,680, and could improve the ability of trout to migrate past J.C. Boyle dam to access spawning habitat in Spencer Creek. Because these measures have some potential to benefit trout spawning, would facilitate the passage of anadromous fish if, in the future, they are restored to this section of the river, and have a relatively low cost, we include them in the Staff Alternative. We do not include rebuilding the Keno and J.C. Boyle ladders to meet current agency criteria in the Staff Alternative, because we do not consider the incremental benefit to migratory fish that may be achieved to warrant the high costs of these measures. Oregon Fish & Wildlife's initial monitoring studies conducted after the J.C. Boyle ladder was constructed demonstrated that the ladder was successfully used by migrating trout, and PacifiCorp's plans to regrade the channel downstream of the ladder should address the only passage condition that has changed since the first several years when the ladder was heavily used. Furthermore, rainbow trout in the J.C. Boyle reaches have access to suitable spawning habitat in the bypassed reach and in Shovel Creek, and trout in the Keno reach have access to suitable spawning habitat in Spencer Creek. Improving the ladder at Keno dam would not improve access to spawning habitat, as little or no spawning habitat is known to occur in Keno reservoir or in the Link River. In addition, we note that we do not include the Keno development itself in the Staff Alternative.

Several agencies recommend or prescribe that PacifiCorp evaluate or implement spillway modifications to improve downstream passage for resident and anadromous fish species at project dams. At most of PacifiCorp's mainstem developments, spills are relatively infrequent, so the exposure of downstream migrating fish to potential injuries during spillway passage is limited. At Keno dam, however, there are no power generating facilities, so the spillway is the only available downstream passage route, and there is the potential for fish to be injured or killed when they pass under spillway gates, especially at narrow openings. PacifiCorp indicates that passage could be improved by adding a top spill gate to the existing gate. This would eliminate the risk of fish being injured passing under the gate through narrow gate openings, because low flow volumes could be spilled over the top of this gated section, eliminating the need for operating the existing conventional gates at narrow openings. We

estimate that the annualized cost for conducting spillway evaluations and potentially implementing spillway modifications would be \$71,990. Because this modification could improve the recruitment of federally listed suckers to the project reservoirs, and the cost is reasonable, we would recommend it, if the Commission should decide to retain the Keno development as part of the project.

PacifiCorp proposes to construct fish ladders and fish screens at the Spring Creek and Fall Creek diversions to provide passage for and to protect resident trout from turbine injuries. NMFS and FWS prescribe, and Cal Fish & Game, Oregon Fish & Wildlife, and the Hoopa Valley Tribe all recommend the installation of both upstream and downstream passage facilities at the Fall Creek development. These measures would prevent trout from being entrained into the diversion canals and would allow trout that pass over the diversion dams to return upstream. At Spring Creek there are two non-project diversions located 0.1 mile above and 0.3 mile below the PacifiCorp diversion.

We estimate that the annualized cost of constructing and operating upstream and downstream passage facilities at Spring Creek would be \$50,750, and \$55,430, respectively, and the corresponding costs at Fall Creek would be \$26,460 and \$111,020. In the draft EIS, we did not recommend upstream and downstream passage facilities at these diversions based on the relatively high cost of the facilities and our conclusion that the habitat in these small streams is unlikely to support a substantive recreational fisheries, and electrofishing data indicating that the trout populations in both streams were self-sustaining. Subsequent to the 10(j) meeting held in December 2006, Oregon Fish & Wildlife filed additional information stating that an impassable waterfall in lower Jenny Creek isolates Jenny Creek rainbow trout from other populations of this species, and that genetic analysis indicates that the populations upstream of this barrier may belong to a unique subspecies. The trout population in Spring Creek is also isolated from downstream populations by the barrier in lower Jenny Creek, and the trout population in Fall Creek is isolated by another waterfall in the lower end of the bypassed reach, and may have similarly unique genetic characteristics. Oregon Fish & Wildlife also noted the relative scarcity of streams with good quality coldwater habitat in this part of the basin. Also, we now acknowledge that some entrainment of trout into the Fall Creek intake is likely occurring, and that mortality rates are likely to be quite high due to the high head and type of turbines at the powerhouse. As a result of these factors, we now conclude that the benefits to these potentially unique trout populations warrant the cost of constructing upstream and downstream passage at the Spring and Fall Creek diversions, consistent with the NMFS/Interior's modified fishway prescription.

### **5.2.9 Hatchery Management**

Iron Gate Hatchery was built in 1961 as mitigation for the loss of spawning areas in the Klamath River and its tributaries between Iron Gate and Copco No. 2 dams. PacifiCorp proposes to continue to fund 80 percent of the annual operation and maintenance costs for production and operation of Iron Gate Hatchery, to fund unspecified minor upgrades at the hatchery, and to purchase and construct a mass-marking facility at the hatchery to enable tagging 25 percent of released fall Chinook salmon. Agency recommendations pertain to funding of existing operations for the hatchery, funding of yearling fall Chinook production at the Fall Creek rearing facility, expanding fish marking, and development of a hatchery and genetics management plan.

The Klamath Tribes recommend that PacifiCorp continue funding operation and maintenance of Iron Gate Hatchery. NMFS, FWS and Cal Fish & Game recommend that PacifiCorp fund 100 percent of hatchery annual operating costs, facility improvements, new construction, fish marking, monitoring and recovery costs, and any permits and plans required by state or federal agencies. Cal Fish & Game specifically recommends that PacifiCorp fully fund the resumed production of yearling fall Chinook at the Fall Creek rearing facility, which has not received funding from the state in the last several years. NMFS, FWS, and Cal Fish & Game recommend that hatchery production targets be adjustable and developed in consultation with the agencies.

Our analysis in section 3.3.3.2.6, *Iron Gate Hatchery Operations*, indicates that return rates of subyearling fall Chinook released from Iron Gate Hatchery were extremely low (0.05 percent or less, compared to a long-term average of 1 percent) for 4 out of 9 brood years between 1990 and 2000 where data were available. Although return rates of yearling releases are also variable, in some years they return at rates that are an order of magnitude higher than subyearling releases. Preliminary data from more recent years indicate an even larger differential: survival-data from the 2001 brood year show 94 percent of adult fall Chinook that returned to the hatchery as age 3+ fish in 2004 were from yearling releases.

The highly variable return rates observed for subyearling smolt releases indicate that pursuing a more balanced strategy of releasing both subyearling smolts and yearling fall Chinook salmon may provide more consistent adult returns, and help to prevent a severe decline if several consecutive years of poor spring migration conditions were to occur. As discussed in section 3.3.3.2.3, *Disease Management*, there appears to be a trend towards increased losses of subyearling juvenile fall Chinook from disease in recent years, with mortality rates exceeding 70 percent during the last half of the outmigration in both 2004 and 2005. Releasing a substantial portion of hatchery-produced fall Chinook salmon as yearlings, which are released in November when water quality conditions are more favorable, would reduce the potential for hatchery fish to be exposed to disease, consequently reducing the potential for a severe decline in adult returns.

We view resumption of the yearling release program to be a critical step towards ensuring that a sufficient number of adult fall Chinook continue to return to meet egg take and production targets in future years. Accordingly, we consider it appropriate for PacifiCorp to provide full funding for the yearling portion of the hatchery program, including the refurbishment, operation, and maintenance of the Fall Creek rearing facility. We estimate the annualized cost of this measure would be \$177,000, and we conclude that the benefits to commercial, recreational, and tribal fisheries would be substantial. Accordingly, we include this measure in the Staff Alternative.

Regarding the funding of existing hatchery operations, the Commission required the construction and operation of Iron Gate Hatchery to compensate for anadromous fish production that was lost between Copco No. 2 and Iron Gate dams due to the construction of Iron Gate dam. The hatchery was intended to sustain the anadromous fishery resource of the upper Klamath River at a level approximately equal to that which existed prior to construction of Iron Gate dam.<sup>172</sup> Since that time, likely effects of the project on water quality conditions and disease incidence, in combination with a basin-wide warming trend, have increased the losses of smolts during outmigration, which limits the number of adults that the hatchery contributes to commercial, recreational, and tribal fisheries. Accordingly, we conclude that full funding of Iron Gate Hatchery operations by PacifiCorp is warranted. We estimate that the annualized cost of increasing PacifiCorp's share of funding from 80 to 100 percent would add \$125,000 to their current funding obligation of \$500,000 per year. Because of the benefits that hatchery production provides to commercial, recreational, and tribal fisheries, we conclude that the benefits of continuing existing hatchery production are worth the costs, and we include full funding of Iron Gate hatchery operations in the Staff Alternative.

PacifiCorp also proposes to fund unspecified minor upgrades at Iron Gate Hatchery, which would have an annualized cost of \$107,370. Periodic upgrades of hatchery facilities are often needed to maintain production rates and to meet new hatchery standards. Although we cannot determine the benefits of the specific upgrades that PacifiCorp anticipates, we expect that PacifiCorp would only implement upgrades that are warranted to maintain and enhance hatchery operations, and we include these costs in the Staff Alternative. Given the potential for adverse effects of increased hatchery

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<sup>172</sup>Although a hatchery was built at Fall Creek to mitigate for anadromous fish losses when Copco No. 1 dam was constructed, the hatchery ceased operations in 1948, prior to the construction of Iron Gate dam.

production on wild stocks, we do not include any provisions for expanding hatchery facilities to accommodate any increases in production from current levels.

Currently, about 5 percent of Chinook salmon produced at Iron Gate Hatchery are tagged with coded wire tags and marked with an adipose fin clip. Cal Fish & Game funds the marking (fin or maxillary clip) of all coho (75,000 released annually since 1996) and all steelhead (200,000 released annually since 1998). PacifiCorp proposes to purchase and construct a mass-marking facility at Iron Gate Hatchery to enable tagging 25 percent of released fall Chinook salmon. NMFS, FWS, and Cal Fish & Game recommend that PacifiCorp fund all fish marking costs, and NMFS recommends that 100 percent of hatchery-released Chinook salmon be marked, which we assume would include both coded wire tags and an adipose fin clip.

PacifiCorp proposes, and FWS and Cal Fish & Game recommend, marking 25 percent of hatchery-released Chinook salmon. Such marking can help reduce harvest mortality on wild Chinook salmon through implementation of harvest restrictions on unmarked fish. Marking all hatchery fish, including coho, would aid recovery and harvest management programs by enabling an assessment of the relative contribution of hatchery and natural production of these fish in the ocean and inland harvests, in-river spawning escapements, straying rates, and hatchery returns. Marking hatchery fish can also aid in distinguishing the origin of fish that may be re-introduced to spawn in habitats upstream of Iron Gate dam. Marking all steelhead released from the hatchery would help fishery management agencies to assess whether the recent low returns of adult steelhead to the hatchery is the result of ocean mortality or released fish remaining in the Klamath River throughout their lives. The outcome of such an assessment could lead to altered hatchery management strategies to facilitate increased adult steelhead returns to the hatchery. Cal Fish & Game manages the hatchery, and we consider it appropriate for this fisheries management agency to fund any steelhead marking that may be of assistance in updating their management strategy.

Marking only a portion of the fish released does not allow anglers to distinguish non-clipped hatchery fish from wild fish. Furthermore, when selective harvest restrictions are imposed to protect natural spawners, this reduces the amount of catch that would otherwise be available for harvest. The ability of commercial and sport anglers to distinguish coho salmon of hatchery origin, which are not protected under the provisions of the ESA, from those of wild origin, which are protected under the ESA, would avoid inadvertent takings of federally listed salmon.

We estimate that marking 25 and 100 percent of fall Chinook salmon and 100 percent of coho salmon would have annualized costs of \$233,880, \$705,040, and \$4,750, respectively. In its comments on the draft EIS, Cal Fish & Game express some concern that marking 100 percent of fall Chinook salmon using a single marking trailer logistically might not be feasible within the time period when smolts are in the proper size range for marking. However, we see no reason why this logistical concern cannot be addressed by procuring a second or third marking trailer. Because 100 percent marking would allow the harvest rates of hatchery fish to be increased without adversely affecting wild stocks including the federally listed SONCC coho salmon, we conclude that this measure would provide substantial benefits to commercial, recreational, and tribal fisheries, and would assist with conservation of the SONCC coho salmon. Accordingly, we include this measure in the Staff Alternative.

NMFS, FWS, Cal Fish & Game, and the Forest Service recommend that PacifiCorp consult with the agencies to develop a hatchery and genetics management plan for Iron Gate Hatchery operations that includes (1) an accurate adult census of natural salmonids; (2) determination of the rate and contribution of hatchery strays to natural spawning stocks; (3) determination of the rate of competition between hatchery and natural salmonids; (4) determination of genetic characteristics of natural and hatchery coho and steelhead stocks; (5) determination of outmigration timing of hatchery and natural stocks; (6) maintenance of tribal trust and resource trustee obligations to mitigate for lost habitat; (7) development of conservation hatchery techniques; and (8) minimization of any negative effects from fish husbandry or

juvenile releases on native, naturally occurring populations of listed salmonids. NMFS further recommends the hatchery facilitate implementation of fish passage measures to restore wild runs of anadromous and resident fish above and below the project. The Klamath Tribes recommend that PacifiCorp fund a group of state, federal, and tribal technical experts to provide recommendations and guidance to fisheries' managers to maximize the use of Iron Gate Hatchery for anadromous salmonid restoration and management efforts on portions of the Klamath River Basin affected by the project, and that hatchery management be brought up to standards appropriate for a conservation hatchery.

Development of a hatchery and genetics management plan in consultation with an agency and tribal advisory committee would provide a structure for ongoing analysis of hatchery programs and recommendations for future management of hatchery production. Development of a hatchery and genetics management plan would guide the evaluation of appropriate hatchery modifications, upgrades, and operating procedures in consideration of potential effects of Iron Gate Hatchery production to federally listed stocks in the basin and in the ocean. We understand that Cal Fish & Game and NMFS are in the process of developing a hatchery and genetics management plan for the Iron Gate Hatchery, which is operated by Cal Fish & Game. Consequently, PacifiCorp would not be responsible for developing this plan. Implementation of a hatchery and genetics management plan is necessary to continue operation of the hatchery in compliance with the ESA, and it is appropriate for PacifiCorp to fund its implementation. However, we maintain that PacifiCorp should not be required to assume responsibility for collecting information that is needed primarily for fisheries management purposes. Among the eight components identified above, we consider items 1 (adult census of natural salmonids), and 2 (determination of the rate and contribution of hatchery strays to natural spawning stocks) to fall into this category. Based on information provided by Cal Fish & Game in its draft EIS comments, we estimate that the annualized cost of implementing a hatchery and genetics management plan would be \$3.5 million. Because this plan must be developed and implemented to continue hatchery operations, and the substantial number of fish that the hatchery contributes to commercial, recreational and tribal fisheries, we conclude that these costs are warranted, and we include this measure in the Staff Alternative. Production and associated costs at Iron Gate and Fall Creek hatcheries could be adjusted downward, depending on defined criteria for success in restoring naturally reproducing wild populations.

#### **5.2.10 Aquatic Habitat Enhancement**

PacifiCorp proposes several measures to enhance aquatic habitat including sediment augmentation (discussed in section 5.2.1, *Seasonal High Flows and Sediment Management*), replacing unscreened gravity-fed irrigation diversions in the J.C. Boyle peaking reach with screened pump systems, and eliminating existing irrigation diversions on Shovel Creek and its tributary, Negro Creek. Other stakeholders recommend developing and implementing habitat enhancement plans designed to compensate for project effects.

PacifiCorp's proposal to modify irrigation diversions associated with its Copco Ranch property would reduce the entrainment of trout fry from mainstem diversions in the peaking reach and from Shovel and Negro creeks, which provide an important spawning area for trout in the California section of the peaking reach. Eliminating diversions on Shovel and Negro creeks would increase minimum flows in Shovel Creek by about 15 cfs during the irrigation season, further increasing the production potential from these tributaries. These tributaries and the J.C. Boyle bypassed reach provide the only substantial spawning areas that are available to trout residing in the 17.3-mile-long peaking reach and 4.5-mile-long bypassed reach. Access to spawning habitat for trout residing in the J.C. Boyle peaking reach has been reduced by the interruption of sediment transport, inundation of spawning habitat by J.C. Boyle reservoir, and potentially by poor performance of the fish ladder at J.C. Boyle dam. We conclude that PacifiCorp's proposed measures, which would have an annualized cost of \$87,180, would provide a substantial benefit to the high quality trout fishery in the J.C. Boyle bypassed and peaking reaches, and we include these proposed measures in the Staff Alternative.

Siskiyou County recommends that PacifiCorp fund about \$18 million of programs for up to a 10-year period to enhance flows and reduce water temperatures in Klamath River tributaries, which we estimate would have an annualized cost of about \$1,792,860. These measures have the potential to benefit anadromous fish that spawn and rear in the tributaries, and also to improve water quality conditions in the mainstem Klamath River, which may help to alleviate disease-related losses. In section 3.3.3.2.3, *Disease Management*, we include these types of enhancements in our listing of measures that could be included in a disease monitoring and management plan. We conclude that the potential benefits of all disease management approaches can be most effectively considered in a single coordinated plan that would allow the most effective combination of approaches to be selected for implementation. Regarding measures that would improve habitat within tributaries, we acknowledge their potential benefits to anadromous fish, but we conclude that the condition of habitat within tributaries downstream of Iron Gate dam is not affected by the project facilities or operations. Accordingly, because of this lack of project nexus, we do not include Siskiyou County's recommendation in the Staff Alternative.

Several agencies including NMFS, FWS, Oregon Fish & Wildlife, Cal Fish & Game, and the Hoopa Valley Tribe recommend that PacifiCorp develop and implement habitat enhancement plans to compensate for fish losses associated with upstream and downstream passage and other continued, ongoing, and cumulative project effects. Although these parties provide some idea of measures that might be considered, they provide no specific details on how such measures would be implemented, where they would occur, how closely associated they would be with project-related effects, or what benefits they would provide. It is most appropriate to address identified project-specific effects with specific protection and enhancement measures that address those effects, rather than considering general types of protection or enhancement measures that may not clearly connect to project purposes. Accordingly, we do not include the enhancement plans recommended by these entities in the Staff Alternative.

### **5.2.11 Aquatic Resources Monitoring**

Monitoring the effects of environmental measures that are included in a new license helps to ensure that the measures are effective, and it affords the opportunity for measures to be modified, if needed, to ensure continued protection from adverse project effects. Numerous stakeholders provided recommendations related to monitoring fisheries and aquatic habitat, reporting monitoring results to stakeholders, and implementing adaptive management. PacifiCorp did not propose any specific measures for monitoring aquatic resources.

Monitoring and reporting of the number and species of fish passing at upstream and downstream passage facilities, as specified in the Interior/NMFS modified fishway prescription, would ensure that fishways are performing as intended and would enable progress in the restoration of anadromous fish to reaches upstream of Iron Gate dam to be monitored. We include these aspects of monitoring in the integrated fish passage and disease management program that we discuss in section 5.2.6, *Anadromous Fish Restoration*, and that we include in the Staff Alternative. Within the integrated plan, we also include costs for initial radio telemetry studies on the movement of juvenile and adult anadromous fish to determine the most beneficial method of providing passage for anadromous fish species, and funding for annual monitoring and reporting of the number, species, and size of fish that are passed at the fish passage facilities that are constructed as an outcome of plan implementation. We also include annual surveys of fish stranding in at least the first 4 years of the integrated plan, with adjustment of ramping rates and continuation of stranding monitoring beyond 4 years, if warranted.

Monitoring of populations of resident fish species within project reaches and tributaries within the project area at 3 year intervals, as recommended by Oregon Fish & Wildlife and Interior, would provide information on reach productivity and population responses to measures that are implemented in the new license, and we acknowledge that this frequency of surveys would better facilitate adaptive management than monitoring every 5 years as we recommend in the draft EIS. However, we consider it

unlikely that population monitoring would need to continue at this frequency for the duration of the new license, especially if the number and species of fish that are passed at each development are monitored and reported on an annual basis as would be required under the integrated fish passage and disease management program. We conclude that the frequency of population monitoring should be reconsidered after the third population assessment has been conducted in the ninth year of the new license.

In the draft EIS, we also conclude that monitoring of populations of listed sucker species in project reservoirs every third year, as recommended by Interior, is not justified due to the long life-span of the species and the lack of proposed measures or changes in operations that could be expected to affect sucker populations. However, the integrated fish passage and disease management plan that we now include in the Staff Alternative includes two measures that could affect reservoir populations of suckers: (1) the installation of a screening facility at J.C. Boyle (which would affect the downstream recruitment of juvenile suckers) and (2) an experimental drawdown of Copco and Iron Gate reservoirs to evaluate effects on smolt migration, downstream water quality, and pathogen density. Monitoring sucker populations in project reservoirs at 3-year intervals for the first nine years would provide information on the effects of these measures on reservoir fish populations, and could help to guide decisions on where listed suckers that are collected in the screening facility should be released.

For reaches where sediment augmentation would occur, annual monitoring for the first 10 years would help to determine whether the quantity and location of sediment placement requires any adjustment to assure that a sufficient amount of habitat is available to support salmonid spawning. The frequency of spawning gravel monitoring could be reduced to every 5 years after the first 10 years, and the frequency of telemetry studies could be reduced to every 10 years after the first three surveys, which should provide a good understanding of the initial response of fish spawning movements to the measures that have been implemented.

Some of the monitoring elements that Oregon Fish & Wildlife recommends appear to go beyond what is needed to monitor the effectiveness of resource measures that would be implemented in a new license. For example, the condition factor of trout collected during population assessments in the J.C. Boyle peaking reach would provide a good indication of fish growth without the need for conducting additional bioenergetics modeling or feeding behavior monitoring, and there is no reason to believe that the project or any proposed measures would have any effect on the sex ratios of fish populations. We see little benefit in monitoring the number, size, and sex of spawning rainbow trout in Scotch, Camp, Shovel, Long Prairie, and Spencer creeks, as FWS recommends, because spawning habitat in these creeks is not affected by project operations. However, periodic population sampling in Jenny and Fall creeks would enable the effects of project operations on trout in these tributaries to be monitored.

We estimate that the aquatic resource monitoring plans recommended by Oregon Fish & Wildlife and FWS, which would include elements specified by the Bureau of Land Management, would have annualized costs of \$158,820 and \$96,610, respectively. Excluding the elements that we conclude are unnecessary and assuming that the frequency of monitoring would be reduced to every 5 years when monitoring needs are re-evaluated in year 9, we estimate that the annualized cost of developing and implementing our recommended plan to monitor resident fish populations would be \$69,710 (the cost of anadromous fish telemetry studies and passage monitoring is included in the integrated fish passage and disease management program). We conclude that monitoring efforts at the level that we recommend would be sufficient to assist with tracking population responses to measures included in a new license and would facilitate adaptive management of these measures, and we include them in the Staff Alternative.

NMFS and FWS recommend that PacifiCorp develop and implement an anadromous fish monitoring plan that describes protocols for (1) estimating the number, size, sex, timing, survival, and origin of anadromous fish returning to Iron Gate dam by using a combination of PIT tags and fish marked in other ways; (2) estimating the spawning populations of each species of anadromous fish in key tributaries within the project area; (3) estimating the numbers of juvenile outmigrant Chinook salmon

originating from the same key tributaries within the project area; and (4) implementing measures recommended by the agencies to meet project passage goals. Both agencies recommend monitoring juvenile outmigrants every third year. We agree that if a program to restore anadromous fish to habitat upstream of Iron Gate dam is undertaken, it would be beneficial for PacifiCorp to include the monitoring of anadromous fish populations as a component of the fish passage and disease management plan that we discuss in section 5.2.6, *Anadromous Fish Restoration*, which would include most of these elements. We conclude, however, that information collected on the number and species of fish that are passed or transported via any fish passage facilities that are constructed should provide sufficient information on the status and trends of reintroduced populations. We do not agree that it is the responsibility of PacifiCorp to monitor spawning populations or juvenile production within key tributary streams, which we estimate would have an annualized cost of \$329,180, because habitat in these tributaries is not affected by project facilities or operations. We note, however, that the adult telemetry studies that we include as part of the integrated fish passage and disease management program would provide some information on the numbers and timing of fish movements into project tributaries, and of any pre-spawning mortality that occurs to fish that are tagged in these studies.

The Bureau of Land Management specifies that PacifiCorp develop an adaptive management plan in consultation with the Bureau designed to monitor how implementation of the Bureau's specified "river corridor management condition" is effective in improving fish habitat quantity and quality for resident, migratory, and anadromous fish. Monitoring and evaluation of the results would be reported annually to the Bureau of Land Management, including PacifiCorp's conclusions about spawning, holding, feeding, juvenile rearing, riparian, and migratory habitat; and the adequacy of flows for providing migration, rearing, and spawning habitat for native aquatic species; moving spawning gravel; achieving riparian habitat objectives; supporting power generation; and providing recreational opportunities.

Some of the habitat-related measures that the Bureau of Land Management specifies would constitute a substantial change from current operations, and would warrant monitoring to determine their effects and to evaluate whether additional alteration of project operations may be warranted. We evaluate these measures in sections 5.2.1, *Seasonal High Flows and Sediment Management*, and 5.2.5, *Instream Flows*. However, because we do not support adopting several of the measures specified by the Bureau, we do not see a benefit in requiring PacifiCorp to monitor implementation of the Bureau's specified river corridor management condition. It is reasonable to expect that in response to any type of environmental monitoring, if the need for corrective actions or opportunities for environmental enhancements becomes apparent, recommendations based on the monitoring results would be specified in any monitoring report submitted to the Commission for approval. We conclude that the alternative monitoring approaches, that we discuss above and include in the Staff Alternative, would be equally effective in providing a basis for reaching adaptive management decisions.

### **5.2.12 Vegetation Management**

Vegetation management at project facilities, along transmission line rights-of-way, project roads, and at recreational sites has the potential to both directly and indirectly affect native plant communities, rare plants, and wildlife habitat either beneficially or adversely. Furthermore, fluctuating reservoir levels, water releases, and altered hydrology in the project reaches may favor invasive plant species.

PacifiCorp proposes to develop and implement a vegetation resources management plan in consultation with the resource agencies within 2 years of license issuance to guide land management practices on PacifiCorp-owned non-aquatic land within the project boundary. PacifiCorp would address (1) project facility vegetation management; (2) noxious weed control; (3) vegetative restoration of sites that have been disturbed by project activities; (4) threatened, endangered, and sensitive plant protection; and (5) long-term monitoring in its proposed vegetation resources management plan. PacifiCorp also proposes to enhance upland habitat for deer by managing about 1,031 acres of PacifiCorp-owned land within the project boundary to increase forage and cover habitat for deer. PacifiCorp proposes working

with resource agencies to investigate and implement habitat enhancements within the project boundary aimed at improving shrub forage in oak woodlands and chaparral habitats, and to reduce or eliminate livestock grazing effects. PacifiCorp also proposes to protect and restore riparian habitat along the margins of three of the project reservoirs and along about 13 miles of tributary and river reaches. PacifiCorp also proposes to protect wetlands near recreational areas. PacifiCorp proposes including these riparian enhancement measures in its proposed wildlife habitat management plan.

The Bureau of Land Management's modified 4(e) condition specifies that PacifiCorp develop a vegetation resources management plan within 1 year of license issuance that includes provisions for managing noxious and invasive plants and threatened, endangered, and sensitive plants on Bureau-administered lands that are affected by the Klamath Hydroelectric Project. Oregon Fish & Wildlife and the Hoopa Valley Tribe recommend that PacifiCorp prepare a vegetation and noxious weed resource management plan within 1 year of license issuance and a vegetation management plan within 2 years of license issuance.

Interior recommends that PacifiCorp consult with the Bureau of Land Management to develop a plan for managing upland vegetation to improve forest health (by reducing risk of insect infestation) and reduce potential fire hazard (by reducing wildfire risk) adjacent to project facilities. Oregon Fish & Wildlife and the Hoopa Valley Tribe recommend that PacifiCorp improve winter range habitat for deer and elk through a variety of vegetation treatments. We conclude that managing upland vegetation at the Klamath Hydroelectric Project would benefit a variety of wildlife species.

Interior also recommends that PacifiCorp consult with affected tribes to develop and implement a vegetation management plan within 1 year of license issuance to reestablish native vegetation and plants that are suitable to tribal members for food, medicine, basket material, cradles, art, and other cultural products. We agree that incorporating plants of ethnobotanical importance into various revegetation projects could enhance ethnobotanical resources as well as benefit a variety of wildlife species.

FWS recommends that PacifiCorp develop a riparian habitat management plan to conserve, develop, and enhance fish and wildlife resources. Protecting and restoring riparian habitat is appropriate because of the presence of cultural and sensitive species along some of the project reaches and because several special status wildlife species and riparian focal species use riparian habitats substantially more often than upland habitats.

The city of Yreka recommends using coniferous vegetation for visual screening instead of deciduous vegetation. We conclude that planting coniferous shrubs and trees to provide visual barriers along roads, rights-of-way, and other open areas would also provide wildlife cover, especially in the winter months when deciduous vegetation is bare. We recommend provisions for vegetative screening in our recommended visual resource management plan (discussed further in section 5.2.15, *Aesthetic Resource Management*). Such vegetative screening would not only effectively enhance aesthetic resources, but it would also provide wildlife benefits.

In its proposed vegetation resources management plan, PacifiCorp proposes addressing noxious weed control. The Bureau of Land Management specifies and Oregon Fish & Wildlife and the Hoopa Valley Tribe recommend including provisions for managing noxious and invasive plants in a vegetation resources management plan. We agree that managing invasive plants and noxious weeds on lands within the project boundary and along roads for which PacifiCorp has shared or sole responsibility for maintenance is necessary to control the spread of invasive plants. PacifiCorp proposes and the Bureau of Land Management specifies addressing threatened, endangered, and sensitive plant protection in a vegetation resources management plan. PacifiCorp documented 67 occurrences of 12 plant species with special status in the project vicinity based on its own surveys and other sources. Subsequent to PacifiCorp filing its license applications, the Bureau of Land Management documented an additional two occurrences of special status plant species. These special status plant species could be affected by the spread of noxious and invasive plant species or by a variety of vegetation management activities,

recreation related activities, and other ground disturbances. Therefore, we conclude that monitoring these special status plant species following implementation of a new license for the project would reveal any effects on these species as a result of the new license conditions and would inform the development of any needed adaptive management measures. The Bureau of Land Management also specifies that PacifiCorp re-survey Bureau of Land Management-administered lands affected by the project to determine or verify the distribution of threatened, endangered, and sensitive plant species. We disagree with the need to re-survey the project area, since PacifiCorp proposes to (1) survey for special status plant and wildlife species prior to conducting ground-disturbing activities, and (2) monitor populations of special status plant species identified by others subsequent to its earlier surveys.

The description of the vegetation and noxious weed plans recommended by Oregon Fish & Wildlife and the Hoopa Valley Tribe is so similar that we do not see a need for separating them into two plans. Also, including the various vegetation management specifications and recommendations in one comprehensive vegetation resources management plan would allow the measures to be addressed efficiently. We consider the differences between PacifiCorp's proposed vegetation management plan content and the content offered by various stakeholders to be relatively minor, and development of a unified approach to vegetation management should be possible during the consultation that would occur during plan development. However, the vegetation resources management plan would only address aspects of vegetation management that have a nexus to the project, which would generally include lands within the project boundary and access roads for which PacifiCorp has shared or sole responsibility for maintaining because they are needed for project purposes.

PacifiCorp proposes to develop the vegetation management plan within 2 years of license issuance and the stakeholders indicate that most aspects of a vegetation management plan should be developed within 1 year of license issuance. Providing PacifiCorp 2 years to consult with the agencies and develop the plan would ensure that all of the elements of the plan are adequately addressed and that any disagreements could be resolved prior to filing the plan with the Commission for approval. We recommend that PacifiCorp consult with the Bureau of Land Management, FWS, Oregon Fish & Wildlife, Cal Fish & Game, city of Yreka, and tribal representatives, as appropriate, to develop a comprehensive vegetation management plan within 2 years of license issuance. In addition to these agencies, we recommend that PacifiCorp consult with the Oregon Department of Agriculture, the Oregon Natural Heritage Program, and the California Native Plant Society to develop the threatened, endangered, and sensitive plant protection element of the plan. Additional agencies that we recommend PacifiCorp consult with during its development of the noxious weed and invasive plant control element of the plan include the Oregon Department of Agriculture, California Department of Food and Agriculture, and Klamath and Siskiyou counties. We also recommend that PacifiCorp consult with local landowners on this aspect of the plan. Providing 2 years to develop the vegetation resources management plan would also allow PacifiCorp to develop the wildlife management plan in the same time frame, to ensure that the appropriate aspects of the vegetation management plan are integrated with the appropriate aspects of the wildlife management plan.

We estimate that consultation and development of a single, comprehensive vegetation management plan for the entire project, incorporating the elements of vegetation management at all project facilities, noxious and invasive plant control, threatened, endangered, and sensitive plant protection, upland vegetation management, riparian and wetland habitat management, implementation of measures that pertain to vegetation management, and long term monitoring would reduce the annual net benefit of the project by about \$93,440. Although this amount is substantial, we consider the protection that would be afforded to sensitive plant species, potential enhancements to wildlife habitat and ethnobotanical resources, and control of noxious and invasive plant populations within project-influenced areas to be worth the cost and we include development and implementation of a vegetation management plan in the Staff Alternative.

### 5.2.13 Wildlife Management

PacifiCorp proposes to develop and implement a wildlife habitat management plan that would describe all wildlife enhancement measures and provide a mechanism for coordinating with the PacifiCorp environmental management system and best management practices and for protecting and monitoring threatened, endangered, and sensitive species. PacifiCorp's proposed plan would include: (1) restoring riparian habitat along river and reservoir shorelines to improve habitat structure and connectivity; (2) installing wildlife crossing structures on the J.C. Boyle canal to enhance connectivity; (3) managing habitats within the project boundary to meet deer winter range objectives; (4) monitoring transmission lines and retrofitting poles on lines where birds have died to improve avian protection; (5) developing amphibian breeding habitat along Iron Gate reservoir; (6) funding annual aerial bald eagle surveys to document new nests and productivity of territories, and protect bald eagle and osprey habitat within the project boundary; (7) selectively closing roads that are unnecessary for project operation or other management activities; (8) installing turtle basking structures in selected sites; (9) installing bat roosting structures near project sites known to support roosting bats; (10) conducting surveys for threatened, endangered, and sensitive species in areas to be affected by new recreation development; and, (11) monitoring the effectiveness of enhancement measures over the course of the new license.

The Bureau of Land Management's modified 4(e) condition specifies that PacifiCorp develop a wildlife habitat management plan within 2 years of license issuance for Bureau-administered land affected by project operations and maintained by PacifiCorp. Oregon Fish & Wildlife, Cal Fish & Game, and Hoopa Valley Tribe recommend that PacifiCorp prepare a wildlife mitigation resource management plan within 1 year of license issuance. Oregon Fish & Wildlife and Cal Fish & Game also recommend that PacifiCorp prepare a comprehensive wildlife mitigation plan within 2 years of license issuance.

FWS recommends that PacifiCorp complete an avian collision and electrocution hazard avoidance plan within 1 year of license issuance to ensure that adverse interactions between project transmission and distribution lines and birds are minimized. Oregon Fish & Wildlife also recommends that PacifiCorp develop a wildlife crossing monitoring plan to evaluate the efficacy of wildlife crossings along project canals and waterways within 1 year of license issuance.

In its proposed wildlife habitat management plan, PacifiCorp proposes installing and maintaining eight wildlife crossings on the J.C. Boyle canal and developing a monitoring program to document the use of the wildlife bridges. The Bureau of Land Management specified and Oregon Fish & Wildlife recommended wildlife crossings and escape ramps for the J.C. Boyle canal and effectiveness monitoring. PacifiCorp disagrees with the need for additional wildlife escape ramps and effectiveness monitoring of the wildlife crossings and believes that monitoring use of the structures would be more appropriate. We agree that wildlife crossings are appropriate for the J.C. Boyle canal and expect that the need for additional crossings and the monitoring of those crossings would be worked out in consultation and included in a wildlife management plan.

The description of the wildlife mitigation and comprehensive wildlife plans recommended by Oregon Fish & Wildlife, the Hoopa Valley Tribe, and Cal Fish & Game is so similar that we do not see a need for separating them into two plans. We have also concluded that measures related to restoring riparian habitat along river and reservoir shorelines and managing upland habitats within the project boundary are more appropriately addressed in a vegetation resources management plan, even though those measures would benefit various species of wildlife. Likewise, we recognize that closing and restoring roads would enhance wildlife habitat connectivity, but conclude that it would be best to handle road closures in a road management plan. We also conclude that annual aerial bald eagle surveys as proposed by PacifiCorp and other specifications and recommendations related to bald eagle management are more appropriately addressed in a separate bald eagle management plan.

Including the remaining wildlife management specifications and recommendations in one comprehensive wildlife management plan would allow the measures to be addressed in an efficient

manner without the need to develop separate plans. We consider the minor differences between PacifiCorp's proposed wildlife management plan content and the content offered by various stakeholders to be relatively inconsequential, and a unified approach to wildlife management should be able to be achieved during the consultation that would occur during plan development. The Bureau of Land Management specifies and Oregon Fish & Wildlife recommends that PacifiCorp develop the wildlife management plan within 2 years of license issuance. We agree that providing PacifiCorp 2 years to consult with the agencies and develop the plan would ensure that all of the elements of the plan are adequately addressed and that any disagreements could be resolved prior to filing the plan with the Commission for approval. We recommend PacifiCorp consult with the Bureau of Land Management, FWS, Oregon Fish & Wildlife, Cal Fish & Game, and tribal representatives, as appropriate, to develop a comprehensive wildlife management plan within 2 years of license issuance. This would also allow PacifiCorp to develop the wildlife management plan in the same time frame that it develops the vegetation resources management plan, to ensure that the appropriate aspects of the wildlife management plan are integrated with the appropriate aspects of the vegetation resources management plan.

We estimate that consultation and development of a single, comprehensive wildlife management plan for the entire project, incorporating wildlife management elements such as installing wildlife crossing structures on the J.C. Boyle canal; developing amphibian breeding habitat; installing turtle basking structures; installing bat roosting structures; conducting surveys for threatened, endangered, and sensitive species in areas to be affected by new recreation development; monitoring transmission lines and retrofitting poles on lines where birds have died to improve avian protection; implementing measures pertaining to wildlife management; and long term monitoring would reduce the annual net benefit of the project by about \$121,510. Although this amount is substantial, we consider the protection that would be afforded various wildlife species and potential enhancements to wildlife habitat within project-influenced areas to be worth the cost, and we include development and implementation of a wildlife management plan in the Staff Alternative.

#### **5.2.14 Recreational Resource Management**

PacifiCorp proposes to finalize the draft Recreation Resources Management Plan that it provided to the Commission in September 2004. This plan specifies extensive recreational facility enhancements that would be implemented at existing and new sites at J.C. Boyle reservoir and bypassed reach, the California portion of the J.C. Boyle peaking reach, Copco and Iron Gate reservoirs, Fall Creek development, and the Iron Gate Hatchery. In addition, the plan identifies programmatic elements that also would be implemented, including an operation and maintenance program, a recreational monitoring program (which not only would include recreational use monitoring, but project patrols by PacifiCorp personnel and support for law enforcement agencies to provide additional project patrols), a resource integration and coordination program (that would coordinate overlapping recreational resource responsibilities with other agencies such as the Bureau of Land Management and Cal Fish & Game, and establish agreements that define the responsibilities of each), provisions for periodically updating the plan in consultation with agencies, and an interpretation and education program.

In general, agencies and other entities do not object to implementation of PacifiCorp's proposed recreational enhancements, but include additional measures that should be included in the plan, such as including operation and maintenance provisions for Topsy Campground, the Spring Island Boater Access site, Klamath River Campground, dispersed recreational sites along the peaking reach (Bureau of Land Management and Interior), and downstream of Iron Gate Hatchery (Forest Service and Interior). Oregon Parks & Rec and Interior recommend that PacifiCorp provide funding for law enforcement at project reservoirs, roads, and dispersed recreation sites along the Oregon portion of the peaking reach, and that PacifiCorp conduct a feasibility study regarding methods to establish communications for recreational boaters along the peaking reach, for emergency purposes. Interior and the Forest Service recommend that PacifiCorp provide for additional Klamath River patrols downstream of Iron Gate Hatchery.

As we discuss in section 3.3.6.2, *Recreation Resources*, we consider most of the proposed measures in PacifiCorp's draft plan to be appropriate to address identified recreational needs in the project area, and we include these measures in the Staff Alternative. The annualized costs of PacifiCorp's proposed recreational enhancements that we include in the Staff Alternative would be about \$1,708,450. PacifiCorp proposes to be responsible for nearly all proposed new or enhanced recreational facilities. Operation and maintenance of several project recreational sites is either assigned to another entity, as in the case of the proposed "old foundations day use area" near J.C. Boyle powerhouse (assigned to the Bureau of Land Management) or the Iron Gate Hatchery day-use area (assigned to Cal Fish & Game), or is unclear, as in the case of proposed trail enhancements at the Fall Creek development (either PacifiCorp or Cal Fish & Game). All three of these sites are project-related recreational areas and, as such, PacifiCorp would ultimately be responsible for their operation and maintenance. In addition, the term of any new license for the project would be from 30 to 50 years. Even with PacifiCorp's proposed operation and maintenance of project recreation facilities, it is probable that the useful life of major facility features would end prior to the expiration of the term of the license and may need to be replaced. Therefore, we have assessed PacifiCorp's proposed operating and maintenance costs, and increased them to account for replacement of facilities, as needed. The final plan should reflect this aspect of operation and maintenance. In response to our draft EIS, PacifiCorp acknowledged that it intends to replace any facilities that reach the end of their useful life, and agreed to reflect this aspect of operation and maintenance in its final Recreation Resources Management Plan, and our estimate of these cost is included in PacifiCorp's proposed measures that we include in the Staff Alternative, summarized above. We estimate that the annualized cost for this increased operation and maintenance, as well as operation and maintenance at the "old foundations," Fall Creek (including protective fencing at the city of Yreka's water supply intake), and Iron Gate Hatchery day-use areas, would be about \$3,570.

Although PacifiCorp should coordinate its proposed project patrol activities with those of local law enforcement agencies, we do not consider it appropriate for PacifiCorp to be directly responsible for funding any public law enforcement patrols of project lands and waters. We also conclude that PacifiCorp should only be responsible for operation and maintenance (either directly or through cooperative maintenance agreements with the Bureau of Land Management) for facilities that provide public access to project lands and waters. Topsy Campground currently serves such a project function and is located within the existing project boundary. Consequently, we include provisions for PacifiCorp to contribute to the long-term operation and maintenance of Topsy Campground, including the provision of an updated potable water system, in the Staff Alternative. We estimate that the annualized cost of this measure would be about \$23,500. We have not been able to establish a similar project purpose for the Spring Island Boater Access Site, Klamath Campground, dispersed recreation sites between the Spring Island Boater Access Site and the California border, or recommended facilities or patrols downstream of Iron Gate Hatchery. Consequently we do not include such measures in the Staff Alternative.

We conclude that, because much of the whitewater rafting recreational use along the peaking reach is supported by PacifiCorp's peaking operations at the J.C. Boyle development, an unscheduled powerhouse outage could place such recreationists at risk if flows in the peaking reach decrease prior to the completion of the complete run. Radio and cell phone reception along the peaking reach is either non-existent or marginal. Given that it is about 11 miles from the Spring Island Boater Access site, where boaters put-in, to the State-line Take-out site, boaters that become stranded in this reach would at best suffer inconveniences but also could suffer from exposure if outfitters cannot reach their home bases to arrange for a pick-up at an alternative site. Consequently, we agree that PacifiCorp should conduct a feasibility study that assesses potential means to enhance communications along the peaking reach and include it in the Staff Alternative. Such enhancements could include installation of a repeater station, cellular tower, or radio tower at a location that maximized coverage along the peaking reach. We estimate that the annualized cost of such a feasibility study would be about \$2,700.

However, if implementation of any such measure is found to be feasible, we do not consider it appropriate for PacifiCorp to be responsible for funding the entire cost of implementation. We consider implementation to be appropriately shared among the parties that would benefit from any such enhanced communications, which could include whitewater boating outfitters, local law enforcement and public safety agencies, and the Bureau of Land Management, in addition to PacifiCorp. A cooperative funding agreement for any planned enhancements to peaking reach communications could be included in PacifiCorp's proposed periodic updates to the plan, and implementation of any such measures would require the Commission's approval, in addition to other appropriate communication agency and governmental approvals.

### **5.2.15 Aesthetic Resource Management**

Project facilities and operations can directly affect the aesthetic character of the project area in both positive and negative ways. Power generation and transmission facilities and the physical elements of recreational facilities often create contrasts with the natural landscape; operations that affect the flow in downstream river reaches can either enhance or detract from the attractiveness of the river; and reservoirs can either add to or detract from the aesthetic appeal of an area, with high pool conditions generally more appealing than low pool conditions.

PacifiCorp proposes to use vegetative screening and repainting or recoating to reduce the visibility of several project facilities, including the Red Barn at J.C. Boyle dam; the powerhouse, penstocks, surge tank, and switching station at the J.C. Boyle powerhouse; and the penstock at Iron Gate dam. PacifiCorp proposes to implement these measures within the first 15 years of a new license, and proposes to consult with the Bureau of Land Management on the color choices that would minimize the visual contrast of project facilities with the natural landscape. PacifiCorp's proposal to improve the appearance of several project features and to reduce their contrast with the surrounding area would clearly improve the aesthetic environment in the vicinity of J.C. Boyle dam, the J.C. Boyle bypassed reach, and Iron Gate dam. We include these measures in the Staff Alternative at an annualized cost of \$51,060. We also considered vegetative screening and repainting or recoating the Fall Creek powerhouse and Copco No. 2 powerhouse and substation, because these structures also create a high degree of visual contrast with the surrounding environment as seen by visitors. Because the Fall Creek and Copco No. 2 facilities are historic properties, we recommend screening, using coniferous vegetation, instead of repainting or recoating. Vegetative screening would not change any features that qualify the Fall Creek and Copco No. 2 facilities for inclusion in the National Register of Historic Places. Painting the facilities would change the historic character of such features. At an estimated annualized cost of \$7,750 over PacifiCorp's proposed measure, we include this aesthetic improvement in the Staff Alternative, because the benefits associated with these measures are worth the additional cost. Implementation of the recommended measures at the Fall Creek and Copco No. 2 facilities would avoid the need for consultation with the California State Historic Preservation Officer. The Staff Alternative includes the Bureau of Land Management's specification that the RRMP include a visual resource management plan that includes provisions and guidelines for managing visual resources on Bureau of Land Management lands. However, we are not including in the Staff Alternative every measure the Bureau of Land Management presents as examples of the types of measures that could be employed. In our judgment, the application of an acid/stain agent to J.C. Boyle dam and bypass canal does not appear to offer a substantial improvement in these project features. The transmission line from J.C. Boyle powerhouse would not stand out visually once the powerhouse and other nearby elements are painted and screened; Copco No. 1 dam and powerhouse do not need screening because they are not visible to the general public; and the Iron Gate Hatchery and fish ladder are not particularly intrusive when viewed from a distance.

### **5.2.16 Road Management**

PacifiCorp-owned or -maintained roads within the project area provide both public access to project lands and waters and PacifiCorp access to project developments. Appropriate project road management provides for safety and protection of environmental resources while continuing to provide reasonable public access to the project.

PacifiCorp proposes to use its proposed project roadway management plan (PacifiCorp, 2004d), filed with the Commission on November 2, 2004, to guide its management of project-related transportation facilities within the proposed project boundary during the term of a new license. PacifiCorp proposes to facilitate long-term coordination and budgeting among PacifiCorp and other transportation-related management entities by annually preparing a rolling 5-year transportation action plan to help guide anticipated activities for normal or recurrent general maintenance, as well as major maintenance. As proposed by PacifiCorp, the transportation action plan would summarize the project-related road, bridge, and major culvert maintenance and capital improvements performed during the previous year and planned for the current year and subsequent 3 years. The plan also would document incurred and planned costs, including the allocation of joint costs, such as between PacifiCorp and the Bureau of Land Management. We conclude that implementing the road management plan as proposed by PacifiCorp would improve access management and road maintenance, as well as coordination with the Bureau of Land Management, and we include this measure in the Staff Alternative. However, we consider it most appropriate to address all aspects of project-related roads in the road management plan, such as road closures to improve wildlife habitat connectivity and to protect sensitive environmental resources. We estimate the annualized cost would be \$21,350, and the environmental benefits associated with implementing the road management plan warrant this relatively modest cost.

### **5.2.17 Cultural Resources Management**

PacifiCorp proposes to manage project-affected cultural resources using a variety of measures presented in its revised (March 2006) HPMP. The HPMP for the project would provide direction and guidelines for management of historic properties within the new project boundary as proposed by PacifiCorp (its APE). Mitigation measures for protection of historic properties defined in the revised HPMP include monitoring, detailed inspections, stabilization, site concealment, site isolation, removing incompatible uses, coordination with law enforcement agencies, erosion control, and, if necessary, archaeological data recovery.

Various entities make recommendations regarding cultural resource management issues that are generally consistent with the content of PacifiCorp's revised HPMP. The Bureau of Land Management specifies that PacifiCorp conduct archaeological surveys on about 77 acres of Bureau-managed land in the vicinity of Big Bend and along the peaking reach. In addition, Interior recommends that PacifiCorp develop a program to provide tribal members with access to traditional gathering places, while limiting access by others, and that PacifiCorp implement a sophisticated surveillance program that includes cameras in addition to patrols by tribal staff. The Oregon SHPO recommends that PacifiCorp consult with the tribes, SHPO, and appropriate land managers and sign a Memorandum of Agreement prior to capping any archaeological sites. The consultation portion of this agreement is consistent with PacifiCorp's revised HPMP, but the Memorandum of Agreement is not addressed in the revised HPMP.

We reviewed and analyzed available information and conclude that the APE for relicensing this project appropriately encompasses (1) the entirety of the APE as delineated by PacifiCorp in its October 2004 draft HPMP and (2) that portion of the Klamath River reach from Iron Gate dam to the mouth. We include the reach below Iron Gate dam largely based on our analysis of project effects on sediment transport (see section 3.3.1.2.3) and water quality, specifically with regard to microcystin toxin (see section 3.3.2.2.2, *Water Quality*). We describe the reasoning for our defined APE in section 3.3.9.2.2, *Management of Cultural Resources*. Our APE would include the area within the existing and

PacifiCorp's proposed project boundary, as well as East Side, West Side, and Keno developments, for as long as these developments remain in the license. We define the downstream limit of the APE (the Klamath River from Iron Gate dam to the mouth) to take into account the geographic extent of project alterations to riparian and aquatic environments supporting natural and cultural resources that contribute to the significance of the Klamath Cultural Riverscape. We also include the Bureau of Land Management's measure to conduct archaeological surveys in areas that had not yet been surveyed as long as those areas are within our defined APE. In addition, although we conclude that the costs of using surveillance cameras to monitor sensitive cultural sites is not warranted (we estimate the annualized cost would be about \$113,500 for such a program), we expect PacifiCorp to use appropriate means as determined in its consultations with relevant law enforcement organizations, to conduct its proposed monitoring program. PacifiCorp may choose to provide tribal members with opportunities to be part of the trained patrol staff it proposes to use for monitoring historic sites or to provide funding to facilitate tribal staff participation in cultural resource-related programs. However, we do not recommend inclusion of either of these recommendations as a condition of a new license.

PacifiCorp should revise its HPMP to reflect the geographic area of historic property management for the project as determined by Commission staff and reflected in a new license and the additional measures that we recommend be addressed during project-related management of cultural resources, and we include this in the Staff Alternative. We estimate that implementation of the protective measures proposed in PacifiCorp's HPMP would reduce the annual benefits of the project by about \$1,052,080. We estimate that additional measures that we include in the Staff Alternative would reduce the annual benefit of the project by an additional \$44,800. Considering the rich cultural heritage that is present in the project area, we consider these costs to be worth the benefits to cultural resources.

### **5.2.18 East Side and West Side Development Decommissioning**

PacifiCorp proposes to decommission both East and West Side developments because the cost of installing fish screens that would be protective of all life stages of federally listed suckers would be prohibitive relative to the revenue associated with the estimated annual generation of 18,800 MWh, which has a power value of about \$907,100. PacifiCorp describes its proposed decommissioning procedures in its license application, and we consider PacifiCorp's approach to be reasonable. If anadromous fish are restored to historical habitat upstream of Upper Klamath Lake, one logical location for a smolt collection facility would be at or near Link River dam, possibly using portions of the intake canal of East Side development. NMFS and Interior include such a collection facility in their fishway prescriptions because, when water quality conditions in Keno reservoir become particularly degraded during the summer, outmigrating smolts could be trapped and transported to a point downstream of Keno dam. We therefore consider it appropriate for the decommissioning plan to specify measures that would not forestall the future construction of a smolt collection facility by other entities at this location. NMFS, Interior, Oregon Fish & Wildlife, and Reclamation (owner of Link River dam) should therefore be included among the consulted entities in developing the decommissioning plan. In addition, PacifiCorp proposes to address the disposition of the Link River Trail, the only recreational facility associated with these two developments, in a decommissioning plan for these developments. We consider addressing whether operation and maintenance of this trail should be turned over to another interested entity, or whether the trail should be dismantled and returned to a natural state, to be appropriately dealt with in a decommissioning plan. Both developments are eligible for listing in the National Register of Historic Places. Therefore, the decommissioning plan would need to address how any adverse effects on these facilities would be resolved, in consultation with the Oregon SHPO.

We estimate that the total annualized cost associated with developing a decommissioning plan and decommissioning both developments, including lost revenue from generation and reduced annual costs, would be \$596,670. If the developments are not decommissioned, the fish screens specified in the 2002 FWS BiOp would be required, which we estimate would have an annualized cost of \$4,439,570.

However, given the small size and weak swimming ability of larval suckers, we consider it likely that even a large facility designed to operate at low velocities would cause more sucker mortality than passing the larvae over the Link River dam spillways, as would occur if East Side and West Side developments were decommissioned. In addition to the fish screens required in the 2002 BiOp, if both developments are not decommissioned, the fishways prescribed for these developments may need to be included in a new license (which would entail facilities, to collect outmigrating salmon smolts and haul them downstream of Keno dam when water quality in Keno reservoir is impaired, and tailrace barriers at each of the powerhouses). The estimated annualized cost for the prescribed fishways would be about \$5,260,020. Because of the high cost of fish screens and the greater level of protection afforded by decommissioning, we conclude that decommissioning East Side and West Side developments would be a reasonable undertaking.

### **5.2.19 Keno Development**

PacifiCorp proposes to remove Keno development from its proposed project because it states that it no longer serves any project purposes. The premise of our analysis of this issue is that, if operation of Keno development enhances generation at PacifiCorp's downstream developments, it would serve project purposes. PacifiCorp currently operates Keno dam under an agreement with Reclamation intended to maintain Keno reservoir water levels sufficient to ensure continued flows to and from the Klamath Irrigation Project. As discussed in section 4.8, *Keno Development Analysis*, we reviewed documentation that PacifiCorp provided to support its position that the project is no longer operated in a manner that enhances downstream project generation. We also conducted our own independent analysis of whether releases from Keno dam were occurring in a manner that could enhance the downstream peaking operations of the hydroelectric developments. Our analysis showed that pulsed releases at Keno dam, as observed by Interior, were adjustments in responses to pulsed inflows to Keno reservoir from the Link River and Klamath Irrigation Project, and are necessary to maintain the Keno reservoir water level within a 0.2 foot range, as requested by irrigators. Our review of historical Keno reservoir fluctuations shows that PacifiCorp has, for the most part, maintained this restrictive water level regime from 1990 to 2004. Consequently, our results agree with the results of PacifiCorp's analysis. We conclude that, although in infrequent instances the operation of Keno dam to maintain a steady reservoir elevation results in a very minor enhancement in downstream generation, overall, operation of Keno development results in no benefit to, or a small net loss of, generation at PacifiCorp's downstream developments. We conclude that although it is likely that future Keno dam operations would be similar to current operations regardless of whether Keno development remains in the project license, provisions in the TMDL or directives from the state of Oregon could result in alternative dam operations. However, applicable BiOps from NMFS and FWS would ensure that releases from Keno dam meet downstream flow needs.

In the event that the Commission should include Keno development in a new license that may be issued for this project, we would recommend that the following environmental measures that pertain to Keno development be included in the new license:

- Operate the Keno development in a run-of-river mode, with hourly outflows to be held within 10 percent of a 3-day running average of daily inflows (which would allow for water withdrawals from Keno reservoir by parties other than PacifiCorp, consistent with applicable water rights). Maintain a yearly minimum Keno reservoir water surface elevation of 4,085.0 feet and notify the Commission, Reclamation, NMFS, Oregon Fish & Wildlife, and others if drawdowns are planned to allow maintenance on irrigation canals and pumps. Specify in the project operations management plan (#5S), provisions for refilling Keno reservoir when it is drawn down that ensure maintenance of Keno reach flows.
- Include specific measures to enhance water quality in Keno reservoir in the comprehensive water quality management plan.

- Evaluate the Keno dam spillway for fish passage survival, and, if appropriate, modify the spillway to accommodate safe downstream passage of smolts and suckers.
- Address enhancements at the Keno Recreational Area in the final Recreation Resources Management Plan.
- Manage historic properties in the APE of the Keno development in accordance with the final HPMP.

### **5.2.20 Project Boundary Changes**

Project boundaries must enclose only those lands necessary for operation and maintenance of the project and for other project purposes such as recreation, shoreline control, or protection of environmental resources. The Staff Alternative generally includes the project boundary proposed by PacifiCorp, but with the following modifications:

- PacifiCorp proposes a new car-top boat access and day-use area at J.C. Boyle reservoir, but does not propose to include the access road to this site, which passes through Sportsman's Park) in the proposed project boundary. We conclude that without this road, the recreation site would be of little value, and recommend that the access road be included in the project boundary of a new license. The portion of this road not within the existing and proposed project boundary is about 0.8 mile long on land owned by PacifiCorp and a small portion by a private landowner.
- PacifiCorp proposes to adjust the existing project boundary at the J.C. Boyle development to exclude Topsy Campground. We conclude that Topsy Campground serves project related recreation purposes, and recommend that it be retained in the project boundary of a new license.
- PacifiCorp proposes to develop a loop trail around the lower portion of J.C. Boyle reservoir. Although the exact alignment of the trail is not yet known, because of ongoing assessments of cultural resources and negotiations with private landowners regarding easements, the trail would be about 5 miles long, and portions are likely to be outside of the proposed project boundary. We conclude that the entire trail and associated trailheads, once the final alignment is set, should be within the project boundary of a new license for this project because it would provide access to project lands and waters.
- PacifiCorp does not propose to include any of Topsy Grade Road in the project boundary. We conclude that Topsy Grade Road from its junction with Route 66 near Pioneer Park to the intersection of the road that accesses PacifiCorp's support building (the Red Barn) and J.C. Boyle dam (designated 300000116 in PacifiCorp's Road Inventory mapping) provides access to the Topsy Campground and serves as alternative access to the Red Barn and J.C. Boyle dam, and would also provide access to PacifiCorp's proposed Boyle Bluffs recreation area. We therefore recommend that this road be included in the project boundary of a new license. The portion of the road not within the existing project boundary is about 0.9 mile long and on land owned by private entities.
- PacifiCorp proposes to adjust the existing project boundary along the right bank of the J.C. Boyle bypassed reach from the river channel upslope to include only the land associated with and immediately adjacent to the intake canal and associated access road. The area upslope of the J.C. Boyle bypassed reach between the power canal, the emergency spillway channel, and the river have been and are likely to continue to be

affected by the project and are likely to require a long term commitment by PacifiCorp to repair project-related environmental damage and prevent their recurrence. We therefore recommend that the existing project boundary not be reduced along the bypassed reach.

- PacifiCorp proposed to include the Stateline Take-out area, often used as the end point by recreational boaters on the peaking reach, within the proposed project boundary. However, PacifiCorp does not propose to include the access road from Ager-Beswick Road to the Stateline Take-out area in the project boundary. We conclude that, without this road, this existing recreational site would have minimal value, and recommend that this access road be included in the project boundary of a new license. The portion of this road outside the proposed project boundary is about 0.3 mile long and on Bureau of Land Management lands.

### **5.2.21 Dam Removal**

We discuss in detail the environmental effects of removal of one or more project dams in each of the resource analysis section in section 3.0, *Environmental Consequences*. We briefly summarize the potential positive, negative, and unknown effects in table 5-2, and in the text that follows this table.

Table 5-2. Summary of environmental resource effects of mainstem dam removal. (Source: Staff)

Resource	Negative Effects of Dam Removal	Positive Effects of Dam Removal	Unknown Effects
<b>Geology and Soils</b>	<ul style="list-style-type: none"> <li>• Sediment stored behind project dams would be released to downstream reaches over at least a several month period, resulting in aberrant geomorphological processes until equilibrium is reached.</li> </ul>	<ul style="list-style-type: none"> <li>• Restoration of natural bedload transport and other fluvial geomorphological processes would increase channel complexity and create more representative riparian habitats, especially in the sediment starved portion of the river upstream of RM 170.</li> </ul>	
<b>Water Quality</b>	<ul style="list-style-type: none"> <li>• Total suspended sediments would increase downstream of Iron Gate dam, even if Iron Gate dam is retained while upstream dams are removed; downstream consumptive water users may need to seek alternative sources, or treat water withdrawn from the Klamath River on a short-term basis.</li> </ul>	<ul style="list-style-type: none"> <li>• Temperature and DO regime downstream of Iron Gate dam would be more favorable for salmonids with removal of Copco No. 1 and Iron Gate dams; <i>Microcystis</i> and its toxin originating from blooms in project reservoirs would be eliminated.</li> <li>• DO in project waters expected to increase because of reaeration associated with turbulence, as water passes through higher gradient reaches that were formerly bypassed or inundated.</li> <li>• Reduced ammonia and pH fluctuation with elimination of Copco and Iron Gate reservoirs.</li> </ul>	<ul style="list-style-type: none"> <li>• Dynamics associated with more rapid transport of nutrients from Keno area to downstream reaches, including whether extent of <i>Cladophora</i> colonization (and associated fish disease risk) would decrease or increase.</li> <li>• Although preliminary reservoir sediment testing indicates that they are relatively free of contaminants, pockets of unsampled contaminants may still exist.</li> </ul>

Resource	Negative Effects of Dam Removal	Positive Effects of Dam Removal	Unknown Effects
<b>Aquatic Resources</b>	<ul style="list-style-type: none"> <li>• Existing habitat for warmwater fish in project reservoirs would be eliminated.</li> <li>• Iron Gate Hatchery would most likely be decommissioned because its primary cold water supply, Iron Gate reservoir would be eliminated; fisheries that depend on releases from this hatchery would be curtailed, until natural production of anadromous fish gaining access to spawning and rearing habitat becomes established.</li> <li>• Release of fine-grained sediment after dam removal would adversely influence downstream aquatic habitat, and could disrupt mainstem salmon spawning and foraging for at least a year.</li> <li>• Removal of J.C. Boyle dam would greatly reduce the size of the thermal refugia created by spring inflow in the bypassed reach, and would increase downstream water temperatures, potentially creating more stressful conditions for salmonids.</li> </ul>	<ul style="list-style-type: none"> <li>• Existing resident salmonid populations in project riverine reaches would expand to newly exposed, formerly inundated river reaches.</li> <li>• Anadromous fish currently blocked by Iron Gate dam would be able to recolonize historical spawning and rearing habitat that may be still available.</li> <li>• Resident and anadromous fish would gain access to spawning habitat inundated by project reservoirs.</li> <li>• Thermal refugia from inundated springs and previously inaccessible spring fed tributaries would be available to resident and anadromous salmonids (not readily quantified).</li> <li>• Spawning gravel dispersal to suitable locations would likely increase.</li> <li>• Increased length of riverine reaches with relatively stable flow regimes would likely increase benthic invertebrate production, and this more abundant food supply would increase the health and condition of riverine fish (in particular,</li> </ul>	<ul style="list-style-type: none"> <li>• Influence of reintroduced anadromous fish on populations of resident fish.</li> <li>• Whether anadromous fish would successfully be able to move upstream and downstream of Keno reservoir and Upper Klamath Lake.</li> <li>• Whether incidence of diseases in resident fish would change once anadromous fish gain access to areas previously blocked.</li> </ul>

Resource	Negative Effects of Dam Removal	Positive Effects of Dam Removal	Unknown Effects
		<p>young rainbow trout) inhabiting former project waters.</p> <ul style="list-style-type: none"> <li>Any effects associated with anadromous fish crowding downstream of the first impassable dam would be eliminated.</li> <li>Any upstream and downstream fish passage inefficiencies (including turbine and spillway mortality) would be eliminated.</li> <li>The incidence of fish diseases downstream of Iron Gate dam would likely be reduced.</li> </ul>	
<b>Terrestrial Resources</b>	<ul style="list-style-type: none"> <li>Reduced resting habitat for migratory waterfowl; reduced foraging habitat for piscivorous birds such as osprey and several species of bats.</li> <li>Vegetation and wildlife habitat enhancements proposed by PacifiCorp would not be implemented.</li> </ul>	<ul style="list-style-type: none"> <li>Additional riparian habitat and upland vegetation could provide habitat for small mammals and songbirds, foraging opportunities for raptors, and high quality winter range for deer.</li> </ul>	<ul style="list-style-type: none"> <li>Vegetation and wildlife habitat effects (beneficial and adverse) would depend to some extent on whether the former reservoir sites are actively or passively managed.</li> </ul>

Resource	Negative Effects of Dam Removal	Positive Effects of Dam Removal	Unknown Effects
<b>Threatened and Endangered Species</b>	<ul style="list-style-type: none"> <li>• Bald eagle foraging habitat associated with project reservoirs would be eliminated.</li> <li>• Habitat that is currently suitable for federally listed sucker rearing in project reservoirs would be eliminated, most likely shrinking the range of habitat available for colonization within the Klamath River Basin.</li> <li>• If available habitat for northern spotted owl near Copco No. 1 dam should be occupied during dam removal, deconstruction activities could disturb or displace owls.</li> </ul>	<ul style="list-style-type: none"> <li>• Coho salmon would gain access to historical habitat upstream of Iron Gate dam.</li> <li>• Any entrainment or impingement mortality of federally listed suckers at project powerhouse intakes would be eliminated.</li> </ul>	<ul style="list-style-type: none"> <li>• Whether foraging habitat losses would negatively influence bald eagle populations.</li> <li>• Whether negative effects of reduction in available habitat and positive effects of eliminating impingement and entrainment losses would result in increases, decreases, or not changes in federally listed sucker populations.</li> </ul>
<b>Recreation Resources</b>	<ul style="list-style-type: none"> <li>• Loss of most commercial whitewater rafting in J.C. Boyle peaking reach, especially during low flow summer periods.</li> <li>• Loss of flatwater recreational opportunities at project reservoirs.</li> <li>• PacifiCorp's existing and proposed recreational facilities at project reservoirs and mainstem river reaches would likely be eliminated unless another entity offers to operate them.</li> </ul>	<ul style="list-style-type: none"> <li>• Increased length of whitewater boating runs.</li> <li>• Increased riverine angling opportunities, especially when anadromous fish are fully restored to upstream habitat.</li> </ul>	<ul style="list-style-type: none"> <li>• Not possible to translate increased opportunities for whitewater boating into a change in actual use.</li> </ul>

Resource	Negative Effects of Dam Removal	Positive Effects of Dam Removal	Unknown Effects
<b>Land Use and Aesthetics</b>	<ul style="list-style-type: none"> <li>• Short-term negative aesthetic effect at newly exposed reservoir bottom, until revegetation occurs.</li> <li>• Demolition debris disposal sites would need to be developed, removing associated sites from other potential uses.</li> </ul>	<ul style="list-style-type: none"> <li>• Visual intrusion on the natural landscape created by project dams, canals, powerhouses, and transmission lines would be eliminated.</li> </ul>	<ul style="list-style-type: none"> <li>• Project lands owned by PacifiCorp could be sold; future land uses unknown.</li> </ul>
<b>Socioeconomic Resources</b>	<ul style="list-style-type: none"> <li>• Elimination of most commercial whitewater rafting in the J.C. Boyle peaking reach could eliminate \$465,567 to \$739,374 in spending in the 5-mile corridor and \$2.2 to \$2.5 million in the 50-mile corridor.</li> <li>• Homeowners with property that abuts project reservoirs would no longer experience the lacustrine environment that may have attracted them to purchase their property.</li> </ul>	<ul style="list-style-type: none"> <li>• Jobs and earnings associated with dam removal: 95 temporary full-time equivalent jobs \$7.0 million in earnings.</li> <li>• Likely positive effect on recreational, commercial, and tribal fishery if disease issues are addressed.</li> <li>• Substantial positive effect on harvest quotas, allowing access to more traditional diet, potentially resulting in improved physical, cultural, and spiritual health.</li> </ul>	<ul style="list-style-type: none"> <li>• Change in spending from reservoir-based recreation to river-based recreation not known.</li> <li>• Whether property values of land abutting former project reservoirs would increase or decrease.</li> <li>• Because effects on property values are unknown, the associated effect on property tax revenue for the affected counties is also unknown.</li> </ul>

Resource	Negative Effects of Dam Removal	Positive Effects of Dam Removal	Unknown Effects
<b>Cultural Resources</b>	<ul style="list-style-type: none"> <li>• Previously submerged cultural resources could be subject to vandalism and looting.</li> <li>• Long-term management of historic properties that would be afforded by implementation of a final HPMP would not occur.</li> <li>• Treatments proposed by PacifiCorp of cultural sites may not be implemented.</li> </ul>	<ul style="list-style-type: none"> <li>• If dam removal enhances restoration of anadromous fish to habitat upstream of Iron Gate dam, traditional tribal ceremonies and fishing practices associated with anadromous fish could also be restored.</li> <li>• Ceremonial and traditional Native American practices downstream of Iron Gate dam that have been hindered by degraded water quality would likely improve, if negative effects were project-related.</li> </ul>	<ul style="list-style-type: none"> <li>• Whether riparian vegetation used by Native Americans for traditional purposes (e.g., basketweaving) would be enhanced under the new post dam-removal flow regime.</li> </ul>

Removal of one or more of the mainstem dams could enhance the prospects for restoring anadromous fish to areas within and upstream of the project and improve conditions within the downstream migration corridor. We evaluate the potential benefits to anadromous fish of removing one or more mainstem dams in section 3.3.3.2.4, *Dam Removal or Decommissioning*. Because of their greater effect on downstream water quality, and because of the quality and quantity of habitat that they inundate, we conclude that the removal of Iron Gate and Copco No. 1 dams would provide a much greater benefit than removing the Copco No. 2 and J.C. Boyle dams. Removal of Iron Gate dam would provide access to two tributaries that are capable of supporting Chinook and possibly coho salmon (Fall and Jenny creeks), would provide access to important Chinook salmon spawning habitat in the Copco No. 2 bypassed reach, and would provide Chinook salmon spawning habitat currently inundated by Iron Gate reservoir. It also would restore access to these same areas for steelhead and Pacific lamprey.<sup>173</sup> If fish passage was provided at Copco No. 2 dam, removal of Copco No. 1 dam would restore Chinook salmon spawning habitat inundated by Copco reservoir, provide coho salmon with access to potential habitat in Long Pine Creek, and provide anadromous fish with access to spawning and rearing habitat and temperature refugia in the J.C. Boyle peaking and bypassed reaches. Based on the similarity of stream gradient in the river sections impounded by Iron Gate and Copco No. 1 dams to the primary fall Chinook salmon spawning areas downstream of Iron Gate dam, we conclude that the habitat inundated by these reservoirs would likely provide a substantial amount of spawning habitat for fall Chinook salmon. In section 3.3.3.2.4, *Dam Removal or Decommissioning*, we use spawner densities calculated for tributary and mainstem habitats from historic redd counts in Jenny and Fall creeks and in the Copco No. 2 bypassed reach to estimate the number of spawners that could be accommodated with these two dams removed. We estimate that about 11,000 fall Chinook salmon spawners could be accommodated in existing riverine habitat between Iron Gate and Keno dams and another 12,000 spawners could be accommodated by habitat that is currently inundated by Copco and Iron Gate reservoirs, if both Iron Gate and Copco No. 1 dams are removed and effective fish passage is provided at Copco No. 2 and J.C. Boyle dams. Providing access to this habitat could substantially reduce crowding of adult fall Chinook in the spawning areas downstream of Iron Gate dam, which should reduce pathogen densities and the transmission of disease among adult and juvenile anadromous fish.

Removal of Iron Gate and Copco No. 1 dams could also have a substantial influence on water quality conditions and disease prevalence in the Klamath River downstream of Iron Gate dam. In section 3.3.3.2.4, *Dam Removal or Decommissioning*, we conclude that the elimination of Iron Gate and Copco reservoirs would be likely to reduce fish stress and disease susceptibility by moderating fluctuations in DO and pH associated with algae blooms, increasing DO levels through natural aeration from turbulent passage of water in areas of higher gradient that are inundated by the reservoirs, and reducing levels of ammonia in downstream areas. Restoring access to these reaches for anadromous fish would allow spawning fall Chinook salmon to distribute over a greater length of the river, reducing crowding and the concentration of disease pathogens that currently occurs in the reach between Iron Gate dam and the Shasta River. Restoring natural sediment transport processes would contribute to the scour of attached algae downstream of the current site of Iron Gate dam, and deposited sediments would provide a less favorable substrate for attached algae due to its greater mobility during high flow events. The reduction in attached algae would reduce habitat for the polychaete intermediate host of the myxosporidian parasites *C. shasta* and *P. minibicornis*, which should reduce the infection rate of juvenile salmonids downstream of Iron Gate dam.

Removal of these two dams would eliminate flatwater recreation and warmwater fisheries at these reservoirs. In addition, removal of Copco No. 1 dams would eliminate the two formal recreation sites on

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<sup>173</sup>We note, however, that there is no conclusive evidence that Pacific lamprey occurred historically upstream of Iron Gate dam, and no Pacific lamprey have been observed entering the fish ladders at Iron Gate Hatchery.

Copco reservoir, Mallard Cove and Copco Cove, from the project, and they would likely no longer serve as recreational resources, unless another entity offered to assume operation and maintenance of these facilities. Likewise, removal of Iron Gate dam would eliminate nine existing recreational facilities at the reservoir and Iron Gate Hatchery, and two new recreational facilities proposed by PacifiCorp at this development would not be constructed. Recreational opportunities accommodated by these existing and proposed facilities include car-top and trailered boat access to the reservoir, picnicking, hiking, tent and recreational vehicle camping, and educational programs at Iron Gate Hatchery. Another entity may offer to continue operation of one or more of these facilities during the decommissioning process for these two developments because they would still provide public access to the newly unimpounded portions of the Klamath River. Salmonid angling opportunities and whitewater boating opportunities would be created by removal of both dams. Removal of Copco No. 1 and Iron Gate dams could also reduce land values adjacent to the reservoirs, although this is by no means a definite outcome, especially given the recent occurrence of toxic algal blooms that would limit the ability of property owners along the reservoirs to enjoy typical activities that may have been enjoyed previously.

Although the potential benefits to commercial, recreational, and tribal fisheries of removing Iron Gate and Copco No. 1 dams are substantial, so are the costs. In section 4.7, *Conceptual Costs of Project Dam Removal*, we estimate that the annualized cost of removing Iron Gate dam, including 116,000 MWh of lost generation, would likely be about \$8,882,950, assuming that the sediments in the reservoir are not contaminated. The corresponding lost generation and reduction in project benefits from removing Copco No. 1 dam would be about 106,000 MWh and \$6,483,500, assuming the sediments in the reservoir are not contaminated. We note that the annualized cost of installing upstream and downstream fish passage facilities at Copco No. 2 dam, which would be needed to provide access to restored habitat currently inundated by Copco reservoir, would be \$4,122,520.

Removal of Copco No. 1 and Iron Gate dams would cause the release of sediments to the Klamath River downstream of Iron Gate dam. If dam removal is conducted in a carefully planned manner, perhaps using a staged approach for the removal of Iron Gate dam, the release of sediments could be minimized and timed to avoid critical spawning and rearing periods for salmon in the downstream reaches. However, if sediments in Copco or Iron Gate reservoirs are found to be contaminated to the extent that release of the sediments to downstream areas could not reasonably occur, the costs for dredging and upland disposal of contaminated sediments could be exorbitant, as we discuss in section 4.7, *Conceptual Costs of Project Dam Removal*. Although characterization and quantification of sediments in each reservoir would be necessary prior to any detailed planning of dam removal, based on available estimates of sediment in each reservoir, the dredging and disposal of sediments at a secure landfill site could range from about \$1 to 3 billion for Copco reservoir, and \$0.5 to 1.5 billion for Iron Gate reservoir. Funds needed for such a major undertaking may be sufficient to dissuade pursuit of the removal of one or both dams. Current information from GEC (2006) indicates that the sediments in the reservoirs are not contaminated to the extent of requiring dredging and upland disposal. However, we continue to conclude that released sediment associated with dam removal would have potential for adverse effects, although these effects could be minimized with careful planning. We know of no existing technology that could eliminate any adverse effects of sediment releases if any mainstem dams are removed. We also note that on page 6 of the study by GEC (2006), it states that the report "...provides an overview, but not a comprehensive analysis of dam removal and its effects on water quality. Much additional analysis will be required to fully evaluate dam removal as a preferred project management alternative." The GEC study should be considered preliminary and not a definitive determination of non-contaminated sediments.

The incremental negative and positive effects of removing all four lower mainstem dams compared to the removal of just Copco No. 1 and Iron Gate dams would be small, and are summarized in table 5-1. Sediment released following the removal of J.C. Boyle dam would be primarily sand and there would only be a relatively small volume of sediment stored behind Copco No. 2 dam that would be susceptible to release following dam removal. Therefore, removal of both dams would result in only

minimal short-term habitat and water quality degradation, compared to the removal of the much taller Copco No. 1 and Iron Gate dams and their associated larger reservoirs. The value of the springs in the J.C. Boyle bypassed reach as a thermal refugium during the summer would be diminished, which could adversely affect resident trout and potentially restored populations of summer steelhead and spring Chinook salmon. This adverse effect could be offset if additional thermal refugia become accessible at springs currently inundated by J.C. Boyle reservoir and spring-fed tributaries. Removal of Copco No. 2 dam would return all flows to the Copco No. 2 bypassed reach, which eventually would likely reduce the current vegetation in the channel, restore a more natural riparian community, and result in potential spawning gravel deposition at suitable locations. Removal of these two dams would result in an incremental increase of about 3.9 miles of currently inundated mainstem salmonid spawning and rearing habitat, in addition to a small amount of habitat at the mouth of Spencer Creek. Upstream and downstream fish passage inefficiencies associated with fishways at both dams would be eliminated, which could result in increased productivity of identified coho salmon spawning and rearing habitat in Spencer Creek. The Bureau of Land Management may continue to operate Topsy Campground, but instead of providing recreational access to J.C. Boyle reservoir, it would provide access for riverine recreational opportunities which would include angling and extended distance (potentially, to the mouth of the Klamath River) whitewater boating opportunities when sufficient flows are present. PacifiCorp's existing Pioneer Park recreational area would likely be abandoned, unless another entity offered to assume operation and maintenance responsibilities. Proposed and recommended new recreational facilities at J.C. Boyle reservoir and bypassed reach would not be constructed. We estimate that the annualized cost of removing J.C. Boyle dam, including 329,000 MWh of lost generation, would likely be about \$15,808,020 and the annualized cost of removing Copco No. 2 dam, including 135,000 MWh of lost generation, would likely be about \$5,413,960. The only remaining source of generation from the project would be at the Fall Creek development, which annually produces about 15,772 MWh of power.

### **5.3 PREFERRED ALTERNATIVE**

Based on our analysis of the environmental benefits and project costs associated with the four alternatives considered in this document, we select the Staff Alternative as the preferred alternative. We recommend this alternative because (1) issuance of a new license would allow PacifiCorp to continue to operate the project as a dependable source of electric energy for its customers; (2) the 161 MW project would avoid the need for an equivalent amount of fossil-fuel fired electric generation and capacity, continuing to help conserve these nonrenewable energy resources while reducing atmospheric pollution; and (3) the recommended environmental measures would enhance water quality, help restore anadromous fish to historical habitat, protect fish and terrestrial resources, improve public use of recreational facilities and resources, and maintain and protect historic and archaeological resources within the area affected by project operations.

Although we acknowledge that the removal of Iron Gate and Copco No. 1 dams would provide greater benefits to anadromous fish, it would result in a substantial reduction in generation benefits and very high costs for decommissioning, especially if sediment contamination levels are high enough to warrant dredging and off-site disposal. In addition, while the Staff Alternative does not include all of the 4(e) conditions filed by Interior or section 18 prescriptions filed by Interior and NMFS, we recognize that the Commission may include them in a license due to their mandatory nature. See table 5-4 for the 4(e) conditions not included in the Staff Alternative along with reasons for exclusion.

### **5.4 SUMMARY OF SECTION 10(j) RECOMMENDATIONS AND 4(e) CONDITIONS**

#### **5.4.1 Fish and Wildlife Agency Recommendations**

Under the provisions of the FPA, each hydroelectric license issued by the Commission shall include conditions based on the recommendations provided by federal and state fish and wildlife agencies

for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project. In response to our REA notice, the following fish and wildlife agencies submitted recommendation for the project: Oregon Fish & Wildlife (letter filed March 28, 2006), Cal Fish & Game (letter filed March 29, 2006), FWS (letter filed March 29, 2006), and NMFS (letter filed March 29, 2006).

Section 10(j) of the FPA states that whenever the Commission believes that any fish and wildlife agency recommendation is inconsistent with the purposes and requirements of the FPA or other applicable law, the Commission and the agency shall attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of the agency. Table 5-3 lists the federal and state recommendations filed pursuant to section 10(j) and indicates whether the recommendations are included under the Staff Alternative. Environmental recommendations that we consider outside the scope of section 10(j) have been considered under section 10(a) of the FPA and are addressed in the specific resource sections of this document.

Of the 77 recommendations that we consider to be within the scope of section 10(j), we included 40 in the Staff Alternative, recommended an additional 4 measures if Keno, East Side, and West Side developments should be included in a new license, and excluded 33 from the Staff Alternative in our draft EIS. Following issuance of the draft EIS, comments on the 33 environmental measures that we did not include in the Staff Alternative were filed by the fish and wildlife agencies. We held a meeting with the fish and wildlife agencies to try to resolve inconsistencies with the FPA and to provide both agency personnel and Commission staff the opportunity to clarify their positions on various measures that we did not adopt as part of the Staff Alternative. The meeting was held in Redding, California, on December 12-14, 2006. We issued a meeting summary on January 17, 2007. Comments from the resource agencies on the summary were provided by letters dated February 5, 2007 (Cal Fish & Game), February 21, 2007 (FWS), and February 26, 2007 (Oregon Fish & Wildlife).

As a result of the comments on the draft EIS, the meeting, and subsequent clarifications, we either modified some of our original recommendations or otherwise resolved some of the measures that we initially did not include in the Staff Alternative or otherwise recommend, including the following: (1) the flow regime downstream of Keno dam, if Keno development remains in a new license (item 26 in table 5-3); (2) the flow regime downstream of the Spring Creek diversion dam; (item 32); (3) the flow regime downstream of Iron Gate dam if project inflow is less than the specified minimum release (item 34); (4) provisions for ensuring protective releases continue at Iron Gate dam (item 35); (5) construction of a new fish screen, bypass, and trapping system at J.C. Boyle dam (item 52); and (6) implementation of a hatchery and genetics management plan (item 66). We also partially modified some of our original recommendations or otherwise partially resolved some of the measures that we initially did not include in the Staff Alternative, including the following: (1) specific gages and details to be addressed in a gage installation plan (items 13 and 15); (2) seasonal flow releases to the J.C. Boyle bypassed reach, but not the Copco No. 2 bypassed reach (item 36); (3) ramping rates at Fall and Spring creek and Iron Gate dams, but not J.C. Boyle dam, the peaking reach, or Copco No. 2 bypassed reach (item 39); (4) new fish ladders at Spring and Fall creek diversion dams, but not at the remaining dams (items 45 and 46); and (5) new downstream fish passage facilities at J.C. Boyle, Spring Creek, and Fall Creek dams, but not the remaining dams (items 53 and 54).

In this EIS, we now include 45 recommendations that we consider to be within the scope of section 10(j) in the Staff Alternative, recommend 5 additional measures if Keno, East Side, and West Side developments should be included in a new license, include portions of 8 others that we originally did not recommend, and do not include 19 measures in the Staff Alternative. We discuss the reasons for not including those recommendations in the following table or in section 5.2, *Discussion of Key Issues*. Table 5-3 shows the basis for our determinations concerning measures that we consider inconsistent with section 10(j) of the FPA.

Table 5-3. Analysis of fish and wildlife agency recommendations for the Klamath Hydroelectric Project. (Source: Staff)

Recommendation	Agency <sup>a</sup>	Subject to Section 10(j)	Annualized Cost	Adopted?
1. Develop a sediment and gravel resource management plan within 1 year of license issuance, provide annual monitoring and compliance reports to the Commission and resource agencies, and update the plan every 5 years.	Oregon Fish & Wildlife (1A4, 1B, 1C, 1D4) Cal Fish & Game (IV)	No <sup>b</sup>	\$17,020	Yes
2. Develop a gravel mapping and sediment augmentation plan within 1 year of license issuance (NMFS & FWS) or 2 years of license issuance (Oregon Fish & Wildlife & Cal Fish & Game) that includes provisions for mapping gravel and specific measures that would be implemented to restore spawning habitat downstream of project dams.	Oregon Fish & Wildlife (9A), Cal Fish & Game (II), NMFS (8), FWS (8)	Yes	\$10,670	Yes
3. Develop and implement specific recommendations for sediment augmentation within 3 years of license issuance.	Oregon Fish & Wildlife (9B), Cal Fish & Game (II), NMFS (8), FWS (8)	Yes	\$33,910	Yes
4. Monitor sediment following augmentation for distribution and spawning use and adaptively manage.	Oregon Fish & Wildlife (9C), Cal Fish & Game (II), NMFS (8), FWS (8)	Yes	\$20,000	Yes
5. Implement flow continuation provisions at J.C. Boyle powerhouse within 1 year of license issuance.	Oregon Fish & Wildlife (7C)	Yes	\$898,760	Yes
6. Develop a plan for restoration of slope failures along J.C. Boyle bypassed reach within 1 year of license issuance.	Oregon Fish & Wildlife (9D)	Yes	\$409,000	Yes
7. Develop a monitoring and maintenance plan to reduce chances of water conveyance system failure and excess use of emergency overflow spillway.	Oregon Fish & Wildlife (9D)	No <sup>b</sup>	\$1,350	No, the need for such a plan would be addressed under Part 12 of the Commission's regulations.
8. Notify and report to agencies in the event of an accidental spill or discharge from project waterway system or other events.	Oregon Fish & Wildlife (9E)	No <sup>b</sup>	\$0	Yes, but phrase "or other events" would need clarification.

<b>Recommendation</b>	<b>Agency<sup>a</sup></b>	<b>Subject to Section 10(j)</b>	<b>Annualized Cost</b>	<b>Adopted?</b>
9. Coordinate on a timely basis with resource agencies regarding remedial measures following waterway failures.	Oregon Fish & Wildlife (9F)	Yes	\$0	Yes
10. Develop an action plan that establishes protocols to be followed following a failure of project water conveyance systems within 1 year of license issuance.	Oregon Fish & Wildlife (9G)	Yes	\$1,350	Yes
11. Consult with agencies to develop a site specific erosion control plan prior to ground-disturbing activities.	Oregon Fish & Wildlife (9H)	No <sup>b</sup>	Costs included in plans for specific actions.	Yes
12. Develop a project operations resource management plan within 1 year of license issuance, provide annual water quantity monitoring and compliance reports to the Commission and resource agencies, and update the plan every 5 years.	Oregon Fish & Wildlife (1A1, 1B, 1C, 1D1, 10A, 10B) Cal Fish & Game (IV)	No <sup>b</sup>	\$11,350	Yes

Recommendation	Agency <sup>a</sup>	Subject to Section 10(j)	Annualized Cost	Adopted?
13. Develop a coordinated gage installation plan. Within 6 months of license issuance install gages with telemetry systems above all project reservoirs or diversions and at outflows from each project dam at the head of the dewatered reach to measure inflow to the reservoir and outflow below each project dam, including ramping rates.	Oregon Fish & Wildlife (6A, 6B)	Yes	\$30,070	Partially resolved; in its comments on the draft EIS, Oregon Fish & Wildlife agrees that Parshall flumes would be acceptable to monitor flows downstream of the diversion dams on Spring and Fall creeks; during the 10(j) meeting it was agreed that the specifics of a gaging plan should be based on the flow regime specified in a new license but Oregon Fish & Wildlife indicates agencies should indicate concurrence with the plan prior to submittal to the Commission. (see section 5.2).
14. Install gages where needed to appropriately monitor inflow, outflow, and reservoir elevations at each project facility.	NMFS (6)	Yes	\$60,450	Yes

<b>Recommendation</b>	<b>Agency<sup>a</sup></b>	<b>Subject to Section 10(j)</b>	<b>Annualized Cost</b>	<b>Adopted?</b>
15. Install gages that allow measurement of inflow above all project reservoirs and outflow from each project dam. Flow records should be made available to resource agencies upon request.	Cal Fish & Game (I)	Yes	\$18,720	Partially resolved; in its comments on the draft EIS, Cal Fish & Game agrees that Parshall flumes would be acceptable to monitor flows downstream of the diversion dams on Spring and Fall creeks. (see section 5.2).
16. Develop a water quality resource management plan within 1 year of license issuance, provide annual water quality monitoring and compliance reports to the Commission and resource agencies, and update the plan every 5 years. Monitoring should include temperature, DO, TDG, pH, chlorophyll <i>a</i> , nutrients, and toxic algae.	Oregon Fish & Wildlife (1A2, 1B, 1C, 1D2, 8A, 8B) Cal Fish & Game (IV)	Yes	\$106,200	Yes
17. Develop decommissioning plans for project developments where meeting water quality standards is not feasible.	Oregon Fish & Wildlife (8C)	No <sup>b</sup>	Development dependent.	No, developing any decommissioning plans would be addressed in a decommissioning proceeding for any such development.
18. Develop a Keno reservoir water quality plan within 1 year of license issuance (NMFS) or 2 years of license issuance (FWS) and implement appropriate measures to address water quality problems.	NMFS (11), FWS (11)	Yes, but timing is not.	\$22,700	Yes, if Keno is included in project license.

Recommendation	Agency <sup>a</sup>	Subject to Section 10(j)	Annualized Cost	Adopted?
19. Develop a temperature control device feasibility and implementation plan conducted by an independent third party and approved by the agencies for Copco No. 1 and Iron Gate dams within 1 year of license issuance.	NMFS (9), FWS (9)	Yes, although who conducts the studies is not.	\$10,120	Yes, although not provisions for an independent third party.
20. Develop a DO enhancement plan that provides for study and implementation of measures to increase DO downstream of Iron Gate dam for the geographic extent of project effects within 1 year of license issuance.	NMFS (10), FWS (10)	Yes	Included in 16, above.	Yes
21. Develop a plan to monitor for <i>Microcystis</i> and reduce the risk of toxic algal blooms on fish in Copco and Iron Gate reservoirs.	FWS (12A)	Yes	\$68,700	Yes
22. Do not operate East Side and West Side developments when flows are 500 cfs or less below Link River dam (if not decommissioned).	Oregon Fish & Wildlife (6A)	Yes	\$3,090	Yes, if East Side and West Side included in project license.
23. Install a gage in the bypassed reach below Link River dam to ensure East Side and West Side developments operate only when flows exceed 500 cfs.	Oregon Fish & Wildlife (6A)	Yes	\$19,440	No, nearly all flow released at Link River dam is under the control of Reclamation; if East Side and West Side developments should be included in a new license, gage placement would be addressed in the project operations management plan.

Recommendation	Agency <sup>a</sup>	Subject to Section 10(j)	Annualized Cost	Adopted?
24. If East Side and West Side developments are decommissioned, operate controlling structures in a manner that avoids fluctuations in river flow.	NMFS (6)	Yes	Cannot be quantified.	No, controlling structures at Link River dam are not within the existing project and would not be after decommissioning. Not within the Commission's jurisdiction.
25. Consult with NMFS regarding flow and facility operation schedule that minimizes effects on anadromous fish, if East Side and West Side developments are not decommissioned.	NMFS (6)	No <sup>b</sup>	\$1,350	Yes, if East Side and West Side included in project license.
26. Release a minimum flow of 625 cfs or inflow to the Keno reach (NMFS & FWS do not specify a minimum flow). When flows are above 625 cfs on a 24-hour basis, flows released from Keno dam should be within 10 percent of the measured inflow. Keno dam should not to be used to regulate flow for downstream peaking operations.	Oregon Fish & Wildlife (6A), Cal Fish & Game (I),	Yes	\$0	Resolved; Oregon Fish & Wildlife and Cal Fish & Game agreed to modify their recommendation to be consistent with FWS's recommendation in item 27.
27. Provide minimum flows in the Keno reach within 10 percent of inflow (NMFS defines inflow as daily inflow, FWS defines inflow as the sum of the 3-day average inflow). Keno dam should not be used to regulate flow for downstream peaking operations.	NMFS (6), FWS (6.2)	Yes	\$0	Yes, if inflow is 3-day average and Keno included in project license (during the 10(j) meeting, NMFS agreed that a 3-day average is appropriate).
28. Release a minimum flow of 640 cfs or 40 percent proportional inflow, whichever is greater, to the J.C. Boyle bypassed reach.	Oregon Fish & Wildlife (6A), Cal Fish & Game (I), NMFS (6)	Yes	\$7,362,230	No (see section 5.2).

<b>Recommendation</b>	<b>Agency<sup>a</sup></b>	<b>Subject to Section 10(j)</b>	<b>Annualized Cost</b>	<b>Adopted?</b>
29. Release a minimum flow of 720 cfs to the J.C. Boyle peaking reach (Cal Fish & Game adds “or inflow”).	Oregon Fish & Wildlife (6A), Cal Fish & Game (I)	Yes	\$0	No (see section 5.2).
30. Release a minimum flow of 730 cfs or 40 percent proportional inflow, whichever is greater, to the Copco No. 2 bypassed reach.	Oregon Fish & Wildlife (6A), Cal Fish & Game (I), NMFS (6), FWS (6.4)	Yes	\$4,685,520	No (see section 5.2).
31. Release 40 percent of the instantaneous flow measured above the Fall Creek diversion into the bypassed reach.	Oregon Fish & Wildlife (6A), Cal Fish & Game (I), FWS (6.5)	Yes	\$257,690	No (see section 5.2).
32. Release all inflow to the Spring Creek diversion dam from June 1 through Sept. 15, and 50 percent inflow for the remainder of the year.	Oregon Fish & Wildlife (6A), Cal Fish & Game (I), FWS (6.6)	Yes	\$83,830	Resolved; all three agencies modified their recommendations to reflect a 4 cfs minimum flow for the remainder of the year, instead of 50 percent inflow; we include the 4 cfs minimum flow in the Staff Alternative.
33. Release minimum flows from Iron Gate dam in accordance with a specific schedule that specifies monthly flows by water year type. Oregon Fish & Wildlife’s monthly flows are identical to Cal Fish & Game except for August and September of a below average water year; Oregon Fish & Wildlife specifies 1,000 and 1,100 cfs, respectively, and Cal Fish & Game specifies 1,200 cfs for both months.	Oregon Fish & Wildlife (6A), Cal Fish & Game (I)	Yes	\$0	No (see section 5.2).

Recommendation	Agency <sup>a</sup>	Subject to Section 10(j)	Annualized Cost	Adopted?
34. Operate Iron Gate development in a run-of-river mode when inflow drops below the specified minimum release and normal active storage above elevation 2,322 feet is depleted.	Cal Fish & Game (I)	Yes	\$0	Resolved; we offered alternative language to this measure in the 10(j) meeting summary, and Cal Fish & Game agreed to the alternative language (now included in our modifications of measure 21P).
35. Ensure releases from Iron Gate dam are equivalent to the combined instantaneous inflow to the project, including tributary inflow, spring accretion, irrigation return flows, and releases from the Klamath Irrigation Project.	NMFS (6), FWS (6.7)	Yes	\$0	Resolved; we incorporated suggested language provided by FWS in response to our 10(j) meeting summary into our modification of measure 21P which addresses the concerns discussed during the 10(j) meeting.
36. Annually release seasonal high flows to the J.C. Boyle and Copco No. 2 (Copco No. 2 included in NMFS rationale only) bypassed reaches by diverting all flows from the powerhouses for 7 days between February 1 and April 15, when inflow to J.C. Boyle reservoir exceeds 3,300 cfs, (FWS specifies this as the inflow to Copco reservoir), with a downramp rate of 2 inches an hour (only specified by Oregon Fish & Wildlife) and 300 cfs per 24 hours.	Oregon Fish & Wildlife (6C), NMFS (7), FWS (7; FWS specifies the Copco No. 2 bypassed reach and Bureau of Land Management 4(e) condition, on behalf of FWS specifies J.C. Boyle bypassed reach), Cal Fish & Game (I)	Yes	\$388,470	Partially adopted; we now include provisions for seasonal high flow releases to the J.C. Boyle bypassed reach in the Staff Alternative (see section 5.2).
37. Consult with resource agencies regarding timing of scheduled maintenance that entails diversion of flow to project bypassed reaches.	Oregon Fish & Wildlife (6D)	Yes	None	Yes

<b>Recommendation</b>	<b>Agency<sup>a</sup></b>	<b>Subject to Section 10(j)</b>	<b>Annualized Cost</b>	<b>Adopted?</b>
38. Operate all project developments except Iron Gate in a run-of-river mode.	Oregon Fish & Wildlife (7A), Cal Fish & Game (I), NMFS (5, 6)	Yes	\$1,218,460	No (see section 5.2).
39. Provide controllable ramp rates of 1-inch per hour and 300 cfs per day maximum. (Oregon Fish & Wildlife excludes Iron Gate from this ramp rate, Cal Fish & Game does not.)	Oregon Fish & Wildlife (7A), Cal Fish & Game (I), FWS (6.1, 6.4, 6.5; FWS excludes J.C. Boyle because it is covered by the Bureau of Land Management's 4(e) condition	Yes	Included in corresponding flow recommendations.	Partially resolved; the agencies agreed that ramping rates at the Fall and Spring creek diversion dams was unnecessary, Cal Fish & Game and FWS agreed to the ramping rate at Iron Gate specified by NMFS in item 41, below; ramping rates at other reaches unresolved (see section 5.2).
40. Provide controllable ramp rates downstream of Iron Gate dam of 125 cfs per hour and 300 cfs per 24-hours when flows are greater than 1,750 cfs; when flow are at or below 1,750 cfs, ramp rates would be 50 cfs per 2 hours and 150 cfs per 24-hours.	Oregon Fish & Wildlife (7B), FWS (6.7)	Yes	Included in flow recommendations.	Yes, the ramping rates in the Staff Alternative would be more restrictive.
41. Provide controllable ramp rates downstream of Iron Gate dam of 125 cfs per 4 hours and 300 cfs per 24-hours when flows are greater than 1,750 cfs; when flow are at or below 1,750 cfs, ramp rates would be 50 cfs per 2 hours and 150 cfs per 24-hours.	NMFS (6)	Yes	Included in flow recommendations.	Yes
42. Re-regulate flows in the development immediately downstream, if peaking should be allowed at any development.	Cal Fish & Game (I)	Yes	Cost would depend on which developments are operated in a peaking mode.	No (see section 5.2).

<b>Recommendation</b>	<b>Agency<sup>a</sup></b>	<b>Subject to Section 10(j)</b>	<b>Annualized Cost</b>	<b>Adopted?</b>
43. Develop a fish passage resource management plan within 1 year of license issuance, provide annual monitoring and compliance reports to the Commission and resource agencies, and update the plan every 5 years.	Oregon Fish & Wildlife (1A3, 1B, 1C, 1D3) Cal Fish & Game (IV)	No <sup>b</sup>	\$14,050	Yes
44. Establish a fish passage implementation committee.	Oregon Fish & Wildlife (5A, 5B, 5C)	No <sup>b</sup>	\$10,000	Yes
45. Construct fish ladders at J.C. Boyle (10 percent slope, within 4 years), Keno (4 percent slope, within 3 years), Copco Nos. 1 & 2 (10 percent slope, within 6 years), Iron Gate (10 percent slope, within 6 years), and Spring & Fall creek diversion dams (10 percent slope, within 3 years). Include fish trap and counting system at Keno and J.C. Boyle and monitoring plans to ensure that passage survival meets Oregon standards of 95 percent in first 5 years and 98percent thereafter.	Oregon Fish & Wildlife (3A, 3B, 3C, 3D, 3E, 3I)	Yes	\$12,371,170	Partially adopted; we include fish ladders at Spring and Fall creek diversion dams in the Staff Alternative (ladders at other dams could be an outcome of Phase 1 studies (see section 5.2).
46. Construct fish ladders at all project dams within 6 years to include monitoring plans that enable effectiveness to be evaluated.	Cal Fish & Game (II)	Yes	\$10,387,830	Partially adopted; we include fish ladders at Spring and Fall creek diversion dams in the Staff Alternative (ladders at other dams could be an outcome of Phase 1 studies (see section 5.2).
47. Construct tailrace barriers at all powerhouse outlets within 8 years.	Oregon Fish & Wildlife (3D), Cal Fish & Game (II)	Yes	\$4,272,670	No, although installation of tailrace barriers, where needed, could be an outcome of Phase 1 studies (see section 5.2).

<b>Recommendation</b>	<b>Agency<sup>a</sup></b>	<b>Subject to Section 10(j)</b>	<b>Annualized Cost</b>	<b>Adopted?</b>
48. Develop standard operating procedures for O&M of all upstream and downstream fish passage facilities.	Oregon Fish & Wildlife (3H, 3J, 4H, 4J)	Yes	\$1,350	Yes
49. Notify agencies prior to scheduled upstream or downstream fish passage maintenance that dewater fishways and conduct fish salvaging during maintenance.	Oregon Fish & Wildlife (3K, 4K)	Yes	\$0 (Fish salvaging currently occurs.)	Yes
50. Develop a plan to evaluate whether Keno dam spillway currently is effective in passing fish safely downstream within 1 year, implement the plan within 2 years, and implement any spillway modification within 4 years, as appropriate.	Oregon Fish & Wildlife (4B)	Yes	\$71,990	Yes, if Keno included in project license.
51. Modify all project dam spillways to current criteria for downstream fish passage within 6 years of license issuance and monitor after modifications to assess effectiveness.	Cal Fish & Game (II)	Yes	\$1,161,630	No, although spillway modifications could be an outcome of Phase 1 studies (see section 5.2).
52. Within 4 years, construct, operate year-round, maintain, and evaluate a fish screen at Boyle dam. Include a trap to evaluate screen performance and long-term monitoring of the downstream migrant population, including holding and sorting of fish by age and species. Detailed designs should be developed within 2 years of license issuance for agency review and comment.	Oregon Fish & Wildlife (4A, 4E, 4F, 4I)	Yes	\$5,010,390	Yes (see section 5.2).

<b>Recommendation</b>	<b>Agency<sup>a</sup></b>	<b>Subject to Section 10(j)</b>	<b>Annualized Cost</b>	<b>Adopted?</b>
53. Construct downstream fish passage facilities within 3 years at Spring and Fall creeks, within 5 years at Iron Gate and within 6 years at Copco 1 and 2. Monitor and evaluate effectiveness.	Oregon Fish & Wildlife (4C, 4E, 4F, 4I)	Yes	\$10,001,500	Partially adopted; we include downstream fish passage facilities at Spring and Fall creek diversion dams in the Staff Alternative; downstream passage facilities at other dams could be an outcome of Phase 1 studies (see section 5.2).
54. Construct downstream fish passage facilities at all project dams within 6 years of license issuance. Monitor and evaluate effectiveness.	Cal Fish & Game (II)	Yes	\$15,011,890	Partially adopted; we include downstream fish passage facilities at J.C. Boyle, Spring, and Fall creek diversion dams in the Staff Alternative; downstream passage facilities at other dams could be an outcome of Phase 1 studies (see section 5.2).
55. Prepare a decommissioning plan for East Side and West Side developments that protects downstream migrating fish within 1 year of license issuance, implement within 1 year of Commission approval (Oregon Fish & Wildlife) or within 3 from license issuance (NMFS, FWS). NMFS and FWS also call for post decommissioning monitoring.	Oregon Fish & Wildlife (4D), NMFS (4)	No <sup>b</sup>	\$122,330	Yes, any post-decommissioning monitoring would be brief.

<b>Recommendation</b>	<b>Agency<sup>a</sup></b>	<b>Subject to Section 10(j)</b>	<b>Annualized Cost</b>	<b>Adopted?</b>
56. Prepare a decommissioning plan for developments where effective upstream or downstream fish passage is not feasible.	Oregon Fish & Wildlife (3L, 4L), Cal Fish & Game (II)	No <sup>b</sup>	Depends on the specific development.	No, developing any decommissioning plans would be addressed in a decommissioning proceeding for any such development.
57. Allow state and federal agencies access to project to inspect fishways and records to monitor compliance with license conditions.	Oregon Fish & Wildlife (14D)	No <sup>b</sup>	None	Yes, but with licensee notification.
58. Develop a plan to provide temporary enhanced flows from Iron Gate dam on emergency basis to protect downstream anadromous fish.	Oregon Fish & Wildlife (14C), Cal Fish & Game (I), NMFS (12A), FWS (12A)	Yes	\$6,040	Yes
59. Develop an upstream and downstream anadromous fish passage habitat protection and enhancement plan that includes provisions for evaluating the survival of upstream and downstream migrating juveniles and adults. Develop project operation and structure modifications that could enhance upstream and downstream passage success including predator and predation control. FWS includes listed suckers in its recommendation.	NMFS (1, 2), FWS (1, 2)	Yes	\$34,830	No (see section 5.2); we include some of the components of this measure in our recommended integrated fish passage and disease management plan.
60. Develop a Pacific lamprey management plan within 2 years of license issuance that includes provisions for telemetry studies to evaluate upstream and downstream passage success through project fishways and reservoirs. Modify project fishways, structures, and operations to enhance lamprey populations based on study results.	FWS (4)	Yes	\$111,930	No, although Phase 1 studies may modify this position (see section 5.2).
61. Fully fund and continue Iron Gate Hatchery operations.	NMFS (13a), FWS (15), Cal Fish & Game (II)	Yes	\$125,000	Yes
62. Fully fund and implement a fall Chinook yearling program, including refurbishment and operation of the Fall Creek juvenile rearing facility.	Cal Fish & Game (II)	Yes	\$177,000	Yes

<b>Recommendation</b>	<b>Agency<sup>a</sup></b>	<b>Subject to Section 10(j)</b>	<b>Annualized Cost</b>	<b>Adopted?</b>
63. Mark 100 percent of Chinook salmon released from the hatchery.	NMFS (13b, 13d)	Yes	\$705,040	Yes
64. Mark 100 percent of coho salmon released from the hatchery.	FWS (15)	Yes	\$4,750	Yes
65. Mark 25 percent of the Chinook salmon released from the hatchery.	FWS (15), Cal Fish & Game (II)	Yes	\$233,880	Yes
66. Implement a hatchery and genetics management plan for Iron Gate Hatchery including an adult census of natural salmonids, hatchery straying, competition, genetic characteristics of natural coho and steelhead stocks, and determination of outmigration timing.	Cal Fish & Game (II, IV), NMFS (13c)	Yes	\$3,500,000	Yes
67. Develop juvenile and adult fish disease risk monitoring and management plan that include studies, recommendations based on the studies, and implementation plans.	Oregon Fish & Wildlife (14A, 14B, 14D), Cal Fish & Game (I, IV) NMFS (12A), FWS (12A)	Yes	\$352,700	Yes
68. Develop a plan for restoration of fish habitat upstream and downstream of the project and key tributaries such as Jenny, Fall, Spencer, and Shovel creeks. Fund the implementation and maintenance of projects identified in consultation with resource agencies.	NMFS (3), FWS (3)	Yes	\$52,700	No (see section 5.2).
69. Develop an aquatic monitoring resource management plan within 1 year of license issuance that includes the following at the J.C. Boyle bypassed and peaking reaches: fish health, fish habitat conditions, reach productivity or bioenergetics, population structure, spawning populations, and fish migration. The plan should include provisions for annual monitoring and compliance reporting to the Commission and resource agencies, and reports every 3 years that summarize the previous 3 years of monitoring results. The plan should be updated every 5 years.	Oregon Fish & Wildlife (1A5, 1B, 1C, 1D5, 11A, 11C)	Yes	\$158,820	No (see section 5.2, we adopt some of the recommended elements).

Recommendation	Agency <sup>a</sup>	Subject to Section 10(j)	Annualized Cost	Adopted?
70. Include in the Oregon Fish & Wildlife aquatic monitoring resource management plan an adaptive management strategy that provides for changes and proposed actions that enable resource goals for restoration of fish and aquatic life in the J.C. Boyle bypassed and peaking reaches to be met.	Oregon Fish & Wildlife (11B)	Yes	\$69,710	Yes
71. Develop an anadromous fish monitoring plan that describes protocols for estimating: the number, size, sex, timing, survival, and origin of fish returning to Iron Gate dam; the size of spawning populations in key tributaries in the project area; number of outmigrating juvenile Chinook salmon from these key tributaries; and implementing measures recommended by the agencies to meet project passage goals.	NMFS (12B), FWS (12B2)	Yes	\$329,180	No (see section 5.2, we adopt some of the recommended elements).
72. Develop a resident fish monitoring plan that describes protocols for monitoring: the distribution, population structure, and abundance of resident fish populations in all project reservoirs and reaches below Keno dam, and the number, size, and sex of spawning rainbow trout in key project tributaries. Monitoring should be at 3 year intervals for the term of the license.	FWS (12B1)	Yes	\$96,610	No (see section 5.2, we adopt some of the recommended elements).
73. Develop an aquatic habitat monitoring plan that monitors the effectiveness of license conditions designed to enhance the quality and quantity of aquatic habitat for resident, migratory, and anadromous fish within project reaches and apply adaptive management as needed. Submit annual reports that document the state of spawning, holding, feeding, juvenile rearing, riparian, and migratory fish habitat and the adequacy of flows to meet these habitat needs and habitat connectivity; movement of spawning gravel; achievement of riparian habitat objectives; power generation; and recreational opportunities.	FWS (13)	Yes	Included in the previous two measures (71 and 72).	No (see section 5.2, we adopt some of the recommended elements).
74. Develop a fish and wildlife habitat restoration resource management plan within 1 year of license issuance, provide annual monitoring and compliance reports to the Commission and resource agencies, and update the plan every 5 years.	Oregon Fish & Wildlife (1A7, 1B, 1C, 1D7)	No <sup>b</sup>	\$22,020	Resolved; Oregon Fish & Wildlife agreed to withdraw this measure.

Recommendation	Agency <sup>a</sup>	Subject to Section 10(j)	Annualized Cost	Adopted?
75. Identify, in consultation with agencies, and fund instream flow and habitat enhancements in mainstem reaches and tributaries with native fish and wildlife, within and upstream of the project.	Oregon Fish & Wildlife (6E), Cal Fish & Game (I, II)	No <sup>b</sup>	Included in the previous measure (74).	No
76. Develop a fish and wildlife habitat enhancement plan designed to increase the success of anadromous fish reintroduction and potamodrous restoration and to support resource protection measures for project-related effects not otherwise covered by specific license conditions. Measures could include those that enhance wetlands, riparian habitats, and aquatic, riparian, and terrestrial species habitat connectivity affected by project operation. Funding of enhancement measures could include mainstem and tributaries with native fish and wildlife species, including those upstream and downstream of the project. PacifiCorp would cooperate with landowners to acquire property for enhancement projects.	Oregon Fish & Wildlife (13A), Cal Fish & Game (II)	No <sup>b</sup>	Included in measure 74.	No
77. Establish a habitat fund to accomplish habitat enhancement measures developed in the Oregon Fish & Wildlife habitat enhancement plan. The amount to be deposited into this fund annually would be developed in consultation with resource agencies.	Oregon Fish & Wildlife (13B)	No <sup>b</sup>	Dependent on post-licensing consultation.	No
78. Notify resource agencies within 48 hours of un-anticipated harm to non-federally listed fish and wildlife, take immediate actions to prevent further losses, comply with restorative measures specified by the resource agencies, and notify the Commission within 10 days of the event and report on actions taken.	Oregon Fish & Wildlife (15B)	No <sup>b</sup>	\$5,000	Yes
79. Notify resource agencies within 6 hours of un-anticipated harm to state or federally listed fish and wildlife, take immediate actions to prevent further losses, comply with restorative measures specified by the resource agencies, and notify the Commission within 10 days of the event and report on actions taken.	Oregon Fish & Wildlife (15A)	No <sup>b</sup>	\$670	Yes

<b>Recommendation</b>	<b>Agency<sup>a</sup></b>	<b>Subject to Section 10(j)</b>	<b>Annualized Cost</b>	<b>Adopted?</b>
80. Consult with appropriate agencies prior to repairing or modifying project operations or facilities and obtain required permits.	Oregon Fish & Wildlife (15C)	No <sup>b</sup>	None	Yes, although limits on what types of repairs require consultation would need to be established.
81. Develop a vegetation and noxious weed resource management plan that includes provisions for managing native vegetation to optimize habitat for wildlife and controlling invasive weed species, within 1 year of license issuance. Provide annual monitoring and compliance reports to the Commission and resource agencies and update the plan every 5 years.	Oregon Fish & Wildlife (1A8, 1B, 1C, 1D8)	Yes, although timing of plan development is not.	\$52,190	Yes, although we plan to recommend consolidation of vegetation-related plans.
82. Develop a vegetation management plan within 2 years of license issuance that guides land management practices on company-owned lands to control exotic and invasive weeds so that they do not infest downstream or adjacent property or compromise the integrity of native fish and wildlife habitat.	Oregon Fish & Wildlife (13C)	Yes	Included in the cost of the previous measures (81).	Yes, we assume Oregon Fish & Wildlife meant company-owned land within project boundary or influenced by the project.
83. Develop a riparian habitat management and monitoring plan within 1 year of license issuance that addresses project effects on fish and wildlife riparian habitat. The plan would provide a basis to adaptively manage license conditions designed to restore riparian habitats within the project area. The plan would also identify actions to minimize project effects on riparian habitat and identify site-specific restoration measures for project-related effects based on an inventory of riparian areas, as needed. Actions would be designed to restore hydrologic connectivity in the varial zone and diversity of riparian species.	FWS (14)	Yes	\$37,440 Monitoring and management included in the cost of measure 81.	Yes, although we plan to recommend consolidation of vegetation-related plans.

<b>Recommendation</b>	<b>Agency<sup>a</sup></b>	<b>Subject to Section 10(j)</b>	<b>Annualized Cost</b>	<b>Adopted?</b>
84. Develop a wildlife “mitigation” resource management plan that includes provisions for monitoring raptor injury and mortality at project transmission poles, installation of protective devices, and monitoring wildlife entrapment and mortality at project canals, within 1 year of license issuance. Provide annual monitoring and compliance reports to the Commission and resource agencies and update the plan every 5 years.	Oregon Fish & Wildlife (1A6, 1B, 1C, 1D6)	Yes, although timing is not.	\$28,730	Yes, although we plan to recommend consolidation of wildlife management plans.
85. Develop an aquatic and riparian habitat and a wildlife resource management plan within 1 year of license issuance, provide annual monitoring and compliance reports to the Commission and resource agencies, and update the plan every 5 years.	Cal Fish & Game (IV)	No <sup>b</sup>	Not specific enough to estimate, but could be similar to the sum of measures 74, 83, and 84.	No
86. Develop a wildlife “mitigation” plan for the project area and related company-owned lands within 2 years of license issuance. The plan would include provisions for monitoring and evaluating wildlife and their habitats and measures to address project effects (river and reservoir fluctuations, habitat degradation or loss, and hazards from power canals and transmission lines). Any new project development or effects authorized during relicensing should be consistent with Oregon Fish & Wildlife’s Mitigation Policy, Wildlife Diversity Plan, and Comprehensive Wildlife Conservation Strategy.	Oregon Fish & Wildlife (12A), Cal Fish & Game (III)	Yes, although timing is not.	Included in the cost of measures 83 and 84.	Yes, although we plan to recommend consolidation of wildlife management plans.
87. Install additional large wildlife crossings and escape ramps at the J.C. Boyle intake canal within 2 years of license issuance.	Oregon Fish & Wildlife (12B)	Yes, although timing is not.	\$45,410	Yes (if determined during consultation to be needed).
88. Install additional small animal crossings at project canals within 2 years of license issuance.	Oregon Fish & Wildlife (12C)	Yes, although timing is not.	Included in the previous measure (87).	Yes

<b>Recommendation</b>	<b>Agency<sup>a</sup></b>	<b>Subject to Section 10(j)</b>	<b>Annualized Cost</b>	<b>Adopted?</b>
89. Develop a wildlife crossing monitoring plan for project canals and waterways within 1 year of license issuance to enable assessment of effectiveness.	Oregon Fish & Wildlife (12D)	Yes, although timing is not.	\$1,350	Yes, although we plan to recommend that this be consolidated with other wildlife plans.
90. Develop a wildlife crossing and escape ramp inspection plan within 2 years of license issuance that provides for maintenance, annual inspections, and reporting to agencies by March 1.	Oregon Fish & Wildlife (12E)	Yes, although timing is not.	Included in measures 87 and 89.	Yes, although we plan to recommend that this be consolidated with other wildlife plans.
91. Implement protective measures for birds at project transmission lines where bird mortalities have been documented.	Oregon Fish & Wildlife (12F)	Yes	Monitoring costs included in measure 84; protective measures in O&M.	Yes
92. Conduct O&M activities in the project area in accordance with the most current spatial and temporal guidelines for avian protection. (Oregon Fish & Wildlife cites these as APLIC, 1996 and 2005.)	Oregon Fish & Wildlife (12G)	Yes	No incremental costs.	Yes
93. Follow existing agreement with Oregon Fish & Wildlife and FWS, dated February 18, 1988, regarding procedures for addressing bird mortalities and nests. This agreement establishes a database that documents bird mortalities near project facilities and annual reports of such to the resource agencies.	Oregon Fish & Wildlife (12H)	Yes	No incremental costs.	Yes, we assume the salient elements of the 1988 agreement would be incorporated into a current avian protection plan (an element of PacifiCorp's proposed wildlife resources management plan).

<b>Recommendation</b>	<b>Agency<sup>a</sup></b>	<b>Subject to Section 10(j)</b>	<b>Annualized Cost</b>	<b>Adopted?</b>
94. Develop an avian collision and electrocution hazard avoidance plan within 1 year of license issuance. The plan should include monitoring strategies sufficiently repetitive to detect sites causing mortalities.	FWS (17)	Yes	Any incremental costs would be included in measure 84.	Yes, although we plan to recommend consolidation of wildlife plans.
95. Develop an adaptive management plan within 1 year of license issuance to evaluate the need for a fish ladder built to federally listed sucker criteria at Keno dam. Data would be collected at the anadromous fish trap prescribed by Interior and NMFS at Keno dam and supplemented by regular visual examination of the existing ladder to evaluate current use by suckers.	FWS (16)	Yes	\$1,350 for plan development; implementation costs \$1,983,340	No (see section 5.2).
96. Monitor project waters for federally listed suckers every 3 years.	FWS (12B1)	Yes	Cost included in measure 70.	Yes, although the frequency would be re-evaluated after 9 years of surveys.
97. Develop a bald eagle management plan for the project area within 2 years of license issuance.	FWS (18)	Yes	\$17,390	Yes
98. Provide a minimum of 60 days for Oregon Fish & Wildlife and other stakeholders to provide comments on all plans and actions required in a new license. Consultation should be documented in each plan or report submitted to the Commission.	Oregon Fish & Wildlife (2A)	No <sup>b</sup>	\$0	Yes, although the term “all actions” should be clarified.

<sup>a</sup> Numbers and letters in parentheses are the designations for the specific measures in the source letter from the fish and wildlife agency.

<sup>b</sup> Not a specific measure to protect fish and wildlife resources.

## 5.4.2 U.S. Bureau of Land Management and U.S. Bureau of Reclamation Section 4(e) Conditions

In section 2.3.1.4, *Section 4(e) Federal Land Management Conditions*, we list the modified 4(e) conditions submitted by the Bureau of Land Management and by Reclamation, and note that section 4(e) of the FPA, 16 U.S.C. § 797(e), provides that any license issued by the Commission “for a project within a federal reservation shall be subject to and contain such conditions as the Secretary of the responsible federal land management agency deems necessary for the adequate protection and use of the reservation.” Thus, any 4(e) condition that meets the requirements of the law must be included in a license issued by the Commission, regardless of whether we include the condition in our Staff Alternative. In section 2.3.1.4 we identify nine Bureau of Land Management and six Reclamation modified 4(e) conditions that we consider to be administrative or legal in nature and not specific environmental measures. We therefore do not analyze these 15 conditions in our EIS. Table 5-4 summarizes our staff conclusions with respect to the modified 4(e) conditions that we consider to be environmental measures. More detailed descriptions of the conditions are presented in table 2-3, in section 2.3.1.4, and in Interior’s letter to the Commission filed on January 29, 2007. Of the 38 modified 4(e) conditions submitted by the Bureau of Land Management and Reclamation, we include in the Staff Alternative 24 conditions. Our reasons for not including measures in the Staff Alternative are summarized in table 5-4 and, in some cases, discussed in more detail in section 5.2, *Discussion of Key Issues*.

Table 5-4. Bureau of Land Management and Reclamation modified 4(e) conditions for the Klamath Hydroelectric Project. (Source: Staff)

Condition <sup>a</sup>	Agency	Annualized Cost	Adopted?
1. For any proposed activity to be implemented by PacifiCorp on or affecting lands administered by the Bureau of Land Management to be added to the project boundary, PacifiCorp should request and obtain a Bureau of Land Management use authorization prior to conducting the activity. PacifiCorp should fund any required environmental analysis related to the issuance of the use authorization, as determined by the Bureau of Land Management to be necessary to meet its NEPA requirements. (1A).	Bureau of Land Management	Unknown	Actions not addressed in this EIS would generally be addressed during a license amendment proceeding, which would include agency consultation.
2. Prepare plans for Bureau of Land Management approval and conduct analysis sufficient to meet NEPA standards for PacifiCorp activities that could affect Bureau-administered lands (1B).	Bureau of Land Management	Costs included in the plans for specific actions.	Yes
3. Conduct environmental analysis sufficient for formal consultation pursuant to NEPA regulations upon approval from the Bureau of Land Management of plans specified in number 2, above (1C).	Bureau of Land Management	Costs included in the plans for specific actions.	Yes

<b>Condition<sup>a</sup></b>	<b>Agency</b>	<b>Annualized Cost</b>	<b>Adopted?</b>
4. Restore Bureau of Land Management administered land to a satisfactory condition prior to any surrender of the project license or surrender of project facilities (1F).	Bureau of Land Management	Unknown	No, appropriate restoration measures for facility or project decommissioning would be addressed in a separate proceeding.
5. Restore Bureau of Land Management administered lands to a satisfactory condition prior to any abandonment of project-related facilities (1G).	Bureau of Land Management	Unknown	No, in the event that PacifiCorp planned to abandon any project facility, a license amendment would be necessary; appropriate restoration measures would be addressed in a separate proceeding.
6. Develop a standard operating procedure (protocol) for emergencies that would address permitting and implementation of subsequent measures for any project-related effects to Bureau of Land Management administered lands, including emergency spillway and slope failures along the canal (1H).	Bureau of Land Management	\$1,350	Yes, except we modify to enable definition of threshold for effect that would trigger implementation of the protocol.
7. Consult annually with the Bureau of Land Management and prepare a report that summarizes the results of monitoring conducted during the past year, foreseeable changes to project operations, upcoming scheduled maintenance, and suggested changes to any environmental programs included in the project license (2A).	Bureau of Land Management	\$2,000 (Assumes a meeting is necessary beyond other consultation requirements).	No, however we expect there to be sufficient flexibility to enable consultation and reporting that would be required for other programs to be consolidated with this consultation.
8. File record of consultation and any Bureau of Land Management comments and recommendations with the Commission within 60 days of issuance of the report detailed in 12, above (2C).	Bureau of Land Management	Costs included in 7 and other annual filings that we recommend.	Yes
9. Consult with the Bureau of Land Management on an as-needed basis to identify and resolve potential conflicts with Bureau of Land Management policy and direction prior to initiating activities on Bureau of Land Management-administered lands (2D).	Bureau of Land Management	Costs included in the consultation elements associated with the plans that define the specific activity.	Yes
10. File a project roads inventory analysis for project-related roads that cross Bureau-administered land within 6 months of license issuance (3A).	Bureau of Land Management	\$21,350	Yes

<b>Condition<sup>a</sup></b>	<b>Agency</b>	<b>Annualized Cost</b>	<b>Adopted?</b>
11. File a project road management plan for project-related roads that cross Bureau-administered land within 1 year of license issuance (3B).	Bureau of Land Management	Included in 10.	Yes
12. Maintain minimum streamflows in the J.C. Boyle bypassed reach of 470 cfs or 40 percent of the combined inflow from Keno reach and Spencer Creek, whichever is the greater of the two flows. When the proportional flow of 40 percent is greater than 470 cfs, the required proportional flows are the average of the previous 3 days of the combined daily flow (4A1[a][b]).	Bureau of Land Management	\$6,590,960	No, flows of at least 470 cfs (or 640 cfs as specified in Oregon Fish & Wildlife's and Cal Fish & Games alternative 4(e) conditions) would wash out thermal refugia and diminish salmonid habitat. We adopt PacifiCorp's second alternative 4(e) condition, with a total of 200 cfs released at the dam (see section 5.2).
13. At least once per year between February 1, and April 15, suspend diversion of water to the J.C. Boyle power canal when inflow to the J.C. Boyle reservoir exceeds 3,300. Cessation of diversion should be maintained for at least 7 full days (4A1[c]).	Bureau of Land Management	\$210,710	Yes
14. Not exceed an up or down ramp rate of 2 inches per hour as measured at a new gage downstream of J.C. Boyle dam when conducting controlled flow events, except during implementation of seasonal high flow (4A2).	Bureau of Land Management	Energy cost included in item 12 (4A1[a][b]); new gage cost \$19,440	Yes
15. Operate the J.C. Boyle development to provide a minimum streamflow of 1,500 cfs a maximum of once a week between May 1, to October 31, with a priority set for Saturday, Sunday, and then Friday (4B1).	Bureau of Land Management	\$621,000	No, would not support the Outstanding Remarkable Value of this Wild and Scenic River segment. We do not adopt Oregon Fish & Wildlife's or Cal Fish & Game's alternative 4(e) condition (which would have J.C. Boyle operate in a run-of-river mode) for the same reason (see section 5.2).
16. Not exceed an up or down ramp rate of 2 inches per hour as measured at the USGS gage downstream of the J.C. Boyle powerhouse when conducting controlled flow events, except during the implementation of seasonal high flow 4B2).	Bureau of Land Management	Included in corresponding flow measures.	No, we recommend that ramp rates be increased gradually whenever peaking is resumed, with monitoring to ensure that adequate protection is provided (see section 5.2).
17. Implement a flow continuation measure at the J.C. Boyle canal and powerhouse to provide a minimum of 48 hours of continuous flow under powerhouse shutdown conditions (4B3).	Bureau of Land Management	\$898,760	Yes

<b>Condition<sup>a</sup></b>	<b>Agency</b>	<b>Annualized Cost</b>	<b>Adopted?</b>
18. Continuously measure the stage of water at a minimum of four gage sites (Keno, Spencer Creek, downstream of J.C. Boyle powerhouse, and a new bypassed reach gage) using the most current USGS protocols. PacifiCorp should operate and maintain the gages if they are no longer served by the current operators (4C1).	Bureau of Land Management	\$19,440 (Cost for refurbishing Spencer Creek gage; J.C. Boyle bypassed reach gage included in 14, above.)	No, gages for which PacifiCorp should be responsible should be determined once the project flow regime is set in a new license (see section 5.2).
19. Provide instantaneous real time data that are readily available and accessible to the public, and design a database for reporting on surface water; within 2 years of license issuance, begin submitting annual water year reports to the Bureau within 6 months of the end of each water year (4C2, 3).	Bureau of Land Management	\$11,350 (Instantaneous real time data are already available; costs include both plan development and reporting costs.)	Yes
20. Develop a sediment management plan that provides for deposition of sufficient sediment in the J.C. Boyle bypassed reach to increase channel complexity and spawning habitat and improve riparian habitat quality, on an as-needed basis, monitoring and evaluation, and adaptation; update the plan every 5 years (4D1-4, 5[b]).	Bureau of Land Management	\$78,270	Yes
21. Provide an annual report to the Bureau of Land Management and the Commission that summarizes sediment augmentation activities, consult with the Bureau about any proposed changes to the sediment augmentation program, provide a comprehensive monitoring report after 6 years on augmentation, with recommendations for adaptive management (4D5[a]).	Bureau of Land Management	\$17,020	Yes
22. Develop an adaptive management plan that is designed to monitor the effectiveness of flow and sediment augmentation in enhancing fish habitat, channel complexity, and riparian quality. Provide annual reports summarizing monitoring results and assessments of spawning, rearing, riparian, and migratory habitat and the adequacy of flows for providing recreational boating (4E).	Bureau of Land Management	\$106,610 (Reporting costs included in 21, above.)	Yes, although we do not include all the specified parameters to be monitored.

<b>Condition<sup>a</sup></b>	<b>Agency</b>	<b>Annualized Cost</b>	<b>Adopted?</b>
23. Complete a cultural resources inventory on 77.2 acres of unsurveyed Bureau of Land Management administered land using Class III survey protocols and develop survey reports in accordance with SHPO report guidelines (5.1).	Bureau of Land Management	\$20,250	Yes, although we would limit the extent of the surveys along the peaking reach to the limits of project capacity.
24. Amend the HPMP to include measures to monitor, protect, and restore known damage to cultural sites within the APE on Bureau of Land Management administered land, including additional sites identified under the previous condition (23) and the following condition (25). Submit annual reports and periodically consult with the Bureau and affected tribes regarding the need to revise the HPMP (5.2).	Bureau of Land Management	\$9,700	Yes
25. Conduct detailed site-specific studies to determine erosion impacts, if any, from project-related flows at five sites on Bureau of Land Management-administered lands (5.3).	Bureau of Land Management	\$13,500	Yes
26. Develop a recreation resources plan in consultation with the Bureau of Land Management and provide a copy of the plan to the Bureau at the same time that it is filed with the Commission. Upon Commission approval, implement the plan (6).	Bureau of Land Management	\$202,300	Yes
27. Include in a recreation resources management plan descriptions of existing and potential recreation sites on Bureau of Land Management administered lands and affected by the project, schedules of implementation, maintenance, monitoring, costs, and identification of instruments for shared administration (6A).	Bureau of Land Management	\$74,840	Yes, except we limit the content of the plan to measures that have a clear nexus to project purposes.
28. Include in the recreation resources management plan a visual resources management plan that addresses provisions for managing visual resources on Bureau of Land management administered land (6B).	Bureau of Land Management	\$51,060	Yes
29. Develop a vegetation management plan for Bureau of Land Management administered land affected by the project. Upon Commission approval, implement the plan (7).	Bureau of Land Management	\$52,190	Yes

<b>Condition<sup>a</sup></b>	<b>Agency</b>	<b>Annualized Cost</b>	<b>Adopted?</b>
30. Develop a wildlife habitat management plan for Bureau of Land Management administered lands affected by the project. Upon Commission approval, implement the plan (8).	Bureau of Land Management	\$76,630	Yes
31. Continue to operate and maintain Link River dam consistent with the Klamath Irrigation Project annual project operations plans (1A).	Reclamation	\$0	No, Link River dam is not in existing or proposed project and its operation is not under the Commission's jurisdiction.
32. Maintain the approach channel to the A Canal of the Klamath Irrigation Project as may be necessary to ensure a flow of at least 1,200 cfs into the canal (1C).	Reclamation	\$10,000	No, ensuring flow to the A Canal has no nexus to project purposes.
33. No rights to water or land along the margin of Upper Klamath Lake. No water used for hydroelectric purposes when needed for irrigation or other purposes by entities serviced by the Klamath Irrigation Project (1E).	Reclamation	\$0	No, water and land rights issues are not within the jurisdiction of the Commission.
34. Operate Keno dam so that the water level of the reservoir would not be below elevation 4,085 feet (Reclamation datum)(1F).	Reclamation	\$0	Yes, except we modify water level management to accommodate occasional drawdowns for water users to service pump intakes, as is the current practice (if Keno included in project license).
35. Operate Keno dam to accommodate a discharge of 3,000 cfs from Lost River diversion channel and 600 cfs from Klamath Straits drain (1G).	Reclamation	\$0	Yes, except we modify to account for events beyond PacifiCorp's control (if Keno included in project license).
36. Develop operating criteria in consultation with Reclamation that provide for coordination of Link River and Iron Gate dam (or the most downstream of the project), consistent with Reclamation's responsibilities (2).	Reclamation	\$0	Yes
37. Develop operating criteria in consultation with Reclamation, that provide for coordination of Keno and Iron Gate dam (or the most downstream project dam), consistent with Reclamation's responsibilities (3).	Reclamation	Costs included in other project operations plans	Yes (if Keno included in license; if not, operating criteria for the most upstream development and Iron Gate would be defined in a project operations management plan).
38. Provide Reclamation with area capacity curves for all project facilities and real time access to reservoir elevations and releases from project facilities (4).	Reclamation	\$1,350	Yes

<sup>a</sup> Numbers and letters in parentheses are the designations for the specific conditions in the source letter from Interior.

## 5.5 CONSISTENCY WITH COMPREHENSIVE AND OTHER RESOURCE PLANS

Section 10(a)(2) of the FPA requires the Commission to consider the extent to which a project is consistent with federal or state comprehensive plans for improving, developing, or conserving waterways affected by the project. Under section 10(a)(2), federal, state and local agencies filed comprehensive plans that address various resources in California and Oregon.

The 64 plans listed below address resources applicable to the project.<sup>174</sup> Some of the plans are described in more detail in the applicable resource sections of this document and in such cases, we indicate the sections of this EIS where the descriptions can be found. However, we do not here elaborate on each one. The majority of the plans listed call for maintaining or improving the existing conditions of natural resources and recreational opportunities in the region. Based on our review and analysis, we concluded that the project as described in the Staff Alternative would be consistent with the plans. We do not expect the Staff Alternative to diminish water quality, riparian habitat, populations of fish and wildlife, forest resources or recreational resources beyond current conditions, our analytical baseline.

### California

Bureau of Land Management. June 1993. Redding Resource Management Plan and Record of Decision. Department of the Interior. Redding, CA. 55 pp. (summarized in section 3.3.7.1.1, *Land Use, Ownership, and Management*).

California Advisory Committee on Salmon and Steelhead Trout. 1988. Restoring the balance: 1988 annual report. Sausalito, CA. 84 pp.

California Department of Fish and Game. 1996. Steelhead restoration and management plan for California. February 1996. 234 pp.

California Department of Fish and Wildlife. 2000. Upper Klamath River wild trout management plan, 2000-2004. Redding, CA September 8, 2000 (discussed in section 3.3.3.1.1, *Aquatic Habitat Condition and section 3.3.3.2.1, Instream Flows*).

California Department of Parks and Recreation. 1998. Public Opinions and Attitudes on Outdoor Recreation in California - 1997. March 1998. 72 pp. and appendices.

California Department of Parks and Recreation. 1994. California Outdoor Recreation Plan - 1993. Sacramento, Ca. April 1994. 154 pp. and appendices (the California State Comprehensive Outdoor Recreation Plan [SCORP] is discussed in section 3.3.6.1.1, *Regional Recreational Setting*).

California Department of Water Resources. 1983. The California water plan: projected use and available water supplies to 2010. Bulletin 160-83. Sacramento, CA. December 1983. 268 pp. and attachments.

California Department of Water Resources. 1994. California water plan update. Bulletin 160-93. Sacramento, CA. October 1994. Two volumes and executive summary.

California State Water Resources Control Board. 1995. Water Quality Control plan report. Sacramento, CA. Nine volumes.

California - The Resources Agency. Department of Parks and Recreation. 1983. Recreation needs in California. Sacramento, CA. March 1983. 39 pp. and appendices.

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<sup>174</sup> Some of the plans listed are over 20 years old and/or are no longer relevant, but still appear on the Commission's list.

- Fish and Wildlife Service. California Department of Fish and Game. California Waterfowl Association. Ducks Unlimited. 1990. Central Valley habitat joint venture implementation plan: a component of the North American waterfowl management plan. Department of the Interior, Portland, OR. February 1990. 102 pp.
- Fish and Wildlife Service. 1991. Long Range Plan for the Klamath River Basin conservation area fishery restoration program. Yreka, CA. January 1991 (summarized in section 3.3.3.2.5, *Anadromous Fish Restoration*).
- Forest Service. 1995. Land and Resource Management Plan: Six Rivers National Forest. Eureka, CA.
- Forest Service. 1994. Land and Resource Management Plan: Klamath National Forest. Yreka, CA (summarized in section 3.3.7.1.1, *Land Use, Ownership, and Management*).
- State Water Resources Control Board. 1999. Water quality control plans and policies. Adopted as part of the State Comprehensive Plan. April 1999. Three enclosures (the applicable Basin Plan objectives are discussed in section 3.3.2.1.2, *Water Quality*).

## Oregon

- Bureau of Land Management. 1985. A five-year comprehensive anadromous fish habitat enhancement plan for Oregon coastal rivers. Department of the Interior, Portland, OR. May 1985. 20 pp.
- Bureau of Land Management. 1990. Final eligibility and suitability report for the Upper Klamath Wild and Scenic River study. Department of the Interior, Klamath Falls, OR. March 1990. 131 pp. and appendices (the peaking reach Wild and Scenic River designated segment is discussed in sections 3.3.6.1.1, *Regional Recreational Setting*, 3.3.6.2.2, *River Recreation*, 3.3.7.1.1, *Land Use, Ownership, and Management*, and 5.6.7, *Wild and Scenic Rivers Act*).
- Bureau of Land Management. 2000. Klamath Falls Resource Area - annual program summary. Klamath Falls, OR. July 2000. 139 pp.
- Bureau of Land Management. 1995. Klamath Falls resource area resource management plan and rangeland program summary, including Record of Decision. Department of the Interior, Klamath Falls, OR. June 1995. 86 pp., appendices, and maps (summarized in sections 3.3.4.1.1, *Botanical Resources*, and 3.3.7.1.1, *Land Use, Ownership, and Management*).
- Bureau of Land Management. 2003. Draft-Upper Klamath River management plan. Lakeview, OR. April 2003.
- Bureau of Land Management. 1994. Klamath Falls resource area resource management plan and environmental impact statement. Department of the Interior, Klamath Falls, OR. September 1994. Three volumes and maps.
- Bureau of Land Management. June 1995. Medford District resource management plan, including Record of Decision. Department of the Interior. Medford, OR. 248 pp. and maps (summarized in section 3.3.7.1.1, *Land Use, Ownership, and Management*).
- Department of the Army, Corps of Engineers. Portland District. 1993. Water Resources development in Oregon. Portland, OR. 78 pp.
- Governor's Hydroelectric Planning Group. 1985. Preliminary site resource inventory: report to the 63rd Legislative Assembly. Salem, OR. March 1985. 146 pp.

- Hydro Task Force. Strategic Water Management Group. 1988. Oregon comprehensive waterway management plan. Salem, OR. 112 pp. and appendices.
- National Marine Fisheries Service, Seattle, Washington. Pacific Fishery Management Council, Portland, Oregon. 1978. Final environmental impact statement and fishery management plan for commercial and recreational salmon fisheries off the coasts of Washington, Oregon, and California commencing in 1978. Department of Commerce. March 1978. 157 pp.
- Northwest Power and Conservation Council. 2005. The Fifth Northwest electric power and conservation plan. Portland, OR. Council Document 2005-07.
- Oregon Department of Energy. 1987. Oregon final summary report for the Pacific Northwest rivers study. Salem, OR. November 1987. 89 pp.
- Oregon Department of Environmental Quality. 1978. Statewide water quality management plan. November 1978. Seven volumes.
- Oregon Department of Fish and Wildlife. 1982. Comprehensive plan for production and management of Oregon's anadromous salmon and trout: Part I. General considerations. Portland, OR. June 1, 1982. 33 pp.
- Oregon Department of Fish and Wildlife. 1982. Comprehensive plan for production and management of Oregon's anadromous salmon and trout: Part II. Coho salmon plan. Portland, OR. June 1, 1982. 118 pp. and appendices.
- Oregon Department of Fish and Wildlife. 1986. Oregon Bighorn sheep management plan. Portland, OR. November 1986. 17 pp.
- Oregon Department of Fish and Wildlife. 1987. The statewide trout management plan. Portland, OR. November 1987. 77 pp.
- Oregon Department of Fish and Wildlife. 1987. Warm water game fish management plan. Portland, OR. August 1987. 60 pp.
- Oregon Department of Fish and Wildlife. 1987. Trout mini-management plans. Portland, OR. December 1987. 58 pp.
- Oregon Department of Fish and Wildlife. 1991. Comprehensive plan for production and management of Oregon's anadromous salmon and trout: Coastal Chinook salmon plan. Portland, OR. December 18, 1991. 62 pp.
- Oregon Department of Fish and Wildlife. 1993. Oregon black bear management plan, 1993-1998. Portland, OR. 33 pp. and appendices.
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## **5.6 RELATIONSHIP OF LICENSE PROCESS TO LAWS AND POLICIES**

### **5.6.1 Section 401 of the Clean Water Act—Water Quality Certification**

The status of the water quality certifications for the project is discussed in section 2.3.1.1.

### **5.6.2 Coastal Zone Management Act—Consistency Certification**

Section 307(c) of the Coastal Zone Management Act requires that all federally licensed and permitted activities be consistent with approved state Coastal Zone Management Programs. If the project is located within a coastal zone boundary or if a project could affect resources located in the boundaries of the designated coastal zone, the applicant must certify that the project is consistent with the state Coastal Zone Management Program. The Klamath Hydroelectric Project is not located within the coastal zone boundary. The California Coastal Commission is currently reviewing whether the relicensing of the project would require a consistency determination, pursuant to the Coastal Zone Management Act.

### **5.6.3 Section 18 of the Federal Power Act—Authority to Prescribe Fishways**

Fishway prescriptions and recommendations for reservation of authority to prescribe fishways are discussed in section 2.3.1.2.

### **5.6.4 Endangered Species Act**

Section 7 of the ESA requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered and threatened species or cause the destruction or adverse modification of critical habitats of such species. Three federally listed fish species (Klamath River coho salmon, Lost River sucker, and shortnose sucker), three federally listed plant species (slender Orcutt grass, Applegate's milk-vetch, and Gentner's fritillaria), and five federally listed wildlife species (California red-legged frog, northern spotted owl, western snowy plover, Canada lynx, and gray wolf) could occur in the project area or in downstream areas potentially affected by project operations. Species were identified as being likely to occur in the project area by the Interior in a letter dated July 21, 2006, and by NMFS in a letter dated July 6, 2006.

Table 5-5 shows our determinations regarding the effect of relicensing the Klamath Hydroelectric on federally listed species that are likely to occur in the project area. Table 5-5 also summarizes the basis for our effect determinations. We requested formal consultation with FWS on the Lost River sucker, shortnose sucker, and bald eagle<sup>175</sup> and NMFS on Klamath River coho salmon by letters dated October 5, 2006. In that letter, we requested simultaneous consultation on two action alternatives, the Staff Alternative and the Staff Alternative with Mandatory Conditions. We also requested concurrence from FWS on our determinations that relicensing would be “not likely to adversely affect” other listed species or critical habitat. The draft EIS serves as our biological assessment.

In response to our October 5, 2006, letter NMFS, by letter filed on November 9, 2006, and FWS, by letter filed November 13, 2006, indicated that insufficient information was available to initiate formal consultation because the proposed action in response to PacifiCorp’s license application had not been fully developed or described. In response to the letters from NMFS and FWS, we issued a letter on March 21, 2007, to both agencies requesting that formal consultation be initiated on a single action alternative, the Staff Alternative with Mandatory Conditions. In letters filed April 25 and May 4, 2007, respectively, NMFS and FWS agree to initiate formal consultation and provide a BiOp by August 3, 2007, as long as certain additional information was provided by the Commission within 30 days of receipt of their letters. The Commission held a meeting on May 23, 2007, with representatives of FWS and NMFS in Redding, California, during which most of the requested information was provided on the Commission’s behalf by PacifiCorp. In letters filed August 8 and August 14, 2007, respectively, FWS and NMFS requested an extension of the formal consultation period to enable the filing of final BiOps by October 2, 2007. In letters dated September 28 and October 2, 2007, respectively, FWS and NMFS requested a second extension of the formal consultation period to enable the filing of final BiOps by December 1, 2007. We granted extensions to both agencies on October 3, 2007. On October 22, 2007, FWS filed its draft BiOp for Commission review and comment, indicating it still intends to issue its final BiOp on or before December 1, 2007 (letter from P. Detrich, Field Supervisor, FWS, Yreka, California to the Commission, dated October 22, 2007).

Table 5-5. Summary of effect determinations for fish, plants, and wildlife. (Source: Staff)

<b>Species</b>	<b>Species Status</b>	<b>Species Finding</b>	<b>Critical Habitat Finding</b>	<b>Basis for Determination</b>
Lost River sucker ( <i>Delistes luxatus</i> )	Endangered	Likely to adversely affect	None designated	Continued potential for entrainment or impingement of young at project powerhouse intakes.
Shortnose sucker ( <i>Chasmistes brevirostris</i> )	Endangered	Likely to adversely affect	None designated	Continued potential for entrainment or impingement of young at project powerhouse intakes.
Coho salmon ( <i>Oncorhynchus kisutch</i> )	Threatened	Likely to adversely affect	Likely to adversely affect	Continued potential for adverse effects of low DO, water temperature, pH, microcystin, project-related disease, blocked passage, hatchery operations, reduced transport of spawning gravel, and impacts of natural hydrologic variability.

<sup>175</sup>As discussed in section 3.3.5.1.9, the bald eagle has been removed from the list of threatened and endangered species. Consequently, there is no longer a need to complete formal consultation for this species.

<b>Species</b>	<b>Species Status</b>	<b>Species Finding</b>	<b>Critical Habitat Finding</b>	<b>Basis for Determination</b>
Bull trout ( <i>Salvelinus confluentus</i> )	Threatened	No effect	No effect	No populations found during surveys in project area.
Slender Orcutt grass ( <i>Orcuttia tenuis</i> )	Threatened	No effect	No effect	No populations or potential habitat found during surveys in project area.
Applegate's milk-vetch ( <i>Astragalus applegatei</i> )	Endangered	Not likely to adversely affect	None designated	Effects are discountable or insignificant.
Gentner's fritillaria ( <i>Fritillaria gentneri</i> )	Endangered	No effect	None designated	No populations found during surveys in project area.
California red-legged frog ( <i>Rana aurora draytoni</i> )	Threatened	No effect	No effect	No individuals found during surveys in project area, no critical habitat near project.
Northern spotted owl ( <i>Strix occidentalis caurina</i> )	Threatened	Not likely to adversely affect	Not likely to adversely affect	Effects are discountable or insignificant.
Western snowy plover ( <i>Charadrius alexandrinus nivosus</i> )	Threatened	No effect	None designated	No individuals or suitable breeding habitat found during surveys in project area.
Canada lynx ( <i>Lynx canadensis</i> )	Threatened	No effect	None designated	No individuals or preferred prey (snowshoe hare) found during surveys in project area.
Gray wolf ( <i>Canis lupus</i> )	Threatened	No effect	None designated	No individuals and little suitable habitat found during surveys in project area.

### 5.6.5 Essential Fish Habitat

Section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act requires federal agencies to consult with the Secretary of Commerce regarding all actions or proposed actions that are authorized, funded, or undertaken by the agency that may adversely affect EFH. The Klamath River downstream of the project comprises EFH for Chinook and coho salmon.

PacifiCorp proposes the following measures that should benefit Chinook and coho EFH in the Klamath River: (1) continue releases from Iron Gate dam consistent with Reclamation's operating plans for the Klamath Irrigation Project, which are developed in accordance with the 2002 BiOps from NMFS and FWS; (2) evaluate low level releases of cooler hypolimnetic Iron Gate reservoir water during the summer to provide cooler water to downstream reaches; (3) install a hypolimnetic oxygenation system at Iron Gate reservoir to increase downstream DO (if studies show that this would not adversely affect other water quality analyses); (4) place 1,800 to 3,500 cubic yards of spawning gravel downstream of Iron Gate dam and monitor the gravel afterwards; (5) mark 25 percent of the fall Chinook salmon released from Iron Gate Hatchery to assist with harvest management efforts by resource agencies; and (6) develop and implement reservoir management plans for J.C. Boyle, Copco, and Iron Gate reservoirs which could result in improved water quality downstream of Iron Gate dam and a reduction in conditions that foster salmon diseases.

In section 5.2, *Discussion of Key Issues*, we discuss five additional measures that we include in the Staff Alternative that would benefit EFH: (1) mapping of spawning gravel deposits downstream of Iron Gate dam, and gravel augmentation and monitoring as needed to enhance salmon spawning habitat;

(2) implementation of turbine venting at Iron Gate dam to enhance the DO regime downstream of the dam; (3) development of a temperature management plan to include protocols that would be implemented to trigger the release and possible oxygenation of cool hypolimnetic water from Iron Gate reservoir for short-term relief when downstream conditions on the Klamath River approach maximum stress levels for salmon; (4) development of an integrated fish passage and disease management plan to evaluate and implement measures to accomplish anadromous fish passage upstream of Iron Gate dam and control fish diseases in the Klamath River between Iron Gate dam and the Pacific Ocean that are related to project operations; and (5) development of a single, comprehensive water quality management plan for all project-affected waters, to include consideration of spilling warm water at Iron Gate dam during late spring, of spilling at Copco No. 1, Copco No. 2, and Iron Gate dams during the summer to enhance dissolved oxygen released at Iron Gate development, turbine venting at Copco No. 1 and No. 2 powerhouses to increase dissolved oxygen in the epilimnion of Iron Gate reservoir and, potentially, downstream of Iron Gate development, consideration of specific measures to reduce nutrient loads downstream of Iron Gate dam, and a specific time frame during which feasible measures to address project-related water quality affects would be implemented. We conclude that the measures that we include in the Staff Alternative would not adversely affect EFH.

### **5.6.6 National Historic Preservation Act**

The NHPA (16 U.S.C 470 et seq.) (as amended) requires federal agencies to manage cultural resources under their jurisdiction and authorizes the Secretary of the Interior to maintain a National Register. The law also provides for the creation of SHPOs to facilitate the implementation of federal cultural resource policy at the state level, and for the responsible federal agency (i.e., agency official) to consult with Native American tribes who attach religious or cultural importance to cultural resources under their jurisdiction. Section 106 of the Act requires federal agencies to take into account the effect of any proposed undertaking on properties listed in, or eligible for listing in the National Register. If the agency official determines that the undertaking may have adverse effects on properties listed in or eligible for listing in the National Register, the agency official must afford an opportunity for the Advisory Council to comment on the undertaking. The relicensing of the Klamath Hydroelectric Project is considered an undertaking, and the Commission acts as the agency official.

To meet the requirements of section 106, the Commission would execute a Programmatic Agreement to take into account the effects on historic properties from the operation of the Klamath Hydroelectric Project. The terms of the Programmatic Agreement would ensure that PacifiCorp would address and treat all historic properties identified within the areas of potential effect through the HPMP. The HPMP entails ongoing consultation involving historic properties for the term of any new license. The Commission intends to circulate the Programmatic Agreement to the signatories for execution after the issuance of the final EIS, but prior to issuance of a license order.

### **5.6.7 Wild and Scenic Rivers Act**

The Wild and Scenic River Act (P.L. 90-542) and its amendments protect in their free-flowing conditions designated rivers and their immediate environments that possess ORVs. ORVs may include scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values. Section 7(a) of the act states that the Commission shall not license the construction of any dam, water conduit, reservoir, powerhouse, transmission line, or other project works under the FPA on or directly affecting any river designated as a Wild and Scenic River. The Wild and Scenic Rivers Act specifically does not preclude licensing of developments upstream or downstream of designated wild, scenic, or recreational rivers if the development does not invade the area or unreasonably diminish the scenic, recreational, and fish and wildlife values present in the designated reach.

Congress added about 189 miles of the mainstem of the Klamath River to the Wild and Scenic Rivers system in 1981 as part of a total 286 mile designation of river segments in the Klamath River

Basin. The upstream end of this designated river segment begins about 3,600 feet downstream of Iron Gate dam in the vicinity of the Iron Gate Hatchery. Portions of the Salmon and Scott rivers and Wooley Creek make up the balance of the designated river segments (97 miles). Most (250 miles) of the total of 286 miles was designated by Congress as recreational; 24 miles was designated as scenic; and 12 miles was designated as wild. The ORV for this 286 mile portion of the Wild and Scenic Rivers system is anadromous fisheries (steelhead and salmon).

The measures to enhance anadromous fish habitat included in the Staff Alternative and summarized in section 5.6.5, *Essential Fish Habitat*, would support the ORV of anadromous fisheries for the Wild and Scenic River segment downstream of Iron Gate dam. In addition, recreational enhancements at the Iron Gate Hatchery day use area that we include in the Staff Alternative would serve to facilitate public education regarding the importance of anadromous fish restoration to the Klamath River Basin. Enhancements at a nearby boater access location at the upstream end of the designated Wild and Scenic River segment would facilitate recreational use of this river reach. Together, these measures would help enhance the environmental attributes of this Wild and Scenic reach.

In 1994, the Secretary of the Interior added an 11-mile segment of Klamath River from downstream of the J.C. Boyle powerhouse to the Oregon and California state line (much of the peaking reach) to the Wild and Scenic Rivers system. This segment was designated by the Secretary of the Interior as scenic, with ORVs of quality whitewater boating, diverse wildlife, prehistoric sites, quality rainbow trout fishery, habitat for endangered species, historic places, scenery, and evidence of Native American traditional uses.

A primary reason for the ORV of quality whitewater boating is the peaking operation at the J.C. Boyle powerhouse. This operation provides quality boating opportunities throughout the summer when low flow conditions curtail whitewater boating opportunities at other regional unregulated river systems. The Staff Alternative retains daily peaking operations which would maintain whitewater boating opportunities for most of the time that existed when this was designated by the Secretary of the Interior as a Wild and Scenic River reach in 1994. It would also, during wet water years, enhance whitewater boating opportunities from July through October because of limitations in the change in generation flows that are also included in the Staff Alternative (see section 3.3.6.2.2, *River Recreation*, for more details). Angling opportunities would be similar under the Staff Alternative to those that existed in 1994. Habitat protection and enhancement measures included in the Staff Alternative for the J.C. Boyle bypassed and peaking reaches, including spawning gravel augmentation, protection of the thermal refugia, increased minimum flow in the peaking reach, and limitations on the rate of flow change in the peaking reach should maintain and result in minor improvements to the existing quality rainbow trout fishery in the peaking reach. Protection of sites of prehistoric, historic, and of importance to Native Americans would be provided for by the HPMP that is included in the Staff Alternative.

The Bureau of Land Management, in its preliminary section 7(a) Wild and Scenic Rivers Act determination and report (Bureau of Land Management, 2007), concludes that the Staff Alternative, which includes PacifiCorp's proposed operation, would maintain or enhance the ORVs of recreation, scenery, fish, and wildlife. The Bureau of Land Management concludes that the project, with its modified 4(e) conditions and retirement of Copco No. 1 and Iron Gate developments alternative, would diminish recreational values, but not unreasonably so, and enhance scenery, fish, and wildlife values. The Forest Service provided a section 7(a) Wild and Scenic Rivers Act preliminary determination report for the portion of the river located in California (Forest Service, 2006). It also concludes that none of the action alternatives as they were presented in the draft EIS would unreasonably diminish the scenic, recreational, fish, or wildlife values in the area upon its designation as a component of the National Wild and Scenic Rivers System.