United States Department of the Interior
OFFICE OF THE SECRETARY
Washington, DC 20240

April 26, 2004

Honorable Magalie R. Salas, Secretary
Federal Energy Regulatory Commission
825 North Capitol Street, N.E.
Washington, DC 20426

Mr. Toby Freeman and Mr. Todd Olsen
PacifiCorp
825 N.E. Multnomah, Suite 1500
Portland, Oregon 97232

Re: PacifiCorp Klamath River Hydroelectric Project Relicensing (FERC No. 2082) – Comments on Final License Application and Additional Study Requests of the U.S. Department of the Interior

Dear Ms. Salas, Mr. Freeman, and Mr. Olsen:

This letter is being provided in response to the Federal Energy Regulatory Commission's (Commission or FERC) Notice of Application Tendered for Filing with the Commission, Soliciting Additional Study Requests and Establishing a Procedural Schedule for Relicensing and a Deadline for Submission of Final Amendments, dated February 26, 2004, issued for the Klamath Hydroelectric Project (Project). The U.S. Department of the Interior (Department or Interior) and its bureaus, the Bureau of Indian Affairs (BIA), Bureau of Land Management (BLM), Bureau of Reclamation (Reclamation), National Park Service (NPS), and U.S. Fish and Wildlife Service (FWS) have reviewed the Application for New License submitted to the Commission on February 25, 2004, by PacifiCorp. Pursuant to 18 CFR 16.8(d), the Department herewith submits its comments on the Final License Application (FLA) and 29 specific additional information and study requests (ASRs), which include completing on-going studies. The Department is submitting this document electronically.

Contrary to the intent of pre-filing consultation requirements of 18 CFR 16.8, this review of the FLA is the Department's first opportunity to comment on significant information and conclusions contained in the FLA, and on PacifiCorp's proposed Project, Project impacts, and measures for protection, mitigation, and enhancement. The Department has identified technical concerns with the information presented in the FLA, including substantive disagreements (See Attachment 1, Specific Comments on the FLA). Information in critical areas such as fish passage and instream flow modeling remains unavailable for the Department's review and key study plans were never agreed upon by the collaborative group. Additional information is needed to form an adequate factual basis for a complete analysis of the FLA on its merits (See Attachment 2, ASRs). Nevertheless, evidence in the record clearly describes significant Project impacts that are not sufficiently addressed by PacifiCorp's proposed measures for protection, mitigation, and enhancement. Although not explicitly stated in the FLA, PacifiCorp has stated in meetings with the

Department and other stakeholders that it intends to supplement the FLA in response to completed studies and modeling.[1] It is the Department's hope that PacifiCorp will respond to the Department's substantive comments and concerns, and thereby complete second stage consultation as required by the Commission's regulations.

Part A of this letter addresses specific issues of concern to the Department and its bureaus, including:

1. *Pre-filing Consultation*: PacifiCorp did not disclose its proposed Project, identify its interpretation of Project impacts, or provide protection, mitigation, and enhancement measures prior to the filing of the FLA, contrary to the Commission's regulations regarding pre-filing consultation, and the goals of the Klamath Collaborative.

2. *Project Impacts*: The FLA does not provide an adequate analysis of the impacts of the proposed Project as a result of continuing operations over the next license term as required by 18 CFR 4.51.

3. *Fish Passage*: Although the Project blocks access to more than 500 miles of salmon habitat and isolates resident fish populations, PacifiCorp proposes only minor upgrades for fish passage at just one of the five main-stem Project facilities. PacifiCorp's decision not to provide fish passage at other Project facilities is premature, and not supported by the record.

4. *East Side, West Side, and Keno Dam and Reservoir*: PacifiCorp must analyze changes to currently licensed facilities such as the decommissioning of the East Side and West Side facilities and the removal of Keno dam and reservoir from the Project. If Keno dam operations affect the timing and quantity of electricity produced at Project facilities, or the maintenance of those facilities, as we believe it does, it must be treated as a Project facility and included in the license.

5. *Proposed Project Boundary*: The proposed Project excludes the J.C. Boyle bypass reach and roads that are essential for Project operations, maintenance and access to recreational facilities.

6. *Electric power for irrigation purposes*: The FLA does not adequately address the likely significant adverse economic impact on irrigation water users, to Reclamation for operating the Klamath Project, or to Lower Klamath National Wildlife Refuge, if the cost of electric service significantly increases.

7. *Net Social Benefits:* PacifiCorp's evaluation of social costs and benefits is methodologically defective, fails to properly address or give equal consideration to non-power benefits, and overstates the power benefits of the Project. PacifiCorp's analysis exaggerates the importance of a Project that represents less than 1% of PacifiCorp's total sales.

Part B describes the Department's involvement in Klamath basin resource issues and summarizes the Department's authorities and responsibilities in this relicensing proceeding.

[1] "Toby [Freeman] said we [PacifiCorp] knew that a lot was missing from the DLA and we recognize that. He continued that we think we'll be able to fill a lot of those gaps and conversations post-filing, in supplements to the FLA down the road with additional information." FLA Appendix E-1A, Appendix C, Plenary Meeting Notes, 11/26/03, Page 8.

A. Issues with the Final License Application

1. *Pre-filing Consultation*: **PacifiCorp did not disclose its proposed Project, identify its interpretation of Project impacts, or provide protection, mitigation, and enhancement measures (PM&Es) prior to the filing of the FLA, contrary to the Commission's regulations regarding pre-filing consultation, and the goals of the Klamath Collaborative. As a result, the Department is providing extensive comments on material, which it is reviewing for the first time in this proceeding (See Attachment 1).**

PacifiCorp initiated the FERC licensing process in December 2000 and chose to use the traditional FERC licensing process. Interior and its bureaus - BIA, BLM, FWS, NPS, and Reclamation - have participated in the relicensing process since its inception.

PacifiCorp and interested parties convened the Klamath Collaborative to develop, conduct, and evaluate studies in order to establish a complete technical and scientific record necessary for analyzing impacts and developing license terms and conditions, PM&Es, and agency recommendations. These, among other goals of the Klamath Collaborative, were not fully realized.

On June 24, 2003, PacifiCorp distributed the DLA to interested parties for comment. The DLA was substantially incomplete according to the terms of 18 CFR 16.8(c)(4) and did not contain much of the information required by 18 CFR 4.51, confirming the Department's concerns discussed in a letter dated April 8, 2003.[2] Existing study results were not compiled, analyzed, and presented. Resource impacts and PM&Es were not identified. And the DLA lacked even basic elements, such as estimates of dependable capacity, operating rule curves for the reservoirs, identification of the Project boundary and federal lands, and identification of the Area of Potential Effects (APE), as required.

Due to the insufficiency of the DLA for the purposes of pre-filing consultation required by the Commission's regulations, the Department, through its comments on the DLA dated September 23, 2003, requested either a supplementary draft license application including resource impacts and PM&Es, or full disclosure of these details in subsequent meetings.

PacifiCorp did not provide a supplemented or updated DLA, but instead provided some details of what became the proposed Project at the joint agency meeting in November 2003 in a document termed an "effects-PM&E matrix."[3] This matrix was vague, provisional, and did not closely resemble the proposed Project as it is described in the FLA.[4] Further, the proposed Project in the FLA contains many new proposals on which the Department has not yet had a chance to consult with the applicant, notably decommissioning of the East and West Side Power Developments and removal of Keno dam and reservoir from the licensing process. PacifiCorp's FLA therefore lacks a description of "all disagreements with a resource agency or Indian tribe on technical or environmental PM&Es in its application" as provided in18 CFR 16.8(c)(8).

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[2] Letter from William Bettenberg, Director, Office of Policy Analysis, Department of the Interior, to Toby Freeman, Project Manager, PacifiCorp, April 8, 2003.

[3] This document was dated 10/27/03 and distributed at the 11/6/03 Joint Agency Meeting. The document was labeled "Deliberative, Predecisional: Not for Release." A later version updated with some comments made by parties at the meeting is included in FLA Exhibit E1A, Appendix C, Plenary November 2003.

[4] For example, the Aquatics Effects-PM&Es Matrix makes no mention of the surface gulper system proposed in the FLA, and makes statements such as "appropriate minimum instream flows and flow fluctuation (ramping) rates are unknown at this time."

2. *Project Impacts*: **The FLA does not provide an adequate analysis of the impacts of the proposed Project as a result of the continuing operations over the next license term as required by 18 CFR 4.51. Accordingly the Department has requested 29 additional studies, which include completing on-going efforts (See Attachment 2).**

In order to design protection, mitigation, and enhancement measures (PM&Es)[5] for the effects of a hydroelectric project, the project's effects must be evaluated first. In the absence of an assessment of the project's effects, no basis exists for crafting a mitigation proposal. Proposing PM&Es without such an assessment runs a number of risks:

- Overburdening the applicant by requiring mitigation of impacts which are not due to operation of the project;
- Overburdening the applicant by requiring it to undertake actions for nonexistent effects; and
- Relieving the applicant of legitimate mitigation responsibilities.

In this case, there is inadequate identification of Project impacts in the FLA. Studies addressing instream flow, fisheries assessment, peaking effects, ramping effects and fish passage have not been completed or are not sufficient, and conclusions are often based upon inadequate information. The Department understands that FERC must develop an Environmental Impact Statement (EIS) that will rely, to the extent practicable, on information in the FLA. The FLA should contain information adequate to analyze a full range of alternatives. At a minimum, the FLA must provide a description of the full range of environmental impacts of its existing and "proposed operations," and cumulatively assess each Project facility for its upstream and downstream fish passage limitations and potential benefits.

Fish Assessment: The FLA lacks a complete discussion of existing conditions and Project impacts to fish populations and habitat, impacts of peaking and ramping on the fisheries resource, impacts of instream flows in the Link River and Keno reaches, and depleted sediment conditions in the J.C. Boyle peaking reach and the Copco II bypass reach.

Hydrology: Flow diversion and peaking operations have altered hydrologic conditions in the Klamath River, affecting the hydrology between J.C. Boyle and Iron Gate Dams and portions of Fall Creek, Spring Creek, and Jenny Creek. This is inadequately analyzed in the FLA.

Water Quality: The FLA consistently understates the impact of Project operations on water quality. Project operations alter water quality within and downstream of Project reservoirs and in river reaches subject to diversion and peaking operations, as well as in Spring and Jenny Creeks. The complete set of water quality modeling results has not yet been released for review; therefore it is impossible to validate conclusions regarding the impact of the Project on water quality. The Department has concerns about the calibration and appropriateness of the modeling, boundary conditions and linkages, meteorological data, water balance, and bathymetry.

Geomorphology: The geomorphology discussion in the FLA describes continuing impacts of the Project on sediment supply and fish spawning but does not consider indirect impacts to other resources, such as riparian habitat. Key issues associated with the analysis relate to the sediment transport study and verification of data used to quantify stored sediment.

Wildlife Habitat: Big game is a primary wildlife interest of the BLM in the Upper Klamath Wild and Scenic River because several species that use the river canyon are considered among a regionally significant population. Wildlife movement studies were limited in scope and duration.

[5] 16 USC § 797

Noxious Weeds: Noxious weeds in the Project area are abundant and widespread and Project operations have the potential to facilitate spread of these species across the broader landscape. Project impacts on hydrologic regimes, Project-related road access, and right-of-way disturbance are the primary vectors for dispersal of invasives. The noxious weed problem and how to address it are inadequately analyzed in the FLA.

Threatened, Endangered, and Sensitive Species: Project impacts to threatened, endangered and sensitive (TES) species are discussed only as they relate to maintenance or alteration of flow regimes. Surveys for TES species were incomplete and did not adhere to agreed upon methodologies or scope for TES surveys developed by the technical work group.

Riparian/Wetland Habitat: The FLA concludes that Project impacts to riparian resources are minor, but the conclusion is not supported by data or analysis. The impact of invasive species that thrive as a consequence of Project operations is not assessed, nor are impacts on sediment supply and transport and their relationship to maintaining a functional riparian community.

Cultural Resources: Surveys of cultural properties within the Project area are incomplete and do not address primary concerns relating to the area of potential effect and impacts to cultural sites as a consequence of Project operations. The Department supports the downriver tribes' position that the Area of Potential Effects (APE) should be expanded to include those downstream corridor segments that extend to the mouth of the river as it enters the Pacific Ocean.

Recreation and Visual Resources: Earlier versions of the PM&E package that PacifiCorp discussed with the Recreation Working Group better reflect the licensee's responsibility to provide recreation opportunities that are Project-induced.

3. *Fish Passage*: **Although the Project blocks access to more than 500 miles of salmon habitat and isolates resident fish populations, PacifiCorp proposes only minor upgrades for fish passage at one of the five main-stem Project facilities. PacifiCorp's decision not to provide fish passage at other Project facilities is premature, and is based on an inappropriate interpretation of a preliminary habitat model run, selective and erroneous interpretations of current and historical literature, and a flawed argument regarding water temperature.**

The consideration of restoring access to habitat and potentially restoring runs of anadromous fish runs upstream of Iron Gate Dam is among the goals of the majority of relicensing stakeholders in this proceeding.[6] At present, fall Chinook salmon (*Oncorhynchus tshawytscha)* are the only commercially viable run of fish in the Klamath River. Fall Chinook salmon spawn and rear throughout the lower river and are of great importance to in-river recreational and tribal fisheries, ocean and in-river sport fisheries, and commercial fisheries throughout the North Pacific. Klamath fall Chinook are an important component of the management of west coast salmon stocks by the Pacific Fishery Management Council. Protective measures for low population levels of this Klamath stock often constrain the harvest of more abundant stocks that occur in the same ocean regions. Protective measures for the threatened coho salmon (*Oncorhynchus kisutch),* which spawn and rear in the lower river and tributaries, also constrain harvest of other ocean stocks, as well as affecting land use activities in the lower basin. Steelhead (*Oncorhynchus mykiss*) also occur in the river and tributaries below Iron Gate and are of economic, recreational, and cultural importance. Listed suckers, as well as other resident fishes, also occur within the Project area.

[6] See for example First Stage Consultation Document Comments, FLA Exhibit E-1A, Appendix B.

3.1 History: The Klamath River was once one of the largest salmon-producing watersheds on the west coast, supporting large anadromous fish runs that included both spring and fall-run Chinook salmon, coho salmon, steelhead, green sturgeon (*Acipenser medirostris*), and anadromous Pacific lamprey (*Entosphenus tridentata*). These runs supported significant commercial, recreational, subsistence, and tribal harvests. Upper Basin tribes also relied on extensive harvests of suckers, lamprey, and resident trout.

Spring and fall runs of Chinook occurred in the Sprague, Williamson, and Wood Rivers in the Upper Klamath Basin, now all rendered inaccessible to anadromous fish by the construction of Copco Dam in 1918.[7] Fortune et al. (1966) provided published reports and personal interviews indicating that the Sprague River was the most important salmon spawning stream, on the basis of testimony received.[8] Salmon were utilized as a major food source by humans in the upper basin at least from May through October.

Pacific lamprey, coho salmon, and anadromous trout also migrated through the Project area to upper basin tributaries.[9] The FLA states that there is no conclusive evidence that steelhead trout ever existed above Upper Klamath Lake.[10] However, whether anadromous redband or steelhead, it is likely that anadromous *O. mykiss* were present in the upper basin.[11] Behnke (1992) stated that the coastal rainbow trout or steelhead (*O. mykiss irideus*) and the Upper Klamath redband trout (*O. mykiss "newberrii")* were both native to the Klamath River system, and proposed that both may have exhibited anadromy.[12]

Salmon passage was considered before the 1918 completion of Copco I Dam blocked upstream fish passage in the Klamath River. During construction of the dam, the Klamath Tribes noted that salmon runs were affected, and the Vice President of the California-Oregon Power Company stated the company's intention to provide a fish ladder at Copco I Dam.[13] Provision of a ladder at Copco I was also consistent with the wishes of the Bureau of Indian Affairs.[14] Subsequently, however, the power company decided to build a hatchery at Fall Creek, and not to construct a fish ladder at Copco I.

3.2 Project Impacts: The FLA fails to address the substantial detrimental effects of the proposed Project on the surrounding environment over the next license term.

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[7] Nehlsen, W., J. E. Williams and J. A. Lichatowich (1991). "Pacific salmon at the crossroads: Stocks at risk from California, Oregon, Idaho, and Washington." Fisheries 16(2): 4-21; Moyle, P. B. (2002). Inland Fishes of California (Revised and Expanded). London, England, University of California Press, Ltd.

[8] Fortune, J.D.; A.R. Gerlach; and C.J. Hanel. 1966. A Study to Determine the Feasibility of Establishing Salmon and Steelhead in the Upper Klamath Basin. Oregon State Game Commission and Pacific Power and Light.

[9] Hamilton, J., G. Curtis, S. Snedaker, and D. White (2004). Historical Distribution of Native Anadromous Fish Above Iron Gate Dam in the Klamath River. USDI Fish and Wildlife Service Yreka, CA. Presentation at the California/Nevada American Fisheries Society Symposium, Redding, California. April 24, 2004.

[10] FLA Fish Resources Technical Report, page 7-3.

[11] Moyle 2002, see note 7.

[12] Behnke, R.J. 1992. Native Trout of Western North America. American Fisheries Society Monograph 6. 275 pp.

[13] "In reply…ample provision has been made in the plans for the dam for a fish ladder which will permit unobstructed passage of fish up the Klamath River." J. McKee, Vice President, California-Oregon Power Company (Copco), to the Commissioner of Indian Affairs, August 23, 1916. Quoted in Lane & Lane Associates, "The COPCO Dams and the Fisheries of the Klamath Tribe," Bureau of Indian Affairs, U.S. Department of the Interior, Portland, Oregon, December 1981, page 151.

[14] "The Indians of the Klamath Reservation…depended upon the supply of fish for a large percentage of their food and it is highly desirable that proper provision be made by the power company for passage of salmon over its dam." Assistant Commissioner of Indian Affairs E.B. Merritt to the Oregon State Fish and Game Commission, August 26, 1918. *ibid*

Project reservoirs will continue to inundate 15 miles of low gradient stream habitat, at least 2.5 miles of which was important spawning habitat for resident and anadromous salmonids. In addition, Project facilities will continue to block access to more than 500 miles of habitat for steelhead and Chinook salmon in the upper basin[15] including at least 60 miles of habitat for the federally-listed coho salmon.[16] Much of this habitat continues to provide a productive environment for redband trout and, at some locations, other salmonids, such as brown trout *(Salmo trutta)* and brook trout *(Salvelinus fontinalis)*. Thus, based on available information, the most supportable conclusion is that habitat upstream of Iron Gate Dam would provide a productive environment for anadromous salmonid migration, spawning, incubation, and rearing.

The proposed Project will continue to isolate or reduce population connectivity for populations of resident redband trout, suckers, and other species that inhabit various river reaches, tributaries, and reservoirs. Existing fish passage facilities throughout the Project are inadequate, and are not designed to current criteria. For example, at J.C. Boyle Dam, upstream passage facilities cause migration delays for trout, and suckers and trout moving downstream are entrained.

3.3 Lack of Measures for Fish Passage: As noted above, the developers of Copco I Dam declined to provide adult salmon passage despite their knowledge of the loss of salmon runs into the upper Klamath basin and the importance of these fish to the Klamath Tribes. Several decades later, when developing plans for Iron Gate Dam that would further reduce salmon and steelhead habitat, the power company argued that there was not "substantial evidence" of the benefits of fisheries mitigation facilities (i.e., a salmon hatchery).[17] The Federal Power Commission required the construction of the Iron Gate Hatchery. Today, as described in their FLA, PacifiCorp states that there is no substantial proof of the benefits of providing passage for salmon and steelhead in the Klamath River. However, while PacifiCorp now seeks credit for the social benefits that accrue from operation of Iron Gate Hatchery (see discussion of Net Social Benefits, below), the FLA has failed to propose modifications of existing facilities that would provide for passage of anadromous fish, or propose a consistent, comprehensive strategy for resident fish passage through Project facilities.

Upgrades are proposed for the J.C. Boyle facility, where existing passage structures required by the current license are not functioning for resident trout. However, no passage facilities are proposed for Iron Gate, Copco I, or Copco II, where resident species are isolated by lack of passage. Thus, passage needs of resident fish, including listed suckers, have not been adequately addressed.

PacifiCorp does not propose the reintroduction of anadromous fishes to the Project area, or to upstream areas now inaccessible due to Project facilities. PacifiCorp provides selective arguments opposing fish passage, ignoring important information that might support reintroduction.

EDT: To assess the potential for reintroducing salmon and steelhead above Iron Gate Dam, PacifiCorp is using two models, the Ecosystem Diagnosis and Treatment Methodology (EDT) model and KlamRas, a salmon life cycle model. Both models are under development by PacifiCorp and are being reviewed by the Habitat Modeling Group (HMG).[18] In the FLA, PacifiCorp uses results from an EDT model run termed "initial and very preliminary"[19] to conclude that reintroduction of fall Chinook salmon is

[15] Huntington, C. W. (2004). Preliminary estimates of the recent and historic potential for anadromous fish production in the Klamath River above Iron Gate Dam. Canby, Oregon, Klamath Tribes**:** 1-11.
[16] Edmondson, S. (2003). Hydro Relicensing and the Klamath River. California Nevada Chapter American Fisheries Society, Annual Meeting, San Diego, CA.
[17] COPCO, quoted in FPC Opinion No. 381, March 14, 1963, page 6.
[18] See Fish Resources Technical Report Pages 7-133 to 147
[19] Fish Resources Technical Report R Page 7-146

"probably not sustainable." However, completion of the model, review of hundreds of model input parameters, and the subsequent production of model results are scheduled to take place over the next few months. The use of these preliminary and unsupported model results to draw conclusions affecting such significant fishery resources is inappropriate, and does not represent an objective analysis of the potential anadromous fish production in the Project area. No results from the KlamRas model are reported in the FLA.

Literature Review: The FLA only partially summarizes a report by Fortune et al. (1966) stating that "the Steering Committee advised against pursuing a program to re-establish anadromous fish runs to the Upper Klamath Basin."[20] PacifiCorp did not discuss the minority recommendation included in the report, indicating 1) that reintroduction was biologically feasible for spring-run Chinook and steelhead trout, and 2) that the biggest impediment to reintroduction was the existence of the three Project dams in California.[21]

The FLA cites the 1997 ODFW Klamath River Basin Fish Management Plan suggesting that it does not appear feasible, or prudent, to attempt re-establishment of anadromous salmon or steelhead to the Upper Klamath River basin[22], but did not include the conclusion of the paragraph, which states that while the welfare or remaining native fish stocks are of concern, ODFW supports studies addressing the feasibility or reintroduction and will support re-introductions if and when the biological and physical questions are addressed and show that such actions are feasible and prudent.[23]

Further, PacifiCorp refers to the "Upper Basin Amendment to the Long Range Plan…completed…in 1992" by the Department's Klamath River Basin Fisheries Task Force as recommending against reintroduction.[24] Reference to this document, and the excerpts provided by PacifiCorp, are wholly inappropriate in this context, because the proposed Upper Basin Amendment to the Long Range Plan was never adopted by the Task Force.

Water Temperature: The FLA suggests that water temperatures are not conducive to upstream and downstream passage.[25] While water quality is often impaired in some areas during late June, July, August, and early September, salmon and steelhead smolts likely avoided migration during those months historically. Fortune et al. (1966) reported that by the end of May, nearly all young salmon had departed from the upper end of their range in the Klamath River. By focusing on the months with the highest water temperatures and poorest water quality, the FLA ignores passage potential during the majority of the year. Puckett et al. (1966) stated that it is biologically feasible for spring Chinook salmon and steelhead trout to be re-established in the Upper Klamath Basin, since both species migrate at such times that the water temperature and dissolved oxygen content of the waters of this Basin would be satisfactory.

[20] FLA Exhibit E, Page 4-117; Fish Resources Technical Report, Page 7-2

[21] Puckett, R., B. B. Cannady, G. O. Black, J. E. Skinner, T. E. Kruse, C. J. Campbell and J. A. R. Hamilton (1966). Report of Steering Committee on the Upper Klamath Salmon and Steelhead Feasibility Study**:** 1-12.

[22] FLA Exhibit E, Page 4-118; Fish Resources Technical Report Page 7-5

[23] Oregon Department of Fish and Wildlife (1997). Klamath River Basin Fish Management Plan. Portland, Oregon, Oregon Dept. of Fish and Wildlife**:** 1-176, page 67.

[24] FLA, Exhibit E, Page 4-117; Fish Resources Technical Report, Page 7-4

[25] FLA Exhibit E-1A, Appendix B Second Stage, page 49, and Response to Comment S3-39; E-1A Appendix B Second Stage page 13, Response to Comment F11-75.

4. *East Side, West Side, and Keno Dam and Reservoir*: **PacifiCorp must analyze changes to currently licensed facilities such as the decommissioning of the East Side and West Side facilities and the removal of Keno dam and reservoir from the Project. This will require an analysis of the impacts on irrigation water deliveries from Lake Ewauna to the Klamath Irrigation Project and private lands, as well as to popular recreation facilities such as the Link River Trail and Sportsman Park, cultural properties, and fish passage. If Keno dam operations affect the timing and quantity of electricity produced at Project facilities, the maintenance of those facilities, or provides for other Project purposes, it must be treated as a Project facility and included in the license.**

PacifiCorp is proposing to decommission the East Side and West Side facilities, and to exclude the Keno Development from the relicensed Project. PacifiCorp proposes to keep Keno dam in operation, "per current operations under the jurisdiction of the state of Oregon."[26]

The Department has concerns, based on statements made by company representatives at the October 2003 Collaborative meetings, that PacifiCorp intends to operate the facility more like a river with widely fluctuating reservoir elevations, particularly during the summer months. The operation of the Keno Reservoir in this manner would have significant and potentially unacceptable impacts on the agricultural community served by the irrigation project. Existing irrigation project facilities and current irrigation practices of the Klamath Irrigation Project rely on Keno Reservoir as the controlling water body for numerous points of diversion to service lands in the southwestern area of the project. Three irrigation project facilities, the Ady Canal, the North Canal, and the Lost River Diversion Channel, divert water from Lake Ewauna. In addition, several individuals and irrigation districts that have contracts with Reclamation also pump directly from Lake Ewauna. If water is not available to irrigators served by facilities dependent on Keno Reservoir, then significant economic losses will occur. Possibly as much as 41 percent of the lands served by the Klamath Project could lose their crop if water deliveries are interrupted or curtailed as a result of changes in Keno Reservoir operations.

In addition, at the southern end of the lands serviced by the Ady and North Canals is the Lower Klamath National Wildlife Refuge. The principal feature of this refuge is Lower Klamath Lake, which is the home of a diverse population of terrestrial and aquatic wildlife that include migratory waterfowl and some threatened and endangered species. The refuge is a beneficiary of the federal irrigation project that would be adversely affected if operation of Keno Reservoir is altered. Species listed under the Migratory Bird Treaty Act are found on the refuge. Bald eagles are also found on the refuge was well as on private lands served by water from Keno Reservoir. The Department's review of Exhibit E, as well as the Terrestrial and Aquatic Technical Reports, concludes that the FLA does not adequately identify the extent to which wildlife resources would be impacted by changes in operations of Keno Reservoir.

FERC regulations require that the Project boundary "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. Existing residential, commercial, or other structures may be included within the boundary only to the extent that underlying lands are needed for project purposes (e.g., for flowage, public recreation, shoreline control, or protection of environmental resources)."[27] PacifiCorp suggests that there is no longer any basis upon which to conclude that the Keno Development is subject to FERC jurisdiction.[28] PacifiCorp argues that the development has no generation facilities, and its operation "does not substantially benefit generation at PacifiCorp's downstream

[26] FLA Exhibit B, page 3-1.
[27] 18 CFR 4.51 (h)
[28] FLA Executive Summary, page 1-7

hydroelectric developments."[29] The Department notes that Keno is used periodically in maintenance activities, and that gauge data from PacifiCorp will be necessary to determine the extent of Keno's role in the timing and quantity power generation. It is also possible that the Keno structure is necessary for other Project purposes, including recreation and the protection of environmental and cultural resources.

If FERC does decide to proceed with relicensing without the Keno development, a decommissioning proceeding, subject to FERC regulations and the Decommissioning Policy is necessary. Such a proceeding would be subject to existing FERC regulations and policy, including the Decommissioning Policy.[30] The manner in which the Keno dam is to be operated must be described, and the effects of those operations must be analyzed.

5. *Proposed Project Boundary*: **The proposed Project excludes the J.C. Boyle bypass reach and roads that are essential for Project operations, maintenance and access to recreational facilities. These lands need to be included in the Project boundary, and PacifiCorp should supplement the FLA to incorporate them and assess management of them.**

PacifiCorp has proposed to exclude from the Project boundary the J.C. Boyle bypass reach and roads necessary for Project maintenance and recreational access. This includes decreasing the amount of United States-owned land within the Project boundary from approximately 219 acres in the DLA to 156 acres of in the FLA.

The bypass reach lies between two PacifiCorp facilities and is essential for Project operations. In fact, the proposed Project includes enhancement flows and ramping rates for the reach, illustrating a discrepancy in approach for including or excluding various Project features from the Project boundary. Adjustment of the Project boundary also excludes roads that are essential for Project maintenance and access to recreation facilities that are maintained by BLM for recreation uses which are enhanced as a direct function of the Project. The proposed boundary adjustment eliminated many of these roads from the Project and therefore PacifiCorp has not analyzed the effects of road and related facilities operation and maintenance.

6. *Electric power for irrigation purposes*: **The FLA does not adequately address the likely significant adverse economic impact on irrigation water users, to Reclamation for operating the Klamath Project, or to Lower Klamath National Wildlife Refuge, if the cost of electric service dramatically increases.**

Historically, PacifiCorp has provided electric service to the Klamath Irrigation Project, as well as to irrigators who are not part of the Project. Due to the configuration of the irrigation project, considerable amounts of electric energy are needed to operate the features and facilities (such as pumps) to provide service to both the irrigation community and the national wildlife refuges in the Project area. In addition to the federal needs for electric energy, local irrigators also use substantial electric energy, primarily for operation of individual pumps for supplying water to crops and for drainage. PacifiCorp has provided reliable electric energy at prices that have allowed for economically favorable farming in the Upper

[29] FLA Exhibit A, page 4-1

[30] 69 FERC ¶ 61,336 1994: "In those instances where it has been determined that a project will no longer be licensed, because the licensee either decides not to seek a new license, rejects the license issued, or is denied a new license, the project must be decommissioned."… "The Commission is of the opinion that implicit in the section 6 surrender provision is the view that a licensee ought not to be able simply to walk away from a Commission-licensed project without any Commission consideration of the various public interests that might be implicated by that step. Rather, the Commission should be able to take appropriate steps that will satisfactorily protect the public interests involved."…"Absent specific authority by the Federal agency involved for continued use of Federal lands at the termination of Commission licensing, it is eminently reasonable that the licensee must restore the lands to that agency's satisfaction, at the licensee's expense."

Klamath Basin. Electric energy consumption represents a major cost in many farm budgets and changes to the service cost structure can have potentially significant adverse economic impacts on irrigation water users and, in turn, the community as a whole.

The FLA notes that irrigated agriculture is an important component of the Project area economy. It presents the following statistics regarding irrigated agriculture in the Klamath Hydroelectric Project area:

- Eighty percent of farms using irrigation water are located in either Siskiyou County, California or Klamath County, Oregon; which are the two counties in the Hydroelectric Project service area.
- Approximately 490 farms, representing 41 percent of the acreage in the Klamath Irrigation Project, receive their water from Keno Reservoir.
- Approximately 95,600 acres of Klamath Project lands are irrigated from Keno Reservoir
- An additional 4,000 acres of non-Klamath Irrigation Project lands are irrigated from Keno Reservoir

The special power rate presently available to water users pursuant to a separate contract between Reclamation and PacifiCorp will likely not be available after early 2006. The FLA provides no information about what the rate structure for service to the irrigation community will be in 2006 and beyond, despite the fact that the existing rate structure is established in a contract required by the Commission in an article of the existing license. This article was based, at lease in part, on the power company's recognition of the reservation of Klamath River water for Reclamation's Irrigation Project. Since PacifiCorp has informally indicated that the current rate structure will likely change, significant uncertainty has arisen about the economic consequences for irrigation water users in Reclamation's irrigation project that stands in contrast to the finding in the FLA that "it is not anticipated that the incremental changes resulting from the proposed Project and PM&E measures *would lead to changes in employment and earnings in any other sectors of the economy* (emphasis added)."[31] FERC will not be able to conduct a thorough analysis of the economic impacts to the irrigation community in the National Environmental Policy Act document that will be prepared for the FLA without a thorough analysis of these impacts.

7. *Net Social Benefits:* **PacifiCorp's evaluation of social costs and benefits is defective and fails to address the benefits of the non-power uses of the resource. PacifiCorp overstates the power benefits of the Project.**

In the FLA PacifiCorp mischaracterizes the implications of the changes to the existing Project. PacifiCorp reports that its costs of its proposed changes in the Project outweigh the benefits by more than two to one at a two percent discount rate and three to one at a seven percent discount rate.[32] The costs involved here are: the cost of the PM&Es; the associated changes in operating costs; and the value of any lost power emanating from the changes. These are only the private costs to the Project operator of internalizing the negative impacts on society's resources (fish and wildlife, water quality, etc.) from operating the Project. Since the changes are an attempt to mitigate the damages to the resource resulting from its power generation activities, it suggests that the power benefits are not socially desirable since more benefit can clearly be obtained by not licensing the Project and allowing the environment to recover.

It is both equitable and efficient for PacifiCorp to internalize these costs. Until now the public has been forced to bear the resource costs associated with operating the Project rather than the beneficiaries of the Project. After these costs are internalized, the cost of producing electricity at the Klamath Hydro Project will more accurately reflect its true resource cost (market and nonmarket) and a maldistribution of these costs will have been corrected.

[31] FLA Executive Summary, Page 9-9
[32] FLA Executive Summary, pages 9-10.

PacifiCorp's violation of its own, inadequate analytical structure has resulted in an inappropriate treatment of hatchery benefits, and compounds an already flawed benefits calculation. Specifically, PacifiCorp counts hatchery benefits of its baseline as incremental benefits to the baseline. As a result, PacifiCorp overestimates the net benefits associated with the proposed Project by a factor of five by attributing benefits from the hatchery to the proposed Project. Eighty percent of the quantified social benefits calculated by PacifiCorp come from recreational and tribal fishing in the lower Klamath River due to the hatchery.[33] Under PacifiCorp's analytic baseline, only *changes* to the hatchery, which is part of the current Project, should be measured as a benefit. Since PacifiCorp is not proposing any changes which affect the hatchery, there cannot be any incremental benefits due to the hatchery.

To calculate power benefits, PacifiCorp chooses values for the marginal opportunity cost of power that may overstate the annual value of Project power by 150% to 300%, even when compared to its own contemporaneous filings in other regulatory jurisdictions. This inflated estimate is an apparent attempt to make what is in reality a socially marginal source of power appear to be of substantial value. In addition, not enough information is presented on the amount of power generated and the daily, monthly, and seasonal timing of that generation.

PacifiCorp reports that "The average value of on-peak generation, assuming a 30-year average value of COB and Mid-Columbia values ($74 per MWh) and a future on-peak generation of 447,209 MWh (proposed Project), is $32.9 million per year. The average value of off-peak generation, assuming a 30-year average value of COB and Mid-Columbia values ($62 per MWh) and a future off-peak generation of 249,834 MWh (proposed Project), is $15.6 million per year." The resulting estimate of the annual value of power is $48.5 million per year.

PacifiCorp's estimate of replacement power is dramatically overstated when compared to:

- Five-year firm power available from Bonneville Power Administration (BPA);
- FERC determinations in other relicensings in the region;
- PacifiCorp's determination of avoided costs filed with the Oregon Public Utility Commission;
- California Energy Commission's Preliminary Assessment; and
- PaciCorp's estimation of avoided costs in its Fish Resources Technical Report.

The table below shows how PacifiCorp's representations compare with the referenced benchmarks:

Source	**Peak ($/mWh)**	**Off-Peak ($/mWh)**
PacifiCorp: FERC Filing, Exhibit D	**$ 74**	**$ 62**
PacifiCorp: Fish Resources Technical Report[34]	50	50
California Energy Commission: Preliminary Assessment[35]	42	42
PacifiCorp: Oregon Avoided Cost Filing, November 2003[36]	29	25
FERC FEIS: C.J. Strike Project [37]	26	20
BPA: PF-02 & RL-02 – HHL and LHL[38]	24	16

[33] FLA Exhibit E, page 9-54, Table 9-24, Net Present Value of Social Benefits

[34] See for example FLA Fish Technical Report, Table 7.8-9. PacifiCorp uses a uniform $50/MWh in calculating the energy cost of lost generation in its engineering cost estimates of fish passage.

[35] California Energy Commission Staff Paper, "Preliminary Assessment of Energy Issues Associated with the Klamath Hydroelectric Project," May 2003

[36] Advice No. 03-016, filed with the Oregon Public Utility Commission (OPUC)on November 10, 2003, http://www.pacificorp.com/Regulatory_Testimony/Regulatory_Testimony32787.pdf.

[37] Federal Energy Regulatory Commission, Office of Energy Projects, Final Environmental Impact Statement – C.J. Strike Project – Idaho, FERC Project No. 2055, FERC/FEIS – 0146F, October 2002, page 205. The numbers shown in the above table are the mean of the values in the FERC report.

[38] Bonneville Power Administration, October 2003 - March 2004 Adjusted Power Rates Corrected. Table 1.

B. The Department of the Interior's Role in the Next Steps in the Relicensing of the Klamath Hydroelectric Project

1. The Department of the Interior role in the Klamath Hydroelectric Relicensing

The Federal Power Act (FPA) authorizes Interior to participate directly in the hydropower licensing process. Pursuant to section 4(e), Interior has authority to set conditions necessary for the protection and utilization of reservations it administers. In this instance, these lands include the Bureau of Reclamation's Klamath Project and lands managed by the BLM downstream of Keno Dam. Interior also has the authority to establish, pursuant to section 18 of the FPA, terms for the safe passage of fish. Finally, Interior may recommend, pursuant to sections 10(a) and (j), conditions necessary to protect, mitigate impacts to, and enhance fish and wildlife, recreation, cultural resources, and other resources.

The Klamath River watershed provides important habitat for a variety of fish and wildlife species over which the Service has responsibilities and authorities. Several of those species are currently listed under the Endangered Species Act (ESA), including the bald eagle (*Haliaeetus leucocephalus*), northern spotted owl *(Strix occidentalis caurina*), Lost River sucker (*Deltistes luxatus*) and the shortnose sucker (*Chasmistes brevirostris*). Also present is the federally listed coho salmon, under the jurisdiction of the National Marine Fisheries Service (NOAA Fisheries).

The Department has trust responsibilities on behalf of Indian tribes and individuals when Indian trust and treaty resources are involved, as they are in this re-licensing. A unique relationship exists between the Federal government and Indian tribes. The Department acts to ensure the proper discharge of Federal trust responsibilities to Indian tribes, a responsibility shared by all Federal agencies including the Commission. With respect to interests potentially affected by the FERC-licensed Klamath Hydroelectric Project, six federally-recognized tribes reside in the Klamath Basin in the geographic area affected by Project operations (Tribes): the Klamath Tribes of Oregon, the Hoopa Valley Tribe, the Yurok Tribe, the Karuk Tribe of California, the Quartz Valley Indian Community, and the Resighini Rancheria of California. The Klamath Tribes have treaty-protected fishing, hunting, trapping, and gathering rights, and the Hoopa Valley and Yurok Tribes have federally reserved fishing rights in the Klamath Basin recognized by various court decisions and Department memoranda.[39] The Tribes' fishing rights entitle them to harvest for subsistence, ceremonial, and commercial purposes.

In addition, three reaches of the Klamath River will be assessed relative to the Project's impact on the designated or eligible Wild and Scenic River (WSR) reaches, within or directly below the Project: Oregon's Hell's Corner Reach (JC Boyle PH to Stateline) – designated in 1994, and State Line to Copco –determined by BLM to be eligible as a WSR; and California below Iron Gate to the Pacific Ocean – designated in 1981. Prior to the development of the Draft Environmental Impact Statement (DEIS), BLM will conduct a Preliminary WSR Act, Section 7 Assessment for Oregon reaches, and the USDA Forest Service and NPS will conduct the assessment for the California reach below Iron Gate.

2. The Klamath River Relicensing and the Restoration and Recovery of the Klamath Basin

The Department has made working towards long-term solutions in the basin a priority, and committed significant resources to that effort. FERC's re-licensing process should ensure that licensing decisions are consistent with the comprehensive goals of on-going basinwide programs, such as those described below.

[39] *See* Treaty with the Klamath, October 14, 1864, art. 1, 16 Stat. 707; *see also* Memorandum from Solicitor to the Secretary of the Interior, Fishing Rights of the Yurok and Hoopa Valley Tribes, M-36979 (Oct. 4, 1993) (Solicitor's Opinion).

The Klamath River Basin Federal Working Group (Working Group) was created March 1, 2002 to advise the President on immediate steps and long-term solutions to enhance water quality and quantity and to address other complex issues in the Klamath River Basin. At the request of the Secretaries of the Interior and Commerce, the National Academy of Sciences' National Research Council (NRC) issued a final report in October 2003 that identified potential actions for the recovery of the coho salmon and the Lost River and shortnose suckers.[40]

A Long Range Plan for the Klamath River Basin Conservation Area Fishery Restoration Program (LRP) and Environmental Impact Statement (EIS) for the lower river was completed by the Klamath River Basin Fisheries Task Force in 1991. The LRP generally directs that fishery restoration is to be achieved through fish habitat protection and restoration, from a total watershed perspective, not simply an instream perspective. The LRP was accepted by FERC as a "comprehensive plan" under the Federal Power Act on January 15, 2004. The Task Force has stated that it hopes that the relicensing of the Klamath Hydroelectric Project will "result in the successful restoration of anadromous salmonids to their historic range as well as improvements to habitat of the Klamath River below the Project."[41]

The Fish and Wildlife Service has active programs in the basin for the protection and restoration of the aquatic habitat upon which endangered fish, tribal treaty and federally reserved fishing rights fisheries, and commercial and sports fisheries depend for spawning, growth and survival. President Bush's proposed budget for Fiscal Year 2005 calls for investing more than $100 million government-wide in habitat restoration and water management and improvement projects and programs for the Klamath River Basin, providing an unprecedented level of commitment to help Klamath communities restore their watershed and avoid future water supply crises.

During Reclamation's consultation with NOAA Fisheries and FWS under the ESA it has generally been recognized that a number of ongoing developments in the Basin have contributed to the decline of the fishery. The subsequent reduction in flows, from irrigation project and non-irrigation project depletions, and deteriorating water quality were key factors in the consultation process. Reclamation currently operates the irrigation project under flow restrictions established by two Biological Opinions issued under the ESA. These opinions require Reclamation to release water in a way that maintains minimum levels in the Upper Klamath Lake reservoir and at rates that assure certain flows in the Klamath River downstream of Iron Gate Dam. Reclamation has a contractual business relationship with PacifiCorp in the operation of the Klamath Hydropower Project and the Klamath Irrigation Project. That arrangement is the product of the relationships between the two projects, including Link River Dam, and their dependence on each other. Reclamation is evaluating the potential ramifications of recent studies and ongoing research and will likely request reinitiation of formal consultation on operation of the Klamath Irrigation Project. When considered in light of the change in Project boundary for the Klamath Hydroelectric Project and other features of the hydropower Project as described in the FLA, it appears to be advantageous for Reclamation and FERC to coordinate their separate ESA consultation responsibilities in a manner that assures each agency's actions and responsibilities under the ESA are met.

The Bureau of Reclamation is proposing to establish a basin-wide multi-organizational program known as the Klamath Basin Conservation Implementation Program (CIP). The aim of the CIP is to recover several threatened and endangered fish including the ESA-listed sucker and coho salmon, largely through restoring the Klamath River ecosystem, while allowing continued human uses of water and furthering the trust responsibilities of the United States to the Klamath Basin Tribes.

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[40] National Research Council. 2003. Endangered and Threatened Fishes in the Klamath River Basin: Causes of Decline and Strategies for Recovery. 334 pages.
[41] Letter from John Engbring, Chairman, Klamath River Basin Fisheries Task Force to Todd Olsen, Project Manager, PacifiCorp, March 21, 2001, Page 1.

There is a great deal of Federal activity focused on restoration and recovery in the Klamath basin. FERC's re-licensing process should ensure that licensing decisions are consistent with the comprehensive goals of these programs. Considerable coordination will be required to ensure that the re-licensed Project can contribute to long-term basin-wide solutions. The Department envisions FERC and PacifiCorp coordinating through programs such as the CIP.

3. Next Steps

The completion of adequate studies and analyses by PacifiCorp is critical to understanding the effects of Project facilities and operations on resources of concern, developing a full range of Project alternatives, and exploring all options for improving management of fish and wildlife resources in the Klamath River watershed so that Interior can carry out its trust, contractual, and statutory responsibilities. The Department hopes that a supplement to the FLA, or studies conducted at the Commission's request will remedy the lack of adequate, Project-specific, information.

The Department continues to advocate for an interactive, interdisciplinary approach to the relicensing process with participation and cooperation of interested parties as the best strategy to assure success and meet multiple objectives. We are encouraged that agreements have been made to continue discussions and technical collaboration. The Applicant also expressed interest in developing a settlement agreement as part of the proceedings which would contain any agreed upon PM&Es for the Project. Settlement is one method that can be used to address issues as diverse and complex as those in this proceeding.

Interior encourages PacifiCorp to continue to work collaboratively with Federal, State, and Tribal governments and other stakeholders. The Department appreciates the opportunity to provide comments on the FLA, and hopes that PacifiCorp will use them to address the significant shortcomings exhibited in its FLA.

If you have any questions or concerns regarding our comments, please contact me at 202-208-5978, or contact:

David Diamond, Department of the Interior, 202-219-1136
Tom Dang, Bureau of Indian Affairs, 916-978-6164
Barbara Machado, Bureau of Land Management, 541-947-6184
Phillip Graf, Bureau of Reclamation, 541-883-6935
John Hamilton, U.S. Fish and Wildlife Service, 530-842-5763
Susan Roseborough, National Park Service, 206-220-4121

Sincerely,

William D. Bettenberg
Director, Office of Policy Analysis
U.S. Department of the Interior

3 Attachments

ATTACHMENT 1: Specific Comments of the Department of the Interior on the Final License Application

This section is of critical importance since so much of the material in the FLA did not appear in the DLA, including the proposed project, descriptions of project impacts, measures for protection, mitigation, and enhancement, and significant study results.

TABLE OF CONTENTS

Part 1: Comments on the Final License Application 2
- Initial Statement 2
- Executive Summary 2
- Exhibit A: Project Description 4
- Exhibit B: Project Operation and Resource Utilization 4
- Exhibit C: Construction History and Proposed Construction 4
- Exhibit D: Statement of Costs and Financing 5
- Exhibit F: Design Drawings 11
- Exhibit G: Maps 11
- Exhibit H: Plans and Ability of Applicant to Operate Project 12

Part 2: Comments on Exhibit E: Environmental Report 14
- E1.0 INTRODUCTION 14
- E2.0 GENERAL DESCRIPTION OF THE ENVIRONMENT 14
- E3.0 WATER USE AND QUALITY 14
  - Hydrology 14
  - Water Quality 20
  - Geomorphology 29
- E4.0 FISH RESOURCES 35
  - Klamath River Fisheries and Fish Habitat 36
  - Ramping, Peaking, and Instream Flow 42
  - Fish Passage 49
- E5.0 BOTANICAL AND WILDLIFE RESOURCES 68
  - Wildlife Habitat 68
  - Noxious Weeds 74
  - TES and Culturally Sensitive Plants 78
  - Riparian/Wetland Habitat 81
- E6.0 CULTURAL RESOURCES 92
- E7.0 RECREATION RESOURCES 102
- E8.0 LAND MANAGEMENT AND AESTHETICS 110
- E9.0 SOCIOECONOMIC RESOURCES 117

Part 1: Comments on the Final License Application

Initial Statement

IS 1. Applicant and Request Term of New License
In the Initial Statement of its draft license application, PacifiCorp indicated that its application would be for a 50-year license for the existing Project. The Department notes that no specific license term is requested in the FLA. Given that there are no significant new investments proposed in this draft license application, and that it is the Commission's general policy to establish 30-year terms for projects with little or no redevelopment, new construction, or extensive environmental mitigative and enhancement measures, it appears that a thirty year license term is appropriate.

IS 9. Proposed New Project Facilities
Operation of the Spring Creek diversion and possible impacts to the Jenny Creek fishery are not discussed in the FLA. Fisheries resources are of concern in Jenny Creek and any reduction in flows to Jenny Creek as a consequence of the Spring Creek diversion could result in corresponding water quality degradation that could adversely affect fish and other aquatic species. PacifiCorp should complete an instream flow assessment of both Spring and Jenny creeks to assess the effects of removing water from Spring Creek on all the flow dependant resources including water quality, fisheries, macroinvertebrates and riparian habitat. The BLM manages resources that may be affected by decisions regarding operation of the Spring Creek diversion and requires this information to ensure that management objectives for the Cascade-Siskiyou National Monument will be attained.

Executive Summary

ES2.0 Consultation Effort
On page 2-1 PacifiCorp states that time was allowed for stakeholders to provide comments on Project impacts, studies, and PacifiCorp's proposed measures. Many of these items were not included in the Draft License Application (DLA) and were only presented to stakeholders as handouts before the Joint Agency Meeting. The review period was informal, short and overlapped with the DLA comment period. It is unrealistic to expect that a thorough review could be completed and meaningful comments developed, given the timeframe in which stakeholder input was requested.

On page 2-3 PacifiCorp proposed a traditional plus process, including technical work groups that would support development of a "high level" analysis which PacifiCorp committed to developing. This evolved into the Klamath Collaborative group.

In response to PacifiCorp's First Stage Consultation Document (FSCD) and DLA there were many issues identified including the three stated on page 2-3.

Section ES7.2. Summary of All Information
This section indicates that non-recreation squatters and cattle grazing affect the recreation sites. Both of these issues can be alleviated by a management presence in the project area. NPS supports the PacifiCorp's plan to develop a law enforcement plan. A management presence is needed on the river reaches as well as the reservoirs.

This section is lacking a statement that concludes that the existence of the project has induced recreation both in the river reaches and the reservoirs. Hell's Corner whitewater boating opportunities exist during the summer months because of PacifiCorp's peaking of this section of the river.

Section ES7.3 Assessment of Project Impacts
Under the J.C. Boyle Bypass reach section, a statement is needed that states the project has severely impacted whitewater boating opportunities. This reach provides a high quality whitewater boating opportunity that has essentially been eliminated because of the project operations. Occasional spill that is at a boatable flow does occur, but it is infrequent and information is not provided to potential users on the availability or amount of spill. In addition, the acceptable and optimal flows for this reach, based on the flow analysis study, should be added to this section.

ES8.3 Assessment of Project Impacts
ES2.2 (Page 8-4): Project facilities and operations are characterized on page 8-4 as being consistent with agency resource management plans. BLM believes that although the Resource Management Plans for the Klamath Falls Resource Area, Redding Field Office, and the Ashland Resource Area were developed with the understanding that PacifiCorp's hydroelectric Project already existed, this does not mean that the facilities and operational impacts are consistent with the goals, objectives, and direction of those plans. BLM management direction is to "maintain and restore" aquatic/riparian ecosystems and water quality (as described in the Northwest Forest Plan ACS), "protect and enhance" outstandingly remarkable values (ORVs) designated for the Upper Klamath Wild and Scenic River (provided for in the Wild and Scenic Rivers Act), and rehabilitate existing projects (BLM Manual 8400—Visual Resource Management).

Exhibit A: Project Description

Modifications have been implemented and are proposed to be implemented to prevent recurring overflow of the J.C. Boyle canal. The description of the overflow spillway fails to mention the approximately 200-foot elevation difference between the end of the concrete-lined chute and the river. Overflows that surge onto steep, unprotected slopes have created and continue to enlarge a substantial erosional feature that has to be evaluated for protection and rehabilitation. While the modifications to the J.C. Boyle Dam may not be determined through the relicensing process, the Dam and spillway are features of the Project and must be included in the FLA.

Section A8.2.2 refers to a reservoir in conjunction with the Spring Creek diversion, however, Table A2.1-1 shows no reservoir associated with the Spring Creek diversion.

Exhibit B: Project Operation and Resource Utilization

The FLA describes the Project as providing flood control and should include a more complete description of water type years when flooding occurs, the areas that are managed to reduce flooding, and how much flood storage is provided by the Project.

Section B4.2.1, second paragraph, states that a "diversion structure at Spring Creek has existed since at least the 1950s to divert flow into Fall Creek…" The Initial Statement, page 7, shows a 1902 priority date for Spring Creek under claim no. 218 and on page 12, section 9 the document states the diversion dam was constructed in 1902.

Exhibit C: Construction History and Proposed Construction

The possible changes in the operation of Keno facilities should be presented as a change from current Project operations and the proposed Project. Also, the Spring Creek out-of-basin transfer needs an effects analysis if PacifiCorp is granted their claim (Number 218) and should be included as a term of the new license.

Section C7.1.2, page C 7-2, mentions that PacifiCorp has recently submitted a water rights claim for 3.865 cfs from five unnamed springs which flow directly into the Spring Creek diversion canal. If not captured by the diversion canal, these springs would flow into Spring Creek. The diversion of these cold water springs, which occurs on BLM-administered land within the Monument, has a detrimental impact on aquatic resources in Spring and Jenny creeks. These springs would make a valuable contribution to reducing stream temperatures in Jenny Creek, which is a water quality limited stream.

Exhibit D: Statement of Costs and Financing

D2.0 Capital and O&M Costs of Proposed PM&Es
In Table D2.0-1 PacifiCorp needs to explain why this summary of capital and O&M costs of non-power resource enhancements differs from the corresponding summary in Exhibit E, tables E9-21 and E9-22.

The Department also notes that fish passage is not included in the costs summarized here (except for the Boyle gulper). In the Fish Resources Technical Report the net present worth of the costs of conventional screens and ladders over the 30 year term is reported to be $190 million ($215 million including Keno), while PacifiCorp's estimate for a combination of experimental technology and trap and haul within the project area is $56 million (or $70 million including Keno). In its comments on the DLA, California Fish and Game suggested that the capital cost of fish passage reported by PacifiCorp may be too high. For the present purposes, we note that fish passage, which we believe to be a central issue in this licensing proceeding, are significant when compared to the non-power enhancement package proposed by the applicant in the FLA.

Table D2.0-3 shows the estimated annual increase or decrease in generation by existing Project development under proposed Project modifications and operations. The decreases at East Side and West Side are well documented in the proposed modification in Exhibit A. The changes in generation at the remaining project facilities lack documentation. Table H3.4-1 in Exhibit H shows a schedule for generation maintenance – do the generation numbers shown here assume the runner and turbine replacements and generator overhauls listed in Exhibit H?

D4.0 Annual Costs of the Project
The following is a reproduction of Table D4.0-1 from the FLA. The Department has a number of comments on this table, and has identified them by letter in the table.

Table D4.0-1. Estimated annual cost of future Project operations for a 30-year license period that starts in calendar year 2006.

Description (in thousands)	**Levelized Annual Cost (in thousands)**	**Department of the Interior questions**
CONTINUING OPERATIONS		
Sunk Costs		
Net Investment of $41,828		A.
Fixed Cost [1]	$3,991	B.
Capital		
Planned Investment of $151,797[2]		C.
Fixed Cost [1]	$7,862	B.
O&M		
Operations and Maintenance	$5,689	D.
Subtotal	**$17,542**	
IMPLEMENTATION COSTS		
Capital		
Planned Investment of $49,926[3]		E.
Fixed Cost [1]	$3,344	B.
O&M		
Operations and Maintenance of $55,734[3]	$1,259	F.
Lost Generation[4]	$1,181	G.
Subtotal	**$5,784**	
TOTAL	**$23,326**	H.

1 Assuming calendar year 2003 as the start year for this analysis, with 3.0 percent inflation, 33-year model period, and 7.5 percent discount rate. Includes components for cost of capital, book depreciation, property taxes, deferred taxes, and income taxes.
2 Planned investment in nominal capital dollars over 33 years (includes relicensing process costs and operations capital).
3 See Table D2.0-1 for details.
4 See Table D2.0-3 for details.

Department of the Interior questions regarding Table D4.0-1:

A. There is no documentation of the $42 million reported as "net investment' in this table. In section D3.2 PacifiCorp needs to clarify the definition of undepreciated net investment. PacifiCorp should either report the gross investment in plant and equipment or the net investment which is gross investment in plant and equipment less the net of accumulated depreciation. These values ought to be reconciled with what is reported to FERC annually in the Form 1 filing.

Also, the Department questions whether these "sunk costs" are relevant to the Commission's analysis in this relicensing. These costs have already been incurred by PacifiCorp and cannot be changed by the outcome of the relicensing. The relevant question in the relicensing is what are the future costs that would be incurred if the proposed project is relicensed.

B. The model period for this calculation should not be 33 years, but should be 30 years beginning in 2006 when the new license is scheduled to be issued. Financing costs of 7.5% may be appropriate if this represents PacifiCorp's private cost of capital, thought we find this to be high in current capital markets. The levelized annual cost analysis should be conducted with a discount rate of 2 and 7 percent, consistent with the presentation in Exhibit E, Tables E9-21 and E9-22. PacifiCorp should document all of the assumptions underlying these calculations, including the tax rate.

C. PacifiCorp reports $151.8 million in planned capital investment for continuing operations. It appears that this number is based on some combination of actions such as runner replacements and generator rewinds, discussed in Exhibit A and tentatively scheduled in Table H3.4-1 of Exhibit H.

PacifiCorp needs to clearly identify the planned capital investments and their timing over the course of the new license, and future capital costs should be evaluated based on the year they are expected to be incurred. PacifiCorp should provide detail on assumed relicensing process costs.

D. PacifiCorp reports $5.7 million in operations and maintenance in levelized annual cost. Theses costs do not seem to be detailed or further explained in the FLA. PacifiCorp should provide the line item detail for these cost assumptions.

E. This number is the capital cost of non-power enhancements such as the proposed surface collector at J.C. Boyle, reported in Exhibit D2.0-1. PacifiCorp needs to explain why this sum differs from the corresponding summary in Exhibit E, Tables E9-21.

F. This number is the O&M cost of non-power enhancements reported in Exhibit D2.0-1. PacifiCorp needs to explain why this sum differs from the corresponding summary in Exhibit E, Tables E9-22.

G. PacifiCorp reports $1.2 million in levelized annual costs due to lost generation. PacifiCorp needs to make clear the assumptions underlying this calculation. It appears that a price of $50.86/MWh is used ($1,181,000 per year divided by 23,516MWH per year equals $50.86/MWh). This value is closer to the value used to value lost generation from operating fish passage facilities in the Fish Resources Technical report ($50/MWh) than it is to the values used elsewhere in Exhibit D. In addition, more support is necessary for the quantity of generation expected to be lost at each facility.

H. PacifiCorp should provide a statement of the estimated average annual cost of the total project as proposed in Exhibit D of the license application, including a cost breakdown of (i) the cost of capital; (ii) local, state, and federal taxes; and (iii) depreciation or amortization as required by Section 4.51 (e)(4) of the Commission's regulations.

D5.0 Estimated Annual Value of Power

PacifiCorp reports that "The average value of on-peak generation, assuming a 30-year average value of COB and Mid-Columbia values ($74 per MWh) and a future on-peak generation of 447,209 MWh (proposed Project), is $32.9 million per year. The average value of off-peak generation, assuming a 30-year average value of COB and Mid-Columbia values ($62 per MWh) and a future off-peak generation of 249,834 MWh (proposed Project), is $15.6 million per year." The resulting estimate of the annual value of power is $48.5 million per year.

PacifiCorp's estimate of replacement power is dramatically overstated when compared to:

- Five-year firm power available from Bonneville Power Administration (BPA);
- FERC determinations in other relicensings in the region;
- PacifiCorp's determination of avoided costs filed with the Oregon Public Utility Commission (OPUC);
- California Energy Commission's Preliminary Assessment; and
- PaciCorp's estimation of avoided costs in its Fish Resources Technical Report.

The table below shows how PacifiCorp's representations to FERC compare with the referenced benchmarks.

Source	Peak ($/mWh)	Off-Peak ($/mWh)
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PacifiCorp: Fish Resources Technical Report[1]	50	50
California Energy Commission: Preliminary Assessment[2]	42	42
PacifiCorp: Oregon Avoided Cost Filing, November 2003[3]	29	25
FERC FEIS: C.J. Strike Project [4]	26	20
BPA: PF-02 & RL-02 – HHL and LHL[5]	24	16

PacifiCorp prepared its estimate of $74/mWh (peak) and $62/mWh (off-peak) for this FERC filing based on an average of spot prices that included unprecedented values as high as $1,000 per MW reached during the California electric supply crisis – prices for which companies and individuals are currently under indictment. They are clearly not prices that one could reasonably assume could reoccur, and therefore cannot be reasonably considered to be part of a basis for estimating replacement power values. Moreover, following the Mead decision, FERC's analyses are to be "based on current economic conditions, without accounting for potential future inflation or escalation of prices."[6] Therefore it may be more relevant to use current or recent values.

PacifiCorp's estimate stands in sharp contrast to the BPA 5-year firm power prices being offered in March of 2004 that are actual market prices and are less than one-third of the estimate PacifiCorp asks the Commission to accept. PacifiCorp's estimate also differs, by about the same magnitude, from the estimates the Commission found reasonable in its Final Environmental Impact Statement for Idaho Power's C.J. Strike Project.

PacifiCorp's estimate in Exhibit D also stands in sharp contrast to its own estimate of $29/MWh (peak) and $25/MWh (off-peak) filed in November, 2003 with the Oregon Public Utilities Commission (OPUC) and scheduled for review by OPUC later this summer. PacifiCorp's OPUC filing was for the purpose of showing its avoided cost and therefore what it would pay a qualifying co-generator or small power producer for power. PacifiCorp's own statement of what it would pay for power is a more reliable estimate of the cost of alternative power than PacifiCorp's speculation about the future.

The California Energy Commission's (CEC) preliminary assessment of the combined cost of foregone hydroelectricity production was $26.8 million per year. The CEC assessment assumed 656,000 mWh of generation each year, and used a uniform price of $50/mWh for peak and off-

[1] See for example FLA Fish Technical Report, Table 7.8-9. PacifiCorp uses a uniform $50/MWh in calculating the energy cost of lost generation in its engineering cost estimates of fish passage.
[2] California Energy Commission Staff Paper, "Preliminary Assessment of Energy Issues Associated with the Klamath Hydroelectric Project," May 2003
[3] Advice No. 03-016, filed with the Oregon Public Utility Commission on November 10, 2003, http://www.pacificorp.com/Regulatory_Testimony/Regulatory_Testimony32787.pdf.
[4] Federal Energy Regulatory Commission, Office of Energy Projects, Final Environmental Impact Statement – C.J. Strike Project – Idaho, FERC Project No. 2055, FERC/FEIS – 0146F, October 2002, page 205. The numbers shown in the above table are the mean of the values in the FERC report.
[5] Bonneville Power Administration, October 2003 - March 2004 Adjusted Power Rates Corrected. Table 1.
[6] *Workshop on Evaluating the Economics of Hydroelectric Projects at FERC*, Office of Hydropower Licensing, February 3, 1998

peak power, offset by savings of $8/mWh in O&M. The CEC correctly cautions that these estimates have a high degree of uncertainty. Base load energy is likely to be significantly cheaper, while peaking energy is likely to be more expensive.

1. Total Generation

PacifiCorp reports that the average future generation of the proposed project is 697,043 MWh. This seems to be overstated, given that the average generation for the existing project over the past 13 years is 636,707 MWh (See table below). Since the proposed project plans to decommission East Side and West Side, it is also relevant to note that the average generation minus production at those two facilities is 619,474 MWh. The past thirteen water years cover a wide range of representative water-year types, and include the development of a river management scheme for the Klamath irrigation project and biological opinion flows.

Total Generation by Facility, 1990-2002 (MWh)

YEAR	WEST SIDE	EAST SIDE	JOHN BOYLE	COPCO NO1	COPCO NO2	FALL CREEK	IRON GATE	TOTAL
1990	3,499	16,753	238,417	83,993	109,509	11,090	110,820	574,081
1991	1,765	10,374	98,261	43,782	57,628	11,945	60,636	284,391
1992	124	12,143	68,960	35,256	46,805	11,248	44,911	219,447
1993	3,252	17,208	295,918	99,705	126,169	12,101	111,186	665,539
1994	1,353	12,047	105,953	46,777	61,014	11,169	60,153	298,466
1995	3,292	15,185	286,613	95,226	121,405	11,768	113,571	647,060
1996	3,709	19,912	445,353	120,853	172,572	11,756	139,652	913,807
1997	2,755	18,348	386,266	106,750	136,486	10,703	130,512	791,820
1998	4,380	14,900	490,936	152,191	179,180	11,207	142,847	995,641
1999	4,741	12,364	467,862	143,012	171,882	10,990	133,906	944,757
2000	3,475	14,211	368,405	118,990	134,456	11,584	122,465	773,586
2001	2,854	11,612	234,066	85,241	223,656	10,296	112,396	680,121
2002	2,930	10,844	192,201	76,822	98,112	11,628	95,941	488,478
Average1990-2002	2,933	14,300	283,016	92,969	126,067	11,345	106,077	**636,707**

Source: Form EIA-906, "Power Plant Report, " Energy Information Administration, http://www.eia.doe.gov/cneaf/electricity/page/eia906u.html

2. Peak versus off-peak generation

Of the total generation 697,043 MWh, PacifiCorp reports a future on-peak generation of 447,209 MWh and a future off-peak generation of 249,834 MWh.

PacifiCorp needs to provide a definition of "on-peak." Hourly generation data for each facility should be provided for recent years in electronic format.

3. Marginal Opportunity Cost of power

PacifiCorp reports that $74/MWh on peak and $62/MWh is a 30-year average of California-Oregon-Border (COB) and Mid-Columbia values. It is not clear how these values were determined.

In any event, the value calculated for the annual value of power is extremely sensitive to the assumed marginal opportunity cost of power. The following three exhibits show the range in the final result given three different input assumptions used by PacifiCorp. Exhibit D1 uses the assumption from Exhibit D, and calculates a $49 million annual power value. Exhibit D2 uses the assumption employed in the Fish Resources Technical Report to calculate the opportunity costs of generation losses due to fish passage engineering changes, and calculates a value of $35

million, a 28% decrease from the Exhibit D estimate. Exhibit D3 uses the price values for 2004 reported by PacifiCorp to the Oregon Public Utilities Commission.[7] In light of the Mead decision, the Department finds this value to be the most supportable. Using this value, the annual value of power is $19 million, a 61% decrease from the Exhibit D estimate. It should also be noted that each of these three numbers may be too high, because in calculating them we have used the generation numbers reported by PacifiCorp, numbers which we questioned above.

Exhibit D1

	Generation (MWh), Exhibit D 5-1	PacifiCorp Estimate, Exhibit D 5-1 ($/MWh)	Annual Value of Power ($)
Peak	447,209	74	33,093,466
Off-Peak	249,834	62	15,489,708
Total	697,043		**48,583,174**

Exhibit D2

	Generation (MWh), Exhibit D 5-1	PacifiCorp Avoided Cost Estimate, Fish Resources Technical Report ($/MWh)	Annual Value of Power ($)
Peak	447,209	50	22,360,450
Off-Peak	249,834	50	12,491,700
Total	697,043		**34,852,150**

Exhibit D3

	Generation (MWh), Exhibit D 5-1	PacifiCorp Avoided Cost, 2004, as reported to the Oregon PUC ($/MWh)	Annual Value of Power ($)
Peak	447,209	28.74	12,852,787
Off-Peak	249,834	24.6	6,145,916
Total	697,043		**18,998,703**

D6.0 Alternative Power Sources

In section D6.0 of the FLA, PacifiCorp estimates project replacement costs using different alternative power sources. It is not clear to the Department that replacement energy specific to the project would be necessary were a new license not granted. PacifiCorp reports on Exhibit H, p. 2-1 that over the next 10 years they expect to add 4,100 MW of new capacity to their system. This capacity will either be built, secured by contract, purchased in short-term markets, or offset by demand-side management and energy-efficiency programs. In our comments on the Draft License Application, the Department noted that replacing about 150 MW from this project may fall within the planned reserve margins, and therefore the replacement cost would just be the O&M costs of production at the new capacity that PacifiCorp will be obtaining in any event over the next ten years.

As discussed above, the Department supports the use of market prices in the evaluation of the economic value of hydropower projects. Nevetheless, since FERC also accepts the cost of the most likely thermal alternative for evaluation purposes, the Department must point out a few

[7] Advice No. 03-016, filed with the Oregon Public Utility Commission on November 10, 2003, http://www.pacificorp.com/Regulatory_Testimony/Regulatory_Testimony32787.pdf.

issues with the calculations in this section. PacifCorp makes a number of assumptions that could significantly overstate alternative power costs.

The replacement cost estimate is based on a capacity cost and a generation cost. Table D6.0.1 reports the capital cost of alternative, supply-side resources, including natural gas and coal. These costs are derived from the January, 2003 Integrated Resources Plan (IRP), Appendix C, Table C.18. The capacity cost reported for natural gas in the FLA is $697/kw. Table C.18 of the IRP contains a list of potential natural gas, supply-side resources; these display a wide range of capacity costs, from $9/kw to $3,544/kw.[8] There is no indication in the FLA as to how PacifiCorp generates the number $647/kw from the individual projects listed in Appendix C, Table C.18. In any event, capacity values should be based on the cheapest, most reasonable capacity addition available, not a composite number based on PacifiCorp's resource plan.

It is more appropriate to consider the specifics of the project we are evaluating, and choose the most likely (and least cost) thermal alternative.[9] In this case this is likely to be either market purchase, natural gas, or coal. Some recent values used in FERC proceedings in the Northwest are $24/kw[10] (based on a market purchase) and $114/kw (based on the construction of a combined-cycle combustion turbine).[11]

D7.2 Impact of License Denial on the Local Environment
PacifiCorp states that if a license is denied, proposed enhancement measures would not be implemented, thereby resulting in potential resource impacts. The proposed enhancements are mitigation for Project effects, and would not be necessary but for Project operations.

Exhibit F: Design Drawings

The Department will use these design drawings in its review of the existing and proposed facilities.

Exhibit G: Maps

The Department has reviewed the proposed Project boundary maps and has expressed concerns with this section elsewhere in this response to the FLA. In summary, the Department maintains that the Project boundary should include the J.C. Boyle and Copco bypass reaches, areas used for project purposes, recreational facilities dependent on Project operations, and Keno Dam and its reservoir.

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[8] PacifiCorp's January 2003 Integrated Resources Plan (IRP), Appendix C, Table C.18.
[9] "To decide the most likely thermal alternative we consider the specifics of the project we are evaluating." *Workshop on Evaluating the Economics of Hydroelectric Projects at FERC*, Office of Hydropower Licensing, February 3, 1998
[10] Final Supplemental Environmental Impact Statement, Condit Hydroelectric Project 2342, 2002
[11] Final Environmental Impact Statement, C.J. Strike Project 2055, October 2002

Exhibit H: Plans and Ability of Applicant to Operate Project

H5.5 PacifiCorp's Safety Record
It is mentioned on page 5-8 that the Emergency Action Plan (EAP) drill is also performed annually. Since this is a coordination effort among various Federal, State, and local agencies, PacifiCorp should ensure the Tribes are invited to this exercise so they have an opportunity to provide input to this effort. The EAP exercise details site-specific information pertaining to emergency management roles, responsibilities, and procedures of PacifiCorp, authorities, and all affected parties in responding to an emergency affecting the dams. Thus, it is important that Tribes are informed and involved in this process. The Tribes readiness to response to an emergency affecting the dam(s) will help save lives, prevent loss of property, protect the environment, and reduce adverse cultural resource impact. This is of special concern for the Yurok Reservation, most of which lacks telephone and electricity service.

It would be helpful if PacifiCorp presented a section within the FLA to address the impact of dam(s) failure, and safety measures required by State and Federal Dam Safety Regulation. The project facilities (dams) have been inspected by FERC engineers annually, and FERC has requested PacifiCorp prepare EAP for the project in 1988, and the current EAP for the project was issued in December 1999. Some information in the latest EAP can be shared in the aforesaid section.

On March 16, 2004, the Bureau of Indian Affairs requested copies of inundation maps, down stream hazard classification, and an EAP for the Klamath Hydroelectric project. The requested was conducted via telephone with Mr. Todd Olson, Project Manager who informed us he would have the information sent on March 19, 2004.

H7.0 License Compliance Record
While PacifiCorp has included a record of non-compliance with the existing license on page 7-1, two other issues of non-compliance need to be illustrated. BLM has previously notified FERC and PacifiCorp about the large erosional feature resultant from overflows from the J.C. Boyle canal. Similarly, the US Fish and Wildlife Service (USFWS) and Oregon Department Fish and Wildlife (ODFW) have engaged PacifiCorp on their non-compliance with the existing license for fish passage facilities J.C. Boyle Dam.

Article 20 of the existing License for FERC Project # 2082 requires the licensee to repair or restore damage to public lands, insofar as practicable, and to prevent further damage to public lands from Project operations. Operation of the J.C. Boyle emergency overflow spillway has resulted in erosion of 70,000 to 80,000 cubic yards of material into the Klamath River and adjoining sideslope below the spillway outfall. This has caused adverse effects to recreation, visual resources, terrestrial habitat, fish passage, and water quality.

Although the FLA includes actions to protect BLM-administered lands in compliance with Article 20, these actions are presented in the FLA as "enhancements." In fact, these actions constitute compliance with the existing license and should be included among the costs of Project operation.

Similarly, Article 32 of the existing license considers modification of existing ladders or screens as compliance with the existing license and not enhancements included in the new license.

Finally, recent examination of half-hourly gage records for 1994, 1995 and 1999, with computation of stage changes over hourly increments, reveals that maximum daily ramp rates in excess of 12 inches per hour are common and that the FERC license maximum ramp rate are exceeded as much as 87 percent of the time (Huntington, 2004).[12] Huntington computed the maximum upward and downward stage changes for each day in the years examined and computed exceedance frequencies for several ramp rates. The maximum FERC license condition of 9"/hour (0.75 ft/hr) was equaled or exceeded 26 to 85 percent of the time for up-ramp events and 30 to 87 percent of the time for down-ramp events. Studies conducted to date by PC to determine stranding impacts due to ramping have examined only ramp rates less than 8.4"/hr (0.7ft/hr) which could not have detected stranding under the apparently common out-of-compliance operations.

[12] Huntington, C. 2004. Klamath R. flows within the JC Boyle bypass and below the JC Boyle Powerhouse. Technical Memorandum to Larry Dunsmoor, Klamath Tribes, April 15, 2004. 22 pp.

Part 2: Comments on Exhibit E: Environmental Report

E1.0 INTRODUCTION

Department comments on the relicensing process, consultation and collaboration, implementation of study plans, and recent changes in the proposed Project are provided in Part 1 of Attachment 1 and in resource-specific comments included in this Part 2 of Attachment 1.

E2.0 GENERAL DESCRIPTION OF THE ENVIRONMENT

This section provides a general description of natural resources in the Project vicinity. The use of generalities results in misleading descriptions of the relation between the Project and certain resources. For instance:

- flows in the J.C. Boyle bypass reach are described as "relatively stable" (page 2-5) when in fact they are held constant at 100 cfs the vast majority of the time;
- the characterization of J.C. Boyle operations during winter and spring suggests that the powerhouse generates continuously (i.e., without peaking) and water spills at the dam (page 2-6), when in fact spill from J.C. Boyle dam occurs only in average and wet years and for limited durations (on the order of one or two months, not entire seasons) and the dam is used primarily for peaking;
- the description of the Fall Creek facility does not mention the trans-basin diversion from the Jenny Creek watershed (page 2-7); and,
- the discussion of factors causing degradation of plant communities omits discussion of Project operations and ongoing inundation of riparian areas.

These inaccuracies are addressed in resource-specific comments included in the following sections of the Department's comments.

E3.0 WATER USE AND QUALITY

Hydrology

FLA Discussion of Existing Environment and Project Impacts

Existing Environment

As described in the FLA, total storage capacity of Project reservoirs amounts to 8% of the mean annual runoff above Iron Gate Dam (Exhibit E 3-5). Relatively small Project storage capacity limits the ability of PacifiCorp to control seasonal average daily flow patterns or peak flows in non-bypass river reaches (Exhibit E 3-2). The Project has a strong effect on hydrologic patterns in bypass reaches and in the J.C. Boyle peaking reach. Although PacifiCorp states that it "only has the ability to influence flows at daily or hourly time steps within its Project area" (Exhibit E 3-3), annual and seasonal flow regimes in Project bypass reaches are highly altered due to Project operations (Exhibit E 3-24 and 3-27). PacifiCorp further states that "seasonal flow patterns on the Klamath River generally reflect climatic conditions" (Exhibit E 3-5); a review of hydrologic data shows pervasive Project impacts on the magnitude of seasonal low and high flows in the J.C. Boyle peaking reach, as well as in Project bypass reaches.

No information is provided regarding the existing environment downstream from the Spring Creek diversion dam. Spring Creek is tributary to Jenny Creek, an important fish-bearing stream,

and is encompassed by a Northwest Forest Plan Tier 1 Key Watershed. Spring and Jenny Creeks are within the Cascade-Siskiyou National Monument and have resource values that are protected under the presidential proclamation of June 9, 2000.

Project Impacts

The FLA describes continuing Project impacts that include diversion of 2,850 cfs from the J.C. Boyle bypass reach, peaking operations at J.C. Boyle powerhouse, and diversion of 3,200 cfs from the Copco II bypass reach (Exhibit E 3-215).[13]

Adequacy of Applicant's Information

The FLA does not present a complete analysis in support of the statement that Keno Dam does not substantially benefit power generation. While this facility does indeed lack the capacity to generate power, its use for optimization of power production at other facilities or for flow regulation during maintenance events is not addressed.

The FLA discussion of ongoing impacts omits discussion of flow regulation by Iron Gate Dam and diversion of the majority of Spring Creek's flow out of the Jenny Creek watershed. These impacts must be considered during the development of PME measures.

Alternative Information and/or Interpretation

The FLA consistently attempts to portray Project impacts as minor in magnitude and limited in scope. Given the fact that the Project is centered around large-scale diversions and peaking operations, this portrayal is inaccurate. The hydrology of all river reaches between J.C. Boyle and Iron Gate Dams, as well as portions of Fall Creek and Spring Creek/Jenny Creek, will be strongly affected by the proposed operations.

J.C. Boyle Bypass Reach

Large volumes of water are continually diverted from the J.C. Boyle bypass reach, except during maintenance periods. Steady flows of 100 cfs from J.C. Boyle Dam into this reach are maintained year-round, and are only exceeded during spill events (which occur when river flows are greater than 2,950 cfs and J.C. Boyle Reservoir is full). The rate of diversion from the reach ranges from 300 to 2850 cfs (E 3-23). Thus, except during spill or maintenance periods, flows in the upstream portion of the bypass reach are reduced by 75 to 97% as a result of Project operations.

Due to accretions from groundwater, flows at the downstream end of the bypass reach during non-spill periods are on the order of 320 cfs. The groundwater inflows reduce the relative impact of the diversion: flows in the downstream end of the bypass reach are reduced by 48 to 90% as a result of Project operations.

The magnitude and frequency of peak flows in the bypass reach have been and will continue to be impacted by Project operations. The diversion of 2,850 cfs represents a large proportion of floods with short recurrence intervals. For instance, Project operations reduce the magnitude of 2-year

[13] Impacts of Keno operations are not included in the discussion of continuing impacts because PacifiCorp asserts that the Keno facility does not substantially benefit generation (E 3-1) and should therefore be removed from FERC jurisdiction.

and 5-year floods by more than 50% and 30%, respectively (Water Resources FTR 5-46). Stated another way, a flood on the order of 5,500 cfs currently occurs about every five years in the bypass reach; were it not for the diversion, floods of this magnitude would occur every two years (Water Resources FTR 5-46).

Project operations also reduce the duration of flood events in this reach. Modeled flow data for 2000 indicates that flows in the bypass reach were elevated above baseflow for about one month and never exceeded 2,000 cfs; were it not for Project operations, flows would have been above 3,000 cfs for approximately two months (Exhibit E 3-24). Cumulatively, the Project and Bureau of Reclamation's (USBR) Klamath Project allow manipulation of flows during the onset and recession of flood events. This is evident in water years 1999 and 2000 (Exhibit E 3-21 and 3-25). In the bypass reach, this manipulation results in rapid onset and recession of peak flows, with a very limited transition period between artificially low base flows and spill events.

J.C. Boyle Peaking Reach

Project operations exert strong control on seasonal and daily streamflow patterns in the J.C. Boyle peaking reach. Impacts far exceed the "typical" scenario described in the FLA (Exhibit E 3-4). During summer months the daily minimum river flows are reduced by approximately 40 to 60% (due to storage of inflowing water) and then increased to flow rates that are two to four times greater than would occur were it not for the Project.[14] Further, USGS gage data indicates that the up- and down-ramping implicit in the peaking operations frequently occurs at rates in excess of those prescribed in the existing license.

Operational control of daily flow patterns is maintained throughout most of each year; run-of-river operations occur only during limited periods of spill in late winter and spring. Data presented in the Water Resources FTR (5-37) regarding the length of annual spill periods at J.C. Boyle Dam indicate that run-of-river operations with duration greater than three months occur only in wet and above average water years, and that during below average and dry years spill periods are either very short or absent. Department analysis of USGS flow records downstream from J.C Boyle powerhouse indicates that flows exceeded Project operational control in 35 out of 45 (77%) of the water years between 1959 and 2003. The average duration of flows in excess of operational control between water years 1993 and 2003 was only 48 days (estimated from hydrographs derived from 30-minute streamflow data).

Peaking operations confound seasonal patterns of high and low flows. Flows on the order of 320 cfs can occur during any month of the year, as can flows in excess of 2,800 cfs. Were it not for the Project, flows would peak in late winter or spring and recede to summer baseflows of approximately 600 to 800 cfs (Exhibit E 3-25). The low flow analysis suggesting that flows less than 400 cfs occur only for limited duration or only at infrequent intervals is misleading (Water Resources FTR 5-47). Hourly flow data clearly indicates that flows on the order of 320 cfs occur on a daily basis throughout the summer months (Exhibit E 3-25).

As discussed above with regards to the bypass reach, upstream reservoir storage affords PacifiCorp the ability to shape the onset and recession of peak flows. In the J.C. Boyle peaking reach, this results in quasi-steady flows of approximately 3,100 cfs over varying lengths of time prior and subsequent to flood peaks (Exhibit E 3-21 and 3-25). When average daily flows are less than 2,950 cfs, peaking operations result in flow fluctuations that further alter the overall shape of the flood hydrograph.

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[14] These values are derived from a review of USGS streamflow data from August 1996 and July 2000.

PacifiCorp does not provide a detailed quantitative description of how proposed operations would affect flow regimes in the J.C. Boyle peaking reach. Without this information it is difficult to gain a thorough understanding of continuing Project impacts on hydrology or associated flow-dependent resources.

Copco II Bypass Reach

Of all river reaches affected by the Project, it is this reach that is most strongly affected. The Project's ability to divert up to 3,200 cfs, combined with minimum flows on the order of 10 cfs, results in almost complete de-watering of this reach. Except during spill events, between 98 and 99.5% of the flow into this reach is diverted.

Downstream from Iron Gate Dam

In general, PacifiCorp asserts that the Project does not affect runoff patterns downstream from Iron Gate Dam. PacifiCorp does, however, present data that indicates slightly increased summer flows as a result of Project operations (Water Resources FTR 5-77). This analysis relies on a comparison of measured data with modeled (assumed) flow accretions (Water Resources FTR 5-6); the magnitude of the implied flow increase is very minor and is likely due to errors in measurement and/or modeling (the average calculated increase in flows is on the order of 35 cfs in June, 12 cfs in July, and 5 cfs in August).

PacifiCorp also presents an analysis that depicts cumulative impacts of the hydroelectric Project and the USBR Klamath Project and suggests summer flows have increased due to their operations (Water Resources FTR 5-76). Although this in direct contradiction to the findings of other researchers presented in the literature review (Water Resources FTR 5-17 to 5-19), no attempt is made to rectify these findings.

PacifiCorp defers to USBR the responsibility for flows downstream from Iron Gate Dam (E 3-3). Given constraints imposed by USBR's obligations under the ESA and by PacifiCorp-USBR operational agreements, such deference may be appropriate for the time being. It is reasonable to expect, however, that these constraints may be relaxed or otherwise altered during the term of the proposed new license. As such, PacifiCorp should contemplate instream flow regimes that would be implemented in the absence of USBR linkages and should propose minimum flows for incorporation in the proposed Project. Indeed, since the FLA describes ramp rates that would be implemented in the absence of ESA obligations (Exhibit E 3-197), it is logical that PacifiCorp should also describe proposed flow regimes.

Fall Creek/Spring Creek/Jenny Creek

The discussion of hydrologic conditions and Project impacts in Fall Creek is unclear. More importantly, discussion of conditions and impacts in the Spring Creek/Jenny Creek system is completely omitted from both the FTR and Exhibit E. Given the potential detrimental impacts associated with this component of the proposed Project a study, interpretation and documentation of the impacts to Fall, Jenny and Spring creeks is needed.

Summer flows in Jenny Creek downstream from Spring Creek commonly approach 10 cfs in the summer (Figure 1-1). Minimum flows measured by the BLM in 1991, 1992, 1993, and 2003

were 12 cfs, 10 cfs, 14 cfs, and 10 cfs, respectively. Were it not for PacifiCorp's diversion from Spring Creek, summer flows in Jenny Creek would be higher.

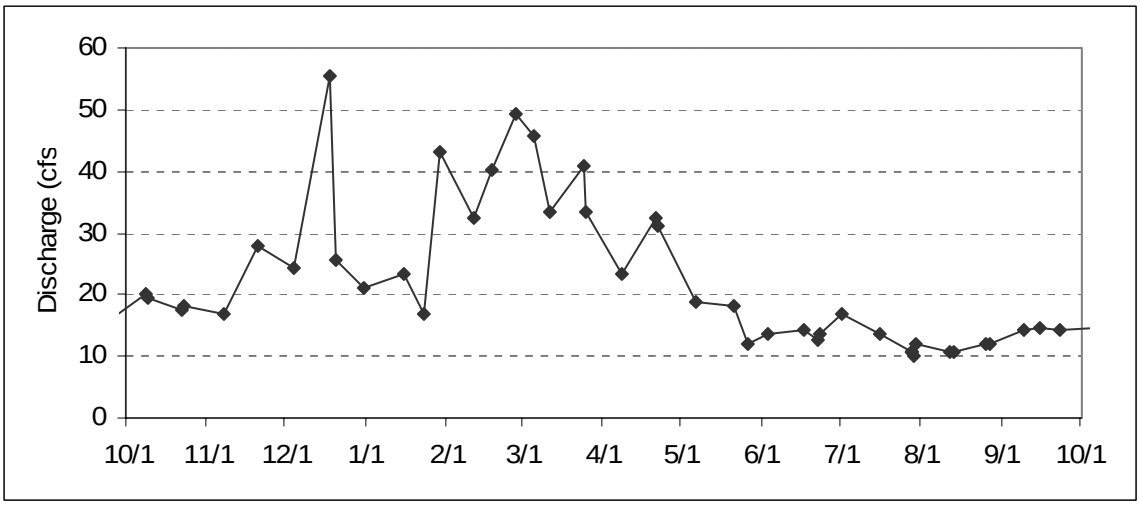

Figure 1-1. Measured streamflow for Jenny Creek downstream of the Spring Creek confluence during water year 1992 (BLM Data).

Department Conclusions Regarding Existing Environment, Project Impacts, and PM&Es

Existing Environment

Hydrologic conditions in the Klamath River have been altered as a result of both the hydroelectric Project and the USBR Klamath Project. In the river reaches between J.C. Boyle and Iron Gate Dams, the impacts from flow diversion to powerhouses and peaking operations have altered the hydrologic character of each river reach.

Streamflow in Spring Creek has been reduced by the diversion to Fall Creek. As a result, aquatic habitat and water quality conditions in Spring and Jenny creeks have been degraded.

Project Impacts

The proposed Project would continue to alter the hydrologic character of river reaches between J.C. Boyle Dam and Iron Gate Dam, as well as of Spring Creek/Jenny Creek. Specific Project impacts include:

- Reduced minimum flows in the J.C. Boyle bypass reach;
- Reduced magnitude, frequency, and duration of peak flows in the J.C. Boyle bypass reach;
- Reduced seasonal and annual variability of flows in the J.C. Boyle bypass reach;
- Reduced minimum flows in the J.C. Boyle peaking reach;
- Increased summer daily maximum flows in the J.C. Boyle peaking reach;
- Alterations to streamflows during the onset and recession of annual peak flows in the J.C. Boyle peaking reach; and,
- Reduced summer baseflows in Spring Creek and Jenny Creek.

Without additional mitigation, these Project impacts will result in continued degradation of aquatic and riparian habitat and water quality. The proposed Project would prevent attainment of Department management objectives regarding watershed function, specifically those addressing flow regimes, geomorphic processes, riparian processes, water quality, and aquatic habitat.

Protection, Mitigation, and Enhancement Measures

Supporting analyses used to develop the proposed PM&E measures are either missing or poorly documented. Consultation with collaborating Tribes, agencies, and stakeholders during the development of PME measures was minimal, and minimal attempt was made to integrate the needs of various flow-dependent resources. For these reasons, the degree to which these proposed measures would maintain or enhance resource values cannot be fully assessed.

As discussed below and elsewhere in this document (refer to the geomorphology, riparian, water quality, recreation, and aquatic habitat sections), the measures proposed in the FLA would not adequately address Project impacts to flow-dependent resources. The proposed measures leave many resource and administrative issues unresolved, including:

- Link River – The fate of PacifiCorp water right claims is not addressed.
- Keno – The framework for consultation regarding operations is not adequately described and would not encompass the complete suite of issues related to this facility, which should be included in the proposed Project.
- J.C. Boyle Bypass Reach – Aquatic instream flow studies for this reach are not complete. PacifiCorp has not made available the results of the water quality modeling effort. The stated goals of the proposed PM&E measure are unnecessarily narrow; No effort has been made to develop riparian and channel maintenance flows that would mitigate for Project impacts. The proposed flow regime would result in continuing adverse impacts to riparian and aquatic resources, as well as water quality.
- J.C. Boyle Peaking Reach – Aquatic instream flow studies for this reach are not complete. PacifiCorp has not made available the results of the water quality modeling effort. While PacifiCorp's goals for this reach encompass an array of resources, beneficial environmental impacts of the proposed flow regime would be very limited. The proposed flow regime would result in continuing adverse impacts to riparian and aquatic resources, as well as water quality. Also, the imprecise description of the method for delivering the additional 100 cfs minimum flow precludes an analysis of Project impacts.
- Downstream from Iron Gate Dam – The FLA defers to USBR the responsibility for flows in this reach and does not present any proposed flows to be implemented in the contingency of relaxed ESA or contractual obligations. PacifiCorp should formally modify its proposed flow regime to address this scenario.
- Spring Creek/Jenny Creek – PacifiCorp proposes to embark on an instream flow assessment, as BLM has requested since the First Stage Consultation. Given that Spring Creek is located within a Northwest Forest Plan Tier 1 Key Watershed, PacifiCorp should ensure that the study addresses riparian and channel condition, as well as aquatic habitat and water quality. The scope of this study should encompass Spring Creek as well as the portions of Jenny Creek downstream from the Spring Creek confluence. PacifiCorp should formally modify its proposed suite of PM&E measures to incorporate an interim instream flow downstream from the Spring Creek diversion.

Water Quality

FLA Discussion of Existing Environment and Project Impacts

Existing Environment

Water quality in the area affected by the Project is characterized as degraded due to conditions in Upper Klamath Lake (Exhibit E 3-89). High levels of nutrients and algae provide conditions well-suited for high productivity in Project reservoirs. As a result, Project reservoirs affect dissolved oxygen (DO) in downstream river reaches.

Despite the assertion that there "appears to be little that influences temperature on the Klamath River between Link Dam and Iron Gate Dam other than ambient climatic conditions" (Exhibit E 3-142), the FLA clearly indicates that Project facilities and operations result in alterations to thermal regimes throughout and downstream from the Project area. As discussed in more detail below, Project reservoirs store and release heat at a different rate than would the river reaches that they inundate, and Project operations alter daily and seasonal temperature patterns in numerous river reaches (as well as Spring Creek and Jenny Creek).

Project Impacts

Water Temperature

Klamath River

Three continuing impacts to water temperature are described in the FLA (Exhibit E 3-214). Alteration of water quality conditions in the J.C. Boyle bypass reach and increases in the daily range of temperature fluctuations in the J.C. Boyle peaking reach are explicitly described. Impacts downstream from Iron Gate Dam are implied but not clearly stated.

Spring Creek/Jenny Creek

The FLA describes water quality in Fall Creek as "excellent" (Exhibit E 3-215), but provides no discussion of Project impacts on water temperature in the stream reaches in the Jenny Creek watershed from which water is diverted to enhance Fall Creek streamflows. The FLA does not include any analysis of the effects of the Spring Creek diversion dam on the water quality in the Spring Creek reach that is ponded above the dam. The lack of shading above the dam along with the pooling of the creek contained by the dam are factors that likely contribute to increased water temperatures and decreased dissolved oxygen.

Dissolved Oxygen

Klamath River

Impacts to dissolved oxygen levels downstream from each Project dam are described in the Water Resources FTR (e.g., 4-41) but are not completely described as continuing impacts (Exhibit E 3-214).

Spring Creek/Jenny Creek

The FLA provides no discussion of Project impacts on DO levels in the stream reaches downstream from the Spring Creek diversion dam.

Adequacy of Applicant's Information

Despite the extensive data collection and modeling effort, the FLA discussion of water quality is inadequate to determine the full scope of Project impacts, does not adequately support proposed PM&E measures.

Model Results for Nutrients and Algae

Model results describing spatial and temporal patterns of nutrient and algae dynamics are discussed throughout the Water Resources FTR (e.g., 4-21, 4-27, 4-35, 4-41, 4-61, 4-66, 4-75, and 4-90). PacifiCorp utilizes these results to inform their determination that Project reservoirs cause "a net decrease in organic matter and nutrients that would otherwise continue downstream" and contribute to water quality degradation (Exhibit E 3-214). These model results have not been released to stakeholders for independent review. It is therefore difficult to validate PacifiCorp's interpretation of these data.

Modeling Scenarios for J.C. Boyle Bypass Reach

Model scenarios for most river reaches affected by the Project include existing condition, steady flow, and without Project. The model scenarios applied to the bypass reach represent only two conditions: existing condition (with Project reservoirs and all but 100 cfs diverted) and without Project (no reservoirs and no flow diverted). Streamflow volumes modeled in this reach under the steady flow scenario were no different than the existing condition, and thus model results for this scenario reflect only altered reservoir operations.

To better understand Project impacts and potential PM&E measures it is necessary to model a range of flows delivered to this reach from J.C. Boyle reservoir. The range of flows considered in PacifiCorp's preliminary assessment of bypass reach instream flows (Exhibit E 3-198) should be modeled for the entire two year period (2000 – 2001), as should "fractional" minimum flows that accommodate seasonal and annual variability.

Model Results for J.C. Boyle Bypass Reach Upstream From Springs

The FLA presents no discussion of Project impacts to water quality in the river segment between J.C. Boyle Dam and the start of groundwater accretion. The Department and other stakeholders have requested this information in the past, including in the BLM response to the DLA. Without this information, adverse impacts on water temperature associated with very low streamflows cannot be rigorously assessed, nor can the downstream extent of the DO depression downstream from J.C. Boyle Dam be determined. From the perspective of numeric water quality standards, the diversion from the bypass reach causes both adverse and beneficial impacts; without information from above the springs it is not possible to adequately describe conditions that would be compromised or benefited as a result of proposed operations.

Supporting Analysis for Proposed Minimum Flow in the J.C. Boyle Bypass Reach

The proposed minimum flow in the bypass reach was developed without stakeholder coordination. The ability of various minimum flows to maintain water quality conditions was assessed in a manner that ignored the complex hydrologic character of the bypass reach, and also ignored the intent of Oregon's water quality standards. The supporting analysis consists of modeled conditions for a five-day period at one site (the downstream end of the bypass reach) (Exhibit E 3-198). No attempt was made to consider conditions in the stream segment upstream from the springs, despite the fact that water quality conditions in this segment are more strongly affected by the Project (for instance, it is only under the existing condition scenario that DO levels in downstream from J.C. Boyle Dam approach zero).

PacifiCorp's interpretation of this analysis assumes that any increase in water temperature or decrease in DO at the downstream end of the bypass reach would degrade conditions. Oregon's water quality rules describe numeric as well as narrative standards, and the purpose of these standards is to protect beneficial uses, including fish habitat. Further, depleted river flows upstream from the groundwater accretions degrade water quality and habitat conditions. Continuing to divert all but 100 cfs from this reach will not maintain the natural thermal regime of the river and will limit the amount of usable fish habitat (as discussed in the aquatic habitat section of this document).

Modeling of Proposed Operations in the J.C. Boyle Peaking Reach

Water quality conditions in the J.C. Boyle peaking reach are sensitive to changes in the timing and rate of releases from the powerhouse (e.g., Exhibit E 3-96 and 3-100). Despite proposing changes in the magnitude, duration, and ramp rate of peaking operations (Exhibit E 3-196), PacifiCorp does not present information describing impacts of these proposed operations on the river's hydrologic and water quality regimes. Without this information, it is not possible to adequately assess Project impacts relative to current conditions or determine the cumulative impact of the Project (measured relative to without Project conditions).

Analysis of Project Impacts to Spring Creek/Jenny Creek

There is no discussion of Project impacts to Spring Creek/Jenny Creek, despite BLM requests in response to the FSC and DLA. Project impacts on water quality in this watershed are likely to be profound, given the fact that relatively large volumes of cold spring-fed streamflow are diverted out of the watershed, thereby reducing summer baseflows and increasing water temperatures.

Alternative Information and/or Interpretation

Water Temperature

J.C. Boyle Bypass Reach

Two major hydrologic features exert strong control on water temperatures in this reach: accretion of 220 cfs of groundwater and diversion of up to 2,850 cfs by the J.C. Boyle canal. Water temperatures at the upstream end of the reach reflect conditions in J.C. Boyle Reservoir, and range from 11 to 23 °C during May through September. Upstream reservoirs result in lower maximum water temperatures but slightly higher median temperatures during the summer period (see Appendix A2 of Department comments, Figures 1, 2, 7, and 8).

Reduced flows downstream from the dam result in increased upstream to downstream warming rates. Although this effect is not well expressed due to the short travel time between the dam and the initiation of groundwater accretions, BLM monitoring data indicates that water temperatures increase by 0.2 to 0.5 °C over the short (less than one mile) river segment upstream from the springs. Although this warming partly reflects equilibration of reservoir releases, it is noteworthy that the warming rate was apparently reduced during the few periods of higher bypass reach flows that occurred during the monitoring record (BLM, 2003).

As stated in the FLA, the springs provided approximately 220 cfs of water with steady temperatures of about 11 °C. During periods when flows are diverted from the bypass reach, this relatively large accretion results in highly altered water temperatures. Compared to without Project conditions, Project facilities and operations result in average daily water temperatures upstream from J.C. Boyle powerhouse that are more than 5 °C cooler in the summer and more than 5 °C warmer in the winter (Water Resources FTR 4-50). In sum, the cumulative impact of the reservoir and diversion is to attenuate annual water temperature patterns in the lower portion of this reach.

The Water Resources FTR notes that "the springs provide benefits in all scenarios, but in the EC and SF cases they provide appreciable cold water benefits in the J.C. Boyle bypass reach" (4-46). It should be emphasized that under all modeled scenarios these springs are responsible for substantial reductions in water temperature (for instance, maximum July water temperatures are reduced by about 3 and 5 °C under the without Project and existing condition modeling scenarios, respectively) (see Appendix A2 of Department comments, Figures 7 to 10).

J.C. Boyle Peaking Reach

Taken together, Project facilities and operations do not strongly affect median daily water temperatures in the J.C. Boyle peaking reach (see Appendix A2 of Department comments, Figures 5 and 6). When Project operations are examined separately under the steady flow scenario (the presence of Project reservoirs is held constant under the steady flow and existing condition scenarios), it is apparent that peaking at J.C. Boyle powerhouse results in slightly higher (approximately 1 °C) maximum daily water temperatures during the period of year when water temperatures are highest (Tables 1-1 and 1-2). Although absolute monthly maximums are consistently higher under without Project conditions (see Appendix B, Figures 11 and 12), the presence and operation of the Project does not consistently result in reduced daily maximums downstream from the powerhouse (Table 1-3).

Project operations increase the daily range of water temperature fluctuations in the peaking reach (Figure 1-2). This is apparent from modeling results (Water Resources FTR 4-48) and empirical measurements (Exhibit E 3-96). The pattern of daily water temperature changes is also affected by Project operations: cessation of powerhouse flows and subsequent reductions in water temperature result in mid-afternoon cooling in the lower portion of the peaking reach (Exhibit E 3-97).

In a discussion of temperature conditions in the J.C. Boyle peaking reach, the FLA refers to BLM water temperature data from July 2002 that indicates operation of "J.C. Boyle Dam in a steady-flow state results in an increase in the daily average temperature in the J.C. Boyle bypass reach" (Exhibit E 3-200). This statement is problematic in numerous regards, including (1) the lack of a citation for this data source; (2) USGS streamflow data indicates that throughout July 2002 the J.C. Boyle facility operated in a peaking mode (with no steady flow releases); and (3) an

inconsistent description of which river reach is being discussed. PacifiCorp asserts that this data indicates that "the daily minimum water temperature [in the peaking reach, apparently] increased 2 °C and the daily average water temperature increased nearly 1 °C" (Exhibit E 3-200). This

Table 1-1. Comparison of modeled maximum daily water temperatures under the steady flow and existing condition scenarios.

Location	Number of days between July 1 and September 30 that maximum daily water temperatures modeled under steady flow conditions are greater or less than water temperatures modeled under existing conditions				
	Downstream from J.C. Boyle Dam	Upstream from J.C. Boyle Powerhouse	Downstream from J.C. Boyle Powerhouse	At OR/CA Boundary	Above Copco Reservoir
(Approximate River Mile)	225	221	220	209	204
2000 Maximum Daily T_w					
• SF ≥ EC	12	34	5	18	7
• SF < EC	80	58	87	74	85
2001 Maximum Daily T_w					
• SF ≥ EC	14	0	0	2	39
• SF < EC	78	92	92	90	53

Table 1-2. Difference in modeled water temperature at the OR/CA Boundary under the steady flow and existing condition scenarios.

Period (Month/Day)	**Average Δ Daily Maximum T_w[1] 2000**	**2001**
7/1 – 7/15	-1.4	-0.5
7/16 – 7/31	-1.0	-0.5
8/1 – 8/15	-1.5	-1.2
8/16 – 8/31	-1.0	-1.7
9/1 – 9/15	-0.4	-1.3
9/16 – 9/30	-0.3	-0.8

Notes: (1) Negative values indicate that SF modeled water temperatures are cooler than EC modeled water temperatures

Table 1-3. Comparison of modeled maximum daily water temperatures under the without Project and existing condition scenarios.

Location	Number of days between July 1 and September 30 that maximum daily water temperatures modeled under without Project conditions are greater or less than water temperatures modeled under existing conditions				
	Downstream from J.C. Boyle Dam	Upstream from J.C. Boyle Powerhouse	Downstream from J.C. Boyle Powerhouse	At OR/CA Boundary	Above Copco Reservoir
(Approximate River Mile)	225	221	220	209	204
2000 Maximum Daily T_w					
• WOP ≥ EC	85	90	73	46	47
• WOP < EC	7	2	19	46	45
2001 Maximum Daily T_w					
• WOP ≥ EC	85	91	57	30	64
• WOP < EC	7	1	35	62	28

conclusion ignores the findings of monitoring conducted during routing of steady flow through the bypass reach in 2002 and 2003:

- In the case of a 400 cfs steady flow from the dam, daily mean and maximum water temperatures in the peaking reach were reduced (Water Resources FTR 7-11); and,
- In the case of a 180 cfs steady flow release from the dam, there were "no discernible effects" on water temperatures in the peaking reach (Water Resources FTR 7-16).

The results of PacifiCorp's monitoring during Project maintenance events support the findings of BLM monitoring efforts during these same events (see Figures 18 and 19 in BLM, 2003), and refute the discussion from Exhibit E (3-200).

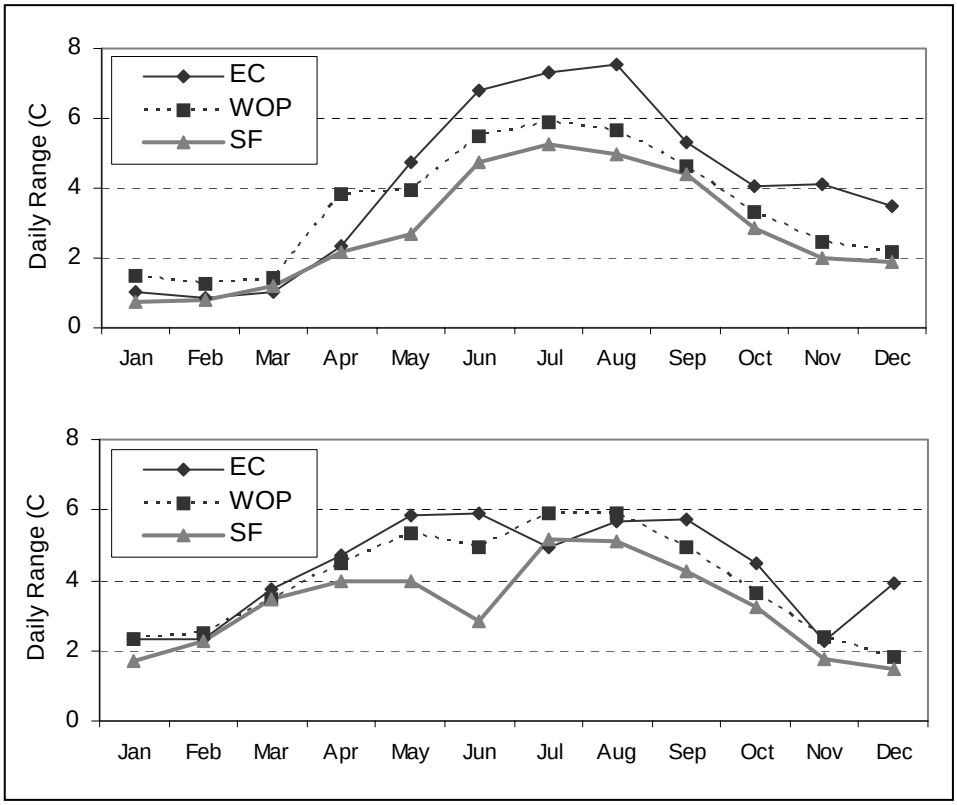

Figure 1-2. Monthly median of daily range in water temperatures modeled at the Oregon-California boundary in 2000 (top) and 2001 (bottom).

Spring Creek/Jenny Creek

Spring Creek is spring-fed and maintains cold water temperatures upstream of the diversion throughout the year. Jenny Creek receives surface streamflows from a larger watershed and is characterized by high summer water temperatures (Figure 1-3). Jenny Creek is included on the 2002 Oregon 303(d) list of water quality impaired streams due to high summer water temperatures. The diversion of a significant proportion of summer baseflow via the Spring Creek diversion contributes to water quality impairment in Jenny Creek.

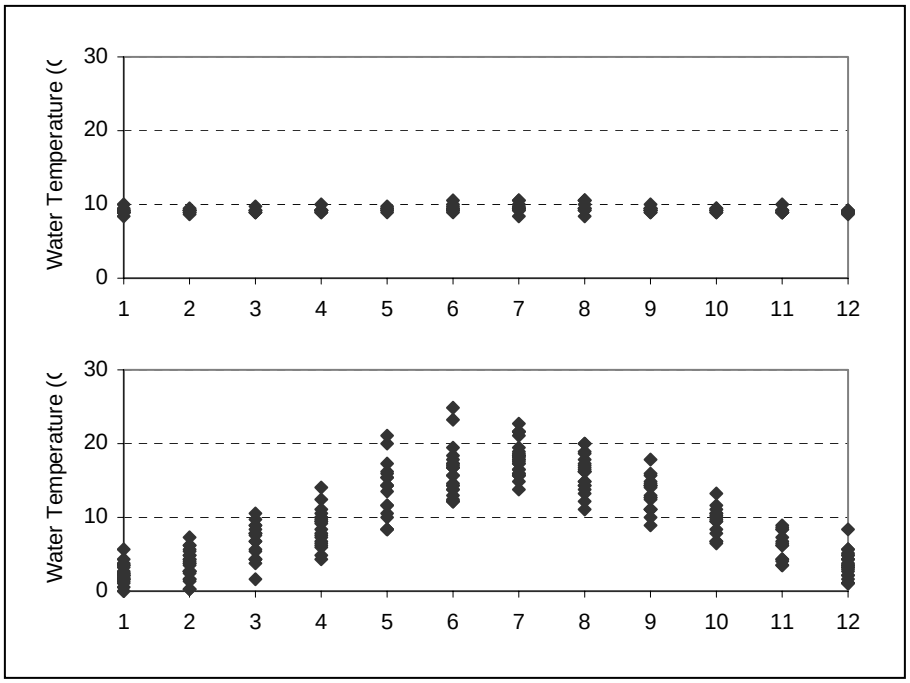

Figure 1-3. 1974 – 2004 monthly (1 = January) grab sample water temperature (°C) data for Spring Creek upstream from the diversion (top) and Jenny Creek downstream from the Spring Creek confluence (bottom) (BLM Data).

Dissolved Oxygen

J.C. Boyle Bypass Reach

Dissolved oxygen levels in the upper portion of this reach are impaired by J.C. Boyle Reservoir (Water Resources FTR 4-41 and 4-53). Median and minimum DO levels are especially impacted by the Project during the summer months (see Appendix A2 of Department comments, Figures 13, 14, 19, and 20). The Project reduces DO levels at the upstream end of the bypass reach by as much as 4 to 5 mg/L during the June to August period, and occasionally causes DO levels to approach zero (Water Resources FTR 4-53). This results in an apparent violation of Oregon DO standard (described at Exhibit E 3-147).

Turbulent flows and accretion of cold groundwater allow DO levels to recover in the downstream portion of the bypass reach. Because Project operations cause summer water temperatures above the powerhouse to be artificially depressed, summer DO levels are artificially enhanced (Water Resources FTR 4-59). As with water temperature, the Project attenuates seasonal variability in DO levels at the downstream end of the bypass reach (Water Resources FTR 4-59).

It is noteworthy that DO conditions modeled at the downstream end of the bypass reach under the without Project scenario are within 2 mg/L of those modeled under the existing condition scenario (Water Resources FTR 4-59).

J.C. Boyle Peaking Reach

Under all modeled scenarios, DO levels in the peaking reach are near saturation (Water Resources FTR 4-52), and the Project does not appear to affect median monthly DO levels (see

Appendix A2, Figures 17 and 18). Analysis of modeled results at the Oregon-California boundary indicates that Project operations may reduce minimum summer DO levels, although a similar pattern is modeled under the without Project scenario (see Appendix A2 of Department comments, Figures 23 and 24). Due to peaking operations, the Project also causes increased daily variability throughout the upper portion of the peaking reach (Water Resources FTR 4-52).

Spring Creek/Jenny Creek

No data is available to describe Project impacts on DO levels in stream segments downstream from the diversion. It is likely that Project impacts on water temperature (discussed above) reduce the concentration of DO in these reaches.

Department Conclusions Regarding Existing Environment, Project Impacts, and PM&Es

Existing Environment

Water quality conditions in the Klamath River reflect natural background conditions, altered water quality in Upper Klamath Lake, and Project impacts. Project facilities and operations impose changes in upstream-to-downstream water quality patterns, especially within and downstream from Project reservoirs and in river reaches subject to flow diversion and peaking operations.

Although PacifiCorp presents no discussion of water quality conditions in Spring Creek/Jenny Creek, it is highly likely that the diversion of relatively large volumes of spring-fed streamflow result in adverse impacts to water temperature and dissolved oxygen. As a result of cumulative anthropogenic impacts, including flow diversion, the entire length of Jenny Creek is included on the 2002 State of Oregon 303(d) list of water quality impaired streams.

Project Impacts

As discussed above, the summaries of water quality conditions contained in the FLA consistently understate the impacts of the Project. Project facilities and operations have widespread adverse impacts on the Klamath River and the Spring Creek/Jenny Creek system. These include:

- Reduced DO levels downstream from Project reservoirs;
- Altered thermal regimes in the J.C. Boyle bypass reach;
- Increased maximum daily water temperatures and increased ranges of daily fluctuation in the J.C. Boyle peaking reach;
- Altered thermal regimes downstream from Iron Gate Dam; and,
- Increased summer water temperature in Spring Creek and Jenny Creek.

Protection, Mitigation, and Enhancement Measures

The PM&E measures proposed in the FLA do not adequately address Project impacts. Proposed minimum flows and operation regimes in the J.C. Boyle bypass and peaking reaches would result in continued adverse impacts to thermal regimes and beneficial uses, and do not address DO depletion downstream from J.C. Boyle Dam. PacifiCorp did not adequately consider resource management objectives during development of minimum flows in the J.C. Boyle bypass reach, and did not adequately assess the beneficial and adverse impacts of various minimum flows.

No PM&E measures are proposed to address Project impacts to water quality and aquatic habitat in Spring Creek/Jenny Creek during implementation of the long-delayed instream flow study.

Geomorphology

FLA Discussion of Existing Environment and Project Impacts

Existing Environment

The FLA accurately depicts the general physiographic setting of the Klamath River and the important role of geologic controls in shaping the alternating character (steep canyons separated by lower gradient river segments) of the river's longitudinal profile (Water Resources FTR 6-30). Differences in stream energy associated with channel gradient changes, in turn, cause various geomorphic processes to function at different rates.

Alluvial geomorphic processes shaped low gradient river reaches that have formed upstream from geologic controls in the vicinity of Spencer Creek (currently inundated), at Frain Ranch (RM 214.4 to 217), in the vicinity of Shovel Creek (RM 204 to 209), and in the area currently inundated by Copco Reservoir. Such processes included deposition of point bars and flood plains and contributed to landscape-scale ecological diversity.

Channel gradients in the intervening steep river reaches are sufficient to enable sediment transport in excess of sediment supply. Local depositional areas that exist in side channels and downstream from flow obstructions represent another scale of structural control on channel processes (Water Resources FTR 6-152).

Project Impacts

The FLA describes the continuing impact of Project reservoirs on sediment supply and fish spawning (Exhibit E 4-169). Other continuing impacts to geomorphic processes (and associated ecological processes) are not explicitly discussed. There is no analysis/discussion of the effects of the Spring Creek diversion on sediment transport below the diversion.

Adequacy of Applicant's Information

The results presented in the Water Resources FTR can be used to develop an understanding of the nature and scope of Project impacts on geomorphic processes. Although the existence of Project impacts on sediment supply and transport is clearly proven, the exact magnitude of Project impacts on the various components of the sediment budget has not been determined or validated. Key issues associated with the sediment budget include:

- Modeling of sediment transport relied on tracer gravel results from one study site (Water Resources FTR 6-128);
- Estimates of sediment stored in Project reservoirs are based on imprecise pre-Project topographic maps (10-foot contours) that were subject to limited verification efforts (probing and slope-extension analysis were conducted only at the mouths of four tributaries) (Water Resources FTR 6-16);
- The sediment budget focused primarily on gravel, and does not include an adequate description of Project impacts on storage, transport, and deposition of sand-sized particles which are trapped in Project reservoirs (Water Resources FTR 6-44) and affected by Project operations (Water Resources FTR 6-117);

- The sediment budget does not provide information regarding the particle size distribution of sediment captured by Project reservoirs and did not provide any information regarding suspended sediment (Water Resources FTR 6-144).

The Department has raised these issues numerous times, both at work group meeting and in response to the FSCD, the SSCD, and the DLA.

The use of estimates for which validation is incomplete or impossible is partly responsible for the "high uncertainty associated with this sediment budget" (Water Resources FTR 6-152). As discussed in the FLA, "sediment transport estimates will be greatly improved when flows are sufficiently high to mobilize the bed and the bed load sampling described in the study plan can be conducted" (Water Resources FTR 6-144). This sampling is scheduled to occur in 2004; the sampling should be carried out as planned. Additional sampling during peaking events in the J.C. Boyle peaking reach should also be conducted, in order to better document impacts of Project operations on sediment transport. The Sediment Budget ASR (see Attachment 2 of the Department comments) describes a recommended approach to address these and other inadequacies in PacifiCorp's analysis of Project impacts on sediment transport.

The assessment of cultural resources implications of Project impacts on geomorphology does not adequately address the concerns of the Cultural Resources Work Group. The investigation described in the Water Resources FTR consisted of brief field visits to several cultural sites. More in-depth, site-specific investigation of relationships between Project-induced geomorphic processes and cultural resources is needed, as described in the cultural resources section and in Attachment 2 of this document.

Alternative Information and/or Interpretation

The discussion of continuing Project impacts does not fully describe Project impacts on geomorphic processes.

PacifiCorp contends that "Project effects on fluvial geomorphology and sediment transport are difficult to detect and differentiate from the large-scale natural and anthropogenic impacts operating in the system" (Exhibit E 4-169). While it is true that careful analysis is required before making any determinations of Project impacts, the information presented in the Water Resources FTR clearly shows that the proposed Project:

- Reduces the availability of sediment (including both gravel and finer materials) to river reaches downstream from dams (Water Resources FTR 6-42 and 6-146);
- Increases the time interval between flow events capable of mobilizing the streambed (Water Resources FTR 6-136);
- Reduces the magnitude and frequency of peak flows in mainstem bypass reaches and in Spring Creek (Water Resources FTR 5-46);
- Increases the transport rate of suspended sediment and sand in the J.C. Boyle peaking reach (Water Resources FTR 6-117);
- Constrains the river channel in the J.C. Boyle bypass reach (Water Resources FTR 6-118); and,
- Reduces the potential future extent of alluvial river reaches due to continued reservoir inundation.

Frequency of Flow Events Capable of Mobilizing the Streambed

The flow required to mobilize the streambed has been increased as a result of reduced sediment supply downstream from J.C. Boyle, Copco, and Iron Gate Dams (Water Resources FTR 6-134). As such, the frequency of flows capable of reshaping the streambed has been reduced. This effect is most pronounced in the J.C. Boyle peaking reach and the river reaches downstream from Iron Gate Dam (Table 1-4). Near the BLM campground in the J.C. Boyle peaking reach (RM 217.5), bed coarsening due to reduced sediment supply has created conditions such that it is estimated that flows in excess of 40,000 cfs are required to mobilize the bed. Such flows are many times greater than the largest peak flow recorded in this reach. Were it not for the Project, it is estimated that flows on the order of 5,000 cfs (with a recurrence interval of about 2 years) would be sufficient to mobilize the bed.

Table 1-4. Project impacts on bed mobility (from Water Resources FTR 6-135).

River Reach (Approximate River Mile)		Discharge and Recurrence Interval of Flows Capable of Mobilizing the Streambed				Ratio of With- to Without-Project Recurrence Interval
		With-Project		Without-Project		
J.C. Boyle Bypass	Upstream (223.3)	1,450 cfs	0.8 yrs *	1,230 cfs	0.8 yrs	2.3 ***
	Downstream(222.4)	3,860	1.5 *	1,780	0.9	2.8 ***
J.C. Boyle Peaking	USGS Gage (219.8)	4,390	1.8	2,340	1.1	1.6
	Campground (217.5)	44,870	**	4,790	2.1	-
	Gorge (214.4)	3,410	1.4	3,190	1.3	1.1
	Shovel Cr (206.4)	4,690	1.9	1,283	0.8	2.4
Downstream of Iron Gate Dam	Fish Hatchery (189.5)	14,940	8.7	4,390	1.7	5.1
	R-Ranch (186.7)	12,180	4.1	8,096	2.6	1.6
	I-5 Rest Area (179.1)	6,350	2.0	3,770	1.5	1.3
	Tree of Heaven (172.2)	17,330	9.7	8,720	2.9	3.3
	Seiad/Hardy (131.5)	389,600	**	210,500	**	-
	Seiad/USGS (128.5)	67,910	10.0	26,660	2.9	3.4

Notes: (*) The diversion of 2,850 cfs from this reach causes the bed mobility threshold flow for the two study sites in this reach to effectively increase to 4,300 and 6,700 cfs, respectively, and the recurrence interval of these flows to increase to approximately 1.8 and 2.5 years; (**) Indicates that bed mobility threshold discharge is higher than peak flow of record; (***) Adjusted to account for impacts of flow diversion.

Project Impacts on the Magnitude and Frequency of Peak Flows in Bypass Reaches

In Project bypass reaches, the effects of bed coarsening on bed mobility have been compounded by reductions in the magnitude and frequency of peak flows. In the upper portion of the J.C. Boyle bypass reach, the recurrence interval of flows greater than 1,450 cfs (the threshold of mobility under with-Project conditions) has increased from less than a year to almost two years. Likewise, in the lower portion of this reach, the recurrence interval of with-Project bed mobilizing flows has increased from approximately 1.5 years to about 2.5 years.

Project impacts on bed mobility result in indirect impacts to aquatic habitat and riparian processes, as discussed elsewhere in this document.

Flow Events Capable of Transporting Suspended Sediment and Sand in the J.C. Boyle Peaking Reach

Sediment transport measurements indicate that Project operations generate flows capable of moving suspended sediment and fine-grained bedload (i.e., sand) (Water Resources FTR 6-117). The bedload transport rate during 3,000 cfs peaking events is on the order of one ton per day. Suspended sediment transport rates during such events are much higher, on the order of 250 tons per day. Peaking operations continue to move fine sediment from these river reaches that have already had their supply of sand and fine sediment reduced by J.C. Boyle Reservoir (Water Resources FTR 6-44). Impacts of daily peaking operations are also evident in the comparison of bedload transport rates calculated using average daily and hourly discharge data (Water Resources FTR 6-142). On average, peaking operations increase the bedload transport capacity by 0 to 8% relative to steady flow conditions.

Altered sediment transport rates resulting from Project operations may result in altered rates and seasonal patterns of sediment deposition in riparian areas and aquatic habitats. Limited data is available to assess this impact; additional data collection is requested as part of the Sediment Budget ASR. The bedload transport rating curves developed during the geomorphology analysis (and presented in DLA) are not included within the FLA; these data should be made available to interested stakeholders.

Constraints on Channel Processes in the J.C. Boyle Bypass Reach

Channel processes in the upper portion of the J.C. Boyle bypass reach are further impacted by the presence of sidecast material generated during the construction of the J.C. Boyle canal. This material extends to the margins of the active channel for approximately 1.5 miles. The river channel in this section has been constrained as a result, and riparian areas have been altered (Exhibit E 5-25). In some areas, sidecast material has entered the active channel and is causing accelerated bank erosion (Water Resources FTR 6-117).

Reduced Extent of Alluvial River Reaches

Project reservoirs currently inundate 14.9 miles of the Klamath River (Table 1-5), including both the longest and the lowest gradient alluvial river reaches in the Project area. The inundated river reaches account for 64% of the potential future low gradient river habitat between Iron Gate Dam and the upstream end of J.C. Boyle Reservoir.

Table 1-5. Characteristics and status of low gradient river reaches in the Project area.

River Reach	Current Status	River Miles[1]	Length	Estimated Gradient
J.C. Boyle	Inundated	224.7 – 228.3	3.6 miles	0.5 %
Frain Ranch	Riverine	214.4 – 217.5	3.1	0.4
Shovel Creek	Riverine	203.7 – 209.1	5.4	0.5
Copco I	Inundated	198.6 – 203.1	4.5	0.2
Iron Gate	Inundated	190.1 – 196.9	6.8	0.5

Notes: (1) Due to sinuous channel geometries, the lengths of river reaches inundated by Copco and Iron Gate Reservoirs are greater than the lengths of the current reservoirs.

Department Conclusions Regarding Existing Environment, Project Impacts, and PM&Es

Geomorphic changes caused by the Project reduce the extent and quality of aquatic habitat and impair riparian ecological processes. In the absence of PM&E measures that adequately address Project impacts to both sediment supply and transport, these impacts will continue during the term of the next FERC license.

Direct impacts of the Project on river geomorphic processes include reductions in the supply of sediment and changes in the frequency of flows capable of transporting sediment. Of the channel types occurring in river reaches affected by the Project, plane bed and pool-riffle channels are the most responsive to changes in sediment supply and transport. Morphological characteristics of plane bed channels are transitional between supply- and transport-limited channel types (Water Resources FTR 6-115). The degree to which bed mobility thresholds have increased as a result of bed coarsening is an indicator of alterations to geomorphic processes. The river reaches within which bed mobilizing events have become less frequent are those that would be expected to exhibit a transformation from alluvial (self-formed) features to more stable features that are organized around immobile structures.

This transformation is evident in the plane bed channels that occur throughout much of the J.C. Boyle peaking reach and the reaches downstream from Iron Gate Dam. These channels lack active alluvial features and are dominated by "featureless bedforms" (Water Resources FTR 6-115). Supply-limited conditions favor the transformation of channels with pools, riffles, and active bars to channels that are much less dynamic and complex. These changes are likely most pronounced in low gradient river reaches such as occur at Frain Ranch, in the vicinity of Shovel Creek, and downstream from Iron Gate Dam (Water Resources FTR 6-87). This conclusion is consistent with the estimated reductions in the frequency of flows capable of mobilizing the streambed (Table 1-4). Given that the potential future extent of low gradient river reaches would be substantially reduced by continued inundation by reservoirs, Project impacts that impair conditions in the remaining low gradient river reaches are especially noteworthy.

Changes in higher gradient river reaches are more subtle because the pre-Project conditions were naturally more supply-limited. In these reaches, reductions in sediment supply have resulted in reduced storage of sediment in low energy areas created by large boulders, bedrock outcrops, or channel expansions. Reductions in the extent of localized depositional areas reduce the diversity of aquatic and riparian habitats

The proposed gravel augmentation does not adequately address Project impacts, for three reasons:

- The proposed volume, spatial scope, and temporal frequency of gravel augmentation events is inadequate;
- The adaptive management framework is not adequately described; and,
- Gravel augmentation, by itself, cannot adequately mitigate for Project impacts on geomorphic processes.

J.C. Boyle Dam captures, on average, 6,100 tons of sediment per year (Water Resources FTR 6-143). This sediment consists of clay, silt, sand, gravel, and perhaps some cobble at the mouth of Spencer Creek and the upstream end of the reservoir (Water Resources FTR 6-44, 6-47, and Appendix 6B). Whereas an average of 410 to 820 cubic yards of gravel and an equivalent volume of sand would need to be supplied to the river each year to mitigate this impact (Table 1-6), PacifiCorp instead proposes to deliver 100 to 200 cubic yards of "spawnable-size gravel" to

the river as a one-time event at one location. The scope of PacifiCorp's proposed program is far from adequate; sediment augmentation should occur on a recurring basis at multiple sites established throughout the J.C. Boyle peaking and bypass reaches to mitigate for Project impacts that occur downstream from J.C. Boyle Dam. Initial large volumes of gravel delivered to multiple sites would replenish in-channel storage sites that have long been deprived of sediment (E 4-169) and thereby allow sediment delivered in subsequent augmentation events to be distributed by reinvigorated alluvial processes.

Table 1-6. Estimated sediment trapping in J.C. Boyle Reservoir.

Average annual mass of sediment captured	6,100 tons
Average annual volume of sediment captured[1]	4,100 cubic yards
Average annual volume of bedload captured[2]	410 – 820 cubic yards
Average annual volume of sand captured[3]	820 cubic yards

Notes: (1) Using a conversion factor of 1.485 tons/yd^3; (2) Using a ratio of bedload to total sediment of 0.1 to 0.2; (3) Assuming 20% of captured sediment volume is sand

Second, as described in the Water Resources FTR, an adaptive management program should incorporate the best available information, a clear set of objectives, a monitoring program, and a mechanism for making adjustments to management actions (6-152). These elements are absent or incompletely developed in PacifiCorp's proposed approach to sediment management. For instance:

- Although the geomorphology study identified a number of reaches in the J.C. Boyle peaking reach that have been affected by the Project, sediment augmentation is proposed only at the upstream end of the J.C. Boyle bypass reach, with consideration of other sites deferred;
- Although Project impacts on geomorphology affect numerous aquatic and riparian resources, PacifiCorp focuses solely on fish spawning (Exhibit E 4-169);
- The proposed monitoring program describes numerous metrics (the rate at which gravel is transported downstream; use by spawning fish; and "consideration of channel conditions") to be used for determining additional augmentation volumes and placement sites, but does not elaborate on specific decision-making criteria or justify their applicability;
- The process for adapting and evaluating management measures, and the role of the Department and other entities in this process, is not discussed.

Third, Project impacts extend beyond sediment supply. Sediment augmentation must be coupled with other measures to ensure adequate mitigation and enhancement in river reaches affected by the Project. These additional measures include "geomorphic flows" in Project bypass reaches and instream treatments that address impacts of the J.C. Boyle canal sidecast to channel processes. As proposed, transport of sediment delivered to the J.C. Boyle bypass reach would be impaired by Project operations, because the magnitude, frequency, and duration of peak flows in this reach would continue to be reduced.

These inadequacies reflect an objective that is stated in unsuitably narrow terms focused solely on fish spawning in two river reaches (Exhibit E 4-169 to 4-171). As discussed above and elsewhere in this document, Project impacts on geomorphic processes result in indirect impacts to all aspects of physical aquatic habitat (not just spawning) and to riparian ecological processes. These impacts and desired future resource conditions need to be considered in the development of PM&E measures.

E4.0 FISH RESOURCES

The Department appreciates the additions to sections 4.5, 4.6, 4.7, and 4.8 of Exhibit E that include information about the fisheries resources that was not presented in the DLA. The FLA is the first opportunity that the Department has had to review and comment on this information.

PacifiCorp presented the results of several studies that had not previously been completed or agreed to by stakeholders. These include fisheries assessment, ramping, instream flow, peaking, genetics, reservoir behavior and survival, and fish passage studies. The Department is concerned that FERC, or others will use the information as it appears in the FLA and FTR without fully understanding that the accuracy and robustness of the data and analyses is inadequate. Results are preliminary in nature and should be viewed as such.

The Department does not concur with the proposed boundary because of the implications this has on the scope of the fisheries analysis. The proposed boundary adjustments accommodate PacifiCorp's omission of a discussion of impacts at the Link River powerhouses and Keno Dam. This approach is inconsistent with the purposes of the fisheries studies that are necessary to develop PM&Es. PacifiCorp's study purpose was to provide baseline information for describing the existing condition of the fishery (E 4-38), and several studies included the Link River and Keno reaches. However, in the FLA this information is presented only in the FTR. The Department understands that the baseline is the existing condition of the Project and Project-affected resources at the time of application filing, not at some future date when proposed Project boundaries have been finalized. The existing Project includes the link River and Keno reaches; therefore the analysis should assess existing resource conditions and Project impacts for the Link River and Keno reaches. This is true especially in the Link River reach, where PacifiCorp describes enhancements to resources that would accrue as a result of proposed facility decommissioning.

Klamath River Fisheries and Fish Habitat

FLA Discussion of Existing Environment and Project Impacts

Existing Environment

The FLA discusses historic (Exhibit E 4.1) and existing (Exhibit E 4.2) fisheries resources affected by the Project. PacifiCorp proposes to exclude Keno and Link River Facilities from the Project boundary. As a result, discussion of these facilities as they relate to fish populations and habitat are excluded from Exhibit E of the FLA and deferred to the FTR.

Project Impacts

The Project reservoirs currently, and will continue to, inundate riverine habitat (Exhibit E 4-173). Upstream movement of resident fish will be blocked by Copco and Iron Gate Dams. Entrainment of downstream migrants will occur at Project facilities (Exhibit E 4-173).

Adequacy of Applicant's Information

Spawning Habitat

While gravel reduction, due to the project (as indexed by project-impacted sediment yield), impacts a small percentage of habitat in the Klamath River, this reach is where the majority of the Klamath River Chinook salmon redds have been observed by the Service during the period 1993 to 2001 (Figure 1-4).

The FLA discussion of spawning gravel recruitment in the J.C. Boyle bypass reach is inadequate. As discussed in the Geomorphology section of this document, the analysis does not link gravel augmentation with any quantitative analysis to support the proposed measure. Geomorphology and sediment studies for the Project reaches and reservoirs are complete. However the applicant has not used the data from the analysis to develop gravel augmentation programs for sediment starved reaches.

The FLA does not acknowledge conditions in the peaking reach and the Copco II bypass. How Project reservoirs have trapped sediment at J.C. Boyle and Copco Reservoirs that has resulted in a sediment "starved" condition in the reaches below the reservoirs.

Inundation of riverine habitat by Project reservoirs is not adequately described. The FLA notes that J.C. Boyle Reservoir inundates habitat which was likely utilized for spawning by resident trout inhabiting downstream river reaches (Exhibit E 4-173) but draws no conclusions regarding historic spawning habitats inundated by Copco and Iron Gate Reservoirs.

Fisheries Population Assessments

Population estimates derived from the City of Klamath Falls Salt Caves study are inadequate (Page 4-12) for use as baseline population indices for trout in the Project reaches. Although the Department agrees that the population estimates from the Salt Caves study may be useful for basic comparisons of the J.C. Boyle Peaking Reach to the Deschutes River study (see PC comments to BLM Response to DLA), however, the Salt Caves data are insufficient to describe the baseline trout population in the peaking reach.

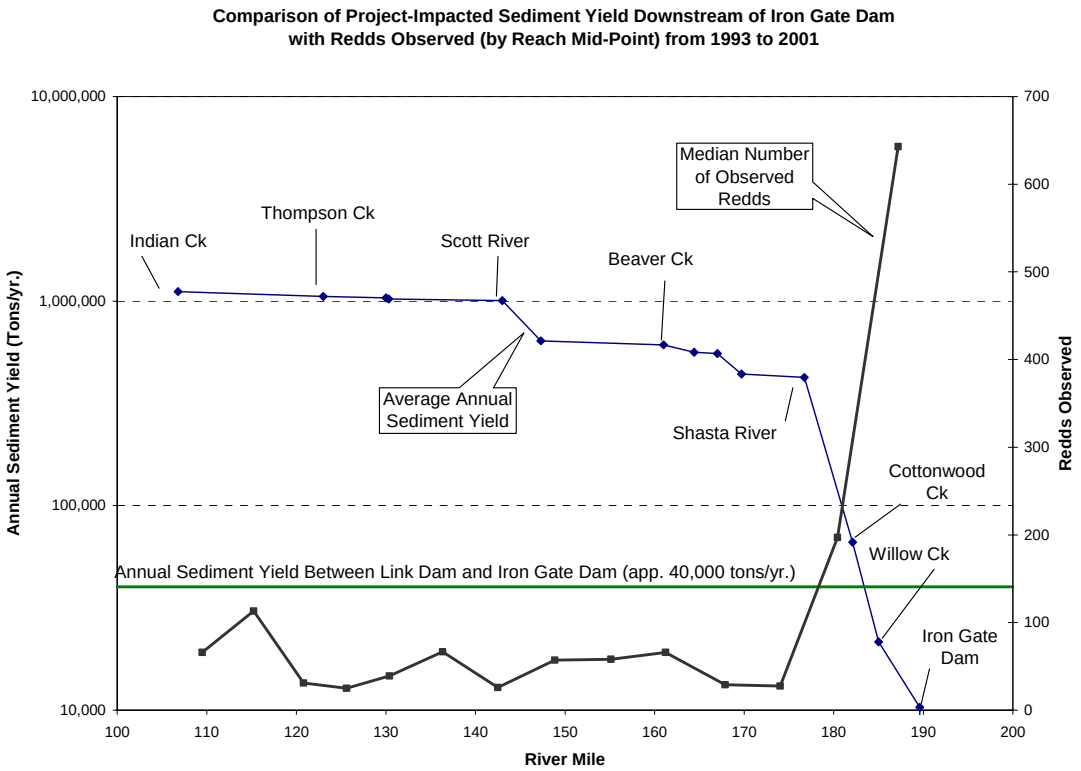

Figure 1-4. Comparison of project-impacted sediment yield downstream of Iron Gate Dam with redds observed (by reach mid-point) from 1993 to 2001 (from U.S. Fish and Wildlife Service, Arcata Fish and Wildlife Office data).

The Department has requested on several occasions (including the Service response to the DLA dated September 23, 2003) that PacifiCorp implement studies in order to describe fish populations in the Project area. To date these studies have not been initiated, and the applicant is relying on results from sampling conducted in Fall 2000 and Spring/Summer/Fall 2001 (Desjardins and Markle, 2000; City of Klamath Falls, 1986; Hardy and Addley, 2001) to describe the baseline condition (Appendix E1-A Consultation Record, Appendix B Comments to BLM response to DLA). This sampling effort was limited, and additional data that the applicant relied on do not address current conditions in all Project-affected river reaches. As such, existing conditions in the river reaches affected by Project facilities and operations are not adequately described.

Trout Movement

The FLA discussion of trout migratory behavior between Project facilities is inadequate. The FLA lacks analysis and conclusions regarding the impacts of project facilities on trout which historically migrated upstream past J.C. Boyle Dam or downstream past the Copco facilities.

The presentation of trout movement data is misleading. The distribution of fish within the study area must be understood in order to adequately assess the study results. Only 14 fish were tagged in the J.C. Boyle bypass reach. One of these migrated above the dam. The other 28 tagged fish were located downstream in the peaking reach: 14 near Frain Ranch and 14 in the California

segment. None of the fish tagged below the J.C. Boyle powerhouse moved above J.C. Boyle Dam. For the one tagged fish that did migrate above the dam, the data indicate a delay of 5 days (it was first marked on March 29 approaching the ladder, but did not actually pass the ladder until April 2). Based on a sample size of one, physical conditions in the J.C. Boyle fish ladder do not appear to impair trout movement; the one fish required only 3.5 hours to pass the ladder. However, data are needed from more than one fish.

The FLA lacks discussion of the potential role spillway flows, or flow augmentation, may have in attracting trout except to note that spill may have been a factor in attracting migratory fish toward the fish ladder (Fisheries FTR 5-34; Exhibit E 4-106).

Trout Growth

The Fisheries Assessment notes that there is a size difference between trout residing in the Keno and J.C. Boyle peaking reaches. No explanation is offered as to the cause of this discrepancy, except that "…there is some environmental condition associated with trout in the Keno Reach may favor greater growth as fish become larger (Exhibit E 4-92)." The comparative trout study indicates that trout growth rates in the peaking reach decline as fish mature, whereas growth rates in the Keno reach remain relatively constant.

Alternative Information or Interpretation

Spawning Habitat

The spawning gravels in the J.C. Boyle bypass reach (Exhibit E 4-9) result from operation of the emergency spillway (natural supplies of gravel are blocked by J.C. Boyle Dam). The majority of trout spawning habitat is downstream from this artificial sediment source. The Water Resources FTR provides quantitative assessments of sediment retention in J.C. Boyle Reservoir. The Department recommends revision of the proposed gravel augmentation analysis to more fully incorporate available information (see also the Water Use and Quality - Geomorphology section of this document).

Both the peaking reach and the Copco bypass reach contain meso-habitats that would support spawning if sediment recruitment was not impeded by Project dams. The gravel augmentation effort does not address continuing impacts of Project-induced gravel depletion in these two reaches. The FLA proposal does not describe timeframes for the likelihood of beneficial effects to the peaking reach upstream gravel augmentation in the bypass reach. Reduced habitat potential limits trout spawning potential that would likely be impaired or absent in these reaches. This conclusion is consistent with the findings from the Fisheries Assessment studies, including fry distribution, which describe an absence of spawning. The Department suggests that fish would utilize spawning habitat if it were available.

Project reservoirs inundate approximately 15 miles of low gradient river channel which would likely have supported resident fish spawning (see also the Geomorphology section of this document). The FLA concludes Project impacts associated with habitat inundation in 3.5 miles of J.C. Boyle Reservoir. The Copco and Iron Gate Reservoirs will inundate an additional 11.5 miles of habitat which, considering factors such as channel gradient and sediment supply, likely would support important spawning habitats for resident and anadromous species.

Fisheries Population Assessments

Application of findings presented in the Salt Caves report (City of Klamath Falls, 1986) must be done with consideration of the precision and accuracy of that analysis. The authors of the Salt Caves report acknowledged the limitations of that report's population assessment (regarding seasonal shifts in abundance) and described limitations of their survey methods (Salt Caves Hydroproject Exhibit E, pgs 3.1-39 to 3.1-40, City of Klamath Falls, 1986). These limitations suggest that the numbers may not be completely representative of the actual population residing in the project area. In addition, these population estimates were made 18 years ago. Several operational changes have occurred since those estimates were made, including shifts in timing of daily peaking events. Changes in minimum flows at Iron Gate Dam associated with Biological Opinions issued by NOAA Fisheries likely have caused changes in the average daily flow and the duration and magnitude of peaking events.

Trout Movement

The FLA includes additional information regarding historic resident fish passage including more detail on the tagging studies conducted in J.C. Boyle Dam and Spencer Creek by the Oregon Department of Fish and Wildlife (ODFW) and Beak Consultants in 1988. This data strongly suggests that trout populations do not move from the peaking reach upstream of J.C. Boyle Dam and only small numbers of trout in the bypass reach migrate to Spencer Creek. ODFW monitoring of downstream fish movement past J.C. Boyle Dam indicated that Spencer Creek trout do not contribute adequate recruitment of juvenile redband to the river between J.C. Boyle Dam and the California state line to maintain that adult population (Hemmingsen et al. 1992).

PacifiCorp's tagging study indicates that trout in the Project reaches exhibit only limited movement between Caldera Rapid and J.C. Boyle Dam. The data also suggests that trout that do attempt to migrate upstream of the dam may be delayed at least five days at some point downstream of the ladder entrance.

Trout Growth

The Department suggests two likely explanations of reductions in trout growth rates in the peaking reach: limited habitat availability and limited forage availability.

The lack of older trout sampled may indicate that adult habitat is more limiting in the peaking reach than in the Keno reach (Behnke, 1992). This may be attributable to altered hydrologic and geomorphic conditions, in particular limitations imposed by reduced minimum flows and peaking operations.

The impacts of J.C. Boyle Dam and the associated screen facility on downstream movement of forage fish into the J.C. Boyle peaking reach have not been studied. Studies of trout food habits in the bypass reach and J.C. Boyle peaking reach did not note the occurrence of prey fish species in stomach contents analysis (City of Klamath Falls, 1990). Stomach content analysis indicates occurrence of piscivory by trout in the peaking reach but does not indicate the segment of the reach from which the trout were collected (31 fish were analyzed by PacifiCorp; the stomach of only one fish showed fish consumption, and forage taxonomies were not included)(Fish Resources FTR 3-66). Downstream passage which may limit the downstream movement of prey may be a consequence of poor passage hydraulics and predation exposure in the forebay of J.C. Boyle Reservoir (FishPro, 2000). PC recognizes that J.C. Boyle reservoir and dam potentially

impact resident trout and in the FLA has proposed modifications to the fish bypass system. PacifiCorp should also consider Project impacts on the downstream movement of other fish species upon which trout feed and develop appropriate mitigation measures.

Department Conclusions Regarding Existing Environment, Project Impacts, and PM&Es

Project impacts to hydrology, geomorphology, water quality, and riparian resources directly and indirectly affect the aquatic habitat in the Project reaches. The proposed Project will continue to degrade habitat and negatively affect fish populations in Project reaches. Proposed mitigations will reduce but not fully mitigate the impacts of Project facilities and operations on the extent and quality of aquatic habitat.

Spawning Habitat

J.C. Boyle Reservoir traps sediment from upstream sources. Sediment supply in downstream river reach will be further reduced by cessation of emergency spillway use. As proposed, the gravel enhancement effort will be inadequate to fully mitigate Project impacts to the existing spawning habitat in the bypass reach and potential spawning habitat in the peaking reach and the Copco II bypass reach. The proposed Project will continue to inundate approximately 2.7 miles of spawning habitat under J.C. Boyle (0.7 miles), Copco (0.8 miles), and Iron Gate (1.2 miles) Reservoirs (CH2MHill, 2003).

Fisheries Population Assessments

The Salt Caves population estimates are insufficient to describe the current condition of the fisheries in the Project area. The FLA does not provide evidence that these numbers accurately represent the current populations of redband trout in the J.C. Boyle peaking reach. Consequently the FLA lacks a baseline description of the existing fishery resources necessary to assess impacts of the Project on trout populations of trout and develop appropriate PM&E measures.

Trout Movement

Taken together, evidence of limited upstream migration and limited downstream recruitment suggests that Project facilities create barriers between trout populations in the J.C. Boyle bypass and peaking reaches and other populations of redband trout within and outside of the Project area. The proposed ladder modifications at J.C. Boyle Dam are not expected to improve upstream fish passage, as most fish do not appear to approach the ladder (Exhibit E 4-107). The fish ladder was not designed, nor assessed, for fish species other that resident trout. The Department assumes that the design of the existing ladder impairs the passage of non-salmonids (sucker, chub, and lamprey) that would have moved through the Project area if the Project were not in place. Based on results of the fish movement study, the proposed Project would continue to delay upstream movement of trout at J.C. Boyle Dam. The proposed Project will prevent movement of trout and other fish species upstream of Copco, Copco II, and Iron Gate Dams. Radio-telemetry data suggests that spill, or flow augmentation, from J.C. Boyle Dam appears to be a critical component of enhancing fish passage through the J.C. Boyle facility.

Trout Growth

Information developed in Salt Caves and from the PacifiCorp studies suggest that trout populations (growth rate) in the river reaches are negatively affected by Project operations and facilities. The proposed Project would continue to hinder the recruitment of forage fish species to the bypass and peaking reaches, thereby limiting prey availability. Forage from macro-invertebrate production will continue to be impaired as a result of Project peaking operations (Exhibit E 4-174 and 4-97).

Reservoirs

Project reservoirs will continue to provide lacustrine habitat that would not exist without the Project. The expansion of this habitat type has contributed to community shifts that favor mostly non-native species and impairs native species. These non-native species displace native species, compete for forage resources with native species, prey on native species, and subsequently limit the productive potential of native fish populations in reservoir-affected reaches.

Spring Creek/Jenny Creek

Proposed Project operations will reduce streamflows in Spring Creek and downstream segments of Jenny Creek, thereby reducing habitat availability and quality. Jenny Creek is a Northwest Forest Plan Tier 1 Key Watershed that provides habitat for a number of BLM-sensitive fish species. The proposed instream flow study should be implemented in a timely manner and should consider the full range of flow-dependent resources and the full scope of Project impacts that occur in the Jenny Creek watershed.

Ramping, Peaking, and Instream Flow

FLA Discussion of Existing Environment and Project Impacts

Existing Environment

The FLA includes a discussion of existing literature and ongoing studies regarding ramping, peaking, and instream flow in Exhibit E (4.2). Keno and Link River facilities are not included within the FLA's proposed Project boundary. Subsequently, operations affecting the Link River and Keno reaches were excluded from ramping and instream flow assessments in the FLA (only in the FTR is relevant information described). The peaking analysis does include some analysis of the Keno reach, but only for comparison with the peaking reach.

Project Impacts

The FLA indicates that the proposed Project operations will restrict the rate and magnitude of flow fluctuations and that negative effects on fish resources (stranding, habitat reduction) will continue. The FLA notes that proposed instream flows will be lower than historic conditions and will reduce available habitat.

Adequacy of Applicant's Information

Ramping

No quantitative analysis was presented on the effects of the existing ramp rate (9 inches/hour) or analysis of effects of proposed ramp rates (4 inches/hour when less than 1000 cfs) in the peaking reach. Discussion of impacts associated with peaking could be extrapolated to discussion of effects from ramping, but the FLA omits any discussion of appropriate ramping rates. Although PacifiCorp has prepared a draft ramping rate study, the existing language in the draft study plan is inadequate. As noted in the BLM comments to the DLA, a sufficient ramping rate study would include a description of how ramping operations occur at Project dams, resulting water surface elevation changes between the powerhouses and downstream river reaches, an inventory of potential fish stranding areas (including areas where stranding is most likely to occur, and areas with less than a 2 percent gradient) related to specific river stage height changes, and identification of ramping rates that sufficiently minimize fish stranding potential.

Peaking

The impacts associated with peaking are numerous and complex. PacifiCorp has not taken timely action to finalize the peaking study; thus the FLA does not adequately describe impacts of peaking. The effects of daily flow fluctuations in the J.C. Boyle reach are significant Project impacts to aquatic and riparian resources that need to be understood and quantified. The incomplete discussion presented in the FLA provides detailed background information but does not describe discrete or cumulative Project impacts which are known to severely affect fish populations (Hunter, 1992). For example, data collected as part of the FLA Instream Flow study were used to conduct a wetted-perimeter analysis at different flow rates. Results presented do not describe the full range of dewatering that occurs during a peaking cycle. No information is provided on the change in wetted perimeter between summer base flows (i.e., with no power generation) and the flows when either one or two turbines are in operation. Instead, the change in wetted perimeter between base flows and two assumed run-of-river (ROR) values of 500 and 700

cfs are given. The source for the ROR values is not given. Percent change in wetted perimeter yields very general information and does not indicate what types of habitats are dewatered. A description of the areas of specific habitat types that are dewatered would allow a better evaluation of the impacts of peaking operations in this reach.

PacifiCorp states that results from a bioenergetics study are forthcoming and will address the impacts of daily flow fluctuations on resident fish populations. The results of this important component of the peaking analysis are not included in the FLA and should aid in a discussion of the relative effects of peaking, including temperature fluctuation, on fish growth and production.

Regarding Fish Resource Comparisons, the FLA analysis uses fish community data collected by PacifiCorp to evaluate the effects of peaking on fishery resources by comparing the peaking reach with the Keno reach. However, there is no reason to presume that differences in the fish community between the two reaches are due to peaking impacts alone; conversely, there is no basis for the assumption that similarities between the reaches indicate that peaking has no effect.

Much of the analysis of peaking impacts on fish resources draws upon data from the Fisheries assessment study. The fish community comparison relies on catch-per-effort data (CPE) to determine the differences in abundance between the reaches. This assumes that catchability is similar between the two reaches, which is likely not the case for angling sampling. Catch-per-unit-effort data can vary due to a myriad of factors, including angler prowess, water conditions, flow rates, etc. A rigorous measurement of fish abundance is needed in the two reaches to make valid comparisons between the two reaches. The Fisheries Assessment study was only conducted during one year; thus, any inter-annual variability was not considered.

Instream Flow

The study plan designed to support this section of the FLA is still under development and has not been approved by the instream flow working group. Significant issues that still need to be resolved by the work group include habitat suitability criteria development and PHABSIM output analysis (see Appendix C). The FLA does not include instream flow recommendations for the Keno Reach, deferring instead to the Total Maximum Daily Load (TMDL) process for consulting with the State of Oregon.

The presentation of instream flow recommendations for anadromous fish is absent from the FLA and FTR. The instream flow working group completed substantial review of the existing curves for coho salmon, Chinook salmon, and steelhead developed for the Klamath River. Further, PacifiCorp and the working group agreed to the use of these curves with the explicit understanding that PHABSIM would be used to model flows in the Project reaches for all native fish species.

PacifiCorp committed to developing site-specific habitat suitability criteria (HSC) for redband trout and, if possible, other resident species. Data collection for redband trout HSC was limited in geographic scope (data was collected only in the J.C. Boyle bypass reach). The bypass reach redband trout HSC does not include larger trout known to reside in the Klamath River (see Trout Growth and Condition analysis at Exhibit E 4-91). Data used to develop the bypass reach redband trout HSC were collected at the base flow of approximately 320 cfs; very little effort was made to collect HSC at higher flows as requested by the working group.

The Department disagrees with the use of the envelope curves as presented in the FLA. The data set used to develop these curves did not include the full breadth of trout age-classes, nor did the

curve-development process consider trout utilization of habitat that would occur with flows approximating conditions that would exist were it not for the diversion of flows from the bypass reach. In the absence of representative site-specific HSC data, use of other existing HSC curves from similar river systems across a broader geographic scope will be necessary to determine appropriate redband HSC for the full study area. These curves should be developed cooperatively with the working group (see Appendix C).

PacifiCorp has not conducted instream flow modeling in the Keno reach. PacifiCorp contends that the Project does not control flows in this reach and that there is a lack of consensus regarding appropriate methodologies. The Department believes that instream flow modeling in this reach will be of great utility in describing baseline conditions, understanding ongoing Project impacts under a new license, and exploring impacts of alternative Project operations. BLM comments on the DLA and SSCD recommend that instream flow needs in the Keno reach should be assessed using IFIM techniques.

PacifiCorp has not adequately described their proposed methodologies for conducting the analysis and interpretation of PHABSIM results. Further, PacifiCorp did not incorporate any of the following important habitat parameters in their analysis:

- Shear zones,
- Velocity shelters,
- Feeding stations,
- Stream margin edge type (SMET), and
- Escape cover habitat.

Based on the analysis presented in the FLA, flow modeling results suggest that the lowest flows in the bypass and peaking reaches would provide the most fish habitat. This is a common error that results when important habitat elements as described above are not considered. Although data were collected for some of these parameters (SMET and cover types) and subsequently presented to the working group, it was not incorporated into the modeling process. In addition, a time series analysis of usable habitat correlated to Project flows has not been presented. In the absence of this analysis it is difficult for PacifiCorp to describe the impact of the Project on aquatic habitat and thus the fisheries.

The FLA notes the presence of adult suckers during testing of sampling protocols. However, field analysis did not sampling for suckers during the first sampling season. Stakeholders requested HSC data for suckers sampling earlier in the year in order to identify and sample spawning suckers (see BLM comments to DLA). This work has not been completed, and consequently little progress has made in the development of HSC for suckers in the bypass reach.

Additionally, no analysis was conducted on the effects of the Spring Creek diversion on the fish and macroinvertebrate populations in Spring Creek.

Alternative Information or Interpretation

Flushing of adult trout downstream from the bypass reach may occur during spill periods due to inadequate refuge habitat (City of Klamath Falls, 1990). Hydropower peaking is likely causing stranding mortality of fry and juvenile fish in the J.C. Boyle peaking reach, thereby exacerbating disparate age structures. Since spawning occurs in the bypass reach (thereby producing fry), and fry and juvenile habitat in the bypass reach may not be fully seeded (City of Klamath Falls,

1990), the younger age structure of trout in the bypass reach may be enhanced and downstream movement and survival of juveniles in the J.C. Boyle peaking reach limited.

The difference in growth rates between the bypass reach and the Oregon portion of the J.C. Boyle peaking reach may also be partly due to the general differences in water temperature and variability of water temperature differences between these two areas (City of Klamath Falls, 1990; see also the Water Quality section of this document).

Although rearing habitat in most segments of the Oregon portion of the J.C. Boyle peaking reach may have been limited historically due to steep channel gradients, velocity fluctuations caused by peaking operations further limit the quality and extent of such habitat (BLM, 2002). Downstream dewatering of habitat resulting from hydroelectric operations eliminates access to cover habitat and potentially degrades the quality of the existing habitat (Marcus et al. 1990). Alteration of instream flows from power operation and changes in sediment regimes due to reservoirs can further degrade trout rearing habitat, as can changes in riparian vegetation that decrease cover habitat (discussed in the Hydrology, Geomorphology, and Riparian sections of this document; see also Marcus et al., 1990 and Behnke, 1992). Rearing habitat in the California segment of the J.C. Boyle peaking reach would be similarly affected, as it is subject to the same suite of impacts.

Ramping

The extent and cumulative impacts of stranding have not been previously studied in the J.C. Boyle peaking reach (CDFG, 2000), but the occurrence of larval stranding has been documented (City of Klamath Falls, 1987). The most common habitat types in the J.C. Boyle peaking reach are shallow rapids, riffles, and runs. Channels with an abundance of shallow habitat are more likely to have larger areas exposed during down ramping where fish could become separated from the main river flow due to declines in stage (Hunter, 1992). The large flow fluctuations associated with the J.C. Boyle powerhouse can cause high mortality to young trout through stranding (City of Klamath Falls, 1990; Hunter, 1992).

Peaking

Daily and seasonal flow patterns created below the project facilities can lead to dewatering of spawning beds, low flow and high flow-induced spawning interference, fish stranding, increased predation, effects to juvenile migration, and loss of macro-invertebrate diversity and abundance (Hunter, 1992). Downstream dewatering and desiccation of spawning habitat is a documented occurrence in the J.C. Boyle peaking reach (City of Klamath Falls, 1986). Frequent dewatering and desiccation result in elimination of usable fry habitat and in greatly reduced availability of juvenile and adult habitat (BLM, 2002) and therefore are undoubtedly the worst of the possible adverse impacts on existing fisheries resources in the peaking reach (Hunter, 1992; Marcus et al., 1990).

Daily temperature fluctuations of up to 12 degrees Celsius occur in the J.C. Boyle Peaking reach during the middle of the summer as a result of daily peaking events (discussed in the Water Quality section of this document; see also City of Klamath Falls, 1986). The effects of these large diurnal temperature fluctuations on the existing cold water fish populations has not been studied specifically for the J.C. Boyle peaking reach. Model results indicate that peaking operations cause elevated daily maximum water temperatures downstream from the J.C. Boyle powerhouse (discussed in the Water Quality section of this document). Impacts of altered thermal regimes to fisheries may include elevation of temperatures beyond the range preferred for

rearing, inhibition of upstream migration of adults, increased susceptibility to disease, reduced metabolic efficiency, and shifts in competitive advantage (Hicks et al. 1991).

The Department disagrees with results based on wetted perimeter analyses that use an assumed run-of-river flow for comparative analysis (Exhibit E 4-79). The peaking reach does not experience run-of-river conditions, but rather base flows of 320 cfs, one turbine flows on the order of 1500 cfs, and two turbines flow on the order of 3000 cfs. Using actual flow volumes in this analysis would demonstrate that Project operations cause substantially higher ranges of wetted perimeter fluctuation than implied in the FLA.

As noted above, the existing fish assessment data is of limited utility for assessing impacts of Project operations (especially peaking) on trout populations.

Instream Flow

In 2002 the BLM completed a study that utilized PHABSIM to develop recommended minimum flows to meet habitat needs for fry, juvenile, and adult redband trout in two segments of the peaking reach (Table 1-7). The BIA has conducted an instream flow analysis for the Link River. Both of these studies provide information on available habitat and provide recommended flows to protect the available habitat in these reaches.

PacifiCorp disregards BLM's instream flow study, deferring to the ongoing instream flow study that PacifiCorp believes will provide a more rigorous assessment of flows for project reaches (Appendix E1-A, Consultation Record Appendix B). The studies include increased hydraulic simulation capability and use of site-specific HSC. While it is true that certain elements of the study are much more detailed than the BLM assessment, it must be noted that the current study is not complete and is not adequately described in the FLA. Further, the site-specific HSC relationships developed rely solely on the habitat preferences of small fish residing in a reach with perennially reduced streamflows (as discussed above). For these reasons, it would be appropriate to consider the findings of the BLM study in this relicensing.

Table 1-7. PHabSim Flow Results for Redband Trout Life-stages in the Upper and Lower Reaches of the Upper Klamath Wild and Scenic River (BLM, 2002).

Trout life-stage	Upper Reach (CFS)	Lower Reach (CFS)
Fry	1700	Not Analyzed
Juvenile	2000	600
Adult	1600	900

Other instream flow recommendations that are applicable to project reaches include Hardy and Addley (2001) (Table 1-8) and the NOAA Fisheries 2002 Biological Opinion instream flow recommendations (NOAA Fisheries, 2002; Exhibit E 4-104). The results from these downriver studies could be utilized to develop minimum flows for all Project reaches by accounting for accretions between the downstream study sites and specific Project reaches. Average daily discharge also provides insight into flows for the JC Boyle peaking reach which would be available for minimum flow requirements in the project reaches (Table 1-9).

Table 1-8. Simulated Unimpaired Monthly Flows for the Iron Gate to Shasta River Reach for the 10 to 90 percent exceedance flow levels. These Values Were Derived From the MODSIM Outputs Within SIAM.

Exceedance	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
10	5282	6439	6302	6430	5259	4163	2829	2131	2076	2169	2664	4522
20	3792	5416	5463	5391	4613	3690	2528	1935	1843	1991	2284	3541
30	3666	4245	5045	4896	4313	3473	2129	1639	1813	1885	2081	2910
40	2990	3724	4394	4541	3785	2870	1986	1490	1754	1700	2020	2460
50	2738	3072	3913	3841	3568	2689	1854	1425	1503	1589	1897	2282
60	2541	2914	3389	3078	2848	2216	1739	1300	1377	1492	1717	2100
70	2299	2559	2838	2637	2361	2033	1462	1158	1296	1450	1613	1903
80	2037	2249	2390	2342	2218	1797	1325	1141	1174	1394	1584	1762
90	1871	1922	1909	1908	1962	1533	1148	1004	1021	1163	1434	1643

Table 1-9. Average Daily Discharge for the JC Boyle Gaging Station for the Water Years 1960 through 2000 (USGS Data).

Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
2483	2584	2932	2540	1888	1043	678	899	1208	1556	1954	2344

Department Conclusions Regarding Existing Environment, Project Impacts, and PM&Es

Ramping and Peaking

The proposed ramp rates for the J.C. Boyle peaking reach exceed the ramp rate standards applied to other hydroelectric projects in the Pacific Northwest (for example, the Pelton/Round Butte, Leaburg/Walterville, and North Umpqua projects). Although stranding of fish has been documented in the J.C. Boyle peaking reach (City of Klamath Falls, 1987), it is difficult to quantify reliable and unbiased estimates of total mortality (Hunter, 1992). The impacts of proposed Project operations in the peaking reach need further clarification with regards to identification of potential fish stranding areas (related to specific river stage changes), and development of ramp rates that sufficiently minimize fish stranding potential. PacifiCorp does not provide any substantive support for their proposed ramp rates.

The FLA acknowledges that Project operations appear to adversely affect the growth of older trout and the abundance of older age-classes in the J.C. Boyle peaking reach (compared to the Keno Reach). The wetted perimeter of the peaking reach experiences substantial changes on a near daily basis, resulting in adverse impacts to the abundance of macroinvertebrates (Exhibit E 4-97 and 4-174; Hunter 1992). The Keno Reach is not subject to the frequent flow fluctuations that characterize the peaking reach. Preliminary results from the fish movement study suggest that adult trout movement is curtailed during peaking events; results from the ongoing bioenergetics study will provide important information regarding the metabolic cost of foraging activities during peaking events. Thus, the J.C. Boyle operations and facilities appear to have an impact on growth and age-class abundance of resident trout.

Instream Flow

The instream flow study is especially time sensitive and needs to be finalized as soon as possible, as it will provide information of great utility to the development of instream flow regimes. The

Department recommends implementation of an instream flow ASR (see also Appendix C of the Department comments).

The Department believes that the proposed minimum flows in the J.C. Boyle bypass and peaking reaches will not provide adequate fish habitat. The proposed 100 cfs minimum flow downstream from J.C. Boyle Dam will reduce the extent of usable habitat for resident trout populations and will likely cause continued degradation of water quality conditions (high water temperatures and low dissolved oxygen) in the upper segment of the bypass reach. The hydraulic modeling conducted for the bypass reach did not separate the reach into two discrete segments and therefore does not account for the large groundwater accretions. Developing flow recommendations for the entire reach then reducing flows in the upstream segment by 220 cfs, is inconsistent with accepted instream flow assessment methodologies as agreed upon by the Instream Working Group and existing literature (Bovee et al. 1998).

The instream flow study is incomplete, and model runs incorporated in the FLA do not incorporate feeding stations, shear zones, velocity shelters, stream margin edge types, and cover categorizations. This data is important, as it represents the fine-scale diversity of riverine habitats. Lacking this data, the FLA presents a very narrow description of the flow-habitat relationships (Bovee, 2003 pers. comm.; Bovee et al, 1998). Further, although PacifiCorp's assessment has not been completed, the FLA does not consider the results of other completed assessments that may provide insight into flows suitable for the J.C. Boyle reaches, the Keno reach, and the Copco II bypass reach.

Fish Passage

FLA Discussion of Existing Environment, Project Impacts, and PM&E Measures

Existing Environment

The FLA describes the facilities present at the Project, including basic information on passage structures and a limited history on fish passage facilities. Where existing passage facilities such as ladders or screens exist (J.C. Boyle, Keno, and Link River Dams), current performance standards of each facility are presented in the FLA and compared with current state and Federal passage criteria for resident species. Current fishways at Keno and Boyle are not designed to current passage criteria for all resident and anadromous fish.

Project Impacts

The FLA states that Copco and Iron Gate Dams will continue to prevent upstream movement of anadromous fish to historic habitats. Hatchery operation, intended to mitigate for loss of passage, is expected to affect naturally produced salmon and steelhead.

Proposed Protection, Mitigation, and Enhancement (PME) Measures

- Install a new downstream screening device in J.C. Boyle Reservoir ("Gulper").
- Install an additional weir at the J.C. Boyle fish ladder to reduce the final step pool height.
- Widen the trashrack bar spacing at the J.C. Boyle fish ladder entrance to improve passage for larger fish.
- Install fishways at Fall Creek and Spring Creek diversions.
- Continue funding 80 percent of the CDFG Iron Gate Hatchery and increase fractional marking of hatchery Chinook salmon to 25 percent.

No PMEs are proposed for Keno Reservoir, fishways, or Dam.

Adequacy of Applicant's Information

Study Results

The Fish Passage Planning and Evaluation Study (Study Plan 1.10) and the subset of anadromous fish passage related studies (Study Plans 1.17 and 1.18) have not been approved by the Collaborative work group. The only proposed passage improvements are at the J.C. Boyle facility (both are actions necessary to bring the existing license into compliance and are inappropriate for consideration by FERC as PMEs for a new license). Information that is currently available for the J.C. Boyle facility includes results of engineering reviews of proposed structural modifications, new facilities, and other fish passage options with potential associated costs, as described in the FTR (7-14 to 7-87) for all other Project facilities. PacifiCorp assembled a body of literature as part of a genetics workshop (FTR 9.0) but did not include that information in the discussion of anadromous fish stocks suitable for reintroduction to the Upper Basin.

High Level Options Analysis

PacifiCorp agreed to conduct a "High Level" analysis of fish passage without Project scenarios in the Fish Passage Work Group (letter from Terry Flores, PacifiCorp Hydro Licensing Director dated February 22, 2002), but failed to include this scenario within the FLA. The omission of those results has contributed to an inadequate description of potential anadromous fisheries production in the Project area. The lack of model results for the without Project scenarios also prevents description of continuing effects associated with considerable potential spawning and rearing habitat currently under Project reservoirs.

The "High Level" analysis was included within the "Systems Landscape Options Matrix" (SLOM) being populated by the Plenary working group (FLA Appendix E1-A Consultation Record, Appendix B). The DOI does not concur with the FLA interpretation that the "High Level" analysis only committed PacifiCorp to developing the SLOM. The SLOM was intended to be used as an analytical tool for assessing an agreed-upon range of scenarios. DOI believes that PacifiCorp would have best met the intent of the "High Level" agreement by analyzing without Project fish passage scenarios in the fisheries component of the FLA.

Characterization of Entrainment

The discussion of fisheries entrainment does not adequately describe downstream passage conditions at Project reservoirs or the effectiveness of existing fish screens. Descriptions of fish movement through all Project reservoirs are absent, as are discussions of attraction flows and false attractions. Options to mitigate Project impacts on downstream passage through J.C. Boyle Reservoir are not discussed. Further, there is no discussion of the justification and expected benefits related to the proposed installation of a gulper type screen at J.C. Boyle Reservoir.

Without resident fish entrainment studies it is unclear how a substantive analysis of resident or anadromous fish entrainment in Project facilities will be developed. Further, since trout passage is not currently possible below Copco I, those fish that would have migrated through the Project can no longer exhibit that migratory strategy (Exhibit E 4-173). The DOI believes that resident fish would move through Project facilities and reservoirs if passage were provided. If adequate passage facilities were provided for resident species fish, movement between Project reservoirs could substantially increase, and the potential level of entrainment would also be expected to increase.

Anadromous Fish Reintroduction

History of Anadromous Fisheries - The DOI is concerned about FLA omission of discussion regarding continuing impacts of the Project on downstream anadromous salmonids and the impact of the Project on the range of culturally and economically important anadromous fishes (Chinook salmon, coho salmon, steelhead, Pacific lamprey, and green sturgeon).

The DOI is also concerned about the FLA omission of a thorough discussion and analysis of the history of anadromous fisheries in the Upper Klamath Basin, including the impacts of the Project on the fish distribution and abundance. Project operations that have affected the abundance and access of anadromous fisheries in the Upper Klamath Basin should be analyzed. The installation of Copco I dam eliminated salmon migration, but that is only part of the story of anadromous fisheries in the upper basin. A substantial body of literature and photographs document the history of anadromous fish, their habitats in the Upper Basin, and impacts to fish passage

(Fortune et al. 1966; Chapman 1981; Lane and Lane Associates 1981; USDI Fish and Wildlife Service 1991; Bowden 2003). This information was not included in the Historical Fisheries Resources (Exhibit E 4.1) and Anadromous Fisheries (Exhibit E 4.3) sections of the FLA. The FLA should build on the discussion presented in the Fish Resources FTR (section 9.7.3) to describe anadromous fish distribution within and upstream of the Project area. DOI believes this comprehensive understanding of anadromous fisheries in the upper basin should be presented. This information will provide context for discerning Project impacts and assessing potential restoration efforts upstream, within, and downstream from the Project.

Modeling

As the DOI has previously stated, all fish passage options for the Klamath Hydroelectric Project should be seriously considered, and this will require an analysis of anadromous fish habitat that would be made available under a full range of fish passage scenarios (potential habitat includes the upper basin in addition to the Project area and areas under existing Project reservoirs). PacifiCorp should have included the potential fish habitat in their modeling efforts rather than deferring to future efforts.

Review of the Ecosystem Diagnosis and Treatment modeling tool (EDT) parameters and attributes has not been completed. Nor has agreement been reached on some of the basic assumptions to be used in the EDT model. The utility of the EDT and KlamRAS relies on the modification of model parameters to accurately reflect the relative effects of each attribute on fish production. A thorough discussion of model parameters used when site-specific information is not available should also be provided. Lacking this background makes it difficult to interpret modeling results from EDT.

Significant adjustments to EDT attributes have been made since the FLA was submitted. Additionally, preliminary estimates for the Upper Basin have identified more than 1,000 miles of potential steelhead habitat and more than 500 miles of potential Chinook salmon habitat (Huntington 2004). None of this upper basin habitat was included in the modeling results presented in the FLA. Exclusion of the Upper Klamath Basin habitat from the results represents a major inadequacy in the discussion of potential fish production to be gained by providing passage.

DOI disagrees with PacifiCorp that EDT is intended to estimate the potential success of efforts to restore anadromous fisheries in the Upper Klamath Basin. The use of EDT was intended to assess productive capacity and limiting factors associated with habitat that exists within and upstream from the Project. EDT was also used to develop a “template” boundary condition that represents pristine (or fully restored) conditions and is to be used for relative comparison with existing conditions. The FLA does not describe model results for the template condition. Using template and existing conditions, EDT can also be used to conduct a limiting factors analysis which allows development of efficient and cost-effective habitat restoration strategies.

On several occasions the stakeholders, including the DOI, requested that EDT model outputs be presented in a manner that clearly indicates their value as relative, rather than absolute, indicators of potential fish production. It should have been clearly stated in the FLA that the model outputs do not represent accurate estimates of actual fish numbers, but instead are only relative indicators of expected productivity. As such, the output values are useful for comparing the relative benefit of various actions but are not directly indicative of actual fish production. DOI believes it is inappropriate to use EDT model outputs to describe expected success or failure of fish passage options, particularly at this stage of the model development when the model is incomplete and not

ready for use as an analytical tool. DOI believes that PacifiCorp's representation of the modeling process and use of such extremely preliminary results was both inappropriate and misleading.

The KlamRAS model is intended to assess the efficacy of various fish passage scenarios. However, no KlamRAS results are presented in the FLA or FTR. The DOI supports the development of KlamRAS for the purpose of assessing fish passage scenarios, but is disappointed that no results from this effort have been presented. PC stated they would conduct sensitivity analysis of model output using those capabilities in the KlamRAS model (see Appendix E1-A Consultation Record, Appendix B), however, like the KlamRAS model results, the sensitivity analysis was not included in the FLA.

DOI believes that the current state of knowledge regarding potential reintroduction strategies is limited, as is the understanding of the relationships and ranges of variability that affect fish and their habitats. It is difficult to describe, much less quantify, complex ecological processes. Therefore it must be recognized that modeling efforts conducted to date, at best, can be used to assess (in terms of relative fish production) various fish passage strategies. DOI believes the use of these models to predict absolute values of fish production numbers is inappropriate. Only by assessing habitat condition based on the actual observed use of habitat by living populations can we begin to reliably develop an understanding of the factors potentially limiting fish production in the Upper Klamath Basin.

Investigation of Trout and Anadromous Fish Genetics

Discussion of ecological relationships between anadromous and resident salmonids is largely absent for the FLA, and is discussed only in relation to the status of the genetics study (Exhibit E 4-145). The FTR provides interesting insights, but there are several issues and associated data needs that were not addressed (see Fish Resources FTR section 9.7.7).

This information would be useful to examine potential reintroduction effects on the genetic structure of existing resident trout populations from introduced steelhead (Fish Resources FTR 9-35). Additional analyses are desirable to identify and characterize the genetic stock structure of anadromous fish populations that are candidates for reintroduction above Iron Gate Dam. This information would allow managers to identify the population origin of fish migrating through fish passage facilities in the Project area. These data would also be useful for studying the outmigration and spawning periodicity of runs originating from geographically distinct regions above Iron Gate Dam. Genetic stock identification would provide managers with a powerful tool for determining if resident and anadromous trout returning to Iron Gate and other Project dams are from populations already residing in and above the Project or from downstream populations.

Genetic data would also be useful for evaluating whether mating and rearing protocols used in hatchery operations have minimized the potential for genetic divergence of hatchery fish from their wild counterparts and thus will maintain long term adaptive traits (FTR 9-35). These considerations, as well as other genetic and physical effects caused by hatcheries, should be integrated in a hatchery genetic management plan.

Investigation of Juvenile Anadromous Fish Behavior and Survival

PacifiCorp has proposed a pilot outmigrant behavior study in 2004 to document juvenile behavior in Copco and Iron Gate Reservoirs (behavior studies were limited to the California reservoirs due to the lack of approval for the proposed study by the Oregon Fish and Game Commission).

Resolution of disagreements regarding the size of the sample population (initial proposal was tagging 75 fish in each reservoir; the current study plan includes tagging of more than 200 fish in each reservoir), study objectives, and other issues delayed study plan implementation. Remaining issues to be resolved include the suitability of the proposal to use hatchery fish (unlike native outmigrant smolts, hatchery fish would not be adapted to the Upper Klamath Basin) and the experimental use of hatchery fish in the Upper Klamath River because this use is inconsistent with ODFW policy. While this study is underway, the plan has never been approved by the Collaborative.

The pilot outmigrant behavior study (originally Study Plan 1.18) is not adequate to address fish survival (Exhibit E 4-139; Appendix E -1A, Consultation Record, Appendix B). The proposed sample size is not sufficient to estimate survival through Project reservoirs or fractional mortality associated with distinct Project features (spillways, turbines, screens, ladders). Despite these important limitations, the proposed study will provide some insight into aspects of fish behavior, within reservoir travel time, and passage characteristics (fish concentrations, attraction flows, and initial assessment of exposure to predation) in Copco I, Copco II, and Iron Gate Reservoirs and associated facilities. Based on the results of this study, further studies would address a range of reservoir operations and specific facility modifications intended to improve reservoir passage characteristics.

Proposed facilities (off-site mitigations such as smolt collectors) located upstream of the Project area also need to be assessed for Project impacts and consistency with restoration objectives.

Alternative Information/Interpretation and Corrections to the Record

History of Anadromous Fisheries

Historically, the Klamath River provided passage, incubation, spawning, and rearing habitat for anadromous salmon, steelhead, and Pacific lamprey from the ocean to various tributaries of the Klamath River, and to headwaters well above Upper Klamath Lake. These fish runs were permanently blocked as early as 1910 by initial construction at Copco I Dam (completed in 1917) (City of Klamath Falls Oregon 1986). Five more dams were subsequently built on the Upper Klamath River. Copco I, Copco II and Iron Gate Dams are located in California. Link River, Keno, and J.C. Boyle Dams are located in Oregon (PacifiCorp 2000). The dams on the Klamath River have affected fish species distribution throughout the Klamath Basin. J.C. Boyle, Keno, and Link River Dams have fish ladders intended for trout migration. Only J.C. Boyle Dam has a screening facility to prevent entrainment of fish into the power diversion canal.

Fall Chinook and spring Chinook salmon historically spawned within the Sprague River (Fortune et al. 1966; Lane and Lane Associates 1981). Runs were seen at Beatty, Oregon, upstream of Sprague River, and spawning was reported in the North and South Forks of the Sprague. Historically, entry of spring Chinook to the Upper Klamath River area probably occurred in March. Fall Chinook entry to the Sprague River was noted in September and October. Spier (1930) states “that runs came in the middle finger months, May and June” meaning they were likely spring Chinook. Spring-run Chinook salmon in the Klamath Basin were very important historically, outnumbering fall Chinook stocks substantially (Gatschet 1890; Spier 1930, Hume in Snyder 1931).

The FLA minimizes the importance of spring run Chinook. The FLA quotes that there may have been a run of spring Chinook salmon to upper Klamath Lake “but they were gone before the time

when the white man came to the area" (Fortune et al. 1966) (Fish Resources FTR, page 2-34 and page 7-3). However, Lane and Lane Associates (1981) refer to the second white visitor to Klamath Lake in May of 1846 and his observation of great numbers of salmon coming up the river to the lake (most likely these would be spring Chinook). Gibbs (in Cooper and Suckley 1859) reported that "Spring salmon enter but few rivers on the coast…Both the spring and winter kinds run up the Klamath and Sacramento in vast numbers."

The coho salmon adapted to the Upper Klamath Basin had been lost sometime prior to fish collections between 1914–1918 at the Klamathon. Currently the Southern Oregon/Northern California Coastal Coho Salmon Evolutionary Significant Unit (which includes the Klamath River populations downstream of Iron Gate Dam) was listed as threatened under the Endangered Species Act in 1997 (62 FR 24588). Designated critical habitat for Southern Oregon/Northern California Coastal coho salmon occurs downstream of Iron Gate Dam (May 5, 1999; 64 FR 24049).

Total Elimination of Anadromous Fish Access and Inadequate Mitigation

As stated in 18 CFR§ Section 4.51(f)(3), Exhibit E is required to discuss the fish resources in the vicinity of the project and the impact of the project on those resources. However, other than a brief discussion on page 4-15, the Exhibit E discussion is focused only on the project study area (page 2-9). The FLA generally downplays the value and extent of habitat lost above Upper Klamath Lake to anadromous fish (including spring Chinook), as well as the loss of Tribal fisheries, that are due to the impacts of the Project. The Long Range Plan for the Klamath River Basin Conservation Area Fishery Restoration Program (Long Range Plan) (USDI Fish and Wildlife Service 1991) clearly identifies the lack of passage beyond Iron Gate Dam as a significant impact to the Klamath River anadromous fishery.

The construction of Iron Gate fish hatchery, after lengthy resistance and delay on the part of the power company, provided mitigation for fishery losses only for the 16 miles of spawning habitat in the Klamath River and its tributaries between the Iron Gate Dam development and Copco 1 Dam (Federal Energy Regulatory Commission 1963). There are an estimated 41.5 miles of possible anadromous habitat within the Project area. However, the Project impacts include the elimination of access to the Upper Klamath River basin, which may have upwards of 1,000 miles of un-utilized habitat (Huntington 2004).

Impacts of Current, Inadequate Upstream Passage for Resident Fish

The FLA has ignored the deficiencies of the existing passage facilities for resident fish, and proposed only minor modifications for upstream passage.

Project Impacts

Redband/rainbow trout (*Oncorhynchus mykiss*) passage studies at the existing upstream fishway at J.C. Boyle indicated that in 1959, over 5,000 trout used the ladder (Hanel and Gerlach 1964), while from 1988-91, only 70 to 588 trout used the ladder. This points out a dramatic decline in fish passage (Hemmingsen et al. 1992). Contemporary passage continues to be less than 10 percent of that reported one year after Project construction of J.C. Boyle Dam (Oregon Department of Fish and Wildlife (ODFW) 2001). Radio-tagging studies of redband trout movements showed that only one of 28 tagged trout passed upstream through the ladder.

Corrections to the Record

Problems with existing upstream passage and the decline in runs at the J.C. Boyle ladder are significant. The FLA attributes this decline to the recent absence of the large numbers of hatchery fish that ODFW stocked until 1978 (Fish Resources FTR, page 7-153). The Department of Interior (DOI) finds this very unlikely. While as many as 21,500 fish were stocked annually at the upper end of J.C. Boyle reservoir each spring, these fish, not native to the basin, were expected to succumb to *Ceratomyxa shasta* prior to successful spawning (and any use of the ladder). Survival of hatchery fish may have elevated ladder counts slightly, but this survival was estimated at no more than 2.8 percent (letter from PacifiCorp to U.S. Fish and Wildlife Service (Service), dated October 10, 2003). Thus, counts of native fish at the ladder were likely to have exceeded 5,000 trout in 1959 regardless of any potential influence of hatchery fish.

Historically, fish in the Boyle reach moved downstream as fry and juveniles, then returned upstream to spawn in Spencer Creek or the mainstem river. Rather than the five reasons proposed in the FLA (Fish Resources FTR, page 7-149) for the severe decline in trout passage, the DOI believes that one of the most likely reasons is that fish often cannot access the ladder entrance. On September 17, 2003, Service and other agency biologists waded the channel from the base of the fish ladder to the fish screen bypass outfall. These observations provided a unique perspective not afforded from the dam or road. This channel is very steep and passage is likely to be extremely difficult for resident fish to navigate under most conditions. The high gradient here is likely due to channel degradation and a reduced sediment supply below the J.C. Boyle Dam over the years since the construction of the dam and spillway. In other words, the gradient that existed as part of the original fishway has not been maintained over the term of the license. This physical characteristic is important to the operation of the existing fishway (letter from the Service and ODFW to PacifiCorp dated February 26, 2004). Some supporting evidence that trout have difficulty accessing this fishway can be seen from the radio-tagging chronology for the five radio-tagged fish that traveled to the vicinity of the ladder. One fish spent five days below the ladder entrance before successfully navigating passage (Fish Resources FTR, Appendix 5C, and page 14). After moving upstream to the vicinity, three others spent significant periods of time in the vicinity of the ladder entrance, but never passed upstream (Fish Resources FTR, Appendix 5C).

The FLA also attributes the reduced passage to a possible change in trout behavior over the years in an adaptive response to new conditions with the dam in place (Fish Resources FTR, page 7-155). If this is true and fish no longer return to natal spawning or over-wintering areas because they have been affected by the construction of the dam, then this is a significant project impact and should be reported as such in the FLA.

Finally, DOI disagrees with the conclusion of the radio-tagging study that there is no evidence of delay or deterrence of fish at the fish ladder (Fish Resources FTR, page 5-41). As noted above, fish are likely deterred from accessing the ladder entrance. Once a trout is in the ladder, we agree that the 3.5 hours to ascend is within the range of other observations for ladders of this length, but data are needed from more than one fish.

DOI also disagrees with the conclusion of the radio-tagging study that there is no evidence of delay or deterrence of fish at the powerhouse. The data presented (Fish Resources FTR, page 5-36 and 37) make the case that in ten instances, downstream migrating fish pass quickly by the powerhouse. However, information on five upstream-moving fish shows that the two longest delays observed (213 and 24 hours) occurred near the powerhouse. As stated in the Fish Resources FTR (page 5-37), the behavior of Fish 13 warrants further consideration. This fish

moved into the vicinity during an extended period of powerhouse generation and remained in this vicinity for 213 hours. This fish represents 20 percent of the observations of upstream passage past the J.C. Boyle Powerhouse. We agree that it is unknown whether this fish was delayed or deterred by project operations at the powerhouse. In total, these observations do not constitute a lack of evidence of delay or deterrence of fish at the powerhouse, as claimed in the FLA.

Fish Entrainment

Significant entrainment of federally listed suckers has been documented in 1997-1999 at the Link River Dam hydroelectric facilities (Gutermuth et al. 2000) upstream from J.C. Boyle Dam. Of ten larval fish species observed, suckers comprised the second greatest percentage of identifiable fish entrained at the Link River facilities in this study. Juvenile or adult suckers comprised between 1-20.5 percent of the total of non-larval fish entrained, with federally listed Lost River and shortnose suckers making up the vast majority of catastomids. These hydroelectric facilities are similar to the downstream generation facilities, especially those at J.C. Boyle.

At the J.C. Boyle Dam, which creates a reservoir with fish populations similar to Upper Klamath Lake, the screens that are currently installed do not meet current design criteria and are ineffective. This is apparent in the number and size of trout and unidentified suckers salvaged during canal maintenance activities. Oregon Department of Fish and Wildlife ((ODFW) 2001) reported fish salvages in the J.C. Boyle power canal of 133, 12, and 68 trout in July 1988, 1990, and 1991, respectively, when the Project was shut down for annual maintenance. Fish ranged in size from 50-300 mm. This was reported as "alarming as only a small percentage of the total volume of water in the canal was sampled, and that fish screens had been operating at J.C. Boyle since the last shutdown. The finding of fish in the canal seems to indicate the effectiveness of the J.C. Boyle dam fish screening devices is limited at best." PacifiCorp (1997) also reported tagging a high number of fish as a result of salvage operations in the canal below the dam. The May 1988 ODFW monthly report also discussed sampling of the attraction flow diffuser chamber at J.C. Boyle dam with a backpack electroshocker, resulting in the capture of seven redband trout, ranging in length from 142-337 mm. Salvage data show the entrainment of over 690 trout into the "Boyle reach" during salvage operations between 1995 and 2002 (PacifiCorp website). In 2003, one salvage operation at J.C. Boyle totaled 86 trout and 17 suckers. All suckers salvaged in the J. C. Boyle canal or bypass were less than 6 inches in length and apparently could not be identified to species. As these salvage data were counts during very limited time periods, they represent only a small fraction of the total fish entrained.

Finally, radio-tracking results showed that the radio-tagged 14-inch trout that passed upstream through the J.C. Boyle ladder also migrated downstream through the power canal and turbines and was not excluded by screens.

The above information clearly indicates that both small and large fish are passing through or around downstream protection screens at J.C. Boyle at some unknown level of entrainment.

Rather than complete studies which measure the magnitude and scope of the entrainment impacts, the FLA instead proposes to substitute a literature review of studies from midwestern lakes and reservoirs dissimilar to the Klamath that do not have federally listed suckers (or, for that matter, few sucker species at all). In many of the ten reservoirs in the Upper Midwest proposed for comparison (Table 7.12-8, Fish Resources FTR Page 7-164), the dominant fish species entrained (such as channel catfish, common shiners, rock bass, white suckers, or walleyes) are not present in Klamath reservoirs. Given the differences in species composition, climatic differences, trophic conditions of mid-western reservoirs, differences in project operations, and the geographic

distance from the Klamath project, the FLA's comparison of these studies with the Klamath reservoirs is inappropriate and may be misleading.

Consultation

The FLA has proposed to forego entrainment studies and instead install a gulper to collect fish at the J.C. Boyle facility. However, without an assessment of the magnitude and scope of project impacts or the efficiency of the existing downstream fishway quantified for a comparison, the DOI has no basis to determine whether a gulper or any other downstream fishway design would be an improvement over properly maintained criteria screens.

One of PacifiCorp's objections to entrainment studies is the expense (Appendix E-1A Page 1-19). At a June 30, 2003, relicensing conference call to discuss a draft agreement concerning fish passage at the J.C. Boyle Dam, PacifiCorp stated that they would install screens to criteria rather than spend money on additional entrainment studies (Kearns & West 2003). However, the FLA did not propose screens, nor did the FLA propose studies of entrainment. This situation could leave the agencies with no study results to determine if screens are necessary, and no screens to mitigate known impacts.

PacifiCorp's claims that bottom dwelling fish such as bullheads and suckers are less prone to entrainment (Exhibit E, page 4-113, Fish Resources FTR, page 7-165) are purely speculative. Gutermuth et al. (2000) showed that these bottom dwelling species behave differently at night and are vulnerable to entrainment. This finding is the basis for the current summer shutdown of the West Side powerhouse at Link River and the requirement to minimize load (200 cfs) at the East Side powerhouse at night, per the Service's 2002 Biological Opinion requirement to reduce take of endangered shortnose and Lost River suckers (Fisheries Resources FTR page 7-170).

It is extremely unlikely that Sacramento perch occur in any of these mid-western reservoirs as Table 7.12-8 (Fish Resources FTR Page 7-164) purports.

PacifiCorp Responses

In response to comment F9-1 (E-1A Appendix B Second Stage Page 7) and comment F9-45 (E-1A Appendix B Second Stage Page 26), PacifiCorp states that proposed PMEs are designed to reduce project impacts on ESA listed sucker, native and non-native resident fish species where these actions are supported by the data collected as part of the relicensing proceedings. However, no data have been collected as part of the relicensing proceedings despite our requests. As stated in the DOI letter dated September 24, 2003, the DLA was inadequate, in that it provided no evaluation of Project entrainment impacts and we requested that data be collected. Despite repeated Service requests for studies, almost no entrainment data have been collected or provided in the FLA. Thus, the impacts of the project are not known, and PMEs proposed by PacifiCorp cannot be adequately supported by information provided to-date by PacifiCorp. While in some instances we may agree that the literature reviews of turbine and spillway mortality are adequate, our position continues to be that site-specific entrainment studies are required.

Without completion of these studies and the associated analyses, the DOI will have insufficient information from which to draw conclusions, and therefore, will need to be conservative in our recommendations to protect, enhance, and mitigate for the loss of resources for which the DOI has specific authorities and responsibilities.

The FLA states that resource agencies have expressed the opinion that facilities must be screened if even one resident fish is entrained and lost. PacifiCorp provides no attribution or documentation for this statement, and the DOI believes that an examination of the record of the proceedings will demonstrate that this statement is simply false. One resource agency, the California Department of Fish and Game, cannot authorize the take of fully protected species, such as shortnose and Lost River suckers. This should not preclude PacifiCorp from completing entrainment studies, especially at J.C. Boyle on the Oregon side of the border.

In the FLA, PacifiCorp states in the response to comment F9-1, that they have been unwilling to collect site-specific data on fish entrainment at Project facilities without DOI and other agencies providing performance criteria from which to evaluate study results. However, it is the responsibility of the applicant to describe the impacts of the project and PME development would require performance standards regardless of the presence of such agency criteria.

Finally, the FLA also states in the response to comment F9-1 that, given the opinion expressed by the agencies regarding this issue, it seems that entrainment studies would have no impact on agency recommendations as to the need for screening. It is also stated that resources should instead be directed towards researching and identifying the appropriate actions to satisfy entrainment reduction and resident juvenile fish passage performance criteria (Appendix E-1A page 1-19); it is also stated that having better estimates of entrainment mortality based upon site specific studies would not provide much more useful information than information obtained from the aforementioned literature-based review (Appendix E-1A page 1-20). DOI does not agree with this statement. Again, it is the responsibility of the applicant to describe the impacts of the project and develop appropriate PMEs. The results of entrainment studies could potentially result in agency recommendations that fish exclusion devices or screens are not needed or needed only during certain periods of the day or year.

Characterization of Anadromous Fish Reintroduction Prospects in the FLA

Citation of Reviews Contrary to Fish Passage

In response to the DOI's Upstream Fish Passage Problem Statement in the DLA letter (Response to Comment F9-30, E-1A Appendix B, Second stage page 22), PacifiCorp refers to three separate reviews performed by resource agencies that have all concluded that anadromous fish should not be introduced into the Upper Klamath Basin, and states that, despite the hundreds of miles of habitat in the upper basin (Edmondson 2003; Huntington 2004), independent reviewers have concluded that factors such as poor water quality, development, lack of suitable stock for reintroduction, lack of fish passage facilities, and low survival through Klamath Lake make it unlikely that anadromous reintroduction would be successful.

DOI strongly disagrees with the FLA's representation of these reports for the following reasons. First, the FLA and PacifiCorp's response is in error in attributing this conclusion to a completed Upper Basin Amendment to the Long Range Plan. The FLA erroneously states (Executive Summary, page 4-14; Exhibit E, pages 4-116 and 4-117; Fish Resources FTR, page 7-4) that the Klamath River Basin Fisheries Task Force completed an Upper Basin Amendment to the Long Range Plan and claims that the Task Force did not support restoration of anadromous fish above Iron Gate Dam. These statements are erroneous. The Upper Basin Amendment to the LRP has never been approved by the Task Force.

Second, the Minority Recommendation from the full Steering Committee for the Fortune et al. (1966) study highlighted limitations in the conclusions made by the Steering Committee and suggested that reintroduction should occur. The following text is taken directly from the Minority Report:

> "The findings of the Steering Committee, based on the above report, indicate that it is biologically feasible for spring Chinook salmon and steelhead trout to be re-established in the Upper Klamath Basin, since both species migrate at such times that the water temperature and dissolved oxygen content of the waters of this Basin would be satisfactory.
>
> It also appears that there is ample spawning area available and that there is little or no question regarding the suitability of the Basin for a spawning area for spring Chinook salmon and steelhead.
>
> The Study indicates that there is no biological problem with the re-establishment of steelhead and/or Chinook salmon as far as Keno at this time, and in all probability as far as Upper Klamath Lake, in the State of Oregon. The basic problem is physical, and that is the existence of three dams constructed by a public utility in the State of California with no fish passage provided" (Puckett et al. 1966, page 12).

Third, the FLA (Exhibit E, pages 4-116; Fish Resources FTR, Page 7-5) cites and quotes the following:

"The Oregon Department of Fish and Wildlife (1997) review concludes with the following statement:

> 'Because of existing habitat problems, loss of native stocks, risk of disease introduction and potential competition with remaining native redband trout, it does not appear feasible, or prudent, to attempt re-establishment of anadromous salmon or steelhead to the Upper Klamath River basin in Oregon, now or in the future.'"

Importantly, the FLA omitted the second half of this paragraph, which goes on to state:

> "However, ODFW will support such re-introductions if and when the biological and physical questions are addressed and show that such actions are feasible and prudent. Further, ODFW would support future studies addressing that feasibility and the habitat restoration that would be conducive to successful reintroductions. Still the welfare of remaining native fish stocks in the upper Klamath River Basin ecosystem should be the paramount deciding factor in any future deliberations," (ODFW1997).

The characterization of these three reviews in the FLA is misleading. DOI has requested and continues to request, that PacifiCorp and FERC ensure that complete, objective, and unbiased information be provided that will contribute to dialogue regarding upstream passage of anadromous fish above Iron Gate Dam.

Regarding the assertion in the FLA (Fish Resources FTR page 9-34) that "there is a high degree of uncertainty in reintroducing salmonids to their native ranges and it is a generally difficult process", we could find no support for that statement in the section of Groot and Margolis (1991) cited. To the contrary, numerous examples of successful introductions of anadromous salmonids

exist from Alaska (Blackett 1981; Wright et al. 1997; Bryant et al. 1999) to New Zealand, Chile, and the Great Lakes (Groot et al. 1991).

Genetic Concerns

In regard to appropriate stock selection and the genetic concerns (Executive Summary, page 4-14; Exhibit E, pages 4-116 through 4-119; Fish Resources FTR page 9-34), colonization and re-colonization of riverine habitats is considered to be part of the natural evolutionary biology, or strategy, of anadromous salmonid fishes. "Straying", as part of the natural biology of anadromous salmonid fishes, provides an evolutionary mechanism for salmonids to invade and colonize new habitats, either on climatic time scales or in response to catastrophic events (e.g., re-colonization of the Toutle River following the eruption of Mount St. Helens). Re-colonization of natural habitats following the extirpation of natural populations does not occur immediately, but is a gradual, dynamic, evolutionary process that may last decades or centuries, both in terms of geographic expansion and relative abundance of populations over time. In this context, the extirpation or absence of "pre-adapted" populations clearly does not prevent natural re-colonization by anadromous salmonids. For example, sockeye salmon were extirpated from the Lake Washington watershed near Seattle in the early 1900's after a river was diverted and a ship canal constructed. Subsequent transplants from Baker Lake (near the Canadian border) into Lake Washington and the Cedar River have resulted in annual runs of 100,000 to 400,000 adults in recent years (Hendry et al. 2000).

Such re-colonization and restoration of naturally spawning populations is also expected to result in the gradual increase in mean fitness and local adaptiveness of natural populations over time with respect to life history traits, physiological traits, etc. Obviously, restoration of anadromous salmonid populations to a high level of local adaptation will not occur in spawning cycle. Rather, one would expect population restoration to take multiple spawning cycles with mean population fitness increasingly gradually over time until some fitness optimum for the specific habitat/environment was attained.

The absence of “pre-adapted” populations is not a valid argument against restoration of naturally spawning populations upstream of Iron Gate Dam where salmon and steelhead historically occurred. Providing existing populations of salmon and steelhead with access to the upper Klamath River above Iron Gate Dam (and other dams on the Klamath River) would allow that natural evolutionary process to begin. There may be habitat or ecological reasons that would inhibit re-colonization of the upper Klamath River by salmon and steelhead (though that is doubtful), but genetic arguments alone are not sufficient to preclude passage and the opportunity for re-colonization to occur. Moreover, an aggressive management strategy to "restore" populations to the upper watershed (such as is occurring on the Elwha River) may not be necessary for all species. Simply providing passage at mainstem dams may be sufficient to achieve the long-term goal, assuming, of course, that dams and the presence of reservoirs does not prevent upstream migration, "straying,” and natural re-colonization.

The DOI believes that State and Federal Fisheries agencies are the best organizations to decide which stocks are appropriate for reintroduction.

Disease Concerns

The FLA Executive Summary (page 4-14) and Exhibit E (page 4-116, page 4-118, and page 4-119) cite concerns raised by the Oregon Department of Fish and Wildlife (ODFW 1997)

regarding the risk of the potential introduction of viral disease to native trout in the upper Klamath Basin. However, no review of the likelihood of introduction of viral disease or objective assessment of this risk has been provided.

Viral testing has been conducted at Iron Gate Hatchery since about 1968, and results have always been negative for IHN, IPN, EIBS, or other viral disease (Pers. Comm. Bill Cox, CDFG). To further ensure the health of fish in the upper basin following establishment of passage, mitigation factors can be applied to reduce disease risk. For example, stocking juveniles from inspected parents involves much less risk than moving feral adults. With the Klamath stocks spawned at Iron Gate Hatchery having no history of viral infection, it would appear that the low risk for this type of pathogen could be rendered almost non-existent with careful selection and screening of eggs and fry for controlled reintroduction.

Adverse Water Temperatures

The FLA states that water temperatures are not conducive to upstream and downstream passage (E-1A, Appendix B Second Stage page 49, and Response to Comment S3-39; E-1A Appendix B Second Stage page 13, Response to Comment F11-75). It is true that water quality is impaired at certain times of the year in some areas such as Lake Euwana and Project reservoirs. However, anadromous smolts likely avoided migration during the poorest water quality months historically. Fortune et al. (1966) reported that by the end of May, nearly all young salmon departed from the upper end of their range in the Klamath River. Coots (1962) reported no seaward migrants to be recovered downstream during the summer and their presence then is doubtful. Reintroduced fish may only need to access water quality impaired areas during spring and fall when water quality is relatively good and not during poor water quality times of the year (June, July, August, September). By focusing on the months of the year with the highest water temperatures and poorest water quality, the FLA ignores passage potential during the majority of the year.

Other Studies and Modeling Efforts

Chapman (1981) developed conservative estimates of Chinook salmon production above Iron Gate Dam. The estimated adult return of Chinook salmon above Iron Gate Dam was 21,000; escapement needed to seed the available rearing habitat above Iron Gate Dam was estimated at 5,974. Upstream from Upper Klamath Lake, adult returns were estimated at 15,052 and escapement needs were 4,181. Chapman noted that these estimates should be considered conservative due to the assumption that degraded habitat would not be restored, the exclusion of tributary production from the analysis, and the high likelihood that average smolt yields from the Williamson and Sprague Rivers should be increased relative to other salmon rearing areas due to the relatively constant streamflows in these rivers. Using six different methods, Huntington (2004) provided preliminary estimates of the current potential of the Klamath Basin upstream from Iron Gate Dam for anadromous fish returns to be 9,000 to 32,000 adult Chinook salmon and 7,500 to 9,500 adult steelhead. Huntington (2004) also provided preliminary estimates of the historical potential of the Klamath Basin above Upper Klamath Lake for anadromous fish returns to be approximately 150,000 to 435,000 adult Chinook salmon and 7,000 to 20,000 adult steelhead.

The Habitat Modeling Subgroup (HMS) has been through the collaborative process to parameterize EDT from Iron Gate Dam to Spencer Creek. These parameters are still subject to review by the HMS and the use of the model has not been endorsed by the HMS or the Collaborative. In its letter dated April 8, 2003, the DOI requested that, “once the work group is

comfortable with modeling assumptions, PacifiCorp needs to include all potential fish habitat in the Phase 1 modeling effort, rather than wait for Phase 2 or Phase 3".

Unfortunately, PacifiCorp has ignored this request and misused the EDT model by including these preliminary results in the FLA (Executive Summary, Page 4-15; Exhibit E, Page 4-122) to make the case that Chinook production is probably not sustainable in the project area (Exhibit E Page 4-122). The FLA Executive Summary (Executive Summary page 4-15) omitted the caveat that these preliminary, unendorsed model runs apply only to the project area, leaving the reader with the impression that results apply to all habitat above Iron Gate Dam.

In our letter dated April 8, 2003, the DOI requested this modeling effort be completed. In informal comments on remaining draft study plans relevant to relicensing, dated June 20, 2003, the DOI stated that "EDT models must be developed in a transparent, collaborative manner with input from stakeholders. Only when agreement is reached on assumptions and a comfort level achieved by stakeholders regarding the basis for modeling will EDT be a useful tool for the Klamath relicensing." In our letter of September 24, 2003, the DOI asked for the completion of this effort, and stated that without adequately completed EDT and KlamRAS models "the [DOI] must rely on historical and other information for an assessment of the quantity and quality of habitat above Iron Gate Dam."

Chinook Life History Plasticity and Spring Chinook Historical Significance

Chinook salmon appear to have evolved a variety of juvenile and adult behavior patterns in order to spread the risk of mortality across years and across habitats (Stearns 1976; Real 1980). The existence of this degree of variation indicates considerable plasticity in the species. By doing so they avoid the potential disaster associated with high mortality associated with a particular year or habitat (Groot et al. 1991). Studies suggest that Chinook should be able to adapt readily to new situations and the success of Chinook transplants to New Zealand, Chile, and the Great Lakes testify to the adaptability of the species. The strategy of having a variety of life history tactics may partly explain why Chinook have been able to persist in the face of continued heavy fishing pressure and, in some cases, significant habitat modification (Groot et al. 1991).

Spring run fish were historically the predominate life history for Chinook in the Klamath River (USDI Fish and Wildlife Service 1991). The dominance of this race likely would also have included all the migratory strategies for smolt outmigration. The periodicity chart as presented does not include all life history strategies that exist in the Klamath. Olson (1996) described the presence of three life history strategies for spring Chinook in the Salmon River, a tributary of the Klamath River:

> Type I – individuals rear in freshwater for a few weeks or months before entering the ocean in late spring or summer.
> Type II – individuals exhibiting these characteristics rear in natal stream, mainstem Salmon and/or Klamath Rivers, or the estuary prior to entering the ocean in autumn or early winter.
> Type III – life history characteristics represent individuals which rear in freshwater for most or all their first year, with some individuals overwintering in their natal stream before emigrating during spring.

Analysis thru back-calculation of scales from Salmon River Spring Chinook salmon identified 8.6 percent as Type I, 84.3 percent as Type II, and 7.1 percent as Type III at timing of outmigration. PacifiCorp's periodicity chart only includes Type II and Type III but does not include Type I

(Exhibit E 4-25). Olson's Salmon River study suggests that if type III is to be represented then type I should also be represented. Studies in this relicensing (such as KlamRAS and EDT) that assess Chinook salmon should also include the Type I life history.

Spring Chinook that existed above Upper Klamath Lake would likely have employed diverse life history strategies similar to the Salmon River spring run Chinook. Other interior stocks east of the Cascades are generally considered stream type (Type II or III). In predicting the potential historical range of Chinook and steelhead, (Thurow et al. 1999) mapped habitat for the upper Klamath River system (north of the California border) as that of stream-type Chinook salmon rather than ocean-type (Type I or fall Chinook). Substantial high water quality habitat exists today in the Wood and Williamson Rivers that would provide for the needs of stream-type Chinook. Significant resources of cold ground water occur in the Sprague (Leonard and Harris 1974). Ongoing restoration efforts promise to further improve habitat in all watersheds above Upper Klamath Lake. The autumn or early winter out-migration timing of the Type II individuals would avoid poor water quality periods of the year.

Fall spawning runs also occurred above Upper Klamath Lake. Lane and Lane Associates (1981) provide at least two accounts (pages 62 and 63) of fishing for Chinook in the fall months in the Sprague River. It is likely that these fall run fish were Type I. This additional life history strategy would have given their cohorts the flexibility to avoid the risk of outmigration from the upper during poor water quality.

Other than Exhibit E-page 4-14 and page 6-6, however, little mention is made in the FLA of the extent of habitat above Iron Gate Dam, the diversity of Chinook life histories, and the predominance of a spring Chinook run in the basin. The diverse life histories of Chinook actually provide opportunities for re-introduction that are not adequately recognized in the FLA.

Historical Presence of Other Anadromous Species Above Iron Gate Dam

Pacific lamprey, coho salmon, and anadromous rainbow/redband trout also occurred in and above the project historically (Hamilton et al. 2004). The FLA (Fisheries FTR page 7-3) states that there was no conclusive evidence that steelhead trout ever existed above Upper Klamath Lake. DOI disagrees. Whether anadromous redband or steelhead, it is likely that anadromous *O. mykiss* were present in the upper basin. Behnke (1992) has proposed that the coastal rainbow trout or steelhead (*Onchorynchus mykiss irideus*) and the native lacustrine Upper Klamath redband trout (*Onchorynchus mykiss "newberrii")* are both native to the Klamath River system, but his data indicate they are quite distinct. He states that it is possible that, as in the Columbia Basin, runs were composed of both subspecies and that the redband group may have utilized anadromy until blocked by Copco dams in the early 1900's. It is generally believed (although definitive information on this topic is scarce) that progeny of non-anadromous *O. mykiss* can be anadromous and that anadromous *O. mykiss* can produce nonanadromous progeny. Thus, given this and the strong possibility that Klamath Lake redband trout utilized anadromy, for the purposes of this summary, the distinction is moot. Again, the construction of Project dams eliminated these anadromous runs and their associated fisheries.

DOI Conclusions Regarding Existing Environment, Project Impacts, and PM&Es

The Project has had profound negative effects on the distribution and populations of anadromous species in the Upper Klamath Basin. Anadromous salmonids once migrated to areas well above the Project. The presence of currently suitable habitat, refugial areas of high water quality, and the persistence of sustained resident salmonids populations (redband trout) in much of the Project

area and in the Upper Klamath Basin (also including brown and brook trout) indicates that reintroduction of anadromous salmonids above Iron Gate Dam is achievable. Fragmentation of habitat for resident fish populations has occurred due to Project dams and reservoirs and fish passage through Project reservoirs would restore connectivity among population segments.

Development of the Iron Gate Hatchery complex was intended to maintain populations of anadromous salmonids and to mitigate for loss of access to habitat between Copco 1 Dam and Iron Gate Dam. It has not achieved this. Since development of the Iron Gate facility, one anadromous species has been listed under the Endangered Species Act. Hatchery operations and production goals for Chinook salmon, coho salmon, and steelhead smolts by themselves do not appear to be achieving basic objectives of providing a stable fishery resource for downstream uses and do not provide any mitigation for upstream Tribes.

The FLA narrowly focuses on impediments to anadromous fish reintroduction, exaggerating uncertainties associated with the process, and largely ignoring the documentation of anadromous salmonid colonization of unused habitat and the adaptability and plasticity these species have demonstrated.

The "sustainability" of reintroduction has been presented in terms of EDT estimates based on conditions within the Project area (Executive Summary, Page 4-15; Exhibit E 4-122). Estimates of fall Chinook production on the order of 450 to 4500 fish do not account for potential habitat upstream from the Project. Referring to these limited, premature analyses, PacifiCorp notes their concerns regarding the sustainability of efforts to restore anadromous fisheries through Project facilities (Exhibit E 4-116). The DOI appreciates the gravity of issues regarding reintroduction as it relates to Project impacts and the breadth of PME measures necessary to establish populations above Project facilities. Nonetheless, the DOI cannot support the inappropriate use of absolute estimates of fish production as the standard for assessing the success or failure of efforts to restore the range of anadromous fish. EDT modeling needs to be completed in coordination with the Collaborative Aquatics Work Group, and mitigation measures that adequately address Project impacts must be developed.

Completion of entrainment and mortality studies will be necessary to evaluate continuing impacts of Project facilities and operations on resident and anadromous fisheries. These studies need to produce reliable estimates of entrainment and turbine mortality (including turbine fraction), bypass mortality (including bypass fraction), and spillway mortality (including spillway fraction). These estimates should be based on empirical, site-specific data collected during a range of representative conditions and over an appropriate period of time. Estimates of collection mortality trap and haul mortality, and estimates of mortality incurred by outmigrants through existing reservoir conditions are needed under a variety of operational scenarios. Implementation of these studies should occur in concert with efforts to reintroduce anadromous salmonids to the Upper Basin.

Two of the PMEs proposed (the installation of an additional weir at the J.C. Boyle fish ladder to reduce the final step pool height and the widening of the trashrack bar spacing at the J.C. Boyle fish ladder entrance to improve passage for larger fish) are actions necessary to bring the existing license into compliance and are inappropriate for consideration by FERC as PMEs.

DOI supports PacifiCorp's proposal to increase fractional marking of hatchery Chinook to 25 percent (consistent with the Klamath Fishery Management Council letter to PacifiCorp dated June 4, 2003). DOI requests this measure be implemented immediately.

Project dams are directly responsible for eliminating access of anadromous fish to large areas of potential habitat. As currently proposed, the Project would result in continued extirpation of fish migrations that are of cultural, ecological, and economic significance throughout the entire Klamath Basin and associated coastal areas. The DOI will continue to work with Commerce to develop joint section 18 fishway prescriptions for the Project and, in the absence of adequate studies, will make conservative recommendations and prescriptions on behalf of anadromous fish and federally-listed species.

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E5.0 BOTANICAL AND WILDLIFE RESOURCES

Wildlife Habitat

FLA Discussion of Existing Environment and Project Impacts

The Klamath River Canyon is one of the most important migration and movement corridors in the southern Cascade Mountain Range. The mixture of vegetation types and landforms provides a variety of wildlife habitats, such that wildlife is a designated outstandingly remarkable value of the Upper Klamath Wild and Scenic River.

Adequacy of Applicant's Information

Deer movement has not been adequately studied in the immediate study area. The South Cascades deer study showed movement from wintering range on Horseshoe ranch to the Cascade Mountains north of the Project reaches. Deer and elk populations in California have been adversely affected during the last century by a combination of habitat loss and degradation, timber harvest, livestock grazing, wildfire and fire suppression, reservoirs, predation, regulated hunting, poaching, diseases, weather patterns, highway mortality, and competition with non-native wildlife species (CDFG, 1998) (Exhibit E 5-45). PacifiCorp's studies regarding big game movement wildlife habitat, and plant species were of limited scope and duration, and therefore are not adequate to assess Project impacts.

Alternative Interpretation or Information

Habitat Continuity

Compared to free-flowing rivers, riparian systems on rivers with multiple impoundments often exhibit reduced habitat continuity. Findings from PacifiCorp studies indicate this type of impact is associated with Project reservoirs. The patchy distribution of riparian habitats and unnatural distribution of riparian plant species may decrease the linear movement of several avian, herptile, and mammalian species (Executive Summary 5-5; Terrestrial Resources FTR 6-54).

In the J.C. Boyle bypass and peaking reaches, the dominance of reed canary grass (a condition caused, in part, by Project facilities and operations) may limit habitat suitability for birds because reed canary grass out-competes native plant species that may offer more suitable structure (Exhibit E 5-51). Project operations render portions of the river margin in the peaking reach unsuitable for riparian vegetation establishment. Riparian habitat in the J.C. Boyle bypass reach is also reduced as a result of sidecast material from the J.C. Boyle canal. Project impacts on riparian/wetland habitats are discussed further in the Riparian section of this document.

Species that are likely to be affected by increased inter-patch shoreline distances and fragmented riparian plant distribution include those that are closely tied to riparian habitat during all or part of their life history. Several amphibian species as well as small mammals, aquatic furbearers, and some reptiles use riparian habitats for breeding, foraging or cover. Several TES and riparian focal species also use riparian habitats significantly more often than upland habitats (Table 1-10).

Floodplain woodlands support higher densities of breeding birds than upland woodland or herbaceous habitats (Stauffer and Best, 1980). Although birds are highly mobile, there has been some documentation that riparian connectivity plays an important role in species distribution,

especially during dispersal. Juvenile birds are often more dependent on continuous riparian habitat for dispersal than are adults of the same species (Machtans et al., 1996). The distribution of riparian habitat may have a major impact on the distribution and abundance of riparian dependent bird species. The Klamath Bird Observatory's long-term monitoring has indicated that the riparian areas are important not only for breeding, but also during fall migration (Terrestrial Resources FTR 6-56). Therefore, the greatest effect of the Project on passerine birds is the effect on the distribution and connectivity of riparian and wetland habitat.

Table 1-10. TES/Riparian focal species occurring within the Project area.

Yellow warbler (*Dendroica petechia*)	Purple martin (*Progne subis*)
Black crowned night heron (*Nycticorax nytcticorax*)	Western yellow-billed cuckoo (*Coccyzus americanus)*
Song sparrow (*Melospiza melodia*)	Oregon spotted frog(*Rana pretiosa*)
Willow flycatcher (*Empidonax traillii*)	Western toad (*Bufo boreas*)
Yellow rail (*Coturnicops noveboracensis*)	Foothill yellow-legged frog (*Rana boylii*)
Yellow breasted chat (*Icteria virens)*	

Avian communities are affected by fragmentation, which has been shown to increase predation of nests and the incidence of parasitism. Avian use of riparian and wetland habitats by riparian focal species along some Project reservoirs (particularly Iron Gate and Copco) tended to be much lower than that found in the various river reaches. This pattern also was noted for amphibian and reptile detections.

Furbearers, such as mink, river otter, beaver, and muskrat, might be affected by the distribution of riparian habitat (Waller et al. 1999). Distribution of these species is dictated by the availability of adequate shelter and aquatic foods (Bellrose and Brown, 1941; Melquist and Hornocker, 1983; Mitchell, 1961; Toweill, 1974) (Terrestrial Resources FTR 6-54).

Wildlife Movement Patterns and Wildlife Dispersal

No data exist on elk wintering near the project reservoirs (Terrestrial Resources FTR 6-52). More than 50% of the critical deer wintering habitat for deer in the study area is on the south side of the Copco/Iron Gate section of the Project. From a regional perspective, the canyon and mid-elevation hillsides and plateaus between the J.C. Boyle powerhouse and Iron Gate Dam are considered critical deer winter range by the BLM, ODFW, and CDFG. This area represents one of the largest contiguous areas of winter range in the southern Oregon and northern California region. In the study area, south-facing lower canyon walls and hillsides are some of the most critical habitat for wintering the migratory Pokegama black-tailed deer herd as well as for resident deer (City of Klamath Falls, 1989; Exhibit E 5-46). There are substantial areas of desirable browse species in the Copco No. 2 bypass (1,136 acres [460 ha]), Fall Creek (780 acres [316 ha]), and J.C. Boyle peaking reach (10,517 acres [4,256 ha]) study area sections (Exhibit E 5-47).

Project-Associated Roads and Road Use

PacifiCorp's studies have shown that Project roads affect small animal connectivity and are a cause of mortality (Terrestrial Resources 6-55). Roads have been shown to be a movement barrier for many small mammal species (Garland and Bradley, 1984; Richardson et al., 1997). While herptile densities near roads are often reduced (Fahrig et al. 1995, Findlay and Houlahan, 1997, Findlay and Bourdages, 2000), use of roads and adjacent habitats by reptiles results increased mortality (McClure, 1951; Bernardino and Dalrymple1992; Krivda, 1993; Rosen and Lowe, 1994; Boarman and Sazaki, 1996; Fowle, 1996).

Reservoir Fluctuation Zones and Riverine Varial Zones

A discussion of Project impacts on riparian/wetland habitat types is included in the Riparian section of this document.

Riparian Habitat in the J. C. Boyle Peaking Reach

A discussion of Project impacts on riparian/wetland habitat types is included in the Riparian section of this document.

Impacts of Livestock Grazing on Wildlife Habitat

The FLA implies that livestock consumption of wedgeleaf ceanothus adversely impacts the availability of browse for deer. BLM monitoring studies have found this to be an inaccurate assessment (BLM, 1996). Cattle and wild horses apparently make insignificant utilization of this shrub, while deer browse this shrub throughout the winter. These use patterns are reflected in PacifiCorp's grazing use figures (Terrestrial Resources FTR table 9.7-4), which indicate high levels of upland shrub use despite notations elsewhere that cattle use is concentrated in riparian areas.

It should be noted that the FLA discussions of grazing use levels are "observational in nature and not the subject of rigorous evaluations" (Terrestrial Resources FTR 2-88). Subjective observers frequently describe livestock use as "heavy" when utilization levels on the order of 35 to 50% actually indicate light to moderate use.

Department Conclusions Regarding the Existing Environment, Project Impacts, and PM&Es

<u>Project Impacts</u>

Habitat Continuity

Absent active management measures that encompass large proportions of reservoir shorelines, the connectivity and diversity of riparian/wetland habitat adjacent to Project reservoirs will continue to be reduced by proposed operations (Terrestrial Resources FTR 7-43). Without active management, it is unlikely that riparian habitat conditions will significantly improve in the Project area even with the proposed changes in the J.C. Boyle minimum flow releases and powerhouse ramp rates. Recreation use and reservoir fluctuation regimes are Project-related effects (Exhibit E 5-128) that must be adequately assessed.

Continuing Project impacts on river flow regimes and sediment supply, as well as continued inundation of low-gradient river reaches under Project reservoirs will result in reductions in the distribution and diversity of streamside riparian communities. These alterations would adversely affect the extent and connectivity of habitat suitable for passerine birds.

Wildlife Movement Patterns and Wildlife Dispersal

Wildlife connectivity across the Project area will continue to be affected by the presence of Project canals, flowlines, and reservoirs. The impact is likely greatest for small mammal, amphibian, and reptile species (Terrestrial Resources FTR 6-57).

It is likely that J.C. Boyle canal significantly impairs wildlife movement (Executive Summary 5-5). It entirely blocks the movement of herptiles and small- to medium-sized mammals (Terrestrial Resources FTR 4-86). It is uncertain whether the proposed PM&E measures are adequate to allow unrestricted movement of small mammals and reptiles from the rocky slopes and open woodlands above the canal to the riparian zone below the canal. (Exhibit E 5-157).

The physical presence of the Project reservoirs affects movement of big game through the area by redirecting movements along shorelines and potentially by limiting the number of locations where animals can cross through the area. (Exhibit E 5-152). Large lakes more than 650 feet (200 m) wide may form barriers for many forest birds during dispersal (Machtans et al. 1996). This would indicate that all of the Project reservoirs might affect aspects of local avian movement (e.g., dispersal, but not migration) in at least some areas.

Project transmission lines cause electrocution and mortality of raptors. The FLA acknowledges that several poles along the transmission line south of Copco II bypass are not raptor safe (Executive Summary 5-5), and it is very likely that other poles also impact raptor populations.

Project-Associated Roads and Road Use

It is expected that Project roads will continue to fragment or reduce the quality of habitat for certain animal species. Mortality caused by Project-related road use and non-Project-related road use on Project roads will continue to occur.

It is evident in the study area adjacent to the J.C. Boyle peaking reach that nine springs located close to recreation sites or trails may have impacts from pedestrian foot traffic or off highway vehicles (OHVs) (Exhibit E 5-118). Recreational access to these areas is provided by roads that are part of the existing Project. Roads will continue to negatively impact spring habitat and spring associated mollusks by redirecting flow or affecting hydrology.

Reservoir Fluctuation Zones and Riverine Varial Zones

Continued water fluctuations in reservoir and riverine habitat will negatively affect amphibians (Terrestrial Resources FTR 4-84). Although wildlife species may be somewhat tolerant of altered habitat conditions (Terrestrial Resources FTR 5-85), Project operations have caused reductions in the extent and quality of riparian/wetland habitat.

Riparian Habitat in the J. C. Boyle Peaking Reach

The largest number of TES plant and animal species were documented in the J.C. Boyle peaking reach; most of the TES avian species were found in association with riparian, wetland or open water habitats. All TES herptile species, western pond turtles and TES mammals (including bats) rely on wetland and riparian habitat during some stage of their life cycle. The extent and suitability of riparian habitat would be adversely affected by proposed Project operations and

therefore should be emphasized during development of PMEs (Terrestrial Resources 5-83 and 5-84).

Project-induced whitewater recreation and Project-facilitated motorized access causes disturbance to mammals, herptiles (including western pond turtles), and birds (including bald eagles).

Protection, Mitigation, and Enhancement Measures

Habitat Continuity

Preservation of Klamath River aquatic systems and associated peripheral wetland and riparian habitat will be critical to the maintenance of wildlife populations currently existing in and around the study area. If unprotected, wetland and riparian habitat along shorelines is likely to decline in the future. Without adequate PM&E measures (including instream flow regimes), riparian habitat and habitat continuity in the J.C. Boyle reaches is likely to further degrade. Given the important role of the Klamath River as a migratory corridor, riparian restoration efforts should focus on Project-affect river reaches.

Wildlife Movement Patterns and Wildlife Dispersal

Seven small (24- to 36-inches wide) and one large (12-feet wide) wildlife crossings of J.C. Boyle canal are proposed. The proposed widths and distribution of these crossings will likely limit the effectiveness of this measure. Similar hydro projects have used crossings up to 36-feet wide (e.g. North Umpqua). The descriptions and illustrations of the wildlife crossings were not clear. The design should consider passage from the top of the crossing down to the road surface, as well as successful movement across the road. A monitoring plan should be implemented to assess the effectiveness of these measures. The timing of monitoring should coincide with periods of the year when small animal movement is high.

In the Wildlife Movement/Connectivity Assessment, the studies used to assess big game movement were not sufficient to derive the “no significant impact” results and therefore PM&Es based on the assessment are inadequate. PM&E measures should focus on winter range habitat on both sides of the river, on both PacifiCorp and BLM-administered lands.

In PacifiCorp’s Transmission Line Collision/Electrocution Assessment, the data used and therefore the conclusions made are not acceptable. The future monitoring plan set up for the project area and described in the FLA is also inadequate. Bird flight diverters should be installed on all Project transmission lines, and perch diverters and elevated perches should be installed on all Project poles. The scope and intensity of the monitoring effort should be increased to allow a better understanding of Project impacts on avian and bat species.

Reservoir Fluctuation Zones and Riverine Varial Zones

Reservoirs cause fragmentation of some wildlife populations due to inadequate or widely spaced shoreline vegetation. Ongoing operation of J.C. Boyle, Copco I and II, and Iron Gate dams will result in impacts to reservoir fluctuation zones, the 4.4 miles (7.1 km) of the J.C. Boyle bypass reach, and the riparian areas adjacent to the 11.5 miles (18.5 km) of the J.C. Boyle peaking reach, as well as vegetation adjacent to Project facilities and recreation sites.

The foothill yellow-legged frog (FYLF) is likely extirpated from its historic range due to modifications of riverine habitat and exotic predatory species influence (Terrestrial Resources FTR 4-83). These impacts can be attributed to the Project. It is unlikely that the FYLF will repopulate its historic range within the Project area, since the nearest known population occurs in the Rogue River drainage.

Riparian Habitat in the J. C. Boyle Peaking Reach

Despite widespread ongoing Project impacts to wildlife habitat adjacent to the Oregon portion of J.C. Boyle peaking reach, no PM&E measures are proposed for this area. This reach would greatly benefit from multiple PM&E measures, especially riparian protection and enhancements and western pond turtle habitat enhancements. One hundred seven of the springs in the study area are in the J.C. Boyle peaking reach; therefore protection of springs adversely affected by roads in this area is necessary.

Noxious Weeds

FLA Discussion of Existing Environment

PacifiCorp presents information on the abundance and distribution of noxious weeds and invasive exotic species within the primary and secondary study areas. Seventeen of the 39 target weed species were found in the study area. Surveys completed in 2002 identified and mapped 60 infestations in the study area. Fifty-two of these infestations were previously mapped by BLM.

Despite some obvious limitations in data collected for the Project area (described below), PacifiCorp's description of the existing environment for noxious weeds documents that noxious weeds in the Project area are abundant and widespread. This will affect the ability of PacifiCorp and other land management entities to control noxious weeds consistent with existing law.

FLA Discussion of Project Impacts

Project operations have the potential to facilitate the spread of noxious weeds and nonnative invasive plants across the broader landscape within which the Project is located (Terrestrial Resources FTR 8-34). Project impacts on hydrologic regimes may create suitable conditions for weed establishment adjacent to reservoirs and river reaches (Terrestrial Resources FTR 8-35).

Adequacy of Applicant's Information

In several respects, noxious weed and invasive non-native plant information collected and compiled by PacifiCorp is inadequate for planning an integrated weed management program.

Some species were considered to have a propensity to occur as relatively large, dense infestations and as individual plants or as groups of thinly dispersed plants, which PacifiCorp concluded made detailed mapping infeasible. These species include St. John's wort, hoary cress, Canada thistle, Dyer's woad, and Mediterranean sage (Terrestrial Resources FTR 8-5). Apparently, these species were only mapped when infestations were associated with Project facilities, roads, recreation areas, or other land use, even though the survey was intended to encompass both the primary and secondary study areas (Terrestrial Resources FTR 8-5).

Infestations of four noxious weed and invasive non-native species documented in the BLM database were not included on the noxious weed map and are not discussed in the Terrestrial Resources FTR. These species include common [toad] flax, Himalayan blackberry, poison hemlock, and salt cedar. The only reason given for this omission is that these species were "not on the target list" (Terrestrial Resources FTR 8-5). These are all "B" designated noxious weeds in Oregon as determined by the Oregon Department of Agriculture (ODA, 2003). Weed species designated as noxious weeds are legally-required targets for control efforts. Maps of the distribution of these species across the affected landscape are needed to plan effective control actions.

Distributions of five (not three as claimed in Exhibit E 5-114) "widespread species" (cheatgrass, Dalmatian toadflax, medusahead, yellow starthistle, and bull thistle) were not mapped (Terrestrial Resources FTR 8-5), but were recorded only for their general distribution in plot data collected as part of the riparian/wetland characterization study (Terrestrial Resources FTR 8-23) and upland habitats during the vegetation cover type mapping and characterization study (Terrestrial Resources FTR 8-21). Dalmatian toadflax was mapped in a small portion of the study area, but

that area is now considered outside the Project boundary. In the majority of the project area, this species was not mapped because its occurrence was considered "minimal."

Although some information was generated on distribution of widespread species from vegetation plots, some of these species are targeted for control efforts and should have been mapped. Yellow starthistle is a "T" or target noxious weed designated by the Oregon Department of Agriculture. "T" weeds are a focus of prevention and control by the Weed Control Program in Oregon, sanctioned by the Oregon State Weed Board. Therefore, to effectively plan management of this species, maps showing the extent and abundance of the distribution of yellow starthistle in the affected landscape would be needed. Where the species is extensive and abundant, density or abundance classes can be mapped.

Dalmatian toadflax is a "B" designated weed in Oregon. Control of outlier populations is the most effective method of control for a biological invasion (Moody and Mack, 1988). Therefore, if the distribution of this species is indeed "minimal" in the majority of the study area, then mapping the location of these populations is essential to plan effective management.

Alternative Information or Interpretation

The Department agrees that continued Project operation has the potential to facilitate the spread of noxious weeds and nonnative invasive plants in the study area (Terrestrial Resources FTR, page 8-34). However, the assertion that noxious weed and non-native invasive species occurrences other than yellow starthistle have little potential to be affected directly by Project operations and maintenance has no obvious basis. Since the noxious weed inventory mapping and the discussion in the Terrestrial Resources FTR focused on Project facilities where Project-related operation and maintenance activities are concentrated, then the mapped infestations of several noxious weed species could certainly be spread by Project activities. We agree that these are areas where the Project is clearly and directly responsible for the management of noxious weeds and non-native invasive plants (Terrestrial Resources FTR 8-34).

Although PacifiCorp claims that non-Project land uses (roads, railroads, agriculture, ranching, recreation, residential developments, and industrial developments) adjacent to Project facilities often determine the level of ground disturbance and potential weed ecology at these sites, the existence of the Project in many cases has established the access and desirability of these developments (Terrestrial Resources FTR 8-34). Additionally, since PacifiCorp states that Project-related vehicles use public and private roads to access Project facilities, the responsibility for weed management should at least be shared by PacifiCorp across the affected landscape (Terrestrial Resources FTR 8-34).

The NWPCP will use existing weed inventory data collected by PacifiCorp as a baseline for identifying target species and management sites (Exhibit E 5-126). As noted above, those data are lacking in several aspects. We support inclusion within the NWPCP of provisions for periodic Project noxious weed inventories (Exhibit E 5-126); the ability to detect new invaders and expansions in existing populations is an essential component of integrated weed management. PacifiCorp also proposes to coordinate regularly with the resource agencies cooperatively involved in noxious weed control in the Project vicinity, which is also a component of integrated weed management.

Department Conclusions Regarding the Existing Environment, Project Impacts, and PM&Es

Project Impacts

The Project and associated roads and facilities are contributing to the ongoing spread of noxious weed and invasive non-native plant species, thereby placing desired native plant communities and special status plant species at risk. Noxious weeds and invasive exotic plants have a negative effect on native species diversity, ecosystem health, and the quality of recreational experiences. Once established as a result of Project activities, these species can spread by other means and affect the larger landscape.

For example, the populations of yellow starthistle that are established along the J.C. Boyle peaking and bypass reaches are considered outliers to larger concentrations in California. However, the largest of these outlier concentrations occurs in association with the J.C. Boyle powerhouse and associated transmission line rights-of-way. Smaller concentrations occur further downstream, primarily in association with roads leading to and from Project facilities. Additional dispersal from these infestations can occur via animals, wind and water. Therefore, the Project is contributing to the increase in distribution and abundance of yellow starthistle across a broader landscape due to activities occurring solely within the currently defined Project boundary.

Protection, Mitigation, and Enhancement Measures

For the purpose of preventing, suppressing, and containing all noxious weed and invasive non-native plant species, PacifiCorp should conduct a systematic survey of all lands within the area affected by the Project (see Attachment 2 of the Department comments). This will provide information regarding the distribution of noxious weeds across the entire area affected by Project facilities and activities. Surveys should focus most intensively on roadsides, recreation facilities, Project facilities/adjacent areas, transmission lines, and other disturbed areas where noxious weeds readily become established. Surveys should also encompass the broader area where noxious weeds and invasive plant species have spread since initial establishment. All species to be targeted for control should be accurately mapped.

The proposed NWPCP recognizes the value to the Project area of a noxious weed management plan which incorporates the principles of integrated weed management. However, as currently proposed that plan does not incorporate all components of integrated weed management. Components of the Project integrated weed management plan typically include:

- Prevention and detection,
- Integrated control methods,
- Awareness and education,
- Coordination,
- Native plant community restoration, and
- Monitoring and evaluation.

Integrated control methods typically utilize cultural, physical, biological, and chemical control techniques.

Implementation of the NWPCP would be most effective if it included the formation of a Weed Management Area (WMA). The WMA would include all landowners within the area affected by the project and would facilitate cooperation and coordination of noxious weed management across ownership boundaries.

PacifiCorp states that their control treatments will focus on areas near Project facilities, roads, and trails, and further states that "the appropriate land managers should carry at least the bulk of the responsibility for management of noxious weed and non-native invasive plants (Terrestrial Resources FTR 8-35)." Proposals to limit the area where noxious weeds and invasive plant species are controlled and to limit the scope of coordination efforts are not consistent with the principles of integrated weed management and will further limit the effectiveness of proposed mitigation measures.

TES and Culturally Sensitive Plants

FLA Discussion of Existing Environment and Project Impacts

Existing Environment

PacifiCorp presents information on the abundance and distribution of threatened, endangered, and sensitive (TES) and culturally sensitive plants that occur within primary and secondary study areas. PacifiCorp also presents reviews of BLM, ONHP, CNDDB, and CNPS occurrence records.

Project Impacts

Project impacts are discussed as related only to river flow manipulations and reservoir water level fluctuations. The FLA does not contemplate impacts of Project-related activities that occur outside of the proposed Project boundary or activities that occur within the Project boundary but affect areas outside of the boundary.

Future impacts to TES plant species are described as uncertain, but are tied solely to maintenance or alteration of flow regimes. Potential impacts to TES species resulting from changes in Project operations could be beneficial or detrimental to species abundance and continued viability (Terrestrial Resources FTR 5-86). Changes in habitat due to changes in operations are described as difficult to determine. However, it is likely that changes in water levels at Keno Reservoir would affect the several TES plant species that occur there, including the endangered Applegate's milkvetch (Terrestrial Resources FTR 5-85).

Adequacy of Applicant's Information

Field surveys were to have applied an "intuitive controlled" approach (Whiteaker et al. 1998) (Terrestrial Resources FTR 5-3) to thoroughly traverse the entire study area and observe a representative cross-section of all major habitats and topographic features. These surveys were to be coupled with a complete survey for target species in areas of high TES plant habitat potential. Implementation of field surveys did not follow the stated methodologies, and instead emphasized sites most likely to be directly affected by Project activities. Also, some known sites of TES plant species within the secondary study area were not visited during PacifiCorp surveys "because of their remote location in the study area" (Terrestrial Resources FTR 5-20). Therefore, survey effort focused on the study area that extends 0.25 miles from Project facilities and associated recreation sites, instead of areas supporting potential habitat for TES species (Terrestrial Resources FTR 5-2).

Because survey methods described in the approved study plans were revised, the survey results probably differ from what would have been found if the cited survey method were applied as described. It is unlikely that all TES plant populations within the area affected by the Project have been located. Therefore, direct and indirect Project impacts are likely to continue on these populations.

PacifiCorp states that because no future ground-disturbing activities on federal land can be identified at this time, survey methods for Survey and Manage Strategy 2 plants (Whiteaker et al., 1998) were not utilized (Terrestrial Resources FTR 5-3). However, PacifiCorp cites this

reference to describe the methods that were used. PacifiCorp should clarify this apparent discrepancy.

The identification of several of the populations of TES plant species have not been confirmed as yet. Confirmation of these identifications of potential TES populations will be valuable information to include in the records of TES plant occurrences for the area.

Alternative Information or Interpretation

The FLA assumes that the Project does not affect a TES plant population if it occurs outside the proposed Project boundary. However, habitat loss from Project reservoirs and Project-related facilities continues to directly and indirectly affect special status plant species and their habitat. Indirect effects include:

- Disturbance from Project roads and spur roads established from Project roads;
- Disturbances from recreationists attracted to the area by Project facilities, operations, and roads; and,
- Competition from noxious weeds and invasive non-native plants introduced by Project-related activities and whose distribution and abundance will increase in the future due to continued operation of the Project.

Several TES species found in seasonally wet alkaline floodplains adjacent to Keno Reservoir may be impacted by changes in reservoir management. These species are Applegate's milkvetch (federally listed as endangered), short-podded thelypodium, Columbia yellow cress, and salt heliotrope. Exclusion of this area from the proposed Project boundary does not absolve PacifiCorp of responsibility for potential impacts to these populations.

For all other TES plant species, PacifiCorp concludes that the hydrology supporting the specific wetland and riparian micro-habitats in which these species were found was independent of Project-influenced flows because these areas are isolated wetlands or springs above the river's normal water surface elevation during the growing season (Terrestrial Resources FTR 5-84). However, a population of one of these species, pendulus bulrush, is found in the riparian zone of the J.C. Boyle peaking reach, the area most influenced by flow manipulations (Terrestrial Resources FTR 5-35). Further, Project roads and roads established from Project roads cross several meadows in which TES plants such as red root yampah, Howell's yampah, Bellinger's meadow foam, and pygmy monkeyflower are known to occur. These roads disrupt the hydrologic regime to which these species are adapted.

Department Conclusions Regarding the Existing Environment, Project Impacts, and PM&Es

Since the standard method for TES plant survey was not applied uniformly across the affected landscape, an adequate inventory of TES plant species has not been completed. More intensive and extensive surveys would be needed to plan an adequate TES plant conservation program for the Project area.

Objectives of such a conservation program should include:

- Mitigating ongoing direct and indirect Project impacts on special status plant species and their habitat, and

- Increasing opportunities for protection, restoration, and enhancement of unique habitats across the entire affected landscape.

Indirect impacts from noxious weeds and invasive non-native species alone are quite extensive in area. Roads which cross seasonally wet meadows should be removed and the natural hydrology of those meadows should be restored.

A population of the federally endangered Applegate's milkvetch was discovered on a site that is considered by PacifiCorp to be potentially affected by Project operations, and potential habitat for this species would potentially become established were it not for Project reservoirs. Therefore, PacifiCorp should participate in and help fund the development and implementation of the recovery plan for Applegate's milkvetch in order to mitigate continuing impacts to this endangered species.

Riparian/Wetland Habitat

FLA Discussion of Existing Environment and Project Impacts

Existing Environment

The FLA understates the impacts of Project facilities and operations on riparian/wetland resources. PacifiCorp contends that "in several locations, there is more riparian vegetation today than what occurred historically" (Exhibit E 5-128) and that the Project has caused "relatively minor shifts in the overall distribution and extent of riparian vegetation" (Exhibit E 5-5). PacifiCorp states that Project impacts to river geomorphology in the J.C. Boyle peaking reach are "minor" and have caused "essentially no change" (Exhibit E 5-27). These statements are not supported by the data and analyses presented in the Terrestrial and Water Resources FTRs.

Riparian communities along the J.C. Boyle bypass and peaking reaches contain abundant reed canary grass. This invasive plant thrives in nutrient-rich conditions subject to frequent inundation (Terrestrial Resources FTR 3-112 and 3-114) and is capable of out-competing desired riparian vegetation (Terrestrial Resources FTR 3-28). The life history (seed dispersal and plant growth patterns) of this species is well-suited to conditions in the J.C. Boyle peaking reach (Terrestrial Resources FTR 3-108).

PacifiCorp correctly states that the area within the Project boundary contains "wetland and riparian habitat along the affected waterbodies" (Exhibit E 5-119). PacifiCorp neglects to state that the proposed Project boundary excludes many riparian/wetland areas that are affected by Project operations, including the entire length of the J.C. Boyle bypass reach and 11 miles of the J.C. Boyle peaking reach, and all of the marshy areas adjacent to Keno Reservoir.

Project Impacts

The Project causes widespread impacts to riparian/wetland communities. The FLA provides a description of impacts resulting from reservoir fluctuations, hydrologic alterations in river reaches, and recreation use, but does not address other impacts that are equally important.

Effects of Reservoir Water Level Fluctuations on Riparian/Wetland Vegetation

Water level fluctuations in the three reservoirs within the proposed Project affect a total area of 324 acres (Exhibit E 5-145). Hydrologic conditions, in concert with relatively steep elevation gradients and a lack of bare substrate in suitable size ranges, limit the establishment of riparian vegetation (Exhibit E 5-146). Riparian/wetland communities on reservoir margins are further impacted by Project-induced recreation use (Terrestrial Resources FTR 2-94) and noxious weeds (Exhibit E 5-146). As a result of these physiographic and anthropogenic factors, riparian patches along reservoir shorelines are spaced at greater intervals than along river reaches (Exhibit E 5-146).

Effects of Hydrologic Alterations and dams on Riverine Riparian/Wetland Vegetation

River reaches downstream from Project facilities are subject to highly altered hydrologic and sediment regimes. The nature and extent of these alterations, and consequently the impact to riparian communities, varies by river reach. This discussion draws, in part, from the discussion of Project impacts on sediment supply and transport.

J.C. Boyle Bypass Reach

Streamflow patterns in this reach have been strongly affected by the Project. Except during infrequent spill events, flows in this reach are maintained at a steady discharge that is much less than average daily flows into or out of J.C. Boyle Reservoir. J.C. Boyle Dam reduces the supply of gravel, sand, and silt to this reach (Exhibit E 5-148). Coupled with flow diversions, this reduces the frequency of scouring and deposition of sediment (see Water Resources FTR 6-135 and also the Geomorphology section of this document).

Reduced minimum and peak flows allow riparian vegetation to encroach into the stream channel (Exhibit E 5-149). Due to reduced sediment supply and reduced bed mobility, the extent of bare substrate of particle sizes appropriate for establishment of willows and other desired riparian plants has been reduced. Conversely, the altered hydrologic and geomorphic character of this reach provides "good growing conditions for reed canary grass" (Exhibit E 5-149). Reduced water surface elevations associated with reduced river flows may also be responsible for reductions in the extent of riparian vegetation in this reach.

J.C. Boyle Peaking Reach

Hydrologic conditions are highly altered in this reach. Proposed operations would result in unnaturally low minimum flows and completely artificial daily flow fluctuations over a range of approximately 1,400 cfs. This proposed flow regime would create a varial zone encompassing the area inundated by flows ranging from 400 to 3,000 cfs. PacifiCorp states that the varial zone would encompass 58 acres (Exhibit E 5-128) (this finding is not supported by an analysis of discharge – wetted perimeter relationships, described below).

The extent of vegetation within the varial zone would continue to be limited, and reed canary grass would continue to dominate the vegetated areas within the varial zone (Exhibit E 5-150). Plots inundated by discharges less than 420 cfs would be constantly inundated, thereby resulting in some reduction in reed canary grass cover on the lower portion of the channel margin (Exhibit E 5-150). Increased inundation duration in the lower portion of the varial zone (due to proposed limits on the range of daily flow fluctuations) could cause increased cover of reed canary grass; decreased inundation duration in the upper portion of the varial zone could cause reduced cover of reed canary grass in these areas (Exhibit E 5-150).

Proposed site-specific restoration measures would offer limited benefits to riparian communities in the lower 5.3 miles of the J.C. Boyle peaking reach. The scope of these measures is vaguely described, but is not likely to be sufficient to fully mitigate for the impacts of continued peaking operations and inadequate sediment augmentation.

Copco II Bypass Reach

Proposed operations would maintain very low minimum flows in this reach, with no expected change in riparian vegetation (Exhibit E 5-150). Mature riparian hardwoods would continue to anchor the streambed in place (Terrestrial Resources FTR 3-96); combined with reduced peak flows this would result in reduced fluvial dynamism and impaired riparian processes in this reach.

Downstream from Iron Gate Dam

Proposed mitigation measures designed to address Project impacts on sediment supply and transport may beneficially affect willow establishment in the reaches downstream from Iron Gate Dam.

Spring Creek/Jenny Creek and Fall Creek

Impacts of altered summer baseflows on riparian vegetation in Spring Creek and downstream portions of Jenny Creek are not addressed in the FLA.

Impacts of Recreationists on Vegetation Near Recreation Sites

Recreation use causes relatively minor impacts compared to other Project impacts that are more systemic in scope. Nonetheless, Project-induced recreation use on reservoir shorelines and in the J.C. Boyle peaking reach reduces the habitat value of riparian areas. Observed recreation impacts were most pronounced in the riparian shrub vegetation type (Table 1-11).

Table 1-11. Recreation impacts on riparian/wetland vegetation (from Terrestrial FTR Table 2.7-15).

Vegetation Type	% of Vegetation Plots with Observed Recreation Impacts
Palustrine emergent	16
Palustrine shrub	19
Palustrine forested	5
Riparian grassland	17
Riparian shrub	62
Riparian deciduous	21
Riparian mixed	0

Adequacy of Applicant's Information

The FLA does not adequately describe the type and extent of Project impacts on riparian/wetland resources. Several lines of evidence indicate that the proposed Project would cause widespread impacts to the extent, character, and condition of riparian areas.

Alternative Information and/or Interpretation

The discussion of the effects of hydrologic alterations on riparian vegetation is incomplete. Other Project impacts are omitted from the discussion altogether. These impacts are described below.

Effects of Hydrologic Alterations and Dams on Riverine Riparian/Wetland Vegetation

J.C. Boyle Bypass Reach

Project-induced hydrologic and geomorphic alterations have, both individually and cumulatively, impaired riparian processes in this reach. Hydrologic changes include reduced minimum flows, reduced peak flows, and reduced seasonal and annual variability. These changes cause a reduction in the extent and diversity of hydrologic conditions available for use by various riparian communities.

The upslope extent of riparian vegetation in this reach is controlled by a combination of geomorphic and hydrologic factors. Adjacent to river segments that are not highly constrained by hillslopes or sidecast material, flood frequency plays a larger role in determining the extent of riparian vegetation. The FLA does not discuss "riparian maintenance flows" for this reach, but estimates that between 3,600 and 5,100 cfs is required to inundate riparian areas in constrained portions of the J.C. Boyle peaking reach (Terrestrial Resources FTR 3-106). Given the general physiographic and climatic similarity between the two reaches, it is reasonable to assume that relationships between peak flows and riparian vegetation are also broadly similar. Proposed operations would continue to reduce the frequency of riparian maintenance flows in the bypass reach by a factor of about 2.3 and would thereby limit the upper elevation range of riparian vegetation (Table 1-12).

Table 1-12. Estimated reduction in the frequency of riparian maintenance flows due to proposed operations.

Estimated Riparian Maintenance Flow		Estimated Recurrence Interval[1]	
		Proposed Operations	Unimpaired Conditions
Lower estimate	3,600 cfs	2.8 yrs	1.2 yrs
Average	4,400 cfs	3.4	1.8 yrs
Upper estimate	5,100 cfs	4.2	1.9

Note: (1) Derived from Water Resources FTR 5-46.

Riparian vegetation would also be affected as a result of limitations on geomorphic processes imposed by Project facilities and operations. Because proposed gravel augmentation would not sufficiently mitigate the impact of J.C. Boyle Dam on downstream sediment supply, the extent and texture of sediment deposits would continue to be excessively coarse. In combination with reduced peak flows, this would result in reduced bed mobility and continuing reductions in the availability of surfaces suitable for establishment of desired riparian vegetation. Impacts of the proposed Project on sediment supply and transport are discussed in more detail in the geomorphology section of this document.

J.C. Boyle Peaking Reach

Proposed Project operations would create a varial zone extending across a total of 83 acres. Compared to current operations, proposed operations would result in a 13% reduction in the extent of the varial zone (Table 1-13). Within the varial zone, the median discharge below which vegetation cannot establish is 760 cfs (based on PacifiCorp data from 19 transects; Terrestrial Resources Appendix 3A). This indicates that approximately 27 acres within the peaking reach varial zone will remain unvegetated due to proposed Project operations.

Reed canary grass is common in the peaking reach (Table 1-14). Frequent inundation and exposure within the varial zone creates conditions that grant reed canary grass a strong competitive advantage over other plant species, as evidenced by the fact that "reed canary grass is the most abundant species in the varial zone…" (Terrestrial Resources FTR 3-102). The extent of this undesired plant is enhanced by peaking operations which "extend the horizontal distribution…of reed canary grass in the peaking reach by creating an artificially narrow range of inundation duration over a greater range of horizontal distances" (Terrestrial Resources FTR 3-102). It is not surprising that Project impacts are beneficial for reed canary grass, given that it is "well suited to coarse substrates [that are] frequently inundated" (Terrestrial Resources FTR 3-

22) and that reed canary grass seeds respond well to mechanical damage (Terrestrial Resources FTR 3-108) such as might occur during peaking events.

Table 1-13. Varial zone width and area in the J.C. Boyle peaking reach under existing and proposed operations.

Impacts of Project Operations – Varial Zone Width[1]		
• Current Conditions (Minimum flow of 325 cfs)	Average width = **48.3 feet** (Flow fluctuation from 3000 to 325 cfs)	Terr. FTR 3-102 Fish. FTR Table 6.7-1
• Proposed Future Operations (Minimum flow of 425 cfs)	Average width = **42.2 feet** (Flow fluctuation from 3000 to 425 cfs)	Terr. FTR 3-102 Fish. FTR Table 6.7-1
Impacts of Project Operations – Varial Zone Area[2]		
• Current Conditions (Minimum flow of 325 cfs)	Average width = **95.4 acres** (Flow fluctuation from 3000 to 325 cfs)	Terr. FTR 3-102 Fish. FTR Table 6.7-1
• Proposed Future Operations (Minimum flow of 425 cfs)	Average width = **83.4 acres** (Flow fluctuation from 3000 to 425 cfs)	Terr. FTR 3-102 Fish. FTR Table 6.7-1

Notes: (1) Wetted widths for each discharge were interpolated from average wetted widths presented in Table 6.7-1 in the Fisheries FTR; (2) Area calculations use average varial zone widths over the length of the Oregon and California portions of the J.C. Boyle peaking reach (approximately 16.3 miles).

Table 1-14. Occurrence of reed canary grass (RCG) within and upslope from the J.C. Boyle peaking reach varial zone (based on analysis of PacifiCorp riparian sampling data).

Affect Portion of Varial Zone (n)	Discharge Range	% of Plots with RCG Present	Median Cover of RCG in Plots Where it Occurs[1]
Constantly inundated (6)	< 320 cfs	33	3
One-turbine peaking (35)	320 – 1540 cfs	91	3
Two-turbine peaking (30)	1540 – 3000 cfs	87	4
Upslope (91)	> 3000 cfs	22	2

Notes: (1) Median cover class values are as follows: 2 = 13%, 3 = 38%, and 4 = 63%.

Reed canary grass would continue to dominate vegetation within the varial zone, although its distribution is expected to change under the proposed flow regime (Exhibit E 5-150). The approximate extent of three reed canary grass "response zones" can be estimated based on discharge-wetted perimeter relationships developed for the aquatic instream flow study (Table 1-15). Results from the riparian analysis (summarized at Exhibit E 3-150) suggest that proposed operations would be expected to reduce reed canary grass cover across 36 acres and increase reed canary grass across 55 acres (because the relationships between flow regimes and plant community response are not precisely understood, these values should be viewed as relative probabilities, rather than exact quantifications).

Table 1-15. Estimated extent of expected varial zone reed canary grass response to proposed operations.

Affected Portion of Varial Zone	Discharge Range	Expected Reed Canary Grass Response[1]	Approximate Area[2]
Constantly inundated	320 – 420 cfs	Reduced cover	8 acres
One-turbine peaking	420 – 1540 cfs[3]	Increased cover	55 acres
Two-turbine peaking	1540 – 3000 cfs	Reduced cover	28 acres

Notes: (1) Summarized from E 5-150; (2) Wetted widths for each discharge were interpolated from average wetted widths presented in Table 6.7-1 in the Fisheries FTR, area calculations use average varial zone widths over the length of the Oregon and California portions of the J.C. Boyle peaking reach (approximately 16.3 miles); (3) Typical discharge observed during one-turbine peaking from water years 1993 to 2002.

Project operations that favor reed canary grass result in reduced riparian diversity. Areas with lower abundances of reed canary grass "tended to support species assemblages in which reed canary grass either occurred infrequently and was unimportant or occurred as one of several species" (Terrestrial Resources l FTR 3-102). The impacts of Project facilities and operations that benefit reed canary grass appear to impair willow establishment. This is evident in the apparent displacement of coyote willow from riparian areas dominated by reed canary grass (Terrestrial Resources FTR 3-28). The inability of willow to compete successfully with reed canary grass under current conditions may reflect the ability of reed canary grass to thrive under altered hydrologic regimes.

Other Project impacts besides the enhancement of conditions suitable for reed canary grass impair willow re-establishment. These include:

- Peaking operations during the May – June seed dispersal period (Terrestrial Resources FTR 3-107) may result in damage to seeds or creation of unsuitable substrate conditions;
- Frequent and rapid changes in river stage (up to 9 inches/hour) associated with peaking operations that may exceed the tolerance of recently established willow plants (which is on the order of 2 inches/day; Terrestrial Resources FTR 3-126);
- The lack of frequent scouring and deposition of alluvial surfaces (discussed in the geomorphology section of this document) may limit the extent of substrate suitable for willow germination and growth (increased dynamism of alluvial processes may be a factor that favors willow recruitment downstream from Iron Gate Dam; Terrestrial Resources FTR 3-107); and,
- Coarse bed material (attributed in part to Project dams; Water Resources FTR 6-129) and dense vegetation cover (linked to reed canary grass abundance) limit the extent of suitable germination sites (Terrestrial Resources FTR 3-107 and E 5-150).

These Project impacts contribute to the observed lack of sexual reproduction by willows (Exhibit E 5-102). Whereas "germination and establishment [of riparian hardwoods] typically takes place on freshly deposited alluvium in channel positions low enough to provide adequate moisture but high enough to escape scour" (Scott et. al., 1993), the Project creates conditions characterized by static geomorphic conditions and frequent scour over a large portion of the area where willows would be most likely to attempt to become established. Proposed operations and PM&E measures would not adequately address these impacts, and the extent of willow would continue to be impaired during the new license.

Reservoir Inundation

Continued inundation of reservoirs will result in ongoing suppression of ecological processes in areas that otherwise would have the potential to support an array of riparian/wetland vegetation types. The type of vegetation that could potentially develop in these currently inundated areas is controlled by slope, substrate characteristics, and hydrologic regimes. The analysis of pre-Project conditions in the currently inundated areas provides context for understanding the balance between riparian and wetland ecological sites that could exist in the future were it not for the reservoirs. This analysis assumes that, on balance, the ratio of riverine riparian vegetation areas to standing-water wetland areas that would develop were it not for the reservoirs would be similar to the ratio that existed prior to construction of the reservoirs.

In sum, approximately 136 acres of potential riparian/wetland habitat are currently submerged under Project reservoirs (Table 1-16). Copco Reservoir inundates the most extensive potential riparian/wetland areas, followed by Iron Gate and J.C. Boyle Reservoirs. Of the potential

Table 1-16. Extent of Direct and Indirect Impacts of Project Facilities and Operations on Riparian/Wetland Vegetation Communities.

Impact	Approximate Extent (Acres)			Affected Vege. Types	Comments
	Loss	Gain	Alter		
J.C. Boyle Reservoir Inundation	5.1 12.1			Riparian PEM	
J.C. Boyle Reservoir Riparian Creation		0.4 44.5		Riparian PEM	18 acres of PEM subtracted from FLA estimate of reservoir-dependent habitat (tributary west of Spencer Creek). N**ote 1.**
J.C. Boyle Bypass Reach Alteration			32 0.9 6.5	Riparian PEM PFO/PSS	Impacts from reduced minimum flow, altered peak flows, and reduced supply of suitable substrate.
J.C. Boyle Bypass Reach Canal Sidecast	2			Riparian	GIS analysis of mapped riparian areas along 0.95 miles of river with canal sidecast extending to the waters edge
J.C. Boyle Peaking Reach Alteration	27		119 0.7	Riparian PEM	Accounts for impacts from flow fluctuation and reduced supply of suitable substrate.
Copco Reservoir Inundation	66.1 10.2 10.2			Riparian PEM PFO/PSS	
Copco Reservoir Riparian Creation		7.6 6.6 3.5		Riparian PEM PFO/PSS	34.2 acres of PFO (spring-dependent) and 11.6 acres of RD (tributaries) subtracted from FLA estimate of reservoir-dependent habitat. Additional areas categorized as reservoir-dependent may indeed be a result of other influences (but are included herein), notably the riverine riparian areas at upstream end of reservoir. **See note 1.**
Copco II Bypass Reach Alteration			18.5	Riparian	
Iron Gate Reservoir Inundation	30.1 2.0 0.5			Riparian PEM PFO/PSS	
Iron Gate Reservoir Riparian Creation		1.4 7.3 14.0		Riparian PEM PFO/PSS	25.2 acres of PFO and 2.3 acres of RD subtracted from EDAW's estimate of current reservoir-dependent riparian (tributaries). **See note 1.**
Transmission Line #62			1	PFO/PSS	100-foot wide ROW under 0.1 miles of transmission line (see Exhibit E 5-144 to 5-145).
Totals	103.3 24.3 10.7 **138.3**	9.4 58.4 17.5 **85.3**	196.5 1.6 7.5 **210.6**	Riparian PEM PFO/PSS **Total**	

Notes: (1) Estimate of reservoir-dependent habitat based on revision of EDAW's analysis in Terrestrial FTR (3-141 to 3-147). GIS-based analysis of EDAW vegetation mapping, 1:24k USGS quads, and Exhibit E Figure 10.7 was used to identify areas that are adjacent to reservoirs but are not hydrologically dependent on reservoirs.

riparian/wetland areas currently inundated, it is estimated that approximately 100 acres could develop into riverine riparian vegetation communities. These values may underestimate the potential future extent of riparian/wetland areas, since the maps that they are based on reflect

other pre-Project human-caused alterations such as agricultural developments and livestock grazing.

The riparian/wetland habitat created by J.C. Boyle, Copco, and Iron Gate Reservoirs is less extensive than the potential habitat inundated by the reservoirs. Also, the existing reservoir-margin habitat generally includes a less diverse array of vegetation types than would occur adjacent to a dynamic river system. In sum, about 85 acres of riparian/wetland habitat is created by the reservoirs (Table 1-16). This value is derived from PacifiCorp's vegetation mapping data.[15] Of the created habitat, 58 acres (or nearly 70%) is palustrine emergent wetland; riparian vegetation consists of less than 10 acres.

Overall, reservoir inundation has resulted in a net loss of approximately 50 acres of riparian/wetland habitat. These losses were not distributed equally between various vegetation types. Riverine riparian vegetation types suffered a net loss of 90 acres (a 90% reduction relative to without Project conditions), while the extent of palustrine emergent wetlands increased by more than 30 acres and palustrine forested and scrub/shrub wetlands expanded by 10 acres.

Project Facilities

In addition to potential future habitat lost due to continued reservoir inundation, other types of Project facilities also impact riparian/wetland habitats. The sidecast material generated by construction of the J.C. Boyle canal, if left in place over the term of the new license, will continue to impair development of riparian vegetation on approximately two acres. This estimate was derived by comparing the extent of riparian vegetation on the southeast side of the river (which has not been directly affected by canal sidecast) with the current extent of riparian vegetation on the northwest side of the river over the approximately one mile length most affected by sidecast (Table 1-17). The difference between the extent of riparian vegetation on the unimpaired and impaired margins of the river provides an estimate of the extent of riparian vegetation that would develop were it not for the sidecast.

Table 1-17. Estimated extent of riparian vegetation affected by J.C. Boyle canal sidecast (Based on analysis of PacifiCorp vegetation mapping data).

Extent of riparian vegetation on southeast (unimpaired) side of river	2.2 acres
Extent of riparian vegetation on northwest (impaired) side of river	0.2 acres
Difference between unimpaired and impaired conditions	2 acres

Transmission Line #62 crosses approximately 0.1 miles of wetland habitat. Given the vegetation management widths described in PacifiCorp's proposed Vegetation Resources Management Plan, up to one acre of habitat could be altered (Exhibit E 5-144).

Altered Composition of Riparian Areas

Riparian communities throughout the area of Project effects are impaired by invasive and/or non-native species (Table 1-18). These plants limit the abundance of desired native species and reduce the habitat value of riparian/wetland areas. Noxious weeds are common along river

[15] These values are inconsistent with estimates presented in the FLA because those estimates included vegetation units that were adjacent to – but not hydrologically dependent on – the reservoirs. Even with these corrections, the extent of "created" habitats may be overestimated because the genesis of riparian areas located where the river flows into reservoirs were attributed to reservoir creation rather than riverine processes.

reaches, predominantly at the riparian-terrestrial ecotone but also within riparian vegetation communities (Exhibit E 5-150). Himalayan blackberry is especially common in the Link River and downstream from the Oregon-California boundary, where it competes with desired riparian grass, shrub, and tree species. In some areas, it dominates the understory of riparian hardwood communities (Terrestrial Resources FTR 3-28). Reed canary grass is the most common species in many riparian areas, and is particularly common in the Link River, Keno, and J.C. Boyle bypass and peaking reaches.

The presence of these invasive plants is the result of many impacts, including some that are related to Project facilities and operations. With respect to noxious weeds, these impacts are discussed in more detail in the Terrestrial Resources-Noxious Weeds section of this document. Project impacts affecting the distribution of reed canary grass are discussed elsewhere in this section.

Table 1-18. Presence of invasive species in riparian sampling plots (from Terrestrial Resources FTR Table 8.7-3 and PacifiCorp riparian vegetation sampling data).

Reservoir/ River Reach	% of sampling plots with noxious weeds present	% of sampling plots with Himalayan blackberry present	% of sampling plots with reed canary grass present
Link River	75	58	42
Keno Reach	33	0	73
J.C. Boyle Bypass	17	0	72
J.C. Boyle Peaking	32	24	49
Copco II Bypass	33	38	2
Downstream from Iron Gate Dam	60	20	0
Fall Creek	100	13	0

Role of Project Reservoirs in Attracting Human Developments

Project reservoirs (especially Copco I) attract human development, as indicated by the fact that "the development of the Project facilities…at Copco… [has] contributed to the value of the land adjacent to these…facilities" (Exhibit E 9-39). Human development can eliminate or alter wildlife habitats and associated ecological processes.

Department Conclusions Regarding Existing Environment, Project Impacts, and PM&Es

Existing Environment/Project Impacts

Despite PacifiCorp's contention that the Project has caused (and will continue to cause, given the proposed PM&E measures) only "relatively minor shifts in the overall distribution and extent of riparian vegetation" (Exhibit E 5-5), the Department has concluded that the continued presence and proposed operation of the Project will result in pervasive ongoing impacts to riparian/wetland resources. These impacts include:

- A 90% reduction in the extent of potential future riparian vegetation types currently inundated by Project reservoirs and an associated landscape-scale shift in the relative abundance of palustrine and riparian vegetation types;
- Project-induced hydrologic and geomorphic changes that result in the continued alteration of more than 170 acres of riparian and wetland habitat adjacent to the mainstem of the Klamath

River, including creation of conditions that favor reed canary grass and impair willow establishment in the J.C. Boyle bypass and peaking reaches;

- Project-induced hydrologic changes that render approximately 27 acres within the J.C. Boyle peaking reach varial zone unsuitable for vegetation establishment;
- Maintenance of conditions which limit riparian/wetland vegetation establishment on the margins of Project reservoirs;
- Habitat disturbance associated with recreation use;
- Habitat alteration due to the spread of noxious weeds and other invasive plants; and,
- Potential future habitat loss or degradation due to human development attracted by Project reservoirs.

Protection, Mitigation, and Enhancement Measures

PacifiCorp's proposed Vegetation Resources Management Plan (Exhibit E 5-122) would guide vegetation and weed management and monitoring near Project facilities and roads, recreation sites, and transmission lines. Elements of this plan specific to management of riparian/wetland resources affected by Project facilities are not provided in the FLA.

In addition, PacifiCorp proposes a riparian management program (an element of the Wildlife Habitat Management Plan) designed to improve and expand riparian/wetland habitats along river and reservoir shorelines (Exhibit E 5-127). This program would consist of two major elements:

- "Protecting the [riparian and wetland] resources from potential future human development and the ongoing livestock grazing" (Exhibit E 5-127); and,
- "…where necessary, restor[ing] currently degraded riparian habitat" by using "Site-specific measures within the FERC Project boundary….focus[ed]…where PacifiCorp owns land" (Exhibit E 5-129).

The scope of PacifiCorp's proposed effort (within the Project boundary and on PacifiCorp land) is not clearly described. Review of vegetation mapping data indicates that this PM&E measure would encompass approximately 165 acres adjacent to the river and tributary streams and perhaps 75 acres of riparian/wetland habitat adjacent to reservoirs. In addition to implementing the two resource management plans described, PacifiCorp proposes to modify the flow regime in the J.C. Boyle peaking reach (Exhibit E 4-151) and introduce a limited volume of gravel into the J.C. Boyle bypass reach (Exhibit E 4-169).

The PM&E measures proposed in the FLA do not sufficiently address continuing Project impacts on the composition and structure of riparian vegetation communities. There are four primary reasons for this.

First, the limited spatial scope and potential management measures described in the proposed WHMP are constrained in a manner that ensures Project impacts will not be adequately mitigated. As is clear from the discussion presented in the FLA and the Department analysis of Project impacts, far more than 244 acres of riparian/wetland habitat are adversely affected by the Project. While the area of Project effects spans from J.C. Boyle Reservoir to river reaches downstream from Iron Gate Dam, PacifiCorp proposes to focus riparian management efforts primarily on one segment of the Klamath River and in numerous small tributaries (thereby ignoring its own finding that the low terraces in the Oregon portion of the J.C. Boyle peaking reach are "critical sites for…restoration opportunities"; Terrestrial Resources FTR 3-154). Using a conservative estimate of the total area affected by the Project, it is clear that only a small percentage of the river and reservoir shorelines affected by the Project would benefit from PM&E measures (Table 1-19).

Table 1-19. Extent of areas impacted by Project included within WHMP area.

Hydrologic Feature	Total Length[1]	Length Included within WHMP Area	% of Total Length
River reaches[2]	23 miles	5.8 miles	25%
Project reservoir shorelines	44 miles	4.7 miles	11%

Notes: (1) Does not include Klamath River downstream from Iron Gate Dam or tributary mouth embayments in Project reservoirs; (2) Includes only J.C. Boyle bypass and peaking reaches and the Copco II bypass.

Rather than focusing on tributaries that happen to occur on PacifiCorp lands, the WHMP should focus on mitigating continuing impacts of the Project. Given the widespread influence of the Project, such mitigation would require a combination of systemic changes designed to accommodate hydrologic, geomorphic, and ecological processes and site-specific restoration measures.

Second, there is a lack of clearly described links between proposed actions and the full range of Project impacts. Protection of habitat from human development is a worthwhile endeavor, but addresses only one Project impact (namely, the role of Project facilities in attracting of human development). Further, the majority of the lands within the proposed WHMP area are currently subject to land use laws that may limit the practical ramifications of PacifiCorp's efforts. Active restoration such as that proposed in the FLA (Exhibit E 5-129) is certainly warranted along many segments of the Klamath River; without a more thorough description of the extent of restoration efforts, however, the adequacy of this PM&E measure cannot be assessed. Regarding tributaries, both the need for restoration actions and the link between tributary and Klamath River habitat conditions (and potential habitat benefits) has not been clearly documented.

Third, proposed operations at J.C. Boyle would continue to alter river hydrology in ways that impair riparian processes (and may also affect the viability of proposed site-specific vegetation planting efforts). Reduced peak flows and associated reductions in rates of fluvial processes (especially scouring and deposition of alluvial surfaces) would continue to affect riparian conditions in the J.C. Boyle bypass reach. Peaking operations at J.C. Boyle powerhouse would continue to impair willow establishment and create ideal growing conditions for reed canary grass. It should be noted that the proposed J.C. Boyle flow regime does not include "spring run-of-river…flows" as implied in the FLA (Exhibit E table E 5.6-1); peaking operations during this period may occur coincident with release of willow seeds and thereby impair germination.

Finally, the volume and frequency of proposed gravel augmentation events would be unlikely to mitigate Project impacts on sediment supply and transport (see the geomorphology section of this document) and associated indirect impacts on riparian ecological processes. The streambed in the J.C. Boyle bypass and peaking reaches would continue to be coarsened due to a net reduction in sediment supply and the reduced frequency of scouring and deposition of alluvial material would limit the extent of substrate suitable for willow establishment.

As a result of widespread continuing Project impacts that are not adequately addressed by proposed PM&E measures, the proposed Project would prevent the attainment of Department management objectives pertaining to the maintenance and enhancement of properly functioning riparian systems and the maintenance and restoration of species composition and structural diversity of riparian habitat.

E6.0 CULTURAL RESOURCES

FLA Discussion of Existing Environment and Project Impacts

The Cultural Resources Final Technical Report (CRFTR) provided by PacifiCorp remains incomplete. This is essentially the document that the CRWG expected to see in the Draft Technical Report (DTR) submitted in June 2003. Thus, the CRFTR is essentially the first opportunity that the CRWG has had to comment on a relatively complete draft; a draft that PacifiCorp seems to intend to be the final report, even though it is incomplete.

Adequacy of Applicant's Information

PacifiCorp states that the "FTR integrates the studies (concluded in late 2003 or early 2004) and describes their approaches, methods, results and conclusions (CRFTR 2-2)". This statement is only partially accurate. The approaches, methods, results and conclusions are compiled and set forth over several hundred pages of text, tables and figures. While the issues are described, no attempt was made to condense the data and results into a cohesive report. For instance, rather detailed research designs are provided for both historical and prehistoric sites. Unfortunately, these research designs are extremely hard to access. The prehistoric research design is offered within the main body of the report while the historical research design is relegated to an appendix and nowhere is there a synthesis that integrates the research designs and the results of the fieldwork.

Cultural Resource Surveys

PacifiCorp states that "While the pedestrian survey within the [field inventory corridor] covers the majority of the APE, the Spring Creek diversion and several tributaries and access roads within the proposed FERC boundary will be surveyed in the spring of 2004 (E 6-33)." As noted for the CRFTR, surveys are needed throughout the newly identified area of potential effect (APE), not just within the Spring Creek diversion, tributaries and access roads referred to by PacifiCorp. A simple GIS overlay of past surveys, PacifiCorp surveys and the newly identified APE will reveal several hundred acres that require inspection. For those areas within the newly identified APE, PacifiCorp needs to clearly identify areas that have been surveyed, areas that cannot be surveyed due to extreme slopes, areas that cannot be surveyed due to landowner access denial (provide correspondence), and areas that will be surveyed in the spring of 2004.

PacifiCorp indicates that surveys were not conducted on private lands the field crew were denied permission to access (CRFTR 3-2). Within the FLA there is no correspondence record to corroborate requests or denials to conduct cultural resource surveys on private lands pursuant to Section 106 of the National Historic Preservation Act within the Project Boundary, the Field Inventory Corridor (FIC), or the APE. The correspondence files should include letters from PacifiCorp to potentially affected landowners requesting access to survey their property as well as the landowner responses to those requests. Figure 3.4-1 showing the location of past and present surveys should then be updated to show which parcels were not surveyed because of access denial.

PacifiCorp states that "the remaining accessible reaches on BLM-managed lands were surveyed by a BLM-hired consultant in late 2003 (CRFTR 3-3, see also E 6-33 and 6-34)." This statement is not accurate. Surveys on BLM administered land within the Klamath River Canyon have been conducted in support of BLM's management objectives. During the 2003 field season, BLM

contractors surveyed 933 acres for cultural resources within the canyon. Some of these acres were located within the FIC; though most were located outside of this boundary and very few of the surveyed acres are within the newly identified APE. When one compares the survey coverage (both past surveys and those conducted by PacifiCorp) within the APE, it is apparent that several hundred acres have yet to be inspected. While some of this unsurveyed land is located on extreme slopes or within marshy areas, there are many areas with relatively gentle relief within the newly defined APE that have not yet been inspected. This includes both PacifiCorp land as well as BLM administered land in California and Oregon. It is PacifiCorp's responsibility to ensure that these surveys are carried out, regardless of land ownership. If additional sites are identified during these investigations they will need to be fully documented, assessed for Project impacts and included in the HPMP and PM&Es.

For the newly identified APE, PacifiCorp needs to clearly identify those areas that have been surveyed, those areas that cannot be surveyed due to extreme slopes, etc., those areas that cannot be surveyed due to landowner access denial (provide correspondence), and those areas that still need to be surveyed in Spring 2004.

Currently, if one wishes to determine whether a site could potentially be affected by Project activities, two separate map tiles must be reviewed – one showing survey coverage and site locations (Figure 3.4-1) and an additional set showing the APE (Appendix 3A). One set of map tiles showing the relationship of known cultural resources to the Project's APE is needed to ensure that these sites are properly managed and protected.

Prehistoric Cultural Resources

PacifiCorp indicates that the Integration Report (pulling together all of the tribal traditional cultural data as well as the regulatory analysis of the riverscape as an NRHP eligible ethnographic landscape) will be available in the spring of 2004 (E 6-55). It is extremely important that the Integration Report be distributed to the CRWG. Unfortunately, PacifiCorp has not yet distributed the report to the entire CRWG for review and comment.

However, preliminary discussions at a recent stakeholder meeting (March 10, 2004), and a review by some members of the CRWG who have received an advanced draft of this document, indicate that the report recommends the expansion of the APE from the mouth of the Klamath River to the tributaries of Upper Klamath and Agency Lakes. Further, the report recommends that the entire riverscape is potentially eligible for the NRHP. The Department supports the downriver Tribes' position and the recommendation presented in the integration report that the APE should extend to the mouth of the river as it enters the Pacific Ocean.

It is likely the Integration Report will lead to the discovery of additional historic properties; particularly, cultural sensitive properties outside the existing APE. PacifiCorp, in consultation with Tribes, resources agencies, and FERC must establish mitigation measures to protect these properties.

Historic Cultural Sites

The discussion of Early Settlement is inadequate (CRFTR 2-40 to 2-47). For instance, the FLA does not reference significant events, such as the contributions of the Martin Frain family, who were among the first Euroamericans to spend time in the Klamath River Canyon, interact with Native American populations, and established one of the first ranches in the area – Frain Ranch. The history of Frain Ranch extends back to 1888-1889, when Frain purchased 160 acres from

David Vanman for $700. Frain deeded the ranch to his surviving sons in 1893. After buying out his two brothers, Wren Frain built a board and batten house for his family in 1910. The remains of this structure are visible today. Later in the FTR, PacifiCorp notes that the historic component of Frain Ranch is potentially eligible for the National Register under Criterion 'a', 'b', 'c', and 'd'.

The Way Cemetery should be included in the discussion of historic cemetery sites (CRFTR 3-168). This historic period cemetery is located within Klamath River Canyon directly above Salt Cave. Although it is just outside the FIC (and thus the APE), it contains the graves of a number of early prominent residents of the region.

As noted for the CRFTR, PacifiCorp presents a rather detailed research design for prehistoric cultural resources (E 6-1 to 6-33). The historical cultural research design should logically follow the prehistoric research design. Instead, the historical research design is relegated to an appendix (2G). Each of the research designs need to be re-analyzed with respect to the data gathered for this project to determine if the new data can address any of the questions posed by PacifiCorp.

Exhibit E (6-34) states that "The CRWG defined the FIC (Field Inventory Corridor) to encompass the current FERC project boundary, riparian and hydrologically connected areas along project-affected reaches, and culturally sensitive lands within the Klamath River Canyon from ridge-top to ridge-top (rim to rim)…..". If historic properties are identified or found within the FIC, they must be treated as they are located within the APE; specifically, Pacific Corp must develop mitigation measures and monitoring programs to protect those properties if they could be adversely affected by Project operations or effects.

NRHP Eligibility

Prior to embarking on a discussion of NRHP eligibility a new section addressing the results of the field work as it relates to the research design is needed. Both the prehistoric and historical research designs presented by PacifiCorp contain some rather detailed data requirements which should now be reviewed (CRFTR 3-177). Some of the questions posed by PacifiCorp can now be addressed with data gathered by the field teams. In addition, new questions undoubtedly could be formulated. Still other questions (perhaps the majority) will need further data to be adequately addressed. A discussion of NRHP eligibility would then logically follow that section.

PacifiCorp states that the analysis and results would be used to develop detailed study plans for the Historic Properties Management Plan (HPMP) (CRFTR 3-2). Further, site specific NRHP eligibility would be evaluated and PM&Es would be identified. While an outline for the HPMP is provided in the CRFTR, the CRWG has not had an opportunity to discuss the details of the document. The statement in Exhibit E (section 6.6.1) that the Historic Properties Management Plan (HPMP) Outline has been approved by the Cultural Resources Working Group (CRWG) is false. An opportunity to discuss this document is scheduled for March or April 2004, after the review period for this FTR is closed. The PM&Es that are included in Exhibit E6.0 (and should have followed from the HPMP) have never been formally discussed/approved by the CRWG.

Traditional Cultural Properties (TCPs) and Sensitive Cultural Resources (SCRs)

Statements in the FLA concerning Traditional Cultural Properties (TCP's) are contradictory. In Section E 6.1.5.1 it is noted that TCPs for the Klamath Tribes do exist within the project boundary. Additionally, the presence of TCPs within former Shasta homelands is detailed in

Section E 6.1.5.2. However, in Section 6.7.3 it is stated that, currently there a no documented TCPs within the project boundaries.

In addition to historic properties, the draft HPMP must include mitigation measures to protect culturally sensitive sites; especially, gathering sites, ceremonial, and sacred sites. The license article requiring the HPMP should also include a provision requiring an opportunity for review and comment by the Tribes and other resource agencies before PacificCorp submits the HPMP to FERC.

Project Impacts on Cultural Resources

PacifiCorp states that "studies of the Project's effect on geomorphology in and below the Project area were conducted (E 6-55)." None of these studies adequately addressed cultural resource concerns, even though several CRWG members (Eric Ritter, BLM and Ron Reed, Karuk Tribe) have requested such site-specific studies for several years. PacifiCorp sponsored a three day tour for the CRWG targeted at geomorphology and Project effects. This tour, while appreciated, did not ameliorate CRWG concerns about erosion of sites due to Project activities. Site specific studies conducted by a geoarchaeologist (an individual trained in both geology/geomorphology and cultural resources) are necessary to determine what, if any, effects are occurring due to Project activities.

Alternative Information or Interpretation

Historic Cultural Resources

During a discussion of the Klamath Hot Springs (Beswick Hotel), PacifiCorp states that after a fire destroyed the hotel in 1915, the facility was never rebuilt (CRFTR 2-47 and 3-167). While this is technically true (the hotel was not rebuilt after the fire), PacifiCorp fails to point out that the hotel was replaced by a dance pavilion sometime around 1920. The dance pavilion became a community focal point for a number of years. Constructed using dressed stone recycled from the burned out shell of the hotel, this is the structure that is currently visible today hidden among the blackberry brambles adjacent to Ager-Beswick Road.

PacifiCorp states that Spencer Cemetery is located outside the Project APE and the FIC but "should be included in future BLM Klamath Falls Resource Area records and management planning and be protected from unauthorized artifact collection or vandalism (CRFTR 3-200)." Spencer Cemetery is not located within lands managed by the BLM. Rather, it is on private property (US Timber) and although we agree that this important historic site should be protected, it does not fall within our jurisdiction.

PacifiCorp indicates that Topsy Grade is not eligible for the NRHP because it has lost its' integrity as a result of modern improvements (CRFTR 3-202; E 6-93). This assessment needs to be discussed further. While portions of Topsy <u>Road</u> have lost their integrity due to modern improvements, Topsy <u>Grade</u> is still much as it was during the 1870s – 1920s when the road was the main artery between the Klamath Basin and the "outside world" (Yreka, CA). The Grade climbs/descends 700 feet from the canyon rim to the river, clinging to the edge of the canyon wall for much of the length. Spectacular views of the river canyon, rapids, and Frain Ranch are present along this route. The only improvements to this stretch of the road are occasional grading of the rocky surface and periodic removal of rocks/boulders to allow vehicle passage. The Grade

appears to retain integrity of place and feeling and is potentially eligible for the NRHP under criterion 'a' and 'c'.

PacifiCorp indicates that the Pokegama Log Chute is not eligible for the NRHP because it does not retain its' integrity (CRFTR 3-204; E 6-63). This assessment needs to be discussed further. While the original wooden log chute has been removed, a vivid scar on the side of the canyon wall is visible from miles away. In addition, the basalt cobble foundation of a fairly substantial structure is present at the head of the chute and the remains of the railroad grade leading to the chute are still visible. Integrity of place and feeling is retained and the site is potentially eligible for the NRHP under criterion 'a' and 'd'.

Traditional Cultural Properties (TCPs) and Sensitive Cultural Resources (SCRs)

PacifiCorp states that "at this time, there are no known TCPs or SCRs within the proposed Project boundary (E 6-129 and 6-130)." This statement does not appear to be accurate. Within Exhibit E (page 6-45), PacifiCorp states "The Klamath Tribes study identified 10 sites that meet the criteria for designation as TCPs, three of which (Big Bend, Link River, and Miller Island oxbow) are located within the Project area of potential effect and seven of which are located upstream of it." PacifiCorp goes on to say (Exhibit E 6-46; CRFTR 4-20) that "Deur's report demonstrates that salmon constitute a sensitive cultural resource and are important for a variety of reasons." "Other SCRs include suckers, trout, mullet, freshwater shellfish, waterfowl species, and birds' eggs, deer, wocus, and tules, among others." While salmon do not currently reach the newly defined Project APE, the tribal stakeholders (Klamath Tribes, Shasta, Karuk, Hoopa, and Yurok), as well as many other specialists, note that Project facilities (dams, etc) block the passage of anadromous fish. Blockage of these fish runs has had (and will continue to have) deleterious effects on the salmonid SCR and thus the health and cultural well-being of tribal stakeholders.

Department Conclusions Regarding Existing Environment, Project Impacts, and PMEs

<u>Existing Environment</u>

PacifiCorp has presented a very restrictive APE. PacifiCorp states that "Many of the CRWG members, including the tribes, feel that the APE should be considerably larger than that shown in Appendix 3A (CRFTR 3-2)." This statement should be revised to read "Most of the CRWG…" or "Nearly all of the CRWG…" since the only member of the working group not advocating a considerably larger APE was PacifiCorp.

If this arbitrary boundary is allowed to remain, areas outside of the current APE containing significant cultural resources will continue to be affected by the Project. Nineteen prehistoric and historical sites are immediately adjacent to the currently defined APE on both BLM and PacifiCorp land and are considered to be potentially at risk during the proposed 30 year license period. The newly proposed APE is inadequate, especially in regard to Project access roads. These roads are used to access Project facilities as well as for recreational activities. Sites such as Coyote's Paw (CA-SIS-1198) located on BLM administered land within the canyon south of the California border are (and will be) at increased risk because of Project related activities. Coyote's Paw lies outside of the APE as currently defined, but is immediately adjacent to Topsy Road, one of the main routes used by visitors for recreation in the canyon. This very significant site contains the remains of numerous house pits, rock rings, rock cairns, rock walls, and girdled trees and may have served as a location for the Ghost Dance in the 1870s. The increase in recreational

opportunities encouraged by PacifiCorp puts this site at great risk over the next 30-year license period. Expansion of the APE is needed in other areas of the Project as well. At a minimum, the following areas need to be included in an expanded Project APE:

- Topsy Road from the intersection of Highway 66 to Topsy Campground (APE map tile 13).
- Topsy Road from the intersection of Picard Road to Beswick (APE map tile 17 – 21).
- Ager – Beswick Road from Beswick to Copco Lake (APE map tile 21 – 23).
- Westside Road from its' current exit out of the APE to it's' terminus (APE map tile 18 – 19).
- The access road leading to Stateline Takeout from its intersection with Topsy Road (APE map tile 19).
- Way Cemetery including the access road from its intersection with Topsy Road (APE map tile 19).
- The area immediately adjacent to Topsy Road containing Coyote's Paw (APE map tile 19).
- The access road leading to the Juniper Point Picnic Area (APE map tile 27).
- The access road leading to the Long Gulch Picnic Area (APE map tile 28).

Project Impacts

PacifiCorp's hydroelectric project will directly affect cultural resources located on BLM administered lands over the next 30 year license period. Twenty archaeological sites are known to exist within the currently defined APE on BLM administered land. Many more exist within the APE on PacifiCorp land. Additional sites are located immediately adjacent to the APE on both BLM and PacifiCorp land. With the completion of required surveys within the APE, additional sites are likely to be discovered. PacifiCorp has stated (CRFTR 3-1) "Some of these sites appear to be affected by Project operations and/or Project-related activities such as public access and recreation." Site specific impacts identified by PacifiCorp during fieldwork in 2002 and 2003 include looting, erosion, recreation development, road and utilities development, vandalism, livestock grazing, and camping.

In addition to the impacts of PacifiCorp's restrictive cultural resource area of potential effect, direct Project effects on cultural resources include:

- Erosion due to ramping rates/duration within the peaking reach;
- Recreation impacts to cultural resources;
- Reservoir shoreline fluctuations, and
- Extirpation of anadromous fish runs above Iron Gate Dam.

Each of these Project effects is discussed below.

Erosion Due to Ramping Rates/Duration Within the Peaking Reach

Fully eighteen sites immediately adjacent to the river within the peaking reach (and within the APE) are potentially affected everyday by periodic fluctuations of water through PacifiCorp hydroelectric facilities. River bank erosion of fragile archaeological site deposits is an ongoing concern on both BLM administered land as well as on PacifiCorp lands. At least one site with human remains (35KL22) has been affected in the past. Emergency stabilization efforts currently protect the portion of this site known to contain human remains. Additional cultural deposits, both upstream and downstream from the stabilized area, remain at risk from erosion. Over the 30-year life of the next license it is reasonable to assume that the continued periodic ramping of the water level, the velocity of the discharge, and the duration of the flows from the hydroelectric facilities will affect the stability of site deposits adjacent to the river. This is true not only for site

35KL22, but at the other seventeen sites (regardless of ownership) immediately adjacent to the river within the peaking reach.

Recreation Impacts on Cultural Resources

Recreational activity within the Project area is expected to be at least as intensive over the next 30 year license period as it is today. Given the nature of the canyon with its' sheer canyon walls and periodic level river terraces, visitors planning day trips or overnight camping experiences concentrate their activities on the terraces adjacent to the river. This appears to be the case regardless of land ownership – in fact, the routine visitor to the canyon often will not know if they are on private or public lands. The same terraces where visitors tend to congregate contain the remains of numerous historical and prehistoric sites; many of which are thousands of years old, extremely significant and easily disturbed. In fact, PacifiCorp proposes that the entire river canyon be nominated to the NRHP as an archaeological district. Thus, sites located along the river within and adjacent to designated recreation areas are at high risk of disturbance by canyon visitors.

Activities such as camping, picnicking, rafting, hunting and fishing all can lead to increased site visitation. Along with increased site visitation comes increased site disturbance. Casual artifact collection is likely to continue over the foreseeable future. Over time, casual collection leads to a loss of site integrity. Increased visitation will also lead to increased looting of these sites by individuals' intent upon the wanton destruction of archaeological deposits for the chance to obtain artifacts for sale or personal use.

The use of all-terrain vehicles (ATVs) within the canyon is expected to continue the degradation of archaeological deposits. Disturbance to archaeological sites on both BLM and PacifiCorp lands by ATV use has been documented in the past and is expected to continue, especially within and adjacent to designated recreation areas. At several sites within the canyon, especially at Frain Ranch, ATVs are using house pit depressions as jumps/ramps and obstacle courses which severely disturbs the context of associated artifacts as well as affecting the integrity of the structures. This activity is expected to continue as long as visitors are allowed to freely access these areas.

Impacts to Cultural Resources from Reservoir Shoreline Fluctuations

During periodic maintenance of PacifiCorp's hydroelectric facilities, reservoirs formed by the dams are de-watered. After maintenance is performed, the lake levels are allowed to rise again. During de-watering episodes, numerous sites are put at risk. Water lapping the edges of sites will, over time, affect the stability of cultural deposits. Wave action during times of de-watering (both from wind as well as from fishing/skiing boats) can also impact site deposits. Perhaps the greatest risk to archaeological sites during these de-watering episodes is the exposure of archaeological site surfaces containing artifacts and features normally protected by water inundation. Local artifact hunters target these sites during low water events (often publicized by PacifiCorp in the name of public safety) causing irreparable damage. This kind of project impact is expected to continue thru the life of the next 30 year license period.

Extirpation of Anadromous Fish Runs Above Iron Gate Dam

PacifiCorp states that "Deur's report demonstrates that salmon constitute a sensitive cultural resource (SCR) and are important for a variety of reasons (Exhibit E 6-46; CRFTR 4-20)."

Blockage of these fish runs has had (and will continue to have) deleterious effects on the health and cultural well-being of tribal stakeholders.

Protection, Mitigation, and Enhancement Measures

PacifiCorp states that the analysis and results would be used to develop detailed study plans for the HPMP (CRFTR 3-2). Further, site specific NRHP eligibility would be evaluated and PM&Es would be identified. While an outline for the HPMP is provided in the CRFTR, the CRWG has not had an opportunity to discuss the details of the document (see also comments provided below). That opportunity is to be given sometime in late March/early April 2004, after the review period for this FTR is closed. The PM&Es (which should have logically followed from the HPMP), that are included in Exhibit E6.0 have never been formally discussed/approved by the CRWG.

PacifiCorp states that "Appendix E6F contains an outline of the HPMP that has been approved by the CRWG, tables identifying archaeological sites and historic structures included in the HPMP with potential PM&E measures and a general description of each proposed PM&E and cost estimates for implementation (E 6-194)." A draft HPMP was distributed and briefly discussed at the November 2003 CRWG meeting. The draft HPMP was not approved during this meeting as suggested by PacifiCorp, nor was it approved at the following meeting in December 2003. No further CRWG meetings have been held since the December 2003 meeting. Furthermore, while potential PM&E measures were discussed in passing at a number of CRWG meetings, none were officially adopted. In fact, those presented within Exhibit E, Appendix E-6F provide the first opportunity for the CRWG to see what PacifiCorp had in mind for protecting cultural resources potentially affected by the Project. Some of the PM&E measures proposed by PacifiCorp ("Warning – Poisonous Snakes") may not be effective in protecting sensitive archaeological sites.

The number of sites that would benefit from the PM&E measures have not been discussed and/or determined by the Cultural Resource Work Group (CRWG). We recommend PacifiCorp conduct site-specific field trips with CRWG as soon as possible to identify mitigation measures to be incorporated in the HPMP and PM&E plans. Some of the PM&Es proposed by PacifiCorp (Appendix E-6F pages 3 to 7) could potentially cause adverse effects themselves including capping, site concealment, proactive site isolation, and erosion control. Further study/analysis is needed to clarify the effects these PM&Es may have on the resources over the 30 year license period.

Because Tribes are most familiar with locations of culturally sensitive sites, PacifiCorp should invite Tribal staff to be part of the monitoring team. Direct Tribal involvement and participation, complemented with appropriate training, will not only ensure that damages to cultural resources are alleviated, but also minimize further deterioration due to possible neglect and failure to implement the HPMP.

The FLA describes a scenario in which PacifiCorp funds a two-person monitoring team that visits all sites every 5 years (Appendix E-6F, page 3). One of the main monitoring objectives is to review and reassess whether mitigation measures have been effective and, as needed, implement alternative strategies. To ensure appropriate and effective mitigation, the monitoring team should conduct site visits more frequently (e.g., every two years). This will provide resource agencies and Tribes an opportunity to review and make sure follow-up actions and mitigation objectives are met.

E 6.1.5.1 E 6.1.5.2 and E 6.7.3

Statements concerning Traditional Cultural Properties (TCP's) in these two sections are contradictory. In Section E 6.1.5.1 it is noted that TCPs for the Klamath Tribes do exist within the project boundary. Additionally, the presence of TCPs within former Shasta homelands is detailed in Section E 6.1.5.2. However, in Section 6.7.3 it is stated that, currently there a no documented TCPs within the project boundaries.

Exhibit E, Page 6-34: The 5th paragraph refers to "The CRWG defined the FIC (Field Inventory Corridor) to encompass the current FERC project boundary, riparian and hydrologically connected areas along project-affected reaches, and culturally sensitive lands within the Klamath River Canyon from ridge-top to ridge-top (rim to rim)…..". If historic properties are identified or found within the FIC, they must be treated as they are located within the APE; specifically, Pacific Corp must develop mitigation measures and monitoring programs to protect those properties.

E 6.6.1

The statement in this section that the Historic Properties Management Plan (HPMP) Outline has been approved by the Cultural Resources Working Group (CRWG) is false. None of the PM&E measures detailed in the outline as well as appearing in Section 6.6.2 of this appendix were ever approved by the CRWG, and many amount to ideas that were simply 'floated' during CRWG meetings.

Exhibit E, Page 6-121, section E6.5.3, Studies Currently Underway: Last sentence, it is mentioned here that "Final tribal (Ethnographic) reports will be submitted to PC no later than June 30, 2004". It is likely these ethnographic reports will lead to the discovery of additional historic properties; particularly, cultural sensitive properties outside the existing APE. Pacific Corp, in consultation with Tribes, resources agencies, and FERC must establish mitigation measures to protect these properties.

Exhibit E, Page 6-124, Cultural Resources: In the 4th paragraph, it is stated that a draft Historic Properties Management Plan (HPMP) will be submitted to FERC in the spring of 2004. In addition to historic properties, this draft HPMP must include mitigation measures to protect culturally sensitive sites; especially, gathering sites, ceremonial, and sacred sites. The license article requiring the HPMP should also include a provision requiring an opportunity for review and comment by the Tribes and other resource agencies before PacificCorp submits the HPMP to FERC.

APPENDIX E-6F, Page 3: It is stated a likely scenario would be for PacificCorp to provide a two-person monitoring team that visits all sites every 5 years. One of the main monitoring objectives is for us to review and reassess whether a mitigation measure has been effective and implement an alternative methodology accordingly. To ensure appropriate and alternative mitigation measures are in place, the monitoring team should conduct site visits every 2 years. This will provide resource agencies and Tribes an opportunity to review and make sure follow-up actions and mitigation objectives are met. More importantly, since Tribes are most familiar with locations of culturally sensitive sites, it is sensible that PacificCorp invites Tribal staff to be part of the monitoring team.

Tribal direct involvement and participation, particularly when they are trained, will not only ensure that damages to cultural resources are alleviated, but also minimize further deterioration due to possible neglect and failure to implement the HPMP.

The number of sites that would be benefited from the PM&E measures have not been discussed and/or determined by the Cultural Resource Work Group (CRWG). We recommend PacifiCorp conduct site-specific field trips with CRWG as soon as possible to identify mitigation measures to be incorporated in the HPMP and PM&E plans.

E7.0 RECREATION RESOURCES

FLA Discussion of Existing Environment and Project Impacts

Existing Environment

Project Boundary

PacifiCorp proposes to exclude several areas of importance to the Department from the Project, including: Keno Dam and Reservoir; the majority of the J.C. Boyle Bypass reach (Exhibit A, Figure A2.1-1); the Powerhouse road on the west side of the river from just below the BLM Spring Island boat launch to the abandoned bridge upstream from Frain Ranch, and on the east side of the river from the abandoned bridge to the junction with Topsy Road (Exhibit A, Figure A2.1-1); and, Transmission line 98 (Exhibit A, Figure A2.1-1).

PacifiCorp proposes including within the Project boundary approximately 5 miles of the Klamath River upstream from Copco Reservoir and associated recreation sites. PacifiCorp is proposing to develop a new Upper J.C. Boyle Reservoir Boater Access (Exhibit E 7-103; D 2). Access to this site will be controlled through Sportsman's Park.

Project Impacts

The BLM Topsy campground needs to be included in the description of Project-related facilities (Exhibit E 7-25, 7-29, 7-30, 7-83 and 7-88).

Although the Sportsman's Park area is not included within the proposed Project boundary (Exhibit E 7-25, 7-30, 7-83 and 7-88), it is incorrect to state that the facility does not provide developed reservoir access. Sportsman's Park provides primary access to an undeveloped area comprising the upper portion of J.C. Boyle Reservoir and the Keno reach for boaters, fisherman and other recreationists. Further, PacifiCorp notes that Sportsman's Park "provides a variety of recreational opportunities (hunting, target shooting, archery) not available at other sites within the proposed Project area (Exhibit E 7-87)."

Adequacy of Applicant's Information

The FLA does not consistently describe the Project boundary in the vicinity of the BLM Topsy campground (located adjacent to J.C. Boyle Reservoir). The shoreline adjacent to this campground is excluded from the proposed boundary in some descriptions (Exhibit E figure 7.1-1) and included within the boundary in others (Exhibit A figure A2.1-1 and Exhibit G). Recreation use at this facility is concentrated near the shoreline, and some recreation facilities are located within this area. The entire Topsy campground is within the current license (Exhibit R, amended). Topsy campground should be included with the discussion of the "J.C. Boyle Reservoir Resource Area." PacifiCorp has identified several facility needs at this facility (Recreation Resources FTR 5-140 and 5-14).

The range of potential fishing opportunities in the J.C. Boyle peaking reach associated with steady flows in the range of 300 to 1500 cfs were not adequately assessed. The FLA does not analyze or consider the impacts of the Project on potential opportunities to fish for anadromous salmon above Iron Gate Dam (including the Upper Klamath Wild and Scenic River reach).

In 2003, the BLM and NPS requested that the licensee provide a discussion of how Klamath River values protected by (or eligible for protection by) the Wild and Scenic Rivers Act have been influenced by Project operations, particularly before and after the following time periods:

- Original license operation conditions affecting flows and water quality;
- Construction of Iron Gate and J.C Boyle Dams and associated license amendments; and,
- Flow changes in the mid-1990's in response to ESA requirements and other factors affecting operation of the USBR Klamath Project.

This information has not been provided to the Department and is not included within the FLA. Nor did the FLA include the information identified in the "Crosscutting Issues – Wild and Scenic River Assessments" (presented to the Plenary in April 2003 and in NPS comments on the DLA). In addition, the NPS is still awaiting the results of ongoing water quality and fishery studies to determine the extent to which the Project has affected conditions downstream from Iron Gate Dam. In the absence of conclusive evidence to the contrary, the Department believes that the proposed Project would significantly affect the Lower Klamath River, at least extending to its confluence with the Salmon River.

Alternative Information or Interpretation

Project Boundary

The FERC boundary should include recreation sites that are affected by project operations. The whitewater boating activities that occur in the J.C. Boyle peaking reach have been induced by the project operations. Therefore, the project boundary should reflect not only PacifiCorp's current land, but also the recreation sites that are currently used by recreation users to access this section of the river. This includes Spring Island, BLM's Klamath Campground, Frain Ranch, and State Line. PacifiCorp's consultants included these sites in the studies and initial plans for improvements. Not including these sites in the Application is a significant change in the approach from the collaborative work of the recreation work group. These sites are clearly affected by the project and the project boundary should be modified to include them. Likewise, these sites should be re-incorporated into Exhibit E 7.0 in the recreation needs section. The J.C. Boyle bypass reach should also be included in the boundary. The bypass reach is highly affected by the project operations and this impact should be reflected by including it in the FERC boundary. In the discussion of PM&Es on the site-by-site basis, the project boundary issue is described in more detail.

An additional effect of reservoir operations is that the continued presence of the reservoirs has induced recreation. PacifiCorp has a responsibility to address this induced recreation on its land as well as on BLM land. Topsy campground, which is located on J.C. Boyle reservoir, should be re-entered into the project boundary. This campground is located on the reservoir and would not exist if it weren't for the on-going impacts of the project.

Other recreationists, including fishermen, campers and off-highway vehicle (OHV) users access the area via the existing Project roads on either side of the river. The area of commingled PacifiCorp and BLM-administered lands within the Klamath River canyon (Exhibit E 7-27 and figure E7.1-1) is not within the proposed FERC Project boundary. PacifiCorp states that "while the Project provides access roads, attractions and facilities that may attract these types of uses (OHV, hunting, target shooting, etc.), it is generally the responsibility of surrounding landowners and resource managers to manage these dispersed use activities occurring on their lands (Recreation Resources FTR 5-5)". The Department contends that PacifiCorp has a management

responsibility to address resource impacts associated with or dependent on Project facilities and operations.

Whitewater Boating

Bypass Reach

The proposed Project would cause a significant reduction in potential high quality whitewater boating opportunities in the J.C. Boyle bypass reach. It is generally accepted (Exhibit E 7-67) that acceptable flows for boating in this reach range from 800 to 3000 cfs. Flows of this magnitude have been effectively eliminated by Project operations in all but the wettest years or largest winter storm events (as discussed in the Hydrology section of this document). Even when this opportunity is available, the information is not readily available to potential users. Sharp rocks generated by sidecast canal construction are located in unexpected placements within the channel and cause degradation or rapids.

The inundation of the river canyon under Boyle reservoir has eliminated 3.2 miles of whitewater boating opportunity and an unknown number, quality, and classes of rapids. Whitewater opportunities in the Keno and J.C. Boyle peaking reaches are disconnected from one another by J.C. Boyle Reservoir and the J.C. Boyle bypass reach. Project facilities and operations thereby eliminate the opportunity for longer float trips of up to 30 miles in length.

Hell's Corner Reach

Daily peaking operations at J.C. Boyle powerhouse have created a stable, predictable opportunity for whitewater boating during the peak use months of July through October. Were it not for Project operations, flows during this period would generally be in the range of 500 to1,000 cfs, a range currently considered unacceptable for non-technical whitewater boating or commercial rafting (Exhibit E 7-67). Flows suitable for whitewater boating currently tend to be clustered in the range of 1,400 to 1,700 cfs (one turbine) or 2,400 to 3,000 cfs (two turbines).

Copco II Bypass Reach

As with the J.C. Boyle bypass reach, the Copco II bypass reach would support high quality whitewater boating were it not for the proposed Project. Although recreation activities are currently discouraged, the reach contains remarkable scenic quality.

Fishing

Resident trout in the J.C. Boyle reaches are generally smaller in size than trout found in other reaches as a function of reduced prey availability and, in the peaking reach, the Project affects fish bioenergetics. Thus the Project has an indirect adverse impact on fishing opportunities in these reaches. Additionally, Project dams continue to eliminate the anadromous fishing opportunity from areas upstream from Iron Gate Dam.

In the J.C. Boyle bypass reach, diversion of flows less than 2,950 cfs has improved fishing opportunities during high flow periods when the reach would have otherwise been "blown out" (discussed in the Hydrology section of this document), and Project roads provide access. Conversely, stabilized low flows have caused vegetation encroachment on banks, resulting in reduced fishability, in terms of both casting and accessing fishing areas from the bank.

The project has limited the range of low flows that are available for all types of fishing. The Recreation Flow Analysis results (Exhibit E 7-67), identifies flows of 300-500 cfs as optimal for fishing. Flows at the low end of this range are typical in the J.C. Boyle bypass reach. In the

peaking reach, however, Project operations limit the occurrence of stable flows in the range of 300 to 1500 cfs. Were stable flows in this range available, it is assumed that a variety of quality fishing experiences, particularly boat-based fishing, would be found. This opportunity and suitable flow levels for it were not adequately analyzed in the Recreation Flow Analysis completed as part of the relicensing process.

Facility Capacity

Camping opportunities have been identified as a limiting factor in the Project area (Exhibit E 7-74 and 7-77). Facility capacity is recognized to be a limiting factor at Topsy campground (Exhibit E 7-88) and Klamath River campground (Exhibit E 7-89), both of which are managed by the BLM and are closely associated with Project facilities (reservoirs and roads). In response to the Draft Recreation Resources Management Plan (RRMP), the BLM noted that Topsy campground is incapable of accommodating large family gatherings, organizational outings, and commercial whitewater groups. Further, social capacity is recognized as a limiting factor at the BLM Spring Island boater launch. Facility capacity at Fishing Access Site 1 is currently inadequate to support use by whitewater boaters taking advantage of Project operations. PacifiCorp should include these Project-related facilities within the proposed Project boundary and should review the Recreation Resources FTR to determine if additional facilities or management actions are needed to address facility capacity limitations.

Within the discussion of overall camping needs (Exhibit E 7-79, 7-86, and 7-94), PacifiCorp recognized the need for providing a range of developed to semi-primitive camping experiences. Despite noting that expansion of existing facilities, including campgrounds "with and without RV hookups," will be required if expected future demand is to be met (Exhibit E 7-79 and Recreation Resources FTR 5-113), PacifiCorp does not fully address the potential demand for additional RV camping sites (with hook-ups) to accommodate the desires of an aging population. This omission is inconsistent with PacifiCorp's conclusion that with an "aging of the U.S. population and the continued high demand for RV campsites, developed campsites in the proposed Project area will likely continue to be popular in the future."

Trails

The BLM has identified the need for improved whitewater scouting trails at two major rapids (Caldera and Hell's Corner rapids) on the Upper Klamath Wild and Scenic River. Enhancements to existing user-created trails are needed to improve safety for boaters scouting these rapids. The need for these trails was identified in the BLM Response to the DLA, the Klamath Falls Resource Area ROD/RMP, the Draft Upper Klamath River Management Plan, and (in the case of the Caldera trail), the FLA (Recreation Resources FTR 5-100 and 5-101). Although located outside of the proposed Project boundary, these facility improvements are needed to address a whitewater boating safety concern associated with proposed J.C. Boyle powerhouse operations.

The BLM Response to the DLA, the Klamath Falls Resource Area ROD/RMP, and the Draft Upper Klamath River Management Plan identify the need for more formalized trails in the Frain Ranch area. PacifiCorp recognizes the need for additional trails in the Frain Ranch area as a high priority (Recreation Resources FTR 5-101 and table 5.7-22). Although proposals for several trail segments were developed in collaboration with recreation working group stakeholders (as recently as October 2, 2003), these measures have been omitted from the FLA. To provide consistency with State Comprehensive Outdoor Recreation Plans and BLM RMPs, PacifiCorp should include these proposed trail opportunities in the PM&E package.

Motorized Trails

Recreation activity survey results indicate existing demand for OHV and mountain bike trails in the J.C. Boyle and Upper Klamath River/Hell's Corner Reach "resource areas" (Recreation Resources FTR table 3.7-11). Existing use and demand for OHV trails is present in the vicinity of Frain Ranch, Spencer Creek, and Sportsman's Park. Future demand for Motorcycling/ATV and mountain biking use is expected to increase (Exhibit E 7-80). PacifiCorp should review the existing recreation survey results to quantify the demand for OHV and mountain bike trails. Additional survey or study may be needed to adequately address this Project-related issue in a manner consistent with broader natural resource management objectives.

Roads

Road conditions affect recreation opportunities in the Upper Klamath River canyon (Exhibit E 7-50). Many of the roads accessing this area are "user maintained" and therefore receive minimal maintenance and are suitable for high clearance vehicles only (Topsy Grade and the "Powerhouse" road included within the existing Project boundary are roads of this type). Such roads influence recreation use by limiting visitation to those willing to endure rough, slow, dusty, and physically punishing roads.

Department Conclusions Regarding Existing Environment, Project Impacts, and PM&Es

Existing Environment

Project Boundary

The proposed Project does not encompass recreation resources that are either located within the existing Project boundary or would be affected by the proposed facilities and operations. The Department notes the following deficiencies in the recreation plan.

Keno Dam, Keno Reservoir, and Associated Recreation Facilities

PacifiCorp proposes to exclude Keno Dam from the Project boundary but retain control of day-to-day operations and maintenance. Although future operations of Keno Dam are not described in the FLA, Keno Reservoir and Lake Ewauna will continue to attract a variety of recreationists and boating enthusiasts, many of whom access these waterbodies via Keno Recreation Area. Altered management of or access to this recreation facility would significantly affect recreation resources, including use levels at the BLM Topsy campground and motorized boating on J.C. Boyle Reservoir. Further study may be needed to adequately address the impacts to recreation from the removal of the Keno and Link River facilities from the Project, if approved by FERC.

PacifiCorp should include the Keno Recreation Area in its proposed Project, as this facility is a primary access point for recreation resources created by the Project. PM&E measures for this site and others located on Keno Reservoir should be included in the FLA (Recreation Resources FTR 5-133 to 5-137).

J.C. Boyle Reservoir and Associated Recreation Facilities

Because it provides recreational opportunities and access to reservoir recreation, and also may provide opportunities for off-site mitigation of Project impacts, Sportsman's Park should be included in the Project boundary.

Topsy campground was constructed by the BLM in the mid-1960s in response to recreation demand created by J.C. Boyle Reservoir. The BLM will continue to incur operations, maintenance, and monitoring expenses over the life of proposed Project. The campground and adjacent shoreline are directly related to the Project and therefore should be included within the Project boundary.

J.C. Boyle Bypass Reach

The existing Project boundary in the vicinity of the J.C. Boyle bypass reach should be maintained for the following reasons:

- Recreational fishing and boating opportunities in this section of the river are severely impacted by flow diversions at J.C. Boyle Dam; and,
- Sidecast material associated with the J.C. Boyle canal has constrained the river channel and continues to adversely impact visual, recreational (especially whitewater boating), and other natural resources.

Powerhouse Road

The Powerhouse road between the Spring Island boat launch and the junction with Topsy Grade should be included in the Project boundary for the following reasons:

- Transferring maintenance responsibility for a road within the BLM right-of-way granted for the existing FERC license is unwarranted;
- Regular maintenance of this road is required to prevent resource degradation and provide access to recreation sites associated with the Project; and,
- This road continues to provide access for maintenance of PacifiCorp transmission lines.

Recreation Facilities Associated with the J.C. Boyle Peaking Reach

The BLM constructed the Spring Island boat launch in the early 1980's to accommodate whitewater boating demand that was created by Project operations but displaced by PacifiCorp's prohibition of boat launches immediately upstream from the J.C. Boyle powerhouse. The BLM will continue to incur operations, maintenance, and monitoring expenses over the life of the proposed Project. The Project boundary should be modified to include the Spring Island Boater Access and thereby reflect the direct impacts of Project operations on recreation use at this site.

The BLM Klamath River campground was developed in response to demand from recreationists attracted to the area partly by flow regimes created by the Project. This facility is accessed via a Project road. The BLM will continue to incur operations, maintenance, and monitoring expenses over the life of the proposed Project. The Project boundary should be modified to include the Klamath River campground and thereby reflect the direct impacts of Project operations on recreation use at this site.

PacifiCorp is to be commended for including six maintained fishing access sites and portions of the Stateline take-out in the proposed Project boundary (Exhibit E 7-27 and figure E7.1-1). It

must be noted that recreation uses on the PacifiCorp and BLM-administered portions of the Stateline facility are interrelated and inseparable. The PacifiCorp portion of the Stateline facility is commonly used for lunch stops or as a whitewater boating take-out, but is accessed via a road that traverses BLM-administered land (Exhibit E 7-32). The BLM provides regular maintenance and monitoring patrols of the entire Stateline facility, and funds portable toilet rental on PacifiCorp property. The BLM will continue to incur operations, maintenance, and monitoring expenses over the life of the proposed Project. The Project boundary should be modified to include the BLM-administered portion of the Stateline facility and thereby reflect the direct impacts of Project operations on recreation use at this site.

Project Impacts

Whitewater Boating

The proposed Project will cause whitewater boating opportunities in the J.C. Boyle bypass reach to be extremely limited and will eliminate less challenging boating opportunities in the river reaches inundated by Project reservoirs. Currently the reach provides a high quality whitewater opportunity in rare spill events, and information on when this opportunity is available is not readily available to potential users.

Project roads facilitate access to boat launch areas. PacifiCorp's proposed operations (Exhibit E 3-196) would maintain flows sufficient for whitewater boating in the J.C. Boyle peaking reach. However, the timing of proposed flow releases (later in morning, no set schedule on Wednesday) has changed since the 1994 designation of the Upper Klamath Wild and Scenic River. This may impair the ability of commercial boaters to operate and book trips, due to constraints associated with travel time between boating take-outs and their base of operations (primarily Ashland, Oregon). Peaking operations will continue to affect boating opportunities by decreasing the diversity of flows that would be encountered, relative to what would occur were the flow regime less manipulated, thereby limiting opportunity to only those boaters who are extremely competent or able to take part in trips led by commercial outfitters.

As with the J.C. Boyle bypass reach, the Copco II bypass reach would support high quality whitewater boating were it not for the proposed Project. Although recreation activities are discouraged, the reach contains remarkable scenic quality.

The project and its operations have affected the river reach below Iron Gate Dam. Due to the flow regime, recreation river use has increased in this lower reach. This increased use is project-induced recreation.

Fishing

Project dams have eliminated the anadromous fishing opportunity from areas upstream from Iron Gate Dam. In the J.C. Boyle bypass reach, the proposed Project will cause flow alterations that both enhance and impair fishing opportunities. In the peaking reach, however, proposed Project operations will cause flow fluctuations that will impair fishing opportunities of all types (bank-based, wading, and boat-based). Project roads facilitate access to certain fishing areas.

Facilities

Continued use of the Frain Ranch area is negatively impacting cultural resources, riparian areas, and wildlife habitat. Vandalism, unregulated OHV use, and target shooting are negatively impacting recreation experiences in the Frain Ranch area (on this note, it should be clarified that the vandalized and recently closed composting toilet described at E 7-27 and 7-33 was constructed by PacifiCorp to address ongoing human sanitation needs). The BLM provides seasonal maintenance and monitoring patrols of the Frain Ranch area that encompass both PacifiCorp and BLM-administered lands. The BLM will continue to incur operations, maintenance, and monitoring expenses over the life of the proposed Project.

Protection, Mitigation, and Enhancement Measures

It should be noted that Recreation Work Group stakeholders have vigorously disagreed with the proposed FERC boundary changes and the elimination of previously proposed PM&Es associated with J.C. Boyle Reservoir and the Upper Klamath River (Exhibit E 7-65). These comments have been delivered in writing (BLM and NPS Comments on the Draft RRMP) and verbally (Joint Agency Meeting November 6, 2003; Recreation Work Group meeting November 19, 2003). The Department believes that earlier versions of proposed PM&E measures (e.g., the October 27, 2003 version) better reflect the licensee's responsibility to address Project-induced recreation opportunities.

The FERC boundary should include recreation sites that are affected by project operations. The whitewater boating activities that occur in Hell's Corner have been induced by the project operations. Therefore, the project boundary should reflect not only PacifiCorp's current land, but also the recreation sites that are currently used by recreation users to access this section of the river. This includes Spring Island, BLM's Klamath Campground, Frain Ranch, and State Line. PacifiCorp's consultants included these sites in the studies and initial plans for improvements. Not including these sites in the Application is a significant change in the approach from the collaborative work of the recreation work group. These sites are clearly affected by the project and the project boundary should be modified to include them. Likewise, these sites should be re-incorporated into Exhibit E 7.0 in the recreation needs section. In addition, Topsy campground, which is located on J.C. Boyle reservoir, should also be re-entered into the project boundary. This campground is located on the reservoir and would not exist if it weren't for the on-going impacts of the project. The J.C. Boyle bypass reach should also be included in the boundary. The bypass reach is highly affected by the project operations and this impact should be reflected by including it in the FERC boundary. In the discussion of PM&Es on the site-by-site basis, the project boundary issue is described in more detail.

The FLA contains a list of PM&E measures in Exhibit E and in the Draft RRMP. As stated above, the Department believes that the earlier version of the PM&Es produced by PacifiCorp's consultants better reflects PacifiCorp's responsibility for recreation. The recreation studies were completed early in the process, and this has allowed the recreation workgroup and PacifiCorp to discuss PM&Es. Since studies related to other resource areas were not completed in a timely matter, integration of cross-cutting PM&Es has not occurred.

E8.0 LAND MANAGEMENT AND AESTHETICS

FLA Discussion of Existing Environment and Project Impacts

The FLA describes a number of federal, state, county, and municipal resource plans and attempts to determine the consistency of the proposed Project with the relevant comprehensive plans.

The discussion of road management in the proposed Project is limited to summaries of methods used to inventory roads in the vicinity of the Project (LUVAR FTR 3.0). PacifiCorp defers discussion of road management to a future management plan, the outline of which is included in Exhibit E Appendix E-8C. The proposed Project boundary excludes 5.6 miles of road adjacent to the Upper Klamath Wild and Scenic River that is within the existing license.

Adequacy of Applicant's Information

Federal Land and Resource Management Planning

PacifiCorp has placed undue emphasis on certain portions of the Klamath Falls Resource Management Plan (RMP) that are not relevant to the FERC proceeding and has overlooked elements of the RMP that are highly relevant. For instance, Project consistency with the Rangeland Program Summary is discussed but consistency with the Northwest Forest Plan Aquatic Conservation Strategy (ACS) and associated Standards and Guidelines is not (Exhibit E 8-95).

The FLA over-generalized the objectives of the Klamath Falls RMP (Executive Summary 8-4). In addition to preservation of late-successional and old growth habitat, Department management objectives described in the Northwest Forest Plan (and tiered to in Resource Area RMPs) include the restoration and maintenance of the ecological health of watersheds and aquatic ecosystems contained within them on public lands. These objectives are met through implementation of the ACS, a core component of the Northwest Forest Plan. This is of primary concern to the Department, because the ACS is the basis for many of the Department's comments regarding Project impacts to aquatic and riparian resources.

For example, beginning with the First Stage Consultation Document, the BLM has recommended that PacifiCorp develop an analysis of the Spring Creek diversion for use in the FERC proceeding. The discussion of studies to assess impacts caused by this facility is inconsistent and vague. This Project facility is located on land administered by the Medford District BLM within the Cascade-Siskiyou National Monument. The discussion of BLM RMPs and associated Standards and Guidelines that apply to this Project facility is inadequate (Exhibit E 8-2 and 8-84).

County Zoning

The zoning information for BLM-administered lands that is presented in the FLA appears to be incorrect and is inconsistent with information presented in the DLA (LUVAR FTR figure 2.7-2). BLM-administered lands are variously portrayed as being zoned for commercial, rural residential, and exclusive farm use, and in some cases no zoning classification is identified. Zoning data presented for the northern-most sections (13, 14, and 15) in California also appears to be of suspect accuracy.

Transportation Management

The discussion of Project roads omits results from the BLM/PacifiCorp road inventory conducted in the Klamath River Canyon during 2001. The FLA does not provide substantive analysis of Project roads and road use. Impacts of Project roads and Project-related or -induced road use are discussed in general terms for many resources, including wildlife, vegetation (including weeds and TES species), cultural, and recreation. No PM&E measures are proposed in the FLA.

Alternative Interpretation or Information

Federal Land and Resource Management Planning

The FLA does not present a credible assessment of the proposed Project's consistency with the Klamath Falls Resource Area RMP and the Northwest Forest Plan ACS. The ACS guides implementation of all resource management programs, including the relicensing of hydroelectric Projects (see the Management Direction section in Part II of this document).

PacifiCorp's discussion of the Project's consistency with management objectives for the Upper Klamath River Area of Critical Environmental Concern (ACEC) is inaccurate and incomplete (Exhibit E 8-95). While the FLA states that "the Project facilities are located in areas that *are generally more developed* than the surrounding lands and *are in character with their surroundings*," it fails to note that these areas would be developed very little were it not for the Project. The statement that "relicensing of these [Project] facilities will retain the character of these landscapes" is not adequately explained or supported.

The discussion of the Draft Upper Klamath River Management Plan/Draft Environmental Impact Statement (DEIS) includes several errors (Exhibit E table E8.3-2). Contrary to statements in the FLA, the DEIS does not propose establishing an ACEC in California but does propose expanding the existing Upper Klamath River ACEC in Oregon. Further, table E8.3-2 in the FLA should be corrected to read as follows: "Alternatives 2, 3, and 4 would expand the existing ACEC to include the river canyon between J.C. Boyle Dam and powerhouse. Alternatives 2, 3, and 4 would expand the Upper Klamath River Management Area in California. BLM would consider proposals for increasing public land holdings within alternative project area boundaries."

In several places the FLA inexplicably omits discussion of the Medford District Record of Decision and RMP (for example, Exhibit E table E8.3-2 and LUVAR FTR table 2.7-1 and 2-118). This document is a comprehensive plan that is directly relevant and applicable to the Project (especially the Spring Creek diversion and resource management objectives in Spring Creek and Jenny Creek). The proposed Project should be reviewed for consistency with this plan and the broader Northwest Forest Plan/ACS to which the plan is tiered.

Regarding the Klamath Falls ROD/RMP, it would be more correct to say that Management Actions/Direction provide for protecting the "free-flowing values *and identified outstandingly remarkable values*," including recreation (Exhibit E 7-59). Further, the discussion of the Draft Upper Klamath River Management Plan EIS should note that this plan is still in draft form and will not "replace previous plans for the W&SR reach" until finalized and approved by reviewing officials (Exhibit E 7-60).

With regards to Project consistency with protection of riparian and wetland resources (LUVAR FTR 2-138) and Executive Order 11990 (LUVAR FTR 2-141), the record is incomplete. The statement that "By definition, the Project is consistent with [Executive Order 11990]" (LUVAR

FTR 2-141) is not adequately supported. As discussed in the Riparian section of this document, the proposed Project would cause ongoing impacts to riparian and wetland resources. Further, PacifiCorp has not fully analyzed impacts to riparian/wetland resources that will result from the implementation of PacifiCorp's proposed operation at J.C. Boyle powerhouse.

Transportation Management

Extent of Project Roads

There are approximately 14 miles of Project roads associated with Project facilities in the J.C. Boyle bypass and peaking reaches. About 3.4 miles of these roads traverse land owned by PacifiCorp; the remainder (10.6 miles) are located on BLM-administered lands. PacifiCorp proposes to exclude the 5.6-mile long "Powerhouse Road" from the Project boundary. Of this length, about 5 miles are on BLM-administered land and 0.5 miles are on PacifiCorp land. The proposed Project therefore contains about 5.6 miles of road on BLM-administered land (Table 1-21, Figure 1-5). On BLM-administered land within the canyon, Project roads account for about 90% of the roads in the bypass reach and 20% of roads in the peaking reach from the J.C. Boyle powerhouse to Copco Reservoir.

Riparian Reserves are a key component of the Aquatic Conservation Strategy (ACS). The width of Riparian Reserves for fish-bearing streams extend outward from the edge of the riparian area for a slope distance equivalent to twice the height of a site potential tree (140 feet in the Klamath River Canyon). Preliminary GIS analysis suggests that four miles of existing Project roads are located within Riparian Reserves adjacent to the Klamath River on BLM-administered lands (2.2 miles in the J.C. Boyle bypass reach and 1.8 miles in the peaking reach) (Table 1-20).

There are 2.5 miles of road within BLM-administered Riparian Reserves within the proposed Project (1.5 miles of the road proposed for exclusion from the Project are located within Riparian Reserves).

Table 1-20. Extent of existing and proposed Project roads on BLM-administered land.

Reach	Existing Project		Proposed Project	
	Total Miles	Miles within Riparian Reserves	Total Miles	Miles within Riparian Reserves
Bypass Reach	4.9	2.2	4.9	2.2
Peaking Reach	5.7	1.8	0.7	0.3

Impacts of Project Roads

Project roads cause both direct and indirect impacts. Direct impacts include those relating directly to the presence and use of Project roads and include:

- Water quality and hydrology – diversion of surface and subsurface hydrologic flow paths;
- Wildlife – disruption of wildlife movement and mortality of animals, as described in the Wildlife section of this document;
- Riparian – unregulated recreation and associated damage to riparian soils and vegetation (including TES species) is facilitated by Project roads;
- Weeds – dispersal of weeds by Project and non-Project use of Project and Project-associated roads, as discussed in the Noxious Weeds section of this document;
- Cultural – Project-facilitated recreation use damages several significant cultural sites, as described in the Cultural Resources section of this document; and,

- Recreation – enhancement of certain recreational opportunities.

Project roads provide access to secondary roads and other, more remote areas within the Klamath River Canyon. Use of these other roads is facilitated by the Project roads, and causes impacts similar to those described above. Recreation use of certain areas accessed partly via Project roads (such as the upstream portion of the Frain Ranch area) causes damage to riparian soils, plant communities (via the introduction of weeds and tire damage), and cultural sites.

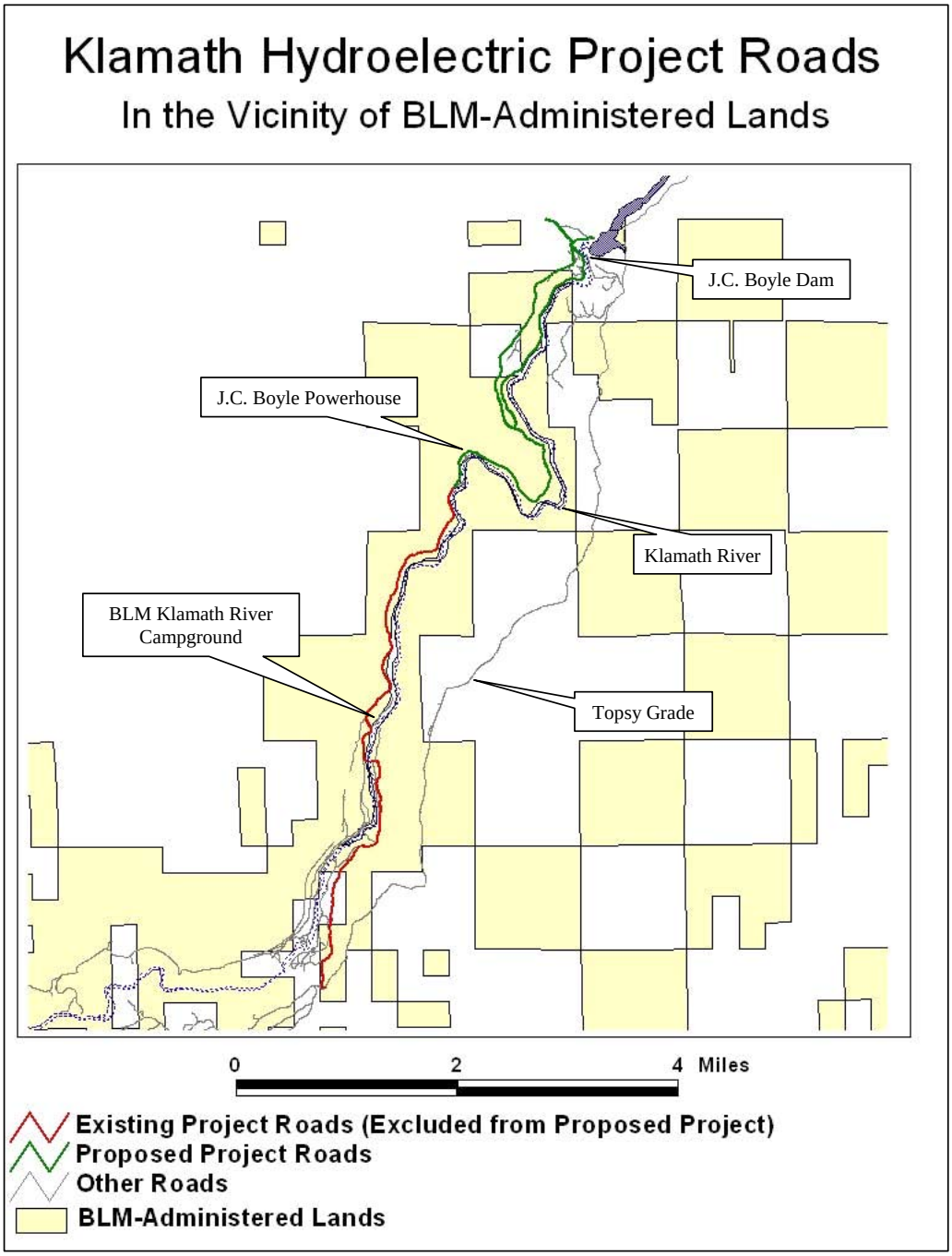

Figure 1-5. Project roads in the vicinity of BLM-administered lands downstream from J.C. Boyle Dam.

Aesthetic/Visual Resources

The Department supports PacifiCorp's effort to identify and mitigate adverse impacts to aesthetic and visual resources caused by Project facilities. PacifiCorp's proposal to reduce overall visibility and visual contrast associated only with Project facilities located near public viewpoints is inadequate and is the result of an apparently improper interpretation of study findings and Department resource management objectives.

Key observation points (KOPs) have been identified for use in determining the aesthetic compatibility of existing facilities with the surrounding natural landscape. KOPs are intended for use as reference points for identification of what a typical visitor might see at a particular viewpoint. KOPs are *not* intended to be used as the *only* points where visual impacts are considered. As the BLM and other stakeholders have communicated to PacifiCorp at a Recreation Work Group Meeting (November 19, 2003) and in response to the Draft RRMP, the use of a limited number of KOPs to determine the full extent of PM&Es is inappropriate. Additional PM&Es are necessary to reduce the discrete and cumulative aesthetic impact of Project facilities visible at other scenic points or places of interest and thereby meet basic BLM VRM objectives.

The Department recommends that PacifiCorp review Project impacts on visual resources (Recreation Resources FTR 4-61 and 4-62) and the adequacy of proposed PM&Es. For example, although "J.C. Boyle dam, powerhouse and an associated transmission line are located in a VRM Class II area…and attract the attention of the casual observer," no mitigation is proposed at J.C. Boyle Dam.

Department Conclusions Regarding the Existing Environment, Project Impacts, and PM&Es

Federal Land and Resource Management Planning

Due to continuing impacts of the proposed Project on watershed resources (including hydrologic processes, water quality, channel geomorphic processes, aquatic habitat, and riparian habitat), the Department cannot support PacifiCorp's implicit conclusion that the proposed Project is consistent with the relevant and applicable BLM RMPs. The analysis necessary to support PacifiCorp's finding is incomplete and inadequate.

Likewise, the proposed Project does not adequately mitigate continuing impacts on other natural resources (wildlife habitat, vegetation communities, cultural resources, recreation, and aesthetics). Findings of consistency with BLM RMPs, including management objectives for the Upper Klamath River ACEC and the Upper Klamath Wild and Scenic River, are therefore questionable.

County Zoning

PacifiCorp should thoroughly review zoning information presented in the FLA and, if warranted, prepare errata sheets in a timely manner.

Transportation Management

The Department has two majors concerns regarding transportation management during the life of the proposed Project. First, Project roads will cause ongoing impacts to BLM-administered resources. Second, although the Powerhouse Road provides access to several important

recreation sites, it also causes degradation of other natural resources and requires maintenance and, in some areas, improvements. Damage to public lands from this road raises an issue of compliance with the existing license (as described in Part I of this document), but is raised here because it is an issue that must be resolved prior to issuance of the new license and relates to other transportation management issues.

Ongoing Impacts of Project Roads

Project roads located within Riparian Reserves cause ongoing impairment of hydrologic, and riparian processes. Such roads divert hydrologic flow paths, fragment wildlife habitat (including spring habitats), prevent the establishment of native vegetation, and function as vectors for noxious weeds. Project roads also facilitate access by motorized recreationists and thereby contribute to cultural site damage.

The Department supports PacifiCorp's proposal to develop a Transportation Management Plan (TMP). Development of this plan should commence as soon as practical, in order to allow products to be included in the FERC NEPA analysis. PacifiCorp should convene a work group of affected stakeholders to set up a process for this work and develop objectives and a common understanding of interests. The Department's involvement in this work group will be guided by appropriate BLM RMPs, the Northwest Forest Plan Aquatic Conservation Strategy, statutory Wild and Scenic River objectives, and Upper Klamath River ACEC objectives.

Products of the work group should include a maintenance plan for Project roads. This plan should clearly address implementation of Best Management Practices (described in Appendix D of the KFRA RMP) and attainment of Department management objectives (especially those regarding recreation, wildlife habitat, riparian management, weed management, and protection of cultural sites). Further, the plan should address road-related sediment production.

Maintenance on Roads Excluded From Proposed Project

The Powerhouse Road traverses substantial portions of both the Upper Klamath Wild and Scenic River corridor and the Upper Klamath River ACEC. This road causes or facilitates erosion, damage to riparian areas, and disturbance of cultural sites. BLM/PacifiCorp road inventory data from 2001 indicates that this road segment contains 7 stream crossings (several of which are non-functional and cause diversion of hydrologic flow paths) and several sites that are extremely rocky or have runoff flowing on the road surface. This road causes damage to public land resources and is therefore out of compliance with Article 20 of the existing license. Resolution of this issue and development of a maintenance plan should occur prior to issuance of the new license.

Visual Resources

No visual resource PM&Es are currently proposed for J.C. Boyle Dam. In addition, the J.C. Boyle canal, penstocks, and powerhouse are located primarily on lands administered by the BLM and attract attention and show strong visual contrasts. Continued operation of the J.C. Boyle facility and the associated 4.3 mile bypass reach, as well as other Project facilities, will adversely impact aesthetic resources and visitor experiences. Transmission line 98 also causes adverse visual impacts. Without additional PM&E measures to address ongoing Project impacts on visual resources, BLM will not meet its Visual Resource Management objectives (described in the Klamath Falls Resource Area ROD/RMP).

The Department has visual/aesthetic resource concerns with J.C. Boyle Dam, canal, penstocks, powerhouse and associated maintenance and transmission facilities, including transmission line 98, due to unnatural contrasts with the existing landscape (Land Use, Visual, and Aesthetic Resources FTR Page 4-61; Appendix 4A, photo KOP BB9), as well as with other Project facilities. Characterization of visual attributes of the dams and transmission lines should clearly state that they are dominant features that significantly contrast with the natural appearance of the river canyon. The fact that the facilities exist would not exempt them from reasonable changes that would enhance the visual experience of visitors to the area. Landscape guidelines should also be developed to ensure that new project facilities and upgrades are consistent and blend in with the natural landscape. These concerns must be addressed in the FLA in order to attain BLM visual resource management objectives for the Upper Klamath River. PacifiCorp's proposed timelime for repainting or recoating facilities represents a change from the proposed schedule presented to the Recreation Working Group (November 19, 2003) and is not adequate. Further, PacifiCorp's original commitment to assess visual affects every ten years is preferable to the fifteen years review frequency described in Exhibit E (section 4.8).

E9.0 SOCIOECONOMIC RESOURCES

The socioeconomic and related analyses by PacifiCorp, in support of their license application for the Klamath Hydroelectric Project (FERC No. 2082) are deficient. They provide little or no information on the current program and little or no information on the extent to which proposed mitigation addresses resource losses attributable to the project. PacifiCorp has explicitly refused to provide such information or to conduct studies to develop such information. Such refusal by PacifiCorp was the reason the Socioeconomics Workgroup found PacifiCorp's proposed methodology deficient and unacceptable.

The analytic baseline chosen by PacifiCorp is not simply the project and its current set of operations, which is appropriate, but also includes an implicit assumption that resource impacts associated with the current operations are both acceptable and an entitlement, which is inappropriate. PacifiCorp then proceeds to measure the difference between its current operations and its proposed operations.[16] Such a measure is at best a measure of the benefits of the mitigation proposed by PacifiCorp, and may be an undifferentiated combination of i) the negative resource effects attributable to PacifiCorp's generation changes and ii) positive resource effects attributable to PacifiCorp proposed mitigation[17]. Moreover, a measure of the net benefits of the proposed mitigation, by itself, is non-responsive. The objective of this regulatory action is not to license mitigation, but to determine whether or not to license the hydropower facility and under what conditions.

As requested by the Socioeconomics Workgroup on numerous occasions, PacifiCorp should have provided an analysis of resource losses attributable to current operations. In most analyses, the impacts of a project's operation are shown by describing the situation with and without the project's operations. PacifiCorp does attempt this for power uses of the resource, but has not done so for non-power uses, despite multiple requests from the collaborative group to do so. A parallel assessment is required. Otherwise, FERC is not able to assess power and non-power uses on an equal basis, as required by law.

There is a very well-established approach in science for estimating the effect of an action (e.g., the operation of a hydro project) on the state of an entity (e.g., a riverine environment). The approach involves a comparison between a control group (the riverine environment as it is currently with the hydropower facility operating) and a treatment group (the riverine environment without the hydropower project, i.e., the project conceptually removed). The effect of the "treatment" is the difference between the two environmental states.

Identifying this difference is not a simple exercise in arithmetic. Initially one has to identify the resource services of interest: environmental, recreational, commercial, and cultural. Then one has

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[16] The exception to this is the hatchery. Although PacifiCorp has proposed no changes to the hatchery or to fish passage, PacifiCorp violates its own analytic structure and includes the total benefits of the hatchery in the net benefits of the proposed operation. The hatchery is a feature of the current project. As such, any benefits from the hatchery are part of the baseline conditions associated with current project operations. Since hatchery benefits constitute approximately 80 percent of the net benefits PacifiCorp reports for the proposed project, these net benefits are overstated by a factor of 5. The hatchery was originally required as mitigation (though partial and largely unsuccessful) for the construction of Iron Gate Dam and the filling of its reservoir.

[17] Whether or not the reported net benefits are an undifferentiated combination of positive and negative impacts is difficult to determine. PacifiCorp is vague regarding specific operational changes and whether or not capital replacement will occur.

to devise measures for the level of each service. And finally one has to design and execute studies to estimate these services with and without the hydropower project. All of this is complex and arduous. But the basic concept for the study designs is not complex. It is simple: a comparison between two states of the world.

PacifiCorp has not followed this universally accepted procedure. What PacifiCorp has done is to skip the first step (determining project effects), and move directly to proposing a set of PM&E's.

PacifiCorp proceeds to justify proposed PM&Es by asserting that the river will be better off under the proposal than it is now. This may be true, but it is irrelevant. What PacifiCorp has measured by comparing the difference between the current riverine state and the river after the application of its proposed PM&Es is at best an inflated measure of the benefits of its mitigation (inflated by past mitigation that is not changed in the filing). And it may not even be that. It may be an undifferentiated combination of the negative resource effects attributable to PacifiCorp's changes in generation and the positive resource effects attributable to PacifiCorp's proposed mitigation. A measure of the net benefits of the proposed mitigation, by itself, is non-responsive to the fundamental goal of the relicensing process. The objective of this regulatory action is not to license mitigation, but to determine whether or not to license the hydropower facility, and under what conditions.

The proper analysis could be easily done as an extension of the same analysis used to determine the social value of the power. In determining the social value of the power, PacifiCorp analytically plucks the project from the landscape, and asks by how much the cost of electricity would rise. This is, of course, the social value of the power, i.e., the amount that society does not have to pay because of the existence of the project. In order to provide an equal consideration of non-power values, PacifiCorp should also have considered, while the project was analytically plucked from the landscape, what non-power uses (e.g., resource changes) would also result. This is the social cost of the continued operation of the project. Specifically, in order for FERC to fulfill its legislative mandate to give equal consideration to power and non-power uses, the applicant clearly must provide a comparison of both uses on the same analytic basis.

ATTACHMENT 2: Additional Study Requests of the Department of the Interior (Pursuant to 18 C.F.R. 4.32(b)(7))

The Application does not provide sufficient information to facilitate management decisions that contribute to attainment of the Department of the Interior's (Department or DOI) goals through written license articles for land use planning, or protection, mitigation and enhancement measures (PM&Es). The FLA acknowledges that PacifiCorp did not complete a number of technical studies. Completion of the studies and further analyses described below is necessary for the Commission to provide equal consideration to fish and wildlife resources as required by the FPA. Multiple Department agencies and bureaus have requested studies in their comments on PacifiCorp's First Stage Consultation Document (FSCD), Second Stage Consultation (SSCD) and Draft License Application (DLA). Interior has limited additional study requests to those necessary for determining Project effects and what actions are obligatory to restore and protect fish and wildlife resources and other management goals and objectives including water quality and quantity, botanical, cultural, aesthetics and socioeconomic resources. Some of the existing studies were inadequate because they did not fully analyze effects of the licensing action, or because the time period of data collection was too short to establish ongoing project impacts and resulting trends over time. Only when further study or analyses would contribute directly to development of license articles, PM&Es, or a land use plan, has the Department requested further work of the Applicant. These additional study requests respond to the requirements of 18 CFR 4.32 (b) (7). In making these additional study requests, the Department relies upon, and hereby incorporates for reference, its previous study requests made in pre-filing stages. The abbreviation "FTR" throughout refers to the applicant's final technical reports.

TABLE OF CONTENTS

GENERAL 4

DOI 1. Project Operations Modeling. The objective of this study is to analyze a full range of reasonable Project operations. 4

DOI 2. Interdisciplinary Suitability Assessment of Alternative Project Operations. The objective of this effort is to develop a foundation for instream flow decision-making. 10

DOI 3. Multi-Disciplinary Study on the Effects of Removing Keno Dam and Reservoir from the FERC-Licensed Project. This study will identify resources that are likely to be affected by any changes in operations from the current Project baseline, determine the magnitude of effects, and help to identify mitigation for the impacts..... 14

DOI 4. Multi-Disciplinary Determination of Project Effects on the Klamath River Downstream of Iron Gate Dam. DOI requests further information regarding the Project's effect on the Klamath River downstream of Iron Gate Reservoir. This request relates to both information needed to conduct the Section 7 Wild and Scenic River (WSR) Assessment and information needed to evaluate the Ethnographic Riverscape (ER). 19

WATER USE AND QUALITY 22

DOI 5. J.C. Boyle Bypass Reach Water Quality Modeling for a Range of Flow Scenarios. This study would provide information needed to describe Project impacts and assess a full range of operation alternatives..... 22

DOI 6. Distribution of Water Quality Modeling Results. The objective of this data request is to allow stakeholders and FERC the opportunity to review PacifiCorp's modeling results and validate conclusions regarding beneficial impacts of the Project. 26

DOI 7. Water Quality Study for Spring and Jenny Creeks. The objective of this study is to analyze the effects of Project operations on water quality including temperature for Spring Creek, above and below the diversion. 29

DOI 8. Verify Sediment Budget. The objectives for this study are; develop data for calibrating bedload transport equations, test and calibrate estimated threshold of bed mobility, develop Project specific ratios of bedload transport to suspended sediment transport, and develop a testable hypothesis regarding the fate of sediment placed in the river during augmentation. 32

FISH RESOURCES 38

DOI 9. Fish Assessment Survey for the Link River, Keno, J.C. Boyle Bypass and J.C. Boyle Peaking Reaches. To characterize existing riverine fisheries affected by the Project, by quantitatively assessing relative abundance, growth, length frequency distribution, condition factor, and age structure of fish populations in project reaches. 38

DOI 10. Fish Passage Evaluation Study. The study is will provide a characterization of project impacts and information to support decision-making regarding restoring access to historic habitat. The study includes the following components: fractional entrainment to Project facilities (turbine, spillway, bypass, ladders), Upper Klamath Lake survival and behavior, reservoir and facility survival, reservoir behavior, operation and management to minimize impacts to survival and behavior of salmonids through Project facilities, salmonid genetics, pathogen risk assessment, and habitat and Project facilities scenario modeling (EDT and KlamRas). 44

DOI 11. Evaluation of Iron Gate Hatchery Performance and Identification of Methods to Reduce Adverse Impacts to Wild Salmonids. Determine the effects of Iron Gate Hatchery production and program practices on wild stocks of Klamath River salmonid populations, and identify methods for reducing the adverse impacts of the hatchery program. 61

DOI 12. Habitat-In-Stream Flow Relationships and Minimum Flows. The study objectives are to analyze and select a suitable flow regime for redband trout and other native fish in the riverine segments of the Klamath River, Spring Creek, and Jenny Creek. 65

DOI 13. Effects of Project Ramping on Resources Below Project Facilities.. The study objectives are to determine the effects of daily and proposed ramp rates and to determine ramping rates necessary to protect fish and aquatic resources. 70

DOI 14. Effects of Project Peaking on Aquatic Resources in the J.C. Boyle Reach. Characterize the effects of peaking-related flow fluctuations on aquatic resources in the J.C. Boyle peaking reach. . 77

DOI 15. Oxygenation of the Hypolimnion of Copco and Iron Gate Reservoirs. Verification of the predicted results of a direct oxygenation or re-aeration system on the biota of Iron Gate and Copco reservoirs and decreased or increased nutrient availability, and an evaluation of disease-host interactions associated with increased oxygenated habitats. 79

DOI 16. Distribution and Abundance of Lamprey Species in the Klamath Hydroelectric Project Area. Determine the lamprey species present in the Project area, determine lamprey distribution, abundance, and habitat use, and evaluate the impacts of Project water management operations (flow fluctuations and timing, peaking operations, and ramping operations at all Project facilities) on lamprey life stages and populations in the Project area, and in the Klamath River below Iron Gate Dam. 82

DOI 17. Demonstration Flows Downstream from Iron Gate Dam. The objective of this study is to assess potential benefits to anadromous fisheries resulting from modified Iron Gate Dam operations... 85

BOTANICAL AND WILDLIFE RESOURCES..... 88

DOI 18. Analysis of Project Operation Scenarios and Riparian/Wetland Resources in the J.C. Boyle Peaking and Bypass Reaches. The objective of the proposed analysis is to provide information for use in determining instream flow regimens that protect, maintain, or enhance the suite of flow dependent resources..... 88

DOI 19. Quantification of Riparian Maintenance Flows in the J.C. Boyle Bypass Reach. The objective of this study is to quantify the hydrologic requirements of unimpaired riparian communities in the J.C. Boyle bypass reach. 92

DOI 20. Noxious Weed Inventory. The objective of this inventory is to fully evaluate the impacts of the project, and act as a basis for the development of a landscape based, integrated noxious weed management plan. 96

CULTURAL RESOURCES..... 99

DOI 21. Complete Cultural Resource Surveys within the Area of Potential Effect (APE). The objective is to survey the complete area of potential effect. 99

DOI 22. Distribute Ethnographic Integration Report. The objective is the complete distribution of an ethnographic integration report to all members of the Cultural Resources Work Group, FERC and State Historical Preservation Offices. 101

DOI 23. Analyze the Historic and Prehistoric Research Designs with Data Gathered During the Cultural Resource Fieldwork. The objective is to ensure that the questions posed in the research designs are analyzed with respect to the new data gathered during their surveys. 103

DOI 24. Supplement and Finalize the Historic Properties Management Plan (HPMP). The objective of this plan is to protect and manage these historic properties over the course of the next license period. 105

DOI 25. Conduct Site Specific Geoarchaeological Studies. Study objectives are to determine Project effects of flow hydraulics and geomorphic processes at sites directly adjacent to the Klamath River between J.C. Boyle powerhouse and the slack waters of Copco Reservoir. 107

DOI 26. Study the Effects on Cultural Resources Should Keno Reservoir be Removed From FERC Jurisdiction. The objectives of the analysis are to prevent adverse effects from occurring to the known sites adjacent to the Reservoir shoreline. 109

LAND MANAGEMENT AND AESTHETICS..... 111

DOI 27. Aesthetics Studies. The goal of this additional study is to complete a thorough analysis of impacts of the project facilities on aesthetics. 111

SOCIOECONOMIC RESOURCES 113

DOI 28. Electrical Service Rate Structure Study. Assess the impacts to electrical service users due to excluding the East and West Side Power Developments downstream of Link River Dam and assess the impacts to electrical service users due to expiration of the electrical service contract with electrical service users..... 113

DOI 29. Tribal Health Study. Explore the possible relationship in the decline of fish in the river and the health issues of the Karuk tribal members who have been forced to rely on less healthy foods in their diet. 117

GENERAL

DOI 1. <u>Project Operations Modeling.</u> The objective of this study is to analyze a full range of reasonable Project operations.

<u>Recommended Study</u>:

The Department requests that the Commission direct PacifiCorp to use existing models and data sets to model a full range of Project operating scenarios. PacifiCorp should cooperate with the Department and other interested parties to identify a reasonable range of alternatives. This analysis is critical for determining the effects of the Project on flow-dependent resources including:

- power generation;
- resident and anadromous fish and fish habitat;
- reservoir and river-based recreation (including fishing and boating);
- riparian/wetland habitat;
- threatened, endangered, and sensitive (TES) plant and animal species;
- water quality;
- cultural resources (e.g., terrestrial and aquatic Traditional Cultural Properties and pre-historic sites);
- operation of the USBR Klamath Project
- management of the Lower Klamath National Wildlife Refuge (NWR).

The results of the study would be incorporated into results of the Interdisciplinary Suitability Assessment of Alternative Project Operations (DOI 2) study and would provide the basis for developing operating scenarios that balance resource uses and impacts.

PacifiCorp should provide Project gage data to the Department and other stakeholders. Electronic data files of streamflows and reservoir elevations recorded during the period of record should be provided, as should associated stage-discharge and elevation-volume curves. PacifiCorp should analyze operations at the Keno Development using hydrologic data that has been collected by PacifiCorp. This analysis should quantify type, frequency, duration, and magnitude of Project-related operations at Keno (hydrograph shaping, flow regulation during maintenance events, augmentation of downstream flows using reservoir storage, etc.).

<u>Basis for Request</u>:

Project operations affect many aspects the flow regime (e.g., timing, magnitude, duration). For example Project operations reduce minimum flows, increase rates of change, and create anomalous flow fluctuations in the J.C. Boyle peaking reach. Project operations reduce magnitude, frequency, and duration of flood peaks in Project bypass reaches. The impacts to flow-dependent resources as a consequence of changes in the flow regime are described in the Department's comments on Exhibit E of the FLA.

PacifiCorp, however, has not modeled the flow regime proposed in the FLA and has limited the scope of operational modeling to four "end-member" scenarios that were completed for an initial assessment of Project impacts on water quality.[1] PacifiCorp did not analyze a full range of operating scenarios. The four scenarios modeled by PacifiCorp are inadequate for assessing Project impacts. Alternative operational scenarios that balance power generation with other resource objectives should be modeled.

[1] Existing Condition, Steady Flow, Without Project I, and Without Project II, described in the Water Resources FTR.

An analysis of "within Project" effects is necessary to understand and integrate the results of other studies (e.g., fish, riparian resources, recreation, and water quality).

Responsible Entity

PacifiCorp should coordinate with the Plenary Work Group to conduct calibration/validation testing of the existing Project operations model. PacifiCorp should provide timely updates on the status of this effort. PacifiCorp should cooperate with stakeholders to facilitate external review of the existing operations model in a manner agreeable to all parties (as was done for the water quality models developed by PacifiCorp's contractor). If the existing model is found to be inadequate for meeting the objectives of this study, PacifiCorp should review and propose alternative models. PacifiCorp should incorporate stakeholder input in developing model scenarios. PacifiCorp should provide electronic data files and electronic output to interested stakeholders.

Participants

PacifiCorp should work with an interagency team of state, federal, and tribal specialists and NGO representatives. The interagency team should provide guidance and assist with developing model simulations, reviewing model results, and assisting with monitoring the effects of demonstration flows on flow-dependent resources.

Study Objectives and Methods

Study Objectives

To analyze the impact of proposed Project operations as well as the impacts of a range of operating scenarios that balance resources. To provide information necessary to assess the consistency of the Project with the Federal Power Act (particularly the comprehensive public interest determination), the Wild and Scenic Rivers Act (sections 7(a) and 10(a)),and the Endangered Species Act.

To provide information necessary to evaluate potential effects of Project operations within and downstream of the Project. To assist in developing a flow regime that protects, mitigates, and/or enhances key Department objectives that are strongly affected by the Project, including:

- anadromous fish production;
- resident fish production;
- water quality;
- riparian processes;
- recreation;
- management of the USBR Klamath Project; and
- management of the Lower Klamath Lake NWR.

To develop a comprehensive understanding of the role of the Keno Development in the existing and proposed Project.

To develop an understanding of flow regulation options that could be implemented if one or more Project dams were decommissioned.

Study Methodology

PacifiCorp should use existing models to evaluate hydrologic processes at each reservoir, facility, and river reach (from Keno Reservoir/Lake Ewauna to downstream from Iron Gate Dam). Namely, the hourly Project operations model described in Study Plan 1.4 (2002, page 7) should be used for river reaches and reservoirs within the current Project boundary (including Keno).[2] River flows downstream from Iron Gate Dam should be evaluated using the Project operations model, SIAM, and, as appropriate, KPOPSIM.

Use of these models is desirable because they provide for analysis of operations based on an hourly time-step. The Department would prefer that PacifiCorp provide the operations model used for management of the Project and training in its application to stakeholders. At a minimum, the operations model used by PacifiCorp for management of the Project should be subject to calibration/validation testing and made available for external review[3] A useful starting point for validation testing would compare modeled "existing condition" flows with the streamflow data collected by the USGS at 30-minute intervals. Should PacifiCorp's model prove incapable of providing this information, other models (such as MODSIM) that can be modified to account for daily peaking operations should be used Modifications to the selected models may need to occur to ensure that PacifiCorp's model can be integrated with other models in the Klamath Basin. Modifications should be made in consultation with interested stakeholders.

The Department recommends that PacifiCorp evaluate a range of operational scenarios that include proposed and alternative ramp rates, minimum flows, peaking limitations, and peaking cycle frequencies. These scenarios would be developed in collaboration with the Plenary and the Aquatics Work Group. The analysis should describe how operations would affect flow and reservoir elevations for a variety of water year types.

PacifiCorp has not provided information adequate to define or analyze a range of operating scenarios. The results of the ramping and instream flow studies are incomplete and preclude definition of scenarios that could optimize fishery resources. There are numerous operational parameters and resource management targets that should also be incorporated into model runs. These include ramp rates, absolute minimum flows, "fractional" minimum flows, maximum Project-induced daily and weekly flow fluctuations, and the maximum frequency of peaking cycles (i.e., daily or weekly).

In the J.C. Boyle bypass reach, PacifiCorp should model scenarios that incorporate "fractional" minimum flows (Figure 2-1). In the J.C. Boyle peaking reach, PacifiCorp should model "modified run-of-river" operations, in which flow manipulations occur only within a given range (e.g., ± 20%) around the average daily or weekly flow.

In the J.C. Boyle and Copco bypass reaches, late-winter/spring geomorphic/riparian maintenance flows should be modeled. In these reaches and in the J.C. Boyle peaking reach, recreation pulse flows of

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[2] In the November 2002 study plan approved by the Plenary, PacifiCorp stated a willingness to "operate the model as needed to help answer specific questions on the potential effects of Project operations on flows and fluctuations at various Project facilities that cannot be satisfactorily answered by the examination of existing short-term data or hydrology and hydrodynamics modeling as described above. Specific questions will be defined as analysis proceeds and based upon further discussion at upcoming Water Quality Work Group meetings. Further work needs to be done to define model needs and to determine how takeholders would have access to the information, to the model, and its validation and calibration." This work has not been initiated, and thus necessitates this ASR.

[3] The Department recognizes that aspects of the existing Project operations model are of proprietary value to PacifiCorp. As with the Water Quality Model developed by PacifiCorp's contractor, the Department believes that proprietary values and "executable" model code can be protected while still allowing for expert review and use.

magnitudes suitable for whitewater boating (1300 to 1500 cfs, described in the Recreation FTR) should be modeled.

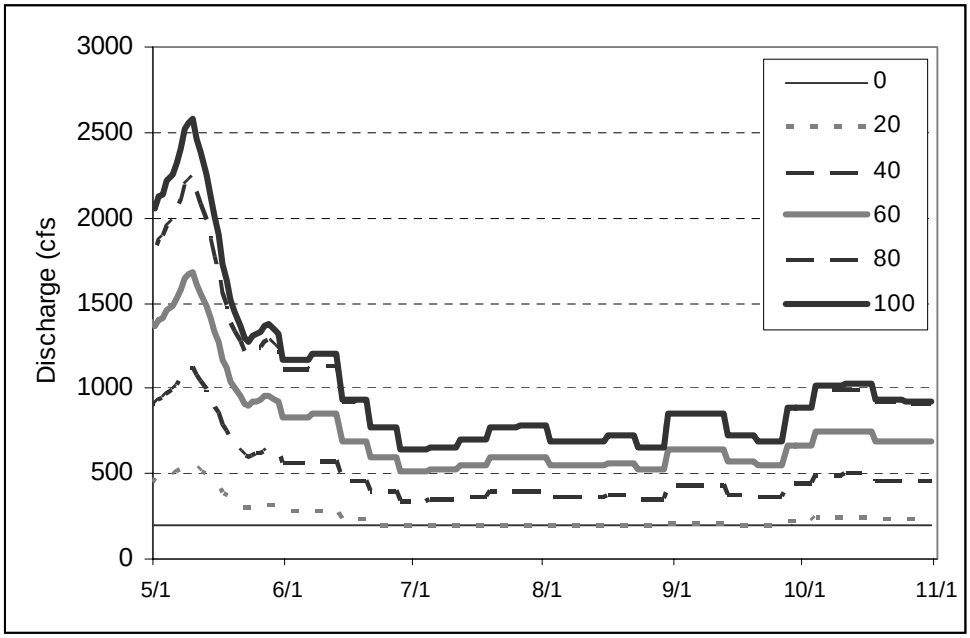

Figure 2-1. Illustration of modeled fractional minimum flows (ranging from 0 to 100% of the average weekly flow, with an absolute minimum of 200 cfs) at the upstream end of J.C. Boyle bypass reach during the summer of 2000.

Model outputs should be linked with other resource-specific "flow suitability curves" to determine the effects of Project operations on flow dependant resources and to derive an assessment of costs and benefits associated with each scenario. Incremental flow relationships for each flow-dependent resource are in various stages of development (described further in the Interdisciplinary Suitability Assessment ASR). In addition to evaluating various operational alternatives, the model should be used to determine the optimal flow regime (as defined by the Plenary Work Group) for the following resources:

- anadromous fish production;
- resident fish production;
- water quality;
- riparian processes;
- recreation; and,
- management of the USBR Klamath Project
- management of the Lower Klamath NWR.

The operations model should also be used to evaluate operational alternatives that would be available if one or more Project dams were decommissioned. Model scenarios that consider options for meeting desired downstream flows and "within Project" resource management goals in the absence of Project reservoir storage (and re-regulation capability) should be developed and evaluated. Further, river management scenarios encompassing a range of options for management of the Keno Development should be considered.

PacifiCorp's analysis is limited to "snapshots" that are used as the basis for drawing conclusions about Project operations. Further, PacifiCorp states that the Keno Development serves no Project purpose and should therefore be excluded from the proposed Project. Complete sets of Project gage data should be provided to stakeholders to allow validation of PacifiCorp's interpretation of results. These data sets

should be provided in electronic format (e.g., Microsoft Excel spreadsheets on CDs) and, at a minimum, should include date, time, stage (or reservoir elevation), and discharge (or reservoir volume) for all Project facilities (reservoirs, spillways, powerhouses, etc.) within the current FERC boundary. PacifiCorp should also provide hourly turbine flow, reservoir elevation, tailwater elevation, and power generaton data for each Project facility. This data should be provided for current (water years 1990 to 2003) and proposed operations. To the extent that extreme headwater or tailwater elevations or fluctuations are the result of abnormal operating conditions, these conditions should also be described.

Acceptance of Recommended Study Methods

Modeling Project operations is commonly used for river management planning, including FERC proceedings.

Usefulness of Requested Studies in Furthering Resource Goals

Implementation of this study would yield information useful to FERC, the Department, other stakeholders, and PacifiCorp. The study is needed to analyze the affect of Project operations on flow dependent resources as well as to analyze a range of alternatives for balancing resource uses. Further, the study would provide information for the Department's consideration during analysis of the proposed Project's consistency with the following resource management objectives:

Bureau of Land Management

- Protecting and enhancing outstandingly remarkable fisheries, wildlife, recreation, and scenic values associated with the Upper Klamath Wild and Scenic River;
- Maintaining, protecting, or restoring scenic, fisheries, and wildlife resources within the Upper Klamath River Area of Critical Environmental Concern;
- Emphasizing instream flows and habitat conditions in the Klamath River that maintain or restore riparian resources, favorable channel conditions, and fish passage;
- Requiring instream flows and habitat conditions in the Jenny Creek watershed that maintain or restore riparian resources, favorable channel conditions, and fish passage; and,
- Emphasizing operation of hydroelectric facilities to eliminate adverse effects that retard or prevent attainment of ACS objectives.

National Park Service

- Represent the national interest regarding recreation, and to assure that hydroelectric projects…recognize the full potential for meeting present and future public outdoor recreation demands, while maintaining and enhancing a quality environmental setting for those projects.

Fish and Wildlife Service

- Protect salmon and steelhead habitat from harmful effects of water and power projects in the Klamath Basin.
- Identify and implement methods to rectify habitat problems… including …water quality above and below Iron Gate Dam and instream flow and habitat below Iron Gate Dam.
- Require water flows adequate to achieve optimal productivity of the basin.

Bureau of Reclamation

- Assure that operation of the Klamath Irrigation Project is conducted in a way that assures the agricultural community a reliable supply of irrigation water.
- Consistent with that priority, USBR operates its facilities in a way that assures protection of natural resources within the standards identified by resource management agencies of the States and the Federal Government

Study Duration

The Department estimates that modeling of Project operations will be completed within six months.

Why Study Objectives Cannot Be Achieved Using Available Data

PacifiCorp modeled four "end-member" operational scenarios. These scenarios do not provide information necessary for analyzing the impacts of current or proposed Project operations. The scenarios do not include a range of reasonable alternatives that would assist stakeholders in developing an operational scenario which balances impacts and benefits to natural resources, power production, and other Project needs. The analysis would provide the foundation for quantifying water availability in the new license, a critical element of the instream flow integration framework proposed by PacifiCorp (e.g., presentation at June 6, 2003 subgroup meeting).

DOI 2. Interdisciplinary Suitability Assessment of Alternative Project Operations. The objective of this effort is to develop a foundation for instream flow decision-making.

Description of Recommended Study

The Department requests that the Commission direct PacifiCorp to integrate results and data of other studies of Project impacts on flow-dependent resources. Numerous flow-dependent resources in the Klamath River, in Project reservoirs, and in the Jenny Creek watershed are affected by Project operations, including hydropower generation. The decision-making framework that would be developed for this study would be incorporated into results of Project Operation Modeling. BLM requested this analysis previously in the FSCD, the SSCD, and the DLA.

Basis for Request

Multiple flow-dependent resources including fisheries, river and reservoir water quality, riparian ecosystems, recreation (boating and fishing), cultural, geomorphic, and energy production are affected by Project operations. Flow needs to maintain these resources overlap to varying degrees and FERC has the ultimate responsibility for "balancing" resources for both natural resource values and energy production.

The Department has the responsibility to attain several resource management objectives as described in the Department response to the FLA. The proposed Project has both positive and negative impacts on resources of interest to the Department. PacifiCorp has completed or is developing a relationship between flows and metrics that describe resource values for resources such as recreation and fish habitat. However, for other resources, such as water quality or riparian vegetation, these relationships have not been established.

During numerous work group and plenary meetings, PacifiCorp has described methods and concepts related to the integration of multiple flow needs (e.g., Aquatics Work Group meeting on November 5, 2002 and June 6, 2003) and the concept of flow integration is reflected in several study plans (Instream Flow Study Plan Scoping, Recreation Flow Analysis, Wetland/Riparian Plant Community Characterization, and Water Quality Modeling). However, there is no discussion, analysis, or substantive evidence of application of these concepts in the conclusions of the FLA.

Development of a similar analysis for the Jenny Creek watershed has not been initiated, despite numerous requests from the Department in the FSCD, the SSCD, and the DLA.

Responsible Entity

PacifiCorp would be responsible for conducting incremental flow assessments as described in the FLA (Exhibit E, pages 4-145 to 4-146) and in Plenary-approved study plans, and as requested by the Department and other stakeholders. PacifiCorp would be responsible for convening meetings at which stakeholders would review findings and develop flow regimes that would accommodate attainment of multiple-use resource management objectives and balance resources.

PacifiCorp would be responsible for developing an instream flow analysis for the Jenny Creek watershed. PacifiCorp would be responsible for convening stakeholders to review field work, discuss analytical assumptions, and review study results.

Participants

Many stakeholders involved in relicensing have expressed interest in analysis of the effects of Project operations on flow-dependent resources. Given this, discussion of the framework should involve the Plenary and associated work groups.

Methodology and Objectives

Methods

Methods to be used for developing incremental flow relationships and/or quantifying operational constraints are described in resource-specific study plans[4] and, in some cases, associated Additional Study Requests (Department ASRs 5, 12, and 18 [Riparian Operation Scenarios]). For many important flow-dependent resources, necessary studies have not been completed or the results have not been distributed (Department ASRs 1, 5, 6, 12 [Minimum Flows], 13 [Ramping], 14 [Peaking], 17 [Demonstration Flows], 18 [Riparian Operation Scenarios], 19 [Riparian Maintenance Flows], and 25 [Geoarchaeological Studies]). In addition to the results on studies not yet completed, information presented in the Recreation Flow Analysis (Recreation Resources FTR, Section 2) would be utilized.

Methods for integrating the flow preferences of multiple resources have been discussed by the Department and other stakeholders in the Plenary and work group meetings. In general, the following methods should be implemented for each river reach and reservoir (from Keno Reservoir/Lake Ewauna to downstream from Iron Gate Dam), as well as for the river system as a whole:

- Review resource-specific flow preferences;
- Review management constraints (water availability, ramp rates, absolute minimum flows, senior water rights, etc.);
- Compare flow requirements; and,
- Discuss resource trade-offs and develop alternatives that meet multiple resource objectives.

These methods are discussed broadly in Whittaker et al. (1993), and should be developed with more specificity in collaboration with the Plenary Work Group.

Alternative operating scenarios and demonstration flows should be used to address uncertainties regarding potential adverse consequences to aquatic and riparian resources resulting from summer recreation pulse flows in Project bypass reaches. These releases would be of magnitude and duration sufficient to support whitewater rafting (on the order of 1300 cfs, as described in the Recreation Resources FTR). Water quality, fish movement, and macroinvertebrate drift would be monitored before, during, and after these releases.

Methods for the Jenny Creek analysis should be developed in coordination with the aquatics, terrestrial, and water quality work groups. The analysis should account for riparian ecosystems, aquatic habitat, and water quality.

Objectives

The objective of this effort is to develop the basis for making decisions regarding instream flows. Use of this information will not be limited to development of minimum flows but, rather, instream flow regimes

[4] Aquatic Resources Study Plan 1.8 (August, 2002; page 2), Aquatic Resources Study Plan 1.3 (October, 2002; page 6), Aquatic Resources Study Plan 1.5 (March, 2003; page 14), Terrestrial Resources Study Plan 2.2 (March, 2003; page 2), and Recreation Study Plan 3.1 (August, 2002).

that describe ranges in flow magnitude, timing, duration, rate of change, and frequency appropriate to various water year types and resource management objectives.

Acceptance of Recommended Study Methods

The study would incorporate methods and concepts previously described by PacifiCorp. These methods are similar to those recommended by Whittaker et al. (1993). The Arkansas River Water Needs Assessment conducted by federal and state agencies in Colorado utilized methods similar to those recommended here (BLM, 2000).

Usefulness of Requested Studies in Furthering Resource Goals

The analysis would yield information useful to FERC, the Department and other stakeholders, and PacifiCorp and could provide a framework for "balancing" of resources. Further, the study would provide information for the Department's consideration during analysis of the proposed Project's consistency with the following resource management objectives:

Bureau of Land Management

- Protecting and enhancing outstandingly remarkable fisheries, wildlife, recreation, and scenic values associated with the Upper Klamath Wild and Scenic River;
- Maintaining, protecting, or restoring scenic, fisheries, and wildlife resources within the Upper Klamath River Area of Critical Environmental Concern;
- Emphasizing instream flows and habitat conditions in the Klamath River that maintain or restore riparian resources, favorable channel conditions, and fish passage;
- Requiring instream flows and habitat conditions in the Jenny Creek watershed that maintain or restore riparian resources, favorable channel conditions, and fish passage; and,
- Emphasizing operation of hydroelectric facilities to eliminate adverse effects that retard or prevent attainment of ACS objectives.

National Park Service

- Represent the national interest regarding recreation, and to assure that hydroelectric projects…recognize the full potential for meeting present and future public outdoor recreation demands, while maintaining and enhancing a quality environmental setting for those projects.

Fish and Wildlife Service

- Protect salmon and steelhead habitat from harmful effects of water and power projects in the Klamath Basin.
- Identify and implement methods to rectify habitat problems… including …water quality above and below Iron Gate Dam and instream flow and habitat below Iron Gate Dam.
- Require water flows adequate to achieve optimal productivity of the basin.

Bureau of Reclamation

- Assure that operation of the Klamath Irrigation Project is conducted in a way that assures the agricultural community a reliable supply of irrigation water.
- Consistent with that priority, USBR operates its' facilities in a way that assures protection of natural resources within the standards identified by resource management agencies of the States and the Federal Government

Study Duration

The analysis would rely on existing data and additional field work and analyses (described in Department ASRs listed above). The study would also rely on completion of the Jenny Creek watershed study. The Klamath River portion of this study should be completed by December 2004. The Jenny Creek watershed portion of this study should be completed within 18 months.

Why Study Objectives Cannot be Achieved Using Available Data

To date, PacifiCorp has provided incremental flow relationships only for recreation. Incremental relationships are being developed for aquatic habitat, and the Department has requested development of such relationships for riparian vegetation and water quality. This study would integrate these relationships.

Without this information the Department and other resource management agencies will rely on existing data to develop flow recommendations that allow attainment of resource management objectives. The existing data is generally adequate to assess Project impacts and develop PM&Es. The proposed study would provide a higher level of analytical precision and affect a transparent decision making process that is currently missing from the FLA.

References:

USDI Bureau of Land Management, USDI Bureau of Reclamation, USDA Forest Service, and Colorado Department of Natural Resources, 2000. Arkansas River Water Needs Assessment. Edited by R.E. Smith and L.M. Hill. 416 pages.

Whittaker, D., B. Shelby, W. Jackson, and R. Beschta, 1993. Instream flows for recreation: A handbook on concepts and research methods. US Department of Interior, National Park Service, Rivers and Trails Conservation Program. 104 pages.

DOI 3. Multi-Disciplinary Study on the Effects of Removing Keno Dam and Reservoir from the FERC-Licensed Project. This study will identify resources that are likely to be affected by any changes in operations from the current Project baseline, determine the magnitude of effects, and help to identify mitigation for impacts project changes.

Recommended Study

The Department requests that the Commission direct PacifiCorp to conduct a multi-disciplinary study on the likely ramifications of removing Keno Dam and Reservoir from the re-licensing process for the Klamath Hydroelectric Project (Project); the request is based on PacifiCorp's stated interest in changing operations of the facility to meet water quality improvement goals.

The study needs to identify how PacifiCorp will operate the Keno Reservoir, with particular emphasis on what changes in lake levels can be expected, over time. Keno Reservoir serves numerous needs in the Klamath Falls community.

The study is companion to many other studies requested which determine the impacts a change in operation would have on riverine resources including fisheries, riparian and water quality resources. These are DOI 1. Project Operations Modeling, DOI 6. Distribution of Water Quality Modeling Results, DOI 9. Fish Assessment Survey for the Link River, Keno, J.C. Boyle Bypass and J.C. Boyle Peaking Reaches, DOI 10. Fish passage Evaluation Study, DOI 12. Habitat-In-Stream Flow Relationships and Minimum Flows, DOI 13. Effects of Project Ramping on Resources Below Project Facilities, DOI 16. Distribution and Abundance of Lamprey Species in the Klamath Hydroelectric Project Area, and DOI 20. Noxious Weed Inventory. These studies determine effects of current Project operations and proposed operations will have on Klamath River resources and should be balanced with all the reservoir resources impacted by the Project operations. This is accomplished by the implementation of DOI 2. Interdisciplinary Suitability Assessment of Alternative Project Operations.

The foundation of the study is the development of operating criteria, on an annual basis, for the reservoir. The operating criteria will allow for determination of reservoir elevations and fluctuations over time. Lake level fluctuations have the potential to severely impact several environmental resource areas. At a minimum, the study must address potential outcomes to:

- Irrigation operations and irrigators within the federal Klamath Irrigation Project and irrigation operations outside of the federal project that rely on Keno Reservoir as a source of water supply;
- Operations and sustainability of the Lower Klamath National Wildlife Refuge;
- Sustainability of the State of Oregon's Miller Island Wildlife Management Facility;
- Recreational use in and around the Lake Euwana complex adjacent to the City of Klamath Falls, including Veteran's Park, Moore's Park and the Link River Trail;
- Recreational use at day use and overnight facilities that are adjacent to the Keno Reservoir;
- Recreational users who have a casual or intermittent need to use the marshy areas adjacent to the Keno Reservoir, including hunters, hikers, bird watchers, and other general recreation users;
- Aquatic, terrestrial and avian biological resources that use the marshy areas adjacent to the Keno Reservoir;
- Aquatic, terrestrial and avian biological resources that occupy the Lower Klamath National Wildlife Refuge;
- Aquatic, terrestrial and avian biological resources that use the irrigated fields and canals in the likely area of impact from changed operations; and
- Effects of changed reservoir operations on industry and local commerce that use the Keno Reservoir.

- Archaeological sites that could be potentially affected by a change in operations

While existing operations at Keno Dam and Reservoir have been generally minimal, resulting in very little reservoir elevation fluctuation, there have been instances, some as recently as April 2004, where PacifiCorp has used the facility under its originally intended purposes, as a re-regulating facility. The minimal amount of storage capability has provided support to required releases of water at other facilities in the hydropower complex to support the needs of endangered species. The proposed study must identify how PacifiCorp has used Keno Dam and Reservoir in this manner and identify how those uses will be satisfied in future operations.

There are numerous stakeholders in the Klamath Basin that have a vested interest in any changes to operations of the Keno Reservoir. Therefore, any study must be conducted in a public arena with opportunities for input into the scope of studies to be undertaken.

Basis for Request

PacifiCorp has identified its' intention to remove a number of facilities from the current Project operating license, including the Keno Dam and Reservoir. PacifiCorp indicates that it will continue to own the facility but will operate it under State of Oregon jurisdiction, outside the regulatory framework encompassing a FERC license. PacifiCorp states in its FLA that the Keno Dam and Reservoir does not meet its original purposes, identified in previous license applications and grants that future development at the facility is not a part of PacifiCorp's development plans. As indicated elsewhere, the Department's view is that the Keno Dam and the reservoir are necessary components of the Project, and must be continued as license features.

Studies conducted by PacifiCorp under the water quality component of the application, indicate that Keno Reservoir is a source of poor water quality in the basin. Summer conditions often create elevated water temperatures while organic material in the reservoir creates concerns regarding dissolved oxygen, and other substances, in the water. Although not detailed in the FLA, PacifiCorp has stated in discussions with the Collaborative agencies that one solution to address water quality concerns is to operate Keno Reservoir more like a river, leading to lowered elevations and more rapid velocities.

Keno Dam and Reservoir is a part of the existing Project and, as such, any changes as well as any resultant impacts from those changes, must be fully evaluated by FERC and PacifiCorp in the process leading to a new license. This will be the case, also, if the Dam and reservoir are retained under the license. Since its development, the Keno Dam and Reservoir has become a significant community resource providing a wide array of diverse services to the area. Irrigators in the Project area, including the federal Klamath Irrigation Project, divert their water allocation directly from the Keno Reservoir. Diversions from Keno Reservoir provide service to more than 41 percent of the federal project alone.

In addition to the federal irrigation project a number of agencies also take their water directly from the river. There are at least three diversion canals, and numerous private diversions, that take water. Like the federal project, these facilities are located near the current surface of the reservoir and any substantive changes in reservoir elevations could render them dry and unusable.

The Lower Klamath National Wildlife Refuge is a customer of the Klamath Irrigation Project and receives a substantial amount of water that is diverted directly out of Keno Reservoir. Those diversions sustain the Lower Klamath Lakes, a principal component of the Refuge.

The Miller Island Wildlife Facility is a feature of the State of Oregon's refuge program. As part of its operations strategy, substantial amounts of water are diverted from Keno Reservoir to manage vegetation

in the complex. These diversions are made at gated facilities which are only submerged one to three feet below the usual level of the reservoir. Any substantive changes in reservoir operations could render those diversion facilities dry at critical times of the year when water would be needed to sustain vegetation growth.

Recreation users will be adversely impacted by dramatic changes in reservoir elevations. There are at least two parks on the reservoir in the vicinity of Klamath Falls that could be rendered unusable if water elevation changes occur. In addition the Link River Trail, near the Link River Dam would have to be evaluated to assure that river operations do not diminish the values of the trail as a result of changes in operations.

There are at least nine known archaeological sites that could be potentially affected by the decision to drop Keno Reservoir from the Project. PacifiCorp has not indicated what will become of these sites if the Keno Development is not part of their license application. A study is needed to analyze the full effects various scenarios could have on cultural resources located adjacent to the reservoir. For instance, a number of sites and portions of sites are submerged by the waters of the reservoir. If a decision is made to drain the reservoir to a return to a river-like setting, these resources will be exposed and will be easily accessible targets for unauthorized collection/looting activities. Likewise, if a decision is made to dredge sediment from the bottom of the reservoir in an attempt to improve downstream water quality, archaeological sites could be affected. These sites could also be adversely affected through the lack of management. Also, Keno Dam operations are likely to be managed to facilitate maintenance operations at PacifiCorp's downstream dams.

With PacifiCorp not stating in its FLA what the final outcomes of operations for Keno Dam and Reservoir will be they have created substantial uncertainty in a number of sectors of Klamath Basin society presenting an untenable situation. Because Keno Dam and Reservoir are part of the current Project baseline it is incumbent on PacifiCorp to better identify their fate as a result of the re-licensing process. Further, recent evidence indicates that Keno Dam and Reservoir is providing some re-regulating services to the Project, which raises the question of whether it can be separated from the Project in the new license.

Responsible Entity

PacifiCorp should conduct the identified studies in partnership with public stakeholders. Because of the high level of local interest in any potential changes to Keno Reservoir PacifiCorp should conduct a public scoping of the study. Interested stakeholders should be invited to participate in identifying issues, determining study methods, and peer reviewing study results.

Participants

There are likely to be numerous individuals and organizations interested in the outcome of the studies. PacifiCorp needs to develop a public involvement process that attempts to incorporate the concerns of a broad array of potential stakeholders. Numerous resource agencies, which have been part of the Project Collaborative process, have interests in the outcome of operations at Keno Reservoir. PacifiCorp should use that network to begin assembling a group of interested stakeholders.

Study Objectives and Methods

Study Objectives

- To develop and analyze an array of feasible operational alternatives for Keno Dam and Reservoir that will support it's being used as potential for mitigation of Project Water Quality concerns.
- Identify resources that are likely to be affected by any changes in operations from the current Project baseline
- Determine the magnitude of effects of operations changes to those natural and human resources
- Identify effective mitigation for those adverse impacts brought about by operational changes
- Develop appropriate Protection, Mitigation and Enhancement measures to lessen the consequences of impacts.
- Prevent adverse effects from occurring to the known sites adjacent to the Reservoir shoreline.

Study Methodology

Because this is a study of the effects of a project change on multiple resources in the project area PacifiCorp will have to design a careful approach to identifying the overall problem, inventorying the resource and conducting impact analysis against a number of alternatives. A potential methodology could include:

- Identify the extent of the water quality problem associated with current operations of Keno Dam and Reservoir. The existing water quality models could be able to satisfy this study requirement with review and validation.
- Identify water quality objectives for Keno Reservoir. This process may be folded in with concurrent TMDL studies of the Oregon Department of Environmental Quality. Then identify alternative operating scenarios that would satisfy those objectives.
- PacifiCorp will have to inventory current uses of Keno Reservoir by entities other than the Hydroelectric Project.
- PacifiCorp will have to inventory current resource values associated with Keno Reservoir, generally along the lines of categories identified elsewhere in this Additional Study Request. This list of resource categories could expand through a necessary scoping process.
- Inventory those resources that are contained in adjacent lands that are likely to be affected by any change in operations, and current water delivery schedules, to the Keno facilities.
- Conduct an impact assessment of the likely consequences of implementing project alternatives on the resources of concern. Once impacts are quantified appropriate PM&E measures can be developed.
- Results of the studies must be displayed and discussed in a public setting with appropriate opportunity given for public input.

Usefulness of Requested Studies in Furthering Resource Goals

Implementation of this study would yield information useful to FERC, BLM, Reclamation, FWS, BIA, NPS, other stakeholders, and PacifiCorp in better understanding the appropriateness and consequences of eliminating Keno Dam and Reservoir from the new FERC license. The proposed action, at a minimum, creates significant uncertainty in the ability of a number of agencies to meet their resource goals as well as assurances of members of the private sector in conducting historic business practices. In a worse case scenario, significant changes in operations of the Keno facilities will have catastrophic economic ramifications to both the public and private sectors of the Project area. Some of the goals affected by changing operations include:

- As much as 40 percent of the federal Klamath Irrigation Project could lose its water supply in the critical summer months when needs are greatest.
- Private irrigators, who take their water from Keno Reservoir may be denied a supply in the critical summer months, or may incur unacceptable costs to keep their systems operating.
- The vast majority of the Lower Klamath National Wildlife Refuge could be adversely affected if reservoir operations changes prevent the continued delivery of water to the refuge.
- Oregon's Miller Island State Wildlife Area might not be able to manage its vegetation growth in the critical summer months.
- Existing lumber processing activities in the Klamath Falls area could be curtailed, particularly in the busy summer period.
- Unacceptable levels of wildlife habitat may be adversely affected, or eliminated, in the critical summer period.
- There are at least nine known archaeological sites that could be potentially affected by the decision to drop Keno Reservoir from the Project

Study Duration

It is difficult to identify the exact duration of this study. While most of the investigations could be conducted over nine to twelve months the addition of including a public process in the studies has the potential to extend the schedule. DOI estimates the study could be completed within a nine to fifteen month timeframe.

Why Study Objectives Cannot Be Achieved Using Available Data

The current FLA wrongly assumes that Keno Dam and Reservoir can be removed from the scope of the new license without giving due consideration to the consequences of that action. Interior questions whether Keno Dam and Reservoir can be removed from the Project license because its operations may effect project production and project facilities maintenance. The FLA identifies PacifiCorp's intention to remove Keno facilities from the new license but provides no information on the consequences of the action. Without identifying those consequences the Project baseline is changed without due consideration for affected resources.

It is noted that the Keno facilities are providing some services to the Project, contrary to statements in the FLA. Recently excess releases from Keno Reservoir were conducted to meet release requirements at Iron Gate Dam. The releases are a requirement of a Biological Opinion, issued by NOAA – Fisheries to the Bureau of Reclamation which place a regulatory requirement on the Hydroelectric Project. Using Keno Reservoir for this re-regulating service seems to be in contrast to the statements in the FLA that Keno Dam and Reservoir do not serve any project purposes, and bring into question whether the Keno facilities can reasonably be removed from the Project.

DOI 4. Multi-Disciplinary Determination of Project Effects on the Klamath River Downstream of Iron Gate Dam. DOI requests further information regarding the Project's effect on the Klamath River downstream of Iron Gate Reservoir. This request relates to both information needed to conduct the Section 7 Wild and Scenic River (WSR) Assessment and information needed to evaluate the Ethnographic Riverscape (ER).

WSR Assessment Information Needs

Rationale:
The Klamath National Forest (KNF) and the NPS will conduct a WSR Act Section 7 assessment on the designated river segment affected by the project. Specific WSR values and the potential project effects were previously identified and communicated to PacifiCorp. The Application did not include the information identified in the "Crosscutting Issues – Wild and Scenic River Assessments". This paper was presented to the Plenary in April 2003 and in NPS's comments on the DLA. DOI is requesting additional information for the designated WSR segments of the Lower Klamath reach in order to effectively protect the resources associated with the outstandingly remarkable values (ORV): fish, wildlife, recreation, and scenery. The WSR assessment will look at the extent to which the project invades the area or unreasonably diminishes these ORVs. The Application does not include a discussion of how Klamath River values protected by the WSR Act have been influenced by the project's historic operational influences.

Relevant Authorities:
NPS

- Federal Power Act, regulations as amended - requires consultation with NPS (18 CFR 4.38(a) and 18 CFR 16.8(a)); identifies topics for consultation (18 CFR 4.51(f) (4), (5) & (6).
- Wild and Scenic Rivers Act of 1968 - FERC license restrictions related to the national wild and scenic rivers system (Sec.7(a) and (b)); NPS assistance related to river resources (Sec.11(b)); and Federal agency consideration for potential wild, scenic, and recreational river areas (Sec.5(d))

DOI's Relevant Resource Goals and Objectives:
Goal: Develop and recommend new license conditions and management programs for the project that conserve, and restore as necessary, the essential attributes of the watershed ecosystem affected by the project while providing for recreation and other beneficial uses.

Objective: Ensure that the free flowing condition and outstandingly remarkable values of the Klamath National Wild and Scenic River in CA and OR are protected and enhanced by conducting an accurate assessment of the KRP's effect on the river including downstream of Iron Gate Dam.

Project Impacts on Resource Goals and Objectives*:*
Under Section 7 of the WSR Act, the National Park Service in conjunction with the United States Forest Service will conduct an assessment of the Klamath River Hydroelectric Project. The WSR assessment will look at the extent to which the project invades the area or unreasonably diminishes the Outstanding Remarkable Values (ORVs). The ORVs that will be evaluated for the reach below Iron Gate are: Free flow, Water Quality, Anadromous Fisheries (coho, Chinook, steelhead), *Secondary* values with WSR Act protection include Recreation (primarily angling, whitewater boating and waterplay), Scenery (river's flow character, water clarity & quality including excessive algae/scum, riparian vegetation, terrestrial & aquatic wildlife), and Wildlife.

Despite a number of previous requests, PacifiCorp's final license application does not include a discussion of how the Klamath River Hydroelectric Project has contributed to conditions below Iron Gate. This information is needed to complete the WSR assessment, which is needed to obtain a license.

Inadequacy of the Work Completed by PacifiCorp and Recommended Action*:*
The final license application does not include a discussion of impacts to the WSR reach below Iron Gate. The baseline for the WSR Act Section 7 assessments are the dates of designation, which are then applied to determine trends and assure sustainability of protected WSR values. The reach below Iron Gate was designated in 1981. In 2003, BLM, KNF, and NPS requested that the licensee provide a discussion of how Klamath River values protected by (or eligible for protection by) the WSR Act have been influenced by the project's historic operational influences, particularly before and after the following time periods:

- Original license operation conditions affecting flows and water quality.
- Construction of Iron Gate and JC Boyle in 1960s and associated license amendments.
- Flow changes in the mid- 90's in response to ESA requirements and other factors affecting Bureau of Reclamation releases.

DOI requests that PacifiCorp provide this information.

Ethnographic Riverscape Information Needs
DOI has developed resource goals and objectives that address project impacts to the downstream segments of the Klamath River from below Iron Gate to the mouth of the river as it enters the Pacific Ocean. It is the Department's position, in agreement with the downriver tribes, that the current project Area of Potential Effects (APE) as determined by PacifiCorp in December of 2003 is inadequate since it fails to acknowledge the existence of these impacts and the negative effects they have had on the resident Native American cultures of the Lower Klamath Basin.

Relevant Authorities:
DOI-BIA

- Federal Power Act (10a) (16 U.S.C. 803(a)
- National Historic Preservation Act, as amended (16 U.S.C. 470)
- Trust responsibility to Native American Tribes

DOI's Relevant Resource Goals and Objectives:
As an overarching resource goal with concern for Native American cultural practices and traditional cultural resources, the Department supports the tribes' position that the entire Klamath River Basin, both upstream and downstream from Iron Gate Dam should be managed to improve the overall ecosystem health and to improve the quality and abundance of resources critical to the maintenance of traditional cultural practices. Additionally, it is the goal to ensure that Native American sacred sites and other traditional cultural properties maintain their integrity and not be subject to negative impacts as the result of project operation.

Project Impacts on Resource Goals and Objectives:
A central objective to meeting these goals is the designation of the Klamath River as a traditional cultural riverscape, and therefore eligible to the National Register of Historic Places. In a paper prepared at the request of the Klamath River Intertribal Fish and Water Commission (KRITFWC) in connection with PacifiCorp's current FERC application for re-licensing of it's hydroelectric generating facilities on the Klamath River, Dr. Thomas King makes a compelling argument for the existence of a definable Klamath Riverscape that may be eligible for inclusion to the National Register of Historic Places (NRHP) (King, 2004). In this paper Dr. King draws on the guidance of National Register Bulletin 38, Identification and Documentation of Traditional Cultural Properties, and its relevance to the Klamath Riverscape and its association "*with significant patterns of events in the traditional histories of the Yurok, Karuk, Hoopa, Shasta, and Klamath Tribes"*. In this paper, Dr. King identifies numerous contributing elements to the

Klamath Riverscape's eligibility status. Several of these elements: Water, Fish, Plants, and Specific cultural locations demand particular concern. In consideration of these contributing elements to the Klamath Riverscape, Department objectives must include: enhancement of water quality and quantity, which thereby improve conditions of traditional fisheries; adjustments to the regulation of seasonal flow to enhance the growth, maintenance and rejuvenation of traditional plants, especially those species used in basketry; and stabilization and maintenance of specific cultural locations that may have been and continue to be subject to erosion resultant from project operations.

DOI supports the tribes' position that the Klamath River hydroelectric project currently under review for re-licensing has resulted in negative impacts that continue to compromise the integrity of the Klamath riverscape, a traditional cultural property that has been evaluated as eligible to the NRHP. These impacts are specific to contributing elements to the Klamath Riverscape's National Register eligibility. These impacts include adverse effects to water, fisheries, important cultural plants, and specific cultural locations.

Inadequacy of the Work Completed by PacifiCorp and Recommended Action*:*
PacifiCorp has in their application process conducted studies that address cultural concerns, including provision of the funding that resulted in Dr. King's study and evaluation of the Klamath Riverscape. Additionally, other studies have been conducted by PacifiCorp concerning water, fisheries, and fluvial geomorphology and this has relevance to the contributing elements of the Klamath Riverscape as identified by Dr. King. However, the downstream tribes contend, and the Department agrees, that these studies were not adequate to address tribal concerns over water quantity and quality, fisheries, traditional cultural plants, and erosional effects to specific cultural locations. Most important, there was no attempt on the part of PacifiCorp to study positive (or negative) impacts that would result from the removal of the dams.

To adequately address these concerns, DOI recommends that additional studies be conducted downstream from Iron Gate Dam so that project effects may be considered for the entire Klamath Riverscape as an integrated and whole traditional cultural riverscape and not segmented by the FERC project boundary. The first step in this effort should be to extend the project APE to the mouth of the Klamath River as it enters the Pacific Ocean. The second step should be to initiate and complete a series of studies that address the concerns expressed in the preceding paragraphs. Such studies should consider all factors that may affect contributing elements to the Klamath Riverscape and ultimately its integrity as a traditional cultural property. These studies must address project effects to water quality, quantity, and temperature, fish passage, fish production, and seasonal regulation of flow as it impacts the viability of traditional cultural plant species, and fluvial geomorphologic processes that may contribute to erosion at specific cultural locations. It also should be incumbent on the applicant to conduct studies that can result in an objective evaluation of he effects, both positive and negative, to the Klamath Riverscape that would result from the removal of project dams. Finally, measures should be taken by the applicant that address overall ecosystem health of the Klamath Riverscape and provides for the enhancement of resources critical for enhancement of Native peoples of the Klamath River Basin ability to maintain their traditional lifeways.

Reference:
King, Dr. Thomas, 2004 First Salmon: The Klamath Cultural Riverscape and PacifiCorp's Klamath Hydroelectric Project.

WATER USE AND QUALITY

DOI 5. J.C. Boyle Bypass Reach Water Quality Modeling for a Range of Flow Scenarios. This study would provide information needed to describe Project impacts and assess a full range of operation alternatives.

Description of Recommended Study

The Department requests that the Commission direct PacifiCorp to model 2000 and 2001 water quality conditions for a range of flows in the J.C. Boyle bypass reach. Model results for water temperature, dissolved oxygen, nutrients, and algae will be presented for six sites:

- Downstream from J.C. Boyle Dam;
- Upstream from the groundwater accretions (RM 224, approximately);
- Upstream from J.C. Boyle powerhouse;
- Downstream from J.C. Boyle powerhouse;
- At the Oregon-California boundary; and,
- Upstream from Copco Reservoir.

This information will yield enhanced understanding of Project impacts and will provide FERC the opportunity to analyze a full range of NEPA alternatives. Beginning with the FSCD, the Department has requested water quality modeling for a "range of alternative operation schemes."

Basis for Request

The J.C. Boyle bypass reach minimum flow proposed in the FLA is not adequately supported by information in the FLA. PacifiCorp states that a 100 cfs steady flow release will "protect the high water quality conditions" by decreasing streamflows into the reach and thereby allowing groundwater accretions to dominate the flow composition (E 3-200).

As noted in the Department's response to the FLA, the approach used by PacifiCorp does not adequately consider the impacts of a range of alternatives on flow conditions throughout the bypass reach (including the river segment upstream from the springs). The analysis within the FLA covers a one week timeframe, does not consider conditions upstream from the springs, and relies on a decision-making framework that is not articulated. Additionally, outputs are displayed for Julian Day 201, the first day of the model run, despite acknowledgement that results are not "stable" until the second or third day of the run (Watercourse Engineering Inc., 2004). These shortcomings are described in more detail as follows:

PacifiCorp conducted model runs of four scenarios (Existing Condition, Steady Flow, Without Project, and Without Project II) encompassing the two-year period 2000 to 2001. The Steady Flow scenario assumed continued diversion of all but 100 cfs from the upstream end of the bypass reach. Therefore, flow and water quality conditions modeled for the bypass reach in the Steady Flow scenario represent, in essence, Existing Conditions with modified reservoir operations. Model results for this reach thus represent two broad end members: Existing Condition and Without Project. No thorough analysis has been conducted to describe conditions under a reasonable range of operational alternatives in this reach.

The FLA consistently fails to describe conditions in the upper segment of the bypass reach, which is one of the free-flowing river segments most affected by Project operations. In the justification for the proposed minimum flow, PacifiCorp also fails to describe conditions immediately downstream from J.C. Boyle Dam. BLM monitoring data suggests that Project flow diversions

cause increased warming rates in the upper segment of the bypass reach (BLM, 2004). PacifiCorp modeling results indicate that the proposed Project operations would substantially reduce DO levels in the upper segment of the bypass reach (Water Resources FTR 4-58).

PacifiCorp provides no analytic results upon which to base conclusions that 100 cfs is the most suitable flow to "enhance usable fish habitat while maintaining high water quality" (E 3-196). This conclusion is based on the limited data presented in the FLA (E 3-199) and information presented in Klamath River Technical Memorandum 3 (Watercourse Engineering Inc., 2004). While it is true that diversion of all but 100 cfs yields the coolest, most DO-laden, and cleanest (in terms of nutrients) water at the downstream end of the reach, it is also true that higher flows are coincident with water quality that meets or approaches State numeric water quality standards (narrative standards and background conditions are described below) and provides more usable fish habitat (discussed in the Part VII of the BLM response to the FLA). Further, by omitting the upstream segment of the reach from analysis, PacifiCorp has inappropriately limited the scope of the study.

As documented by PacifiCorp's analysis of Without Project and Existing Condition scenarios, the Project alters water quality conditions throughout the bypass reach. The Klamath River is included on the Oregon 303(d)-list for exceedance of water temperature standards. Oregon's water quality rules describe numeric as well as narrative standards necessary to protect beneficial uses, including fish habitat, and to maintain natural thermal regimes. The proposed flows in the bypass reach do not meet Oregon's standards. ODEQ has adopted a watershed approach to developing and implementing TMDL's for waters included on the States 303(d) list. That relies on efforts of all responsible parties in a watershed to assess impacts of individual actions and to develop appropriate mitigations or restorations so water quality in listed segments is not further impaired. In this case, PacifiCorp has failed to analyze the effects of Project operations on water quality.

Water quality conditions in the bypass reach are also of importance to management of downstream river reaches, including the Upper Klamath Wild and Scenic River segment. As proposed, the flow regime in the bypass reach would expand the range of daily water temperature fluctuations and lower minimum daily water temperatures in the peaking reach downstream from the powerhouse (Water Resources FTR 4-8). Alternative flow regimes that model a range of bypass reach flows are necessary to develop appropriate mitigations for this Project impact.

Responsible Entity

PacifiCorp should be responsible for modeling, collating, conducting quality assurance, and distributing the data.

Participants

Model outputs, graphical relationships, and analyses would be provided to stakeholders. Tribal, agency, and NGO representatives to the aquatics and water quality work groups should be afforded the opportunity to comment on PacifiCorp's proposed timeline and scope for this work.

<u>Methodology and Objectives</u>

Methods

This study would utilize the calibrated and validated models that have been developed for this relicensing. RMA-2 would be used to develop hydrodynamic simulations that would be passed to RMA-11 for water quality modeling. Modeling would be conducted at an hourly time step for the period 2000 to 2001. Existing hydrologic and meteorologic parameters would be used (these are described in the Water Resources FTR).

Model scenarios would incorporate a range of absolute and fractional minimum flows. Absolute flows would range from 100 cfs to the entire average daily flow volume (run-of-the-river outflows from J.C. Boyle Reservoir) in increments of 100 to 200 cfs. Fractional minimum flows would reflect a percentage of daily average inflows to J.C. Boyle Reservoir, but would not fall below an absolute minimum of 200 cfs (Figure 2-2).

Objectives

This study would provide information necessary to describe Project impacts and assess a full range of operating alternatives. This study will be used to develop flow regimes that account for flow-dependent resources throughout the entire bypass reach (not just the lower segment) and thereby provide a substantive basis for developing flows that appropriately balance natural resources and power generation.

Acceptance of Recommended Study Methods

The modeling methods described in this study have been implemented throughout the Project area. These methods were developed by a skilled water quality modeling practitioner and have been accepted by PacifiCorp and relicensing stakeholders.

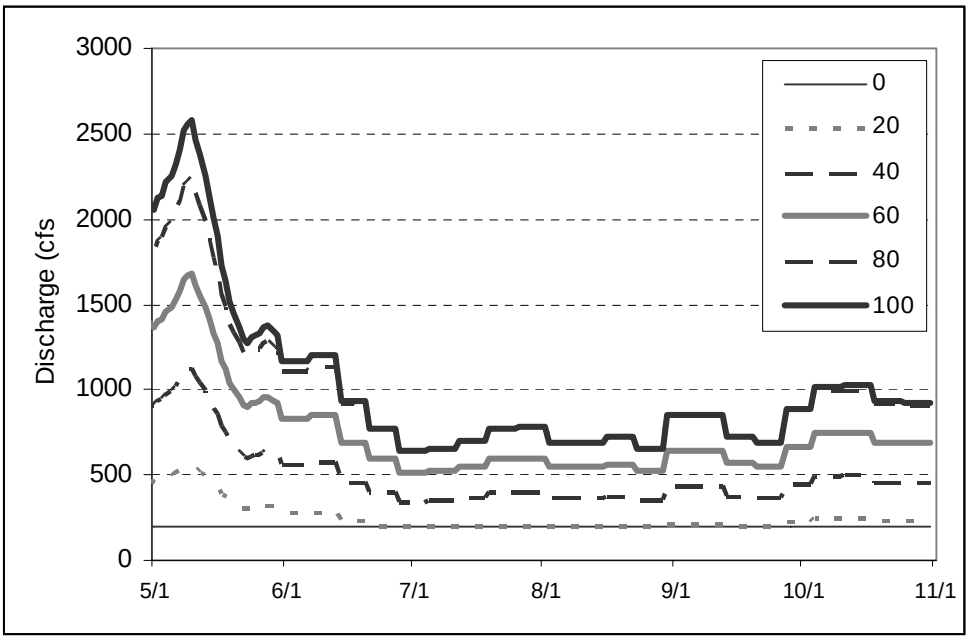

Figure 2-2. Illustration of modeled fractional minimum flows (ranging from 0 to 100%, with an absolute minimum of 200 cfs) at the upstream end of J.C. Boyle bypass reach during the summer of 2000.

Usefulness of Requested Studies in Furthering Resource Goals

It is the goal of the BLM to work with appropriate state and federal agencies to implement the Clean Water Act and protect beneficial uses. As described above, the requested study will provide information necessary to fully analyze Project impacts to water quality and alternative operating scenarios.

A substantial portion of the river reaches between J.C. Boyle Dam and Copco Reservoir occur on BLM-administered land, management of which is guided by the Northwest Forest Plan Aquatic Conservation Strategy. The proposed analysis would assist in meeting the following resource goals described in BLM resource management planning documents:

- "Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain in the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities." (Northwest Forest Plan Standards and Guidelines, page B-11);
- "Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic and wetland habitats and to retain patterns of sediment, nutrient and wood routing. The timing, magnitude, duration and spatial distribution of peak, high and low flows must be protected." (Northwest Forest Plan Standards and Guidelines, page B-11);
- "…Give priority emphasis to instream flows and habitat conditions that maintain or restore riparian resources, favorable channel conditions, and fish passage…" (KFRA RMP Appendix D-10);
- "Comply with state water quality requirements to restore and maintain water quality necessary to protect identifiable beneficial uses" (KFRA RMP page 28); and,
- "Maintain and enhance the natural integrity of river related values in designated and suitable [Wild and Scenic] river areas" (KFRA RMP page 45).

Study Duration

This study relies on modeling, and does not require additional field data collection. The study could be completed in three months.

Why Study Objectives Cannot be Achieved Using Available Data

PacifiCorp has not provided model outputs that adequately describe a full range of alternatives in the J.C. Boyle bypass reach, nor have they presented modeling outputs for the upstream segment of this reach. This data is necessary to inform decision-makers involved in determining flow requirements to meet natural resource management objectives. Incremental flow-water quality relationships will provide a key basis for implementing the Instream Flow Incremental Methodology used to describe other resources (fish habitat and water-based recreation). Further, this study will provide the basis for discussions regarding PacifiCorp's responsibility for restoring thermal regimes and ecological conditions as described in the Oregon water quality standards.

DOI 6. Distribution of Water Quality Modeling Results. The objective of this data request is to allow stakeholders and FERC the opportunity to review PacifiCorp's modeling results and validate conclusions regarding beneficial impacts of the Project.

Description of Recommended Study

The Department requests that the Commission direct PacifiCorp to release water quality model outputs for review and analysis by relicensing stakeholders. The data describes water quality conditions upstream of several springs in the J.C. Boyle bypass reach as well as nutrient and algae dynamics in Project reservoirs and the Klamath River. This information has been generated by PacifiCorp during water quality modeling efforts but has not been provided to interested tribes, agencies, or NGOs. This information has been previously requested by the Department (in response to the DLA) and other stakeholders.

Basis for Request

Water Quality Conditions Upstream from the Springs in the J.C. Boyle Bypass Reach

PacifiCorp describes water quality enhancements that will result from proposed minimum flows in the J.C. Boyle bypass reach (E 3-200). These conclusions ignore potential adverse impacts in the upper segment of the reach.

Output from water quality model runs must include the Klamath River upstream of springs in the J.C. Boyle bypass reach. Low flows released from J.C. Boyle Dam cause altered water quality dynamics (described in Part VII of the BLM response to the FLA). Impacts of the proposed Project include reduced DO downstream from the dam and altered thermal regimes. In addition to effects of equilibration with ambient temperatures, depleted flow volumes downstream of the dam are sensitive to solar loading and conduction from south-facing rock outcrops and sidecast material adjacent to the stream. Low flows are also susceptible to temperature change when dam releases are different from ambient temperatures.

These impacts are most pronounced upstream of the springs in the bypass reach. Over a distance of about 0.4 miles, these springs introduce 220 cfs of cold groundwater into the depleted flows of the Klamath River, and dominate water quality regimes in the lower portion of the bypass reach (Figure 2-3).

The bypass reach groundwater accretions are a major hydrologic feature of the Upper Klamath River. They represent the largest sustained tributary inflow between Upper Klamath Lake and Iron Gate Dam. The relative importance of these springs has increased as a result of Project operations. Under the proposed Project, the area immediately upstream from these springs would continue to be impacted by Project operations. This analysis is necessary to assess Project impacts on water quality.

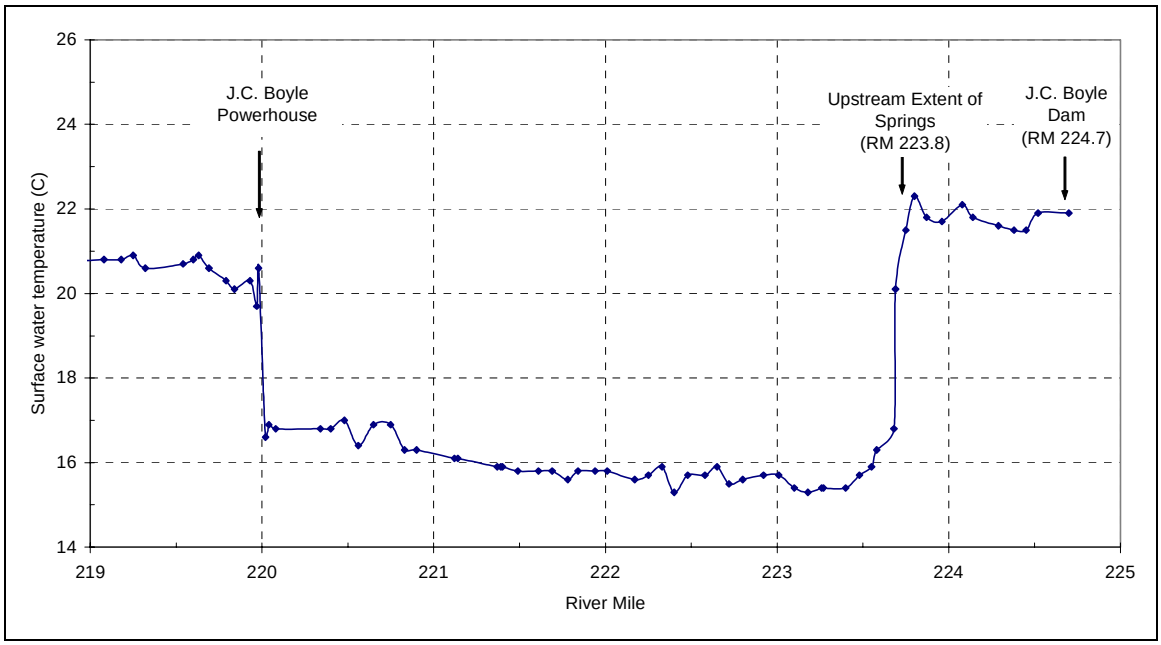

Figure 2-3. July 2001 surface water temperature longitudinal profile derived from Forward Looking Infrared Radiometry (FLIR) data (Watershed Sciences, 2001).

Nutrient and Algae Modeling Results

PacifiCorp uses nutrient and algae modeling data to support a conclusion that Project reservoirs are more effective than river reaches in retaining organic matter and nutrients, and thus prevent downstream algae growth (E 3-214). This statement is not supported by results that have been made available for peer review. These model results must be made available to validate PacifiCorp's conclusions regarding Project impacts, particularly because the results contradict findings from other studies (Campbell, 1999) and relicensing efforts (Eilers and Gubala, 2003).

Responsible Entity and Participants

PacifiCorp would be responsible for collating, conducting quality assurance, and distributing the data and providing modeling outputs, graphical relationships, and analyses to interested parties.

Methodology and Objectives

Methods

This information has already been developed. The node spacing in the water quality model clearly accommodates development of output data files upstream from the springs (Water Resources FTR Appendix 4A page 60). The nutrient data is referenced in the Water Resources FTR (e.g., 4-21, 4-27, 4-35, 4-41, 4-61, 4-66, 4-75, and 4-90).

Objectives

The objective of this data request is to allow Interior bureaus the opportunity to review PacifiCorp's modeling results and validate conclusions regarding beneficial impacts of the Project.

Acceptance of Recommended Study Methods

The modeling methods described in this study have been implemented throughout the Project area. These methods were developed by a skilled water quality modeling practitioner and have been accepted by PacifiCorp and relicensing stakeholders.

Usefulness of Requested Studies in Furthering Resource Goals

It is the goal of the BLM to work with appropriate state and federal agencies to implement the Clean Water Act and protect beneficial uses. As described above, the requested study will provide information needed to fully analyze Project impacts and develop appropriate PM&E measures.

A substantial portion of the river reaches between J.C. Boyle Dam and Copco Reservoir occur on BLM-administered land, management which is guided by the Northwest Forest Plan Aquatic Conservation Strategy. The proposed analysis would assist in meeting the following resource goals described in BLM resource management planning documents:

- "Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain in the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities." (Northwest Forest Plan Standards and Guidelines, page B-11);
- "Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic and wetland habitats and to retain patterns of sediment, nutrient and wood routing. The timing, magnitude, duration and spatial distribution of peak, high and low flows must be protected." (Northwest Forest Plan Standards and Guidelines, page B-11);
- "…Give priority emphasis to instream flows and habitat conditions that maintain or restore riparian resources, favorable channel conditions, and fish passage…" (KFRA RMP Appendix D-10);
- "Existing [hydroelectric] support facilities that must be located in Riparian Reserves should be located, operated, and maintained with an emphasis to eliminate adverse effects that retard or prevent attainment of Aquatic Conservation Strategy objectives." (KFRA RMP Appendix D-10);
- "Comply with state water quality requirements to restore and maintain water quality necessary to protect identifiable beneficial uses" (KFRA RMP page 28); and,
- "Maintain and enhance the natural integrity of river related values in designated and suitable [Wild and Scenic] river areas" (KFRA RMP page 45).

Study Duration

This study involves the distribution of existing data. One month should be a sufficient amount of time to fulfill this request.

Why Study Objectives Cannot be Achieved Using Available Data

PacifiCorp has not made the information necessary to make conclusions regarding beneficial impacts of the Project available to stakeholders. The data is necessary to understand complex water quality issues associated with the Project and the benefits and costs of various alternatives.

DOI 7. Water Quality Study for Spring and Jenny Creeks. The objective of this study is to analyze Project operations effects on water quality including temperature for Spring Creek, above and below the diversion.

Description of Recommended Study

The Department requests that the Commission direct PacifiCorp to model water quality conditions for a range of flows in the Spring and Jenny creeks. Model results for water temperature, dissolved oxygen, nutrients, and algae will be presented for appropriate sites. This information will yield enhanced understanding of Project impacts. Beginning with the FSCD, the Department has advocated water quality modeling for Spring and Jenny creeks.

Basis for Request

There is limited water quality information for Spring and Jenny creeks in the FLA. The FLA does not include any analysis of the effects of the Spring Creek diversion dam on water quality, including the Spring Creek reach that is ponded above the dam (see photo below). The lack of shading above the dam along with the pooling of the creek contained by the dam are factors that likely contribute to increased water temperatures and decreased dissolved oxygen.

PacifiCorp does not describe the rationale used for determining what amount of flow will be diverted from Spring Creek and what the effects are of that action.

Responsible Entity

PacifiCorp would be responsible for modeling, collating, conducting quality assurance, and distributing the data. The Department believes that PacifiCorp staff and consultants are capable of conducting this study.

Participants

Modeling outputs, graphical relationships, and analyses would be provided to interested relicensing stakeholders. Tribal, agency, and NGO representatives to the aquatics and water quality work groups should be afforded the opportunity to comment on PacifiCorp's proposed timeline and scope for this work.

Methodology and Objectives

Methods

This study would utilize the models that have been developed for this relicensing. RMA-2 would be used to develop hydrodynamic simulations which would be passed to RMA-11 for water quality modeling. Existing hydrologic and meteorologic parameters would be used (these are described in the Water Resources FTR).

Model scenarios would incorporate a range of absolute and fractional minimum flows. Fractional minimum flows would reflect a percentage of daily average inflows to the Spring Creek pond, but would not fall below an absolute minimum.

Objectives

This study would provide information needed to describe Project impacts to Spring and Jenny creeks and the beneficial uses dependent on them. This study will be used to develop flow regimes that account for flow-dependent resources and thereby provide a substantive basis for developing flows that appropriately balance natural resources and power generation.

Acceptance of Recommended Study Methods

The modeling methods described in this study have been implemented throughout the Project area. These methods were developed by a skilled water quality modeling practitioner and have been accepted by PacifiCorp and relicensing stakeholders.

Usefulness of Requested Studies in Furthering Resource Goals

It is the goal of the BLM to work with appropriate state and federal agencies to implement the Clean Water Act and protect beneficial uses. As described above, the requested study will provide information needed to fully analyze Project impacts and alternative operation scenarios.

The Spring Creek diversion and associated canal are located on BLM-administered land in the Cascade-Siskiyou National Monument (CSNM). The CSNM was established on June 9, 2000 by a presidential proclamation. The presidential proclamation provides the principal management direction for the monument and identifies many specific species, plant communities and other objects of scientific and historic interest in this area. The guiding principle for management of the CSNM is to protect, maintain, restore or enhance relevant and important objects and natural processes. The FLA does not provide adequate analysis to determine the effect of the Project on the objects for which the CSNM is managed.

Study Duration

This study relies on modeling, but does require additional field data collection. One year at a minimum is needed to complete this study.

Why Study Objectives Cannot be Achieved Using Available Data

PacifiCorp has not provided model outputs for Spring or Jenny creeks. This data is needed to inform decision-makers involved in determining flow requirements to meet natural resource management objectives. Incremental flow-water quality relationships will provide a key basis for implementation of Instream Flow Incremental Methods used to describe other resources (fish habitat and water-based recreation). Further, this study will provide a basis for discussions regarding the responsibilities of PacifiCorp and FERC in attaining restoration of thermal regimes and ecological conditions as described in the Oregon water quality standards.

DOI 8. Verify Sediment Budget. The objectives for this study are; develop data for calibrating bedload transport equations, test and calibrate estimated threshold of bed mobility, develop Project specific rations of bedload transport to suspended sediment transport, and develop testable hypothesis regarding the fate of sediment placed in the river during augmentation.

Description of Recommended Study

The Department requests that the Commission direct PacifiCorp reduce the level of uncertainty associated with key elements of the sediment budget by refining the characterization of sediment stored in Project reservoirs and completing work necessary to determine sediment transport rates. The study elements and objectives included in this request have been described previously in comments on the FSCD, the SSCD, and the DLA, as well as in letters (August 22, 2002 and November 15, 2002) and during work group meetings with PacifiCorp.

Basis for Request

The Project sediment budget is intended to provide a "basic framework within which the relative magnitude of Project effects can be evaluated" (Water Resources FTR 6-24). As it is currently presented, the budget meets this intent but fails to address two core objectives of the sediment transport/river geomorphology study (Water Resources FTR 6-1):

How do Project facilities and operations affect fluvial geomorphic processes?

What are potential measures or actions that can be taken to meet resource management objectives related to Project impacts on sediment transport and river geomorphology?

Reservoir Sediment Characterization

Sediment trapping within Project reservoirs is a well-documented ongoing Project impact (Water Resources FTR 6-50). However, the current assessment of trapped sediments has been based on methods with high associated degrees of uncertainty.

The characterization of reservoir sediments provided in the FLA relies on information from reservoir sediment mapping (Water Resources FTR 6-44) and sediment samples from tributary deltas (Water Resources FTR Appendix 6B). Reservoir sediment mapping focused only on the upper 10-cm of the sediment layer and used techniques that excluded particles larger than 3.75-cm or 5-cm in diameter (Water Resources FTR 6-4). Classifications derived from remote sensing were "supervised" using a limited number of samples (Table 2-1). The data for this effort was derived from the water quality modeling effort and did not involve an assessment of geomorphic processes (See Eilers and Gubala 2003, Page 2). Although the data are suitable primarily for making comparisons of the general character of sediment at the sediment-water interface in each reservoir and for describing the range of materials encountered at various sampling sites within the reservoirs, the data has limited applicability to conclusions regarding geomorphic processes.

Table 2-1. Number of successful surface sediment samples within Project reservoirs (from Eilers and Gubala, 2003).

Reservoir	Number of Samples
J.C. Boyle	4
Copco	9
Iron Gate	4

The sediment sampling at tributary deltas yields more comprehensive information (due to deeper samples and fewer sampling errors), but is of limited utility due to the small number of samples (especially at Jenny Creek and Spencer Creek) (Table 2-2).

Table 2-2. Extent of sediment sampling effort at reservoir tributary deltas (Water Resources FTR Appendix 6B).

Tributary	Number of Sites
Camp/Dutch Creeks	4
Jenny Creek	2
Scotch Creek	4
Spencer Creek	1

Neither of the existing assessments focused specific attention on textural characteristics at the upstream end of the reservoirs, where coarse sediment transported by the river would be mostly likely to deposit. Samples taken farther upstream in the J.C. Boyle and Copco reservoirs were collected from a sample location more than one mile from the upstream end of the reservoir (Eilers and Gubala 2003, Figures 15 and 16). Samples were collected at the upstream end of Iron Gate Reservoir; thus the utility of this data for characterizing river-transported sediment is very limited. The limited data suggests that areas where river-transported sediment are more likely to be deposited are areas with higher proportions of sand (as indicated by the high proportion of sand in the upstream end of Copco Reservoir) (Water Resources FTR figure 6.7-8).

Bedload Transport Dynamics

One impact of reduced sediment supply is bed coarsening/armoring that is observed in the Project area. Bed coarsening/armoring creates conditions in which higher flows are necessary to mobilize the streambed (Water Resources FTR 6-129 and 6-135). Given this the bedload downstream of the Project facilities is mobilized less frequently (Water Resources FTR 6-136).

Two components of the sediment transport/geomorphology study that address sediment transport dynamics have not been completed. These are the bedload sampling effort and the tracer gravel study. Completion of these tasks will provide improved understanding of Project impacts on the rate of sediment movement under current conditions and potential future conditions (e.g., proposed sediment augmentation).

Bedload and associated suspended load measurements should be collected as planned at three sites along the Klamath River (Water Resources FTR 6-117). In order to capture variability, sampling should be conducted during a minimum of two peak flow events. Lack of peak flows in 2002 and 2003 resulted in limited bedload sampling (one measurement was collected at one site in 2003). One sampling event occurred at the downstream end of the J.C. Boyle peaking reach during a peak flow event that registered at 3,000 cfs (Water Resources FTR 6-117). The limited data was used to base conclusions that Project operations, which generate flows on the order of 3,000 cfs in this reach, are capable of transporting sand and suspended sediment. These data do not provide information about flows at the threshold of bed mobility that are estimated to be on the order of 4,700 cfs in this reach (Water Resources FTR 6-134).

Tracer gravels were emplaced in nine river reaches during 2002 and 2003 (Water Resources FTR 6-122). Surveys to determine tracer movement were conducted in only three of these reaches. Results from tracer gravel analysis were used to estimate thresholds of bed mobility (the data

from one site was extrapolated across the entire study area; Water Resources FTR 6-128). Data from additional tracer gravel measurements will contribute to a more rigorous analysis of Project impacts on sediment transport.

The data are necessary for calibrating sediment transport estimates used in sediment budgeting. The data would also be used to estimate thresholds of bed mobility (Water Resources FTR 6-128), evaluate impacts of Project operations on sediment transport in the J.C. Boyle peaking reach (Water Resources FTR 6-117), and develop Project-specific ratios of bedload to suspended sediment (Water Resources FTR 6-145).

This information would be useful for refining the sediment augmentation strategy described in the FLA. Because the proposed sediment augmentation effort is based on an adaptive management framework, baseline assessments of sediment transport rates will be very useful for developing an augmentation program that strategically targets resource management objectives and for monitoring the effectiveness of the sediment augmentation plan. An additional element of this study should include implementation and monitoring of "pilot" gravel augmentation projects. The scope of these projects would be intermediate between tracer gravel studies and comprehensive restoration of sediment regimes. Monitoring of sediment movement from placement areas would provide a clear picture of sediment transport dynamics under conditions more similar to what would occur were
it not for the Project.

Responsible Entity and Participants

PacifiCorp should be responsible for collating, conducting quality assurance, and distributing the data to stakeholders, as well as acquiring permits necessary for pilot sediment placements. Tribal, agency, and NGO representatives to the aquatics and geomorphology work groups should be afforded the opportunity to comment on PacifiCorp's timeline and scope and participate in the design and monitoring of pilot sediment placements.

Methodology and Objectives

Reservoir Sediment Characterization

Methods

Sediment sampling would be expanded upon. Sampling at tributary deltas would apply methods used in the 2003 sampling (described in Water Resources FTR Appendix 6B). Additional sampling is recommended to increase the current sample size, particularly for the Jenny Creek and Spencer Creek deltas.

Sampling reservoir sediment would rely on methods that would accommodate sampling at variable depths in order to accommodate assessment of Project-related sedimentation and comparison of surface and subsurface sediments. Sampling should be adequate to allow characterization of substrate sizes, including particles with diameters greater than 5-cm. Bucket augers and boat-based coring systems would be effective for generating this type of information. Sampling should be adequate to characterize river-transported sediment deposited in upstream portions of J.C. Boyle and Copco Reservoirs.

Objectives

The objectives of this effort are to:

Determine the particle size distribution of sediment stored in Project reservoirs;

Verify assumptions regarding the ratio of fine to coarse sediments in Project reservoirs (Water Resources FTR 6-120);

Develop PM&E measures that mitigate Project impacts on several elements of the river sediment regime, including both the volume and character of sediment.

Bedload Transport Dynamics

Methods

This effort would utilize methods described in the Water Resources FTR. Bedload sampling would occur at three sites and coincide with peak flowevents) (Water Resources FTR 6-12 and 6-117). Tracer gravel observations would be recorded in nine river reaches (Water Resources FTR 6-12 and 6-17). Regardless of peak flows in 2004, additional bedload and suspended sediment sampling should be conducted at the downstream end of the J.C. Boyle peaking reach during peaking operations in order to develop an understanding of Project impacts on sediment transport and deposition.

Small scale gravel augmentation projects would occur in the J.C. Boyle bypass and peaking reaches and downstream from Iron Gate Dam. Placement locations would include the bypass reach downstream from the bridge near the flume crossing, the peaking reach immediately downstream from the powerhouse, the peaking reach in the vicinity of Frain Ranch, and the Klamath River in the vicinity of the Iron Gate fish hatchery. At each site, approximately 20 to 50 cubic yards of sediment would be placed in the river channel. Sediment would range in size from small gravels (2 to 8 mm diameter) to small cobbles (64 mm), and would, as much as practical, consist of lithologies exotic to the Klamath River (i.e., quartzite) to facilitate tracking of movement. In order to minimize detrimental impacts of this "pilot" project, sediment would be washed prior to placement in the stream channel. Monitoring of sediment placements would consist of cross-section and pebble counts at the placement site and at downstream depositional areas (e.g., gravel bars).

Objectives

The objectives of this effort are to:

- Develop additional data for calibrating bedload transport equations (which are currently calibrated using data from only one site);
- Test and calibrate estimated thresholds of bed mobility;
- Develop Project-specific ratios of bedload to suspended sediment transport;
- Develop a more robust understanding of the impacts of Project operations on sediment transport in the J.C. Boyle peaking reach; and,
- Develop testable hypotheses regarding the fate of sediment placed in the river during augmentation activities.

Acceptance of Recommended Study Methods

Most of the methods were agreed to previously as described above and in the Water Resources FTR. Prior to initiation of reservoir sediment sampling, the geomorphology work group should convene to refine study objectives and methods.

Usefulness of Requested Studies in Furthering Resource Goals

A thorough understanding of Project impacts is needed to develop PM&E measures that will allow attainment of resource management objectives. Whereas the FLA focuses solely on "spawning gravel" in its discussion of sediment augmentation (E 4-169), BLM management objectives describe all elements of the "sediment regime," including the timing, volume, rate and character of sediment input, storage and transport (ACS Objective 5). Management of sediment regimes is necessary to accommodate a suite of objectives that is much broader than spawning habitat, which is emphasized in the FLA. These additional objectives include maintenance and restoration of other aquatic habitats (salmonid rearing habitat, fine substrate areas for use by lampreys and mollusks) and restoration of riparian habitats that have been degraded or altered as a result of reduced sediment supply.

A substantial portion of the river reaches between J.C. Boyle Dam and Copco Reservoir occur on BLM-administered land that is managed to attain Northwest Forest Plan objectives. The proposed analysis would assist in meeting the following resource goals (emphasis added):

- "*Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic and wetland habitats* and to retain *patterns of sediment, nutrient and wood routing*. The timing, magnitude, duration and spatial distribution of peak, high and low flows must be protected." (Northwest Forest Plan Standards and Guidelines, page B-11);
- "*Maintain and restore the sediment regime* under which aquatic ecosystems evolved. Elements of the sediment regime include the *timing, volume, rate and character of sediment input, storage and transport*." (Northwest Forest Plan Standards and Guidelines, page B-11);
- "Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands…" (Northwest Forest Plan Standards and Guidelines, page B-11);
- "Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species." (Northwest Forest Plan Standards and Guidelines, page B-11);
- "…Give priority emphasis to instream flows and habitat conditions that *maintain or restore riparian resources*…" (KFRA RMP Appendix D-10);
- "Existing [hydroelectric] support facilities that must be located in Riparian Reserves should be located, *operated*, and maintained with an *emphasis to eliminate adverse effects* that retard or prevent attainment of Aquatic Conservation Strategy objectives." (KFRA RMP Appendix D-10);
- "Emphasize…rehabilitation and maintenance of riparian areas…" (KFRA RMP page 29);
- "Manage riparian-wetland areas to protect, maintain, or improve riparian habitat for wildlife and native plant diversity." (KFRA RMP page 29);
- "Ensure that new resource management plans and activity plans, and *revisions of existing plans*, incorporate, as applicable, practices that enhance or maintain properly functioning riparian systems…" (KFRA RMP page 29); and,

- "Identify, encourage, and support research and studies needed to ensure that riparian-wetland area management objectives can be properly defined and met" (KFRA RMP page 30).

Study Duration

Reservoir and reservoir tributary delta sediment sampling should occur during drawdown in 2004. Pilot sediment placements would be initiated in the fall of 2004. Monitoring of sediment movement would occur in the spring of 2005.

In order to be most useful, bedload sampling and tracer gravel observations need to occur during and after (respectively) peak flows that approach or exceed the estimated threshold of bed mobility. This may or may not occur in 2004. If this is the case, implementation of the sampling plan described in the Water Resources FTR (6-12) should occur as soon as possible.

If the magnitude of peak flows does not occur in 2004, sampling of bedload and sediment transport in the peaking reach should be conducted during peaking operations when flows reach 3,000. Tracer gravel sampling may reveal transport at flows less than estimated thresholds of bed mobility and; therefore, sampling should be conducted in 2004 regardless of the magnitude of the annual flood peak.

Why Study Objectives Cannot be Achieved Using Available Data

The Department has commented on these study plan tasks and objectives many times.

The BLM response to the FSCD stated that the study should:

- "Determine the character (i.e., grain size) of impounded sediments"
- "Determine streamflows needed to entrain (1) the median particle size…and (2) fine sediments…"
- Develop information to "understand Project effects on the processes that shape aquatic and riparian habitat"

The BLM response to the SSCD reiterated many of the FSCD comments and also noted that "core transects should be collected near the mouths of major tributaries and where the river enters the reservoir."

In a letter dated August 22, 2002, the BLM noted the need for replication of bedload sampling measurements.

In a letter dated November 15, 2002 the BLM noted that geomorphic impacts to a variety of "important aquatic habitats" and "the extent and type of riparian vegetation" were of concern.

BLM comments on the DLA reiterated many of these comments and specifically noted the need to "characterize the particle size of trapped sediments" and the fact that "geomorphic processes also affect aquatic habitat, riparian vegetation, wildlife habitat, and cultural resources…"

Although the Department has raised these concerns many times in the past, to date PacifiCorp has not developed the information requested. The gravel augmentation proposal in the FLA is similarly, narrowly focused and does not account for the diversity of resources impacted by Project-induced changes in geomorphic processes.

FISH RESOURCES

DOI 9. Fish Assessment Survey for the Link River, Keno, J.C. Boyle Bypass and J.C. Boyle Peaking Reaches. To characterize existing riverine fisheries affected by the Project, by quantitatively assessing relative abundance, growth, length frequency distribution, condition factor, and age structure of fish populations in project reaches.

Recommended Study and Basis for Request

The Department requests that the Commission direct PacifiCorp to conduct a scientifically-rigorous, quantitative assessment of fish populations in riverine reaches affected by the Project. This evaluation should expand PacifiCorp's existing assessment of fish populations to year round and include an assessment of the impacts to the various species and life stages as a result of flow fluctuation with load following.

DOI's comments on the DLA identified numerous mistakes in PacifiCorp's fish assessment survey methods and analysis of redband trout and other native species. The fish assessment survey (Study Plan 1.9, later changed to Study Plan 1.23 when stakeholders could not agree to PacifiCorp's study methodology and parts were abandoned by PacifiCorp) did not adequately characterize existing conditions, nor did the information provide a clear statement or analysis of Project impacts. Without adequate study results, DOI is reliant on information from other potentially outdated studies and other research including ODFW research (1988-91) and the fish management study developed by ODFW as the basis for that agency conclusions about existing fishery resources, Project impacts, and PM&Es.

PacifiCorp summarized results with an index of relative abundance using catch per unit effort (CPUE) that generated meaningless averages. This kind of analysis does not examine natural variability of populations within seasons, within reaches, or between years. One year of sampling over 4 days per segment per season is inadequate for describing fish populations. Since the analysis was not standardized to sample size, number of days, length of area sampled, and seasonality in some cases, it is impossible to draw meaningful comparisons or conclusions about population abundance and distribution. The assumption inherent in this type of analysis is that catchability of a particular species using a particular gear-type is similar among the reaches, which may not be the case. The results and conclusions from PacifiCorp's fish assessment are not consistent with fish population and community evaluations from other sampling efforts conducted for licensing studies including the proposed Salt Caves Project ODFW research conducted from 1988-1991 (Buchanan et al. 1991; Hemmingsen et al. 1992), and ODFW fish management data collected in 2003.

The fish assessment study remains an area of disagreement between DOI and PacifiCorp specifically in regard to study methodology, analysis, results, and conclusions. DOI also views PacifiCorp's analysis of the data as inadequate, since many of the conclusions PacifiCorp draws are misleading and inaccurate and based on a technically flawed study implementation. This study plan was not approved by the Aquatics Working Group because PacifiCorp misapplied standard scientific methods, failed to collect sufficient data over sample reacles, and limited the sample periods and number of seasons during which sampling was conducted. Since release of the DLA, PacifiCorp has separated the study plan into two separate plans (that address fry sampling, and reservoir and riverine sampling) that are considered inadequate by agency and tribal stakeholders.

The goal of PacifiCorp's fisheries assessment was to characterize the baseline riverine and

reservoir fish communities. The stated objectives were to assess relative abundance, growth, length frequency distribution, condition factor, and age structure of fish populations within and between reaches. PacifiCorp conducted a test of sampling methodologies in fall 2001 and then conducted a general fisheries sampling effort of the riverine sections in spring, summer, and fall of 2002. The fish assessment has a sample size of one in most cases, sampling only one to four days for each reach per season, and then drawing conclusions on the general abundance of fish communities and populations in each reach based on these data.

Using PacifiCorp's results and existing data as the basis for analyzing project effects on fishery resources is problematic because PacifiCorp over-extended the limits of the data and analytic results. The short sample periods, the limited amount of data that was collected, and the lack of information on age structure limit this study's findings to correlative statements about the relationship between relative fish abundance, growth, and environmental variables. As a consequence it will be difficult to assess project effects on variables such as water quality, competition, and habitat and correlate results with impacts to fisheries. For example, PacifiCorp's analysis of load-following operations on redband trout abundance in the J.C. Boyle and Keno reaches is based on CPUE. However, results derived based on a limited sample size and the CPUE method do not accommodate this comparison. The results are invalid. The analysis assumes that catchability is similar in each reach, which may not be the case. Further, CPUE data can vary based on a number of factors including angling ability, water conditions, and flow. Limiting factor analysis usually relies on large data sets that include measurement of environmental variables and statistically-rigorous analysis of abundance for the entire fish community. The PacifiCorp study does not include this comprehensive data set.

The PacifiCorp 2002 sampling effort was presented in the DLA and at the Aquatics Work Group meeting. DOI and other stakeholders submitted recommendations for analysis of sample size, sample dates, time of day, and flow measurement (i.e., J.C. Boyle peaking reach discharge ranges from 350 to over 1500 cfs each day), among other information. Other comments recommended identification of outliers. For example, most of the chubs and minnows in the Keno Reach were observed near the dam and were not observed farther downstream. Sample sizes were not stated and conclusions about the Keno Reach were based on this very small sample size (i.e. 4 trout in the Link River in spring 2002 and none in any other season). An unusually high capture of redband trout in the J.C. Boyle bypass reach generated higher estimates of relative abundance that are not representative of the population. Sampling effort during low versus high flow periods in the J.C. Boyle peaking reach influenced capture success and likely skewed the data. As a result, conclusions regarding relative abundance are difficult to make given the variability of sampling conditions and the limited sampling effort applied in this study.

PacifiCorp declined to conduct more exhaustive data collection or analysis in 2003 and based the conclusions in the FLA on a limited data set. DOI disagrees that the study results are adequate. This fundamental study is necessary for interpreting results of other studies (e.g., fish passage, recreation, and water quality). Misleading conclusions from the fishery assessment will be amplified if used as the basis for conclusions about Project effects on other resources. Most study results presented in the FLA are qualitative therefore it is inappropriate to develop a discussion that is quantitative in its'conclusions.

Study Participants

DOI recommends that PacifiCorp reconvene the Aquatics Work Group or a subgroup thereof to develop a study design and analytic approach for assessing fish populations in the Klamath River.

PacifiCorp should re-conduct the fish assessment and incorporate stakeholder input in study plans, methods, surveys, summary, analysis and data interpretation.

Study Objectives and Methods

Study Objectives

To characterize existing riverine fisheries affected by the Project. Quantitatively assess relative abundance, growth, length frequency distribution, condition factor, and age structure of fish populations in project reaches. In particular, to quantify redband trout populations and their diurnal and seasonal feeding habits.

To expand PacifiCorp's fish assessment for riverine populations using a statistically-based sampling design, adequate sample sizes, representative samples, and adequate stratification in seasonal and year-round surveys. To develop an impact assessment for the various species and life stages as a consequence of flow fluctuations with load following and other operational scenarios. In this analysis, ramping rates should be measured within 0.25 miles of each Project facility including below dams and below powerhouses.

Provide information to other Project studies (e.g. fish passage, ramping, recreation, and water quality) to assess the impact of Project operations and develop appropriate PM&Es.

Study Methods

PacifiCorp needs to conduct additional field sampling using a statistically valid sampling design, standardized protocols, a larger sample size, and replication. In addition, PacifiCorp should conduct year-round surveys. PacifiCorp should conduct additional surveys using established protocols for sampling, summary, and analysis of results. Seasonal changes in temperature and water quality in the Klamath River along with migration of some fish species in riverine reaches cause changes in seasonal abundance and distribution of life stages (City of Klamath Falls, 1986). Sample design should discern changes in relative abundance that may occur as a result of changes in temperature and water quality that affect emigration and recruitment. The study plan needs to detail how data will be summarized, how results will address objectives, and, ultimately, how objectives will be used to identify PM&Es that reduce project impacts and conserve fish populations.

Recommended sampling design considerations include the following:

Larger Sample Sizes: The two reaches of Link River were sampled during different seasons with a sample size of one sample per reach. This approach will not produce a defensible estimate of relative abundance.

Sampling Gear: Gear selection should be based on minimizing sampling bias and should accommodate sampling the greatest range of size-classes possible. Previous sampling included trap nets, angling, and electro-shocking. No effort was made beyond CPUE to control for sampling bias. Using CPUE to compare active and passive sampling techniques is limited in its application. Electro-shocking would result in the least sampling bias and would accommodate sampling of a range of habitats and life-stages. Although larger fish are known to be more at risk to capture due to increased surface area exposure to shocking, and are more visible to samplers than smaller fish these individuals may be overrepresented in the sample. Where gear type introduces known sampling bias, effort to correct for bias or correction for samplingbias should

be incorporated into the analysis. Methods to correct for sampling bias would include the use of other gear in order to sample underrepresented size- or age-classes. Alternate gear sampling should be based on accepted protocols intended to correct for bias.

Representative Sampling of Units and Reaches: Sample representative reaches with representative pool, riffle, run, and glide habitat. Sampling design should include upstream and downstream net installation across habitat units, in order to collect data from closed populations. Where population closure is not possible efforts should be made to determine the level of emigration and immigration from the sample unit or should be derived from the literature or based on mark/recapture data or telemetry studies.

Seasonal Sampling Stratification and Year-round Surveys: While PacifiCorp conducted seasonal sampling, sample sizes were too small to contribute to meaningful results. Stratified sampling conducted on a seasonal basis, should be sufficient for analysis and interpretation of results. Data collection during all seasons is important for describing the existing fishery.

Stratify Variability: The analysis should include a stratified sampling approach across project reaches and at multiple sites. Where electro-shocking gear is used to conduct multiple passes a similar level of effort within representative units should be applied. Sampling should accommodate adequate statistical analysis, including habitat unit population estimates.

Marking: Target species should be fin clipped or tagged. All trout and suckers greater than 50 mm should be marked. Other species should be tagged using sub-sampling protocols to provide information on their abundance and distribution within reaches and units. In the absence of unique external markings, passive transponders (PIT) tag should be emplaced in target fish greater than 75 mm. Data collection should include fork length, collection location (including GPS coordinates), habitat type, water temperature, river flow, and hydrologic regime during sampling (1 turbine, 2 turbine, or run of river). Subsequent recaptures should be recorded and data collected as described above. This approach will allow for establishment of a mark and recapture fishery database that would allow for analysis of fish movement within reaches and between habitat units, growth rate between seasons and between years, will aid in subsequent monitoring efforts, and could contribute towards developing population estimates within various reaches of the Project.

Sampling and Marking Mortality: Sample mortality should be recorded to estimate mortality from sampling gear and marking. Three replicates of 25 to 30 fish, should be held and monitored at 12, 24, and 48 hour intervals per reach per season per treatment (ex. shocked and shocked/marked). If possible fish should be collected using less invasive techniques (e.g., seines or traps) that could be used to determine holding mortality. The percentage lost during handling, minus any losses as a result of holding mortality, could then be used to infer mortality from collection and handling of fish.

Analysis and Interpretation: Growth structure and analysis should be assessed by back calculating length at age using statistically valid sample sizes and techniques. Standardize analyses to sample size, number of days, locations, length of area sampled, and seasonality.

Environmental Variability: Impacts to species and life stages from load following and other operational scenarios should be analyzed by comparing populations in the Link River, Keno, J.C. Boyle Bypass, J.C. Boyle Peaking and below Iron Gate to other regional rivers that are not affected by hydropower operations. Development of sampling design in the fisheries assessment

study should include a protocol for relating results of fisheries impacts as a consequence of Project operations to other studies.

Acceptance of Recommended Study Methods

DOI recommends that FERC require that PacifiCorp develop and implement protocols that have been approved by the Aquatics Work Group or a subgroup thereof. Use of accepted survey and assessment techniques will accommodate a more thorough evaluation of fishery resources in the Project reaches and analysis of impacts from Project operations including load following, ramping, and fish passage.

Usefulness of Requested Studies in Furthering Resource Management Goals

DOI management authorities include the goal of protecting and restoring native fish and wildlife populations for use and enjoyment by present and future generations. Avoidance of new impacts to these populations, protection of genetic diversity, protection and restoration of natural habitats on which these populations are dependent, and providing fish access through artificial obstructions are all management techniques that DOI uses to utilize to achieve its goals.

Information collected at other hydroelectric relicensing projects supports PM&Es such as reduced ramp rates, flow enhancement, and fish passage. The requested information will inform answers to questions regarding the impacts of Project operations and facilities. This information will also contribute to development of PM&Es and analysis of the extent to which proposed PM&Es will benefit aquatic species. Understanding the relationship between fishery resources and flow and habitat are essential to understanding the impacts of Project operations on the aquatic environment.

Duration of Study

This study should be completed in one year, although at least one additional year of sampling is recommended. Additional sampling provides insights to differences in productivity associated with water year, changes in thermal regimes, and anthropogenic effects on the fishery resource.

Existing Information and the Need for Additional Information

DOI does not agree that PacifiCorp's fish assessment accurately reflects the effect of Project operations and facilities on native fish species, and does not provide adequate information on existing conditions or current and future impacts of the Project on fishery resources. Thus, DOI recommends additional surveys and analyses. Uncertainty related to the inadequacy of the data and interpretation of qualitative results raises questions regarding the extent to which load following, fish passage, and dewatering of bypass reaches impact fishery resources.

Over objections made by DOI and all other stakeholders of the Aquatics Work Group PacifiCorp conducted an incomplete assessment of fish populations. PacifiCorp's sampling amounted to a "grab sample" with one data point that cannot be used to assess Project effects on fish populations. PacifiCorp's fish assessments for the Klamath River is inadequate and their implementation of methods inconsistent with other surveys (City of Klamath Falls Oregon 1986; Buchanan et al. 1991; Hemmingsen et al. 1992, ODFW 2003). Thus, PacifiCorp's conclusions are misleading. Study results are qualitative and do not lend to a quantitative discussion of results, that PacifiCorp has included in the FLA.

Subsequent analyses must describe sampling procedures (i.e. single or double pass, random sampling) to better evaluate data quality. Further, methods must describe how relative estimates of fish populations will be calculated.

The Keno and J.C. Boyle bypass and peaking reaches of the Klamath River are essentially three different rivers. Project operations and facilities affect different impacts on flow, temperature, turbidity, and channel character and thus fish populations. Based on results from previous studies, DOI strongly suspects that fish populations are affected by Project operations. However, the 1.9 Fisheries Assessment Study Plan, as currently presented will not accommodate verification of these or other conclusions regarding the affect of the Project on fishery resources.

Literature Cited:

Buchanan, D. V., A. R. Hemmingsen, D. L. Bottom, P. J. Howell, R. A. French and K. P. Currens (1991). Annual Progress Report Fish Research Project Oregon - Native trout Project. Portland, OR, Oregon Department of Fish and Wildlife.

City of Klamath Falls Oregon (1986). Salt Caves Hydroelectric Project - No-Dam Alternative FERC No. 10199-000. Klamath Falls, Oregon, City of Klamath Falls, Oregon. **1:** Sections 1.0 to 13.0; Appendices A, B, D, E, and F.

Hemmingsen, A. R., R. A. French, D. V. Buchanan, D. L. Bottom and K. P. Currens (1992). Annual Progress Report Fish Research Project Oregon - Native Trout Project. Portland, OR, Oregon Department of Fish and Wildlife.

DOI 10. **Fish Passage Evaluation Study**. The study is will provide a characterization of project impacts and information to support decision-making regarding restoring access to historic habitat. The study includes the following components: fractional entrainment to Project facilities (turbine, spillway, bypass, ladders), Upper Klamath Lake survival and behavior, reservoir and facility survival, reservoir behavior, operation and management to minimize impacts to survival and behavior of salmonids through Project facilities, salmonid genetics, pathogen risk assessment, and habitat and Project facilities scenario modeling (EDT and KlamRas).

Recommended Study and Basis for Request

The Department requests that the Commission direct PacifiCorp to conduct the additional study components (below) for the DOI to make better decisions regarding PMEs, recommendations, and section 18 fishway prescriptions.

Fractional Entrainment to Project Facilities (Turbine, Spillway, Bypass, Ladders)

Fish moving downstream in the Klamath River, including federally-listed suckers, are entrained into Project generation facilities. The magnitude of the entrainment impact is unknown, but mortality levels are undoubtedly significant. When anadromous fish passage is re-established above Iron Gate Dam, out-migrating salmonid smolts would be entrained and some unknown, but significant, portion killed by turbines. With the exception of the J.C. Boyle facility, there are no downstream fish screens or other exclusion devices to prevent entrainment and mortality. Little information is provided regarding the scope and magnitude of entrainment of downstream migrant fish at this facility.

Studies are needed to quantify entrainment and mortality at each Project facility, including J.C. Boyle. This information is needed by resource agencies to develop adequate protection, mitigation, and enhancement measures to recommend to FERC.

Prompt completion of these studies is important, because a supportable estimate of mortality of federally-listed suckers will be essential to FERC's section 7 consultation for the relicensing of the Project. The Service will review these mortality estimates before completion of a Biological Opinion or provision of exemption for the prohibition of take pursuant to section 9 of the Endangered Species Act for the Lost River and shortnose suckers.

Upper Klamath Lake Survival and Behavior

Survival and behavior of outmigrant salmonids is a concern in regard to assess the viability of fish passage options. This study would assess outmigrant survival and behavior through Upper Klamath Lake.

The FLA states that mortality through Upper Klamath Lake may be significant. However, no studies have addressed this concern. Outmigrants navigated downstream through Upper Klamath Lake historically and it is likely that a significant percentage of smolts would do so again. This study is key to addressing a critical uncertainty in regard to reintroduction and PacifiCorp's enhancement and mitigation obligations.

Reservoir and Facility Survival

Survival of outmigrant salmonids is a critical uncertainty in assessing fish passage options for the Klamath River. This study would assess outmigrant survival through Project reservoirs (Keno, J.C. Boyle, Copco I, Copco II, and Iron Gate). For the DOI, this study is needed to identify opportunities to improve outmigrant survival through reservoirs and facilities.

Reservoir Behavior

Behavior of outmigrant salmonids through Project reservoirs is a critical uncertainty in regard to assessing fish passage options. This study would assess outmigrant behavior through Project reservoirs. For the DOI, this study is needed to identify opportunities to improve outmigrant survival through reservoirs and facilities.

Operations & Management to Minimize Impacts to Survival and Behavior of Salmonids through Project Facilities

The impacts of Project operations and maintenance on outmigrant salmonids are critical uncertainties in assessing fish passage options. This study would assess the impacts of different Project operations and maintenance on outmigrant salmonids. For the DOI, this study is needed to identify opportunities to improve outmigrant survival through reservoirs and facilities.

Salmonid Genetics

The genetic impacts of reintroduction of anadromous salmonids on resident salmonid populations are a critical uncertainty in regard to assessing fish passage options. This study would assess the impacts of reintroduction on resident salmonids and provide powerful management tools for evaluating the contribution of different anadromous stocks to reintroduction.

Pathogen Risk Assessment

This study is necessary to objectively assess potential for introducing disease to resident fish that might result from potential reintroduction of anadromous fish above Iron Gate Dam and into the upper Klamath Basin. This study should be designed to evaluate critical uncertainties related to potential disease factors and to determine when and how DOI passage goals might be achieved.

Habitat and Project Facilities Scenario Modeling (EDT and KlamRAS)

PacifiCorp's approach to evaluating fish passage has been primarily a review of upstream and downstream fishways that have been tested and installed at other dams for determining potential extent of entrainment and survival thru project facilities. PacifiCorp has completed cursory site specific engineering studies. However, they have not integrated the biological requirements, the full complement of species, or developed biological risk assessments for each design. PacifiCorp should implement the fish passage study to specifically address opportunities and biological needs through project facilities.

Study components related to resident and anadromous salmonids have not been adequately covered under the FLA and need additional data collection and analysis. PacifiCorp has committed to conducting a pilot reservoir behavior study, and completion of EDT and KlamRAS modeling analysis with Working Group participants (E 4-146; see Appendix C – FLA inserts).

The DOI appreciates PacifiCorp efforts to conduct these aspects of study and recommends completion of those studies as agreed upon.

Study Participants

The study would be initiated by PacifiCorp with direction provided by an interagency group (including the USFWS, USBOR, ODFW, CDFG, NOAA Fisheries, and Tribes) who will provide guidance on the study plan, assessment and development of conclusions.

Study Objectives and Methods:

Alternatives for passage need to ensure that the entire suite of native organisms impeded by the Project is addressed. Biological requirements of all species evaluated for passage such as fish behavior, migration timing, and swimming ability and performance may not be the same for all species and need to be considered in the design and construction of fishways.

Dam decommissioning and removal should be evaluated as one of the reintroduction alternatives as agreed upon under the "High Level Option". The assessment should include whether existing Klamath River dams could be removed to assist in the reintroduction of anadromous fish. Specific options that should be studied, including a cost analysis for each alternative, are: 1) upstream passage options including, at a minimum, fishways that emphasize biological attributes, and dam removal; and 2) downstream passage options including, at a minimum, spillgates, surface bypass facilities, tributary collection facilities, reservoir operations (i.e. drawdown), and dam removal.

Biological field studies should be conducted concurrently with the engineering feasibility studies. Field studies should include release and monitoring of tagged adult and juvenile salmon, steelhead, and trout via a variety of operations scenarios to determine reservoir migration patterns, times, and survival, location and success of spawning, egg hatch boxes to determine survival from egg to fry, and pathogen surveys.

Fractional Entrainment to Project Facilities (Turbine, Spillway, Bypass, Ladders)

A substantial body of literature demonstrates that entrainment and mortality in hydroelectric facilities often results in significant impacts to individual fish as well as fish populations. Because of the tremendous variability in entrainment and mortality between facilities, site-specific assessment of project impacts is needed.

Study methodology should utilize test releases of excess hatchery juvenile fish to produce estimates, including entrainment estimates for turbines (including turbine fraction [the proportion of water passing through turbines]), bypass (including bypass fraction), and spillway (including spillway fraction). These estimates should be statistically viable and based on empirical, site-specific data collected during a range of representative conditions and over the appropriate period of time. Mortality needs to be estimated at J.C. Boyle. Mortality at Iron Gate, Copco 1, and Copco 2, which have more standard facilities, may be based upon values in the literature.

Use the net sampling methods of Gutermuth et al. (2000) at J.C. Boyle. We recommend the use of split-beam, digital echosounders at the intakes of Copco 1, Copco 2, and Iron Gate hydroelectric facilities. Species composition for hydroacoustics would be established by subsampling with netting and applied to the acoustical data.

Resident Species - In addition to Lost River and shortnose suckers, studies should assess entrainment of other resident fishes that are known or are likely to be migratory within the Project area. These include: redband/rainbow trout (*Onchorynchus mykiss* subspp.), resident lamprey species (*Lampetra* spp.), blue chub (*Gila coerulea)*, and Klamath large-scale (*Catostomus snyderi*) and Klamath small-scale (*Catostomus rimiculus*) suckers.

Anadromous Species - At each facility, studies will need to estimate passage efficiency for out-migrant smolts. These would include estimates of collection mortality and trap and haul mortality. Proposed facilities (such as smolt collectors) located outside the Project area would also need to be assessed for Project impacts and restoration impacts. Existing reservoir fish communities need to be adequately characterized and an evaluation completed of potential effects on out-migrants.

Upper Klamath Lake Survival and Behavior

DOI recommends that PacifiCorp estimate Upper Klamath Lake passage survival to out-migrant smolts. Study methodology should utilize test releases of excess hatchery juvenile fish to estimate mortality to be incurred by out-migrants through existing lake conditions. Anadromous salmonid fry and juveniles would be released at the mouth of the Williamson and Wood Rivers, and then collected at the A Canal Fish screen or Link River to assess lake passage survival. Survival through the lake, passage time, and outmigrant condition and growth would be assessed on this basis.

Reservoir and Facility Survival

At each facility, PacifiCorp needs to estimate reservoir passage survival and facility-related mortality to out-migrant smolts. Study methodology should utilize test releases of excess hatchery juvenile fish to estimate mortality to be incurred by out-migrants through existing reservoir conditions under a variety of operational scenarios. Physical modeling and prototype testing of alternative juvenile fish collection and turbine intake screening structures should be conducted. If implementation of non-volitional passage technology is considered, collection mortality as well as trap and haul mortality also need to be estimated.

As part of this study, DOI is also requesting a further evaluation of proposed fish passage (upstream and downstream) engineering designs in terms of applicability to local conditions, mortality impacts, and estimated costs.

Evaluation of Proposed Fish Passage:

A. Keno

1. Provide a detailed assessment of design modifications and associated costs for the Keno sucker ladder option (Fish Resources FTR page 7-25).

2. Provide a detailed study of outmigrant anadromous salmonid and sucker downstream passage and mortality through Keno spillway gates.

3. Provide an inventory of existing unscreened water intakes for Keno reservoir and estimated costs for exclusion screens.

B. J.C. Boyle

1. Provide advanced design drawings and cost estimates for both a ladder and a fish trap/aerial tramway system, with a new entrance adjacent to the USGS staff gauge (modification to figure 7.8-13; Fish Resources FTR page 7-41). Provide a literature review on necessary attraction flows for suckers, lamprey, redband trout, steelhead, and salmon. Provide an estimate for the supply of water of an appropriate temperature for both a ladder and a fish trap/aerial tramway system.

2. Provide efficiency studies for the proposed gulper system.

3. Provide advanced design drawing and cost estimates for a High Speed V-screen (Modification to figure 7.8-9; Fish Resources FTR page 7-35).

4. Better information regarding current problems with upstream passage at J.C. Boyle is needed to inform decisions on fishways, regardless of design. Thus, studies should include, but need not be limited to:

a) An examination of flow records for the J.C. Boyle ladder. This will help assess whether proper flows have been released through the ladders.

b) A comparison of flow distribution rates for the J.C. Boyle ladder and powerhouse during the first years after ladder installation versus current flow distributions. This would help assess whether there are now false attraction flows from the powerhouse.

c) Measurements of water height at weirs and entrance of the ladder. This will ensure that the ladder is being operated as designed.

d) An examination and comparison of water temperatures in the J.C. Boyle ladder, the bypass reach, and in the tailrace of J.C. Boyle powerhouse. This would determine if there are water temperature differentials between ladder flows and the bypass, and would also determine if the ladder is increasing water temperature. Historical ladder water temperature data should be provided, if available, for all ladders.

e) A continuation of radio-tagging studies of redband trout, with an adequate number of trout (with thermal sensors) to better determine fish attraction and movements to and through the J.C. Boyle ladder, bypass reach, and tailrace flows under different temperature regimes. This may require 6-10 antennae placed strategically along the length of the ladder and a similar number near the powerhouse.

C. Copco 1

1. Provide advanced design drawings and cost estimates for the fish trap and aerial tramway system (Modification to figure 7.8-22; Fish Resources FTR page 7-54). Provide literature review on attraction flows for Pacific lamprey, redband trout, steelhead, and salmon. Provide an estimate of the supply of water of an appropriate temperature for both a ladder and a fish trap/aerial tramway system.

2. Provide efficiency studies for the proposed gulper system.

3. Provide advanced design drawings and cost estimates for a High Speed V-screen (Modification to figure 7.8-20; Fish Resources FTR page 7-51).

D. Copco 2

1. Provide advanced design drawings and cost estimates for a fish ladder to Copco 2 Forebay (Modification to figure 7.8-27; Fish Resources FTR page 7-63). Provide an estimate of the supply of water of an appropriate temperature for a ladder.

2. Provide instream flow estimates for migration habitat for anadromous and resident fish in the Copco 2 bypass channel.

3. Provide advanced design drawings and cost estimates for High Speed V-screen (Modification to figure 7.8-26; Fish Resources FTR page 7-58).

E. Iron Gate

1. Provide advanced design drawings and cost estimates for a fish trap/ aerial tramway system (Modification to figure 7.8-36; Fish Resources FTR page 7-78). Provide an estimate of the supply of water of an appropriate temperature for both a ladder and a lock/tramway.

2. Provide design drawings and a cost estimate for a fish sorting facility at the brood stock collection juncture of the existing hatchery ladder. This sorting facility needs to be designed for upstream fish passage by ladder, fish lock, or tanker trucks. Sorting facility needs to be designed to minimize fish handling.

3. Provide efficiency studies for the proposed gulper system.

4. Provide advanced design drawings and cost estimates for a High Speed V-screen (Modification to figure 7.8-32; Fish Resources FTR page 7-71).

F. All facilities

1. Review literature for electronic, sonic, or other alternatives to physical tailrace barriers.

2. Provide a literature review of trap and haul mortality estimates for both upstream and downstream passage for resident as well as anadromous fish. Review should especially include comparable situations in terms of distance and climate.

Reservoir Behavior

The proposed behavior study would ensure an adequate understanding of fish behavior, such as reservoir travel time and passage characteristics (fish concentrations, attraction flows, and initial assessment of exposure to predation) in Keno, J.C. Boyle, Copco I and II, and Iron Gate Reservoirs and associated facilities so that the DOI can make prescriptions and recommendations with specific information regarding relevant options and their costs and benefits. Utilizing the results of this preliminary study, further efforts should address a range of reservoir operation

scenarios and specific facility modifications intended to improve reservoir passage characteristics.

Study methodology should also include test releases of excess hatchery adult fish to monitor migration patterns, times, survival, and location and success of spawning.

Operations and Maintenance to Minimize Impacts to Survival and Behavior of Salmonids through Project Facilities

The proposed study would ensure an adequate understanding of the effects of project operations and maintenance so that the DOI can make prescriptions and recommendations based on a full understanding of the potential costs and benefits of relevant options. PacifiCorp needs to evaluate the feasibility of instituting operational changes and structural modifications that would modify reservoir flow patterns to provide conditions more conducive to downstream movement of juvenile salmonids for Keno, J.C. Boyle, Copco, and Iron Gate dams. PacifiCorp should also utilize a three dimensional hydrodynamic model to assess the potential consequences of different water withdrawal scenarios on surface currents and vertical velocity distributions for Copco and Iron Gate Reservoirs. PacifiCorp should investigate velocities over a range of flows including 3,000 cfs plus and the capability of current facilities and facilities with modifications to operate at those flows. Past analysis of this and other projects clearly indicate that juvenile fish migration through reservoirs is usually the most difficult obstacle of fish passage.

The potential for biotic interactions, such as predation and competition, between anadromous and resident fish also needs to be investigated. Predation potential by both native and non-native species needs to be evaluated. The predation potential by warm water species on the early life stages of reintroduced species has been clearly documented in the scientific community. PacifiCorp should investigate how structural modifications or changes in operation, e.g. drawdown, affect predator density and feeding at J.C. Boyle, Copco, and Iron Gate dams. Competition of reintroduced salmonids with upper basin resident fish needs to be objectively assessed.

Salmonid Genetics

The proposed study would ensure an adequate understanding of the effects reintroduction on resident fish genetics so that the DOI can make prescriptions and recommendations based on a full understanding of the potential costs and benefits of relevant options. Filling in data gaps that currently exist, through tissue sampling and genetic analysis, would be very useful to monitor future reintroduction impacts on the genetic structure of existing resident trout populations and introduced steelhead (Fish Resources FTR 9-35). Additional analyses would help identify and characterize the genetic stock structure of anadromous fish populations that are candidates for reintroduction above Iron Gate Dam.

Microsatellite DNA data should be collected on stocks being used for restoring anadromous runs above Iron Gate Dam to determine the relevant demographic history of these populations to identify genetic bottlenecks that would potentially cause inbreeding (FTR 9-36).

This information would enable managers to identify the population origin of fish migrating through fish passage facilities in the Project area. This data would be useful for determining the outmigration and spawning periodicity of runs originating from geographically distinct regions above Iron Gate Dam. Genetic stock identification would provide managers with powerful tools

for determining if adfluvial and anadromous trout returning to Iron Gate and other Project dams are from populations already residing in and above the project, or from downstream populations.

Genetic data would be useful for evaluating if mating and rearing protocols used in hatchery operations minimize genetic divergence of hatchery fish from their wild counterparts and thus maintain long term adaptive traits (FTR 9-35). These considerations, as well as other genetic and physical effects caused by hatcheries, should be integrated in a hatchery genetic management plan.

Pathogen Risk Assessment

The proposed study would ensure an adequate understanding of the risk of disease introduction above Iron Gate Dam so that the DOI can make prescriptions and recommendations based on a full understanding of the potential costs and benefits of relevant options. There is significant concern regarding the introduction of disease pathogens associated with the reintroduction of anadromous salmonids and other fish to their historical habitats. A pathogen survey and risk assessment was requested by ODFW (ODFW comments to PacifiCorp's FSCD). The DOI agrees with ODFW on the value of such information and recommends this effort be implemented by PacifiCorp. A pathogen risk assessment should occur concurrently with other efforts to evaluate fish passage. The survival of reintroduced fish species and resident fish populations above Project could be seriously jeopardized by movement of pathogens not presently found above the dams or from fish pathogens already present in this habitat. Progeny from the reintroduced adults may be susceptible to infection, and this may limit reproduction. Additionally, the impact of new strains of pathogens or completely exotic disease organisms on resident fish above the Project could be considerable. Little information exists concerning endemic fish pathogens or the presence of intermediate hosts that may allow exotic pathogens to become permanently established above the Project.

DOI recommends the following components be included in a detailed study proposal:

1. Conduct a thorough literature review and document recent history of fish pathogens that might be found in salmonid species in the Lower Klamath River and introduced above Iron Gate Dam.

2. Prepare a list of pathogens of concern. These should include all pathogens that will likely affect the success of reintroduction and impact resident fish.

3. Once a potential pathogen list is prepared, collect baseline information regarding the presence, distribution, prevalence, and potential virulence of specific pathogens upstream and downstream of the Iron Gate Dam.

4. Obtain information necessary to evaluate and monitor changes in certain fish pathogens above the Project, if reintroduction of anadromous fish or passage of resident fish is attempted. Monitor fish populations passed over the dams and resident fish for important pathogens for at least four years.

5. Evaluate non-lethal methods for detecting fish pathogens that will eliminate the necessity of lethal sampling of threatened and endangered fish.

6. Establish decision criteria that will be used to evaluate disease risks associated with providing passage for anadromous and resident fish at Iron Gate Dam.

7. The likelihood of pathogens becoming established in resident fish populations as well as in reintroduced fish should be evaluated. Determine if alternate hosts are present.

8. The study should also develop fish health criteria and guidelines to determine which hatchery fish can be transferred above the Projects.

9. Develop methods to address fish pathogen issues that may arise during implementation of a reintroduction program. An example would be to inject adult salmon that are passed over the dams with erythromycin to prevent excessive mortality prior to spawning from bacterial kidney disease.

Habitat and Project Facilities Scenario Modeling (EDT and KlamRAS)

The proposed study would ensure a better assessment of the habitat quantity and quality above Iron Gate Dam so that the DOI can make prescriptions and recommendations based on a full understanding of the potential costs and benefits of relevant options. There is significant concern regarding the quality of upstream habitat associated with the reintroduction of anadromous salmonids and other fish to their historical habitats. PacifiCorp and stakeholders need to complete the review of EDT attributes, and development of EDT and KlamRas models as promised.

As the DOI has previously stated, all fish passage options for the Klamath Hydroelectric Project should be seriously considered, and this will require an analysis of anadromous fish habitat that would be made available under a full range of fish passage scenarios (potential habitat includes the upper basin as well as habitat located under Project reservoirs). Assessments of habitat in the upper basin have identified more than 1,000 miles of potential steelhead habitat and more than 500 miles of potential Chinook salmon habitat upstream of Project facilities that should be accounted for in the EDT modeling effort. PacifiCorp states in the FTR that EDT is intended to estimate the potential success of efforts to restore anadromous fisheries in the Upper Klamath Basin. The DOI disagrees with PacifiCorp on this point. The use of EDT was intended to assess productive capacity and limiting factors associated with habitat that exists within and upstream from the Project. EDT was also used to develop a “template” boundary condition that represents pristine (or fully restored) condition and is to be used for comparison with existing conditions. This portion of the modeling is not complete, and therefore the FLA does not describe model results for the template condition. Using template and existing conditions, EDT can also be used to conduct a limiting factors analysis which allows development of strategies and priorities that are expected to achieve habitat restoration.

Stakeholders, including the DOI, have requested several times that EDT and KlamRas model outputs should be presented in a manner that clearly indicates their value as relative, rather than quantitative. DOI disagrees with PacifiCorp and contends the model outputs do not represent estimates of actual fish numbers, only relative indicators of expected productivity.

The EDT model needs to be developed for the entire upper basin above Iron Gate Dam, with flow and water quality data developed for the upper basin included.

<u>Acceptance of Recommended Study Methods</u>

The scientific and natural resource community has been conducting evaluations of fish passage for many years. PacifiCorp conducted a preliminary assessment of the engineering issues

associated with developing fish passage. The scientific community has spent considerable time evaluating the technical and biological needs for fish passage at hydropower dams since the 1960's. EDT has been used to assess habitat quality and quantity at various locations on the west coast (Lestelle et al. 1996). There exists a large body of scientific literature to guide the design and implementation of the proposed studies.

Usefulness of Requested Studies in Furthering Resource Management Goals

There is significant concern regarding the introduction of disease pathogens, competition with resident fish, predation of reintroduced fish, survival of fish through project facilities and Upper Klamath Lake, inadequate habitat above Iron Gate Dam, and/or impacts on upper basin native fish. These concerns may be valid in some cases. These concerns and potential conflicts associated with DOI's goals of examining the potential for reintroduction of anadromous salmonids and other fish to their historical habitats need to be addressed. In other cases, these concerns are misguided or even misleading. The proposed study would ensure a better assessment of potential conflicts so that the DOI can make prescriptions and recommendations based on a full understanding of the potential costs and benefits of relevant options. The completion of an integrated evaluation of fish passage, upstream habitats, seasonal use, and project operations would provide the information necessary to fully evaluate the ecological and economic impacts associated with project management. DOI has responsibility for addressing federally listed species, and sensitive species that may be impacted by federally licensed projects. Fish passage has been identified by every resource management agency and Tribe in this relicensing as being important to their resource goals. Thus, this in-depth assessment that looks at all project variables should be completed.

In regard to entrainment studies specifically, results may indicate that fish exclusion devices for resident fish may not be needed.

These comments are also based in part on the DOI and National Marine Fisheries Service guidance for developing fish passage prescriptions and the need of Interior and Commerce to develop appropriate prescriptions under section 18 of the Federal Power Act. Evaluation of the potential benefits and feasibility of fish passage is necessary as background for the fishway prescription process, and in relation to the potential exercise of reserved rights of affected Indian tribes.

Duration of Study

DOI recommends that PacifiCorp conduct the multiple components of this comprehensive fish passage study concurrently. At initial relicensing consultations and during the relicensing study phase, DOI requested that PacifiCorp initiate the multi-faceted study to obtain initial information regarding fish passage. Because PacifiCorp did not conduct the requested study or components of a study, or delayed initiation of the study during relicensing consultation, DOI recommends this be started immediately.

Existing Information and the Need for Additional Information

Many significant concerns regarding the introduction of disease pathogens, competition with resident fish, predation of reintroduced fish, extent of high quality habitat, and fish genetics, remain unaddressed. In 2000, PacifiCorp initiated studies to develop a relicensing package for the continued operation of the Project. In the March, 2001 comment letter on the First Stage Consultation Document, DOI indicated that PacifiCorp should investigate reintroduction, via fish

passage facilities, for salmon, steelhead, and lamprey to the Klamath River and its tributaries blocked by the Project. DOI recommended that at a minimum, PacifiCorp should provide a complete evaluation of anadromous fish habitats available, an estimate of production potential; conceptual designs for fish passage and collection facility options that could be used to accomplish fish passage and an assessment of the risks and benefits of project modifications. DOI recommended the options consider decommissioning and dam removal, and the assessment of risks and benefits should be comprehensive, including a full evaluation of the fish production, recreational, wildlife, and environmental outcomes anticipated from each reintroduction alternative.

PacifiCorp has not evaluated the integration of fish passage with upstream watershed studies, disease risk assessment, salmonid population requirements or opportunities for anadromous fish population expansion.

As the DOI has previously stated, all fish passage options for the Klamath Hydroelectric Project should be seriously considered, and this will require an analysis of anadromous fish habitat that would be made available under a full range of fish passage scenarios (potential habitat includes the upper basin above Upper Klamath Lake as well as those inundated by Project reservoirs). This analysis was not included in the potential fish habitat in the modeling efforts and should be completed.

Fish passage discussions were initiated during the initial licensing process. Anadromous fish requirements, opportunities for population expansion, improved watershed conditions and improved engineering approaches require a rigorous assessment of fish passage. Without completion of the requested component studies, the adequacy of PMEs cannot be fully assessed

Fractional Entrainment to Project Facilities (Turbine, Spillway, Bypass, Ladders)

This information is not available because Study Plan 1.10, one of the key fish passage studies, remains unapproved (Exhibit E Page 1-2) by the Collaborative because the plan was inadequate.

With the exception of the salvage information, almost no data are available on entrainment at project generation facilities below Link River. To date, PacifiCorp has declined to initiate entrainment studies and has offered only to conduct a literature review. However, a literature review cannot provide an accurate accounting of Project impacts.

Site-specific studies for Project entrainment impacts to the above species are needed for several reasons. First, the Klamath River, its impoundments, and resident fish communities constitute a unique and impacted ecosystem. The Iron Gate and Copco reservoir fish populations consist of mainly exotic species versus the assemblage of largely native species in J.C. Boyle reservoir. Water quality and characteristics of flow in the Project's eutrophic reservoirs likely influence fish communities and fish behavior.

Project facilities have unique characteristics. For example, J.C. Boyle has more than 400 feet of head and is operated as a peaking facility. Peaking takes place during both day and night periods. Entrained fish are exposed to extreme pressure changes as they transit through the Project, with impacts that are unknown and unique. Entrainment of larvae and juvenile fish, including federally-listed suckers, may be significant at certain times of the year. In contrast, the facilities discussed in the Literature Based Characterization of Resident Fish Entrainment and Turbine-Induced Mortality (RFETM; provided by PacifiCorp) are generally operated on a run-of-the-river basis and their impoundments are inhabited by fish communities different than those associated

with the Project. Comparison of entrainment and mortality in the unique Project facilities to the entrainment and mortality in low-head facilities, located in the upper Midwest on mesotrophic or oligotrophic impoundments, is inappropriate.

Federally-listed suckers and California State Species of Special Concern are present in all Project impoundments. Little is known about the behavior of these fish and their vulnerability to entrainment and mortality.

DOI goals for the Klamath watershed include assessing the viability of the reintroduction of anadromous salmonids and other fish to their historical habitats. Entrainment and mortality studies for anadromous species may not be appropriate until after reintroduction takes place. However, resident fish studies will provide great insight into entrainment and mortality for reintroduced anadromous fish. These studies would help focus future efforts on spatial and temporal areas where entrainment and mortality to anadromous outmigrants would be of the greatest concern. In the long run, if done correctly, resident fish entrainment studies would likely help narrow the scope of future anadromous fish studies.

One of PacifiCorp's main objections to site-specific studies at each facility seems to be their perceived expense. However, the California Department of Fish and Game has proposed less expensive options for entrainment studies that have merit and need to be considered by PacifiCorp.

Upper Klamath Lake Survival and Behavior

In general terms, this study was requested in DOI's April 8, 2003, letter to PacifiCorp. No assessment is available of Upper Klamath Lake outmigrant survival and behavior. This information is not available because Study Plan 1.18, one of the key fish passage studies, was not approved (Exhibit E Page 1-2) by the Collaborative because the plan was inadequate.

Characterization of transit patterns and migration timing relative to lake management, and survival rates are critical information gaps noted in the FLA. Information on timing and movement would contribute to management recommendation for both lake elevation and instream flow focus periods. Information of survival rates would guide specific reintroduction timing, acclimation, and release methods under various reservoir conditions.

Reservoir and Facility Survival

A study of the mortality to be incurred by outmigrants through project reservoirs was requested in DOI's April 8, 2003, letter to PacifiCorp. No study was completed and no assessment is available for outmigrant survival through Project reservoirs. This information is not available because Study Plan 1.18, one of the key fish passage studies, was not approved (Exhibit E Page 1-2) by the Collaborative because the plan was inadequate.

In regard to engineering evaluations for fishways at facilities, in their existing state, the evaluations lack sufficient detail to evaluate, in detail, potential fishway options and costs. The specific fishway engineering information requested above will help to make better fishway recommendations and prescriptions consistent with DOI goals.

The adult rainbow trout movement assessment at J.C. Boyle, while a good pilot study, is inconclusive because of inadequate sample size. There are data for only one fish which

successfully navigated the J.C. Boyle ladder. The DOI believes more study is necessary in regard to potential delay associated with attraction flows at the J.C. Boyle powerhouse.

Information of survival rates would guide specific reintroduction timing, acclimation, and release methods under various reservoir conditions.

Reservoir Behavior

In general terms, this study was requested in DOI's April 8, 2003, letter to PacifiCorp. No assessment is available of outmigrant behavior through Project reservoirs. Other than PacifiCorp's studies for California reservoirs (on going), no data are available. This information is not available because Study Plan 1.18, one of the key fish passage studies, was not approved (Exhibit E Page 1-2) by the Collaborative because the plan was inadequate. Information on reservoir behavior including migration timing and movement patterns would contribute towards specific management recommendations such as reservoir water surface elevations, reservoir withdrawal patterns, and downstream flow focus periods.

Operation & Maintenance to Minimize Impacts to Survival and Behavior of Salmonids through Project Facilities

In general terms, study of flows through reservoirs and an evaluation of the likelihood that out migrants could successfully transit reservoirs were requested in DOI's April 8, 2003, letter to PacifiCorp. No understanding of operations and maintenance that would minimize impacts to survival and behavior of salmonids through Project facilities is currently available.

Salmonid Genetics

Very little information is available. This information is not available because Study Plan 1.17 was not approved (Exhibit E Page 1-2) by the Collaborative because the plan was inadequate. Understanding the genetics of Klamath Basin stock within, above, and below the project would contribute towards management decisions including brood stock selection, hatchery management impacts on natural production, and reintroduction effectiveness monitoring.

Pathogen Risk Assessment

There is insufficient information available. Limited information available to DOI indicates that viral pathogen risk associated with reintroduction of anadromous salmonids above Iron Gate Dam is low and could be minimized further. A pathogen risk assessment is critical in order to address the State of Oregon's concerns regarding disease transmission associated with anadromous fish passage above Iron Gate Dam. The results of this study would provide the foundation to develop management strategies to protect Upper Klamath Basin fish stocks, at the same time protect introduced anadromous salmonids from disease impacts.

Why Studies were not Requested during Pre-Filing Consultation

Fractional Entrainment to Project Facilities (Turbine, Spillway, Bypass, Ladders)

Requests for entrainment studies were made pre-filing. See the Service letter dated December 31, 2002, (addressed to Todd Olson); Service letter dated May 5, 2003, (addressed to Todd Olson); DOI letter dated April 8, 2003, (addressed to Toby Freeman); DOI DLA comments letter dated September 24, 2003, (addressed to Toby Freeman); Service letter to Kearns and West, dated

September 26, 2003; and verbal comments by the Service provided at the November 5, 2003, Joint Agency Dispute Meeting.

The DOI continues to request that robust and complete entrainment mortality studies be conducted at all Project facilities below Link River. Federally-listed suckers are present in all Project reservoirs (Federal Energy Regulatory Commission 1990; Desjardins and Markle 2000). At the J.C. Boyle facility, entrainment of these listed species has been documented as well (PacifiCorp website 2003). Entrainment and mortality are probably taking place at the Copco (both 1&2), and Iron Gate facilities, but are unquantified at present.

Entrainment and mortality studies should be conducted at each facility to assist with fishway design for resident fish and anadromous species, including salmonids and lamprey.

The proposal to exclude Keno Dam and reservoir from the project and FERC jurisdiction were not included in the DLA, therefore, DOI has not had an adequate opportunity to consider these impacts.

Upper Klamath Lake Survival and Behavior

There is significant concern regarding the passage of reintroduced fish through Upper Klamath Lake and this issue has come to the for as potential bottlenecks to anadromous fish production have been considered. Passage through Upper Klamath Lake is critical to DOI's goal of examining the potential for reintroduction of anadromous salmonids and other fish to their historical habitats above the lake.

Reservoir and Facility Survival

Gulpers have been proposed to protect outmigrant anadromous and resident fish from entrainment and mortality. The use of gulpers at most facilities was not proposed until the FLA.

The J.C. Boyle ladder studies were recommended in the DOI letter dated September 24, 2003.

This study will be critical in the development of strategies and priorities that are expected to achieve DOI goals.

Reservoir Behavior

There is significant concern regarding reservoir passage behavior of reintroduced fish. A pilot study now underway will provide initial indications of the movement of hatchery fish through California reservoirs. Additional information on wild fish and Oregon Reservoirs, however, may also be required.

Operations and Maintenance to Minimize Impacts to Survival and Behavior of Salmonids through Project Facilities

This information was requested in DOI's letter of April 8, 2003. There is significant concern regarding the unknown impacts of project operations on the passage of anadromous fish through reservoirs.

Salmonid Genetics

There is significant concern regarding the genetic implications in regard to the achievement of DOI goals. Genetics studies were requested in DOI's letter of April 8, 2003. This information is needed to monitor reintroduction impacts on the genetic structure of existing resident trout populations and introduced steelhead (Fish Resources FTR 9-35). Additional analyses are desirable to identify and characterize the genetic stock structure of anadromous fish populations that are reintroduced above Iron Gate Dam. This information would allow managers to identify the population origin of fish migration through fish passage facilities in the Project area. This data would be useful for studying the outmigration and spawning periodicity of runs originating from geographically distinct regions above Iron Gate Dam. Genetic stock identification would provide managers with powerful tools for determining if residual and anadromous trout returning to Iron Gate and other Project dams are from populations already residing in and above the Project or from downstream populations.

Pathogen Risk Assessment

The need for this study did not become clear until PacifiCorp proposed to utilize hatchery salmonids from California within Oregon project reservoirs as part of the reservoir survival and behavior study (PacifiCorp Study Plan 1.18). The design of the study originally utilized resident trout to describe the survival and behavior characteristics through project reservoirs. Initially, the use of resident species wasn't expected to result in an increased risk of pathogen exposure to other resident species. However, substantial inadequacies in PacifiCorp's proposed study included statistical validity of the proposed sample size and assumptions made regarding out-migration of resident fish, and the study was not approved.

PacifiCorp then introduced a new study design utilizing Chinook salmon from Iron Gate Hatchery in California. This change in the proposed study raised the concerns regarding disease transmission to the Upper Basin and resulted in the need for a study effort to assess pathogen risk. The scope of the proposed behavior study has now been limited to California as a result of disease concerns raised by ODFW.

This pathogen risk study needs to objectively assess the disease risk associated with passage above Iron Gate Dam to native fishes and will be critical in the development of strategies and priorities that are expected to achieve DOI's goals.

Habitat and Project Facilities Scenario Modeling (EDT and KlamRAS)

Requests for completion of this study were made pre-filing. The DOI requested this effort be completed in our letter dated April 8, 2003. The Service requested this study in their informal comments on remaining draft study plans relevant to relicensing, dated June 20, 2003; and the DOI requested this in DLA comments of September 24, 2003. Progress has been made on this study. However, it has not been completed.

This study will contribute to other assessments of the quantity and quality of habitat above Iron Gate Dam (Edmondson 2003; Huntington 2004) and be critical in the development of strategies and priorities that are expected to achieve habitat restoration.

Why the Requests Should be Considered by the Commission

This information is critical for DOI to make the best decisions possible regarding PMEs, 10(j) and other recommendations, and section 18 fishway prescriptions consistent with DOI's Long Range Plan goals, specifically, examining the potential for reintroduction of anadromous fish to historical habitats in the Klamath River (USDI Fish and Wildlife Service 1991; USDI Klamath River Basin Fisheries Task Force 2001).

The DOI believes that FERC needs this information to discharge its duties consistent with sections 10(a) and 10(j) of the FPA, sections 7(a)1 and 7(a)2 of the Endangered Species Act, and the Fish and Wildlife Coordination Act. FERC also needs this information to meet its National Environmental Policy Act (NEPA) and Tribal Trust obligations, and provide PMEs that will mitigate for the impacts of the Project.

Because Keno Dam and reservoir are part of the current Project baseline, it is incumbent on PacifiCorp to better identify the fate of fish passage at this facility as a result of the relicensing process.

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DOI 11. Evaluation of Iron Gate Hatchery Performance and Identification of Methods to Reduce Adverse Impacts to Wild Salmonids. Determine the effects of Iron Gate Hatchery production and program practices on wild stocks of Klamath River salmonid populations, and identify methods for reducing the adverse impacts of the hatchery program.

Recommended Study and Basis for Request

The Department requests that the Commission direct PacifiCorp to conduct studies to evaluate the fishery contributions, by species, of the hatchery program, assess the impacts of the hatchery program on wild fish populations and production, identify methods to reduce adverse impacts to wild fish as a result of the hatchery program, and identify or evaluate alternate water supplies for hatchery. DOI notes that the FLA evaluates the performance of the mitigation hatchery program in terms of whether production goals were met. While this is a component of an evaluation of the existing mitigation hatchery program, the equally important questions of whether the existing hatchery program fulfills the appropriate mitigation function of foregone anadromous fish production, and whether the ecological effects to wild fish are being minimized, is not addressed in enough detail.

DOI believes that PacifiCorp's proposal to continue to operate the hatchery in a manner consistent with what is required under their existing FERC license is not an Enhancement, but rather is a continuation of an existing mitigation requirement for habitat lost from the construction of Iron Gate Dam. DOI also believes that thorough reviews of hatchery operations and impacts are needed to determine the appropriateness of PacifiCorp's proposed action.

In their March 29, 2001, comments on PacifiCorp's first stage consultation document, the California Department of Fish and Game (CDFG, the agency partially funding and operating the Iron Gate Hatchery) recommended the following studies that would: 1) identify potential hatchery operational and structural improvements, 2) develop an on-going monitoring program with adaptive management objectives, 3) evaluate the effects of hatchery fish on natural stocks, and 4) evaluate the hatchery role in the recovery of ESA-listed fish species. In response to CDFG's request for a comprehensive evaluation of hatchery operations and impacts, PacifiCorp distributed an audit questionnaire to the Iron Gate hatchery staff in 2001. This questionnaire was originally developed for assessment of the Columbia River system's federally run hatcheries, operating under different constraints and with different management goals and objectives. The CDFG staff that participated in the audit and the PacifiCorp's consultants generally agreed that the questionnaire was not applicable to the Iron Gate facilities and had limited utility for informing the current relicensing effort.

PacifiCorp does include a discussion of their analysis of the potential use of warmer water to incubate Chinook salmon eggs, thereby accelerating their growth and achieving greater flexibility for release strategies (see Fish Resources FTR section 7). This analysis included a discussion of potential changes to hatchery facilities that would be needed to accomplish this, and mentioned several potential adverse effects of this strategy (e.g., changes in run timing, vulnerability of eggs and fish to equipment failure, heating of hatchery effluent) but did not analyze these potential adverse effects in detail. The ability to selectively use warmer incubation and/or rearing water for hatchery fish would increase the flexibility for hatchery release strategies and timing, and provide a potentially important tool for decreasing mortality due to hatchery/wild fish interactions while still producing appropriate mitigation production levels. Therefore, additional study of this strategy is still warranted and should be a component of the study described above.

Under a decommissioning or Dam removal scenario (as recommended by NRCS), the hatchery would need alternative water supply. No analysis of this option has been made available.

Study Participants

DOI recommends a working group be assembled consisting of hatchery and genetics experts from CDFG, NOAA Fisheries, DOI-FWS, Tribes, and other affected stakeholders (including those that participated in the Aquatic Work Group, Fish Passage Hatchery Subgroup).

Study Objectives and Methods

Study Objectives

1. Determine the contribution of the Iron Gate Hatchery program to Klamath River fisheries, and the effects of Iron Gate Hatchery production and program practices on wild stocks of Klamath River salmonid populations downstream of the dam.

2. Further analyze the potential use of warmer water to incubate Chinook salmon eggs, thereby accelerating their growth and achieving greater flexibility for release strategies

3. Identify methods for reducing the adverse impacts of the hatchery program on wild Klamath River salmonid populations.

4. Develop, in coordination with affected agencies and stakeholders, a schedule for implementing those identified methods for reducing adverse impacts to wild fish populations.

5. Identify alternative water supplies for the Iron Gate hatchery including an evaluation of water quantity, quality, and cost of delivery to the current hatchery site.

Study Methods

1. Develop and implement a detailed study plan to quantitatively and qualitatively characterize the effects of the existing hatchery production and practices on wild stocks of Klamath River wild salmonid populations. This detailed study plan must be completed and approved by the Plenary Group as soon as possible. An agreed-upon monitoring plan will assess the contribution of the hatchery to the Klamath River fisheries.

2. PacifiCorp should disseminate study results to affected agencies, stakeholders and Tribes as they become available; consult with this group to develop analyses of the study results; and develop effective methods to minimize or eliminate any identified adverse impacts of the hatchery program on wild salmonid populations. PacifiCorp should compile all of these measures into a report for approval of the group.

3. PacifiCorp should coordinate with affected agencies, stakeholders and Tribes to develop an expedited schedule and associated cost estimates for all of the adverse impact minimization measures identified.

4. List alternative water supply quality, quantity, and cost of delivery, including assumptions

Acceptance of Recommended Study Methods

The recommended team of experts and the considerable amount of supporting scientific literature on these topics should ensure that analyses are scientifically-rigorous and defensible.

Usefulness of Requested Studies in Furthering Resource Management Goals

The Project has had profound negative impacts on the distribution and populations of anadromous species in the Upper Klamath Basin and continues to prevent and delay the achievement of DOI (USDI Fish and Wildlife Service 1991; USDI Klamath River Basin Fisheries Task Force 2001) and Service goals of examining the potential for restoration of native populations of anadromous fish.

The requested studies will provide an adequate understanding of the effects of the hatchery program on wild salmonid populations and production. An understanding of the effects of the hatchery program on wild fish, and effective measures to minimize adverse impacts on wild fish, will further facilitate DOI goals of examining the potential for restoring the Klamath River anadromous salmonid fisheries (USDI Fish and Wildlife Service 1991).

Specifically, potential changes in hatchery fish rearing and release strategies are likely to minimize any acute competition for food and habitat resources between hatchery-released fish and wild fish. Increased collection of data available from hatchery fish tagging programs, and thorough analyses of these data would contribute toward optimization of hatchery practices to provide for appropriate levels of harvest consistent with the well-being of wild fish populations.

Duration of Study

The specific duration of this study would be determined cooperatively by PacifiCorp, and affected agencies, stakeholders and Tribes. Following the implementation of an increased hatchery fish tagging effort, collection of tag-related data and associated analyses are expected to take at least several years. A monitoring program fully utilizing the additional tagging effort proposed by PacifiCorp would be required for ongoing evaluation of the hatchery program throughout the life of the license.

Existing Information and the Need for Additional Information

The existing information in the FLA does not provide PacifiCorp and FERC the ability to make informed decisions about appropriate PM&Es to apply to project facilities and operations for the new licensing period. Additional information that would be accrued by this additional study is necessary to determine whether anadromous fish mitigation programs are functionally being met, and whether adverse effects to wild fish (including species listed under the Endangered Species Act) are being minimized or eliminated.

The impact of Iron Gate Hatchery operations (including the release of large numbers of juveniles during a short period in the spring) on wild salmonid out-migrating during the same time period, and on other hatchery fish within the Klamath River system, is unknown. Information is needed on how the habitat, run timing, and growth of outmigrating wild fish may be affected.

The effectiveness of the hatchery program toward functionally meeting its mitigation purpose is also unknown, as is its role in counteracting the continued fish migration blockage posed by the continued existence of dams without passage facilities.

References:

USDI Fish and Wildlife Service (1991). Long Range Plan For The Klamath River Basin Conservation Area Fishery Restoration Program. Yreka, Ca, Klamath River Basin Fisheries Restoration Task Force**:** 1-19.

USDI Klamath River Basin Fisheries Task Force (2001). Comments on First Stage Consultation for Klamath Hydroelectric Project Relicensing (FERC No. 2082). T. Olson. Portland, OR.

DOI 12. Habitat-In-Stream Flow Relationships and Minimum Flows. The study objectives are to analyze and select a suitable flow regime for redband trout and other native fish in the riverine segments of the Klamath River, Spring Creek, and Jenny Creek.

Recommended Study and Basis for Request

The Department requests that the Commission direct PacifiCorp to analyze habitat and instream flow relationships in order to determine habitat suitability for redband trout and native fish, and restoration potential for anadromous species in Project-affected reaches. This information is necessary to understand the effects of water diversions and minimum instream flows in all reaches of the Klamath River and the extent to which altered flow regimes have affected habitat.

Under the current license, there are a number of flow agreements for the Oregon portion of the Klamath River. For example, the Link River bypass and the Keno reaches of the Klamath River have adopted minimum flow requirements of 90 cfs and 200 cfs, respectively, per agreements between the Oregon Department of Fish and Wildlife and PacifiCorp (FSCD 5-18). Similarly, the bypass reach below J.C. Boyle has a minimum flow requirement of 100 cfs

The instream flow study for the Project is incomplete; or analysis has been completed but the methods used were not approved by the Aquatics Work Group. PacifiCorp's analysis should include an assessment of flow:habitat relationships and as well as an assessment of the behavioral and physiological response of various species and life stages to various flow regimes. PacifiCorp should re-run the habitat simulations, results that were presented in the FLA, using methods agreed upon by the Aquatics Work Group. These include, but are not limited to the following simulations:

- Physical Habitat Simulation (PHABSIM) 1-dimensional hydraulic and habitat models using both depth/velocity calibration data sets. The analysis presented in the FLA uses only one depth/velocity calibration data set. PacifiCorp previously agreed to run these simulations using both data sets.
- The habitat computation algorithm should use the "geometric mean" rather than a "multiplicative." PacifiCorp previously agreed to the use of the geometric mean for computation.
- Weighting transects for habitat analysis is inappropriate. PacifiCorp previously agreed to weight each transect proportional to the length of the transect and the size of the habitat unit. PacifiCorp weighted transects uniformly for each habitat unit type.
- The FLA describes how habitat simulation was conducted and referenced with and without functional cover types and did not include substrate in the computations. PacifiCorp previously agreed to use cover types and substrate in the analysis.

The Aquatics Work Group did not agree to depth calibration in hydraulic simulations without prior consultation over the need for and manner in which depth calibration would be conducted. PacifiCorps did not follow through with consultation on the use of depth calibration prior to rerunning hydraulic and habitat simulations.

Flow maintenance for reservoir operation or to regulate inflow to the J.C. Boyle Reservoir affect flows in the Keno Reach. The instream flow study should include a collection of IFIM data along with analysis for the Keno Reach that is affected by Project operations. PacifiCorp refused to conduct an instream flow study in the Keno Reach to IFIM standards, agreeing to conduct a Tennant analysis. Tennant analysis is insufficient and will not accommodate development of

minimum flow recommendations and ramp rates. DOI requests that the flow study be revised to provide information necessary for assessing minimum flows and ramp rates for the Keno Reach. The Keno Reach is included in the current license. Thus, PacifiCorp is obligated to analyze the affect of Project operations on resources in this reach.

The analysis and results included in Exhibit E should be sufficient and allow development of appropriate PM&Es for affects of the Project on flow, minimum flows, habitat, and fisheries.

DOI's comments on the DLA identified omission of an instream flow study for the Keno Reach and lack of progress in PacifiCorp's instream flow analysis for redband trout and other native species. These studies are essential for defining habitat and flow relationships for native salmonids and will be necessary if a full and fair assessment of impacts to habitat from Project operations is going to be assembled.

PacifiCorp previously agreed that further study was necessary to develop an understanding of flow habitat relationships. However, rather than respond by modifying or expanding their studies, PacifiCorp has requested that FERC recommend further collaboration with stakeholders in order to refine model variables and complete the instream flow study (see Appendix C - Fish Passage and Instream Flow Insert Language)

The basis for DOI's request are two fold and reflect DOI goals and objectives to protect and restore native fish and wildlife for the use and enjoyment by present and future generations. First, results of PacifiCorp's analysis are inadequate for developing PM&Es that avoid, minimize, or reduce impacts to these resources, protect genetic diversity, protect and restore habitat, and modify Project facilities to provide access to habitat. Second, proposed minimum instream flows will not allow DOI to meet management objectives. DOI believes that further analysis is necessary because of outstanding questions and data gaps in the modeling and interpretation of results.

Study Participants

DOI recommends that PacifiCorp complete the instream flow study, and include an analysis of the Keno Reach. PacifiCorp should work through the collaborative to revise study plans, methods, transects, and habitat suitability curves. PacifiCorp should work with the Aquatics Work Group or a sub-group thereof to develop the analytic approach.

Study Objectives and Methods

Study Objectives

The study objectives are to analyze and select a suitable flow regime for redband trout and other native fish in the riverine segments of the Klamath River, Spring Creek, and Jenny Creek. The analysis should include development of a flow regime that would accommodate restoration of anadromy above Iron Gate Dam and incorporate the results of studies that have examined flows to maintain anadromy below Iron Gate Dam (Hardy and Addley, 2001; NOAA Fisheries BO, 2002). A second objective is to collect information for the Keno Reach and analyze flow and habitat relationships below the Project facilities in order to develop minimum and optimum flows for aquatic resources.

Completion of the instream flow study will require work on the following:

- approve rainbow trout and sucker HSC curves,

- complete 2D analysis for peaking reach,
- develop a habitat time series,
- complete bioenergetics modeling,
- conduct peaking analysis,
- discuss modeling results as they relate to fisheries recreation, and geomorphology; and
- develop river flow regime recommendations for aquatic resources.

This information will be used to identify flows necessary to assess habitat condition and restoration potential for recovery of depressed populations and species that use the Klamath River and tributaries that are affected by Project (e.g., redband trout, suckers) and to improve reproductive success and survival of all life stages of resident salmonids and suckers.

Study Methods

If PacifiCorp's hydraulic models have sufficient data and are appropriately calibrated, no additional field data will be necessary to analyze most project reaches. The Keno Reach, Spring Creek, and Jenny Creek are exceptions. Additional data including habitat mapping, establishing channel cross-sections using the 3 X 3 protocol, substrate/velocity/depth measurements at each cross-section, and developing a longitudinal profile should be collected for these reaches.

Jenny Creek redband trout are located above a natural barrier that isolates the population from the Klamath River. Thus, development of site specific Habitat Suitability Criteria (HSC) or applicability of other HSC to this population is recommended.

DOI recommends that PacifiCorp utilize IFIM methodology, and apply the PHABSIM model to generate 1-Dimensional Weighted Useable Area (WUA) versus flow results for redband trout and other native resident species in the Klamath River for each segment, and 2- Dimensional WUA versus flow for the peaking reach. Specifically, PacifiCorp should asses WUA versus flow relationships in the JC Boyle Peaking Reach, including effective habitat analysis and times series analysis, with current operations (baseline), operations without load following (ROR), proposed operations and ramp rates for one turbine and two turbine operations, and operations with maximum ramping rates of nine inches per hour and one foot per day and two inches per hour and one foot per day. Flow should be measured within 0.25 miles of each Project facility and operation that affects flow. These scenarios will permit development of minimum flow recommendations and assessment of the impacts of load following and the proposed ramp rates on native fish in the Klamath River. WUA versus flow relationships should be developed for the entire year.

The model runs should be developed with stakeholder input and incorporate feeding stations, shear zones, velocity shelters, stream margin edge types, and cover categorizations. Without this data the diversity of micro-sites will not be appropriately represented and will limit the analysis of flow-habitat relationships (Bovee, 2003 pers. comm.; Bovee et al, 1998). Bioenergetics may be useful in developing criteria associated with feeding stations, shear zones, velocity shelters. PacifiCorp should incorporate the results of the bioenergetics analysis as they become available.

<u>Acceptance of recommended study methods</u>

There is a broad body of research on aquatic species response to instream flows as related to hydroelectric Project operations (BLM, 2002; Bovee et al, 1998; Hardy and Addley, 2001).

. The Oregon Department of Fish and Wildlife, the California Department of Fish and Game, and DOI Bureaus and Services have conducted and participated in instream flow analysis on several rivers throughout Oregon.

Usefulness of Requested Studies in Furthering Resource Management Goals

The information developed through this analysis will be used to determine whether flow enhancement will benefit aquatic species. An accurate description of habitat and flow relationships is essential to fully understand the impacts of Project operations on the aquatic environment and to define a suitable flow regime in the Klamath River.The study is necessary to analyze a range of alternatives for balancing resource uses. Further, the study will provide information necessary for DOI's use during analysis of the proposed Project's consistency with the following resource management objectives:

Bureau of Land Management

- Protecting and enhancing outstandingly remarkable fisheries, wildlife, recreation, and scenic values associated with the Upper Klamath Wild and Scenic River;
- Maintaining, protecting, or restoring scenic, fisheries, and wildlife resources within the Upper Klamath River Area of Critical Environmental Concern;
- Emphasizing instream flows and habitat conditions in the Klamath River that maintain or restore riparian resources, favorable channel conditions, and fish passage;
- Requiring instream flows and habitat conditions in the Jenny Creek watershed that maintain or restore riparian resources, favorable channel conditions, and fish passage; and,
- Emphasizing operation of hydroelectric facilities to eliminate adverse effects that retard or prevent attainment of ACS objectives (described in Part II of the BLM response to the FLA).

National Park Service

- Representing the national recreation interest to assure that hydroelectric projects…recognize the full potential for meeting present and future public outdoor recreation demands, while maintaining and enhancing a quality environmental setting for those projects.

Fish and Wildlife Service

- Protecting salmon and steelhead habitat from harmful effects of water and power projects in the Klamath Basin.
- Identifying and implementing methods to rectify habitat problems… including … instream flow and habitat below Iron Gate Dam.
- Maintaining flows adequate to achieve optimal productivity of the basin.

Bureau of Reclamation

- Providing assurances that operation of the Klamath Irrigation Project will not be jeopardized..
- Providing assurances that Reclamation can continue to operates facilities in a way that protects natural resources to the standards identified by State and Federal resource management agencies.

Duration of Study

DOI anticipates this study should be completed in less than one year.

Existing Information and the Need for Additional Information

PacifiCorp initiated an instream flow study for the relicensing of the Klamath Hydroelectric Project in spring 2002. PacifiCorp's analysis of habitat-flow relationships for resident fish habitats under proposed operations does not adequately address impacts of Project operation. PacifiCorp completed studies related to flow management for most Project-affected reaches with the exception of the Keno Reach and below Iron Gate Dam. However PacifiCorp did not analyze a range of flow regimes, model output including 2-dimensional Potential Habitat Simulation (PHABSIM) analysis, or analyze all operational alternatives. PacifiCorp did not model habitats properly and for a full compliment of native species. DOI believes that PacifiCorp's analysis could potentially misrepresent the relationship between WUA and discharge, especially at higher flows.

PacifiCorp did not evaluate Project impacts on movement, spawning and survival of shortnose and Lost River suckers. Studies to evaluate spawning habitat have been conducted by other researchers (Buettner and Scoppettone 1990, Desjardins and Markle 2000), however, the results of this studies have not been incorporated into PacifiCorp's results or conclusions. Thus, Project impacts from load following, reservoir fluctuation, and impacts to up- and downstream fish passage have not been adequately analyzed or described. The study does not provide adequate information to model the effects of reduced flow in bypass reaches and load following operations on native fish species.

The hydraulic modeling conducted for the bypass reach did not separate the bypass segments into discreet reaches to account for the groundwater accretions. Developing flow recommendations for the entire reach then reducing flows in the upstream segment is inconsistent with accepted instream flow assessment methodologies (Bovee et al 1998).

DOI 13. Effects of Project Ramping on Resources Below Project Facilities.. The study objectives are to determine the effects of daily and proposed ramp rates and to determine ramping rates necessary to protect fish and aquatic resources.

Recommended Study and Basis for Request

The Department requests that the Commission direct PacifiCorp to analyze the effects of ramping below Link River, J.C. Boyle and Keno dam, and below the J.C. Boyle Powerhouse to determine what flows are necessary to protect fish and aquatic resources from adverse effects from Project operations. In the J.C. Boyle peaking reach the study should analyze potential adverse effects of ramping nine inches/hour, ramping at four inches/hour when flows are less than 1000 cfs, and ramping at nine inches/hour when flows are greater than 1000 cfs.[5]

The study should also evaluate implementation of National Oceanic Atmospheric Administration (NOAA) Biological Opinion ramp rates of 50 cfs/ hour and the Pacific Northwest regional ramp rates of 2 in/hr and 1 ft/day. The ramping study should evaluate impacts on resident fish and analyze the potential for anadromous restoration given various operational scenarios. The analysis should include assessment of lost rearing habitat, changes in amount and location of habitat, fish stranding, and energetic impacts

The Project, as described in the FLA, is operated in response to demands for power. Annually, PacifiCorp institutes load following operations when flows in the Klamath River drop below 3,000 cfs, primarily from late spring to some time in the winter (but throughout the year during some years). PacifiCorp has proposed a ramp rate of 9 inches per hour when flows are greater than 1000 cfs and 4 inches per hour when flows are less than 1000 cfs in the Upper Klamath Wild and Scenic River reach downstream of the J.C. Boyle powerhouse. PacifiCorp has proposed new ramp rates in other Project reaches, except for Link and Keno (Table 2-3).

Table 2-3. PacifiCorp's Project Reaches with proposed Ramp Rates from FLA.

Project Reach	Down Ramp Rate (cfs or inches / hour)
Link River	None proposed
Keno Reach	None proposed
J.C. Boyle Bypass	150 cfs
J.C. Boyle Peaking	9" when flow >1000 cfs and 4" when flow < 1000 cfs
Copco II Bypass	125 cfs
Iron Gate Dam	USBR KPOP, BO's, in lieu of ESA BO PacifiCorp will implement Hunter (1992).

No ramp rates were proposed in the FLA below Keno Dam, although it is a Project facility that historically ramps at 9 inches/hour. Stakeholders have requested a ramping study for the Keno Reach and previously PacifiCorp consented to work with the USBR and the Aquatics Work Group to identify and address flow-related concerns in this reach (Final Working Draft 1.7 Evaluation of Ramping Effects on Fish Downstream of Link Dam, Keno Dam, JC Boyle Dam, JC Boyle Powerhouse and Copco No. 2 Dam, August 2003). PacifiCorp has not evaluated the effects of ramping on aquatic resources below Keno Dam.

[5] The proposed ramp rates of 4 to 9 inches per hour are measured 0.25 miles downstream of the J.C. Boyle Powerhouse.

Load following (e.g., response to short-term peaks in power demand) results in rapid and significant changes in river flow and reservoir elevation. Rapid flow fluctuations can have a number of impacts on aquatic ecosystems but in general these operations result in a decrease in the productivity and carrying capacity of the aquatic ecosystem. Although the magnitude and type of impacts vary between sites, rapid flow fluctuations from load following operations may impact fisheries by:

- stranding fish,
- altering or obstructing fish migrations,
- disrupting spawning activity,
- desiccating redds and/ or eggs,
- limiting the availability of critical margin habitat,
- displacing macroinvertebrates, or
- impairing amphibian populations.

The early life history and adult stages may be forced to move laterally or vertically several times per day in response to flow fluctuations. Large flow fluctuations can result in increased erosion of gravel and cobble bars and daily loss of side channels that can reduce habitat for spawning and rearing fish and macroinvertebrate.

The adverse effects of load following operations on aquatic resources are well documented in the scientific literature. Down ramping of only one inch per hour can impact fish populations. One very significant ramping event at a critical time can create a significant limiting condition for one or more age classes of fish, or a area of habitat, such as a side channel that might be used for rearing (Hunter 1992).

The DOI has previously commented that PacifiCorp did not adequately analyze the effects of daily ramping (including magnitude, duration and frequency) including effects on aquatic, terrestrial, and botanical resources. PacifiCorp's analysis further mischaracterized study findings concluding that Project operations had very little impact on fish populations in the Peaking Reach. Conclusions regarding streambed de-watering, fish community, adult trout movement and juvenile fish stranding were based on inappropriate assumptions, small sample sizes, inadequate surveys, and improper use of equipment. For example, the fry stranding study was conducted over a very short time frame, conditions for encountering fry in the peaking reach were favorable on only 3 of 9 days that surveys were conducted over a two-year period. While the study results conveyed low fry densities for the Peaking Reach compared to the Bypass Reach, conclusions based on these survey results stated that peaking had no effect on juveniles. DOI believes this conclusion is erroneous.

Another example of how PacifiCorp's limited sampling was expected to produce inconclusive information was conferred by PacifiCorp in the statement that "It is expected that the results of the fry stranding observations will only provide qualitative interpretation that must be applied cautiously. The susceptibility of fish to stranding is dependent upon numerous variables that cannot be evaluated independently in a limited number of actual in-river down ramping tests. The numbers of fish present along the stream margins at the start of the downramp event would influence the number of fish potentially stranded. Such numbers are not known. Also, the ability to observe small fish that may have become stranded among large cobbles is very limited. The potential for scavenging birds or other animals to remove stranded fish prior to inspections of the study site can also influence results" (Study Plan 1.7 August 2003). Observations of stranded fish would likely be very low based on results of the fry density study which showed very low

densities of fish in the Peaking Reach compared to the Bypass reach. However, given the paucity of data it was inappropriate for PacifiCorp to present conclusions that ramping had no impact on fish.

Finally, ramping rates proposed by PacifiCorp are inconsistent with ramping rates forother hydroelectric projects. Unregulated rivers rarely experience drops in water surface elevation in excess of two inches per hour except during floods. PacifiCorp's proposed ramping rate of 9 inches per hour is considerably greater than ramping rates set for other projects (ramp rates at Pelton Round Butte, Leaburg/Walterville, and North Umpqua are all equal to or less than 2 inches per hour and one foot per day).

The proposed ramping rate has the potential to adversely affect the following resources of concern to the DOI and other parties:

- Resident and potential anadromous fish populations downstream of the Project facilities. The proposed ramping rate exceeds recognized standards established for other rivers in the Pacific Northwest where anadromy is of interest The proposed ramping rate may cause and/or contribute to stranding in low gradient channel habitat exposed during downramp.
- Gravel/Cobble bar erosion. A rapid change in stage can increase the rate of bank erosion and exacerbate erosion downstream of Project facilities. Gravel and cobble bars and beaches provide important rearing habitat for fry and juvenile fish.
- Isolation of side channel habitat that would trap or strand of fry and juvenile fish.
- Survival of fry and juvenile fish life history stages in the peaking reach.
- Behavioral impacts including spawning interference and juvenile emigration.
- Riparian vegetation. Rapid stage change such as that proposed by PacifiCorp makes it more difficult for riparian vegetation to establish and thrive. This impacts riparian dependent species of animals as well as the plant communities themselves.

Study Participants

DOI recommends that PacifiCorp conduct a ramping study in coordination with state, federal and tribal resource agencies and interested stakeholders.

Study Objectives and Methods

Study Objectives

- Determine the effects of the daily ramping and proposed ramping rates on aquatic resources.
- To determine ramping rates necessary to protect fish and aquatic resources from adverse effects from up- and down-ramping.

Study Methods

Quantification of Stranding Habitat

The study should describe impacts to aquatic habitat and quantify the potential for stranding and trapping along the entire length of the Project reaches. Specifically, the analysis should focus on known areas of trapping/stranding potential including lengths of river with shallow cross-sections, potential/historic spawning areas, and side channels. The study should quantify impacts to rearing and adult habitat using data from IFIM study (cross-sections, habitat mapping, and

longitudinal profiles), Geographic Information Systems (GIS) polygon mapping incorporating high and low flow aerial photographic analysis (equal to or less than 1:12,000), and field-level reconnaissance and calibration. Stage-discharge relationships should be developed for at-risk habitats using either existing IFIM cross-sectional data or, where necessary, the collection of additional cross-sections. Quantifying at-risk stranding habitat should include the full range of operational scenarios that occur or are proposed for the peaking reach. The range of flow analyzed in other Project reaches should be based on the best available data such as USGS and PacifiCorp gage data. These ramping rates should be measured within 0.25 miles of each Project facility.

Field investigations for stranding along river margins would be conducted by visual observation during and after down-ramping. The study should identify potential stranding areas and target isolated channels and puddles, during the down-ramping phase of hydropower operations. These areas should be inventoried, mapped, and georeferenced, and sufficient documentation of the habitat unit where stranding/trapping habitat occurred should be recorded for correlation with stage-discharge data (this data would included channel slope, cross-section gradient estimates, vegetation, substrate, and type of stranding risk). If stranded, trapped, or dead fry/juveniles are found they should be photographed, locations georeferenced, and sufficient documentation of the habitat unit where stranding/trapping occurred should be recorded. The stranding habitats and fish stranding data should be used to calibrate a quantifiable GIS-based analysis of stranding/trapping habitat. Field investigations should include efforts to sample a reasonable percentage of habitats identified as at risk of stranding based on GIS analysis.

Stranding Information

The ramping study should contain the following:

- To fully evaluate the effect of ramping on fry and juvenile fish, sampling should be coordinated with operations such that rearing habitats could be sampled during periods that include ramp events and periods with no Project-induced water fluctuation. For example:

  Sample continuously during late spring periods when Project essentially operates in a run-of-river (ROR) mode with no Project-induced fluctuations. Following the onset of peaking operations, sample continuously through June and July. Ramping and non-ramping sampling periods would be blocked up so that representative habitat conditions would exist throughout the sampling period. Stranding risk of ramping rates to be assessed, at a minimum, should include 2”/hr, 4”/hr, 9”/hr, and where possible additional increments between 4 and 9 during peaking operations in order to develop a continuum of stranding risk for various ramp rates. The lowest ramp rates should be assessed first to minimize impacts to fry and juvenile species and to assess increased ramp rates latter into the study. Ramping rates would be measured within 0.25 miles below Project facilities.
- The study would evaluate the impacts of ramping on fry and juveniles rearing along the margins of the Klamath River. Studies of potential stranding sites using juvenile fish observation techniques would be required. Ground searches during down ramping would be required using a systematic stratified sampling approach.
- Field evaluation of stranding must focus on periods when the most susceptible life-stage is expected to be present in the project reach. Sucker larvae would be anticipated to be within in project areas between May and June (City of Klamath Falls, 1987). Trout fry, as a result of spring influence in the J.C. Boyle bypass reach and a long spawning period,

may have a protracted emigration into the peaking reach April, May, June, July and potentially August.

- A special sampling effort must be implemented in order to locate and quantify stranding/trapping of the small larval age-classes of sucker and minnow species. This would include pre-peaking event fish surveys for the presence of target species and also include benthic sampling of at risk stranding habitats.
- A past sampling effort of a one-day period for each of 4 months documented stranding by juvenile fish was inadequate to fully characterize usage of these important habitats. Daily sampling, including continuous observation, may be necessary to determine the effect of ramping on fry and juveniles.
- For trout, and other fish species greater than 50 mm, growth rates of sampled fish would be determined by measuring and weighing fry and juveniles captured in rearing habitats during the sample period using established statistical methods. For other fish species less than 50 mm, length measurements should be collected through statistically sound random sub-sampling to characterize size classes at risk to stranding.
- The temperature and ramping flow information would be correlated with movement of fry and juveniles through each reach.

Loss of Access to Side Channel Habitat

PacifiCorp needs to implement reach mapping and stage discharge relationships to establish a critical flow threshold below each Project facility to avoid stranding of fish in side channels. The DOI has preliminarily reviewed the peaking reach and has identified over 33 side channels potentially affected by Project operations that could strand juvenile fish. This critical flow should be established based on measurements and observations at mutually established sites by representatives of the Aquatics Work Group (AWG) to minimize the adverse effect that side-channels may play in fish stranding. To identify the stream discharge where a few of the side-channel are dewatered is insufficient (Fisheries FTR 4-30).

Synthesis of Results from Relevant ASR's

The DOI has recommended relevant ASR's including Verify Sediment Budget and Analysis of Project Operation Scenarios and Riparian/Wetland Resources in the J.C. Boyle Peaking and Bypass Reaches to assess project ramping impacts on sediment and riparian resources. A synthesis analysis of the results from these ASR's should be conducted to further describe aquatic resource impacts from project ramping.

Acceptance of Recommended Study Methods

It is difficult to quantify the actual impact of stranding on fish populations (Hunter, 1992). The observation of subsurface stranding is problematic and typically appears to result in underestimating total standing, with error based in part on substrates types. Hence, the goal of this study is address the quantity of habitat that is susceptible to stranding/trapping and to use this information to develop ramp rates which minimize the impacts. This study is consistent with the Salt Caves study design and builds on this design with GIS-based field-calibrated estimates of stranding/trapping habitats (City of Klamath Falls, 1987). Additional fish stranding analysis is designed to further clarify and calibrate stranding habitat estimates.

Usefulness of Requested Studies in Furthering Resource Management Goals

DOI will use the study results to assess the aquatic impacts of Project ramping and supplement the evidentiary basis to support recommendations for Project ramping rates that will avoid or

minimize impacts to aquatic organisms. The completion of this study will provide the DOI with information pertaining to the existing and future impacts of load-following operations on aquatic species and their habitats managed for the benefit of the public.

A substantial portion of the river reaches between J.C. Boyle Dam and Copco Reservoir occur on BLM-administered land, management which is guided by the Northwest Forest Plan Aquatic Conservation Strategy. The proposed analysis would assist in meeting the following resource goals described in BLM resource management planning documents:

- "Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain in the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities." (Northwest Forest Plan Standards and Guidelines, page B-11);
- "Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic and wetland habitats and to retain patterns of sediment, nutrient and wood routing. *The timing, magnitude, duration and spatial distribution of peak, high and low flows* must be protected." (Northwest Forest Plan Standards and Guidelines, page B-11);
- "…Give priority emphasis to instream flows and habitat conditions that maintain or restore riparian resources, favorable channel conditions, and fish passage…" (KFRA RMP Appendix D-10);
- "Existing [hydroelectric] support facilities that must be located in Riparian Reserves should be located, operated, and maintained with an emphasis to eliminate adverse effects that retard or prevent attainment of Aquatic Conservation Strategy objectives." (KFRA RMP Appendix D-10);
- "Comply with state water quality requirements to restore and maintain water quality necessary to protect identifiable beneficial uses" (KFRA RMP page 28); and,
- "Maintain and enhance the natural integrity of river related values in designated and suitable [Wild and Scenic] river areas" (KFRA RMP page 45).

Duration of Study

For impacts to trout fry and juveniles the literature review, investigation of stranding, and identification of critical flows to avoid stranding should be completed within a six to twelve month period of time starting from spring sampling. The relative timing of emergence/emigration of trout (salmonids) versus suckers (and other native species) may result in a study not sufficient to assess both groups of species at the same time. Implementation of flow scenarios (run of river and peaking) designed to assess trout may miss impacts to larval sucker, or vice versa, to an extent that impact assessment on one group is limited. Consequently, additional sampling in the spring of a second year may be necessary to collect adequate field data of stranding for the full compliment of native species.

Existing Information and Need for Additional Information

The Klamath River provides habitat for three Federally-listed ESA species including Lost River and Short-nosed suckers in and above the Project and coho salmon below Iron Gate Dam, along with numerous non-listed native fish species. PacifiCorp's ramping studies are inadequate and thus far PacifiCorp proposes to continue load following operations despite the lack of conclusions in PacifiCorp's study and the apparent impacts noted by DOI staff and the Salt Caves FERC EIS. PacifiCorp's proposal to continue Project operations will continue to cause harm to both listed and non-listed aquatic species.

In addition to the ODFW research from 1988-1991, the FERC 1990 Final EIS for the proposed Salt Caves Project noted low adult trout densities in the upper end of the peaking reach. The EIS reported that trout in the upper peaking reach, where peaking impacts would be the most intense, had relatively low growth rates and that large trout were under-represented in the age structure. The EIS cited 5 years of investigation compiled by the City of Klamath Falls. The FERC EIS concluded that flow fluctuations below the J.C. Boyle powerhouse caused chronic stress on trout and stranding of eggs, fry, and juveniles. Stress occurred from daily flow fluctuations and related changes in water temperature and water quality. These flow fluctuations caused trout to continue to seek new feeding and resting habitat while water temperature changed metabolism and feeding rates.

PacifiCorp's entire analysis of impacts is based on a preliminary stranding survey during very limited time periods and a very limited literature review of ramp impacts on stranding fish. Thus far, PacifiCorp's habitat analysis relies on a comparison of total wetted perimeter under one flow (350 cfs) to wetted perimeter under another flow (run-of-river of 700 or 1400). It does not evaluate or consider the energetic impacts to fish as they move around seeking other suitable (or less than suitable habitat) as flows fluctuate. Tallying up the amount of area lost between the two flows and comparing those two numbers does not adequately evaluate impacts of flow fluctuation on fish.

Most of the redband trout spawning occurs in tributaries of the Klamath River including Spencer and Shovel Creeks. Redband trout migrate to the Klamath River from April to June. Most rearing studies have shown that fry and juveniles are heavily associated with shoreline/stream margin habitats. These are the habitats most affected by Project ramping. In addition, researchers have observed that ramping events initiate downstream movement of Chinook fry in affected habitats (Hunter, 1992).

PacifiCorp has included some analysis of the effect of ramping in the IFIM studies. However, DOI believes there is enough evidence to suggest that PacifiCorp's proposed ramping rate of 9 inches per hour has the potential to negatively affect listed species by fragmenting existing rearing habitat and reducing fry survival in the Klamath River. DOI maintains that ramping operations reduce the extent of side channel habitat and may be causing stranding and premature migration of fry, which results in lowered survival.

DOI does not believe that PacifiCorp's efforts thus far accurately portray the effects of load following operations on native fish species. Interior believes that further analysis and data collection is necessary. High levels of uncertainty in the existing modeling and interpretation make it challenging for the DOI to determine if and how management objectives would be attained under proposed Project operations. J.C. Boyle operations and proposed ramp rates below other Project facilities remain a major issue.

DOI 14. Effects of Project Peaking on Aquatic Resources in the J.C. Boyle Reach.

Characterize the effects of peaking-related flow fluctuations on aquatic resources in the J.C. Boyle peaking reach.

Recommended Study and Basis for Request: The Department requests that the Commission direct PacifiCorp to conduct the analyses proposed in the study: *Evaluation of Effects of Flow Fluctuation on Aquatic Resources within the J.C. Boyle Peaking Reach* (Fishery Resources FTR Section 10; Draft Study Plan 1.16). This study represents an integrated analysis of the impacts of peaking on a variety of aquatic and flow-dependent resources.

DOI believes that the results of analyses of peaking impacts in the J.C. Boyle peaking reach were premature and incomplete. PacifiCorp should reassess the project impacts of peaking using updated information from additional data collection and analysis as part of the following Additional Study requests: Ramping Studies, Fisheries Assessment Studies, and Instream Flow Studies. PacifiCorp should also complete the Bioenergetics study as described in the FLA and conduct additional sampling for macro-invertebrate drift during critical time frames to supplement the limited drift sampling conducted to date.

The comparative analysis of peaking effects on fishery resources presented in the FLA uses information derived from inadequate fisheries assessment sampling in the J.C. Boyle peaking reach and the Keno reach. The analysis presented in the FLA uses limited information developed as part of PacifiCorp's existing ramping study with results limited to wetted perimeter analysis and fish stranding observations from a limited sampling efforts conducted by PacifiCorp consultants. DOI has requested that PacifiCorp conduct additional studies on ramping, fisheries assessment, and instream flow to clarify and quantify Project impacts to the fishery resources. Thus, any subsequent changes or new results from these studies will affect the results and conclusions of the existing peaking study due to their interrelated nature.

Study Participants: DOI recommends that PacifiCorp conduct the peaking study and consult with The Aquatics Work Group (or a representative sub-group) on study design and implementation, including any additional data collection and analysis.

Study Objectives and Methods: The study objectives described in PacifiCorp's Fishery Resources FTR (Section 10) on peaking appears to adequately cover the areas of particular concern associated with addressing peaking impacts to project affected resources. PacifiCorp should complete the analysis and discussion of the study as outlined in that study plan, incorporating those changes as noted in the recommended interrelated studies

In addition to the objectives outlined in Fishery Resources FTR (Section 10), DOI recommends the following additions or alterations:

1. Compare the areas (e.g. in terms of square meters) of habitat dewatered at base flow (i.e., flow without diversion through turbines) versus one-turbine and two-turbine operational flows. Measure the area of habitat dewatered in each meso-habitat type for a full range of potential base flows. This analysis was also requested in a separate ASR regarding Project ramping analyses, and would thus serve two specific purposes.

2. Complete ongoing bioenergetics analysis to address the implications and interaction of temperature and food availability on trout growth. Collect any additional field data on available forage (e.g. abundance of drift organisms, etc.) for which existing data are

determined to be insufficient (due to inadequacy of sampling or any other reason) during the course of the bioenergetics analysis.

3. Integrate results from lamprey assessment studies (requested in a separate ASR) to specifically evaluate peaking effects on these fishes.

Acceptance of Recommended Study Methods: The scientific community has conducted significant research regarding fisheries and aquatic species responses to flow fluctuations as part of hydroelectric project operations. There is an abundance of scientific literature available for reference to assist in completing this study. The proposed study integrates information from a variety of separate studies, each with their own scientific review.

Usefulness of Requested Studies in Furthering Resource Management Goals: The additional information developed by this interrelated analysis of the effects of peaking on various aquatic resources will address questions that DOI and other fishery agencies have regarding the suitability and impact of existing flow regimes below each Project facility and whether or not altering ramp rates and enhancing flows has the potential to benefit aquatic species.

The goal of protecting and restoring native fish and wildlife populations for use and enjoyment by present and future generations is central to DOI objectives. Avoidance of new impacts to these populations, protection of genetic diversity, protection and restoration of natural habitats on which these populations are dependent, and providing fish access through artificial obstructions are all management techniques that DOI uses to achieve its goals.

Duration of Study: DOI anticipates this study can be completed within one year, unless additional data needs as part of Fisheries assessment cannot be met within a single year.

Existing Information and the Need for Additional Information: The Klamath River provides habitat for three Federally Listed species including Lost River and Short-nosed suckers in and above the Project and coho salmon below Iron Gate Dam along with numerous non-listed native fish species. PacifiCorp's peaking studies is inadequate due to the inadequate conclusions from interrelated studies. Thus far PacifiCorp proposes to continue peaking despite the lack of reliable conclusions in PacifiCorp's study and the apparent impacts noted by DOI staff and the Salt Caves FERC EIS. PacifiCorp's proposal to continue Project operations will continue to cause harm to both listed and non-listed aquatic species.

DOI does not believe that PacifiCorp's efforts accurately portray the effects of peaking operations on native fish species, and that additional data collection and analysis is necessary. There is too much uncertainty in the analysis of peaking impacts on fishery resources presented in the FLA for DOI or FERC to understand potential impacts of peaking, or to be able to determine appropriate PM&Es to protect and enhance fishery resources.

This study was requested by the Aquatics Work Group early in the collaborative process.

DOI 15. Oxygenation of the Hypolimnion of Copco and Iron Gate Reservoirs.

Verification of the predicted results of a direct oxygenation or re-aeration system on the biota of Iron Gate and Copco reservoirs and decreased or increased nutrient availability, and an evaluation of disease-host interactions associated with increased oxygenated habitats.

Recommended Study and Basis for Request

The Department requests that the Commission direct PacifiCorp to study the expected outcomes of each of the methods under evaluation for oxygenation or re-aeration of Copco and Iron Gate reservoirs be evaluated as to the expected increases in dissolved oxygen levels. The expected reductions in nutrients released downstream, and the potential effects of increased dissolved oxygen on the abundance of organisms that serve as intermediate hosts for fish disease organisms also need to be evaluated.

Section E3.8.4 (Pages 3-211 to 213) provides a proposal from the FLA for oxygenation or re-aeration of the hypolimnion of Iron Gate Reservoir. In this new application PacifiCorp acknowledges the fact that as a consequence of normal temperature stratification of this reservoir, high nutrient loading, and biological processes that the hypolimnetic water is deficient in oxygen during the summer and fall. In order to prevent the possibility of this oxygen-deficient water from being released from Iron Gate Dam to the Klamath River, PacifiCorp has proposed to install an oxygenation or re-aeration system. The proposal also states that PacifiCorp will consult with CSWRCB during the Section 401 water quality certification process prior to selecting a specific system.

PacifiCorp has proposed to evaluate two systems of increasing dissolved oxygen levels in Copco Iron Gate reservoirs: 1) a system to oxygenate the hypolimnion of Iron Gate reservoir using hypolimnetic oxygen diffuser technology, or 2) a system to oxygenate or re-aerate low-level (hypolimnetic) waters released from the dam using a re-aeration valve or oxygen injection. The FLA presents results from CE-QUAL-W2 modeling efforts that indicate that while increased dissolved oxygenation would occur with an associated decrease in nutrient loading downstream. The latter conclusion is contrary to other studies in the scientific literature and needs to be evaluated more closely for the proposed applications at Iron Gate and Copco reservoirs.

DOI believes that the projected outcome of oxygenation of the hypolimnion of Iron Gate reservoir may be different than what the FLA contends. While it is likely that dissolved oxygen levels in the reservoirs can be increased, it is not clear if reduced nutrient loading (see Exhibit E 3.8.4.2) would also occur. In addition, the effects of the proposed action on the organisms that serve as intermediate hosts for fish disease organisms in not known. The consequences of an altered outcome as presented in Section 2 of this ASR would be significant to downstream beneficial uses.

Study Participants

DOI recommends that PacifiCorp assemble a team of water quality experts to guide the development and implementation of this study. Participating members of the team could be drawn from: USFWS, ODFW, CDFG, NOAA Fisheries, Tribes, EPA, California State Water Resources Control Board, and California Department of Water Resources.

Study Objectives and Methods

Study Objectives

1. Verification of the predicted results of any direct oxygenation or re-aeration system on biota of Iron Gate and Copco reservoirs and decreased or increased nutrient availability.

2. Evaluation of disease-host interactions with increased oxygenated habitats. In particular, a determination of whether increasing the oxygenation of Iron Gate and Copco reservoirs would result in an increase the proliferation of *C. shasta*, a disease organism of particular importance to salmonid fishes.

Study Methods

1. Review model input parameters and subject the model input and output, and interpretation of results to a peer review process. Conduct pilot project to evaluate likely outcomes of any oxygenation system considered.

2. Conduct an experiment to evaluate the *C.shasta* host parasite (polycheate worm) distributions in oxygenated and non-oxygenated segments of the reservoir during a pilot study. A previous study has shown that the polychaete is unable to survive in anoxic conditions but it still remains to be seen whether or not this organism can survive below the photic zone.

Acceptance of Recommended Study Methods

DOI recommends that specific experimental design and methodologies be developed by the team of water quality experts described above to ensure the appropriateness of data collection and analysis procedures.

Usefulness of Requested Studies in Furthering Resource Management Goals

Accurate forecasting of likely effects of oxygenation of the entire Iron Gate and Copco reservoirs on nutrient cycling is critical before implementation of any action. If the proposed action results in increased nutrification of the Klamath River system it is likely that severely low dissolved oxygen levels downstream will result in fish kills that will further impair fishery restoration efforts as well as current and future fishing opportunities to Tribal, sport, commercial entities.

Polychaete studies in the reservoir setting would help determine the possibility of having higher disease proliferation in the main stem Klamath River system.

Duration of Study

These studies should be conducted by the end of the year.

Existing Information and the Need for Additional Information

Preliminary model simulations using CE-QUAL-W2 by the FLA indicate that oxygenation of Iron Gate Reservoir would: 1) increase the dissolved oxygen concentration over base case; and 2) reduce the nutrient loading to the Klamath River below Iron Gate Dam. While the former effect is likely to occur, the latter simulated effect may be incorrect. In many cases, literature on this subject has indicated that oxygenation of an oxygen-deficient hypolimnion of a reservoir

usually results in the release of many nutrients from the sediments which increases the amount of nutrients in solution that then become available recycling; and in this case may become available to downstream areas (e.g. Klamath River). Why the effects of oxygenation on nutrient levels differ between the FLA and other literature that was reviewed is not certain at this time. It may be that model assumptions were incorrectly applied. In any event, because the proposed project may result in increased nutrification of the Klamath River below Iron Gate Dam, which may subsequently impair the already impaired water quality of the river, it is our belief that this proposal be thoroughly reviewed prior to implementation.

An additional and related effect of oxygenation of the reservoir is that it may result in increased proliferation of fish diseases of the Klamath River, both in the reservoir and in downstream reaches of the Klamath River. In recent surveys of the polychaete worm that acts as the host organism for the fish disease Ceratomyxa Shasta, it was discovered that this organism is incapable of surviving in anoxic water in upstream reservoirs (J. Henderson pers. comm.). Does this mean that increasing the oxygenated habitat of the reservoir will increase the potential for higher infection rates in salmonids residing in the river below Iron Gate Dam? This is a very significant problem in the Klamath River below Iron Gate Dam and maybe exacerbated through increased abundance of this disease host.

Although portions of this ASR can probably be completed using currently available data from ongoing water quality monitoring and modeling studies, the existing studies do not provide DOI sufficient information to determine if the proposed oxygenation of Iron Gate and Copco reservoirs would be successful or desirable. Some information was provided in the FLA, but those results are contradicted by the literature and other water quality experts that indicate that oxygenation of the hypolimnion will result in excess nutrification to the Klamath River system.

Why the Study Was Not Requested in the Pre-Filing Consultation Process

The specific proposal was not formally presented to the Collaborative Group until the FLA.

DOI 16. Distribution and Abundance of Lamprey Species in the Klamath Hydroelectric Project Area. Determine the lamprey species present in the Project area, determine lamprey distribution, abundance, and habitat use, and evaluate the impacts of Project water management operations (flow fluctuations and timing, peaking operations, and ramping operations at all Project facilities) on lamprey life stages and populations in the Project area, and in the Klamath River below Iron Gate Dam.

Recommended Study and Basis for Request

The Department requests that the Commission direct PacifiCorp to provide information on the lamprey species present, and their distribution and abundance in the Project area and in areas where lampreys are potentially impacted by Project operations. Lampreys in the Klamath River are an important native fish resource. There five species known to reside in the Klamath basin, although the taxonomic status of some remain uncertain (Kostow 2002).

The information provided in the FLA is insufficient to determine baseline conditions and Project impacts on this important group of fishes. The FLA presents little information on the distribution and abundance of lampreys in the Project area. The Fishery Assessment study collected very little information on the various lamprey species present (or likely present) within the Project, because lampreys were not a specific target species in that study. The requested study would need to be conducted concurrent with the Fishery Assessment study requested (see requested ASR: *Fish Assessment Survey for the Link River, Keno, J.C. Boyle Bypass and J.C. Boyle Peaking Reaches.)*, sampling techniques specifically designed to capture lamprey ammocoete larvae would need to be employed.

The FLA also does not consider specific impacts on lampreys. PacifiCorp presented a review of the scientific literature in the FLA which provides considerable background on the species and a good review of the existing information. However, there have been few Klamath Basin-specific studies, and none above Iron Gate Dam. PacifiCorp also hosted an excellent half-day workshop on lampreys, which also provided considerable background information, and some specific information on Klamath River lamprey species. However, without specific information on the distribution and abundance of lampreys in Project area, baseline population levels remain unknown and Project impacts on these fishes cannot be evaluated.

The FLA did not provide sufficient information on the distribution and abundance of lampreys in the Project area, and existing information is inadequate to allow determination of Project impacts on this group of species.

Lampreys have important cultural value to Tribes throughout the Basin, as well as important ecological implications for salmon and other fishes (Close et al. 2002). Lamprey ammocoete larvae may serve as food source for out-migrating salmon. They may also serve as buffer for predation on out-migrating salmon by other species of fish and birds, because they move downriver at similar times. Lampreys migrating form the ocean into the river for spawning have been found in the stomachs of sea lions and thus may serve to reduce predation pressure on adult salmon (Close et al. 2002). Thus, changes in lamprey populations may indirectly affect the abundance and survival of salmon.

The anadromous Pacific Lamprey is believed to have been abundant in the Upper Basin above Iron Gate Dam (Gilbert 1897, ODFW 1987, PacifiCorp 2004) and are now blocked from a considerable portion of their historical habitat. In addition, the effect of the loss of connectivity for several other native lamprey species due to Project dams is unknown.

What appear to be resident native lampreys have been captured in out-migrant traps fished for salmon on the main-stem river below Iron Gate dam, indicating a propensity for downstream movement in the river (Stuart Reid, USFWS, personal communication). Project dams would render return passage upstream difficult or impossible, with unknown consequences for population abundance and genetic integrity.

The DOI recognizes the difficulty in identifying lamprey species during field sampling. However, as a group, lampreys are an important component of the ecosystem that has not been adequately addressed.

Study Participants

DOI recommends that PacifiCorp reconvene the Aquatics Work Group (or a sub group of its members) to develop an appropriate and agreed-upon sampling strategy and analysis of lamprey populations in Project reaches.

Study Objectives and Methods

Study Objectives

1) Determine the lamprey species present in the Project area
2) Determine lamprey distribution, abundance, and habitat use.
3) Evaluate the impacts of Project water management operations (flow fluctuations and timing, peaking operations, and ramping operations at all Project facilities) on lamprey life stages and populations in the Project area, and in the Klamath River below Iron Gate Dam.

Study Methods

DOI recommends that study methodologies be determined by the Aquatics Work Group (or a sub group of its members), and incorporate fishery sampling methodologies specifically designed to sample lamprey species

Acceptance of Recommended Study Methods

Implementation of a peer-reviewed study plan employing standard fisheries sampling techniques and protocols would ensure the reliability of study results. The scientific community has conducted significant research on lamprey life history, distribution, and abundance. There is an abundance of scientific literature available for reference to assist in completing this study.

Usefulness of Requested Studies in Furthering Resource Management Goals

In 2003, the USDI, Fish and Wildlife Service was petitioned to consider four species of lamprey for listing under the Endangered Species Act (Siskiyou Regional Educational Project et al. 2003), of which three of the species are found in, or once inhabited, the Project area. Present and future Project operations may impact the distribution, abundance and survival of one or more of these species.

Duration of Study

Study should encompass two field seasons.

Existing Information and the Need for Additional Information

Little information currently exists on the distribution and abundance of lampreys in the Project area. PacifiCorp has presented a review of the scientific literature in their FLA which provides considerable background on the species and a good review of the existing information. PacifiCorp also hosted an excellent half-day workshop on lampreys, which also provided considerable background information, and some specific information on Klamath River lamprey species. However, without site-specific information on the distribution and abundance of lampreys in Project area, baseline population levels remain unknown and Project impacts on these fishes cannot be evaluated.

Information on the species present, etc was requested by the collaborative on numerous occasions. The USDI, Fish and Wildlife Service Service letter of September 23, 2003, commenting on the Draft License Application, stated that lampreys should be a focus species for fisheries assessment studies. Other similar requests were made by various entities at several Aquatic Work Group meetings.

The information provided in the FLA is insufficient for DOI to determine baseline conditions and Project impacts on this important group of fishes PacifiCorp's fishery assessment study, which has been deemed inadequate, does not provide the necessary baseline information on lamprey species to allow a determination of Project impacts. The lamprey workshop referred to above revealed the presence of considerable confusion regarding the taxonomy of the species that may be present in the Project area or impacted by Project facilities and operations. In addition, downstream impacts of flows and water quality coming from the Project on anadromous Pacific Lampreys have not been addressed.

References:

Close, D.A., M.S. Fitzpatrick, and H.W. Li. 2002. The Ecological and Cultural Importance of a Species at Rick of Extinction, Pacific Lamprey.

Gilbert, C.H. 1897. The Fishes of the Klamath Basin. Bulletin U.S. Fish Commission, 17(4-1897):1-13.

Kostow, K. 2002. Oregon Lampreys: Natural History Status and Problem Analysis. Oregon department of Fish and Wildlife report dated January 24, 2002.

PacifiCorp. 2004. Fish Resources Technical Report, page 2-68, *in* Application for New License for Major Project, Klamath Hydroelectric Project (FERC Project No. 2082).

Siskiyou Regional Education Project, and ten co-petitioners. 2003. A Petition for Rules to List: Pacific Lamprey *(Lampetra tridentata)*; River Lamprey (Lampetra ayresi); Western Brook Lamprey *(Lampetra richardsoni)*; and Kern Brook Lamprey *(Lampetra hubbsi)*. Submitted to the U.S. Department of the Interior, Fish and Wildlife Service, January, 2003.

DOI 17. **Demonstration Flows Downstream from Iron Gate Dam.** The objective of this study is to assess potential benefits to anadromous fisheries resulting from modified Iron Gate Dam operations.

Recommended Study:

The Department requests that the Commission direct PacifiCorp to evaluate the potential benefits to anadromous fish production resulting from altered seasonal Iron Gate Dam operations. This study element would utilize an existing decision support system (the Systems Impact Assessment Model, or SIAM) to develop predictions that would be validated with demonstration flow releases from Iron Gate Dam.

Basis for Request:

Initial model simulations conducted by the FWS and the USGS indicate that specific Iron Gate Dam operational changes may result in increased biomass of exiting fall Chinook salmon. These operational changes address Project impacts on water temperatures in the fall (the thermal lag caused by Iron Gate Reservoir is described on page 4-71 of the Water Resources FTR) and Project impacts on downstream migration of salmonids. If Iron Gate Dam were managed to improve conditions in the Klamath River between Iron Gate Dam and the Scott River confluence, it may result in improved year class strength in many water years. Demonstration flow releases and associated monitoring efforts are needed to assess the hypotheses developed during SIAM modeling.

Responsible Entity

PacifiCorp should convene stakeholder meetings to develop plans for demonstration flows. PacifiCorp should release demonstration flows in a timely manner and provide stakeholders advance notice of such releases.

PacifiCorp would be responsible for coordinating the release from Iron Gate Dam of demonstration flows needed to assess flow-related thermal and habitat changes for spawning and out-migrant life stages of fall Chinook salmon. The Department and other stakeholders would assist in the coordination of these flow releases.

Participants

PacifiCorp should collect the requested information with direct oversight from an interagency team of state, federal, and tribal specialists and NGO representatives from the stakeholder group. The interagency team should provide overall guidance and assist with developing model simulations, reviewing model simulation results, and assisting with monitoring the effects of demonstration flows on flow-dependent resources.

Study Objectives and Methods

Objectives

To analyze a full range of Iron Gate Dam operations alternatives using the existing SIAM decision support system. To evaluate altered flow releases from Iron Gate Dam on flow-

dependent resources in the Klamath River between Iron Gate Dam and the confluence of the Scott River.

Methods

SIAM model simulations for a variety of hydrologic year types have been performed by USGS staff in Fort Collins. The hydrologic years that were simulated included representative wet, dry, and average hydrology and cool, average, and warm meteorological conditions. A total of 9 historical years were selected for simulation. A baseline simulation for each selected year was performed, and compared to a simulation where Iron Gate releases were re-distributed. Preliminary results indicate that lower flows in October may have beneficial effects on spawning conditions for fall Chinook salmon in the Klamath River between Iron Gate Dam and the confluence of the Scott River. Specifically, water temperature could be reduced by 3 to 5 °C. Cooler water temperatures may reduce both adult and in vivo egg mortalities, thereby increasing viable egg production and biomass of exiting smolts the following spring. Model simulations also indicate that earlier (March/April) spring "pulse" flows that move smolts downriver to the ocean may have beneficial effects. In addition, there may be some potential to "flush" some of the smaller reservoirs on the Klamath River in late summer to improve thermal conditions within the Project area. Although these preliminary results cannot be distributed at this time (internal USGS review has not been completed), they indicate the potential for modification of Iron Gate Dam operations to improve fishery conditions.

PacifiCorp would be required to provide test flows from Iron Gate Dam to allow monitoring of thermal conditions, habitat and other flow dependent aquatic resources in the Klamath River. The requested flows would be variable (depending on water supply) but may be substantially different from the current FERC flow schedule. PacifiCorp would also provide funding for monitoring of flow-dependent aquatic resources during test flows.

Usefulness of Requested Studies in Furthering Resource Goals

Implementation of this study would yield information useful to FERC, the Department, other stakeholders, and PacifiCorp. The study would provide information for the Department's consideration during analysis of the proposed Project's consistency with the following resource management objectives:

Fish and Wildlife Service

- Restore the biological productivity of the Klamath River Basin in order to provide viable commercial and recreational ocean fisheries and in-River tribal (subsistence, ceremonial and commercial) and recreational fisheries.
- Evaluate the instream flow needs... of each salmon and steelhead run and life stage affected by flows released from Iron Gate Dam.
- Protect salmon and steelhead habitat from harmful effects of water and power projects in the Klamath Basin.
- Identify and implement methods to rectify habitat problems… including …water quality above and below Iron Gate Dam and instream flow and habitat below Iron Gate Dam.
- Require water flows adequate to achieve optimal productivity of the basin.

Study Duration

Demonstration flows would have to be evaluated in at least two “average” (or nearly average) water years. Ideally, these years would occur consecutively, beginning in 2004.

BOTANICAL AND WILDLIFE RESOURCES

DOI 18. Analysis of Project Operation Scenarios and Riparian/Wetland Resources in the J.C. Boyle Peaking and Bypass Reaches. The objective of the proposed analysis is to provide information for use in determining instream flow regimens that protect, maintain, or enhance the suite of flow dependent resources.

Description of Recommended Study

The Department requests that the Commission direct PacifiCorp conduct and analysis for six transects in the J.C. Boyle bypass reach and 19 transects in the J.C. Boyle peaking reach. For each riparian vegetation plot that is located at elevations inundated by flows less than or equal to 3,000 cfs, inundation duration and inundation frequency would be calculated for a range of operation scenarios. These scenarios would include Steady Flow, Without Project, and Without Project II (these scenarios are defined in the Water FTR). Additional scenarios would also be analyzed:

- Proposed Project operations (described in E 3-196);
- "Modified proposed operations," incorporating a range of minimum flow releases in the J.C. Boyle bypass reach (from 100 cfs to 600 cfs); and,
- Other scenarios developed in collaboration with the aquatics, water quality, and terrestrial work groups.

This analysis would utilize modeled hydrologic data from 2000 and 2001 and the existing stage-discharge relationships for each transect (described in Terrestrial FTR Appendix 3A).

Basis for Request

In comments on the FSCD, the BLM requested that PacifiCorp "model the distribution and composition of riparian areas for a full range of alternatives"…by "applying the relationships…to modeled flow duration curves."

Reed canary grass is an invasive species that displaces other riparian communities. The current abundance of reed canary grass in the J.C. Boyle reaches is an indicator of degraded riparian conditions. Proposed Project operations would maintain hydrologic conditions which grant reed canary grass a strong competitive advantage over desired riparian species. The analysis proposed in this ASR would provide information necessary to assess the impact of potential flow regimes on riparian management objectives.

One additional issue that was pointed out by a member of the Karuk Tribe was the potential impact that the project may have on basketry materials. Specifically it has been observed that flow regulation as it relates to timing and intensity of hydrologic events has resulted in the maintenance of decadent willow stands along point bars that do not rejuvenate. Stem diameter of individual willows located within these stands are in excess of what is suitable for basketry material.

The information compiled during this analysis would supplement the existing analysis of relationships between streamflow metrics and riparian vegetation communities. Analysis conducted to date indicates that inundation duration is moderately correlated with the distribution of vegetation communities (Terrestrial FTR 3-73). In both J.C. Boyle reaches, vegetation types dominated by reed canary grass occur over nearly the entire range of inundation durations from 0 to 100%. In the bypass reach, reed canary grass is most dominant in plots with high inundation

duration (approximately 55%). In the peaking reach, the abundance of reed canary grass is highest in plots with inundation duration on the order of 35%.

The existing analysis used streamflow records from 1996 to 2001 to develop these relationships (Terrestrial FTR 3-9). Development of similar relationships for the Steady Flow, Without Project, and Without Project II scenarios would enable a more thorough understanding of Project impacts. Development of relationships for the proposed Project operations and "modified proposed operations" would provide insight into continuing Project impacts and would enable development of incremental relationships between streamflow and riparian characteristics. Conducting this analysis would allow the hydrologic preferences of desired riparian vegetation (and, perhaps more importantly, undesired riparian vegetation) to be adequately considered during the development of flow regimes intended to balance power and non-power resources.

Responsible Entity

PacifiCorp would be responsible for soliciting and integrating input from the Terrestrial and Aquatics Work Groups and conducting the analysis.

Participants

The analysis would be conducted collaboratively with relicensing stakeholders. PacifiCorp would discuss hydrologic parameters for model runs with stakeholders to ensure that objectives and information needs are adequately met.

Methodology and Objectives

The analysis would employ hydraulic and hydrologic analyses developed for other studies conducted in the course of this relicensing. These include:

- Plot elevation data and vegetation analyses derived from the Riparian/Wetland Characterization (Terrestrial FTR 3.0);
- Hydrologic modeling conducted for the Water Quality Modeling effort (Water Resources FTR 5.0) or for descriptions of proposed or potential Project operations;
- Hydraulic analyses conducted during the Instream Flow (Fish Resources FTR 6.0) and Geomorphology (Water Resources FTR 6.0) studies; and,
- Stage-discharge relationships developed for each riparian vegetation transect (Terrestrial FTR Appendix 3A).

Data needed for the proposed study is readily available. This data is already in a format that, with minor modifications (e.g., the creation of flow duration curves for the modeled hydrology data sets), can be incorporated in the proposed analysis.

The objective of the proposed analysis is to provide information for use in determining instream flow regimes that protect, maintain, or enhance the suite of flow-dependent resources in these two reaches. Further, information developed from this analysis would allow FERC and relicensing stakeholders to compare hydrology-riparian linkages between a range of operation scenarios and thereby conduct a more thorough analysis of Project impacts on riparian vegetation.

Acceptance of Recommended Study Methods

The methods proposed for this analysis are similar to methods already employed in the Riparian/Wetland Assessment for linking hydrologic processes to riparian vegetation

communities (see Terrestrial FTR 3-8 and Terrestrial Appendix 3A). These methods were developed by PacifiCorp, its consultants, and the Terrestrial Work Group.

Usefulness of Requested Studies in Furthering Resource Goals

A substantial portion of the riparian areas in these two river reaches occur on BLM-administered land, management of which is guided by the Northwest Forest Plan Aquatic Conservation Strategy. The proposed analysis would assist in meeting the following resource goals (emphasis added):

- "*Maintain and restore spatial and temporal connectivity* within and between watersheds. Lateral, longitudinal and drainage network *connections include floodplains, wetlands*, upslope areas, headwater tributaries and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species." (Northwest Forest Plan Standards and Guidelines, page B-11);
- "*Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic and wetland habitats* and to retain patterns of sediment, nutrient and wood routing. The *timing, magnitude, duration* and spatial distribution of peak, high and low flows must be protected." (Northwest Forest Plan Standards and Guidelines, page B-11);
- "*Maintain and restore the timing, variability and duration of floodplain inundation* and water table elevation in meadows and wetlands." (Northwest Forest Plan Standards and Guidelines, page B-11);
- "*Maintain and restore the species composition and structural diversity of plant communities in riparian areas* and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability." (Northwest Forest Plan Standards and Guidelines, page B-11);
- "…Give priority emphasis to instream flows and habitat conditions that *maintain or restore riparian resources*…" (KFRA RMP Appendix D-10);
- "Existing [hydroelectric] support facilities that must be located in Riparian Reserves should be located, *operated*, and maintained with an *emphasis to eliminate adverse effects* that retard or prevent attainment of Aquatic Conservation Strategy objectives." (KFRA RMP Appendix D-10);
- "Emphasize…rehabilitation and maintenance of riparian areas…" (KFRA RMP page 29);
- "Manage riparian-wetland areas to protect, maintain, or improve riparian habitat for wildlife and native plant diversity." (KFRA RMP page 29);
- "Ensure that new resource management plans and activity plans, and *revisions of existing plans*, incorporate, as applicable, practices that enhance or maintain properly functioning riparian systems…" (KFRA RMP page 29); and,
- "Identify, encourage, and support research and studies needed to ensure that riparian-wetland area management objectives can be properly defined and met" (KFRA RMP page 30).

Study Duration

Three months should be a sufficient amount of time to conduct, review, and summarize the results of the proposed analysis. No additional field work is required.

Why Study Objectives Cannot be Achieved Using Available Data

The existing analysis of flow and riparian vegetation established relationships between inundation duration and the distribution of vegetation communities, as well as between inundation duration and the abundance of reed canary grass. Thus, inundation durations calculated from model results for other operational scenarios (including PacifiCorp's proposed Project operations) can be used to predict the future extent and abundance of reed canary grass. The Department has requested this analysis throughout this relicensing process, beginning with comments on the FSCD. Without this additional analysis, rigorous quantitative analysis of continuing Project impacts will be foregone and incremental assessment of potential instream flow regimes will not be possible.

DOI 19. Quantification of Riparian Maintenance Flows in the J.C. Boyle Bypass Reach. The objective of this study is to quantify the hydrologic requirements of unimpaired riparian communities in the J.C. Boyle bypass reach.

Description of Recommended Study

The Department requests that the Commission direct PacifiCorp to quantify the peak flow regime necessary to maintain and restore the extent and character of riparian vegetation communities in the J.C. Boyle bypass reach. The study would rely primarily on existing data, although additional limited data collection may be required to obtain a more robust sample size.

Basis for Request

Peak flows affect riparian communities through linkages with geomorphic, hydrologic, and ecological processes. Such processes include substrate scouring, sediment and organic matter deposition, vegetation disturbance and rejuvenation, and soil moisture recharge (Poff et al., 1997). The water surface elevation of moderately frequent peak flows (1.5 to 10 years) can be correlated with the upslope extent of riparian vegetation in unconstrained and moderately constrained river segments (Terrestrial FTR 3-106; Hill et al., 1991; Poff et al., 1997; Chapin et al., 2000). The rate at which peak flows recede affects reproductive success of riparian deciduous trees and is therefore of interest as well (Scott et al., 1993).

The magnitude, frequency, and duration of peak flows in the J.C. Boyle bypass reach will continue to be reduced by proposed Project operations (E 3-24; Water Resources FTR 5-46). Peak flow magnitudes will be reduced by 2,850 cfs, with consequent reductions in the frequency of flows exceeding a given magnitude (Table 2-4).

Table 2-4. Project impacts on the frequency of peak flows in the J.C. Boyle bypass reach.

Flood Magnitude (cfs)	Estimated Return Interval[1]	
	Without Project	Proposed Project
3000	1.1	2.3
4000	1.4	3.1
5000	1.8	4.1
6000	2.4	5.4
7000	3.2	7.1
8000	4.2	9.4
9000	5.6	12.4
10000	7.4	16.3
Note: (1) Derived from Water Resources FTR 5-46.		

Of the two J.C. Boyle reaches, Project impacts on peak flows are greatest in the bypass reach (Water Resources FTR 5-45). Despite more pronounced Project impacts in the bypass reach, however, riparian maintenance flows have been estimated only for the J.C. Boyle peaking reach (Terrestrial FTR 3-106). Two lines of evidence suggest that the proposed Project will impact riparian maintenance flows (and therefore limit the elevational range of riparian vegetation) in the bypass reach:

Estimated riparian maintenance flows in constrained segments of the peaking reach are on the order of 4,370 cfs and recur, on average, every 1.8 years (± 0.3 years) (Terrestrial FTR 3-106).

Topography in the bypass reach is approximately similar to that in the peaking reach, and the proximity of the reaches suggests that overarching climatic and ecological factors are also similar. It can then be assumed that 4,370 cfs would be an adequate riparian maintenance flow in the bypass reach. Project operations will increase the return interval of 4,370 cfs flows to approximately 3.4 (± 0.6) years in the bypass reach. This equates to reducing the occurrence of riparian maintenance flows by a factor of nearly two.

Initial estimates of riparian maintenance flows for the six riparian transects in the bypass reach can be derived using the methods described in the FLA (Terrestrial FTR 3-106). This method is based on determining the average flow required to inundate plots exhibiting strong riparian character (in the bypass reach, these are the Coyote Willow/Reed Canarygrass/Colonial Bentgrass, Mock Orange/Reed Canarygrass, and Reed Canarygrass vegetation types[6]). The flows required to inundate the highest plot on each transect containing one of these three vegetation types ranged from 1,260 to 6,550 cfs, with an average value of 2,940 cfs (based on analysis of PacifiCorp data compiled during the riparian analysis). It is estimated that the recurrence interval for flows of this magnitude under the proposed Project would be approximately 2.3 years.

The similarity between return intervals (approximately two years) of riparian maintenance flows estimated in each river reach support the assumption that similar controlling hydrologic, geomorphic, and riparian processes are at work in these two reaches. The discrepancy between the estimated riparian maintenance flows in the peaking reach (4,370 cfs) and in the bypass reach (2,940 cfs) suggests that the elevational range over which riparian vegetation can establish is currently narrower in the bypass reach than in the peaking reach. This more narrow elevational range may reflect a combination of geomorphic constraints and Project impacts. Since construction of J.C. Boyle Dam, riparian corridors along less-constrained portions of the bypass reach may have contracted in correspondence with reduced magnitudes of two-year floods. Absent implementation of a flow regime that incorporates riparian processes, the proposed Project would perpetuate this impact.

Responsible Entity

PacifiCorp would be responsible for soliciting and integrating input from the Terrestrial and Aquatics Work Groups and conducting the analysis and any necessary field work

Participants

The analysis would be conducted collaboratively with relicensing stakeholders.

Methodology and Objectives

The study would utilize data and methods developed from and applied to the J.C. Boyle peaking reach (described in the Terrestrial FTR at 3-106). Application of data and analyses from the upper segment of the peaking reach is necessary to remove from the study any bias associated with past Project impacts on the relationship between peak flows and riparian vegetation in the bypass reach.

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[6] Sample plots of the Mock Orange vegetation type commonly included non-riparian species such as ponderosa pine, white fir, chokecherry, and Oregon oak and were therefore not considered in developing this estimate.

Additional data collection, if necessary, would be able to utilize some or all of the aquatic instream flow study 23 transects established in the upper segment of the J.C. Boyle peaking reach for the (Fish Resources FTR 4-17 and 4-21). Data collection at these transects would focus on surveying the elevation above the transect datum and characterizing the upper-most riparian vegetation community. Stage-discharge relationships developed for the aquatic instream flow study would then be compared with daily average streamflow records to quantify the hydroperiod for each plot (as described in Appendix 3A of the Terrestrial FTR).

The objectives of this study would be to quantify the hydrologic requirements of unimpaired riparian communities in the J.C. Boyle bypass reach. The magnitude, frequency, and duration of peak flows needed to support the extent and character of riparian communities would be described.

Acceptance of Recommended Study Methods

The proposed study recommends methods that have been utilized by PacifiCorp to quantify riparian maintenance flows for the J.C. Boyle peaking reach. These methods are similar to the methods used by Chapin et al. (2000) and Auble et al. (1994).

Usefulness of Requested Studies in Furthering Resource Goals

A substantial portion of the riparian areas in these two river reaches occur on BLM-administered land, management of which is guided by the Northwest Forest Plan Aquatic Conservation Strategy. The proposed analysis would assist in meeting the following resource goals (emphasis added):

- "*Maintain and restore spatial and temporal connectivity* within and between watersheds. Lateral, longitudinal and drainage network *connections include floodplains, wetlands,* upslope areas, headwater tributaries and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species." (Northwest Forest Plan Standards and Guidelines, page B-11);
- "*Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic and wetland habitats* and to retain patterns of sediment, nutrient and wood routing. The *timing, magnitude, duration* and spatial distribution of peak, high and low flows must be protected." (Northwest Forest Plan Standards and Guidelines, page B-11);
- "*Maintain and restore the timing, variability and duration of floodplain inundation* and water table elevation in meadows and wetlands." (Northwest Forest Plan Stndards and Guidelines, page B-11);
- "*Maintain and restore the species composition and structural diversity of plant communities in riparian areas* and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability." (Northwest Forest Plan Standards and Guidelines, page B-11);
- "…Give priority emphasis to instream flows and habitat conditions that *maintain or restore riparian resources*…" (KFRA RMP Appendix D-10);
- "Existing [hydroelectric] support facilities that must be located in Riparian Reserves should be located, *operated,* and maintained with an *emphasis to eliminate adverse effects* that retard or prevent attainment of Aquatic Conservation Strategy objectives." (KFRA RMP Appendix D-10);

- "Emphasize…rehabilitation and maintenance of riparian areas…" (KFRA RMP page 29);
- "Manage riparian-wetland areas to protect, maintain, or improve riparian habitat for wildlife and native plant diversity." (KFRA RMP page 29);
- "Ensure that new resource management plans and activity plans, and *revisions of existing plans*, incorporate, as applicable, practices that enhance or maintain properly functioning riparian systems…" (KFRA RMP page 29); and,
- "Identify, encourage, and support research and studies needed to ensure that riparian-wetland area management objectives can be properly defined and met" (KFRA RMP page 30).

Study Duration

If additional field work is required, three months should be a sufficient amount of time to conduct, review, and summarize the results of the proposed analysis. If no additional field work is required, one month should be an adequate amount of time.

Why Study Objectives Cannot be Achieved Using Available Data

PacifiCorp conducted an analysis of riparian maintenance flows in the J.C. Boyle peaking reach but not in the bypass reach. Results from the peaking reach are not directly transferable to the bypass reach, since geomorphic conditions may differ. The upper segment of the peaking reach is the river segment that is most similar to the bypass reach and is represented within the existing riparian and hydraulic modeling data sets. Only four riparian transects were sampled in this segment, and it is not certain whether these transects can adequately represent conditions in constrained river segments.

Existing data from the bypass reach cannot be used for this analysis, because the distribution of riparian communities in this reach reflects the past 50 years of flow depletions caused by the Project.

DOI 20. **Noxious Weed Inventory.** The objective of this inventory is to fully evaluate the impacts of the project, and act as a basis for the development of a landscape based, integrated noxious weed management plan.

The Recommended Study, Basis and Objectives

The Department requests that the Commission direct PacifiCorp conduct a systematic survey of all lands within the affected landscape of the Project for all noxious weeds and invasive non-native plants to fully evaluate the impacts of the project, and act as a basis for the development of a landscape based, integrated noxious weed management plan.

Noxious weeds and invasive exotic plants have a negative effect on native species diversity, ecosystem health, and recreational experience quality. The project and associated roads and facilities are contributing to the continual spread of noxious weed and invasive non-native plant species, placing desired native plant communities and special status plant species at risk. Once established as a result of Project activities, these species can spread by other means and affect the larger landscape.

Because the control of outlier populations of widespread species and new invaders is the most effective method to manage a biological invasion (Moody and Mack 1988), the surveys that were conducted over only a portion of affected landscape will fail to locate populations that may be essential for effective management of noxious weeds and invasive non-native plants. Incomplete noxious weed and invasive non-native plant surveys and analyses in the application include: "Noxious Weed Inventory" (Terrestrial Resources FTR, Section 8).

Who Should Conduct and Participate in the Study

A qualified botanist, funded by PacifiCorp, should conduct noxious weed and invasive non-native plant surveys and analyses. Data and assistance from the USFS, BLM, Siskiyou County (California), Klamath County (Oregon), California Department of Food and Agriculture, and Oregon Department of Agriculture should be integrated into the study.

Methodologies and Objectives

The study should identify and map all infestations of all noxious weeds and invasive non-native plants targeted for management throughout the landscape affected, directly or indirectly by the project.

The study should use the "intuitive controlled" approach as described for special status species (Whiteaker et al. 1998), which traverses the entire study area thoroughly enough to see a representative cross section of all the major habitats and topographic features, with a complete survey for the target species in areas with a high potential of supporting noxious weeds and invasive non-native plants.

Therefore, surveys should be most intensive on roadsides, recreation facilities, PacifiCorp's facility grounds, transmission lines and other disturbed areas where noxious weeds readily become established. However, all lands within the affected landscape should be surveyed, and all noxious weeds and invasive non-native plants targeted for management should be mapped, regardless of abundance or extent. Locations of populations found should be documented with a GPS, and this information should be used to produce a GIS layer of weed locations with attached data table of species, density and extent.

Analysis should include primary areas to concentrate control efforts based on the presence of new invaders to the affected landscape, and on the distribution of outlier populations of widespread species. An integrated noxious weed management strategy should include both of these approaches when planning control efforts.

Acceptance of Recommended Study Methods by the Scientific Community

Complete noxious weed and invasive plant surveys and analysis of their distributions are described by the scientific community as necessary to evaluate impacts and as an essential component of an integrated weed management strategy.

Usefulness of Requested Studies in Furthering Resource Goals Affected by the Project

Early detection and treatment of new noxious weed invaders is the most effective method of weed management. Similarly, control of outlier populations of widespread species is the most effective method of control for a biological invasion (Moody and Mack 1988). Thorough information on the distribution and abundance of noxious weeds is needed to formulate management actions that will effectively address the impacts of noxious weeds on natural resources and economic activities. The complete, systematic inventory for all target species proposed here will allow for the development of an effective management strategy for each weed species, and thereby a more effective overall program.

Study Duration

One field season should be adequate to complete the surveys. Surveys should be conducted during the spring and summer of 2004, during the appropriate flowering period for the target species such that they can be accurately identified. Analyses should be complete prior to relicensing.

Why Study Objectives Cannot be Achieved With Available Data

Noxious weed and invasive non-native plant information collected and compiled by PacifiCorp is inadequate in several respects for planning an integrated weed management program. Although some information was generated on distribution of widespread species from vegetation plots, several of these widespread species are targeted for control but were not mapped. In order to effectively plan management of these species, maps showing the extent and abundance of the distribution in the affected landscape would be needed. Where these species are extensive and abundant, density or abundance classes can be mapped.

The distribution of one species was described as “minimal” in the majority of the study area, but infestations in that portion of the study area were not mapped. Since the control of outlier populations is the most effective method to control a biological invasion (Moody and Mack 1988), then the location of these populations would be essential to plan the most effective management of this species.

Available data described several designated noxious weed species as occurring in the study area, but infestations were not mapped. Weed species designated as noxious weeds are legally required targets for control efforts. To prioritize control efforts for an integrated weed management program, the distribution of all species targeted for control is required.

If a study was not requested during the pre-filing consultation process, explanation for why the request was not made at this time and why the request should be considered by the Commission

A study was requested during the pre-filing consultation process, and PacifiCorp conducted a noxious weed inventory. Review of the FLA revealed that the study results were inadequate in several respects for planning an integrated weed management program.

Literature Cited

Moody, M.E. and R. N. Mack. 1988. Controlling the spread of plant invasions: the importance of nascent foci. Journal of Applied Ecology 25: 1009-1021.

CULTURAL RESOURCES

DOI 21. Complete Cultural Resource Surveys within the Area of Potential Effect (APE). The objective is to survey the complete area of potential effect.

Description of Recommended Study and Basis for Request

All lands within the APE require a cultural resources survey to fulfill the intent of the *National Historic Preservation Act* (NHPA) and Tribal trust responsibilities. This includes all PacifiCorp and BLM administered lands. For the last several years, PacifiCorp has refused to identify a cultural resources APE. Instead, a Field Inventory Corridor (FIC) was proposed that was to encompass the APE when it was finally developed. Cultural resource surveys were conducted within portions of the FIC during the 2002/2003 field seasons. A proposed APE was submitted to the California and Oregon State Historic Preservation Officers and the Yurok Tribal Heritage Preservation Officer on February 2, 2004. A copy of the proposed APE was also provided to the Cultural Resources Work Group (CRWG) at this time. Unfortunately, the surveys conducted within the FIC do not adequately cover the entire APE. When one compares the survey coverage (both past surveys and those conducted by PacifiCorp) within the newly proposed APE, it is readily apparent that several hundred acres have yet to be inspected. While some of this unsurveyed land is located on extreme slopes or within marshy locations, there are many areas with relatively gentle relief within the newly defined APE that have not yet been inspected. This includes both PacifiCorp land as well as BLM administered land in California and Oregon. Additional survey work to meet the objectives of PacifiCorp's Study Plan 6.1 is needed to determine whether cultural resources are present within the unsurveyed portions of the APE.

It is PacifiCorp's responsibility to ensure that these surveys are carried out, regardless of land ownership.

Study Participants

DOI recommends that PacifiCorp fund and conduct the study and consult with state, federal and tribal resource agencies in study design and implementation, including collection and analysis of data.

Methodology and Objectives

The methodology to be used should be the same as was used for the cultural resource surveys of the FIC. The objective of the surveys is to completely survey the entire APE.

Acceptance of Recommended Study Methods

Complete survey of an APE is a routine method. On other projects this methodology has been reviewed and approved by State Historic Preservation Office for both California and Oregon (SHPO).

Usefulness of Requested Studies in Furthering Resource Management Objectives

It is essential that the remaining unsurveyed lands within the APE be inspected so that all cultural resources are identified and appropriately protected in accordance with the NHPA and Department's Tribal trust responsibilities.

Study Duration

Field work associated with this additional study request should not require more than 2 – 3 weeks depending on crew size/composition. Subsequent to the fieldwork, office related tasks associated with the survey will need to be accomplished. These tasks may include, but need not be limited to, site form preparation, map production, artifact analysis, and integration of the results into the Cultural Resources Final Technical Report. Depending upon the length of the actual fieldwork and the complexity of sites discovered, completion of the office related work can take as many as 3 days for every 1 day in the field.

Why Study Objectives Cannot Be Achieved Using Data Already Available

Complete survey of the APE is required so that all potentially affected historical and prehistoric sites are identified and protected.

DOI 22. Distribute Ethnographic Integration Report. The objective is the complete distribution of an ethnographic integration report to all members of the Cultural Resources Work Group, FERC and State Historical Preservation Offices.

Description of Recommended Study and Basis of Request

Per PacifiCorp's Study Plan 6.3, tribal ethnographic studies were prepared by the Klamath, Shasta, Karuk, Hoopa and Yurok Tribes. An integration report (currently being prepared by Dr. Thomas King) melds all of these separate reports into a cohesive document outlining the cultural connection that all of the Tribes have to the river. This integration report outlines why the riverscape is eligible for the National Register as a Traditional Cultural Property, documents effects that PacifiCorp's project has (and will continue to have) on cultural resources, and supports the extension of the APE to the mouth of the Klamath River.

Study Participants

DOI recommends that PacifiCorp ensure that the integration report is distributed to the entire CRWG and other appropriate entities. DOI also recommends that PacifiCorp analyze the ramifications of the report in light of is relicense application.

Methodology and Objectives

The methods of distribution are straight forward: mail copies of the integration report to all members of the CRWG and other appropriate stakeholders. The objective to be met with this request is the complete distribution of ethnographic integration report to all members of the CRWG, FERC, SHPO, and THPO.

Acceptance of Recommended Study Methods

The scientific community routinely expects to receive all data relevant to a particular study. The methodologies employed by Dr. King are common to the science and the report will be reviewed by the CRWG, SHPOs, and THPOs.

Usefulness of Requested Studies in Furthering Resource Management Goals

The integration report takes each of the ethnographic studies conducted in support of the project and melds them into a single summary document showing the similar connections each tribe has to the river demonstrating that the entire riverscape should be considered a traditional cultural property eligible for the National Register. This is in accordance with the DOI's Tribal trust responsibilities.

Study Duration

Distribution of the integration report should not take more than a few days to accomplish. Analysis of the report in terms of PacifiCorp's relicense application and the implication of project effects to cultural resources outside of the currently defined APE may take several months to accomplish.

Why Study Objectives Cannot Be Achieved Using Data Already Available

Although the ethnographic studies currently exist, a report that ties them all together is needed. The integration report is meant to achieve this goal and is necessary to understand the interdependent and interrelated nature of the affected cultural resources. The complete

understanding of the cultural resources can be generated by pulling data and information from different sections of FLA. The cumulative effects of Project operations can only be determined by the synthesis of all the information in this integration report.

DOI 23. Analyze the Historic and Prehistoric Research Designs with Data Gathered During the Cultural Resource Fieldwork. The objective is to ensure that the questions posed in the research designs are analyzed with respect to the new data gathered during their surveys.

Description of Recommended Study and Basis of Request

The Cultural Resources portion of the Final License Application contains fairly detailed research designs outlining the prehistoric and historical data themes that could be addressed by data gathered during the cultural resources surveys. Unfortunately, the results of the survey are not analyzed with respect to the research questions posed. Each research question posed by PacifiCorp needs to be evaluated in light of the new data gathered during PacifiCorp's field studies and new questions should then be formulated as appropriate.

It is PacifiCorp's responsibility to ensure that the questions posed in the research designs are analyzed with respect to the new data gathered during their surveys.

Study Participants

DOI recommends that PacifiCorp fund and conduct the study and consult with state, federal and tribal resource agencies in study design and implementation including collection and analysis of data.

Methodology and Objectives

Each question posed by PacifiCorp within the historical and prehistoric research designs need to be addressed and analyzed with respect to the data gathered during the field work phase of the cultural resource surveys. As with any scientific endeavor, some research questions can be readily addressed using the data in-hand – many others will need to await further data. Still other, new questions will become relevant during the analysis. This is part of the scientific process. Without a thorough post-field analysis pitting the data gathered against the research questions posed, the original research design is meaningless.

Acceptance of Recommended Study Methods

Research designs have been an accepted part of the scientific community for many decades. Analysis of the research design subsequent to the fieldwork to be conducted is an essential element of any scientific undertaking. Without a thorough analysis of the questions posed prior to the fieldwork, advances in our knowledge of the past will never be achieved.

Usefulness of Requested Studies in Furthering Resource Management Goals

A thorough analysis of the research design will be extremely useful for justifying NRHP eligibility recommendations made by PacifiCorp. Additionally, it will be difficult to understand if the implementation of the proposed Project will accommodate achievement of the cultural resources objectives and conservative measures will have to be put into practice for protection of resources.

Study Duration

Analysis of the field data with respect to the research designs will probably take 3 – 4 weeks of concentrated effort by PacifiCorp and its contractors.

Why Study Objectives Cannot Be Achieved Using Data Already Available

The analysis of a project's research design is an essential part of the scientific process. The data to be analyzed is already available. The analysis of that data with respect to the original research designs under which PacifiCorp was conducting its' fieldwork is currently needed for completion of the study to assess Project impacts.

If a study was not requested during pre-filing consultation process, explanation for why the request was not made at this time and why the request should be considered by the commission

Formulation of research designs to guide the fieldwork was requested during the pre-filing consultation process (PacifiCorp Study Plan 6.1). Analysis of the data with respect to the research designs, while not specifically requested, is a normally expected ingredient of a research design.

DOI 24. Supplement and Finalize the Historic Properties Management Plan (HPMP). The objective of this plan is to protect and manage these historic properties over the course of the next license period.

Description of Recommended Study and Basis of Request

PacifiCorp's Study Plan 6.5 called for the preparation of an HPMP. Unfortunately only a brief outline of the HPMP was included in the Final License Application. The complete plan is critically needed for the future management of cultural resources within the APE as well as in the formulation of appropriate PM&Es. A draft HPMP was distributed and briefly discussed at the November 2003 CRWG meeting. The draft HPMP was not approved during this meeting as suggested by PacifiCorp, nor was it approved at the following meeting in December 2003. No further CRWG meetings have been held since the December 2003 meeting. Furthermore, while potential PM&E measures were discussed in passing at a number of CRWG meetings, none were officially adopted. In fact, those presented within Exhibit E, Appendix E-6F provide the first opportunity for the CRWG to see what PacifiCorp had in mind for protecting cultural resources potentially affected by the Project. Some of the PM&E measures proposed by PacifiCorp ("Warning – Poisonous Snakes") may not be effective in protecting sensitive archaeological sites. Some of the PM&Es proposed by PacifiCorp could potentially be adverse effects themselves including capping, site concealment, proactive site isolation, and erosion control. Further study/analysis is needed to clarify the effects these PM&Es may have on the resources over the 30 year license period.

It is PacifiCorp's responsibility to prepare and distribute the HPMP. As part of the collaborative process, it is the responsibility of the CRWG to assist PacifiCorp in the preparation of the HPMP by suggesting appropriate site specific management and protection actions as well as commenting on the draft document.

Study Participants

DOI recommends that PacifiCorp fund and conduct the study and consult with state, federal and tribal resource agencies in study design and implementation including collection and analysis of data.

Methodology and Objectives

PacifiCorp needs to prepare a plan for the management of cultural resources potentially affected by project activities. The objective of this plan is to protect and manage these historic properties over the course of the next license period. The methodology/format will be reviewed and approved by the CRWG.

Acceptance of Recommended Study Methods

Preparation of a historic properties management plan is a readily accepted method employed by the scientific community for the protection of potentially affected cultural resources.

Usefulness of Requested Studies in Furthering Resource Management Goals

The HPMP is essential for the long term protection and management of cultural resources potentially affected by the project.

Study Duration

Preparation of the plan will take PacifiCorp and its' contractors several months to accomplish and incorporate results from other cultural studies. Consultation and coordination between PacifiCorp and the rest of the CRWG will need to occur to ensure that appropriate future management plans for potentially affected sites are developed.

Why Study Objectives Cannot be Achieved Using Data Already Available

The data to develop the HPMP already exists but the actual plan that details how potentially affected sites will be managed and protected over the course of the license period is necessary.

DOI 25. Conduct Site Specific Geoarchaeological Studies. Study objectives are to determine Project effects of flow hydraulics and geomorphic processes at sites directly adjacent to the Klamath River between J.C. Boyle powerhouse and the slack waters of Copco Reservoir.

Description of Recommended Study and Basis of Request

While geomorphology studies were conducted by PacifiCorp consultants, none of these studies were specific to cultural resource concerns, even though several CRWG members (Eric Ritter and Ron Reed) had been requesting such site specific studies for several years. PacifiCorp sponsored a three day tour for the CRWG targeted at geomorphology and Project effects. This tour, while appreciated, did not alleviate CRWG concerns about erosion of sites due to Project operations and related recreation. Site specific studies conducted by a geoarchaeologist (an individual trained in both geology/geomorphology and cultural resources) are needed to determine what, if any, effects are occurring due to the Project. The main concern that needs to be studied is the effects of project hydroelectric flow discharge (ramping duration/velocity and timing) as it relates to continued river bank saturation of cultural deposits and the potential for site erosion problems. Sites directly adjacent to the river bank where PacifiCorp has indicated on impact forms that erosion is occurring and where geoarchaeological investigation may be warranted include: 35KL536, 35KL22, 35KL567, 35KL1083, 35KL17/20/21/786, 35KL18, 35KL578/578H, 35KL19, 35KL16, 35KL632, 35KL635, CA-SIS-1721, CA-SIS-2263, CA-SIS-2569, CA-SIS-2576, CA-SIS-2574, RM-20, and CA-SIS-2579.

It is PacifiCorp's responsibility to conduct site specific geoarchaeological studies at these sites to determine whether project-related flow regimes are causing the erosion noted during the field work. Participants in the study should include a geoarchaeologist trained to recognize geological/geomorphic processes as they relate to archaeological sites.

Study Participants

DOI recommends that PacifiCorp fund and conduct the study and consult with state, federal and tribal resource agencies in study design and implementation including collection and analysis of data.

Methodology and Objectives

The geoarchaeologist needs to focus on project effects of flow hydraulics and geomorphic processes at sites directly adjacent to the Klamath River between J.C. Boyle powerhouse and the slack waters of Copco Reservoir. Sites below Iron Gate Dam should also be assessed by a geoarchaeologist if it is found that project effects extend to the mouth of the river.

Acceptance of Recommended Study Methods

Geoarchaeological investigations have been an accepted method of study for a number of decades.

Usefulness of Requested Studies in Furthering Resource Management Goals

These studies are critical for determining current and future effects to archaeological site deposits adjacent to the river. The results of the studies will allow for a more informed HPMP and subsequent PM&E measures.

Study Duration

Field work associated with the geoarchaeological investigations at these sites will take approximately 3 – 4 weeks to accomplish. For each day in the field we can assume that 2 – 3 days of associated office work will be required in order to prepare assessments, maps and a report.

Why Study Objectives Cannot be Achieved Using Data Already Available

PacifiCorp sponsored a 3-day geomorphology field trip for members of the CRWG to look at and discuss issues with their geomorphology contractors. This field trip was not sufficient to study the effects of the project on cultural resources. The geomorphology study was too general in scope to be able to address site specific issues.

Requests for geoarchaeological studies at specific sites were made during a number of CRWG meetings by Dr. Eric Ritter (BLM – Redding) and by Ron Reed (Karuk Tribe). In addition, the BLM requested (BLM First Stage Consultation Document, page 46) that PacifiCorp "identify project effects on flow hydraulics and geomorphic processes in the vicinity of cultural sites". This was not done. It is assumed that the general geomorphology studies conducted by PacifiCorp were meant to fulfill these requests. However, those studies did not focus on site specific impacts. The three-day geomorphology tour sponsored by PacifiCorp which did visit several sites along the river was not sufficient to address specific site erosion issues.

DOI 26. Study the Effects on Cultural Resources Should Keno Reservoir be Removed From FERC Jurisdiction. The objectives of the analysis are to prevent adverse effects from occurring to the known sites adjacent to the Reservoir shoreline.

Description of Recommended Study and Basis of Request

There are at least nine known archaeological sites that could be potentially affected by the decision to drop Keno Reservoir from the Project. PacifiCorp has not indicated what will become of these sites if the Keno Development is not part of their license application. A study is needed to analyze the full effects various scenarios could have on cultural resources located adjacent to the reservoir. For instance, a number of sites and portions of sites are submerged by the waters of the reservoir. If a decision is made to drain the reservoir to a return to a river-like setting, these resources will be exposed and will be easily accessible targets for unauthorized collection/looting activities. Likewise, if a decision is made to dredge sediment from the bottom of the reservoir in an attempt to improve downstream water quality, archaeological sites could be affected. These sites could also be adversely affected through the lack of management.

The Department requests that the Commission direct PacifiCorp to conduct the necessary studies to determine project effects should Keno Reservoir be removed from FERC jurisdiction.

Study Participants

The Department requests that the Commission direct PacifiCorp to fund and conduct the study and consult with state, federal and tribal resource agencies in study design and implementation including collection and analysis of data.

Methodology and Objectives

PacifiCorp needs to fully analyze the effects of removing Keno Reservoir from the project boundary on cultural resources. The objectives of the analysis are to prevent adverse effects from occurring to the known sites adjacent to the Reservoir shoreline. If adverse effects cannot be avoided, mitigation measures will be needed. The methodology should be developed and approved by the CRWG and the collaborative to ensure appropriate methods are used.

Acceptance of Recommended Study Methods

Analyzing the potential effects that a project might have on cultural resources is an accepted method of investigation in the scientific community.

Usefulness of Requested Studies in Furthering Resource Management Goals

Knowing the potential effects to cultural resources that removing Keno Reservoir from the FERC boundary may have is essential for the formulation of a management plan.

Study Duration

Until PacifiCorp reveals what will happen to this area after it is removed from the project boundary, there is no clear indication as to how long the studies might take to complete.

Why Study Objectives Cannot be Achieved Using Data Already Available

Removal of Keno Reservoir is a very recent development. While general data is available, too little information is presently known about what will actually happen to this area once it is no longer within the project boundary. Without a clear understanding of the future management of this area, it is impossible to know whether sufficient data is currently available.

If a study was not requested during pre-filing consultation process, explanation for why the request was not made at this time and why the request should be considered by the Commission

Removal of Keno Reservoir is a very recent development in the relicensing process. Since it was not an issue during pre-filing consultation, studies were never contemplated.

LAND MANAGEMENT AND AESTHETICS

DOI 27. Aesthetics Studies. The goal of this additional study is to complete a thorough analysis of impacts of the project facilities on aesthetics.

Rationale: The current aesthetics study is insufficient. Project facilities do not meet the BLM's Visual Management Classification (VMCs) or the aesthetic policies of Siskiyou County. NPS and BLM requested a more thorough analysis in both the DLA and preliminary Recreation Resource Management Plan (RRMP) comments. The application includes a very limited analysis on aesthetic resources. A more thorough analysis is needed to understand the impacts of the proposed project facilities on aesthetics.

Relevant Agency Authorities:

- BLM
  - Federal Power Act (FPA) Section 4(e)
  - Wild and Scenic River Act of 1968 - FERC license restrictions related to the national wild and scenic rivers system (Sec.7(a) and (b)); and Federal agency consideration for potential wild, scenic, and recreational river areas (Sec.5(d))
- NPS
  - Federal Power Act, regulations as amended - requires consultation with NPS (18 CFR 4.38(a) and 18 CFR 16.8(a)); identifies topics for consultation (18 CFR 4.51(f)(4),(5) & (6).
  - Wild and Scenic Rivers Act of 1968 - FERC license restrictions related to the national wild and scenic rivers system (Sec.7(a) and (b)); NPS assistance related to river resources (Sec.11(b)); and Federal agency consideration for potential wild, scenic, and recreational river areas (Sec.5(d))

DOI's Relevant Resource Goals and Objectives:

Overall Goal: Create, preserve, or enhance recreation and aesthetic resources by providing a broad range of developed and dispersed opportunities that meet current and projected demand while preserving and enhancing the natural character of the watershed and providing for other beneficial uses.

Objectives:

- Ensures that existing plans for the region (BLM's Klamath River Management Plan, Klamath National Forest Land Management Plan, SCORPs, County plans, etc.) are considered while developing a comprehensive recreation and aesthetic resource plan for the project.
- Ensure that the free flowing condition and outstandingly remarkable values of the Klamath National Wild and Scenic River in CA and OR are protected and enhanced by conducting an accurate assessment of the KRP's affect on the river including downstream of Iron Gate Dam.

Project Impacts on Resource Goals and Objectives*:* Scenery is one of the WSR's outstanding remarkable values for the Klamath River from J.C. Boyle Powerhouse to the Stateline. DOI has a mandate to protect and enhance the outstanding remarkable values designated in WSR. PacifiCorp's project facilities including the dams, powerhouses, canals, etc. have an impact on aesthetics. Many of these facilities are currently not in compliance with BLM's aesthetics standards.

Inadequacy of the Work Completed by PacifiCorp and Recommended Action*:* The existing study identified key observation points (KOPs) and used them for defining where the appearance and visual contrast of existing facilities are incompatible with the surrounding natural landscape. KOPs are to be used as a snapshot or reference point, to identify what a typical visitor might see at a particular viewpoint. KOPs should not be used for defining the only points of interest where visual contrasts need to be addressed. Project compliance is needed with BLM's aesthetic standards, which are its "Visual Management Classes" (VMCs). To meet the BLM VMCs, the Aesthetic/Visual Enhancement study must first evaluate all PacifiCorp project facilities to identify their current consistency, or noncompliance with the VMC's, as well as the aesthetic policies of

Siskiyou County. Viewpoints should include BLM's inventory of sensitive roads, trails, public use and recreation sites for the Klamath River and its reservoirs that were initially used to develop the VMCs. DOI requests a thorough investigation of existing facilities as they relate to visual resources.

SOCIOECONOMIC RESOURCES

DOI 28. Electrical Service Rate Structure Study. Assess the impacts to electrical service users due to excluding the East and West Side Power Developments downstream of Link River Dam and assess the impacts to electrical service users due to expiration of the electrical service contract with electrical service users.

Description of Recommended Study

This is to include the impacts and costs of change in the electrical service rate structure due to the loss of East and West Side Power Developments on Link River.

The Department requests that the Commission direct PacifiCorp to identify the process it will use to develop a new electrical service rate structure. The process must include a description of any studies needed to support that process. The process and study should recognize the need for periodic rate increases but should also recognize the need to transition into a new rate structure in a way that will not result in an undue economic hardship to the agricultural industry that has been historically served by both the Klamath Hydroelectric Project and Klamath Irrigation Project. Identification of a new service rate structure should be completed before the granting of a new license to the applicant. Further, the results of the new rate structure should be included in the economic impact analysis that will be incorporated into FERC's National Environmental Policy Act documents and decisions.

Basis for Request

DOI is very concerned about the content of the Final License Application (FLA) and believes it is incomplete and inadequate in several areas, including its treatment of facilities that have been part of the historic PacifiCorp Klamath Hydroelectric Project, but would be eliminated under a license issued pursuant to the FLA as proposed by PacifiCorp. Although PacifiCorp had indicated throughout the collaborative process that it was considering a project that might not look like the original project, it wasn't until the October 2003 Collaborative Meetings that PacifiCorp announced its intent to remove the East and West Side Power Developments and Keno Reservoir from the licensing process. The Draft License Application, distributed in July 2003, made no mention of this change, and DOI's comments on the Draft did not reflect any concerns regarding this change due to the ommission. DOI acknowledges that eliminating these facilities from the project under a new license may be beneficial to PacifiCorp, within PacifiCorp's authority to propose, but such an action must be part of the new application and the FLA must consider all of the ramifications of that action on operation of the irrigation project. Impacts need to be completely identified and appropriate mitigation presented that will minimize the impacts of such an action.

PacifiCorp has an electrical service contract dated 1956 with Klamath Irrigation Project electrical service users, non- Klamath Irrigation Project electrical service users and governmental entities. The contract will expire on April 14, 2006.

Entity Responsible - PacifiCorp

Study Participants – DOI, Tribes, Klamath Irrigation Project electrical service users, non- Klamath Irrigation Project electrical service users, and governmental entity electrical service users

Study Objectives and Methods

Study Objectives

Assess the impacts to electrical service users due to excluding the East and West Side Power Developments downstream of Link River Dam.

Assess the impacts to electrical service users due to expiration of the electrical service contract with electrical service users.

Provide a clearly defined future rate structure for Klamath Basin electrical service users.

Study Methodology

Conduct an economic analysis of the change in electrical service rate structure with a time frame for the rate structure to coincide with the new license term.

Acceptance of the Recommended Study Methods in the Community

Economic analysis is commonly used for electrical service rate studies.

How the Study Will Be Useful in Furthering DOI Resource Management Goals

Reclamation's mission is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public. The Klamath Irrigation Project was authorized in 1905 to provide for the irrigation of approximately 240,000 acres of land in south-central Oregon and north California.

Reclamation's objectives in conducting operations on the Klamath River are to 1) assure that operation of the Klamath Irrigation Project is conducted in a way that assures the agricultural community with a reliable supply of water for irrigation purposes. Consistent with that priority, Reclamation operates its facilities in a way that assures protection of natural resources within the standards identified by resource management agencies of the States and the Federal Government.

A reliable supply of water for irrigation purposes is directly tied to reliable electrical service for Reclamation's customers and Reclamation's mission to manage, develop, and protect water and related resources water in the interest of the American public in an environmental and economically sound manner.

DOI has a trust responsibility to protect the interests of Native American Tribes. These include the federally recognized tribes in the Klamath Basin which are the Yurok, Karuk, Hoopa Valley, and Klamath Tribes as well as the Resighini Rancheria of California. Interior committed to carrying out its Tribal Trust responsibilities, in cooperation with the FERC, to protect the fish, wildlife, botanical, cultural, and historic resources the Federal government holds in trust for the benefit of the Tribes. In relationship to the Tribes, and specifically the individual members of the tribes that have electrical service, depend on a known published electrical service rate structure.

Time Required for Study

DOI estimates that the time required for a study would be from three (3) to six (6) months. It would consist of an analysis of existing electrical service data, company resources, and revenues to compensate for the lack of the use of the East and West Side Power Developments on Link River, presentation of preliminary results

to decision makers, PacifiCorp's decision on a rate and time structure to coincide with the new FERC license term.

Why the Study Objectives Cannot Be Achieved Using Data Already Available

This is analysis of future costs and revenues projected by PacifiCorp. The decision makers within PacifiCorp need to be a part of this activity. None of this propriety data is available outside of PacifiCorp.

Why the Study was not requested in the Pre-filing Consultation Process

Although PacifiCorp had indicated throughout the collaborative process that it was considering a project that might not look like the original project, it wasn't until the October 2003 Collaborative Meetings that PacifiCorp announced its intent to remove the East and West Side Power Developments and Keno Reservoir from the licensing process. The Draft License Application, distributed in July 2003, made no mention of this change

Why the Request Should Be Considered by the Commission

Proposed changes have not been discussed at any level of specificity by PacifiCorp until the FLA. PacifiCorp states I the FLA that no socioeconomic impacts are expected. DOI believes this is inaccurate. Electrical service rates are forecasted to go up approximately ten percent. In order for the electrical service users to have some sort of certainty, a new, post-April 2006 electrical service rate structure is requested for all present electrical service users.

Historically, PacifiCorp has provided electrical service to the Klamath Irrigation Project, as well as to irrigators who are not part of the Project. Due to the configuration of the irrigation project, considerable amounts of electrical energy are needed to operate the features and facilities (such as pumps) to provide service to both the irrigation community and the national wildlife refuges in the project area. In addition to the federal needs for electrical energy, local irrigators also use substantial electrical energy, primarily for operation of individual pumps for supplying water to crops and for drainage. The principal needs for electrical energy are for pumping water.

PacifiCorp has provided reliable electrical energy at prices that have allowed for efficient and economically favorable agriculture in the Upper Klamath Basin. Electrical energy consumption represents a major cost in a farm budget and changes to the service cost structure can have potentially significant adverse economic impacts on irrigation water users and, in turn, the community as a whole.

The FLA notes that irrigated agriculture is an important component of the Project area economy. It presents the following statistics regarding irrigated agriculture in the Klamath Hydroelectric Project area.

- There are 1744 farms and ranches that use irrigation water supplied by the federal Klamath Irrigation Project.
- Eighty percent of farms using irrigation water are located in either Siskiyou County, California or Klamath County, Oregon; which are the two counties in the Hydroelectric Project service area.
- Approximately 490 farms, representing 41 percent of the farmed acres in the Klamath Irrigation Project, receive their water from Keno Reservoir.
- Approximately 95,600 acres of Klamath Project lands are irrigated from Keno Reservoir
- An additional 4,000 acres of non-federal lands are irrigated from Keno Reservoir

The FLA does not adequately address the likely significant adverse economic impact on irrigation water users and to DOI for operating the Klamath Project, if the cost of electrical service dramatically increases. The

document states that "It is not anticipated that the incremental changes resulting from the proposed (Hydroelectric) Project and PM&E measures ***would lead to changes in employment and earnings in any other sectors of the economy*** (emphasis added)."

The special electrical service rate presently available to water users pursuant to a separate contract between Reclamation and PacifiCorp will likely not be available after early 2006. While not an element of the new license, the FLA provides no information about what the rate structure for service to the irrigation community will be in 2006 and beyond. The Applicant has informally indicated, in discussions at the collaborative meetings, that the current rate structure will likely change, but has not indicated what that new structure will be. The result is significant uncertainty about economic consequences and future for irrigation water users in DOI's irrigation project.

DOI believes FERC will be able to conduct a thorough analysis of the economic impacts to the irrigation community in the National Environmental Policy Act document that will be prepared for the FLA if this study request is granted and PacifiCorp completes the study.

DOI 29. **Tribal Health Study**. Explore the possible relationship in the decline of fish in the river and the health issues of the Karuk tribal members who have been forced to rely on less healthy foods in their diet.

The gradual decline in the anadromous fish population in the Lower Klamath River over the past century has had a variety of impacts to the Native American tribes who have lived for centuries along the river. Salmon has always been, and continues to be, a crucial item in the tribes' cultures, serving as a major source of food in their diet and providing a source of income through the commercial fisheries. The life stages of the salmon are central to the rich ceremonial heritage of the Lower Klamath River tribes.

The continuing lack of salmon in the everyday diet of the members of the Karuk Tribe, who occupy the middle reaches of the Lower Klamath River, is beginning to be perceived as a potentially serious factor in the health of the people. Health issues such as strokes, heart attacks and other heart-related problems affecting numerous tribal members in recent times have led some to suggest that dependence on a less healthy diet without fish is contributing to this health decline. Replacing fish with more foods higher in cholesterol could contribute to a greater tendency toward more heart-related problems.

Although this health issue among the Karuk people has yet to be linked directly to the decline of fish in their diet, it seems a logical hypothesis given the high value placed on fish for cholesterol-reducing diets of heart patients. Therefore, we request that PacifiCorp consider initiating a study to explore the possible relationship in the decline of fish in the river and the health issues of the Karuk tribal members who have been forced to rely on less healthy foods in their diet. The Karuk traditionally relied on the spring run of Chinook salmon which has been adversely impacted by PacifiCorp's project.

ATTACHMENT 3: References and Appendices

TABLE OF CONTENTS

Appendix A: Historic Photos of the Klamath River.....1

Appendix B: Summarized Water Quality Model Outputs 5

Appendix C: Draft FLA Discussion of Fish Passage and Instream Flow 17

References 20

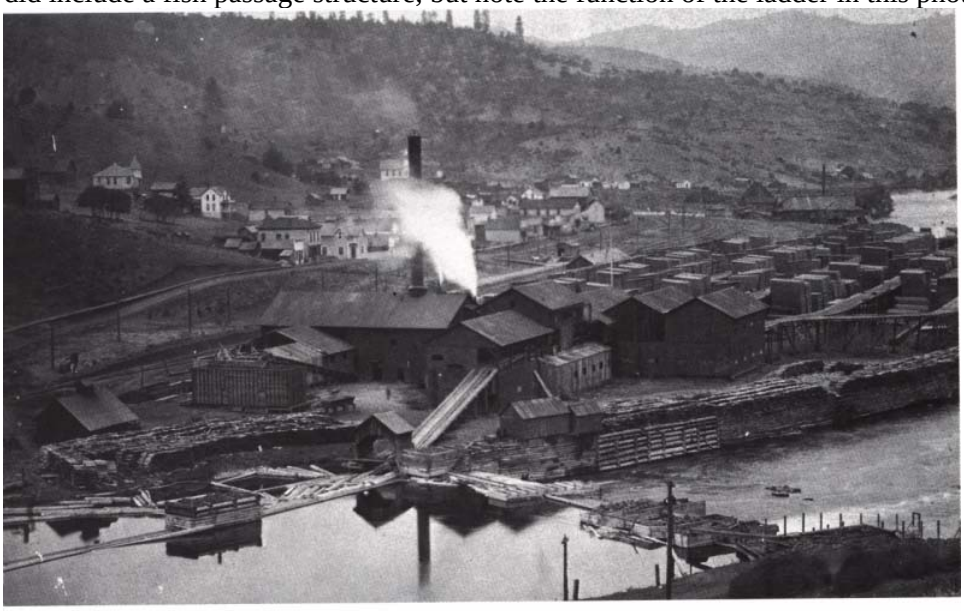
Appendix A: Historic Photos of the Klamath River

Photo 1 – Klamathon was located near the current towns of Grenada and Yreka.

Klamathon Dam and Fish Ladder.

Courtesy Siskiyou County Historical Society

Photo 2 – Klamathon Dam with spillgates open, presumably in the spring time. Klamathon dam did include a fish passage structure, but note the function of the ladder in this photo.



Klamathon Mill, 1900. Business district and homes not seen in this view.

Courtesy Siskiyou County Historical Society

Photo 3 – Topsy Bridge, which also functioned as a splash dam. This bridge was located about 1000-1500 feet upstream of current day JC Boyle Dam. Splash dam operation began and ceased

in 1891 (Bowden 2003). Downstream gold miners complained about the sudden changes in water elevations and had the splash dam log drives stopped (Photo by Maud Baldwin).

The Klamath River bridge.

Photo 4 – Pokegama Chute operated for a number of years in the 1890s. Logs were transported down the chute into the river above present-day Copco Reservoir, and then were floated down to Klamathon in the Klamath River.

Pokegama log chute dumped logs into river.

Courtesy Klamath County Historical Society

Photo 5 – Early photo of salmon fishing in the Link River.

Link River salmon "fishing" around 1860.
Site of present Klamath Falls.
Courtesy Klamath County Historical Society

Photo 6 – This photo provides clear documentation of salmon in the Link River (photo by Maud Baldwin).

Gentlemen display their catch while salmon fishing on the rapids of Link River, 1891.

Appendix B: Summarized Water Quality Model Outputs

Modeled Water Temperature Patterns

Monthly Median Water Temperatures [1, 2]

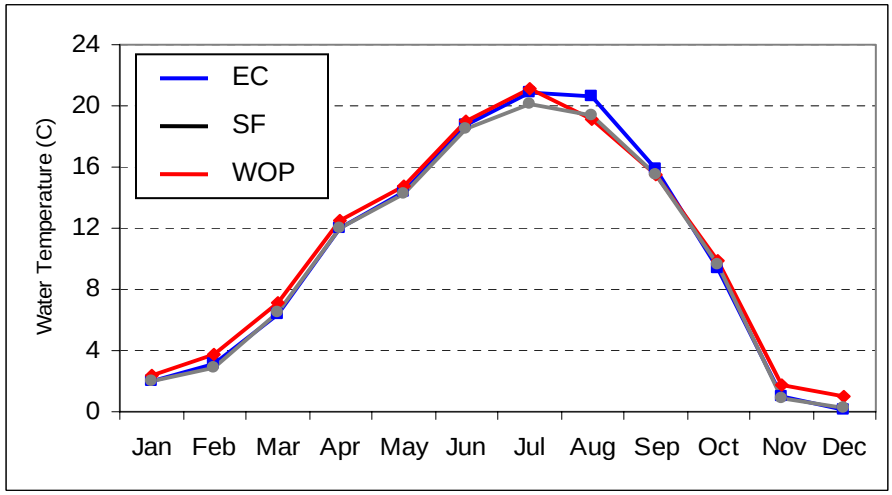


Figure 1. Modeled 2000 median water temperatures at the upstream end of the J.C. Boyle bypass reach.

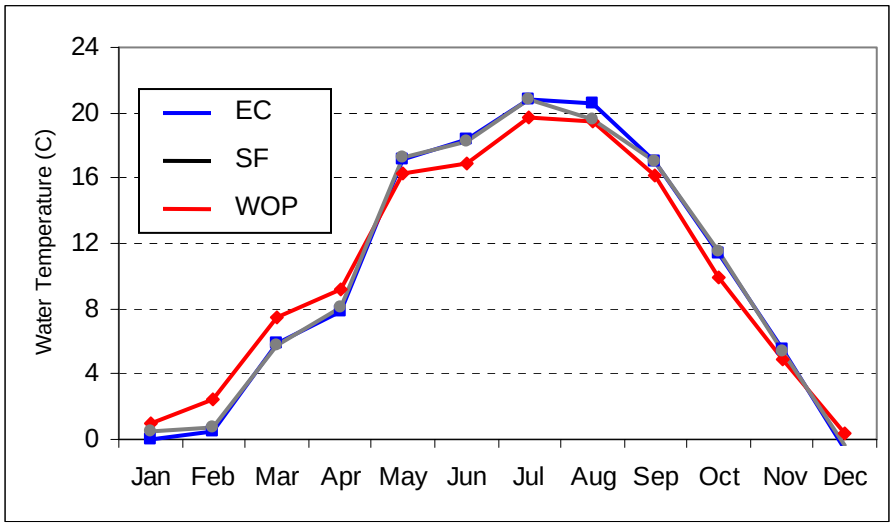


Figure 2. Modeled 2001 median water temperatures at the upstream end of the J.C. Boyle bypass reach.

[1] Analyses presented in this appendix are derived from water quality conducted by the Applicant (described in the Water Resources Final Technical Report). These analyses compare the results of the Existing Condition (EC), Steady Flow (SF) and Without Project I (WOP) scenarios.
[2] Median values represent the monthly median of daily average water temperatures.

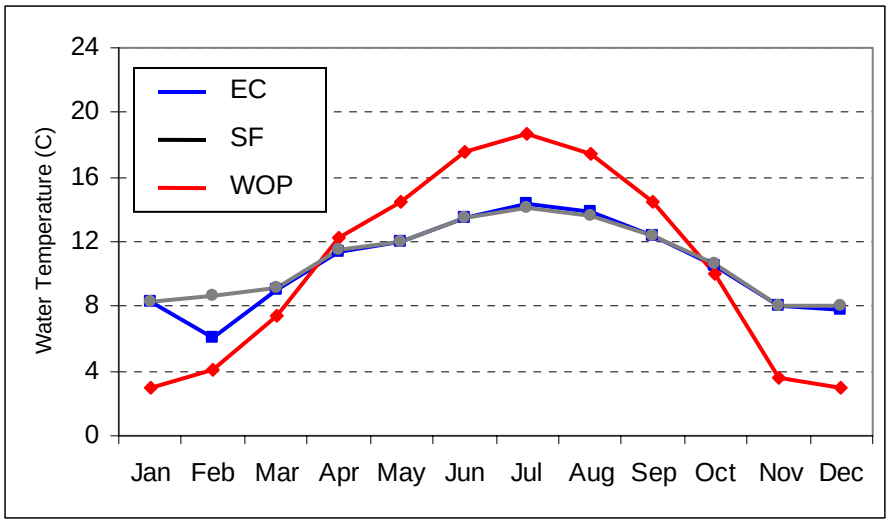


Figure 3. Modeled 2000 median water temperatures at the downstream end of the J.C. Boyle bypass reach.

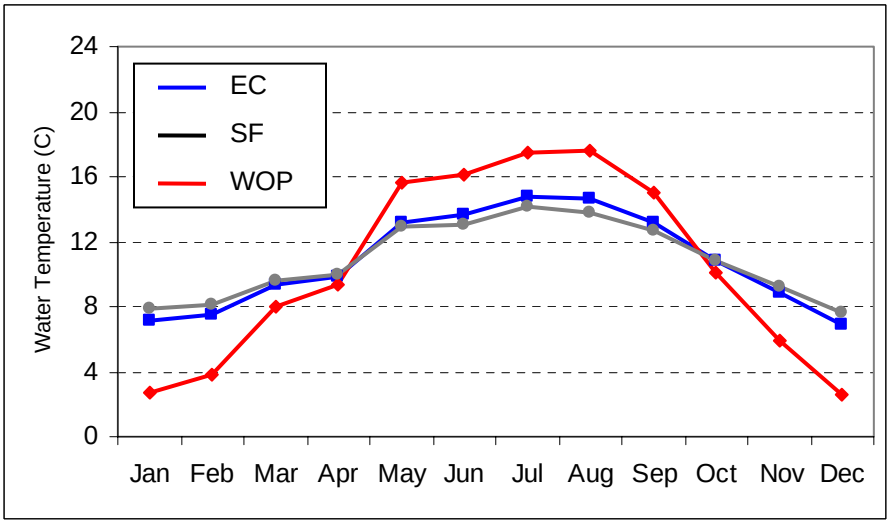


Figure 4. Modeled 2001 median water temperatures at the downstream end of the J.C. Boyle bypass reach.

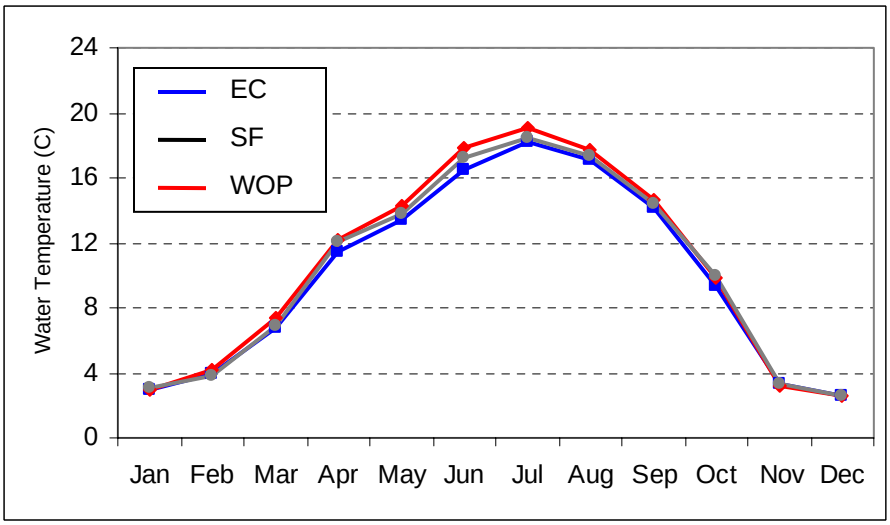


Figure 5. Modeled 2000 median water temperatures at the Oregon/ California boundary.

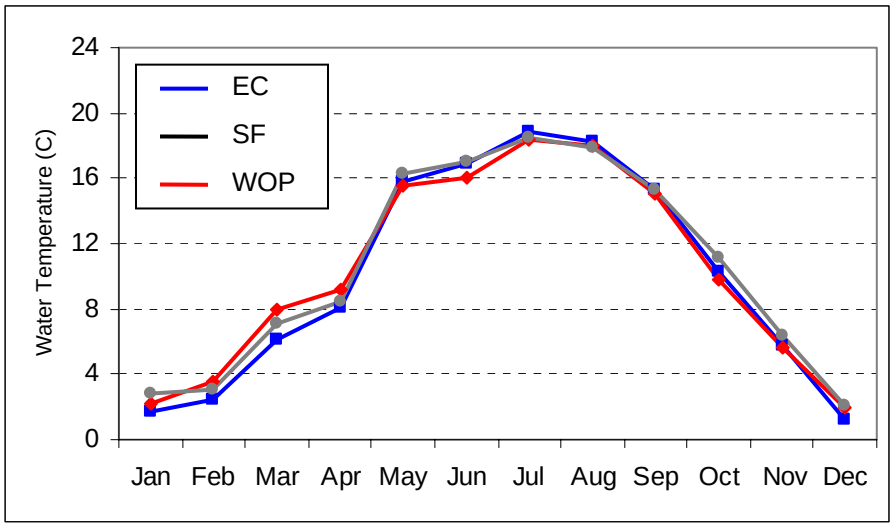


Figure 6. Modeled 2001 median water temperatures at the Oregon/ California boundary.

Monthly Maximum Water Temperatures

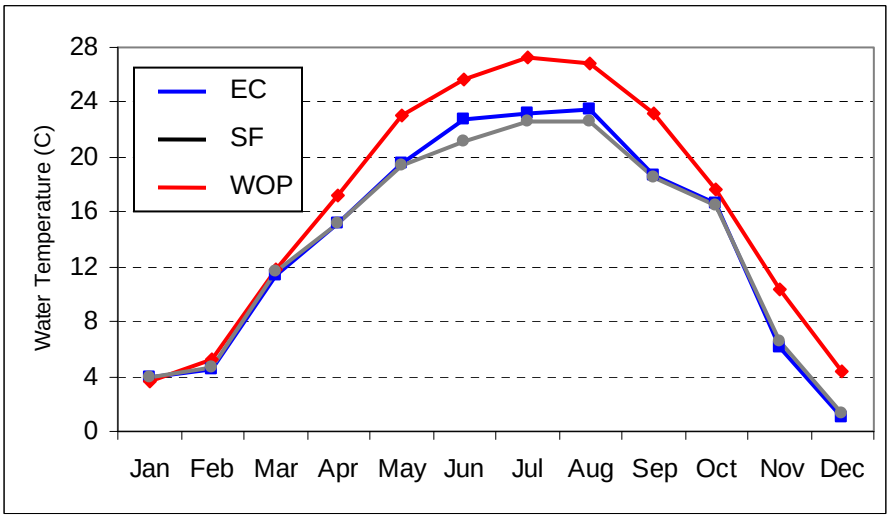


Figure 7. Modeled 2000 monthly maximum water temperatures at the upstream end of the J.C. Boyle bypass reach.

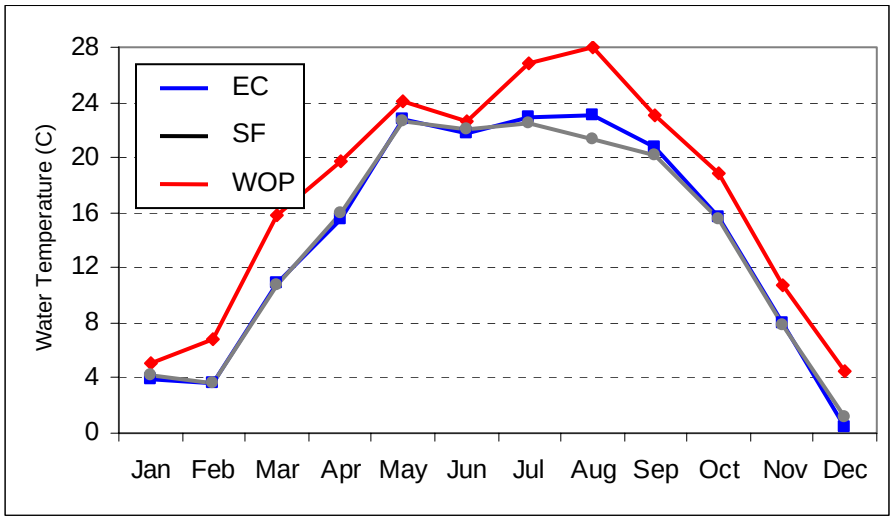


Figure 8. Modeled 2001 monthly maximum water temperatures at the upstream end of the J.C. Boyle bypass reach.

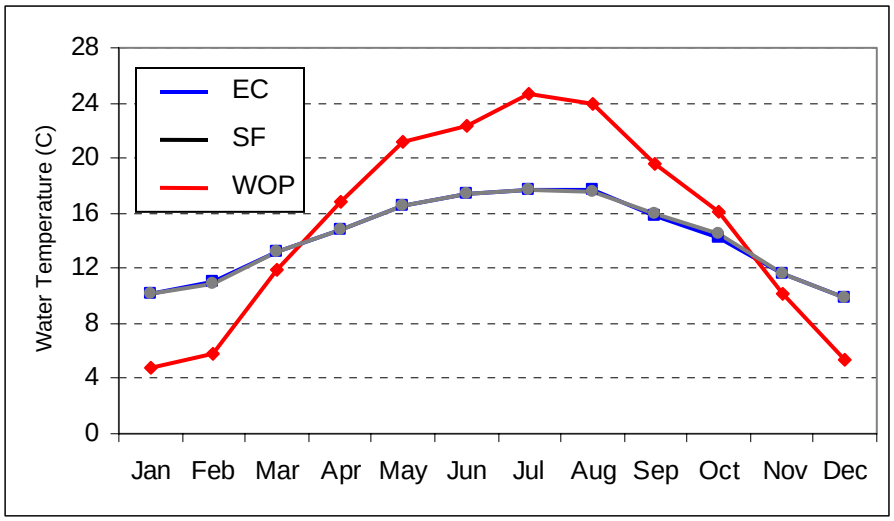


Figure 9. Modeled 2000 monthly maximum water temperatures at the downstream end of the J.C. Boyle bypass reach.

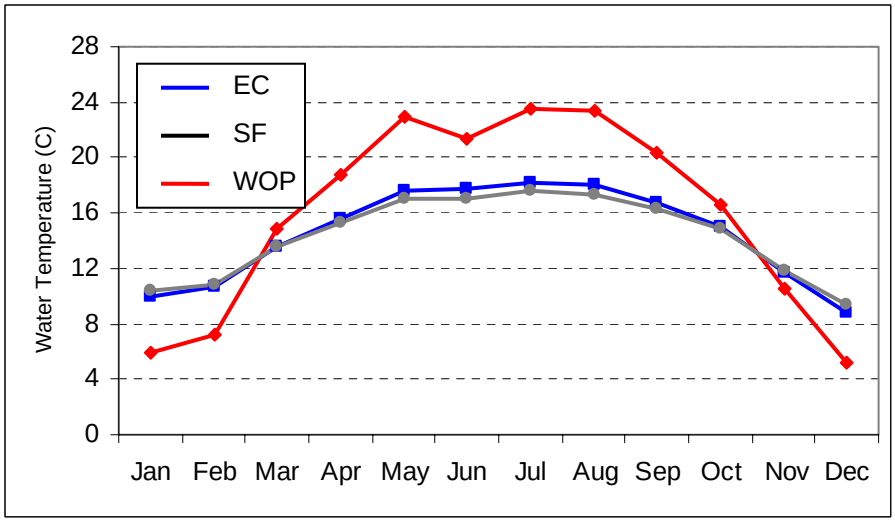


Figure 10. Modeled 2001 monthly maximum water temperatures at the downstream end of the J.C. Boyle bypass reach.

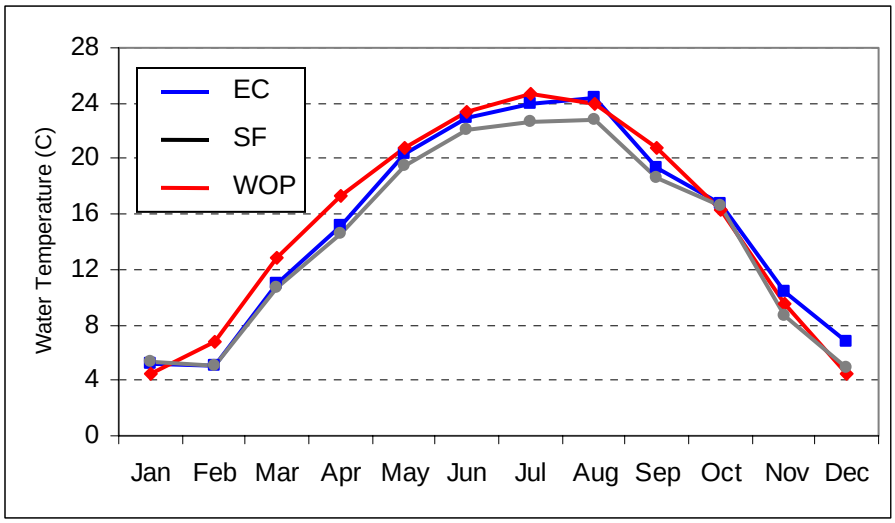


Figure 11. Modeled 2000 monthly maximum water temperatures at the Oregon/California boundary.

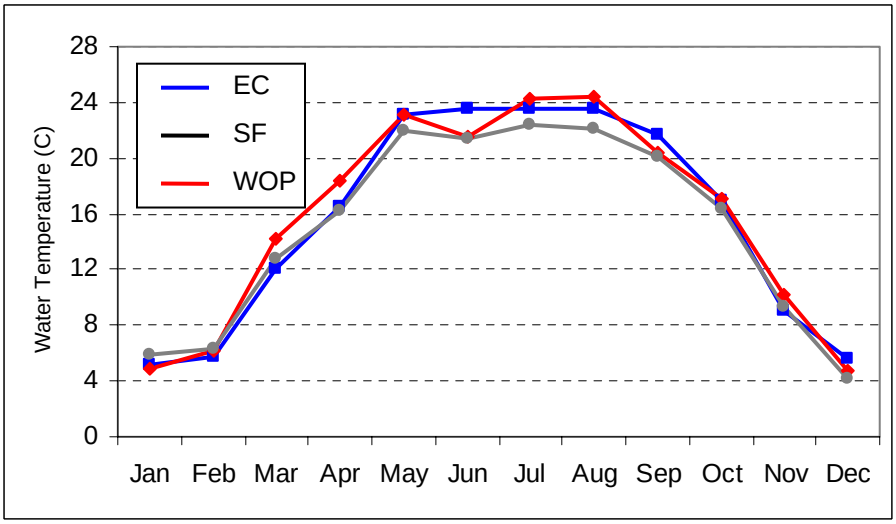


Figure 12. Modeled 2001 monthly maximum water temperatures at the Oregon/California boundary.

Modeled Dissolved Oxygen Patterns

Monthly Median Dissolved Oxygen Concentrations [3]

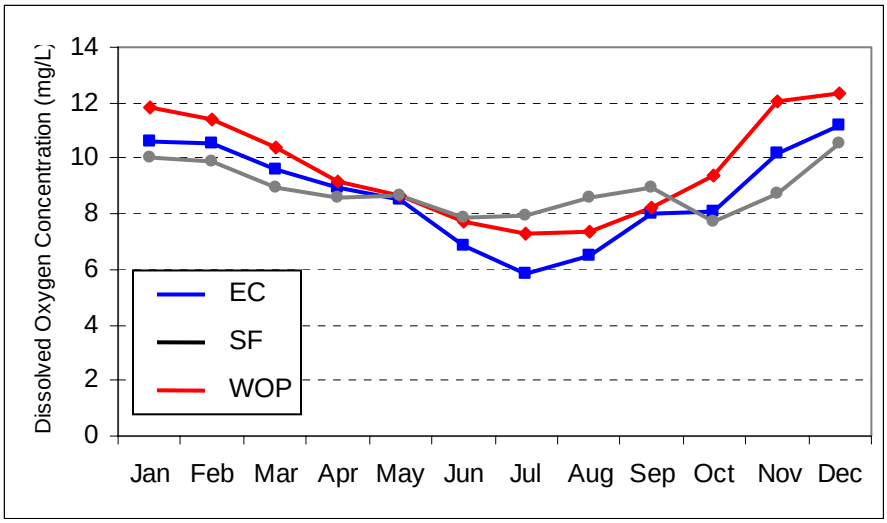


Figure 13. Modeled 2000 median dissolved oxygen concentrations at the upstream end of the J.C. Boyle bypass reach.

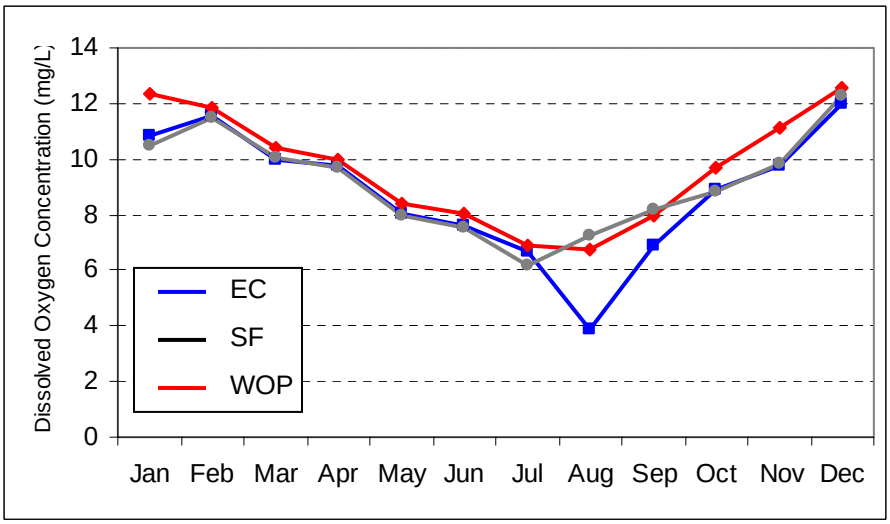


Figure 14. Modeled 2001 median dissolved oxygen concentrations at the upstream end of the J.C. Boyle bypass reach.

[3] Median values represent the monthly median of daily average dissolved oxygen concentrations.

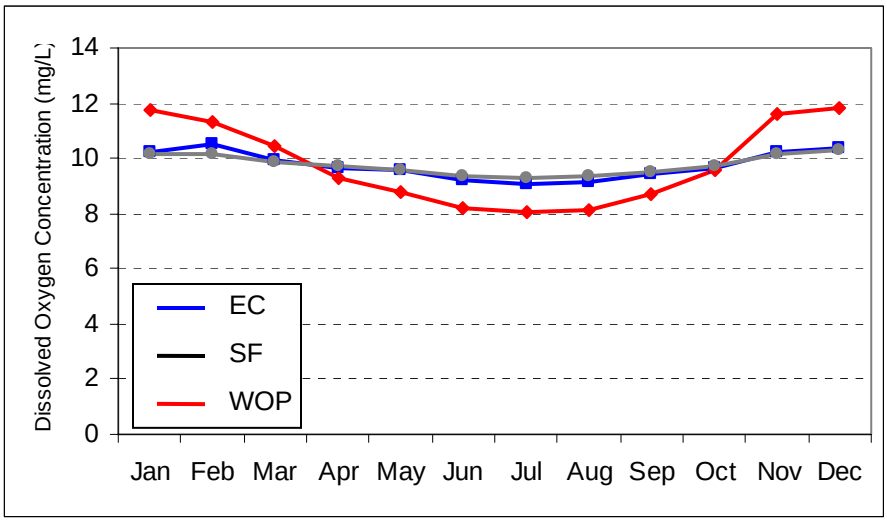


Figure 15. Modeled 2000 median dissolved oxygen concentrations at the downstream end of the J.C. Boyle bypass reach.

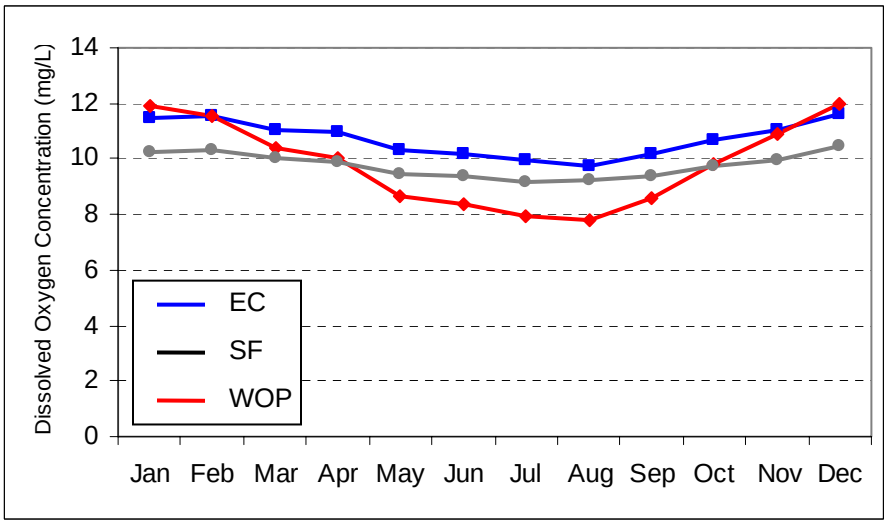


Figure 16. Modeled 2001 median dissolved oxygen concentrations at the downstream end of the J.C. Boyle bypass reach.

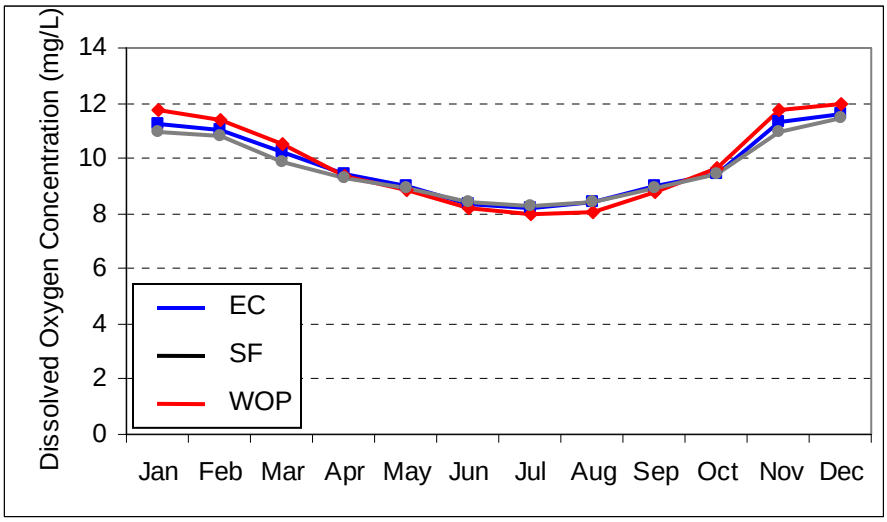


Figure 17. Modeled 2000 median dissolved oxygen concentrations at the Oregon/California boundary.

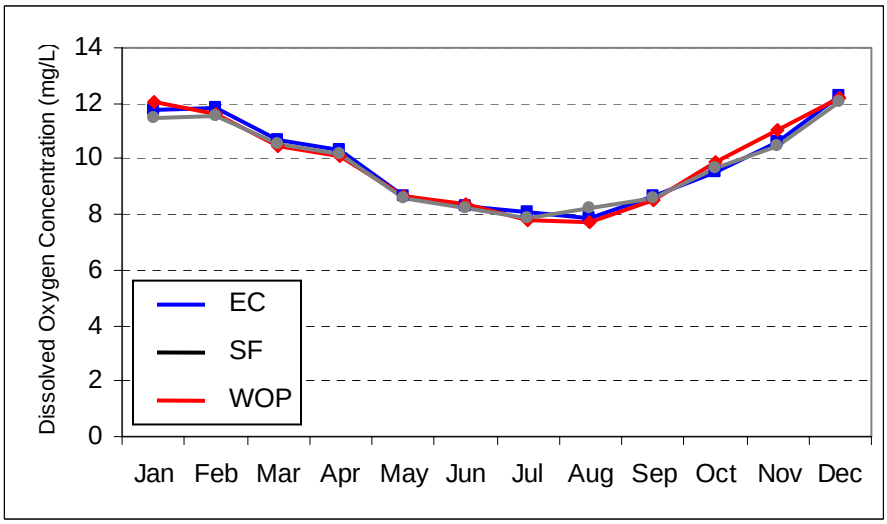


Figure 18. Modeled 2001 median dissolved oxygen concentrations at the Oregon/California boundary.

Monthly Minimum Dissolved Oxygen Concentrations

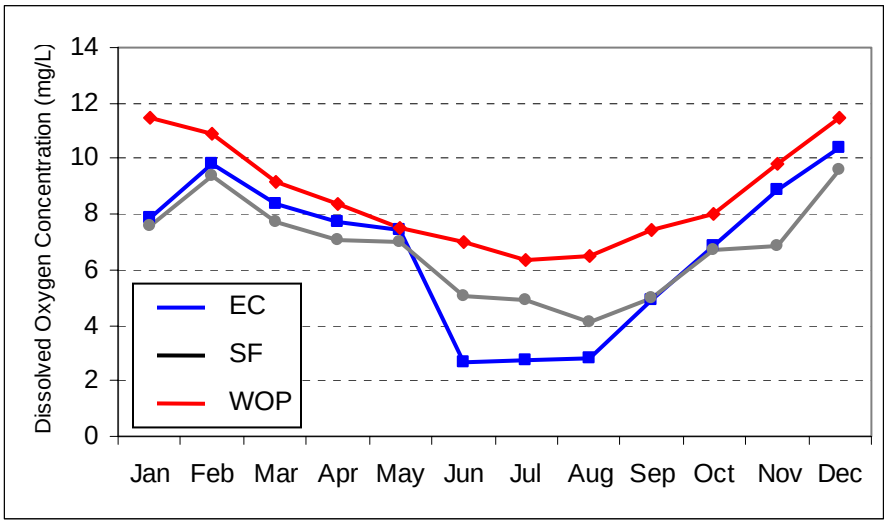


Figure 19. Modeled 2000 monthly minimum dissolved oxygen concentrations at the upstream end of the J.C. Boyle bypass reach.

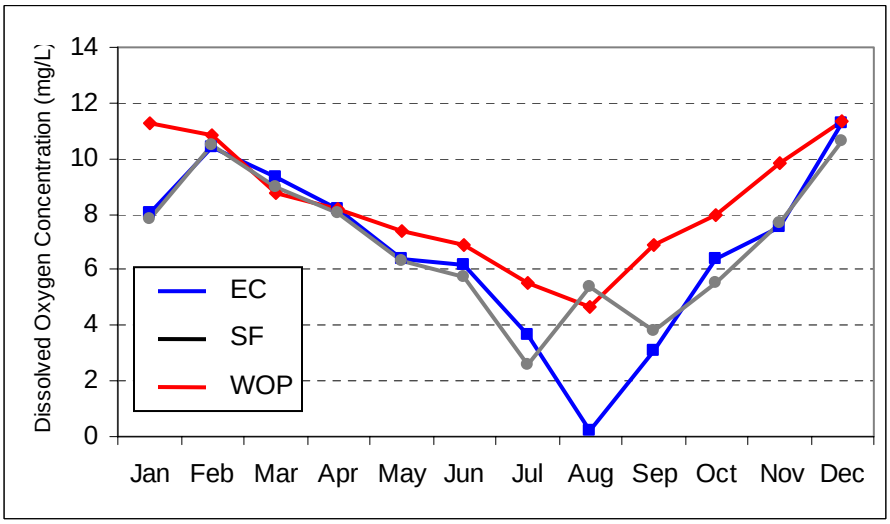


Figure 20. Modeled 2001 monthly minimum dissolved oxygen concentrations at the upstream end of the J.C. Boyle bypass reach.

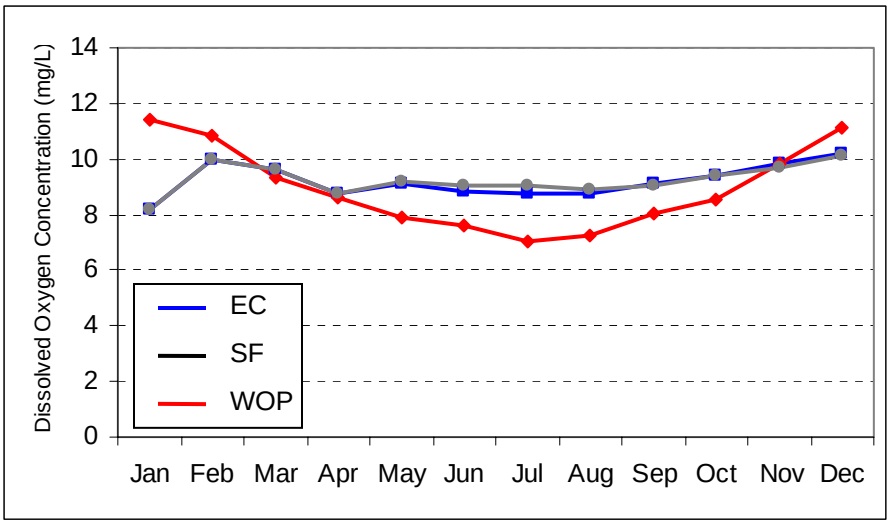


Figure 21. Modeled 2000 monthly minimum dissolved oxygen concentrations at the downstream end of the J.C. Boyle bypass reach.

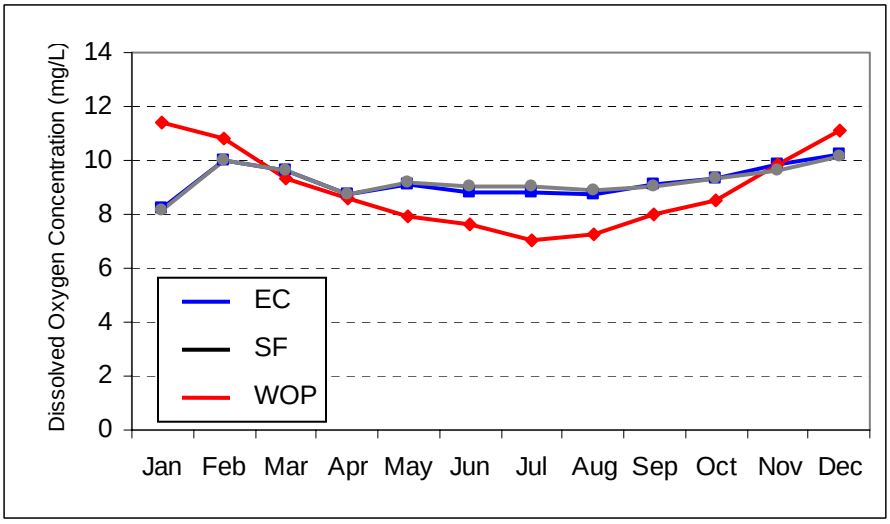


Figure 22. Modeled 2001 monthly minimum dissolved oxygen concentrations at the downstream end of the J.C. Boyle bypass reach.

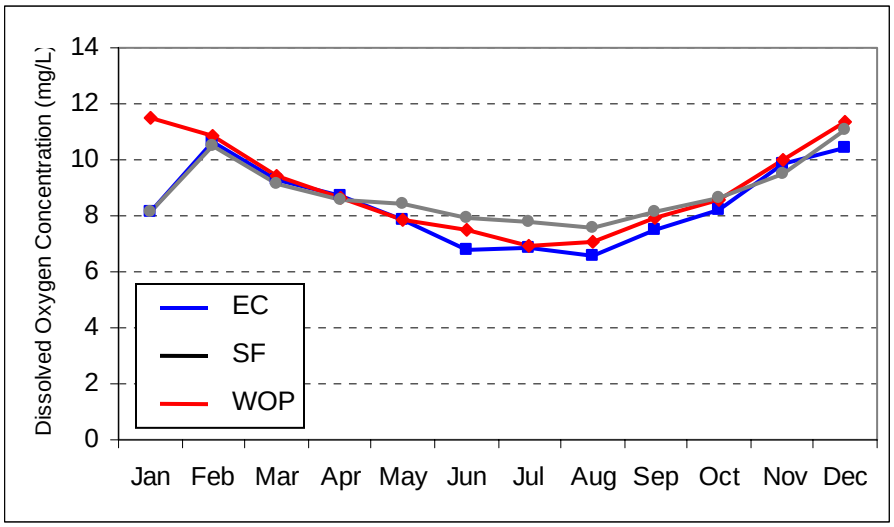


Figure 23. Modeled 2000 monthly minimum dissolved oxygen concentrations at the Oregon/California boundary.

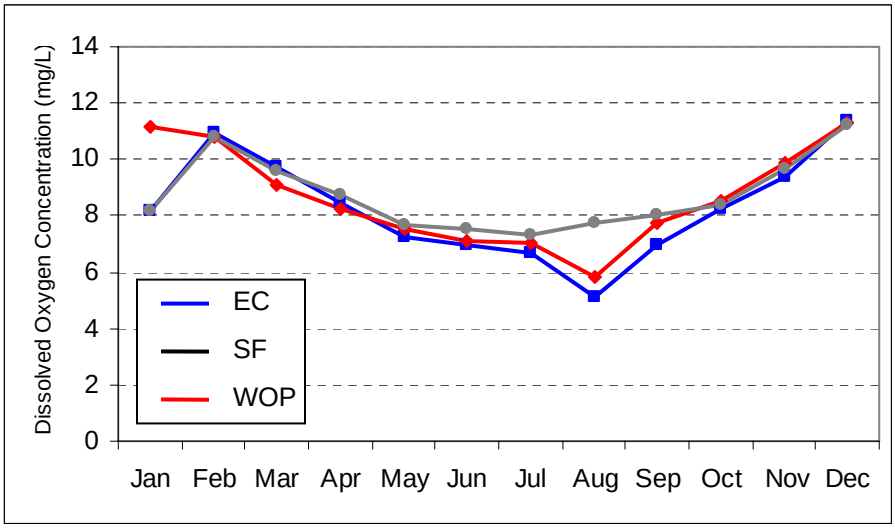


Figure 24. Modeled 2001 monthly minimum dissolved oxygen concentrations at the Oregon/California boundary.

Appendix C: Draft FLA Discussion of Fish Passage and Instream Flow

This appendix includes text collaboratively developed by the Aquatics and Fish Passage working groups describing aspects of the work remaining which is necessary to complete the Fish Passage Modeling Study and Instream Flow Study. As shown by the excerpts from emails sent by the working group facilitators, there was general agreement that the FLA needed to include a discussion of how study efforts that are still under way could be completed. This discussion was not included in the FLA.

A. Insert for the FLA – Fish Passage Modeling Section.

Excerpt from an E-mail dated 01/28/2004 by Emily Armstrong of Kearns and West:

At the January 15th & 16th Habitat Modeling Subgroup meeting, the subgroup felt it was important to include language in the Final License Application that describes what the group plans to accomplish over the next several months regarding the investigation of reintroducing anadromous salmonids in the Project area and the upper basin. Draft language was distributed to subgroup members on Tuesday, January 20th. Edits were made based on feedback received over the last week. Attached is the final version of the language that will be included at the beginning of the fish passage modeling section of the final technical report in the FLA. Thanks to those of you who provided edits via email.

In the License Application PacifiCorp will include up front in the fish passage modeling section the following:

The Habitat Modeling Group (HMG) will continue working in 2004 to investigate the reintroduction of anadromous salmonids in the Project area and the upper basin. The tasks PacifiCorp and stakeholders commit to completing in 2004 correspond with both modeling issues, and finding solutions to the issues identified in previous anadromous fish reintroduction reviews. A description of the tasks and a time frame for completing each is presented below:

- *Conduct a parameter-by-parameter review of the habitat and fish passage inputs used in modeling stream habitat in both the Project area and the Upper Klamath River Basin (above Keno dam). As can be seen from the preliminary EDT results presented above, the accuracy of key assumptions regarding harvest, dam and reservoir survival have tremendous influence on resulting estimates of production. The parameter review is expected to be complete by April 2004.*
- *Identify and model other anadromous species that could be candidates for reintroduction to the Project area and upper basin. (Complete by June 2004)*
- *Develop criteria for modeling a "restored condition" for habitat in the upper basin. Based on these criteria develop a suite of actions that would meet habitat objectives and goals. Different actions and approaches would be combined and modeled as separate scenarios to determine the best reintroduction strategy. Information on expected benefits, when these benefits are likely to be achieved, and how they may effect the implementation of different fish passage facilities and their location would be described. This task would start in June 2004 and continue until completed.*

- *Identify reintroduction strategies including broodstock source, stocking strategy, numbers of fish released, their location, and the facilities needed. Also, identify the parties that will need to be contacted to assist in this effort (start in May 2004)*
- *Identify those issues that parties outside of the HMG will need to address before reintroduction can take place. For example, parties outside of the HMG will need to provide input (both policy and technical) on issues such as candidate introductory stocks, anadromous fish impacts on disease prevalence, and competition with resident redband trout populations. (May 2004)*
- *Identify critical data gaps and uncertainties that will need to be addressed through data collection or other methods (modeling etc.). Priority would be given to those data gaps that are needed for decision-making. This task would be on-going throughout the process.*

PacifiCorp will be submitting the results of HMG efforts to the stakeholders for review and comment as they are completed. PacifiCorp expects to use the work performed by the HMG to better define PacifiCorp's role in any proposed anadromous fish reintroduction effort. As the above tasks are completed, PacifiCorp will review this additional information, and revise as appropriate the Project Operations and PM&E measures included in this License Application.

B. Insert for the FLA – Instream Flow Study Section of FTR.

Excerpt from an E-mail dated 01/28/2004 by Emily Armstrong of Kearns and West:

"At the January 14th & 15th IFIM Subgroup meetings, the group discussed the importance of including language in the Final License Application that spells out what the group hopes to accomplish over the next several months regarding instream flow study tasks. A conference call was held on January 21st with the subgroup to review a first draft of the language. Edits were made based on feedback received during the conference call and via email following the conference call. Attached is the final version of the language that will be included at the beginning of the instream flow study section of the final technical report in the FLA. Thanks to those of you who participated on the call and provided edits via email."

In the License Application PacifiCorp will include up front in the instream flow study section the following:

This study has received much attention from PacifiCorp and the relicensing stakeholders. Many meetings have been conducted by the Aquatic Working Group and the Working Group's Instream Flow Subgroup. The Subgroup was formed to work through technical issues and towards agreed upon instream flow input, analysis, and recommendations. PacifiCorp recognizes, and requests that FERC also recognize that additional collaboration, refinement of model input variables, and analysis is needed with stakeholders to meet the company's commitment to complete the instream flow study needed to provide a good technical basis for instream flow recommendations. This includes such items as working collaboratively to develop and produce agreed upon modeling input, and consequently modeling results and recommendations.

PacifiCorp constructed its own rainbow trout envelope curves that were used for the instream flow analysis. However, these curves have not been reviewed or approved by the Instream Flow subgroup. As such, stakeholders have technical uncertainty surrounding the instream flow analysis presented in this application. PacifiCorp and the stakeholders will continue to develop Klamath River HSC curves.

In order to address the instream flow study tasks, PacifiCorp and relicensing stakeholders will continue to meet to work on the following:

- *Approve rainbow trout and sucker HSC curves,*
- *Develop a habitat time series,*
- *Complete bioenergetics modeling efforts,*
- *Conduct peaking analysis,*
- *Discuss modeling results as they relate to fisheries and other interrelated studies (e.g., recreation, geomorphology, etc), and*
- *Develop river flow regime recommendations for aquatic resources*

It is anticipated that the above tasks will be completed by the end of May 2004. At the conclusion of these tasks, a final instream flow report will be distributed to FERC and interested stakeholders by the end of June 2004. At that time PacifiCorp will review this additional information, and revise as appropriate the Project Operations and PM&E measures included in this License Application.

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