Oregon
Theodore R. Kulongoski, Governor

Water Resources Department
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April 14, 2004

Magalie R. Salas, Secretary
Federal Energy Regulatory Commission
888 First Street NE
Washington D.C. 20426

ELECTRONIC FILING

Subject: State of Oregon's Comments on PacifiCorp's Klamath Hydroelectric Project (FERC # 2082) Final License Application and Additional Study Requests.

Dear Secretary Salas:

On February 26, 2004, the Federal Energy Regulatory Commission (FERC) issued a "Notice of Application Tendered for Filing with the Commission, Soliciting Additional Study Requests, and Establishing Procedural Schedule for Relicensing and a Deadline for Submission of Final Amendments" for PacifiCorp's Klamath Hydroelectric Project (Project) (FERC # 2082). This Project is located on the Klamath River in southwestern Oregon and northern California.

In response to this notice, the State of Oregon Hydroelectric Application Review Team (HART) has prepared comments on the Klamath Project's Final License Application as well as Additional Study Requests. The Klamath HART is a team of state agencies that are required under Oregon law to "represent the state in any federal proceeding to reauthorize the federal license for the project." Oregon Revised Statute (ORS) 543A.400(3)(a). The Klamath HART is made up of the following state agencies: the Oregon Department of Environmental Quality (ODEQ), the Oregon Department of Fish and Wildlife (ODFW), the Oregon Parks and Recreation Department (OPRD), the Oregon Public Utility Commission (OPUC), and the Oregon Water Resources Department (OWRD).

Relative to the FERC hydroelectric relicensing process, ODEQ administers the state's water quality laws and water quality certification under Section 401 of the Clean Water Act. The ODFW manages the state's fish and wildlife resources and prepares and submits fish passage terms and conditions required by Federal Power Act Section 10(j) to FERC. In addition, ODFW has responsibility for maintaining or enhancing the natural resources of the state and to protect the natural resources of the state from adverse impacts caused by the continued existence of a project. ORS 543A.025. OPRD implements the state's outdoor recreation policy, owns and manages an extensive system of parks and campgrounds throughout the state, and advocates for the development of the recreation potential of Oregon's land and water resources and the protection of natural resource values, open spaces, and Oregon's scenic landscapes for the public's appreciation, use and enjoyment. The OPUC regulates investor-owned electric utilities to ensure that Oregon electric consumers receive safe and reliable service at reasonable rates. ORS 756.040. Finally, OWRD regulates the appropriation of waters of the state, including the administration of water rights.

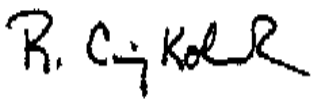
The Oregon Klamath HART is pleased to have the opportunity to comment on the Klamath Project's Final License Application and submit Additional Study Requests. The HART has been participating in this relicensing process since PacifiCorp issued the First Stage Consultation Document. It has worked hard to fully participate in this process and appreciates the dedicated efforts of PacifiCorp's staff during this relicensing. The following Klamath HART members have provided comments and Additional Study Requests that are attached in the following order.

Oregon Department of Environmental Quality Dennis Belsky (541) 779-6010 x226	Attachment 1
Oregon Department of Fish and Wildlife Amy Stuart (541) 447-5111 x27	Attachment 2
Oregon Parks and Recreation Department Jan Houck (541) 388-6073	Attachment 3
Oregon Public Utility Commission Bill McNamee (503) 378-6360	Attachment 4

In closing, the OWRD would like to express its full support for the comments and Additional Study Requests submitted by OWRD's fellow Klamath HART members. As noted above, OWRD regulates the appropriation of waters of the state, including the administration of water rights. The Klamath Project has one state hydroelectric water right (HE 180) for 2,500 cubic feet per second at the J.C. Boyle facility that is under review at OWRD for reauthorization. In order to reauthorize this water right, OWRD must demonstrate that the Project meets the standards expressed in ORS 543A. These standards include an analysis of Project impacts on the following resources: 1) fish, 2) wildlife, 3) water quality, 4) recreation, 5) cultural resources, 6) recreation, 7) wetlands, 8) seismic and geologic and 9) economic. At this time, OWRD does not have enough information about Project impacts to be able to reauthorize the Project's water right. Acceptance by FERC and appropriate implementation by PacifiCorp of the HART's Additional Study Requests would provide OWRD with further information to assess the Project's impacts and determine whether the Project's water right should be reauthorized.

Please do not hesitate to contact me at (503) 986-0823, or by e-mail at ron.kohanke@wrd.state.or.us if you have any questions or concerns regarding this filing.

Sincerely,



R. Craig Kohanek
Hydroelectric Project Analyst
Oregon Water Resources Department

ATTACHMENT

1

Oregon Department of Environmental Quality

PRELIMINARY COMMENTS ON THE FINAL LICENSE APPLICATION

ADDITIONAL STUDY REQUESTS

for

Klamath Hydroelectric Project
(FERC 2082)

April 2003

Oregon
Theodore Kulongoski, Governor

Department of Environmental Quality
Western Region Medford Office
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Medford, OR 97501
(541) 776-6010
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April 23, 2004

Magalie R. Salas, Secretary
Federal Energy Regulatory Commission
888 First Street NE
Washington, DC 20426

Subject: PacifiCorp's Klamath Hydroelectric Project (FERC #2080-027)
Comments by Oregon Department of Environmental Quality
FERC Notice of Application Tendered for Filing, Soliciting Additional Study Requests, and Establishing Procedural Schedule for Relicensing and a Deadline for Submission of Final Amendments

Dear Secretary Salas:

The Federal Energy Regulatory Commission (FERC) issued a Notice of Application Tendered for Filing with the Commission, Soliciting Additional Study Requests, and Establishing Procedural Schedule for Relicensing and a Deadline for Submission of Final Amendments for PacifiCorp's (PacifiCorp) Klamath Hydroelectric Project (Project) on February 26, 2004. The Oregon Department of Environmental Quality (ODEQ) provides general comments related to the Final License Application as Enclosure 1 and Additional Study Requests (ASRs) as Enclosure 2.

Our comments and Additional Study Requests herein do not preclude ODEQ, under authority of the Federal Clean Water Act Section 401 (401) and state law, to require PacifiCorp conduct and submit additional environmental studies identified at such time as PacifiCorp submits an application for 401 certification. To avoid possible delay in the relicensing process, ODEQ urges FERC to require PacifiCorp to implement the enclosed ASRs at this time.

Please contact me at (541) 776-6010, extension 226, or by e-mail at belsky.dennis@deq.state.or.us if you have any questions regarding this filing.

Sincerely,

Dennis Belsky
Water Quality Engineer

Enclosure 1: ODEQ FLA Comments
Enclosure 2: ODEQ Additional Study Requests

cc: Service List

ENCLOSURE 1

COMMENTS ON THE FINAL LICENSE APPLICATION
FOR THE RELICENSING OF THE
KLAMATH HYDROELECTRIC PROJECT, FERC #2080
Submitted by
OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY
APRIL 23, 2004

The Oregon Department of Environmental Quality (ODEQ; Department) has reviewed the Final License Application (FLA) filed by PacifiCorp (PacifiCorp) and provides the following response comments.

- Pursuant to Oregon Revised Statute (ORS) 468B.040, the Director of the Oregon Department of Environmental Quality, or a designated representative, is authorized to approve or deny the water quality certifications required for federally-licensed hydroelectric projects in Oregon under Section 401 of the federal Clean Water Act, 33 USC § 1341. Oregon water quality regulations are contained in OAR Chapter 340, Divisions 41 through 53. Division 41 entitled "State-Wide Water Quality Management Plan: Beneficial Uses, Policies, Standards, and Treatment Criteria for Oregon" is the most significant with respect to § 401 certification of a proposed hydroelectric project. The requirements and standards set forth in Division 41 were adopted to comply with the water quality protection provisions of both state and federal law. The water quality standards in Division 41 are composed of three elements: beneficial uses, water quality criteria, and the antidegradation policy.
- ODEQ has been an active participant in the relicensing process including review and comment on the First Stage Consultation Document and Draft License Application, and participated in Water Quality, Aquatics, and Plenary Work Groups. The ODEQ believes the FLA improves upon the Draft License Application but remains deficient in its qualitative and quantitative assessment of Project effects on natural resources, beneficial uses and water quality. Further, the FLA has inadequately and incompletely addressed Project effects through proposed PME measures in several areas:
    - For water quality and beneficial use Project effects, PacifiCorp has emphasized other natural and anthropogenic causes for poor water quality in the Klamath Basin while performing only a minimal assessment or partitioning of Project caused impacts to water quality and beneficial uses.
    - ODEQ believes that many of the conclusions drawn by PacifiCorp in the FLA regarding WQ and many other resources are drawn from limited information and field study, or without sufficient impartial scientific evaluation.
    - PacifiCorp's Klamath FLA lacks clear identification and quantification of Project-caused impacts to water quality and beneficial uses.
    - The FLA provides little or no direct comparison of Project-related impacts to each of the numerical and narrative water quality standards.
- Of PME measures proposed by PacifiCorp, only a few may have a beneficial effect on water quality. Those PME measures that could be identified to improve water quality are an incremental increase in flow in the JC Boyle peaking reach and aeration of Copco 1 and Iron Gate reservoirs. However, the FLA does not evaluate these PME measures in terms of compliance with water quality standards. No PME measures are proposed for known water quality issues in either of the Project's Oregon impoundments at Keno and JC Boyle dams.
- ODEQ has concern for proposed removal of the upper part of the existing Project from Link River dam to Keno dam, and not including JC Boyle Bypass Reach dam from the proposed license boundary. Therefore, agencies with mandatory authority may not be able to prescribe conditions.
- PacifiCorp should be held accountable for Keno Dam and reservoir and associated resource impacts including exacerbation of poor WQ within Keno Reservoir caused by the impoundment of the Klamath River. FERC allowed for the Keno facility to be constructed and operated which has contributed to resource impacts. FERC should not release PacifiCorp from FERC jurisdiction for the Keno facilities until first holding PacifiCorp responsible for rectifying environmental impacts caused by the FERC-approved

construction and operation of the facilities. FERC has an obligation to hold PacifiCorp accountable for the Keno dam and reservoir, and other Project facilities.

- With respect to the Eastside and Westside facilities, decommissioning requires application to ODEQ for 401 certification.

ENCLOSURE 2

ADDITIONAL STUDY REQUESTS
FOR THE RELICENSING OF THE
KLAMATH HYDROELECTRIC PROJECT, FERC #2080
Submitted by
OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY
APRIL 23, 2004

The Oregon Department of Environmental Quality (ODEQ; Department) has reviewed the Final License Application (FLA) filed by PacifiCorp (PC) and is providing recommendations for additional studies that should be completed before the Federal Energy Regulatory Commission (FERC) accepts the license as adequate to conduct its environmental review.

Throughout the relicensing consultation process, ODEQ has worked with PacifiCorp and other parties to identify appropriate studies and review proposed study plans. Our interests have been to encourage comprehensive, well planned studies to aid the identification of Project impacts and determination of appropriate protection, mitigation, and enhancement (PME) measures. The Department's emphasis has been directed towards water quality studies and studies related to the designated beneficial uses of the water bodies impacted by the Project such as fish and aquatic life. ODEQ appreciates PacifiCorp's and other stake holder's efforts to work together on study plan development. We also appreciate PacifiCorp's efforts to solicit ODEQ's perspective on issues relative to relicensing in general and specifically in matters related to the federal Clean Water Act Section 401 (401) certification for the Project.

Notwithstanding the significant efforts of all involved to provide perspective and offer suggestions for study plan development, the FLA lacks adequate definition of project impacts such that appropriate PME measures cannot be identified. In some cases where impacts have been acknowledged and quantified, appropriate PME measures have not been identified. In other cases, where impacts have been conceded, PME measures have not been proposed or the expected efficacy of proposed PME measures have not been adequately evaluated. In some instances, field studies and data analysis have not been completed, thereby limiting ODEQ's ability to adequately determine sufficiency of the studies or to determine if follow-up studies are warranted at this time. In other cases, PacifiCorp has chosen not to use standard study methodologies recommended by stakeholders, and ODEQ lacks confidence in both the results or the conclusions drawn from the results.

In accordance with 18 C.F.R. §4.32(b)(7) of FERC's regulations, ODEQ requests that FERC require PacifiCorp to conduct the additional studies and gather the additional information described below. The additional studies and information requested are essential for a complete and factual record that FERC must have to evaluate the FLA and provide "equal consideration" to development and non-developmental values. Further, information garnered from the requested studies is needed for ODEQ to conduct its Clean Water Act Section 401 certification application analysis. We urge FERC to withhold acceptance of the application for environmental review until the requested studies are completed, as they are essential for FERC to satisfy its legal obligations under both the Federal Power Act (FPA) and the National Environmental Policy Act (NEPA). Further, ODEQ requests that FERC require PacifiCorp implement these ASR's as soon as possible, thereby limiting delay and need for ODEQ to require these studies at a later date in response to and in support of an otherwise potentially-inadequate application for 401 certification.

ODEQ's additional study requests include the following:

1. Water Quality Standards Compliance Study
2. Water Quality PME Measures Study
3. Macroinvertebrate Drift/Bioenergetics Study
4. Project Operations and Hydrology Study
5. Project Ramping Impacts on Downstream Resources Study

6. Habitat-Instream Flow Relationships and Minimum Flows Study of the Link River, Keno, JC Boyle Bypass, and JC Boyle Peaking Reaches
7. Fish Assessment Survey for the Link River, Keno, JC Boyle Bypass and JC Boyle Peaking Reaches
8. Entrainment and Associated Mortality Study
9. Fish Passage Study
10. Project Boundary Changes

1. Water Quality Standards Compliance Study

Requested Study and Basis for Request

ODEQ requests that PacifiCorp conduct a thorough study to determine the extent that the existing Project complies with Oregon and California water quality standards (WQS) and where and how the Project degrades water quality and adversely affects beneficial uses. Ultimately, PacifiCorp will need to obtain this information so as to determine the potential effects of its proposed Project. It is important to identify on qualitative and quantitative basis how the current and proposed Project affects WQS compliance and impacts to beneficial uses to help make informed decisions on future Project operation and developments. Therefore, this study would form the basis for developing and evaluating prospective PME measures to address WQS non-compliance and Project effects under another requested ASR: "Water Quality PME Alternatives Study", discussed below.

The Klamath River is documented to have poor water quality. From its headwaters at Upper Klamath Lake to its mouth at the Pacific Ocean, the Klamath River is identified by the States of Oregon and California as water quality limited under Section 303(d) of the federal Clean Water Act. Warm water temperatures and enriched nutrient conditions, particularly during the summer months, plague the river system and affect fish and aquatic life, and other state-designated beneficial uses of the waters.

Though PacifiCorp has conducted studies and collected historic information directed at identifying water quality within the Basin, additional effort should be directed toward determining the extent to which the Project complies with water quality standards, and contributes to or exacerbates non-attainment of standards. PacifiCorp will need CWA Section 401 certifications from both the states of Oregon, issued by ODEQ, and California, issued by the California Water Resources Control Board (CSWRCB), in order to receive a new FERC license for the Project. ODEQ and CSWRCB will need reasonable assurance that the Project complies with all WQS and protects beneficial uses before the respective agencies can issue an affirmative 401 decision. This ASR does not waive our authority to request additional studies and information from PacifiCorp needed to support the 401 decision.

Study Participants

ODEQ recommends that PacifiCorp work with ODEQ and CSWRCB and any other interested stakeholders in the design of this study and interpretation of its results. Ultimately, for purpose of 401 application review, the 401 agencies will maintain full authority to determine WQS compliance for the existing or future Project. Nonetheless, if PacifiCorp works closely with ODEQ and CSWRCB, the likelihood of divergent assessment/determination of WQS compliance will be minimized.

Study Objectives and Methods

Study Objectives

Identify, in consultation with ODEQ and CSWRCB, those WQS that the Project might reasonably be expected to impact at a level that would cause or contribute to WQS non-compliance in any waters potentially impacted by the Project. Water potentially impacted by the Project would include waters from Link River Dam to Iron Gate Dam; waters downstream of Iron Gate Dam to the Pacific Ocean unless identified differently by CSWRCB; and, non-mainstem streams of the Project from points of PacifiCorp diversion to their mouths (Jenny, Spring, and Fall Creeks).

For those WQS of concern (WQS_{con}), identified in the above objective, PacifiCorp should determine the spatial [longitudinal and vertical (in reservoirs)] extent of WQS_{con} compliance/non-compliance for all waters impacted by the Project under a range of current operations and conditions, including seasonal low-flow warm weather conditions.

Determine the temporal [seasonal and diurnal (for temperature, dissolved oxygen, and pH) longitudinal and vertical (in reservoirs)] extent of WQS_{con} compliance/non-compliance for all WQS_{con} for all waters impacted by the Project under a range of current operations and conditions, including seasonal low-flow warm weather conditions.

For each WQS_{con} determined as not attained at times or locations within surface water bodies affected by the Project, determine the extent that the Project contributes to such non-attainment. The extent should be fully characterized both spatially and temporally as described above. For instance, identify all reaches where a given WQS_{con} is not met or would not be met under a range of current operations and conditions, and quantify for each of these reaches the longitudinal, vertical (if a reservoir), seasonal, and diurnal (if temperature, dissolved oxygen or pH) extent of non-compliance.

Study Methods

Much of the determination of WQS compliance under existing conditions could be done via comparison of Existing Condition (EC) and Without Project (WOP) water quality modeling simulations already performed by PacifiCorp. These simulations provide useful output information at select locations that allow parsing-out of Project water quality impact for the times of year and the specific years (2000 and 2001) for which the model has been adequately calibrated and verified. ODEQ notes that the models are not calibrated for the winter months. PacifiCorp must determine whether there would be WQS_{con} during the period of inadequate calibration/verification.

Additionally, WQS compliance determination may be needed for different water years (if sufficient data is/isn't available) or a modified water year to identify compliance/non-compliance under less-favorable flow and weather conditions that might be expected to occur. Modification of the models may be needed to yield output information at locations (nodes) not currently represented. For example, an important node of concern for water quality including temperature, dissolved oxygen and possibly pH is located just upstream of where the springs flow into the JC Boyle bypass reach.

Where possible, output water quality information yielded from EC vs. WOP simulation comparisons would need to be processed and presented in a way that allows direct comparison with WQS and beneficial use protection.

Other models such as the ODEQ pH model or modified ODEQ pH model may be needed to yield quality parameters not directly provided for via the RMA-2, RMA-11, and CE-QUAL-W2 models.

For certain WQS, existing data may provide sufficient information for evaluation of WQS compliance for certain standards. An example is total dissolved solids.

Use of surrogate measures may be needed for certain standards. For instance, use of data on turbidity, secchi depths, chlorophyll a, nutrient concentrations and recreational surveys may be used to determine compliance with certain aesthetic-related WQS.

How the Study will be useful in Furthering ODEQ Resource Management Goals

ODEQ is the state agency responsible for protecting Oregon's surface water keep these waters safe for a wide range of uses, such as drinking water, recreation, fish habitat, aquatic life, irrigation, and hydro power. ODEQ's Water Quality Program accomplishes this mission in many ways including developing WQS, monitoring water quality of state waters, regulating discharges to state waters, controlling non-point sources of pollutants, and, in the case of FERC licenses for hydroelectric projects, issuing protective 401 water quality certifications.

Section 401 of the Federal Clean Water Act (33 USC §1341; CWA) establishes requirements for state certification of proposed projects or activities that may result in any discharge of pollutants to navigable waters. Before a Federal agency, such as FERC, may issue a permit or license for any project that may result in any discharge of pollutants to navigable waters, the state, in this case ODEQ, must certify that the proposed project or activity will comply with specific sections of the CWA and state regulations adopted to implement these sections.

More specifically, with respect to the Klamath Hydroelectric Project, ODEQ is charged with the responsibility of reviewing PacifiCorp's ultimate relicensing proposal to make a determination regarding compliance with Oregon WQS. In California, CSWRCB has similar responsibilities for protection of California waters impacted by the Project. PacifiCorp will need to submit 401 applications to the respective 401 agencies that clearly articulate Project water quality and beneficial use impacts in the context of compliance with the states' WQS. ODEQ and CSWRCB must be reasonably assured that the proposed Project will comply with both states' WQS in order to issue affirmative certifications.

This study is specifically designed to provide PacifiCorp and the two 401 agencies with critical information needed for the development and determination of appropriate PME measures (see ASR #2) and for PacifiCorp's development of future 401 applications.

Existing Information and the Need for Additional Information

PacifiCorp has put forth a significant effort to identify and characterize existing and historic water quality within the Klamath River from Link River Dam downstream to the river's mouth at the Pacific Ocean. This effort has included a compilation and assessment of historic water quality, collection of additional targeted water quality data, and development of sophisticated water quality models that assist with characterization of the existing water quality. However, with respect to Fall Creek, PacifiCorp's non-mainstem facility, PacifiCorp has not collected or compiled water quality data or otherwise model the impacted streams, namely Fall, Spring, and Jenny Creeks.

PacifiCorp assessment of mainstem data has included some limited nonparametric exploration of data trends, data distributions and site comparisons. Comparison of this data against WQS numeric and narrative criteria is necessary to identify or dismiss particular WQS as potential WQS_{con}. This additional step needs to be performed.

PacifiCorp has also used EC and WOP simulations that begin to allow parsing-out of Project-related impacts at select locations for specific water quality parameters at particular times. As identified under "Study Methods" above, this modeling effort is helpful but needs to be expanded to allow comprehensive WQS compliance evaluation.

Lastly, the information generated from this study needs to be used to evaluate potential PME measures necessary to rectify conditions of WQS non-compliance, the subject of the following ASR.

Time Required for Study

ODEQ estimates the study will be completed within a 6-12 month timeframe.

2. Water Quality PME Measures Study

Requested Study and Basis for Request

ODEQ requests that PacifiCorp conduct a study directed at the development of appropriate water quality PME measures to address non-compliance with numeric and narrative water quality standards (WQS). PME measures would be formulated and subsequently evaluated to address all spatial and temporal Project-caused or Project-exacerbated conditions of WQS non-compliance identified in the "Water Quality Standards Compliance Study"

ASR. Additionally, PME measures not generated through this process, for which there is concern for potential water quality impact (such as minimum instream flows for habitat or recreation) would also be evaluated for WQS compliance by this study.

This study is needed to identify and evaluate PME measures necessary to support PacifiCorp's 401 certification applications and subsequent evaluation by the 401 agencies. This study is essential since certification by both agencies is needed before FERC can re-issue a license for the Project.

Study Participants

ODEQ recommends that PacifiCorp work closely with ODEQ, CSWRCB, and a reconvened Water Quality Working Group to formulate "prospective" PME measures. PacifiCorp would provide the necessary modeling and other-agreed upon analysis techniques to evaluate prospective PME measures and develop "candidate" PME measures that are considered WQS-compliant and fully address Project effects on water quality and beneficial uses. Results from all analyses would be brought back immediately to the group for review and consideration.

Study Objectives and Methods

Study Objectives

- Formulate prospective water quality PME measures to address Project-related water quality effects relative to the water quality standards and beneficial use impacts identified via the "Water Quality Standards Compliance Study" ASR.
- Identify means for evaluating PME measures for WQS compliance.
- Evaluate the prospective WQ PME measures and identify candidate (WQS-compliant) PME measures.
- Evaluate WQS compliance of all other resources' proposed PME measures that may have significant impact on WQS compliance and report the findings to appropriate resource groups.
- Identify candidate WQ PME measures to all other resource work groups for their consideration and identification of any potential conflicts. Critical resource conflicts would be brought back to the water quality work group for additional exploration to identify non-conflicting candidate WQ PME measures.
- Strive to identify candidate WQ PME measures that do not conflict and preferably support PME measures desired for other resources.
- Iteratively, but at specific and agreed upon times in the process, re-evaluate the complement of candidate WQ PME measures and other resource PME measures as necessary to guard against and remedy mutually exclusive or antagonistic measures that would result in WQS non-compliance.

Study Methods

Where possible, the existing suite of hydraulic and water quality models could be used, including RMA-2, RMA-11, and CE-QUAL-W2. In some agreed-upon instances, less resource intensive modeling simulations could possibly be performed with models such as the WQRRS model. Aside from use of water quality models, other agreed-upon assessment tools could be used for WQS-compliance determination such as non-parametric evaluations and surrogate evaluations as described in the study methods for the Water Quality Standards Compliance Study ASR.

All methods used for evaluation of WQS compliance should be approved by consensus agreement of the group. Note, however, considering the ODEQ's and CSWRCB's independent 401 authorities, that it essential for the 401 agencies to be in agreement with all methods accepted by the larger group. Also, ODEQ and CSWRCB would reserve their authorities to independently evaluate and determine WQS compliance in association with later review of PacifiCorp-submitted applications for 401 certification.

How the Study will be useful in Furthering ODEQ Resource Management Goals

ODEQ is the state agency responsible for protecting Oregon's surface water and groundwater to keep these waters safe for a wide range of uses, such as drinking water, recreation, fish habitat, aquatic life, irrigation, and hydro power. ODEQ's Water Quality Program accomplishes this mission in many ways including developing WQS, monitoring water quality of state waters, regulating discharges to state waters, controlling non-point sources of pollutants, and, in the case of issuance of FERC licenses for hydroelectric projects, issuing protective 401 water quality certifications.

Section 401 of the Federal Clean Water Act (33 USC §1341; CWA) establishes requirements for state certification of proposed projects or activities that may result in any discharge of pollutants to navigable waters. Before a Federal agency, such as FERC, may issue a permit or license for any project that may result in any discharge of pollutants to navigable waters, the state, in this case ODEQ, must certify that the proposed project or activity will comply with specific sections of the CWA and state regulations adopted to implement these sections.

Specifically, with respect to the Klamath Hydroelectric Project, ODEQ has responsibility to review PacifiCorp's relicensing proposal to determine compliance with Oregon WQS. In California, CSWRCB has similar responsibilities for protection of California waters impacted by the Project. PacifiCorp will need to submit 401 applications to the respective 401 agencies that clearly and completely identify Project water quality impacts in the context of compliance with the states' WQS and that contain PME measures to address these Project effects. ODEQ and CSWRCB must be reasonably assured that the proposed Project will comply with both states' WQS in order to issue affirmative certifications.

This study is specifically designed to formulate and develop appropriate WQ PME measures that assure compliance with state WQS. Compliance with these WQS is intended to protect the designated beneficial uses made of the water, including protection of sensitive fish and aquatic life.

Existing Information and the Need for Additional Information

PacifiCorp has made significant efforts to identify and characterize existing and historic water quality within the Klamath River from Link River Dam downstream to the river's mouth at the Pacific Ocean. This effort has included a compilation and assessment of historic water quality, collection of additional targeted water quality data, and development of sophisticated water quality models that assist with characterization of the existing water quality.

With the exception of the winter months, the RMA and CE-QUAL-W2 water quality models have been formally calibrated and validated. These models can be used most precisely to simulate existing conditions and can, with lower confidence in the output, project effects of modified Project operations, facilities, and flow conditions on surface water quality for several criteria. To date, only a limited number of predictive simulations have been run and reported back to stakeholders. Upon determination of WQS compliance/non-compliance status in the Water Quality Standards Compliance Study above, PacifiCorp and work group members will have greater insight about which of the WQ PME measures should be evaluated conjunctively with these predictive water quality models.

It may be necessary to calibrate and validate the water quality models for the wintertime if it is determined that the Project likely contributes to non-compliance with certain WQS or beneficial use impacts during the winter. Alternatively, wintertime calibration/validation may be deemed necessary to generate reliable, and perhaps vital, wintertime water quality input information important to other resource purposes such as aquatic habitat modeling.

With respect to PacifiCorp's non-mainstem Fall Creek hydroelectric facility, PacifiCorp has yet to collect or compile water quality data or otherwise model the streams impacted by the facility, namely Fall, Spring, and Jenny Creeks. For these streams, neither existing water quality condition nor predicted water quality condition (under alternate operations, configuration, or conditions) have been presented.

Existing water quality information for Keno Reservoir/Lake Ewauna clearly indicates Project-related contribution to WQS non-compliance. Information generated from PacifiCorp's modeling and comparison of EC and WOP model simulations, unmistakably shows that extended summertime residence within this reservoir, attributable to

impoundment of the river behind Keno Dam, contributes to very high water temperatures and nearly anoxic dissolved oxygen conditions. For this reservoir, PME measures that should be evaluated include seasonal and annual drawdown, and wetland restoration. Wetland restoration, akin to wetland conditions prior to impoundment at Keno, may potentially provide significant nutrient assimilation to help offset the current nutrient sink dynamics caused by impoundment-induced settling of organics. Thus, the water quality benefits of reduced retention time (less summertime warming and higher dissolved oxygen) could potentially be realized while reducing the potential pass-through of nutrients and nutrient-related problems to downstream waters. Wetland restoration would also provide sediment stabilization as well as a modicum of shading.

Similarly, existing information comparing EC and WOP water quality simulations for JC Boyle Reservoir indicates Project contributions to violations of temperature and dissolved oxygen standards. As is the case for Keno Reservoir, PacifiCorp has yet to propose PME measures to address Project-contribution to WQS non-compliance for JC Boyle Reservoir.

PME measures need to be formulated and evaluated to address the Project-caused components of WQS non-compliance that are identified for these Oregon reservoirs as well as all other water bodies within Oregon and California for which it is determined the Project has an adverse effect.

Time Required for Study

ODEQ estimates the study will be completed within a 6-12 month timeframe.

3. Macroinvertebrate Drift/Bioenergetics Study

Basis for Request

PacifiCorp should reassess the project impacts of peaking using updated information from additional data collection and analysis as part of the requested additional Ramping Studies, Fisheries Assessment Studies, and Instream Flow Studies. PacifiCorp should revise the wetted perimeter analysis to reflect existing peaking operations rather than a hypothetical "run of river" operation. PacifiCorp should complete the Bioenergetics study as described in the FLA and conduct additional sampling for macroinvertebrate drift during critical periods to supplement the limited drift sampling conducted to date.

The existing peaking study uses inadequate information derived from fisheries assessment sampling in the peaking reach and Keno reach. This study 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. The ODEQ has requested that PacifiCorp conduct additional study on ramping, fisheries assessment, and instream flow to clarify the project impacts to the Fisheries Resources. Any subsequent changes in these studies will affect conclusions and analysis derived in the peaking study as a result of their interrelated nature.

In the Ramping and Flow Fluctuation Final Technical Report (FTR 6.0), PacifiCorp presents a "Quantification of Varial Zone" analysis based on changes in wetted perimeter. However the flow scenarios on which this analysis is based are neither existing conditions or proposed project operations. The analysis is therefore meaningless and does not represent appropriate comparisons or conclusions. Instead, PacifiCorp should reanalyze the wetted perimeter information to evaluate existing peaking operations that vary between 350 cfs and the two typical peaking operations flow levels, approximately 1500 to 1800 cfs with one turbine and 2800 to 3200 cfs with two turbines.

Preliminary bioenergetics modeling studies indicate that low invertebrate drift rates may be limiting fish growth in the J.C. Boyle peaking and contradicts one of the basic conclusions of the Klamath Hydroelectric Project report, which states on FTR 8.0, page 8-39,

> *The macroinvertebrate fauna are susceptible to drawdown and drying of habitats in varial zones. However, the general richness and abundance of the fauna throughout the system suggest adequate to good availability of macroinvertebrates as a food source for fish and wildlife.*

Macroinvertebrates are an important food resource for fish, in particular macroinvertebrates drifting in the water column. Project peaking operations have been identified as having substantial adverse impacts on benthic macroinvertebrate production in the varial zone created by peaking operations in the J.C. Boyle Peaking Reach. Drift macroinvertebrates have been studied by direct (limited) sampling and their importance as a food source to fish is being investigated in the Bioenergetics Study. Preliminary drift sampling in the Peaking Reach indicates a probable influence of peaking flow changes on invertebrate drift patterns and densities (FTR 8.0, page 8-29).

However, the FTR concludes that drift samples, collected only once at one location without replication, were inadequate to determine whether the drift patterns and densities were due to project peaking flow changes. Preliminary information from the Bioenergetics Study indicate that drift densities make a substantial difference in the growth of larger trout and that drift densities in the peaking reach result in negative growth rates in trout 300 – 400 mm (12 – 16 in.) in length (invertebrate drift in the peaking reach was low, 0.01 insects/cubic foot (#/cu.ft.)). In contrast, drift densities in the Klamath River below Iron Gate Dam, not subject to peaking operations, were about 8 times higher and that this level of drift provides significant excess food for growth by larger trout (January 14, 2004 Aquatics Work Group meeting minutes).

Methods used to collect previous drift samples are a concern. Page 8-4 describes the drift sampling technique as "Drift invertebrates were captured on a 2.5 by 4-foot frame of fine-mesh window screening (approximately 1-by 2-mm mesh) held on poles, perpendicular to the current." Mesh size for invertebrate sampling, including drift samples, should not usually exceed 500 microns. The mesh size of 1-by 2-mm, used for this study, likely missed a significant portion of invertebrates in the drift. Effective drift nets are also designed with a long tapered bag two to four feet in length to minimize clogging and backwash of invertebrates out of the net. The described equipment sounds like a flat frame of window screen held between two poles. If true, such equipment would not collect an accurate drift sample. Finally, the drift net collection periods used in September 2002, were often only 10 to 15 minute duration. Such short collection periods would not likely provide a representative sample. Typical drift sampling periods are one to two hours in duration.

Given the importance of invertebrate drift organisms as a food source for larger trout, the observations that the peaking reach has insufficient drift to support larger trout; the significant reduction in macroinvertebrate production in the J.C. Boyle Peaking Reach varial zone and fish assessment data that shows there to be fewer larger/older trout in the peaking reach, additional macroinvertebrate drift sampling, as described below, is warranted.

Study Participants

ODEQ recommends that PacifiCorp fund and conduct the peaking study and consult with state, federal, and tribal resource agencies in study design and implementation including any additional data collection and analysis of data.

Study Objectives and Methods

The study objectives as described in PacifiCorp's FTR report (Fisheries FTR section 10) on peaking appears to adequately cover the areas of particular concern associated with addressing peaking impacts to project affected resources. Additional, quantitative sampling for macroinvertebrate drift is warranted in order to meet some of these objectives. PacifiCorp should complete the additional sampling, analysis and discussion of the study incorporating those changes as noted in the recommended study and basis for request as described above.

Based on the above short comings of previous drift sampling and the importance of developing an accurate bioenergetics model for fish growth in the J.C. Boyle peaking reach ODEQ recommends additional invertebrate drift studies be completed as outlined below.

Equipment:

- Drift nets should consist of a rectangular frame (either 1 by 2 feet or 2 by 3 feet) with a three to four foot tapered collection bag of 500 micron mesh size.
- Depth and water velocity flowing into each drift net should be measured at the start and end of each drift sample collection period. The discharge stage during drift sampling events should also be recorded.

Sampling Periods:

- Drift samples should be collected during two sampling periods – one in the late spring early summer (May/June), and the other during late summer early fall (August/September).
- Daily drift samples should cover early morning and late evening peak drift periods and daytime drift before, during, and after increasing and decreasing flow changes.
- Duration of each sample period depends on volume of invertebrates and debris drifting in the water column. Typically one to two hours provides an adequate sample without clogging and backwash from the net.

Sampling Locations:

- Two sites upstream in the Keno reach should be used as a control channel that does not experience peaking flows.
- Four sites in the J.C. Boyle peaking reach appropriately spaced to provide good longitudinal profile of the reach.
- Sample each site with six nets placed at three locations across the channel: two nets near mid-channel (as close as possible depending on flows), two nets mid-way between shore and mid channel, and two nets near shore.
- Sample sites should be located near the downstream segment of moderate riffle habitats.

Sample Processing (based on personal communication with Craig Addley):

- Samples may be sorted by subsampling to reduce processing time and costs. An appropriate subsampling technique should be used to achieve a minimum sample size of 500 organisms. The proportion of sample sorted should be recorded so total sample size can be calculated.
- Family level identification is adequate for the bioenergetics model.
- All sorted and identified organisms need to be measured for length and counted into 1mm length size classes.

Accepted Practice

The scientific community has conducted significant research regarding the response of fisheries and aquatic species to hydroelectric Project operations. There is an abundance of scientific literature available for reference to assist in completing this study.

How the Study will be useful in Furthering ODEQ Resource Management Goals

ODEQ is the state agency responsible for protecting Oregon's surface water and groundwater to keep these waters safe for a wide range of uses, such as drinking water, recreation, fish habitat, aquatic life, irrigation, and hydro power. ODEQ's Water Quality Program accomplishes this in many ways including developing WQS, monitoring water quality of state waters, regulating discharges to state waters, controlling non-point sources of pollutants, and, in the case of issuance of FERC licenses for hydroelectric projects, issuing protective 401 water quality certifications.

Section 401 of the Federal Clean Water Act (33 USC §1341; CWA) establishes requirements for state certification of proposed projects or activities that may result in any discharge of pollutants to navigable waters. Before a Federal

agency, such as FERC, may issue a permit or license for any project that may result in any discharge of pollutants to navigable waters, the state, in this case ODEQ, must certify that the proposed project or activity will comply with specific sections of the CWA and state regulations adopted to implement these sections.

More specifically, with respect to the Klamath Hydroelectric Project, ODEQ is charged with the responsibility of reviewing PacifiCorp's ultimate relicensing proposal to make a determination regarding compliance with Oregon WQS. In California, CSWRCB has similar responsibilities for protection of California waters impacted by the Project. PacifiCorp will need to submit 401 applications to the respective 401 agencies that clearly articulate Project water quality impacts in the context of compliance with the states' WQS. ODEQ and CSWRCB must be reasonably assured that the proposed Project will comply with both states' WQS in order to issue affirmative certifications.

The additional information developed by PacifiCorp will also address questions that ODEQ and other fishery resource agencies have regarding the suitability and impact of existing ramping and flow regimes on Oregon water quality standards including Biological Criteria, and Fish and Aquatic Life below each Project facility.

This study is specifically designed to formulate and develop appropriate WQ PME measures that assure compliance with state WQS. Compliance with these WQS is intended to protect the many designated beneficial uses made of the water, including protection of the more sensitive fish and aquatic life uses.

Time Required for Study

ODEQ anticipates this study can be completed within one year, unless additional data needs as part of Fisheries assessment and macroinvertebrate sampling 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 are deficient due to the inadequate conclusions drawn from interrelated studies and the lack of conclusions from yet to be completed studies. PacifiCorp's current proposal to continue load following despite the lack of reliable conclusions in PacifiCorp's study and the apparent impacts identified in the Salt Caves FERC EIS. PacifiCorp's proposal to maintain current Project operations will continue to harm both listed and non-listed aquatic species.

ODEQ does not accept that PacifiCorp's analysis accurately portray the effects of load following operations on native fish species. In our opinion, further analysis and data collection is necessary. There is too much uncertainty in both the modeling and interpretation of data for ODEQ to dismiss load following and proposed ramping rates below Project facilities as a major issue.

Request During Pre-Filing

Although ODEQ requested a thorough study of Project impacts due to load following during pre-filing consultation, PacifiCorp chose not to complete adequate studies.

4. Project Operations and Hydrology Study

Requested Study and Basis for Request

PacifiCorp does not sufficiently characterize Project operations and subsequent impacts on instream flow, habitat, and fish and wildlife resources, water quality and geomorphic processes. ODEQ requests that PacifiCorp conduct a thorough operations modeling study that considers a full range of Project operations alternatives. PacifiCorp should work cooperatively with ODEQ and other interested parties to evaluate current and alternative Project operations.

PacifiCorp should provide Project gage data to ODEQ and other stakeholders including electronic data files of streamflows and reservoir elevations recorded during the period of record as well as associated stage-discharge and elevation-volume curves.

The FLA provides limited operational modeling and does not analyze the full range of potential alternatives. This information is critical for determining Project effects on aquatic life, including resident and potential anadromous fish, and for identifying optimal flow needs for spawning, incubation, emergence, and migration of native salmonids. To date, PacifiCorp has not even modeled the flow regime that it proposes in their FLA.

How the Project currently impacts hydrology or may impact hydrology under future operations is critical and fundamental information for understanding and integrating other study results such as the fish resource assessment and water quality studies. Evaluation of impacts to hydrology using a full range of operational alternatives will aid in the identifying potential PME Measures and operational schemes that balance power generation with minimized adverse effects on aquatic and other natural resources. This analysis should include a wide range of potential Project operational management schemes, including those that would provide for flows at each facility more closely mimicking natural historic regime while recognizing that other habitat alteration occurrences in the basin. The results of this study are necessary to provide a basis for developing appropriate project operations that minimize impacts to aquatic and riparian resources.

Many stakeholders have requested that PacifiCorp conduct several studies relating to Project operations and hydrology. With respect to a requested Indicators of Hydrologic Alteration (IHA) evaluation, PacifiCorp has deferred this study "until determined necessary based on results of other hydrologic analyses" (Draft License Application [DLA] (p.1-5)). PacifiCorp has not conducted this study and remains unwilling to provide this critical analysis. From the information presented in the DLA and FLA, ODEQ believes PacifiCorp must still conduct an IHA for an adequate understanding of hydrologic alteration in the basin caused by the Project. The stakeholders of the Aquatics Work Group have also requested a study to locate and quantify accretion of spring flows as habitat and refuge areas for fish and other aquatic biota. Additionally, requests have been made for an analysis of the magnitude, duration and frequency of flow changes in the Link, Keno, and JC Boyle peaking reaches to understand impacts on aquatic resources. PacifiCorp has declined to conduct these studies and ODEQ requests that FERC require PacifiCorp conduct them as part of the Project Operations and Hydrology Study.

At a minimum, ODEQ recommends that PacifiCorp thoroughly evaluate the following operational management alternatives that encompass a potential range of operations. These alternatives should be evaluated in the context of the biological and water quality effects of the Project operations under current and future regional fishery programs. This would help agencies in identifying optimal flow needs and appropriate fishery and water quality PME measures for relicensing. This should include an assessment of flow, reservoir elevations, and reservoir and riverine water quality, and should provide description of important aquatic habitats and how the different operational scenarios influence the size and location of these habitats.

1. Existing operations including flood control, load following, and minimum flow requirements in the JC Boyle Bypass Reach (baseline condition).
2. Existing operations without load following but with flood control and minimum flow requirements in the JC Boyle Bypass Reach. This would assess the impacts of load following on water supply and habitat availability.
3. Existing operations with a 2 in/hour load following limit measured within 0.25 mile of each load following facility with flood control and minimum flow requirements in the JC Boyle Bypass Reach. This would assess the impacts of a 2 in/hr ramping rate limit on water supply and habitat availability.
4. Existing operations with a 50 cfs/hour load following limit measured within 0.25 mile of each load following facility with flood control and minimum flow requirements in the JC Boyle Bypass Reach. This would assess the impacts of a 50 cfs/hr ramping rate limit on water supply and habitat availability.

5. Existing operations with a flat line or no load following at Project facilities with flood control and minimum flow requirements in the JC Boyle Bypass Reach. This would simulate a run of river project and allow assessment of impacts with existing water supply and habitat availability.
6. To supplement PacifiCorp's study "Feasibility of Reintroduction of Anadromous Fish Above or Within the Project" an additional scenario needs to be modeled whereby Keno, JC Boyle, and Copco reservoir are drawn down to a point that which water velocities are sufficient to allow out-migrating smolts and juvenile fish to pass through the reservoir.

This study will assist in modeling alternative operation management schemes to meet the following objectives:
1) achieve flow augmentation goals for increasing migration rates of juvenile salmon, steelhead and native resident fish through the Project;
2) provide optimal habitat, including water quality, for native salmonids including redband trout and potential anadromous steelhead and Chinook, including protection of redds and provide rearing habitat for juvenile fish;
3) optimize value of stored water delivered from Upper Klamath Lake for fish mitigation purposes by passing through the Project or storing in Project reservoirs for later release;
4) provide rearing habitat for redband trout and other native resident fish;
5) manage reservoir operations to minimize impacts to resident fish and fishing opportunities in riverine reaches; and
6) aid determination of the optimal choice for power generation that minimizes impacts to aquatic and other natural resources.

Study Participants

ODEQ recommends that PacifiCorp fund and conduct the Project Operation and Hydrology Study. PacifiCorp has staff and consultants capable of conducting the modeling and analysis. An interagency stakeholder team of state, federal, and tribal biologists and NGO representatives should provide overall guidance and assist with developing the model runs and inputs. This interagency team should also include representatives from the U.S. Bureau of Reclamation (BOR) that have worked with project operations modeling to ensure consistency with regional modeling efforts. PacifiCorp should conduct agreed-upon model runs in a timely manner, and provide written results and electronic files of modeling results to all interested stakeholders.

Study Objectives and Methods

Study Objectives

- Analyze a full range of management alternatives for operating the Project
- Permit a comprehensive evaluation of the potential biological effects of Project operations within the Project and below Iron Gate Dam
- Assist in identifying an appropriate biologically based flow regime that would benefit both aquatic/riparian resources and power generation
- Determine how different operational management alternatives would influence aquatic habitats of native salmonids and endangered suckers within the Project across varying hydrologic regimes
- Conduct an IHA evaluation to characterize degree of alteration of river hydrology from historic conditions to the present in terms of magnitude, duration and frequency of flow below each Project facility
- Locate and quantify accretion of spring flows as habitat and refuge areas for fish and other aquatic life.

Study Methodology

PacifiCorp should use existing models to evaluate operational scenarios at each Project facility, reservoir, and river reach. This may include integrating the hydrologic and hydraulic modeling for the Hydrologic and Water Quality modeling effort (see Water Resources FTR sections 4 and 5) and KPOPSIM, the latter of which is used by BOR to model the Klamath Irrigation Project operations. These models have been used to assess water quality and should also provide model results input into the resource analyses including instream flow assessments.

PacifiCorp should use the project operations modeling to evaluate the physical and operational changes at each Project facility including alternative ramp rates, minimum flows, and peaking cycle duration and magnitude. These modeling scenarios should be developed in close consultation and with the approval of the Aquatics Work Group. More particularly, PacifiCorp should model scenarios in the Keno, JC Boyle Bypass and JC Boyle Peaking reaches that incorporate a range of minimum flows that better protect aquatic life including a run-of-river and partial run-of-river (i.e. flows occur within a designated limit) around an average daily or weekly flow.

The spring flow accretion study component requires a survey and assessment of all possible sources of inflow from natural spring sources. The survey will require location and quantification of accretion of spring flows within and along the river including springs located under impoundments. It may also include coldwater inputs from tributary sources such as Jenny Creek that also provided historical thermal refugia that are now largely lost by inundation.

Accepted Study Methods

Modeling of Project operational management alternatives is a commonly accepted element of river management planning study; other FERC proceedings such as the Pelton Round Butte relicensing (FERC #2030) used this method. Hydrologic modeling typically encompasses a baseline alternative that describes how the Applicant has operated the hydroelectric complex and also provides an array of potential future operational management alternatives.

How the Study will be useful in Furthering ODEQ Resource Management Goals

Modeling a sufficient range of operational scenarios is necessary for the development of suitable PME measures and an understanding of the complex tradeoffs that occur as a result of Project operations. ODEQ will use the study results to:

- Assess the impacts of the Project dams and associated reservoirs on designated beneficial uses such as Fish and Aquatic Life; Wildlife; Fishing; Boating; and Hydropower.
- Assess compliance with state water quality standards including the Biological Criteria standard.
- Evaluate potential PME measures under a range of operational scenarios to comply with WQS.
- Inform the Total Maximum Daily Load (TMDL) process for the Klamath Basin.

Time Required for Study

ODEQ estimates the study will be completed within a 6-12 month timeframe.

Why Study Objectives cannot be Achieved Using Available Data

PacifiCorp only modeled four "book-end" operational scenarios, which do not provide adequate information to compare Project impacts under current conditions to proposed operations or other reasonable operations alternatives. Conducting additional operational scenario modeling will assist PacifiCorp, stakeholders, and FERC in identifying an operational scenario that benefits natural resources, power production, and other Project needs.

Request During Pre-Filing

Although this study was requested during pre-filing consultation the Applicant chose not to complete adequate project operations modeling.

5. Project Ramping Impacts on Downstream Resources Study

Requested Study and Basis for Request

ODEQ requests that PacifiCorp conduct a complete study of the ramping below Link River, Keno, and J.C. Boyle dams, and below the J.C. Boyle Powerhouse to determine rates necessary to protect fish and aquatic resources from adverse impacts from up-ramping and down-ramping. An adequate ramping study should be conducted to evaluate the potential adverse impacts of PacifiCorp's proposed Project operations of four inches per hour below 1,000 cfs and nine inches per hour above 1,000 cfs ramp rate. The study should also evaluate implementation of NOAA Biological Opinion ramp rate of 50 cfs/hour (used below Iron Gate Dam) in the JC Boyle Peaking Reach and the more typical Pacific Northwest regional rate of 2 in/hr and 1 ft/day ramp rate. These ramping rates should be measured within 0.25 miles of each Project facility.

The ramping study should evaluate impacts on:
1) resident and potential anadromous fish populations including assessment of lost rearing habitat, changes in amount and location of habitat, fish stranding, and energetic impacts;
2) impacts to other aquatic organisms such as benthic macroinvertebrates;
3) impacts to shoreline substrate, and
4) riparian vegetation.

PacifiCorp's proposal in the FLA is to operate the Klamath Hydroelectric Project with only some minor adjustment in the ramp rate below JC Boyle Powerhouse in the Peaking Reach. The Project is presently operated such that causes daily flow fluctuations in response to power load demands. PacifiCorp institutes load following operations when flows in the Klamath River drop below 3,400 cfs, typically from spring to some time in the winter, although it can be year-round in low-water years. PacifiCorp has proposed to continue an extremely high ramp rate of nine inches per hour when greater than 1000 cfs, and a high four inches per hour rate when less than 1000 cfs in the Peaking Reach downstream of the J.C. Boyle powerhouse. The proposed rates of four to nine inches per hour are measured 0.25 miles downstream of the J.C. Boyle Powerhouse. PacifiCorp has proposed new ramp rates in other Project reaches, except for Link and Keno (Table X).

Table 5.1. PacifiCorp Project reaches of the Klamath River 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
Below 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 has historically ramped at nine inches per hour, with reported fish kills associated with these extreme ramping events. In addition, stakeholders have repeatedly requested a ramping analysis in the Keno Reach and PacifiCorp has indicated that "PacifiCorp will work to engage BOR with the Aquatics Work Group to identify flow-related concerns in this reach and collaboratively develop means to address these concerns" (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 followed through with an evaluation of ramping impacts to aquatic resources below Keno Dam.

The practice of using reservoir storage to follow short-term peaks in power demand – known as load following – results in rapid and significant changes in river flow and reservoir elevation. Rapid flow fluctuations cause a wide variety of adverse impacts to aquatic ecosystems.

Exact impacts are site-specific and may include:

- Stranding of fish
- Altered or obstructed fish migration
- Disrupted spawning activity
- Washed-out or stranded redds resulting in reduced spawning success
- Desiccation of eggs
- Reduction in spawnable habitat
- Limitation of low-velocity critical margin habitat for juvenile fish
- Isolation of side-channel habitat
- Increased energy expenditure of fish and aquatic organisms to adjust to fluctuating flow regimes
- Displacement of macroinvertebrates
- Reduced productivity and carrying capacity of the aquatic system
- Armoring or erosion of gravel and cobble bars
- Increased turbidity
- Entrapment of terrestrial organisms
- Impaired establishment, vitality, and diversity of riparian vegetation that also impacts riparian-dependent wildlife.

The adverse effects of load following operations on aquatic resources are well documented in scientific literature. Down ramping of only 1 inch per hour can impact fish populations. A significant ramping event at a particularly vulnerable time can cause a significant limiting condition for one or more age classes of fish, or a section of habitat (such as an important side channel used for rearing habitat) can be impacted for a long period (Hunter 1992).

ODEQ identified in our comments on the DLA that PacifiCorp did not adequately assess the effects of daily ramping (including magnitude, duration and frequency) on aquatic and riparian resources. In its FLA, PacifiCorp further mischaracterized results from poorly conducted studies as causing very little impact to fish populations in the Peaking Reach. Conclusions regarding streambed de-watering, fish community, adult trout movement and juvenile fish stranding were done with inappropriate assumptions, small sample sizes, and inadequate surveys and equipment. ODEQ supports comments by the Oregon Department of Fish and Wildlife (ODFW) to the DLA and PacifiCorp's Study Plans.

For example, the fry stranding study had a very small accumulated survey time. Only 3 of the 9 days surveyed over 2 years from late May to late August were likely for surveyors to encounter fry in the Peaking Reach. The fry study acknowledged that fry densities in the Peaking reach were extremely low compared to the Bypass Reach. However, the conclusions were summarized to state that peaking had no effect on juveniles, a false conclusion drawn from the very small sample sizes.

The ramping rates that PacifiCorp proposes are inconsistent with that deemed appropriate and required in FERC license conditions at other 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 four inches below 1,000 cfs and nine inches per hour above 1,000 cfs is considerably greater than ramping rates set at other Projects. Northwest hydropower projects, such as Pelton Round Butte, Leaburg/Walterville and North Umpqua, typically have ramping rates that are on the order of less than 50 cfs per hour and a maximum of less than 1-2 inches per hour and not more than one foot per day.

Study Participants

ODEQ recommends that PacifiCorp fund and conduct the ramping study. PacifiCorp should consult with state, federal, and tribal resource agencies in study design and implementation including collection and analysis of data.

Study Objectives and Methods

Study Objectives

To determine the effects of the existing and proposed ramping, including magnitude (hourly and daily rates and extent), frequency and duration on aquatic resources, aquatic habitat including side channels, gravel and cobble bars, and riparian resources in the Klamath River.

To determine ramping magnitudes, frequencies, and durations that are protective of aquatic and other resources that are impacted by ramping.

Study Methods

This study should expand on the initial PacifiCorp instream flow analysis as related to Project operations with particular emphasis on load following operations.

Significant and peer-accepted research has been conducted in the scientific community to assess instream flows and the relational response of aquatic species to hydroelectric Project operations, including load following. The ODFW has conducted and participated in significant instream flow work in many rivers and streams in Oregon. Study methods are described in the following sections by resources potentially impacted by ramping and load following: 1) resident and potential anadromous fish populations throughout Project reaches, 2) gravel and cobble bar and shoreline erosion, 3) loss of side channel habitats, and 4) riparian vegetation.

1. Stranding Information: The ramping study should contain the following:

a. Evaluation of the impacts of ramping on fry and juveniles rearing along the river margins of the Klamath River. Study of potential stranding sites using juvenile fish observation techniques would be required. Ground searches during and after down-ramping events would be required using a systematic stratified sampling approach. Notation should be made of bars that could potentially stand fish in cut-off channels and puddles during down ramping. These areas should be inventoried for stranded or dead fry or juveniles.
b. Continuous daily and weekly sampling through June and July with lesser frequency in May and August will be needed to sufficiently characterize the effect of ramping on fry and juveniles. Note that a previous sampling effort conduct one day each month for four months documented stranding by juvenile fish but was inadequate to fully characterize usage of these important habitats.
c. Special sampling to locate and quantify stranding and/or trapping of small larval age-classes of sucker and minnow species. This includes pre-peaking event fish surveys for the presence of target species and also includes benthic sampling of at risk stranding habitats.
d. For redband trout and other fish greater than 50 mm, growth rates of sampled fish should be determined by measuring and weighing fry and juveniles captured in rearing habitats during the sample period using established statistical methods. For fish smaller than 50 mm, length measurements should be collected through statistical subsampling.
e. Correlation of temperature and flow ramping information with movement of fry and juveniles through each reach.
f. 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 both periods including ramp events and periods with no Project-induced water fluctuation. For example, sample continuously April and May during a period of no fluctuations. Once ramping begins, sample continuously in June and July. As a result, habitat conditions representative of blocks of ramping and non-ramping sampling periods would be available for comparison. Ramping rates would be measured within 0.25 miles below Project facilities.

3. Loss of Side Channel Habitat.

PacifiCorp should conduct a study to establish a critical flow threshold below each Project facility to avoid stranding fish in side channels. This critical flow should be established based on measurements and observations at mutually established sites by representatives of the Aquatics Work Group. Note that the stranding and the potential for stranding of salmonid fry has been documented by PacifiCorp in the Peaking Reach below JC Boyle Powerhouse.

4. Gravel and Cobble Bar Armoring and Erosion.

Evaluate the processes that could result in erosion of gravel and cobble bars. These processes include: drag and lift forces from the river water that tend to detach and entrain smaller surface particles including sand and small gravel; weakening and weathering of the small substrate particles due to moisture changes; current and wave action; and fluvial transport and erosion of sediments that could lead to scouring at the toe of the slope.

Evaluate the effects of proposed ramping practices in a one hour time frame, down to the minimum flow level proposed. Under the existing license, daily ramping below the JC Boyle powerhouse generally occurs at flows between 320 and 1,500 cfs through summer and fall. The effects of this ramping on bar and shoreline erosion are unknown. In addition, peak discharges are believed to contribute to bar erosion. The relative contribution of these processes to erosion is currently unknown and needs to be determined to fully assess Project impacts to resources. This information would aid development of PME measures related to goals and objectives for sediment and sediment-dependent resources.

5. Riparian Vegetation

Conduct a literature search in the area of arid riparian vegetation and the effects of differing irrigation scenarios. This would include a review detailing how species handle flow fluctuations and how they perpetuate themselves in conditions similar to those proposed by PacifiCorp for the Project. In addition, riparian vegetation community potentials need to be determined for each reach of the Project. This information will allow a comparison of existing vegetation species diversity and abundance to Desired Future Conditions (DFC) for the site and help identify management actions necessary to move towards DFCs.

Accepted Study Methods

The study methodologies proposed are standard methodologies. In some cases, PacifiCorp followed standard methodologies, but used inadequate time, season and extent of surveys to draw major conclusions from very limited results, and that contradict other scientific surveys drawn from more extensive investigation.

How the Study will be useful in Furthering ODEQ Resource Management Goals

In accordance with the CWA and Oregon law, ODEQ has a responsibility to assure, via the 401 certification process, that future licensing of the Project will comply with state water quality standards, inclusive of the Biological Criteria standard, and be protective of state-designated beneficial uses of the water. Designated beneficial uses for the Klamath River within Oregon include Fish and Aquatic Life; Wildlife; Fishing; Boating; and Hydropower.

ODEQ will use the study results to assess the impacts of current and potential alternatives for Project ramping, thus providing the evidentiary basis to support 401certification conditions. Without sufficient information to provide reasonable assurance that proposed operations are adequate to protect sensitive designated beneficial uses of fish and aquatic life, ODEQ will deny certification or prescribe ramp rates that the agency is reasonably assured are protective of beneficial uses.

Time Required for Study

The modeling, literature review, instream flow work, investigation of stranding, and identification of critical flows to avoid stranding should be completed within a six to twelve month period of time.

Existing Information and 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 IFIM studies are incomplete and thus far PacifiCorp proposes to continue load following despite the lack of conclusions from its study and the apparent impacts identified in the 1990 Salt Caves FERC EIS. PacifiCorp's proposal to continue current Project operations is inconsistent with the results demonstrated from the Salt Caves EIS and ODFW research analyses from 1988-91. PacifiCorp's proposal to continue current Project operations would expect to cause harm to both listed and non-listed aquatic species.

The Salt Caves EIS reported that trout in the upper peaking reach, where peaking impacts would be most visible, 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 JC 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.

Peaking during high summer temperatures and low winter temperatures may cause additional stress on fish. Increased metabolic demands are placed on fish having to actively search for new, suitable habitat during such times when they are not actively feeding. Their metabolism may be elevated or reduced by high or low water temperatures, respectively, and they are generally relying on body fat stored during the spring and early summer.

PacifiCorp's analysis of impacts is based solely on a preliminary stranding survey conducted during very limited time periods and using a very limited and selected literature review of ramp impacts on fish stranding. Thus far, PacifiCorp's habitat analysis has been a comparison of total space available under differing scenarios. Such an analysis does not evaluate or consider the energetic impacts to the fish as they seek out suitable or marginally suitable habitat as flows fluctuate in response to peaking operations. The simplified analysis of tallying and comparing the amount of habitat produced by two scenarios does not sufficiently evaluate Project-induced flow fluctuation impacts 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 likely affected by Project ramping. In addition, researchers have observed that ramping events initiate downstream movement of Chinook fry in affected habitats. Peaking operations may force fry and juveniles away from near-shore habitat to mid-channel-type habitats shared with larger fish, leaving them more prone to predation due to the peaking-caused concentration of habitat, reduced cover, and less-favorable velocity habitat. PacifiCorp's proposed ramping rate of nine inches per hour has the potential to negatively affect fish, including listed species, by contributing to rearing habitat fragmentation and reducing fry survival.

6. Habitat-Instream Flow Relationships and Minimum Flows Study of the Link River, Keno, JC Boyle Bypass, and JC Boyle Peaking Reaches

Requested Study and Basis for Request

The streamflow within the Klamath River is significantly altered by the operation of the Klamath Hydroelectric Project. In turn, such alteration impacts the habitat and overall ecology of the fish and aquatic life residing in the river. Information is needed to understand how Project operations such as flow diversion and minimum instream flows impact fish and aquatic life and whether or not such operations should be modified to better protect fish and aquatic life. Under the current license, there is a mixture of adopted flow agreements for the Oregon section of the Klamath River, both in the FERC license and flow agreements with ODFW. 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, as per agreements between ODFW and PacifiCorp (FSCD 5-18). The bypass reach below JC Boyle has a minimum flow requirement of 100 cfs.

ODEQ requests that PacifiCorp complete a thorough assessment of instream flow needs for redband trout, other sensitive native resident species and potential anadromous species including steelhead and Chinook in each Project-affected reach. While an instream flow study has been ongoing for the past 1 ½ - 2 years, results of the studies have yet to be presented to the Aquatics Work Group. The evaluation should expand PacifiCorp's assessment of flow-to-habitat-availability to year round. The evaluation should also include an assessment of the behavioral changes and energetic impacts to the various species and life stages, considering existing operations, including peaking, as well as the various scenarios identified under the Project Operations and Hydrology ASR.

Though the Keno riverine reach is referred to as a full-flow reach, flow manipulations at Keno Dam, to maintain upstream lake levels or to regulate riverine inflow into the JC Boyle Reservoir, result in significant flow variations in the Keno Reach. Thus, the instream flow study should also include a collection of Instream Flow Incremental Methodology (IFIM) data as part of the analysis for the Keno Reach.

With respect to receiving a 401 certification for the Project, PacifiCorp will be responsible for not only maintaining minimum water *quality* (compliance with water quality standards), but also maintaining minimum water *quantity* (minimum instream flows). Maintenance of minimum flows is vital to water quality and the protection of the designated beneficial use of Fish and Aquatic Life. Though minimum instream flows impact many designated beneficial uses, including Hydro Power and Boating, the beneficial use of Fish and Aquatic Life is considered the most sensitive to minimum flows.

The PME measures currently proposed in the FLA have not been evaluated in terms of adequacy for Fish and Aquatic Life. Study is needed to determine and support appropriate minimum instream flow PME measures. ODEQ expects that seasonal minimum flows that closely mimic the natural historic flow regime, (a flow regime within which fish and aquatic life evolved), would provide desirable habitat for native salmonids and endangered suckers. Additional flow analyses are needed to adequately define the habitat-versus-flow relationships for native salmonids and to allow agencies to conduct a full assessment of impacts to aquatic habitat due to Project-induced flow changes and hydraulic regimes. This information will also be necessary to allow assessment of incremental tradeoffs of the alternative operational scenarios requested in the ASR.

Study Participants

ODEQ recommends that PacifiCorp fund and conduct this study. PacifiCorp should complete the instream flow study, including the Keno Reach, using the collaborative approach that is described by the Instream Flow Incremental Methodology (IFIM), in which study plans, methods, transects and habitat suitability curves are jointly agreed to by a team of stakeholders. ODEQ recommends that PacifiCorp continue to convene a representative subgroup of the Aquatics Work Group comprised of fish biologists and instream flow experts to develop an appropriate and agreed-upon analysis and interpretation of fish populations in riverine reaches of the Klamath River.

Study Objectives and Methods

Study Objectives

Determine a suitable year-round flow regime for the riverine segments of the Klamath River in and below each Project facility for redband trout and other sensitive native fish species. The analysis should include instream flow regime for potential anadromous fish above Iron Gate Dam and for existing anadromous fish species below Iron Gate Dam.

Collect additional information (Keno Reach) and conduct additional analyses on flow to habitat relationships below each Project facility, including dams and powerhouses to determine suitable minimal and optimal flows in each reach for aquatic resources.

Identify flows needed to provide habitat conditions to support restoration and recovery of depressed populations of aquatic species that reside in the Klamath River and tributaries within the Project, including redband trout and ESA-listed suckers, and to improve the reproductive success and overall survival of all life stages of native resident salmonids and suckers.

Study Methods

The scientific community has conducted significant research assessing instream flows and aquatic species responses as related to hydroelectric Project operations. The ODFW has conducted and participated in instream flow work in many rivers and streams in Oregon. There is an abundance of scientific reference literature available to assist in completing this study.

ODEQ recommends that PacifiCorp utilize IFIM, and apply the PHABSIM model to generate WUA versus flow results for redband trout and other sensitive native resident species in the Klamath River for each segment for the operational scenarios identified in the requested Project Operations and Hydrology Study. In particular, PacifiCorp should asses WUA versus flow relationships with current operations (baseline), without load following, and with maximum ramping rates of six inches per hour and one foot per day and two inches per hour and one foot per day, 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 sensitive native fish species in the Klamath River.

The model runs should be developed cooperatively with stakeholder to incorporate feeding stations, shear zones, velocity shelters, stream margin edge types, and cover categorizations. Excluding this data would effectively ignore the fine-scale diversity of riverine habitats and result in a very narrow description of the flow-habitat relationships.

PacifiCorp should also expand the analysis to year round. WUA versus flow relationships should be developed for the entire year.

How the Study will be useful in Furthering ODEQ Resource Management Goals

In accordance with the CWA and Oregon law, ODEQ has a responsibility to assure, via the 401 certification process, that future licensing of the Project will comply with state water quality standards, inclusive of the Biological Criteria standard, and be protective of state-designated beneficial uses of the water. Designated beneficial uses for the Klamath River within Oregon that are considered sensitive to minimum instream flows include Fish and Aquatic Life, Boating, and Hydro Power.

ODEQ will use the study results to determine suitability of proposed minimum flows. The information will be used in the determination of compliance with the Biological Criteria standard and protection of flow-sensitive beneficial uses, particularly Fish and Aquatic Life. The information will provide an evidentiary basis to support these determinations and assist in the development of appropriate 401 certification conditions.

Time Required for Study

ODEQ 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 proposed to model habitat-flow relationships for resident fish habitats under proposed operations that thus far continues to includes load following. Other relicensing instream flow studies have demonstrated significant reductions in modeled habitat for certain life stages of resident fish species during load following operations and for reduced flow in bypass reaches.

PacifiCorp completed important studies related to flow management in most segments of Project-affected reaches with the exception of the Keno Reach and below Iron Gate Dam; however they did not complete adequate assessments over a complete range of flow regimes or operational alternatives. Existing data needs to be augmented and reapplied to existing models and proposed operational scenarios in the requested Project Operations and Hydrology Study in order to complete a scientifically valid assessment.

Wide-ranging flows have been interpolated from a limited number of flow data points. Many of the flow data points are clustered around the lower end of the range. The flows chosen by PacifiCorp in its analysis could potentially misrepresent the relationship between WUA and discharge, especially at higher flows. It is likely that the habitat versus flow curves peak within the historic pre-Project range of flows but needs to be better evaluated.

PacifiCorp also has not evaluated Project impacts on movement, spawning and survival of shortnose and Lost River suckers. Studies previously conducted by other researchers in other venues evaluated spawning habitat (Buettner and Scoppettone 1990, Desjardins and Markle 1999) and age classes (Roger et al. 2000). However, information on Project impacts such as load following, reservoir fluctuations and upstream and downstream fish passage has not been studied. Stakeholders have requested that the relicensing study data gap be filled but PacifiCorp has not implemented the study.

ODEQ does not believe that PacifiCorp's instream flow study provides adequate information to sufficiently model and interpret the effects of reduced flow in bypass reaches and load following operations on native fish species. Further analysis is necessary.

7. Fish Assessment Survey for the Link River, Keno, JC Boyle Bypass and JC Boyle Peaking Reaches

Requested Study and Basis for Request

ODEQ requests that PacifiCorp conduct a thorough 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 caused by Project-induced flow fluctuation related to peaking and ramping and other alternative operational scenarios included in the requested Project Operations and Hydrology Study.

Oregon's Department of Fish and Wildlife's comments on the DLA identified numerous flaws in PacifiCorp's fish assessment surveys methods and analysis of redband trout and other native species. ODFW reports that 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 then finally abandoned by PacifiCorp) did not adequately characterize existing conditions, nor did the information provide a clear statement or analysis of Project impacts. Without provision of adequate study results by PacifiCorp, ODEQ will need to place greater reliance on previous studies conducted by other researchers, including the ODFW research study (1988-91) and a recent and ongoing fish management study being conducted by the ODFW district biologist to draw conclusions about existing fish populations, Project impacts, and appropriate PMEs.

PacifiCorp's current fish assessment study results were summarized with an index of relative abundance using catch per unit effort (CPUE). The CPUE averages generated do not consider the expected natural variability of populations within seasons, reaches, and between years. A single year of very brief sampling, generally 1-2 days in each segment, cannot be expected to accurately represent fish populations and their variability. Since the analysis was not standardized to sample size, number of days, length of area sampled, and seasonality in some cases, it is inappropriate and perilous to make comparisons and draw conclusions. The results and conclusions from PacifiCorp's fish assessment are inconsistent with fish population evaluations from previous sampling efforts conducted by City of Klamath Falls (1986) and from licensing studies conducted for the proposed Salt Caves Project, ODFW research conducted from 1988-1991 (Buchanan 1991, Hemmingsen et al. 1992), and ODFW fish management data collected in 2003.

The fish assessment study is a key area of disagreement between ODFW and PacifiCorp regarding study methodology, analysis, results, and conclusions for the relicensing of the Project. ODEQ's concern is that many of PacifiCorp's conclusions are based on inadequately designed studies, faulty field work, and marginal science-based analysis. As a result, ODEQ lacks reasonable assurance regarding the validity of conclusions drawn from such study and analyses. PacifiCorp's study plan was not approved by the Aquatics Working Group stakeholders due to misapplication of standard scientific methodology procedures and the insufficient collection of data over sample reaches, sample periods and number of seasons. In addition, PacifiCorp did not follow the process protocol agreed to by stakeholders to resolve the fish assessment disagreement for approving study plans as stated in the "Collaborative Process Protocol". Since release of the DLA, PacifiCorp has chosen to fragment the study plan into separate study components that have been agreed to (i.e. fry sampling, reservoir sampling), and that have not been agreed to (i.e. riverine sampling that is considered inadequate by agency and tribal stakeholders).

The goal of the fisheries assessment study was to characterize existing riverine and reservoir fish communities. Specific objectives were to assess relative abundance, growth, length frequency distribution, condition factor, and age structure of fish populations. PacifiCorp conducted a test of sampling methodologies in fall 2001 and then a general fisheries assessment of the riverine sections in 2002. The fish assessment has a sample size of one in most cases and sampling only one to four days for each reach. PacifiCorp then uses this very limited data to draw conclusions on the general abundance of fish communities and populations in each reach. This is clearly inadequate to address the study objectives.

PacifiCorp declined to conduct more extensive data collection in 2003 and has stated that there is adequate information to draw conclusions. This is a fundamental study that is important for understanding the results of many other interrelated studies associated with water quality, fish passage, and recreation. Erroneous conclusions from this study may result in inappropriate input to other studies, potentially contributing to less-reliable analyses and conclusions drawn from those related studies. The study summarized in the DLA indicated that most results were qualitative in nature (Fish Resources DTR p.2-2) while the FTR study results do not acknowledge that the results are qualitative. PacifiCorp inappropriately then goes on to draw conclusions based on qualitative results that are questionable and based on inadequate sample design.

The PacifiCorp 2002 sampling effort was presented in the DLA and at an Aquatics Work Group meeting. Many of the stakeholders offered important comments, identified concerns and made recommendations related to sample size, sample dates, sample time of day, sample flow range (i.e. JC Boyle peaking reach discharge ranges from 350 to over 1500 cfs each day), and other basic scientific collection information of an influential nature. Other comments were to identify outliers of information, for example, most of the chubs and minnows in the Keno Reach were observed near the dam and not found farther downstream. Sample sizes were not stated and conclusions are inappropriately drawn on very small sample sizes (i.e. 4 trout in the Link River in spring 2002 and none in any other season). An incidentally high capture of redband trout in the JC Boyle bypass reach weighted a higher relative abundance and an apparent greater length at age that was not representative of the population. Sampling effort at low versus high flow periods in the JC Boyle peaking reach influenced success of capture and affects interpretation of data. Therefore, relative abundance is difficult to make conclusions given the variability of influential sampling conditions and the very limited sampling effort by PacifiCorp.

Study Participants

ODEQ recommends that PacifiCorp fund and conduct this fish assessment study. PacifiCorp should reconvene the Aquatics Work Group to develop an appropriate and agreed-upon representative sampling strategy and analysis of fish populations in riverine reaches of the Klamath River, employing standard scientific methodology and analysis procedures. PacifiCorp, in collaboration with a team of fish biologists, including representatives from ODFW and other resource agencies, should repeat the fish assessment study using an approach in which study plans, methods, surveys, summaries, analysis and interpretation are agreed to.

Study Objectives and Methods

Study Objectives

Characterize the existing riverine fish populations affected by the Project. Assess relative abundance, growth, length frequency distribution, condition factor, and age structure of fish populations.

Re-conduct and expand PacifiCorp's existing assessment of riverine fish populations using representative sampling techniques that give consideration to influential factors such as sampling size, seasonality, time of day, and flow levels. Assess the impacts to the various species and life stages due to flow fluctuations with load following and other operational scenarios.

Provide information to other relicensing studies (e.g. fish passage, water quality, and recreation) to assess Project facilities and operations and their impacts and determine appropriate PME measures such as a suitable flow regimes.

Study Methods

Conduct additional field sampling and analysis following standardized protocols with more representative sample sizes, reaches and habitat types. Additional sampling should be conducted to adequately assess variability due to seasonality, changes in water quality including temperature, and expected shifts in seasonal abundance and distribution of migrational fish species related to life stages.

The Aquatics Work Group should be reconvened to collaboratively develop an appropriate and agreed-upon representative sampling strategy and analysis of fish populations in riverine reaches, employing standard scientific methodology and analysis procedures. PacifiCorp, in collaboration with a team of fish biologists, including representatives from ODFW and other resource agencies, should repeat the fish assessment study using an approach in which study plans, methods, surveys, summaries, analysis and interpretation are agreed to.

The scientific community has conducted significant research regarding fish assessments and aquatic species responses related to hydroelectric Project operations. The ODFW has conducted and participated in fish assessments affected by hydroelectric projects in many rivers and streams in Oregon. To aid design and interpretation of study results, the Aquatic Work Group could reference abundant available scientific literature relating to fish assessments and aquatic species response to hydroelectric operations.

How the Study will be useful in Furthering ODEQ Resource Management Goals

In accordance with the CWA and Oregon law, ODEQ has a responsibility to assure, via the 401 certification process, that future licensing of the Project will comply with state water quality standards, inclusive of the Biological Criteria standard, and be protective of state-designated beneficial uses of the water. Designated beneficial uses for the Klamath River within Oregon include Fish and Aquatic Life, Wildlife, Fishing, Boating, and Hydro Power.

ODEQ will use the study results to aid determination of compliance with the Biological Criteria standard and protection of the sensitive Fish and Aquatic Life designated beneficial use. In addition, characterization of the spatial and temporal distribution and abundance of cold-water fish species and sensitive life stages is important information for determining appropriate seasonal and waterbody-specific water quality targets for temperature and dissolved oxygen. The information provided will provide evidentiary basis to support determination of appropriate 401 certification conditions.

The additional information will be useful in determining whether or not fish populations would or would not benefit from potential PME measures such as flow enhancement, and modified peaking and ramping.

Time Required for Study

Though this study could be completed in one year, an additional year during the NEPA analysis would provide a more complete and robust record.

Existing Information and the Need for Additional Information

Existing information and the need for additional information is characterized above under the section "Recommended Study and Basis for Request".

8. Entrainment and Associated Mortality Study

Requested Study and Basis for Request

Field study is requested to quantify and characterize the facility-specific entrainment and associated mortality that is occurring at the Klamath Hydroelectric Project.

The Project entrains downstream moving fish, including federally listed sucker species, into its generation facilities. PacifiCorp has not quantified the mortality associated with this entrainment, though it is reasonable to consider it to be significant. At such time as anadromous fish passage is re-established above Iron Gate Dam, out-migrating salmonid smolts would be entrained and some unknown portion killed by turbines, thereby reducing potential success of reintroduction. With the exception of the J.C. Boyle facility, there are no downstream fish screens or other exclusion devices to prevent entrainment and mortality.

Though PacifiCorp did perform a literature review of entrainment studies performed at other hydroelectric projects, PacifiCorp has been unwilling to perform field study to characterize the actual entrainment and mortality associated with its Project facilities. PacifiCorp identifies that annual entrainment at other projects with: a) similar reservoir area (500 ac. to 1,500 ac.) range from 21,762 to 834,377 (median 83,576); b) similar dam heights (50' to 150') range from 25,296 to 154,779 (median 48,269); and c) similar hydraulic capacity (1,000 cfs to 5,000 cfs) range from 21,762 to 834,377 (median 85,848) (Fish Resources FTR Table 7.12-6). Though these comparisons are useful, they do not speak to known or evaluated entrainment and attendant mortality associated with the Project that is up for relicensing.

Significant entrainment of fish, including federally-listed Lost River and shortnose suckers, has been documented in 1997-1999 at the Link River Dam hydroelectric facilities (Gutermuth et al. 2000). These hydroelectric facilities are similar to the downstream generation facilities, especially J.C. Boyle.

At the J.C. Boyle dam, the screens that are currently installed are not designed to current criteria and are ineffective. This is apparent in the number and size of trout salvaged during canal maintenance activities. The 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 since a small percentage of the total volume of water in the canal was sampled, and the fish screens at J.C. Boyle had been operating since the last shutdown.

The finding of fish in the canal strongly suggests the effectiveness of the J.C. Boyle dam fish screening devices is quite limited. 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 reported sampling 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 indicated entrainment of over 690 trout into the JC Boyle reach during salvage operations between 1995 and 2002 (PacifiCorp website). In 2003, a JC Boyle fish salvage totaled 86 trout and 17 suckers. All suckers salvaged in the Boyle canal or bypass were less than 6 inches in length and apparently could not be identified as species. As these salvage data were counts during very limited time periods, it stands to reason that they represent only a small fraction of the total fish entrained.

Finally, preliminary radio-tracking results presented at the Collaborative meeting in September 2003 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.

As indicated above, it is clear that both small and large fish are passing through or around downstream protection screens at J.C. Boyle. Field study is needed to quantify and characterize entrainment and associated mortality at each facility, including J.C. Boyle.

Study Participants

ODEQ recommends that PacifiCorp fund and conduct this entrainment and mortality study. PacifiCorp should reconvene the Aquatics Work Group to develop an appropriate and agreed-to study plan to characterize Project-specific entrainment and mortality associated with its hydroelectric facilities. Specifically, the U.S. Fish and Wildlife Service (USFWS), ODFW, California Department of Fish and Game (CDFG), NOAA Fisheries, and concerned tribes should be enlisted as participants.

Study Objectives and Methods

Study Objectives

The entrainment and associated mortality experienced due to the Project operations need to be characterized. The study should include an estimation of entrainment and associated mortality based on empirical, site-specific data collected during a range of representative operations and over a representative time period. The Study should also determine the temporal and vertical distribution of fish passage through the generation facilities and across the spillways at J.C. Boyle and Iron Gate Dam.

Little is known about the temporal and vertical distribution of native fish of interest in the Klamath system and their associated vulnerability to entrainment. For example, entrainment of redband trout was usually more common outside of summer months at Link River (Gutermuth et al. 2000). Such vital information has significant implications for development of appropriate PME measures.

Turbine mortality (including turbine fraction (the proportion of water passing through turbines)), bypass mortality (including bypass fraction), and spillway mortality (including spillway fraction) needs to be estimated using empirical, site-specific data collected at J.C. Boyle during a range of representative operations and over a representative time period. Mortality at Iron Gate and Copco 1, which have more standard facilities, may be based upon literature values.

Study Methodology

Use methods of Guttermuth et al. (2000) for the diversion facilities of J.C. Boyle and Copco 2. For the reservoir facilities, please refer to the study methodologies recommended by ODFW in its ASR for entrainment/mortality.

In addition to Lost River and shortnose suckers, the study should assess entrainment of other resident fishes that are known or are likely to be migratory within the Project area, including redband/rainbow trout (*Oncorhynchus mykiss* subspp.), resident lamprey species (*Lampetra* spp.), blue chub (*Gila coerulea),* and Klamath large-scale (*Catostomus snyderi*) and small-scale (*Catostomus rimiculus*) suckers.

With respect to anadromous species, the study should estimate passage efficiency and facility-related mortality to out-migrant smolts. This would include estimates of collection mortality and trap and haul mortality, as well as estimates of mortality to be incurred by out-migrants through existing reservoir conditions under a variety of operational scenarios. Flows will need to be mapped through the reservoirs and evaluated for the likelihood that out-migrants could successfully transit them. 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.

Accepted Study Methods

Guttermuth et al. (2000) was used to assess entrainment at Link River. Please refer to ODFW's ASR for entrainment/mortality with respect to accepted hydroacoustic study methods for reservoirs.

How the Study Will Be Useful in Furthering ODEQ Resource Management Goals

In accordance with the CWA and Oregon law, ODEQ has a responsibility to assure, via the 401 certification process, that future licensing of the Project will comply with state water quality standards, inclusive of the Biological Criteria standard, and be protective of state-designated beneficial uses of the water. Fish are a very sensitive state-designated beneficial use. ODEQ will use the study results to aid determination of compliance with the Biological Criteria standard and protection of the Fish (and Aquatic Life) designated beneficial use. The information provided will provide evidentiary basis to support determination of appropriate 401 certification conditions.

Time Required for Study

Nine months of one year (February-October).

Why the Study Objectives Cannot Be Achieved Using Data Already Available

With the exception of the salvage information, ODFW research from 1988-91, and the Salt Caves information for JC Boyle, very little information is available on entrainment at project generation facilities below Link River. To date, PacifiCorp has declined to initiate entrainment/mortality studies and has offered to conduct a literature review. Literature review is inadequate. Such a review will not provide an accurate accounting of Project impacts.

Site-specific studies for Project entrainment and mortality 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 lower reservoirs (Iron Gate; Copco) fish populations consist of mainly exotic species versus the assemblage of largely native species in J.C. Boyle reservoir. Water quality impacts to the Project's eutrophic reservoirs likely have an influence on fish communities and fish behavior. As we can see from the preliminary relicensing water quality results, the limnological behavior of these reservoirs affects water movement through them at times of the year that are critical to the survival of young fish and their exposure to entrainment. Diurnal behavior of fish in Project reservoirs is not well understood and may greatly influence the risk of entrainment. At Link River, for fish in general, Gutermuth et al. (2000) observed substantially higher night time entrainment.

Second, Project facilities have unique characteristics. For example, J.C. Boyle is operated as a peaking facility with more than 400 feet of head. Peaking takes place during both day and night periods. Entrained fish are exposed to extreme pressure changes as they transit through the penstocks and turbines, 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 facilities located in the upper Midwest on mesotrophic or oligotrophic impoundments is inappropriate.

Third, some key existing Project studies have been poorly designed and have been implemented over the objection of the Collaborative Group. Study Plan 1.9, Fish Assessment, remains unapproved by the Collaborate Group

because the study plan is inadequate. Adequate information on fish community structure and habitat use from this study is fundamental to understanding entrainment mortality.

Fourth, federally listed suckers are present in all Project impoundments. Little is known about the behavior of these fish relative to their vulnerability to entrainment and mortality.

Fifth, goals of the ODFW and other fish agencies for the Klamath watershed include 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 out-migrants would be the greatest concern. In the long run, if done correctly, resident fish entrainment studies would likely help narrow the scope of anadromous studies, achieving better use of time and resources.

9. Fish Passage Study

Requested Study and Basis for Request

The Project effectively blocks access and upstream movement of salmonid and lamprey adults into the historic spawning areas above RM 190 (Iron Gate Dam) and many important tributary habitats. The dams further constrain the ability of juvenile fish to migrate downstream. The present day distribution of anadromous fish in the Klamath River is restricted to below Iron Gate Dam. The Project has eliminated connectivity between of redband trout and other native resident populations above, within, and below the Project.

Lost River and Short-nosed suckers in and above the Project, and coho salmon below the Project, have been listed under the federal Endangered Species Act. These listings emphasize the need to provide mitigation that will increase or restore self-sustaining populations in historic ranges to ensure conservation of these species.

Passage through the Project for a suite of species is essential to reconnecting the system ecologically. Pacific salmon and steelhead called the Klamath and its tributaries home in the area in and upstream of the Klamath Hydroelectric Project. Runs of spring and fall Chinook salmon, Coho salmon, steelhead and Pacific lamprey were present in the Klamath mainstem and many of the major tributaries (Fishpro 2000). Lamprey distribution is thought to have coincided with anadromous fish distribution.

ODEQ requests that PacifiCorp develop a plan that accommodates a phased-in approach to fish passage. This plan should be designed to reduce risk through the use of well-designed experiments to evaluate critical uncertainties and to determine whether program goals are achievable. It should also be designed to change Project facilities and operations over time to help identify the desired future condition and PME measures to achieve that goal. The plan would be used to determine which fish passage strategies and treatments are effective and should be continued, and to should implement monitoring and evaluation programs to achieve identified goals in the long term.

Quantifiable goals and objectives, clearly identified measures for evaluation, tasks and timelines, and a clearly defined timeline for decision making should be included. Decision-making should include determining whether to continue fish passage evaluation or abandon in exchange for alternative mitigation. An outline of steps for analysis of alternatives and prototype testing, methods for measuring success, and critical decision points should also be included. Efforts directed at increasing likelihood of success such as habitat enhancement and water quality improvement need to be identified, prioritized, and tasks and timelines set.

Study Participants

ODEQ recommends that PacifiCorp fund and conduct this fish passage study. PacifiCorp should continue to enlist the expertise offered by stakeholders who are party to the relicensing process, particularly the state and federal fish

agencies and tribes, to develop appropriate study methodology. Consultation should include study design, implementation, and data analysis.

Fish pathogen surveys should be performed using a qualified fish health specialist. PacifiCorp should develop a cooperative effort with the entities responsible for fish health in the region to ensure applicable rules and methods are followed.

Study Objectives and Methods

Study Objectives

To evaluate the feasibility of juvenile and adult resident and anadromous fish upstream and downstream passage through the Project, considering a full range of structural and operational modifications.

To identify and develop feasible alternatives for passage of native resident fish.

To identify and develop feasible alternatives for anadromous fish passage.

Study Methods

ODEQ recommends that PacifiCorp work closely with fisheries agencies and tribes to develop study methodologies and to identify those fish passage concepts that are most promising (biologically and ecologically feasible) for testing at the Project.

How the Study will be Useful in Furthering ODEQ Resource Management Goals

In accordance with the CWA and Oregon law, ODEQ has a responsibility to assure, via the 401 certification process, that future licensing of the Project will comply with state water quality standards, inclusive of the Biological Criteria standard, and be protective of state-designated beneficial uses of the water. Fish are a very sensitive state-designated beneficial use. ODEQ will use the study results to aid development of appropriate 401 certification conditions relative to reconnection of native resident fish and reintroduction of native anadromous fish.

Time Required for Study

Many years of research may be needed to determine the optimal methods and facilities for reintroduction, passage, and habitat protection. To reduce the time required, multiple components of passage feasibility could be performed concurrently.

Existing Information and the Need for Additional Information

Feasibility of fish passage tends to be very site specific. In-depth evaluation of both traditional and innovative technologies should be explored. To date, PacifiCorp has only generally looked at traditional technology. PacifiCorp's evaluation of engineering feasibility has focused on an intensive historical information gathering effort. Detailed engineering drawings of what could work for the Project, including major structural or operational modifications are needed.

ODEQ strongly recommends that the passage studies culminate in clearly identified measures for evaluation and timelines for decision-making, as well as quantifiable goals and objectives. This will require outlining steps for analysis of alternatives and prototype testing, methods for measuring success, and critical decision points.

10: Project Boundary Changes

Requested Study and Basis for Request

ODEQ requests that PacifiCorp conduct a thorough study to determine the extent that their proposal to remove Keno dam and reservoir, other developments at Eastside and Westside, and the JC Boyle bypass reach (FLA, Vol. 2, Exhibit maps E8.1-1 (2 of 11) and maps E8.1-2 and E8.1-3 (all map 2 of 11)) from the existing Project boundary complies with Oregon and California water quality standards and requirements to protect beneficial uses.

The FLA contains limited discussion of the relationship of the Keno development to generation, and there is little to no discussion of the Keno Dam and Reservoir relationship to other Project purposes and public interests. ODEQ believes that PacifiCorp's focus on benefit to generation is too narrow. FERC should apply a broader test as described under section 3(11) of the Federal Power Act, 16 USC 796(11), and that until FERC makes a determination whether to approve removal of Keno Dam and Reservoir from the Project, it is premature for PacifiCorp to omit evaluation of the environmental impacts of Keno Dam and Reservoir in connection with existing or proposed conditions.

The study would also determine if Keno Dam affects water quality and beneficial uses in the Keno riverine reach to JC Boyle Reservoir. If suspected Project effects are determined present, the Keno riverine reach may warrant inclusion into the FERC boundary.

PacifiCorp will need CWA Section 401 certifications from both the states of Oregon, issued by ODEQ, and California, issued by the CSWRCB, in order to receive a new FERC license for the Project. ODEQ and CSWRCB need reasonable assurance that the Project complies with all WQS and protects beneficial uses before the respective agencies can issue affirmative 401 decisions. This ASR does not waive our individual authorities to request additional studies and information from PacifiCorp needed to support the 401 decisions.

Study Participants

ODEQ recommends that PacifiCorp fund and conduct this study. PacifiCorp should continue to enlist the expertise offered by stakeholders party to the relicensing process, particularly the state and federal fish agencies and tribes, to develop appropriate study methodology. Consultation should include study design, implementation, and data analysis.

ODEQ recommends that PacifiCorp fund and conduct the Project Boundary Changes Study. PacifiCorp should consult with state, federal, and tribal resource agencies in study design and implementation including collection and analysis of data.

Study Objectives and Methods

Study Objectives

1. The extent to which Eastside, Westside, Lake Ewauna, Keno Reservoir, Keno Dam, and the Keno riverine reach to JC Boyle Reservoir are physically linked to the Project's generating facilities.
2. The extent to which Project features in (1) above are needed for any project purpose, including but not limited to protection, mitigation, and enhancement (PME) of fish, wildlife, recreation, water quality, and other environmental values.
3. The regulatory scheme under state and federal law by which the environmental impacts of these features in (1) above would be prevented or mitigated, should FERC approve removal of these features from the existing Project boundary.
4. PME measures at these features for fish, wildlife, recreation, water quality, and other environmental values, in the event FERC does not approve removal of the some or all of the features in (1) above from the Project boundary.
5. As an alternative to removal of these features in (1) above from the Project boundary, evaluate the decommissioning and physical removal in whole or in part of the Keno Dam and Reservoir.

Study Methods

Study methods as described for ASR 1 and ASR 2 above would be applicable and included herein by reference.

How the Study will be Useful in Furthering ODEQ Resource Management Goals

ODEQ is the state agency responsible for protecting Oregon's surface water and groundwater to keep these waters safe for a wide range of uses, such as drinking water, recreation, fish habitat, aquatic life, irrigation, and hydro power. ODEQ's Water Quality Program accomplishes this mission in many ways including developing WQS, monitoring water quality of state waters, regulating discharges to state waters, controlling non-point sources of pollutants, and, in the case of FERC licenses for hydroelectric projects, issuing protective 401 water quality certifications.

Section 401 of the Federal Clean Water Act (33 USC §1341; CWA) establishes requirements for state certification of proposed projects or activities that may result in any discharge of pollutants to navigable waters. Before a Federal agency, such as FERC, may issue a permit or license for any project that may result in any discharge of pollutants to navigable waters, the state, in this case ODEQ, must certify that the proposed project or activity will comply with specific sections of the CWA and state regulations adopted to implement these sections.

More specifically, with respect to the Klamath Hydroelectric Project, ODEQ is charged with the responsibility of reviewing PacifiCorp's ultimate relicensing proposal to make a determination regarding compliance with Oregon WQS. In California, CSWRCB has similar responsibilities for protection of California waters impacted by the Project. PacifiCorp will need to submit 401 applications to the respective 401 agencies that clearly articulate Project water quality and beneficial use impacts in the context of compliance with the states' WQS. ODEQ and CSWRCB must be reasonably assured that the proposed Project will comply with both states' WQS in order to issue affirmative certifications.

This study is specifically designed to provide PacifiCorp and the two 401 agencies with critical information needed for the development and determination of appropriate PME measures (see ASR #2) and for PacifiCorp's development of future 401 applications.

Time Required for Study

ODEQ estimates the study will be completed within a 6-12 month timeframe.

Existing Information and the Need for Additional Information

PacifiCorp has made significant efforts to identify and characterize existing and historic water quality within the Klamath River from Link River Dam downstream to the river's mouth at the Pacific Ocean. This effort has included a compilation and assessment of historic water quality, collection of additional targeted water quality data, and development of sophisticated water quality models that assist with characterization of the existing water quality.

Existing water quality information for Keno Reservoir/Lake Ewauna clearly indicates Project-related contribution to WQS non-compliance. Information generated from PacifiCorp's modeling and comparison of EC and WOP model simulations unmistakably shows that extended summertime residence within this reservoir, attributable to impoundment of the river behind Keno Dam, contributes to very high water temperatures, and anoxic water column and sediment conditions. Effects may persist downstream in the Keno reach above JC Boyle reservoir but haven't been evaluated or reported in the FLA.

For Keno reservoir, PME measures that should be evaluated include seasonal and annual drawdown, and wetland restoration. Wetland restoration, akin to wetland conditions prior to impoundment at Keno, may potentially provide significant nutrient assimilation to help offset the current nutrient sink dynamics caused by impoundment-induced

settling of organics. Thus, the water quality benefits of reduced reservoir retention time (less summertime warming and higher water column dissolved oxygen) could potentially be realized while reducing the potential pass-through of nutrients and nutrient-related problems to the Keno riverine reach and beyond. Wetland restoration would also provide sediment stabilization as well as a modicum of shading.

PME measures need to be formulated and evaluated to address the Project effects on water quality, beneficial uses, and WQS non-compliance that are identified for the Keno Reservoir as well as all other water bodies within Oregon and California for which it is determined the Project has an adverse effect.

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ATTACHMENT

2

Oregon Department of Fish and Wildlife's

PRELIMINARY COMMENTS ON THE FINAL LICENSE APPLICATION

ADDITIONAL STUDY REQUESTS

and

INFORMATION REQUEST

for

Klamath Hydroelectric Project
(FERC 2082)

April 2004

Oregon Department of Fish and Wildlife
Prineville, Oregon

Oregon
Theodore R. Kulongoski, Governor

Department of Fish and Wildlife
High Desert Region
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April 23, 2004

Magalie R. Salas, Secretary
Federal Energy Regulatory Commission
888 First Street NE
Washington, DC 20426

Subject: ODFW COMMENTS TO THE FERC NOTICE OF APPLICATION TENDERED FOR FILING WITH THE COMMISSION, SOLICITING ADDITIONAL STUDY REQUESTS, AND ESTABLISHING PROCEDURAL SCHEDULE FOR RELICENSING AND A DEADLINE FOR SUBMISSION OF FINAL AMENDMENTS FOR KLAMATH HYDROELECTRIC PROJECT (FERC #2080)

Dear Secretary Salas:

The Federal Energy Regulatory Commission (FERC) issued a NOTICE OF APPLICATION TENDERED FOR FILING WITH THE COMMISSION, SOLICITING ADDITIONAL STUDY REQUESTS AND ESTABLISHING PROCEDURAL SCHEDULE FOR RELICENSING AND A DEADLINE FOR SUBMISSION OF FINAL AMENDMENTS for the Klamath Hydroelectric Project, FERC Project No. 2082-027 on February 26, 2004. Enclosed, please find the Oregon Department of Fish and Wildlife's (ODFW) Preliminary Comments on the Final License Application and Additional Study Requests and Information Requests (Enclosure 1). These comments and requests are submitted pursuant to 18 CFR Section 4.32(b)(7) as outlined in the above referenced Federal Energy Regulatory Commission (FERC) Notice.

Please contact me at (541) 447-5111, or by e-mail at prihydro@crestviewcable.com if you have any questions regarding this filing.

Sincerely,

Amy M. Stuart
Hydropower Program Biologist
High Desert Region

Enclosure 1: Preliminary Comments on the Final License Application and ODFW Additional Study Requests and Information Request

cc: Service List

ENCLOSURE 1

PRELIMINARY COMMENTS ON THE KLAMATH HYDROELECTRIC PROJECT (FERC #2080) FINAL LICENSE APPLICATION

Submitted by
OREGON DEPARTMENT OF FISH AND WILDLIFE
April 23, 2004

In February 2004 PC (PC) released its Final License Application (FLA) to FERC for relicensing of the Klamath Hydroelectric Project (FERC #2080). The Oregon Department of Fish and Wildlife's (ODFW) review of the FLA will primarily evaluate information or analysis provided in the FLA. This review includes comments provided to PC regarding the adequacy of the Project's Draft License Application (DLA) and to identify additional studies needed to address ODFW's concerns relative to Project impacts to Oregon fish and wildlife resources.

ODFW will provide detailed comments relative to the adequacy of Protection, Mitigation, and Enhancement (PM&Es) measures proposed by PC when the factual base for the analysis of impacts and development of appropriate PME measures is established and FERC has published the Ready for Environmental Analysis Notice.

ODFW Goals and Relicensing Standards

The goal of the ODFW in a hydropower project licensing or relicensing is to maintain or enhance the natural resources of the state and to protect the natural resources of the state from adverse impacts caused by the continued existence of a project. State law (ORS 543A.025) defines the minimum requirements for the renewal of hydroelectric projects within Oregon and issuance of new state water rights. Standards that pertain specifically to fish and wildlife are summarized as follows:

- Requirement to mitigate for adverse impacts to fish and wildlife resources attributable to the project due to new construction or operational changes, and ongoing adverse impacts at the time of reauthorization.
- Promotion, through mitigation measures, of restoration and rehabilitation of fish and wildlife to levels identified in goals, plans and policies of the Fish and Wildlife Commission.

ODFW regards this relicensing effort to be of critical importance to fish and wildlife resource protection and restoration in the Klamath River Basin. A number of fish and wildlife species listed under the state and federal Endangered Species Acts are present in the Project area. The three downstream-most dams of the Project were constructed without fish passage and Iron Gate Dam at River Mile 190 now forms the upstream extent for anadromous fish populations in the mainstem Klamath River. In addition, the Project causes impacts to remaining habitats upstream, in the Project area, and downstream. Because of these and other important natural resource issues, ODFW has participated fully in this relicensing effort since PC officially

initiated relicensing in 2000. We have participated in resource work groups, Plenary Work Group meetings, site visits, and consultations associated with relicensing the Project. ODFW has provided data, information and expertise on various aspects of fish and wildlife species distribution and abundance, and habitat quality and utilization. Staff has actively contributed to issue scoping and study planning.

While we hope to eventually reach agreement with PC on many of the PM&E measures that should be included as conditions of the new license, we still have concerns, however, regarding several important fish and wildlife issues. In particular, ODFW believes PC needs to conduct additional studies and collect information are needed on fish passage, fish assessments, instream flow, ramp rates, water quality, and information for potential dam decommissioning and removal for ODFW to conduct its analysis of environmental impacts.

ODFW has multiple resource management goals derived from Oregon statute and adopted rules that guide our recommendations in hydro relicensing processes. Permeating each of these policies is 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 passage at artificial obstructions are all management techniques that ODFW is directed to utilize to achieve its goals.

ODFW's goals and objectives for the fish and wildlife populations in the Klamath Basin are found in the following statutes (ORS) and rules (OAR):

Wildlife Policy (ORS 496.012)
Establishes wildlife management policy to prevent serious depletion of any indigenous species and maintain all species of fish and wildlife at optimum levels.

Oregon Plan for Salmon and Watersheds (ORS 541.405)
Restore native fish populations, and the aquatic systems to support them, to productive and sustainable levels that will provide environmental, cultural, and economic benefits.

Policy to Restore Native Stocks (ORS 496.435)
Establishes goal of the State of Oregon to restore native stocks of salmon and trout to their historic levels of abundance.

ODFW's Fish Passage Law (ORS 509.580 - 509.645)
Establishes as state policy that upstream and downstream passage is required at all artificial obstructions in those Oregon waters in which migratory native fish are currently or have historically been present. For existing hydroelectric Projects, relicensing by the Federal Energy Regulatory Commission (FERC) is the "trigger" that initiates consideration of fish passage.

Native Fish Conservation Policy (OAR 635-007-0501-0506)
(1)Prevent the serious depletion of any native fish species by protecting natural ecological communities, conserving genetic resources, managing consumptive and non-consumptive fisheries. (2) Maintain and restore naturally produced native fish species, taking full advantage of

the productive capacity of natural habitats. (3) Foster and sustain opportunities for sport, commercial, and tribal fishers.

Trout Management (OAR 635-500-0100-0120)
Maintain the genetic diversity and integrity of wild trout stocks; and protect, restore, and enhance trout habitat.

Fish and Wildlife Habitat Mitigation Policy (OAR 635-415-0000-0025)
Require or recommend mitigation for losses of fish and wildlife habitat.

Klamath Basin Fish Management Plan (OARs 635-500-3600 thru -3860)
Protect and promote natural production of indigenous species and protect and restore those habitats through coordination and cooperation with other agencies, entities and landowners.

Project Impacts

The Project has many impacts to fish and wildlife resources and their habitats within the Project area and downstream along the Klamath River. These impacts are briefly summarized and include but are not limited to the following:

1) Fish Passage: The Project has several impacts to upstream passage at Oregon Project facilities, including Keno and JC Boyle dams because current fish ladders do not meet current state and federal criteria. There are no upstream fish passage facilities at the California Project facilities.

With regard to downstream fish passage and entrainment in power canals**,** there are no screens at Eastside and Westside diversions at Link River Dam, and Copco 1, Copco 2, and Iron Gate diversion intakes. JC Boyle intake is screened but not to current state and federal design standards. ODFW has documented injury and mortality of Redband trout and suckers at the JC Boyle screens. Currently, the majority of downstream migrating fish are diverted through unscreened or inefficiently screened diversions and into powerhouse turbines.

Lack of fish passage facilities at Copco 1 and Copco 2 and later at Iron Gate Dam blocked passage to the upper basin that encompasses 65% of the total Klamath River Basin area. More than 300 miles of migration, spawning, and rearing habitat for salmon, steelhead, and Pacific lamprey is no longer accessible due to the construction and operation of the California dams of the Klamath Project. All species of anadromous fish in the Klamath Basin have been on a general decline for much of the past century. The decline of the anadromous fish in the Klamath Basin coincides with the construction of the Project.

2) Fish Resources: Existing operating conditions and facilities cause impacts to fish populations by reducing stream flow which limits spawning and rearing habitat, fluctuating stream flow which causes mortality of fish by stranding, entraining fish into power diversions and adversely affecting water quality. PC is proposing to adjust the Project boundary which will limit the scope of analyzing project affects on fish populations.

Baseline population indices for trout in the JC Boyle peaking reach are inaccurate. The study implemented by PC was inadequate because of inappropriate sampling methodology and bias and PC's conclusions are misleading regarding trout migratory behavior because PC indicates fish passage is adequate at JC Boyle and no longer needed because of spawning redds found in the JC Boyle Bypass Reach. Fisheries population estimates are based on dated information (e.g., 18 years) that was not reviewed or revised following significant changes in Project operations that occurred since fish population records were assembled.

Based on ODFW research and other sources, the following impacts to fish resources include but are not limited to:

- Reduced trout spawning and rearing habitat in the Copco bypass reach and the JC Boyle peaking reach.
- Continued loss of spawning habitat inundated by JC Boyle, Copco, and Iron Gate reservoirs.
- Delayed upstream migration of trout past the JC Boyle facilities.
- Depleted prey and macroinvertebrate sources.
- Stranding and mortality of juvenile and fry salmonids in the JC Boyle peaking reach
- Loss or alteration of spawning and rearing habitat as a consequence of peaking operations.
- Impacts of altered thermal regimes on fisheries.
- Impediments to upstream migration that result in increased susceptibility to disease, reduced metabolic efficiency, and reduced reproductive potential.
- Barriers to upstream migration and downstream recruitment of trout
- Enhanced habitat for non-native fish that compete with native species for forage and habitat in Project reservoirs.
- Reduced habitat and degraded water quality for resident trout as a function of proposed minimum flows downstream of JC Boyle Dam.
- Habitat loss and degradation as a result of diversions and lack of fish ladders and screens on Spring Creek.

3) Flow Fluctuations and Minimum Flows: Under the existing FERC license, no power generation peaking or ramping restrictions apply to Project operations, except at JC Boyle, where minimal ramping restrictions are in place. Ramping impacts vary with rates, magnitude, duration, and frequency and reduce habitat for fish, strand fish on shorelines, reduce important stream edge habitat, and reduce production capacity. Peaking also causes bank erosion and can detrimentally affect the extent and character of riparian vegetation.

The Project impacts approximately 45 miles of Klamath River within Oregon, and many more miles within California. Low flows and high ramping rates affect both bypass reaches and peaking reaches below dams where flow is regulated. There are no FERC mandated minimum streamflow requirements in Project bypass reaches except the JC Boyle bypass reach for 100 cubic feet per second (cfs). Low stream flows reduce available fish habitat and exacerbate water quality problems. During most of the year, from JC Boyle powerhouse to Iron Gate Dam, river flows are diverted through powerhouse turbines. In the case of JC Boyle and Copco 2 facilities, these flow diversions result in largely dewatered segments of the river, or bypasses, between the

dam and the powerhouse, with the majority of water diverted to penstock intakes and turbines. JC Boyle releases approximately 80-100 cfs through screen bypasses and the fish ladder. The majority of water is directed to the penstock intakes. Fish that enter the JC Boyle and Copco 2 bypass reaches below the JC Boyle and Copco 2 dams face substantially altered river characteristics.

In addition, flow diversion and peaking operations have altered hydrologic conditions in the Klamath River, affecting the hydrology between JC Boyle and Iron Gate Dams and portions of Fall Creek, Spring Creek, and Jenny Creek. The proposed boundary adjustment by PC will eliminate analysis of Project-affected reaches from Link River Dam to the JC Boyle Powerhouse. ODFW suggests the following impacts are occurring:

- Diversion of flows from the JC Boyle bypass reach (300 to 2,850 cfs) reduces flows in the upstream portion of the bypass by 75% to 97% and with addition of natural springs, reduces flows in the downstream portion of the bypass reach by 48% to 90%.
- The magnitude, frequency, and duration of peak flows (seasonal high flows) in the JC Boyle bypass reach are reduced as a result of Project operation.
- The seasonal and annual variability of flow in the JC Boyle bypass reach is reduced as a result of Project operations.
- Project operations reduce summer daily minimum flows (40 to 60%) in the JC Boyle peaking reach, exceeding impacts described in the FLA.
- Project operations increase summer daily maximum flows in the JC Boyle peaking reach.
- Project operations divert 98 to 99.5% of flow from the Copco II Bypass Reach except during peak flows in excess of 3,200 cfs.
- The Spring Creek diversion reduces flows in Jenny Creek.

In the absence of mitigation these Project impacts will continue to degrade aquatic and riparian habitat and water quality and prevent ODFW management objectives for restoration of riverine and riparian habitat and fish and wildlife species.

4) Water Quality: The Klamath River suffers from very poor water quality in part attributable to the Project. From its headwaters at Upper Klamath Lake to its mouth at the Pacific Ocean, the Klamath River is identified by the States of Oregon and California as water quality limited under Section 303(d) of the federal Clean Water Act. Warm water temperatures and enriched nutrient conditions, particularly during the summer months, plague the river system and affect fish, aquatic organisms, and other state-designated beneficial uses of the waters.

Data and modeling results from the water quality relicensing studies indicate that Project dams including Keno, JC Boyle, Copco 1, and Iron Gate, negatively affect water quality parameters by storing water, increasing retention time and solar exposure, thereby contributing to water quality problems related to temperature, dissolved oxygen, and nutrient dynamics. Reduced flows in the JC Boyle bypass reach likely cause seasonally increased warming and rates of warming upstream of the springs and colder stream temperatures downstream of the springs to the powerhouse.

The FLA does not include an adequate and comprehensive discussion of Project impacts on water quality and beneficial uses. The complete set of water quality modeling results has not yet

been released for review; therefore it is impossible to fully validate PC's conclusions regarding the impact of Project operations on water quality. The conclusions PC's draws with regard to Project impacts on water quality seem particular inappropriate when the currently available data appears to indicate that 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.

5) Sediment and Geomorphology: The Project has impacted sediment and channel geomorphology. Project dams have trapped sediment, blocking movement of bedload materials such as gravels. Peaking flows in the JC Boyle have coarsened the bedload and much of what was once the riparian zone along the mainstem has become a varial zone of alternately wetted and dried riverbed with little remaining riparian function. Project dams have changed channel morphology and fluvial processes, such as coarsening of bed material and reducing the extent of active alluvial features, resulting in deleterious effects on stream and riparian habitats, including channel incision and/or widening or narrowing, increased bank erosion, and reduced channel migration. In addition, the overflow spillway in the JC Boyle Bypass Reach has caused impacts to water quality, floodplains, riparian, and aquatic habitat with a release of a mixture of dirt, fines, sands, and coarse cobble, large rocks and pumice into the Klamath River.

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. Project impacts on elements of the sediment budget have not been fully validated. Key issues associated with the analysis relate to the sediment transport study and verification of data used to quantify stored sediment.

The FLA describes a difficulty in determining "project effects on fluvial geomorphology and sediment transport" because of synergies between natural and anthropogenic impacts. However, the technical analysis clearly illustrated impacts as a result of Project operation.

6) Wildlife Species and Habitat Impacts: Project canals restrict wildlife movement resulting in habitat fragmentation. Project roads and property also impair terrestrial habitats. Project roads cause direct mortality to wildlife (including sensitive species) and create barriers to wildlife movement /habitat continuity. Project roads and operations spread non-native noxious weeds, affecting terrestrial habitat and ecosystem functions. These 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 disturbances are the primary vectors for dispersal of invasive species. Project transmission lines cause direct bird and bat (including sensitive species) mortality/injury from collision and/or electrocution. Ramping and peaking limit accessibility and create unsuitable habitat for native amphibians. For example, ramping and peaking cause continued degradation and instability of western pond turtle basking sites and nesting/over-wintering habitat adjacent to the river. Potential pond turtle foraging habitat is unsuitable during peak flows. Riparian habitat has been altered by peaking and ramping and altered hydrologic and geomorphic processes that limit establishment of riparian habitat and impact overall habitat suitability.

7) Riparian and Wetland Habitat:
The Project has caused a 90% reduction in potential future riparian vegetation inundated by Project reservoirs and an associated landscape-scale shift in distribution of palustrine and riparian vegetation. Altered geomorphic, hydrologic, and ecologic processes have altered 170 acres of riparian and wetland habitat. The Project has reduced habitat potential for colonization of native riparian species due to highly altered flows, reduced sediment supply and reduced seasonal and annual variation of flows in the JC Boyle bypass reach. The Project has caused a reduction of 27 acres of riparian habitat within the varial zone of the JC Boyle Peaking Reach. Flow fluctuations in the Peaking Reach have enhanced conditions suitable for establishment of invasive reed canary grass monocultures and reduced the potential for establishment of native riparian species (e.g., coyote willow).

8) Recreation Resources: Flow manipulation in the JC Boyle peaking and bypass reaches creates and detracts from a variety of recreation opportunities, primary among these fishing and boating. Peaking operations diminish the value of the reach for recreational fishers by impacting fish resources through lost productivity and habitat and also impacts angling catch rates. While the Project does support whitewater boating, it does so to the detriment of fisheries and angling opportunities.

9) Cumulative Impacts: The incremental impact of the Project and other land and water use practices, such as alteration of the natural hydrology, on the environment has not been analyzed in the FLA. Such an analysis is necessary in order to understand the cumulative effects of the Project. Cumulative effects can result from individually minor, but collectively significant impacts occurring over the lifetime of the Project. In addition, ODFW has requested that PC clarify the link between the operation of the Klamath Project for hydropower production and the U. S. Bureau of Reclamation (BOR) operations to meet their multi-purpose objectives.

Federal Power Act Requirements for the FLA

As described by FERC regulations (18CRF4.51), the purpose of the FLA is to fully disclose effects of the Project on the environment, provide sufficient information for FERC to meet its obligations under the National Environmental Policy Act (NEPA) and the Endangered Species Act (ESA) as well as tribal trust responsibilities, and propose PME's that will mitigate for the impacts of the Project. The FLA is required to address study deficiencies and determine appropriate PME types and scale. The FLA should present conclusions of comprehensive studies that have been requested by ODFW and other participants, including description of the scope, methods, results, and analysis of such studies. In adddition, the FLA should completely describe current conditions, Project impacts and PM&E's. In the absence of such adequate information, and if the additional studies are not completed by PC, ODFW will need to submit 10j recommendations that are conservative in order to avoid or minimize the risks of the Project to fish and wildlife populations to the greatest extent possible and to ensure resource goals and objectives and state statutory requirements are met.

Deficiencies of the FLA

The FERC license for the Project expires on March 1, 2006. ODFW has participated in the relicensing proceedings since December 15, 2000, when PC provided its First Stage Consultation Document (FSCD) for the Project. During relicensing consultation, PC modified the formal traditional process by adding an informal collaborative process with ODFW and other stakeholders such as tribal, state and federal agencies and non-governmental organizations (NGO's) 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, PMEs, and agency recommendations. This process was called the Klamath Collaborative process. ODFW fully participated in this informal collaborative process and met numerous times with PC and other stakeholders to resolve disagreement, develop study plans and gather important information for the relicensing.

ODFW supported the Klamath Collaborative process and looked forward to completion of study plans. However, the proliferation of many study plans did not necessarily translate into substantial progress on studies. Of the ten study plans developed, only three were approved by the Aquatics and Fish Passage Work Groups since major disagreements prevented stakeholders from approving study plans (Exhibit E 4-139). In response, PC tended to split studies into smaller proposals where stakeholders could live with individual pieces. For example, documenting impacts of peaking at JC Boyle Peaking Reach became a mix of three approved study plans, three unapproved study plans and others as incomplete concepts. PC also tended to "lump" unresolved issues in study plans as "additional considerations" or "next steps" which indicated that some future study activity might occur. However, in all cases, no future studies have occurred or been committed to by PC, other than completing a few remaining studies such as the Fish Passage Modeling using "KlamRAS" and "EDT".

ODFW also disagreed with the conclusions PC drew from specific studies. As an example, PC drew strong conclusions from a radio-telemetry study where PC and stakeholders had previously agreed it was simply a pilot study and not intended for conclusive results on fish passage. PC has used the results that one fish out of 42 fish ascending the ladder as conclusive evidence that the "ladder is functioning properly, and that few of the downstream fish are inclined to migrate upstream toward the dam" (Exhibit E 4-142). In fact, ODFW research has led to the opposite conclusion that lack of an effective ladder has caused a 98% decline in redband trout abundance when compared to one year after the ladder was constructed in 1961 and a substantial decrease in size of redband trout using the ladder in the intervening years (Buchanan et al. 1990, 1991).

In addition, many of the study plans are simple compilations of background information from other projects or a literature review that would normally be included in a first stage consultation document. While stakeholders agreed on the need for baseline information that does not translate into site-specific impacts of a project on fish and wildlife resources or significant progress in understanding project impacts and developing PM&Es.

Moreover, because many of the studies were not completed, such as the instream flow study and fish passage modeling, the FLA, lacks detailed descriptions of existing conditions, affected resources, Project impacts, and proposed PME measures. Results of an approved and technically

qualified study would have been used to assess Project effects and then identify appropriate PME's. Similarly, the Fish Passage Study Plan (Study Plan 1.10) also has not been approved via the collaborative process and does not meet the stated objectives of describing current conditions, completing adequate studies and developing PME's.

In other instances, PC did conduct a particular study, but chose not to use standard study methodologies recommended by ODFW. For example, the unapproved fisheries assessment study (Study Plan 1.9), that should provide a baseline of information for existing fish populations, is technically flawed and cannot meet the stated objectives of understanding the baseline conditions of fish populations and Project impacts. As a consequence the results from this study were used to draw misleading conclusions on the Project impact to fish populations from lack of fish passage and hydroelectric peaking. PC has reached the erroneous conclusion that the Project does not continue to cause major impacts to fish populations when in fact it does. ODFW has drawn different conclusions from studies conducted by ODFW Research (1988-91), the Sale Caves License Documents (City of Klamath Falls 1986), and recent work conducted by ODFW management personnel (Tinniswood and Smith 2003).

Because PC either did not conduct a particular study or did not use recommended study methodologies, a complete technical and scientific record has not been assembled in the FLA. As a result, ODFW's primary concern with the FLA is the lack of significant PMEs to address Project impacts. Consequently, where PC and ODFW share agreement about Project impacts to fish and wildlife resources, ODFW believes relevant and meaningful PMEs can be developed and included as terms and conditions of the license. Where discrepancies of fact have not been resolved, where differences in interpretation of study results remain, or where results and conclusions based on independent analysis contradict the PC's conclusions, it will be difficult for PC, ODFW and other stakeholders to develop PMEs in consultation with FERC that will prevent or minimize impacts to fish and wildlife.

Removal of Keno and the JC Boyle Bypass from Project Boundary, Application for Amendment of License (18CFR 4.35)

PC has not applied for a license amendment for removal of Keno Dam or the JC Boyle Bypass from the FERC boundary. Keno Dam is owned and operated by PC and has a mixture of functions including managing flows for the Project downstream through the JC Boyle, Copco 1 and 2 and Iron Gate facilities along with facilitating management of water for the US Bureau of Reclamation (BOR) irrigation project. The management of these facilities was described in multiple ways in the DLA and included flow regulation for hydroelectric power (see ODFW comments on DLA, page 40). Keno Dam has substantial Project impacts to fish and wildlife resources including lack of effective upstream and downstream fish passage (see ODFW Comments to DLA pages 14 and 21). Keno Dam also causes major water quality problems to the Klamath River. Water quality modeling and data indicates that Project dams such as JC Boyle, Copco 1, and Iron Gate along with Keno negatively affect water quality parameters by storing water, increasing retention time and solar exposure, thereby contributing to water quality problems related to temperature, dissolved oxygen, and nutrient dynamics. Water quality is particularly impacted at Keno Dam, which impounds a large shallow reservoir with a long

retention time and high solar exposure, leading to lethal conditions for fish during summer periods and violations of water quality standards.

PC has proposed in the FLA to exclude Keno Dam from the FERC boundary while continuing to own and operate the facility. This proposal would allow PC to avoid the legal obligations imposed by relicensing through both the Federal Power Act and possibly through the Section 401 Clean Water Act requirements. Until FERC makes a determination whether to approve PC's proposal to remove these features from the Project boundary, it is appropriate for PC to evaluate the environmental impacts of Keno Dam, in connection either with existing conditions or proposed and mitigate for those impacts. Furthermore, the FLA deficiencies in this regard should be addressed by additional studies required of PC or through Additional Information Requests issued by FERC.

The additional studies or information requests should address the following areas:

1. The extent to which the Lake Ewauna, the Keno Reservoir, the Keno Dam, and the Keno Reach are physically linked to the project's generating facilities.

2. The extent to which these features are needed for any project purpose, including but not limited to protection, mitigation, and enhancement ("PME") of fish, wildlife, recreation, water quality, and other environmental values.

3. The regulatory scheme under state or federal law by which the environmental impacts of these features would be prevented or mitigated, should the Commission approve removal of the features from the project boundary.

4. PME measures at these features for fish, wildlife, recreation, water quality, and other environmental values, in the event the Commission does not approve removal of the features from the project boundary.

5. As an alternative to removal of these features from the project boundary, evaluation of decommissioning and physical removal in whole or in part of the Keno Dam and Reservoir.

ODFW also is concerned about PC's proposal to remove the JC Boyle Bypass Reach from the Project boundary and believes the reach should remain as part of the Project. 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, indicating a discrepancy in approach for including or excluding various Project features from the Project boundary. Project impacts extend through this entire reach, therefore enhancement measures such as increased stream flows and ramp rate restrictions will also extend through this reach. If this stream reach is removed from the project boundary, enforcement of license required measures, monitoring of adaptive management measures, and evaluation of habitat restoration will be complex because FERC will have to apply enforcement authority outside of the project boundary.

Decommissioning Information Needs

The federal relicensing process is designed to determine whether an existing Project should be granted a new license. As part of this process, FERC completes an Environmental Impact Statement (EIS). Within the EIS, FERC considers "the degree to which the effects on the human environment are likely to be highly controversial" (40 CFR 1508.27.). FERC's EIS will require analysis of a full range of alternatives, including the alternatives of issuance of a non-power license or Project retirement, for any one or more of the Project facilities. The Federal Power Act states that "Non-power licenses may be issued at the motion of an interested party or on the Commission's [FERC's] own motion (16 U.S.C. s 808(b))". FERC could determine that a non-power license is necessary if it concluded that power production needs were outweighed by recreational or environmental considerations. Therefore, the consideration of what conditions to attach to a new license and the questions involved in determining whether a non-power license is necessary requires the preparation of an EIS. In accordance with FERC guidance, PC should anticipate this NEPA need and include in its FLA an evaluation of decommissioning alternatives.

System Landscape Option Matrix

PC committed to an options analysis in the February 22, 2002 letter to stakeholders. PC writes, "We are pleased to announce that PC has agreed to work collaboratively with stakeholders to conduct a high-level options analysis, including some without Project scenarios, to explore fish passage options as described below." In addition, PC also committed in the same letter to identify Project options ranging "from installation of different types of fish passage at various facilities to without Project scenarios at some or all of the hydroelectric facilities." The items for consideration under each option would describe "impacts (positive or negative and cost) of the fish passage options on the following resources: resident fisheries* (recreation resources); anadromous fisheries* (socioeconomics); water quality* (cultural and historic resources); water use (construction or removal/permitting), hydrology (scenic-aesthetic resources); geomorphic processes, including sedimentation (resource management goals); and wildlife resources."

While PC worked with stakeholders to develop a process for "high level" analysis of fish passage through the System Landscape Options Matrix (SLOM), the analysis and documentation was not completed. The Collaborative stakeholders worked with PC to describe the alternatives of the SLOM. PC should have then produced an impact assessment, including a discussion of methods, assumptions and uncertainties, to facilitate comparison of SLOM alternatives. PC should still complete this impact assessment and incorporate it into a decision support tool. The results of a decision structure assessing the SLOM alternatives could provide the bookends for a reasonable range of alternatives. In addition, this tool could be used to facilitate settlement discussions as well as address the bigger basin issue of restoring anadromous fish to the Klamath Basin.

Consultation Record

While PC's consultation record is complete in following process chronology, the result of the process reflected in the FLA is incomplete and fails to adequately convey complexity of issues, points of agreement and disagreement, or present the details of issue resolution. In addition, the

consultation record is spread over multiple sections and volumes of the FLA making it difficult to follow issues and develop a clear picture of consultation, accomplishments and disagreements. Moreover, stakeholders did not anticipate that the draft license application (DLA) would not include an impact analysis or any preliminary PME measures, which are typically required by the Federal Power Act. As a result, the FLA is the first opportunity for stakeholders to review and comment on the results of PC's analyses and proposed Project. Therefore, the additional studies are required because the FLA does not adequately convey the effects of the Project on state fish and wildlife resources. If stakeholders had been allotted the time intended by the CFRs for the review of information critical to the process, perhaps certain deficiencies could have been addressed prior to submission of the FLA. Further, if the Collaborative had functioned as a truly collaborative process, perhaps the FLA would have been more complete with impacts and PM&Es more broadly supported by stakeholders who are committed to the process.

Appendix E1-A: Correspondence Record

ODFW has corresponded with PC and FERC with the following letters.

1. Letter dated February 6, 2004 Provisional Unified State Position with State of Oregon Hydroelectric Application Review Team (HART) (RE: State standards of Reauthorization and Preliminary Conditions)

2. Letter dated November 18, 2003. Provisional State Position with State of Oregon Hydroelectric Application Review Team (HART) (RE: State standards of Reauthorization and Preliminary Conditions).

3. Letter dated October 5, 2003 addressed to Toby Freeman, Hydro Licensing Manager and Todd Olson, Klamath Hydro Project Licensing Manager of PC from Amy M. Stuart, Power Program Biologist, High Desert Region of Oregon Department of Fish and Wildlife (Re: ODFW Comments on Anadromous Fish Reintroduction and Study Plan 1.18, Description of Migratory Behavior of Juvenile Salmon Smolts through California Reservoirs using Radio-Telemetry Techniques in the Klamath Basin, 2004 – Initial Study).

4. Letter dated September 16, 2003 addressed to Toby Freeman, Licensing Project Manager, of PC from Amy M. Stuart, Hydro Power Program Biologist, High Desert Region of Oregon Department of Fish and Wildlife (RE: Response to PC to Draft License Application).

5. ODFW email dated August 27, 2003 to Todd Olson of PC and Ken Carlson of CH2MHill from Rick Kruger, Instream Flow Specialist (Re: Keno Reach Instream Flow Analysis).

6. ODFW memorandum dated June 20, 2003 to Roger Smith, Klamath District Fish Biologist from William Tinniswood, Assistant District Fish Biologist (Re: Klamath River Fish Kill below Keno Dam).

7. Letter dated February 27, 2003 addressed to Toby Freeman, Hydro Licensing Manager and Todd Olson, Klamath Hydro Project Licensing Manager of PC from Amy M. Stuart, Power Program Biologist, High Desert Region of Oregon Department of Fish and Wildlife (RE: ODFW

comments on content of the Klamath Hydro (FERC No. 2080) Draft License Application and correspondence).

8. Letter (Memorandum) dated February 24, 2003 addressed to PC from Amy S. Stuart Hydro Power Program Biologist, High Desert Region of Oregon Department of Fish and Wildlife (RE: Input to Study 1.9 Fisheries Assessment).

9. Email dated January 3, 2003 to Todd Olson of PC and Christine Kennelly of Kearns and West from Amy Stuart, Hydro Power Program Biologist, High Desert Region of Oregon Department of Fish and Wildlife (Re: ODFW Research Review of Rainbow Trout Movement Study).

10. Letter dated May 1, 2002 addressed to Mr. Toby Freemen, Hydro Relicensing Director and Mr. Todd Olson, Klamath Relicensing Manger of PC from Amy S. Stuart Power Program Biologist, High Desert Region of Oregon Department of Fish and Wildlife (RE: Response to PC February 22, 2002 letter; Request for Mid-Study Status Review; Concern Adequate and Timely Studies.

11. Letter dated August 20, 2002 addressed to Toby Freeman, Hydro Relicensing Manager and Todd Olson, Project Relicensing Manager of PC from Rick Kepler, Water Resources Program Manager, Habitat Division, Oregon Department of Fish and Wildlife (Re: Needed Improvements to the Instream Flow Study Plan)

12. Letter dated August 2, 2002 addressed to Toby Freeman, Hydro Relicensing Manager and Todd Olson, Project Relicensing Manager of PC from Amy M. Stuart, Hydro Power Program Biologist, High Desert Region, Oregon Department of Fish and Wildlife (Re: ODFW Concerns for the Proposed Instream Flow Study; Results of July 23 and 24, 2002 Field Trip on the Klamath River)

13. Letter dated February 25, 2002 addressed to Todd Olson, PC from Amy M. Stuart, Hydro Power Program Biologist, High Desert Region, Oregon Department of Fish and Wildlife (RE: ODFW Response to Version 2 of the Evaluation of Ramping Downstream of Link Dam, Keno Dam, JC Boyle Dam, JC Boyle Powerhouse and Copco Dam (1.7), Instream Flow Scoping (1.8), Fisheries Assessment (1.9), Fish Passage Planning and Evaluation (1.10), and Wetland and Riparian Community Characterization (2.2) Studies).

14. Letter dated December 20, 2001 addressed to Todd Olson of PC from Amy M. Stuart, Hydro Power Program Biologist, High Desert Region, Oregon Department of Fish and Wildlife (RE: ODFW Response to the Proposed Water Quality, Hydrology, Vegetation and Wildlife Studies.

15. Letter dated July 22, 2001 addressed to Todd Olson, PC from Amy M. Stuart, Hydro Power Program Biologist, High Desert Region, Oregon Department of Fish and Wildlife (RE: Response to Second Stage Consultation Document).

16. Letter dated March 19, 2001 addressed to Todd Olson of PC from Amy M. Stuart, Hydro Power Program Biologist, High Desert Region, Oregon Department of Fish and Wildlife (RE: Response to First Stage Consultation Document).

Non-compliance with the Existing FERC License

The existing Project is not in compliance with some of the Articles of the current FERC license. For example, ODFW and the USFWS and other stakeholders have worked with PC to identify fish passage problems at the JC Boyle facilities. Fish passage problems were also documented by the ODFW Research Project from 1988-91 (Buchanan et al. 1991 and 1992). The Project is not in compliance with Article 32 of the existing license for operation and maintenance of fishways and screens and any proposed modifications to existing ladders or screens should be considered compliance with the current license and not "enhancements" for the new license.

In addition, erosion has resulted from the JC Boyle emergency spillway and resource damage caused by the Powerhouse Road has caused erosion of 70,000 to 80,000 cubic yards of material into the Klamath River. Impacts to adjacent sideslopes, recreation, terrestrial habitat, fish passage, and water quality are compliance issues for Article 20 of the existing license for the Project which makes the Licensee "liable for injury to, or destruction of any buildings, bridges, roads, trails, lands or other property of the United States". The Licensee is required to repair or restore damage to impacted resources and prevent further damage from Project operations. ODFW is also concerned because the Powerhouse Road causes erosion and damage to riparian areas and springs. Although the FLA includes actions to add a spillway bypass release valve, this proposal should be regarded as compliance with Article 20, and not as an "enhancement" as described in the FLA.

A recent examination of historical gage records indicates that PC appears to regularly exceed the FERC license maximum ramp rate condition of 9 inches per hour. 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). 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 inches per hour (0.75 feet per hour) 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. This data reveals substantial non-compliance with the existing FERC license and has serious ramifications for adverse impacts due to stranding and the need for additional studies of ramping impacts.

ADDITIONAL STUDY REQUESTS

and

INFORMATION REQUEST

FOR THE RELICENSING OF

PACIFICORP'S KLAMATH HYDROELECTRIC PROJECT, FERC 2080

Submitted by

OREGON DEPARTMENT OF FISH AND WILDLIFE

April 23, 2004

The Oregon Department of Fish and Wildlife (ODFW) has reviewed the Final License Application (FLA) filed by PacifiCorp (PC) and is providing recommendations for additional studies that should be completed before the Federal Energy Regulatory Commission (FERC) accepts the license as adequate to conduct its environmental review.

ODFW has worked with PC and other parties to this relicensing and has reviewed proposed studies and provided comments in an attempt to ensure that comprehensive and meaningful studies would be conducted. We appreciate PC's efforts to obtain ODFW's views on issues and aquatic and terrestrial study requirements for relicensing the Project. However, in a number of areas, as detailed in these additional study requests (ASR) and the information requests, the FLA fails to provide information requested by ODFW. In some cases field studies and data analysis have not been completed. In other cases, PC chose not to use standard study methodology recommended by ODFW. We request that FERC require PC conduct these ASRs and provide the information needed by ODFW for

its analysis of Project impacts and to support recommendations to protect, mitigate losses, and enhance fish and wildlife resources.

This enclosure summarizes recommendations for additional studies that should be completed prior to the FERC's determination that the FLA is ready for environmental analysis. The FLA acknowledges that PC did not complete a number of technical studies. As a consequence of this failure and the limited scope and analysis of several studies, ODFW is concerned that Project impacts have not been adequately analyzed. ODFW is requesting additional studies that, ODFW's regard, are necessary to determine Project effects on ODFW fish, wildlife and habitat resources and as a consequence our inability to meet management goals and objectives.

Pursuant to 18 C.F.R. §4.32(b)(7), ODFW requests that FERC require PC to conduct the additional studies and provide the information described below. The additional studies and information requested are essential to a complete and factual record on which FERC must evaluate the application's giving "equal consideration" to development and non-developmental values. We urge FERC to withhold acceptance of the application for environmental review until the requested studies are completed, as they are essential for FERC to satisfy its legal obligations under both the Federal Power Act (FPA) and the National Environmental Policy Act (NEPA). The following ASRs and Information Request have been identified:

Additional Study Requests:

1. Project Operations Modeling
2. Effects of Project Ramping on Resources below Project Facilities
3. Effects of Project Peaking on Resources below Project Facilities
4. Habitat-Instream Flow Relationships and Minimum Flows in the Keno, JC Boyle Bypass, and JC Boyle Peaking Reaches
5. Fish Assessment Survey for the Link River, Keno, JC Boyle Bypass and JC Boyle Peaking Reaches
6. Fish Passage
7. Entrainment
8. Sediment/Geomorphology
9. Riparian Resources
10. Recreational Angling Survey and Flow Preference Survey
11. Systems Landscape Option Matrix

Information Request

1. Removal of Project Features from the FERC Boundary: Keno Development and the JC Boyle Bypass Reach

ADDITIONAL STUDY REQUESTS

1. Description of Recommended Study: PROJECT OPERATIONS MODELING

PC should adequately characterize Project operations and subsequent impacts on instream flow, habitat, and fish and wildlife resources, water quality and geomorphic processes. The FLA includes brief bits of information or snapshots of Project gage data to prove PC's pattern and impacts of operations. ODFW recommends that PC conduct a thorough operations modeling study that considers a full range of Project operations alternatives. PC should work cooperatively with ODFW and other interested parties to evaluate current and alternative Project operations. PC should provide Project gage data to ODFW and other stakeholders including electronic data files of streamflows and reservoir elevations recorded during the period of record as well as associated stage-discharge and elevation-volume curves.

Basis for Request

The FLA had limited operational modeling and did not analyze the range of scenarios. This information is critical for determining the effects of the Project on resident and potential anadromous fish populations and for identifying optimal flow needs for spawning, incubation, emergence, and migration of native salmonids. As an example, PC has not modeled the flow regime proposed in the FLA. Within Project hydrology needs to be modeled and is fundamental to understanding and integrating other study results

such as the fish resource assessment and water quality studies. The study also needs to evaluate the full range of hydrology options to provide optimal choice for power generation that minimizes impact to aquatic and other natural resources. The analysis should display a wide range of scenarios of how the Project could be managed, with flows at each facility that would mimic a more natural historic regime, recognizing that other habitat alterations have occurred in the basin. The results of the study are necessary to provide a basis for developing appropriate project operations that minimize impacts to aquatic and riparian resources while providing Project generation.

ODFW also requested that PC conduct an Indicators of Hydrologic Alteration (IHA) evaluation (Agency letters to PC July 22, 2001 and December 20, 2001 responses to Second Stage Consultation Documents) but PC deferred this study "until determined necessary based on results of other hydrologic analyses" (Draft License Application [DLA] (p.1-5)) and has still not conducted the study. From the information presented in the DLA and FLA, ODFW believes PC must still conduct an IHA for an adequate understanding of hydrologic alteration in the basin by the Project. ODFW and other stakeholders have also requested in the Aquatics Work Group (AWG) a study to locate and quantify accretion of spring flows as habitat and refuge areas for fish and other aquatic biota. ODFW has also requested analysis of the magnitude, duration and frequency of flow changes in the Link, Keno, and JC Boyle peaking reaches to understand impacts on aquatic resources. PC has declined to conduct these two studies and we request that FERC require PC to conduct them as part of the Project Operations and Hydrology study.

The ODFW recommends that PC evaluate the following operational scenarios to encompass a wide range of operations in order to conduct a comprehensive evaluation of the biological effects of the Project operations under current and future regional fishery programs to identify optimal flow needs and appropriate fishery mitigation measures for relicensing. This should include an assessment of flow, reservoir elevations, reservoir water quality, and describe important aquatic habitats and how different operational scenarios influence these habitats including water quality and size and location of habitats across varying hydrologic regimes in the Klamath River within and below Project dams.

1. Existing operations including flood control, load following, and minimum flow requirements in the JC Boyle Bypass Reach (baseline condition).
2. Existing operations without load following but with flood control and minimum flow requirements in the JC Boyle Bypass Reach. This would assess the impacts of load following on water supply and habitat availability.
3. Existing operations with a 2 in/hour load following limit measured within 0.25 miles of Keno, JC Boyle and Iron Gate dams with flood control and minimum flow requirements in the JC Boyle Bypass Reach. This would assess the impacts of a 2 in/hr ramping rate limit on water supply and habitat availability.
4. Existing operations with a 50 cfs/hour load following limit measured within 0.25 miles of Keno, JC Boyle and Iron Gate dams with flood control and minimum flow requirements in the JC Boyle Bypass Reach. This would assess the impacts of a 50 cfs/hr ramping rate limit on water supply and habitat availability.
5. Existing operations with a flat line or no load following at Keno, JC Boyle and Iron Gate dams with flood control and minimum flow requirements in the JC

Boyle Bypass Reach. This would assess the impacts of a run of river project with existing water supply and habitat availability.

6. To supplement PC's study "Feasibility of Reintroduction of Anadromous Fish Above or Within the Project" an additional scenario needs to be modeled whereby Keno, JC Boyle, and Copco reservoir are drawn down to a point at which water velocities are sufficient to allow out-migrating smolts and juvenile fish to pass through the reservoir.

This study will assist in modeling alternative scenarios to meet the following objectives: 1) achieve flow augmentation goals for increasing migration rates of juvenile salmon, steelhead and native resident fish through the Project; 2) provide optimal habitat for native salmonids including redband trout and potential anadromous steelhead and Chinook, including protection of redds and provide rearing habitat for juvenile fish; 3) optimize value of stored water delivered from Upper Klamath Lake for fish mitigation purposes by passing through the Project or storing in Project reservoirs for later release; 4) provide rearing habitat for redband trout and other native resident fish; and 5) manage reservoir operations to minimize impacts to resident fish and fishing opportunities in riverine reaches.

Responsible Entity

PC has existing staff and consultants capable of conducting the modeling. PC should conduct agreed-upon model runs in a timely manner and provide electronic output files to

a team of interested stakeholders. PC should provide electronic data files containing Project gage data to interested stakeholders.

Study Participants

PC should collect the requested information with oversight from a stakeholder team of state, federal, and tribal biologists and (non-governmental organizations) NGO representatives. This interagency team should also include representatives from the U.S. Bureau of Reclamation (BOR) and the tribal biologists that have worked with project operations modeling to ensure consistency with regional modeling efforts. The interagency team should provide overall guidance and assist with developing model inputs.

Study Objectives and Methods

Study Objectives

The objectives of the study are described below.

- Analyze a full range of prudent and reasonable alternatives for operating the Project
- Permit a comprehensive evaluation of the potential biological effects of Project operations within the Project and below Iron Gate Dam
- Assist in identifying an appropriate biologically based flow regime that would benefit both aquatic/riparian/riverine resources and power generation

- Determine how different operational scenarios influence aquatic habitats of native salmonids and endangered suckers within the Project across varying hydrologic regimes
- Conduct an IHA to characterize degree of alteration of river hydrology from historic conditions to present in terms of magnitude, duration and frequency of flow below each Project facility
- Locate and quantify accretion of spring flows as habitat and refuge areas for fish and other aquatic biota.

Study Methodology

PC should use existing models to evaluate operational scenarios at each Project facility, reservoir and river reach. This may include integrating the hydrologic and hydraulic modeling for the Hydrologic and Water Quality modeling effort (see Water Resources FTR sections 4 and 5) and KPOPSIM, the latter of which is used by USBR to model irrigation project operations. These models have been used to assess water quality and should also provide input of model results into resource analyses including instream flow assessments.

PC should use the Project Operations Modeling to evaluate physical and operational changes at each Project facility including alternative ramp rates, minimum flows and peaking cycle duration and magnitude. These modeling scenarios should be developed with the Aquatics Work Group. More particularly, PC should model scenarios in the Keno, JC Boyle Bypass and JC Boyle Peaking reaches that incorporate a range of

minimum flows that better protect aquatic life including a run-of-river and partial run-of-river (i.e. flows occur within a designated limit) around an average daily or weekly flow.

The spring flow accretion study requires a survey and assessment of all possible sources of inflow from natural spring sources. The survey will require location and quantification of accretion of spring flows within and along the river including springs located under impoundments. It may also include coldwater inputs from sources such as Jenny Creek that also provided historical thermal refugia that are now largely lost by inundation.

Accepted Practice

Modeling of Project operation scenarios is a commonly accepted element of river management planning, including other FERC proceedings such as the Pelton Round Butte relicensing (FERC #2030), Pit 3, 4 and 5 by Pacific Gas & Electric (FERC #233), Mokelumne, and Stanislaus relicensing proceedings. Hydrologic modeling typically encompasses a baseline alternative that describes how the licensing applicant has operated the hydroelectric complex and also provides an array of scenarios for environmental analysis of how the proposed project might be managed.

How the Study will be useful in Furthering ODFW Resource Management Goals

Modeling a sufficient range of operational scenarios is necessary for the development of suitable protection, mitigation and enhancement (PME) measures and an understanding

of the complex tradeoffs that occur as a result of Project operations. ODFW will use the study results to undertake the following actions:

- Assess the impacts of the Project dams and associated reservoirs on aquatic, terrestrial, and recreation resources
- Assist regional managers and all parties in the relicensing in assessing Project impacts
- Determine scientifically based Project operations scenarios that will provide biological and hydropower benefits.
- Further ODFW's resource management goals by providing information on Project affects on fish populations and habitat in the Klamath Basin and what kinds and levels of mitigation measures would be most appropriate to include in the new license to support protection and restoration of fish populations.

Time Required for Study

ODFW estimates the study should be completed within a 6-12 month timeframe.

Why Study Objectives cannot be Achieved Using Available Data

PC only modeled four "end-member" operational scenarios, which do not provide adequate information to compare Project impacts under current conditions to proposed operations or other reasonable operations alternatives. Conducting additional operational scenario modeling will assist stakeholders in developing an operational scenario that benefits natural resources, power production, and other Project needs.

Request during Pre-Filing

Although this study was requested during pre-filing consultation PC chose not to complete adequate Project operations modeling.

2. Description of Recommended Study: EFFECTS OF PROJECT RAMPING ON RESOURCES BELOW PROJECT FACILITIES

PC should conduct additional ramping studies below Link River, JC Boyle and Keno dam, and below the JC Boyle Powerhouse to adequately determine rates necessary to protect fish and aquatic resources from adverse effects from up-ramping and down-ramping. The existing ramping study completed by PC (Study Plan 1.7 Evaluation of Ramping Rates on Fish Downstream of Link Dam, Keno Dam, JC Boyle Dam, JC Boyle Powerhouse and Copco No. 2 Dam) inadequately characterizes ramping impacts and is based on scanty, inconclusive data compiled from other studies.

The additional study should evaluate the potential adverse impacts of the existing 9 inches per hour ramp rate and PC's proposed ramp rates of 4 inches per hour when flows are less than 1,000 cfs and 9 inches per hour when flows are greater than 1,000 cfs in the JC Boyle Peaking Reach. The study should also evaluate implementation of National Oceanic Atmospheric Administration (NOAA) Biological Opinion ramp rates used below Iron Gate Dam to the JC Boyle Peaking Reach of 50 cfs per hour and the more typical Pacific Northwest regional rate of 2 inches per hour and 1 foot per day ramp rate. These ramping rates should be measured within 0.25 miles of each Project facility. The ramping study should evaluate impacts on 1) resident and potential anadromous fish

populations including assessment of lost rearing habitat, changes in amount and location of habitat, fish stranding, and energetic impacts 2) shoreline substrate, and 3) riparian vegetation.

Basis for Request

The Project, as described in the FLA, is operated in a manner that causes daily flow fluctuations in response to power load demands. Annually, PC 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). PC has proposed continuing a liberal ramping rate of 9 inches per hour when flows are greater than 1000 cfs, and 4 inches per hour when less than 1000 cfs, in the Upper Klamath Wild and Scenic River reach downstream of the JC Boyle powerhouse. The proposed rates of 4 to 9 inches per hour are measured 0.25 miles downstream of the JC Boyle Powerhouse. PC has proposed new ramp rates in other Project reaches, except for Link and Keno (Table 1).

Table 1. PC Project reaches of the Klamath River with proposed Ramp Rates from FLA.

Project Reach	Down Ramp Rate cfs or inches / hour
Link River	None proposed
Keno Reach	None proposed
JC Boyle Bypass	150 cfs
JC Boyle Peaking	9" when flow >1000 cfs and 4" when flow < 1000 cfs
Copco II Bypass	125 cfs
Below Iron Gate Dam	USBR KPOP, BO's, in lieu of ESA BO PC will implement Hunter (1992).

ODFW is very concerned about PC's proposal to continue operations at the high ramp rate of 9 inches per hour, partially because the actual impact of this rate has not been adequately determined, but also due to the fact that PC appears to regularly exceed the FERC license condition maximum of 9 inches per hour. 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). 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 inches per hour (0.75 feet per hour) 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 inches per hour (0.7 feet per hour) which could not have detected stranding under the apparently common out-of-compliance operations.

No ramp rates were proposed in the FLA below Keno Dam, although it is a Project facility that historically ramps at 9 inches per hour and has been knows to have fish kills associated with these extreme ramp rates. In addition, stakeholders have repeatedly requested a ramping analysis in the Keno Reach and PC indicated that "PC will work to engage USBR with the Aquatics Work Group to identify flow-related concerns in this reach and collaboratively develop means to address these concerns" (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). PC has not followed through with any evaluation of ramping impacts to aquatic resources below Keno Dam.

The practice of using reservoir storage to follow short-term peaks in power demand – known as load following – results in rapid and significant changes in river flow and reservoir elevation. Rapid flow fluctuations can have a wide variety of adverse impacts to aquatic ecosystems. Although the magnitude and types 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, and
- 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 also result in increased erosion of gravel and cobble bars and daily loss of side channels, which can reduce available habitat for spawning and rearing fish and macroinvertebrate species.

Generally, these operations result in a decrease in the productivity and carrying capacity of the aquatic ecosystem.

The adverse effects of load following operations on aquatic resources are well documented in the scientific literature. Down ramping of only 1 inch per hour can impact fish populations. One very significant ramping event at a very unusual time can cause a significant limiting condition for one or more age classes of fish, or a section of habitat (such as an important side channel used for rearing habitat) can be impacted for a long period (Hunter 1992).

ODFW identified in comments on the DLA that PC did not adequately assess the effects of daily ramping (including magnitude, duration and frequency) on aquatic and riparian resources. Daily and hourly flow fluctuations may be causing energetic impacts to native fish species and isolating side channel habitat, thus affecting aquatic, terrestrial and botanical resources. Peaking operations also caused increased transport of fine sediments.

The FLA further mischaracterized findings from a poorly conducted study by concluding Project operation caused very little impact to fish populations in the Peaking Reach. Conclusions regarding streambed de-watering, fish community, adult trout movement and juvenile fish stranding were done with inappropriate assumptions, small sample sizes, and inadequate surveys and equipment. These comments are summarized in ODFW's comments to the DLA (September 16, 2003, pages 34-38) and comments to

Study Plans. For example, the fry stranding study had a very small survey time and only 3 of the 9 days surveyed over 2 years from late May to late August were likely for surveyors to encounter fry in the Peaking Reach. While the fry study acknowledged that fry densities were extremely low in the Peaking Reach compared to the Bypass Reach, conclusions were summarized to state that peaking had no effect on juveniles, a false conclusion from very small sample sizes.

Another example is that the PC Study Plan acknowledged that the study was unlikely to produce conclusive information: "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 from the scanty data produced, PC made erroneous, definitive conclusions that ramping had no impact.

In addition, ramping rates proposed by PC are inconsistent with FERC conditions at other hydroelectric Projects. Unregulated rivers rarely experience drops in water surface elevation in excess of two inches per hour except during floods. PC's proposed ramping rate of 4 inches below 1,000 cfs and 9 inches per hour above 1,000 cfs is considerably greater than ramping rates set at other Projects (Pelton Round Butte, Leaburg/Walterville, and North Umpqua – all equal to or less than 1-2 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 ODFW and other parties.

1. Resident and anadromous fish populations downstream of the Project. The proposed ramping rate exceeds recognized standards established for rivers in the Pacific Northwest that contain anadromous fish (other Northwest hydropower Projects have ramping rates typically on the order of 50 cfs/hour and a maximum of 1-2 inches/hour). The proposed ramping rate may cause and/or contribute to fish stranding, including stranding of threatened and endangered species in low gradient channel habitat exposed during downramp.

2. Gravel/Cobble bar erosion. Rapid stage change (particularly down-ramping) can increase the rate of bank erosion and exacerbate the already serious erosion of small particles below the Project. These gravel and cobble bars and beaches are important rearing areas for fry and small juvenile fish.

3. Isolation of side channel habitat and stranding of fry and juvenile fish.

4. Survival of fry and juvenile fish life history stages in the peaking reach. While PC found a few stranded fish in a very limited survey of habitat stranding, the lack of finding many fish likely demonstrates that peaking operations have impacted survival of these early lifestages.

5. Behavioral impacts to fish species present within the Project-affected reaches including spawning interference and juvenile emigration

6. Riparian vegetation. Rapid stage change such as that proposed by PC 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.

Responsible Entity

PC as the Licensee should fund and conduct the ramping study and its affect on aquatic resources.

Study Participants

ODFW recommends that PC fund and conduct the ramping study and consult with state, federal and tribal resource agencies and interested stakeholders during study design and implementation (including collection and analysis of data).

Study Objectives and Methods

Study Objectives

Determine the effects of the existing and proposed daily ramping on aquatic resources and habitat including side channels, and gravel and cobble bars.

Determine rates necessary to protect fish and aquatic resources from adverse effects from up-ramping and down-ramping.

Study Methods

Quantification of Stranding Habitat

The study should describe impacts to aquatic habitat including quantification of susceptible stranding and trapping habitat along the full length of the Project reaches. Particular effort should focus on known areas of trapping/stranding potential including lengths of river with mild cross-sections gradient, potential/historic spawning areas, and side channels. The study should quantify impacted rearing and adult habitat using PC data from Instream Flow Incremental Methodology (IFIM) study, (cross-sections, habitat mapping, and longitudinal profiles), Geographic Information Systems (GIS) polygon mapping incorporating high flow and low flow aerial photographic analysis (equal to or less than 1:12,000), and field-level reconnaissance and calibration through all Project reaches which may experience ramping. Stage-discharge relationships should be developed for these at-risk habitats using either existing IFIM cross-sectional data or, where necessary, the collection of additional cross-sections. The quantification of at-risk stranding habitat should include the full range of operations that occur in the peaking

reach, between 3000 to 320 cfs. The range of flow analyzed in other Project reaches should be based on the best available data such as U.S. Geological Survey (USGS) and PC gage data. These ramping rates should be measured within 0.25 miles of each Project facility.

Field investigations for stranding habitats and stranding of fry and juvenile fish along river margins should be conducted by visual observation during and after down-ramping episodes. The study should identify potential stranding areas, especially in cut-off channels and puddles, during the down-ramping phase of hydropower operations. These areas should be inventoried and mapped (including GPS coordinates), and sufficient documentation of the habitat unit where stranding/trapping habitat occurred should be collected 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 documented with photographs, GPS coordinates, and sufficient documentation of the habitat unit where stranding/trapping occurred (as above). The stranding habitats and fish stranding data should then be used to calibrate GIS based analysis in stranding/trapping habitat quantification. 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:

1. 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 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 later into the study. Ramping rates would be measured within 0.25 miles below Project facilities.

2. 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.

3. 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 JC Boyle bypass reach and a long spawning period, may have a protracted emigration into the peaking reach April, May, June, July and potentially August.
4. 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.
5. 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.
6. 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.
7. 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.

PC should 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. ODFW and other stakeholders have preliminarily reviewed the peaking reach and 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 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).

Gravel and Cobble Bar Armoring and Erosion.

An adequate evaluation of the processes that could result in erosion of the bars was not included. These processes include the following scenarios: drag and lift forces from the river water that tend to detach and entrain smaller surface particles including sand and small gravel; weakening and weathering of the small substrate particles due to moisture changes; current and wave action; and fluvial transport and erosion of sediments that could lead to scouring at the toe of the slope.

PC should conduct a study to look at the effects of proposed ramping practices in a 1 hour time frame, and down to a flow level that is proposed. Daily ramping generally occurs at flows between 350 and 1,500 cfs through summer and fall. The effects of this ramping on bar and shoreline erosion are unknown. In addition, peak discharges are

believed to contribute to bar erosion. The relative contribution of these processes to erosion is currently unknown and needs to be determined to fully assess Project impacts to resources.

This information would be critically important in determining the relative contribution that PC has had gravel and cobble bar erosion during past and current operations. In addition, this information would aid in developing terms, conditions, and mitigations that would be most effective in meeting applicable goals and objectives for sediment and sediment-dependent resources.

Riparian Vegetation

PC should conduct a literature search in the area of arid riparian vegetation and the effects of differing irrigation scenarios. This literature review would detail how species handle flow fluctuations and how they perpetuate themselves in conditions similar to those proposed by PC for the Project. In addition, riparian vegetation community potentials need to be determined for each reach of the Project. This information will allow a comparison of existing vegetation species diversity and abundance to Desired Future Conditions (DFC) for the site and help identify management actions necessary to move towards DFC's.

Accepted Practices

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 developing 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.

How the Study will be useful in Furthering ODFW Resource Management Goals

ODFW has multiple resource management goals derived from Oregon statute and adopted rules that guide agency recommendations in hydro relicensing processes. Permeating each of these policies is 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 passage at artificial obstructions are all management techniques that ODFW is directed to utilize to achieve its goals.

ODFW will use the study results to assess the aquatic impacts of Project ramping and provide 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 ODFW with information pertaining to the existing and future impacts of load

following operations on species that we statutorily manage for the benefit of Oregon's public.

Time Required for 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 and 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 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. PC's IFIM studies are incomplete and thus far PC proposes to continue load following despite the lack of conclusions in PC's study and the apparent impacts noted by ODFW research staff and the Salt Caves FERC EIS. PC's proposal to continue Project operations is inconsistent with the results

demonstrated from the Salt Caves and ODFW analyses. PC's proposal to continue Project operations will cause harm to both listed and non-listed aquatic species.

In addition to the ODFW research from 1988-91, the FERC 1990 Final EIS for the proposed Salt Caves Project also 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 most visible, had relatively low growth rates and that large trout were under represented in the age structure. The EIS cited five years of investigation compiled by the City of Klamath Falls. The FERC EIS concluded that flow fluctuations below the JC 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.

PC'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, PC'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).

Peaking during high summer temperatures and low winter temperatures may cause additional stress on fish. The impact of the increased metabolic demands placed on fish having to actively search for new, suitable habitat during a time when they are not actively feeding, their metabolism may be elevated or reduced by high or low water temperatures, respectively, and they are generally relying on body fat stored during the spring and early summer.

PC has included some analysis of the effect of ramping in the IFIM studies. However, ODFW believes there is plenty of evidence to indicate that PC'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. ODFW 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.

ODFW does not believe that PC's efforts thus far accurately portray the effects of load following operations on native fish species. In our opinion, further analysis and data

collection is necessary. High levels of uncertainty in the existing modeling and interpretation make it impossible for the ODFW to determine if and how management objectives would be attained under proposed Project operations. JC Boyle operations and proposed ramp rates below other Project facilities remain a major issue.

Request during Pre-Filing

A thorough study of effects of load following was requested but not conducted by PC.

3. Recommended Study: EFFECTS OF PROJECT PEAKING ON AQUATIC RESOURCES BELOW PROJECT FACILITIES

PC should reassess the Project impacts of peaking using updated information from additional data collection and analysis as part of the requested additional Ramping Studies, Fisheries Assessment Studies, and Instream Flow Studies. PC should revise the wetted perimeter analysis to reflect existing peaking operations rather than a hypothetical "run of river" operation that does not currently exist. PC should 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 study completed by PC thus far (Study Plan 1.16 Evaluation of Effects of Flow Fluctuations on Aquatic Resources within the JC Boyle Peaking Reach, August 2003) inadequately characterizes peaking impacts with a summary of scanty inconclusive data compiled from other studies.

Basis for Request

The existing peaking study uses inadequate information derived from fisheries assessment sampling in the peaking reach and Keno reach. The existing study uses limited information developed as part of PC's existing ramping study with results limited to wetted perimeter analysis and fish stranding observations from a limited sampling efforts conducted by PC consultants. The ODFW has requested that PC conduct additional study on ramping, fisheries assessment, and instream flow to clarify the Project impacts to the fisheries resources. Any subsequent changes in these studies will affect conclusions and analysis derived in the peaking study as a result of their interrelated nature.

In the Ramping and Flow Fluctuation Final Technical Report (FTR 6.0), PC presents a "Quantification of Varial Zone" analysis based on changes in wetted perimeter. However the flow scenarios on which this analysis is based are neither existing conditions or proposed Project operations. The analysis is therefore meaningless and does not represent appropriate comparisons or conclusions. Instead, PC should reanalyze the wetted perimeter information to evaluate existing peaking operations that vary between 350 cfs and the two typical peaking operations flow levels, approximately 1500 to 1800 cfs with one turbine and 2800 to 3200 cfs with two turbines.

Preliminary bioenergetics modeling studies indicate that low invertebrate drift rates may be limiting fish growth in the JC Boyle peaking and contradicts one of the basic

conclusions of the Klamath Hydroelectric Project report, which states on FTR 8.0, page 8-39,

> *The macroinvertebrate fauna are susceptible to drawdown and drying of habitats in varial zones. However, the general richness and abundance of the fauna throughout the system suggest adequate to good availability of macroinvertebrates as a food source for fish and wildlife.*

Macroinvertebrates are an important food resource for fish, in particular macroinvertebrates drifting in the water column. Project peaking operations have been identified as having substantial adverse impacts on benthic macroinvertebrate production in the varial zone created by peaking operations in the JC Boyle Peaking Reach. Drift macroinvertebrates have been studied by direct (limited) sampling and their importance as a food source to fish is being investigated in the Bioenergetics Study. Preliminary drift sampling in the Peaking Reach indicates a probable influence of peaking flow changes on invertebrate drift patterns and densities (FTR 8.0, page 8-29). However, the FTR concludes that drift samples, collected only once at one location without replication, were inadequate to determine whether the drift patterns and densities were due to project peaking flow changes. Preliminary information from the Bioenergetics Study indicate that drift densities make a substantial difference in the growth of larger trout and that drift densities in the Peaking Reach result in negative growth rates in trout 300 – 400 mm (12 – 16 in.) in length (invertebrate drift in the peaking reach was low, 0.01 insects/cubic foot (number/cu.ft.)). This information is supported by low relative weights observed in fish caught in the Peaking Reach compared to fish captured in the Keno Reach in a fish management survey conducted in 2003 by ODFW district fish management personnel

(Tinniswood and Smith 2003). In contrast, drift densities in the Klamath River below Iron Gate Dam, not subject to peaking operations, were about 8 times higher and that this level of drift provides significant excess food for growth by larger trout (January 14, 2004 Aquatics Work Group meeting minutes).

Methods used to collect previous drift samples are also a concern. Page 8-4 describes the drift sampling technique as follows, "Drift invertebrates were captured on a 2.5 by 4-foot frame of fine-mesh window screening (approximately 1-by 2-mm mesh) held on poles, perpendicular to the current." Mesh size for invertebrate sampling, including drift samples, should not usually exceed 500 microns. The mesh size of 1-by 2-mm, used for this study, likely missed a significant portion of invertebrates in the drift. Effective drift nets are also designed with a long tapered bag two to four feet in length to minimize clogging and backwash of invertebrates out of the net. The described equipment sounds like a flat frame of window screen held between two poles. If true, such equipment would not collect an accurate drift sample. Finally, the drift net collection periods used in September 2002, were often only of 10 to 15 minute duration. Such short collection periods would not likely collect a representative sample. Typical drift sampling periods are one to two hours in duration.

Given the importance of invertebrate drift organisms as a food source for larger trout, the observations that the peaking has insufficient drift to support larger trout, the significant reduction in macroinvertebrate production in the JC Boyle Peaking Reach varial zone and

fish assessment data that shows there to be fewer larger/older trout in the peaking reach, additional macroinvertebrate drift sampling, as described below, is warranted.

Responsible Entity

PC as the Licensee should fund and conduct the peaking study and its affect on aquatic resources.

Study Participants

PC should consult with state, federal and tribal resource agencies in study design and implementation including any additional data collection and analysis of data.

Study Objectives and Methods

The study objectives as described in PC's FTR report (Fisheries FTR section 10) on peaking appears to adequately cover the areas of particular concern associated with addressing peaking impacts to Project affected resources. Additional, quantitative sampling for macroinvertebrate drift is warranted in order to meet some of these objectives. PC should complete the additional sampling, analysis and discussion of the study incorporating those changes as noted in the recommended study and basis for request as described above.

Based on the above short comings of previous drift sampling and the importance of developing an accurate bioenergetics model for fish growth in the JC Boyle peaking

reach it is recommended additional invertebrate drift studies be completed as outlined below.

Equipment:

- Drift nets should consist of a rectangular frame (either 1 by 2 feet or 2 by 3 feet) with a three to four foot tapered collection bag of 500 micron mesh size.
- Depth and water velocity flowing into each drift net should be measured at the start and end of each drift sample collection period. The discharge stage during drift sampling events should also be recorded.

Sampling Periods:

- Drift samples should be collected during two separate sampling periods – one in the late spring early summer (May/June), and the other during late summer early fall (August/September).
- Daily drift samples should cover early morning and late evening peak drift periods and daytime drift before, during and after increasing and decreasing flow changes.
- Duration of each sample period depends on volume of invertebrates and debris drifting in the water column. Typically one to two hours provides an adequate sample without clogging and backwash from the net.

Sampling Locations:

- Two sites upstream in the Keno reach to be used as a control channel that does not experience peaking flows.
- Four sites in the JC Boyle peaking reach spaced to provide good longitudinal profile of the reach.
- Sample each site with six nets placed at three locations across the channel: two nets near mid-channel (as close as possible depending on flows), two nets mid-way between shore and mid channel, and two nets near shore.
- Sample sites should be located near the downstream segment of moderate riffle habitats.

Sample Processing (based on personal communication of Rick Kruger, ODFW instream flow specialist with Craig Addley):

- Samples may be sorted by subsampling to reduce processing time and costs. An appropriate subsampling technique should be used to achieve a minimum sample size of 500 organisms. The proportion of sample sorted should be recorded so total sample size can be calculated.
- Family level identification is adequate for the bioenergetics model.
- All sorted and identified organisms need to be measured for length and counted into 1mm length size classes.

Accepted Practice

The scientific community has conducted significant research regarding fisheries and aquatic species responses as related to hydroelectric project operations. There is an abundance of scientific literature available for reference to assist in completing this study.

Usefulness of Requested Studies in Furthering ODFW Resource Management Goals

The goal of protecting and restoring native fish and wildlife populations for use and enjoyment by present and future generations is central to ODFW management direction. 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 thru artificial obstructions are all management techniques that ODFW is directed to utilize to achieve its goals.

The additional information developed by PC will address questions that ODFW and other fisheries managers 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.

Time Required for Study

ODFW anticipates this study can be completed within one year, unless additional data needs as part of Fisheries assessment and macroinvertebrate sampling 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. PC's peaking studies are inadequate due to the inadequate conclusions from interrelated studies and the lack of conclusions from yet to be completed studies. Thus far PC proposes to continue load following despite the lack of reliable conclusions in PC's study and the apparent impacts noted by ODFW staff and the Salt Caves FERC EIS. PC's proposal to continue Project operations will continue to cause harm to both listed and non-listed aquatic species.

ODFW does not believe that PC's efforts accurately portray the effects of load following operations on native fish species. In our opinion, further analysis and data collection is necessary. There is too much uncertainty in both the modeling and interpretation of data for ODFW to dismiss load following and proposed ramping rates below Project facilities are a major issue.

Request during Pre-Filing

Although a thorough study of Project impacts by load following was requested during pre-filing consultation, PC chose not to complete adequate studies.

4. Description of Recommended Study: HABITAT-INSTREAM FLOW RELATIONSHIPS AND MINIMUM FLOWS IN THE LINK RIVER, KENO, JC BOYLE BYPASS AND JC BOYLE PEAKING REACHES

PC should complete a thorough assessment of instream flow needs for redband trout, other native resident species and potential anadromous species including steelhead and Chinook in each Project-affected reach. Information is needed to understand and display the effects of current water diversions and minimum instream flows in all Project reaches and the extent to which flows have been altered and affect habitat. Under the current license, there is a mixture of adopted flow agreements for the Oregon section of the Klamath River, both in the FERC license and flow agreements with ODFW. 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, as per agreements between ODFW and PC (FSCD 5-18). The bypass reach below JC Boyle has a minimum flow requirement of 100 cfs, although springs augment the flow up to 300 cfs or more approximately one half mile below the dam.

Basis for Request

An instream flow assessment should include the 2D analysis agreed upon by the AWG. While an instream flow study has been ongoing for the past two years, several key elements have not been completed yet, and in several cases, analyses that have been completed, and presented in the FLA have used inappropriate method or methods not agreed to between PC and the Aquatics Work Group. The evaluation should expand

PC's assessment of flow to habitat availability to year round and include an assessment of the behavioral changes and energetic impacts to the various species and life stages as the Project is managed to fluctuate flow with load following. Further, PC should re-conduct habitat simulations performed to date using methods agreed to with the Aquatics Work Group. These include, but are not limited to the following simulations:

- Run Physical Habitat Simulation (PHABSIM) 1-dimensional hydraulic and habitat models using both depth/velocity calibration data sets collected. The analysis presented in the FLA uses only one depth/velocity calibration data set. In consultation with the Aquatics Work Group, PC has agreed to the use of both data sets collected,
- The habitat computation algorithm used should be changed to "geometric mean" rather than "multiplicative". In consultation with the Aquatics Work Group, PC has agreed to the use of the geometric mean, therefore the analysis should be changed to this method of computation,
- Transect weighting used in the FLA habitat analysis is incorrect. In consultation with the Aquatics Work Group, PC agreed to the use of a fully proportional weighting scheme, where each transect is weighted according to how much it represents in its respective habitat unit, which is then expanded to the full set of that habitat unit type. The method used in PC habitat analysis uses uniform transect weighting with habitat unit types.
- In the FLA, PC states that habitat was simulated in two ways, with and without functional cover types and that substrate was not used at all in the computations.

In consultation with the Aquatics Work Group, PC has agreed to the use of cover types and substrate and the analysis should be conducted with these parameters included.

The use of depth calibration in hydraulic simulations was specifically disallowed in agreements between PC and the Aquatics Work Group, without specific consultation between these parties as to the need for and manner in which depth calibration would be used. PC needs to follow through with consultation on the use of depth calibration prior to rerunning hydraulic and habitat simulations.

Flow manipulations to maintain upstream lake levels or regulate inflow into the JC Boyle Reservoir result in significant flow variations in the Keno Reach. The instream flow study should also include a collection of IFIM data along with analysis for the Keno Reach, a riverine reach affected by Project operations below Keno Dam. PC has refused to conduct an instream flow study in this reach to IFIM standards to develop minimum flow recommendations and ramp rates and has only agreed to conduct a Tennant analysis, which is insufficient for an instream flow study for a relicensing effort. ODFW is seeking a revised flow study to provide needed information for determining the most effective minimum flows and ramp rates for the Keno Reach. ODFW believes that PC is obligated to conduct and analyze a scientifically based instream flow study for the Keno Reach.

Relicensing should result in developing PME measures for the new license period that will establish minimum flows in Project-affected reaches that will provide greater potential to meet fish management goals and objectives through restoration of stream habitat. Seasonal minimum flows that also reflect a closer approximation to the natural historic flow regime will improve habitat for native salmonids and endangered suckers.

ODFW's comments on the DLA identified several flaws (e.g. lack of instream flow study in the Keno Reach) and lack of progress in PC's instream flow analysis for redband trout and other native species. These additional flow analyses are essential to adequately define the habitat versus flow relationships for native salmonids, necessary to permit a full and fair assessment of impacts to habitat due to operationally caused flow changes and regimes.

In the FLA, PC has acknowledged the need for additional study based on further consultation with the Aquatics Work Group and requested the FERC to also acknowledge the need for additional work. ODFW requests that FERC recommend additional collaboration, refinement of model input variables, and analysis 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 (see Appendix A - Fish Passage and Instream Flow Insert Language)

Responsible Entity

ODFW recommends that PC fund and conduct the habitat instream flow study.

Study Participants

ODFW recommends that PC and its consultants complete the instream flow study, including the Keno Reach, using the collaborative approach that is described by the Instream Flow Incremental Methodology (IFIM), in which study plans, methods, transects and habitat suitability curves are jointly agreed to by a team of stakeholders. While much has been accomplished by PC, ODFW recommends that PC continue to convene a representative subgroup of the AWG comprised of fish biologists and instream flow experts to develop an appropriate and agreed-upon analysis and interpretation of fish populations in riverine reaches of the Klamath River, again including the Keno Reach.

Study Objectives and Methods

Study Objectives

To determine suitable flow regime year round in the riverine segments of the Klamath River in and below each Project facility for redband trout and other native fish species. The analysis should include instream flow regime for potential anadromous fish above Iron Gate Dam and for existing anadromous fish species below Iron Gate Dam (Hardy and Addley, 2001; NOAA Fisheries BO, 2002).

To collect additional information (Keno Reach) and conduct additional analyses on flow to habitat relationships below each Project facility, including dams and powerhouses to determine suitable minimal and optimal flows in each reach for aquatic resources.

In order to address the instream flow study tasks, PC and working group stakeholders will continue to meet to work on the following action items:

- Approve rainbow trout and sucker HSC curves
- Complete 2D analysis for peaking reach
- 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

This additional information will be used to identify flows needed to provide habitat conditions to support restoration and recovery of depressed populations of aquatic species that reside in the Klamath River and tributaries within the Project, including redband trout and ESA-listed suckers, and to improve the reproductive success and overall survival of all life stages of native resident salmonids and suckers.

Study Methods

If PC's hydraulic models have sufficient input data and are adequately calibrated, no additional field data collection should be necessary for most of the Project reaches. However, the Keno Reach has additional data collection needs including habitat mapping, establishing of channel cross-sections using the 3 X 3 protocols,

substrate/velocity/depth measurements at each cross-section, and developing the longitudinal profile.

ODFW recommends that PC 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. In particular, PC should asses WUA versus flow relationships, including effective habitat analysis and times series analysis, with current operations (baseline), without load following (ROR), proposed operations and ramp rates for one turbine and two turbine operations, and with maximum ramping rates of nine inches per hour and one foot per day and two inches per hour and one foot per day, 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 species in the Klamath River.

The model runs should be developed cooperatively with stakeholder to incorporate feeding stations, shear zones, velocity shelters, stream margin edge types, and cover categorizations. Excluding this data would effectively ignore the fine-scale diversity of riverine habitats and result in a very narrow description of the 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. PC

should incorporate the results of the proposed bioenergetics analysis as appropriate when they become available.

PC should also expand the analysis to year round. WUA versus flow relationships should be developed for the entire year.

Accepted Practice

The scientific community has conducted significant research regarding assessing instream flows and aquatic species responses as related to hydroelectric Project operations. The ODFW, California Department of Fish and Game (CDFG), U.S. Fish and Wildlife Service (USFWS), U.S. Geological Survey (USGS), and U.S. Bureau of Land Management (BLM) have conducted and participated in instream flow (including IFIM) work in many rivers and streams in Oregon. There is an abundance of scientific literature available for reference to assist in completing this study (BLM 2002; Bovee et al, 1998; Hardy and Addley 2001).

How the Study will be useful in Furthering ODFW Resource Management Goals

ODFW has multiple resource management goals derived from Oregon statute and adopted rules that guide our recommendations in hydroelectric relicensing processes. The basis for each of these policies is 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 passage at artificial obstructions are all management techniques that ODFW is directed to utilize to achieve its goals.

The additional information developed by PC will address questions that ODFW and other fisheries managers have regarding the suitability of existing flow regimes below each Project facility and whether or not enhancing that flow has the potential to benefit aquatic species. Accurate flow to habitat information 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.

Time Required for Study

ODFW anticipates this study should be completed in less than one year.

Existing Information and the Need for Additional Information

PC initiated an instream flow study for the relicensing of the Klamath Hydroelectric Project in spring 2002. PC proposed assessment of habitat-flow relationships for resident fish habitats under proposed operations does not adequately address impacts of load following.

PC completed important studies related to flow management in most segments of Project-affected reaches with the exception of the Keno Reach and below Iron Gate Dam; however they did not complete adequate assessments over a complete range of flow regimes, model output including 2-dimensional Potential Habitat Simulation (PHABSIM)

analysis, available operational alternatives, proper modeling of habitats, and the full compliment of native species. ODFW believes that the flows chosen by PC in this analysis could potentially misrepresent the relationship between WUA and discharge, especially at higher flows. It is likely that the habitat versus flow curves peak in a range of flows not analyzed and a larger range of flows needs to be evaluated.

PC also has not evaluated Project impacts on movement, spawning and survival of shortnose and Lost River suckers. Various studies were conducted by other researchers in other venues to evaluate spawning habitat (Buettner and Scoppettone 1990, Desjardins and Markle 2000). However, information on Project impacts such as load following, reservoir fluctuations and upstream and downstream fish passage has not been adequately studied. This is a data gap in the relicensing study that stakeholders have requested but not implemented by PC.

ODFW does not believe that PC's instream flow study has provided 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 two 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 as agreed upon by the Working Group and existing literature (Bovee et al 1998). As currently proposed, minimum flows do not appear to be justified in this reach to meet ODFW management objectives. In our opinion, further analysis is necessary

because there is too much uncertainty in both modeling and interpretation for ODFW to dismiss very low flows and load following of the Project as major issues.

Request during Pre-Filing

Although an instream study was requested during pre-filing consultation PC has partially completed the instream flow study and in some cases, deviated from agreed-upon tasks and analysis.

5. Description of Recommended Study: FISH ASSESSMENT SURVEY FOR THE LINK RIVER, KENO, JC BOYLE BYPASS AND PEAKING REACHES

PC should re-conduct and complete a much more thorough and comprehensive assessment of fish populations in riverine reaches affected by the Project. This evaluation should expand PC's existing assessment of fish populations to year round and include adequate sampling design and an assessment of the impacts to the various species and life stages as they fluctuate flows with a load following. Ramping rates should be measured within 0.25 miles of each Project facility including below dams and below powerhouses.

Basis for Request

ODFW's comments in several work group meetings and comments on the DLA identified numerous flaws in PC's fish assessment surveys methods and analysis 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 PC's study methodology and

then finally abandoned by PC) did not adequately characterize existing conditions, nor did the information provide a clear statement or analysis of Project impacts. Without adequate study results provided by PC, ODFW will rely on previous studies by other researchers, including the ODFW research study (1988-91) and a recent and ongoing fish management study conducted by ODFW district biologist to draw conclusions about existing fish populations, Project impacts, and appropriate PM&E's.

Results were summarized 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, and between years. One year of very brief sampling, usually 1-2 days in each segment, did not accurately reflect 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 invalid to draw comparisons and conclusions. The results and conclusions from PC's fish assessment are inconsistent with fish population evaluations from previous sampling efforts conducted by City of Klamath Falls (1986) from licensing studies for the proposed Salt Caves Project, ODFW research conducted from 1988-1991 (Buchanan 1991, Hemmingsen et al. 1992), and ODFW fish management data collected in 2003.

Some of the conclusions ODFW research conducted on the Klamath River at Project facilities in the early 1990s (January 29, 1997 ODFW memorandum, Al Hemmingsen, Buchanan 1991, Hemmingsen et al. 1992) were:

- Abundance and average size of redband trout that migrated upstream past JC Boyle Dam have declined dramatically since the dam was built. Reasons for that are unclear but likely related to hydroelectric facilities.
- Abundance of redband trout that migrated upstream past Keno or Link River dams was much less than that seen at JC Boyle Dam. Some fish that passed the two former dams returned to spawn downstream in Spencer Creek. That behavior may in influenced by hydroelectric facilities.
- Genetic relationships between redband trout of the Klamath River and certain populations higher in the basin are not likely to be maintained since few fish appear able to successfully pass into and through Upper Klamath Lake. Prevention of migration between populations may enhance genetic divergence between them, and possibly threaten long-term existence of tributary populations upstream.
- Rainbow trout both upstream and downstream of JC Boyle spawn in Spencer Creek. Good access must be maintained for all that intend to get there.
- Safe passage downstream past JC Boyle Dam for migrants of all sizes must be assured.

In summary, the methodology and analyses used for the fisheries assessment by PC was flawed, with inadequate data collection and analyses that do not reflect current conditions. The method used by PC was akin to a "grab sample" with very few data points, and therefore cannot be used to assess Project effects on fish populations. PC

made an independent decision with strong disagreement from the Aquatics Work Group to conduct one sample per reach per season as a baseline assessment for fish populations.

The fish assessment study is a key area of disagreement between ODFW and other stakeholders with PC regarding study methodology, analysis, results, and conclusions for the relicensing of the Project. ODFW also views PC's analysis of the data as a key dispute, since many of the conclusions PC draws are misleading and inaccurate, and based on a technically flawed study. This study plan was not approved by the Aquatics Working Group stakeholders due to misapplication of standard scientific methodology procedures and the insufficient collection of data over sample reaches, sample periods and number of seasons. PC also did not follow the process agreed to by stakeholders to resolve the fish assessment disagreement for approving study plans as stated in the "Collaborative Process." Since release of the DLA, PC has chosen to break apart the study plan into separate studies that are agreed to (i.e. fry sampling, reservoir sampling) and that are not agreed to (i.e. riverine sampling that is considered inadequate by agency and tribal stakeholders).

The goal of the fisheries assessment study was to characterize existing riverine and reservoir fish communities. Specific objectives were to assess relative abundance, growth, length frequency distribution, condition factor, and age structure of fish populations. In the study that PC conducted for relicensing the Project, PC conducted a test of sampling methodologies in fall 2001 and then a general fisheries assessment of the riverine sections in 2002. The fish assessment has a sample size of one in most cases,

sampling only one to four days for each reach, and then draws conclusions on the general abundance of fish communities and populations in each reach.

The PC 2002 sampling effort was presented in the DLA, FLA and at AWG meeting. ODFW and many other stakeholders offered many comments and recommendations such as including sample size, sample dates, time of day, flow (i.e. JC Boyle peaking reach discharge ranges from 350 to over 1500 cfs each day), and other basic scientific collection information. Other comments were to identify outliers of information, for example, most of the chubs and minnows in the Keno Reach were observed near the dam and not found farther downstream. Sample sizes were not stated and conclusions are inappropriately drawn on very small sample sizes (i.e. 4 trout in the Link River in spring 2002 and none in any other season). An incidentally high capture of redband trout in the JC Boyle bypass reach weighted a higher relative abundance and an apparent greater length at age that was not representative of the population. Sampling effort at low versus high flow periods in the JC Boyle peaking reach influenced success of capture and affects interpretation of data. Therefore, relative abundance is difficult to make conclusions given the variability of sampling conditions and the very limited sampling effort put forth by PC.

Sampling results presented in the DLA, FLA and at Aquatics Work Group meetings were questionable due to inappropriate analyses and in comparison to previous studies by other researchers that had spent far more time sampling fish populations using standardized methodology. Some of the following examples explain ODFW's concerns for the fish

assessment data collection, analyses, interpretation and conclusions:

- PC results of sampling in the JC Boyle peaking in California had a relatively high CPUE of redband trout. However, the data is not shown in the FLA that many of these fish were 50-75 mm, or age 0+ fish that are young of the year, caught below Shovel Creek, a known spawning tributary.
- ODFW suggested that PC re-analyze the scale data to produce a back-calculated length at age that would give more meaningful results of trout growth in selected reaches of the Klamath River. PC re-analyzed the scale data, but apparently had difficulty reading scales due to the high amount of scale regeneration (incorrectly called resorption), had difficulty reconciling age at first annuli, did not document their assumptions and used scales for reading that should not have been used due to the amount of regeneration. ODFW has since collected a large amount of scales from fish from the Keno, JC Boyle Bypass and JC Boyle Peaking reaches and is conducting an independent analysis to compare age at growth for fish in the 3 reaches of the Klamath River.
- PC's conclusions about condition factor ("no clear pattern of difference in condition factor" Exhibit E 4-96) are contradicted by information collected by ODFW district management in 2003 (Tinniswood and Smith 2003). ODFW found that redband trout collected in the Peaking Reach are smaller in size and have significantly lower condition factors (relative weights) compared to fish from the Keno Reach.

- PC highlights spawning observed in the JC Boyle Bypass Reach (Exhibit E 4-170). However, it is better to characterize that there is limited trout spawning in an area that is subjected to extreme flows fluctuations from spill events, maintenance, and unplanned outages. No additional protection to trout spawning or rearing is proposed by PC under the proposed mitigation and enhancement measures. Trout could be attached to an area that will produce no offspring due to the destruction of redds from planned for and un-planned for water release events. The same section of the FLA describes the high quality spring water. If the reference is to the temperature of the water then it could be described as high quality. However, the lack of nutrients available for trout growth in the spring water could be characterized as poor water quality. The end of the section concludes that the reason fish are in the area is due to the gravel and hence this must be the major limiting factor. An alternative hypothesis that is supported by ODFW research is that the challenges to trout to adapt to the fluctuating daily flows, the lack of attraction flows and the poorly designed fish ladder and screens have impacted trout that historically migrated upstream to spawning habitat above JC Boyle Dam. Trout may have spawned in the Bypass reach and in the inundated area of JC Boyle Reservoir prior to JC Boyle Dam. The present use of marginal spawning areas in the JC Boyle Bypass Reach under artificially low flows should not prevent PC from implementing PM&E measures restore that reduce Project impacts, reconnect populations and restore habitat such as improving passage, flow regime and reduce peaking.

PC declined to conduct more extensive data collection in 2003 and has stated that there is adequate information to draw conclusions. This is a fundamental study that is important for understanding the results of many other studies such as fish passage, recreation, and water quality. Misleading conclusions from this study amplifies mistakes in other studies. The study summarized in the DLA indicated that most results were qualitative in nature (Fish Resources DTR p.2-2) while the FTR study results do not acknowledge that the results are qualitative. PC inappropriately then goes on to draw conclusions based on qualitative results that are questionable and based on inadequate sample design.

PC's use of historical fisheries information is sometimes mis-leading and used to draw erroneous conclusions. PC's citation of historical population surveys (USDI 1994 citation) was actually based on the population estimates from the Beak Consulting data from the City of Klamath Falls application for the Salt Caves hydroelectric license (City of Klamath Falls 1986). PC did not include the confidence intervals for two sections of the peaking reach report that were subject to uncertainty. The upper peaking reach population estimate from JC Boyle Powerhouse to Caldera Rapid was 890 fish/mile, with a 95% confidence of 763/mile to 1069 fish/mile, while the lower reach (Caldera Rapid to Salt Caves Powerhouse Site) estimate was 1911 fish/mile with very wide 95% confidence intervals of 475 fish/mile to 7936 fish/mile. PC provides no discussion of how this sampling was conducted, the validity of methods use, or the probability that populations have changed or remained the same over the last 17 years.

Then, using the Beak Consulting data, which had many invalid assumptions regarding fish/mile, PC expands the questionable population estimates of 1,911 fish per mile number to compare with other rivers in Oregon and state that the Klamath River compares favorably for fish production. Population estimates for the Deschutes River range from 642 to 2566 trout per mile, and trout compete for food and habitat with sympatric populations of other salmonid species including steelhead, fall and spring Chinook, whitefish and bull trout. The Crooked River, a tributary of the Deschutes, has population estimates ranging from 825 trout per mile (when winter flows averaged 10 cfs) to 8,228 trout per mile (when winter flows were raised to 50 to 75 cfs). The trout abundance data from the Deschutes and Crooked rivers indicates that Klamath River rainbow trout abundance in the peaking reach is relatively low for a large river east of the Cascades.

Responsible Entity

ODFW recommends that PC fund and conduct the fish assessment study.

Study Participants

ODFW recommends that PC reconvene the Aquatics Work Group to develop an appropriate and agreed-upon sampling strategy and analysis of fish populations in riverine reaches of the Klamath River. PC should re-conduct the fish assessment study using a collaborative approach in which study plans, methods, surveys, summary, analysis and interpretation are jointly agreed to by a team of fish biologists including representatives from ODFW and other resource agencies. Upon approval from the

Aquatics Working Group stakeholders, PC should use standard scientific methodology and analysis procedures and collect sufficient collection data over representative sample reaches, sample periods and number of seasons.

Study Objectives and Methods

Study Objectives

Characterize existing riverine affected by the Project. Quantitatively assess relative abundance, growth, length frequency distribution, relative weight, and age structure of fish populations

Re-conduct and expand PC's existing assessment of riverine fish populations using adequate sample sizes, representative sample, and seasonal and year round surveys and include an assessment of the impacts to the various species and life stages due to flow fluctuations with load following and other operational scenarios.

Provide information to other Project relicensing studies (e.g. fish passage, recreation, and water quality) to assess Project facilities and operations and their impacts and determine appropriate PM&Es such as a suitable flow regime

Study Methods

As stakeholders have repeatedly requested, PC should conduct additional field sampling following standardized protocols with larger sample sizes, sampling representative reaches with representative habitat types, and a more thorough analysis. PC needs to

conduct additional surveys following established protocols for sampling, summary and analysis of results. In addition, PC should expand surveys and analysis to year-round. Seasonal changes in temperature and water quality in the Klamath River along with migration of some fish species in riverine reaches causes 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 emigration, and recruitment. The study plan needs to detail how data will be summarized, how results will address objectives, and, ultimately, the objective will help identify measures to reduce Project impacts and conserve fish populations.

The following methodology protocols are recommended.

Larger Sample Sizes: For example, the two reaches of Link River were sampled during different seasons with a sample size of one sample per reach. This is not a defensible estimate of relative abundance.

Sampling Gear: Gear selection should be based on minimizing sampling bias and to sample 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 known sampling bias. Using CPUE to compare active and passive sampling techniques is very limited. Appropriate use of electro-shocking would likely exhibit the least sampling bias as a result of coverage of diverse habitat and equal exposure of life-stages to shock. However, 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, and subsequently may be overrepresented in the sample. Where gear types have known selectivity efforts should be implemented to correct the bias, or acknowledge the bias, in the analysis of data. Methods to correct sampling bias would include the use of alternate sampling gears with known bias toward underrepresented size-classes. Alternate gear sampling should be based on a representative sampling protocol intended to correct primary gear bias.

Representative Sampling of Units and Reaches: Sample representative reaches with representative habitat types such as pool, riffle and glide. 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 conduct sampling via standard mark/recapture protocols and determine the level of emigration and immigration to the sampled unit or reach through literature estimates and radio telemetry.

Seasonal and Year-round Surveys: While PC conducted seasonal sampling, sample sizes were too small to be meaningful. Re-conduct surveys during all seasons with additional stratification over the length of each season should be implemented along with collecting sufficient sample sizes and reaches to make analysis and interpretation meaningful.

Stratify Variability: Stratify sampling across the length of Project reaches, and collect multiple samples. Where electro-shocking gear is used conduct multiple passes at similar

levels of effort within representative units. Conduct sampling protocol to allow adequate statistical analysis, including habitat unit population estimates.

Marking: Visual marking with fin clips, or other external tags, should be applied to target species. 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 marking, application of passive transponders (PIT tags) into target fish greater than 75 mm should be implemented. Individual fish 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 ROR). Subsequent recaptures should be documented as described above. Development of unique identifier marking systems will establish a mark and recapture fishery database that would serve several purposes including fish movement within reaches and between habitat units, growth rate between seasons and between years, aid in subsequent monitoring efforts, and potentially contribute towards estimates of populations within riverine project reaches.

Sampling and Marking Mortality: During sampling, mortality tests should be conducted to estimate the extent of mortality associated with sampling gear and marking. Three replicates of 25 to 30 fish collected as part of the sampling effort 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 with less invasive

sampling techniques, seines or traps, which could be used to determine holding mortality. The percentage lost during holding, minus any holding associated mortality, could then be used to infer short-term mortality associated with collection and handling of fish.

Analysis and Interpretation: Growth structure and analysis should be assessed with back calculated age at length using adequate sample sizes. Standardize analyses to sample size, number of days, length of area sampled, and seasonality where appropriate.

Environmental Variability: Assess impacts to the various species and life stages to environmental variables such as load following and other operational scenarios by comparing populations in the Link River, Keno, JC Boyle Bypass, JC Boyle Peaking and below Iron Gate to other regional rivers that do not have these large flow fluctuation impacts. Development of sampling design in the fisheries assessment study should include protocol to take advantage of changes in project operations tied to other studies, including the proposed ramping study described above.

Accepted Practice

The scientific community has conducted significant research regarding fish assessments and aquatic species responses as related to hydroelectric Project operations. ODFW has conducted and participated in fish assessments affected by hydroelectric projects in many rivers and streams in Oregon. There is an abundance of scientific literature available for reference to assist in completing this study.

ODFW recommends that PC re-conduct and expand the riverine surveys and follow a standardized protocol agreed to by a representative subgroup of the Aquatics Work Group. Using standard fish surveys and assessments, this study will permit a more thorough and complete evaluation of the impacts of the project such as load following, ramping rate, and fish passage at barriers.

How the Study will be useful in Furthering ODFW Resource Management Goals

ODFW has multiple resource management goals derived from Oregon statute and adopted rules that guide our recommendations in hydroelectric relicensing processes. Permeating each of these policies is 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 passage at artificial obstructions are all management techniques that ODFW is directed to utilize to achieve its goals.

Information collected at other hydroelectric relicensing projects supports PM&Es such as reducing ramp rates, improving instream flow and providing fish passage over barriers that restore habitat for aquatic species. The site-specific additional information developed by PC will address questions by ODFW, other fisheries managers, and relicensing stakeholders regarding the impacts of Project operations and facilities in and below the Project such as dams, bypass reaches, peaking reaches. The additional information will also support development of adequate PMEs and whether or not

enhancing flow and reducing peaking has the potential to benefit aquatic species. Accurate flow to habitat information is essential to fully understand the impacts of Project operations on the aquatic environment and to define a suitable flow regime in the Klamath.

Time Required for Study

ODFW anticipates this study should be completed in one year, although an additional year during the NEPA analysis will provide a more complete record.

Existing Information and the Need for Additional Information

Over objections made by ODFW and all other stakeholders of the Aquatics Work Group with the exception of PC, PC made the unilateral decision in 2002 to conduct one sample per reach per season as a baseline assessment for fish populations. The method used by PC was akin to a "grab sample" with one data point, and therefore cannot be used to assess Project effects on fish populations. PC's information record on fish assessments in the Klamath River is inadequate and inconsistent with results found in other, more extensive surveys (Buchanan 1991, City of Klamath Falls 1986, Hemmingsen et al. 1992, and ODFW fish management data collected in 2003). The misleading conclusions from this study amplify mistakes when used for other relicensing studies. While the study indicates that most results are qualitative in nature (DLA Fish Resources DTR p.2-2), PC then goes on to draw conclusions based on quantitative results that are questionable and based on inadequate sample design. These include misleading conclusions about impacts caused by the Project. For example, with scanty, qualitative data, PC concludes that fish

populations including resident redband trout are in excellent shape and are not impacted by lack of fish passage or extreme flow fluctuations, contrary to results from the other studies listed above.

In reaches where angling and boat shocking are the primary capture techniques, the data will be biased towards larger individuals and may misrepresent the proportion of smaller individuals and species. If this is the case, the methods will preclude obtaining good information on size distribution and age structure in reaches where these techniques are used. In addition, the methods of Study Plan 1.9 indicated that boat shocking was only conducted at low to moderate flows in the peaking reach, however, the consultant described the methods collection as "occurring at all flows." Data was summarized as catch per unit effort. However, large fluctuations in flow, which occur daily in the peaking reach, can dramatically affect capture efficiency either by fish seeking new holding spots or condensing fish into less water. These inconsistencies in capture techniques, competency of samplers, time of day, season, flow, duration analyses make conclusions difficult other than stating general presence and absence of species.

ODFW research staff provided input to PC regarding the original Study Plan 1.9 Fisheries Assessment (ODFW email January 22, 2003). ODFW comments identified that the objectives could not possibly be met with the proposed sampling. Research staff identified many shortcomings including misrepresentation of fish sizes based on capture techniques, lack of specific sampling procedures, and extrapolating findings beyond the capability of the data. The comment on PC's third objective of assessing the influence of

environmental factors, including Project operations, on fisheries resources, was that it was the most problematic and overextended the limits of the data. Since long-term data sets with comprehensive measurements of environmental variables and statistically rigorous abundance of data were not included, it was unlikely that PC could explain Project impacts.

The methods need to describe specific sampling procedures (i.e. single or double pass, randomly selected habitat units) to better evaluate the quality of the relative abundance data. The methods do not describe how relative abundance will be calculated or what they mean by 'life stage timing'. If 'life stage timing' is equivalent to 'age at maturity', then a study specifically designed to identify this will yield more reliable results.

The Keno, JC Boyle Bypass, and Peaking reaches of the Klamath River are essentially three different rivers that as a result of project operations and facilities, with substantially different characteristics in flow, temperature, turbidity and, as a result, fish populations. Based on studies in the past, ODFW staff has a strong professional opinion based on past studies that fish populations are adversely affected by Project operations including diminished instream flow, ramping and in-river environmental conditions such as temperature, habitat and similar factors. However, the 1.9 Fisheries Assessment Study Plan, as currently designed and conducted, cannot adequately answer these questions.

In summary, PC needs to repeat the fish assessment work using agreed-upon assessment methodology, analyses, and methods to interpret results. ODFW does not believe that

PC's current fish assessment efforts accurately portray the effects of Project operations and facilities on native fish species. In our opinion, further survey and analysis is necessary. There is too much uncertainty in both the collection of data and interpretation of qualitative results for the ODFW to dismiss load following, fish passage, and dewatering of bypass reaches by the Project as major issues.

Request During Pre-Filing

Although a complete and thorough study was repeatedly requested during pre-filing consultation, PC chose to conduct an incomplete study with inadequate analysis of Project impacts on fish populations.

6. Recommended Study: FISH PASSAGE

PC should develop a plan that accommodates a phased-in approach to fish passage, such as that developed at the Pelton Round Butte Hydroelectric Project (FERC #2030). Blocking of fish passage by dams is one of THE major impacts caused by this Project. Dams block fall and spring Chinook salmon, coho salmon, summer and winter steelhead, Pacific lamprey, and green sturgeon from migrating to reaches within and through the project to their historic holding/spawning/rearing areas. Passage through the Project using volitional methods for a suite of species is essential to reconnecting the system ecologically. Pacific salmon and steelhead called the Klamath and its tributaries home in the area in and upstream of the Klamath Hydroelectric Project. Runs of spring and fall Chinook salmon, coho steelhead and Pacific lamprey were present in the Mainstem river

and many of the major tributaries (Fishpro 2000). Lamprey distribution is thought to have coincided with anadromous fish distribution.

The Project effectively blocks access and upstream movement of salmonid and lamprey adults into the historic spawning areas above RM 190 and many important tributary habitats. The dams further constrain the ability of juvenile fish to migrate downstream. The present day distribution of anadromous fish in the Klamath River is restricted to below Iron Gate Dam. The Project has eliminated connectivity between of redband trout populations above, within, and below the Project. Lost River and Short-nosed suckers in and above the Project and coho salmon below the Project have been listed under the Endangered Species Act. These listings emphasize the need to provide mitigation that will increase or restore self-sustaining populations in historic ranges to ensure conservation of these species.

PC's approach to evaluating fish passage has been primarily a review of upstream and downstream passage facilities that have been tested and installed at other dams for determining potential extent of entrainment and survival thru project facilities. PC has completed engineering studies however they have not integrated the biological requirements, the full complement of species, or developed a biological risk assessment for each design.

Corrections to the FLA Record

PC 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 300 miles of habitat in the upper basin, 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.

First, the FLA and PC's response is in error in attributing this conclusion to a completed Upper Basin Amendment to the Long Range Plan. The FLA 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. While the Upper Basin Amendment to the Long Range Plan has yet to be formally approved by the Klamath Basin Fisheries Task Force, the Task Force has recommended reintroduction as part of their comments to the FLA.

Second, the Minority Recommendation from the Fortune Report (1966) 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."

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 (ODFW) 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, p. 67).

Through this relicensing process, stakeholders have asked PC to objectively examine some of these concerns. Other concerns, such as the selection of appropriate stocks of

fish for reintroduction, are better addressed by the management agencies rather than PC. In regard to the genetic concerns (Executive Summary, page 4-14; Exhibit E, pages 4-116 through 4-119), colonization and re-colonization of riverine habitats is considered to be part of the natural evolutionary biology, or strategy, of anadromous salmonid fishes. "Straying" is part of the 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).

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 one generation. Rather, population restoration may take

generations with mean population fitness increasingly gradually over time until some fitness optimum for the specific habitat/environment was attained.

PC's argument on the absences of "pre-adapted" populations is not valid 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, 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 other Pacific Northwest rivers, the Elwha and Deschutes) may not be necessary. Simply providing passage at mainstem dams may be sufficient to achieve the long-term goal, assuming, of course, that the height of the dams and the presence of reservoirs do not prevent upstream migration, "straying," and natural re-colonization.

Basis for Request

A plan with a phased-in approach to fish passage, such as that developed at the Pelton Round Butte Hydroelectric Project (FERC #2030), should be designed to reduce risk through the use of well designed experiments to evaluate critical uncertainties and to determine whether program goals can be achieved. It should also be designed to change Project facilities and operations over time to help achieve desired future conditions and goals. The plan would be used to determine which fish passage strategies and treatments

were effective and should be continued and to implement a monitoring and evaluation program. Clearly identified measures for evaluation, tasks and timelines, and a clearly defined timeline for decision-making should be included. Decision making should include determining whether to continue fish passage evaluation or abandon in exchange for alternative mitigation. An outline of steps for analysis of alternatives and prototype testing, methods for measuring success, and critical decision points should also be included. Efforts directed at increasing likelihood of success such as habitat enhancement and water quality improvement need to be identified, prioritized, and tasks and timelines set.

Study components related to resident and anadromous salmonid that have not been adequately covered under the FLA and need additional data collection and analysis:

- Fractional Entrainment to Project Facilities (Turbine, Spillway, Bypass, Ladders)
- Reservoir and Facility Survival
- Reservoir Behavior
- O&M to minimize impacts to survival and behavior of salmonids thru Project Facilities
- Salmonid Genetics
- Pathogen Risk Assessment
- Habitat and Project Facilities Scenario Modeling (EDT and KlamRAS)

PC has committed to conducting reservoir behavior studies, and completion of EDT and KlamRAS with Working Group participants (E 4-146). ODFW appreciates PC's efforts to conduct these aspects of study and recommends completion of those studies as agreed upon. The EDT analysis (Exhibit E 4-122) of attribute populating is undergoing review and modification by PC and a limited number of stakeholders. Significant changes have occurred to the EDT attributes since submittal of the FLA. In addition upper basin modeling has identified that there has been over 700 miles of habitat that may have been historically available to anadromous steelhead and over 350 miles of habitat annually available to anadromous Chinook salmon. The model attributes have not been reviewed by the larger stakeholders for agreement.

ODFW recommends that PC work closely with fisheries agencies and tribes to identify those fish passage concepts that are most promising for testing at the Project, and begin to design prototypes as part of a fish passage plan. This major component of a fish passage plan needs to be evaluated on site while other parts, such as tributary habitat restoration are being implemented.

PC's conclusions regarding the likely poor potential success of fish passage and reintroduction of fish are based on misleading conclusions and interpretations of historic information:

- In reference to comments made in the FLA (Exhibit E 4-116) regarding historic proposals for reintroduction, the Steering Committee conclusions indicates that in

general the presence of Project reservoirs hinder the likelihood of achieving self-sustaining populations of anadromous fish. However, the minority report supported restoration of anadromous fish to historic upstream habitat. In fact, anadromous fish currently exist in other watersheds with habitat impacts listed in the FLA, and resource managers and hydroelectric operators are pursuing restoration of runs through a combination of bringing fish passage facilities up to current environmental standards with performance measures along with habitat restoration efforts.

- PC's redband trout tagging study results and conclusions for passage over JC Boyle Dam were misleading in several ways. First, the distribution of tags along the full length to the study area must be incorporated in the analysis. While one of forty two fish passed the ladder, only fourteen tagged fish were placed close to the ladder in the bypass reach of which one tagged fish migrated above the dam. The other twenty eight tagged fish were located downstream of the Powerhouse, fourteen in the Peaking reach near Frain Ranch, and fourteen in California. None of the lower river tagged fish passed the JC Boyle Dam. Second, successful passage of this one tagged fish through the JC Boyle project took five days. It was marked on March 29 approaching the ladder, but delayed passage of the ladder until April 2. While passage through the ladder occurred quickly once the fish arrived at the ladder, the fish appeared to be delayed. Location of ladder entrance, attraction water, nearby spill, erosion of the channel bed to the ladder entrance may affect success of fish finding the ladder. In addition, the ladder does

not meet current federal and state standards for salmonid or other native fish species (i.e. suckers) for fish passage.

- PC's modeling at best describes the methods of reintroduction that will likely return the greatest numbers by differing reintroduction strategy. The ability of any model to accurately predict actual numbers is difficult with the current level of information from relicensing studies thus far. Habitat assessments (requested by stakeholders) will assist to more accurately define limiting factors and estimate potential production of anadromous fisheries in the Upper Klamath in the upper basin.

Responsible Entity

ODFW recommends that PC fund and conduct the fish passage study.

Study Participants

The study should be initiated by PC with direction provided by an interagency group (Federal, state and tribal) who will provide guidance on the study plan, assessment and development of conclusions. Consultation should include study design, implementation, and data analysis.

ODFW recommends that PC work closely with fisheries agencies and tribes to identify those fish passage concepts that are most promising for testing at the Project, and begin to design prototypes as part of a fish passage plan.

Study Objectives and Methods

Objectives

Evaluate the structural, operational, and biological feasibility of juvenile and adult upstream and downstream passage at the Project. These analyses are necessary to evaluate a full range of Project alternatives as required under NEPA and to identify adequate and equitable mitigation if a new license is issued.

Develop and implement a phased-in approach to fish passage.

Methods

Alternatives for passage should ensure that all native fish species impeded by the Project are addressed. Biological requirements of all species considered for passage such as fish behavior, motivation, preferences, migration timing, and swimming ability and performance may not be the same for all species and needs to drive design and construction of fishways.

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 (such as run of river) 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 and turbine mortality (including turbine fraction [the proportion of water passing through turbines]), bypass mortality (including bypass fraction), and spillway mortality (including spillway fraction). These estimates should be statistical viable and based on empirical, site-specific data collected during a range of representative conditions and over the appropriate period of time.

PC should evaluate the feasibility of instituting structural modifications that would modify reservoir flow patterns that would provide conditions more conducive to downstream movement of juvenile salmonids. PC should also utilize a three dimensional hydrodynamic model to model the potential consequences of different water withdrawal scenarios on surface currents and vertical velocity distributions. PC should investigate velocities over a tier of flows including 40,000 cfs plus and the capability of current facilities and facilities with modifications to operate at those flows. Past research at this and other projects with large reservoirs clearly indicates that juvenile fish migration through reservoirs is usually the most difficult obstacle of fish passage.

Habitat

PC should undertake field activities to collect habitat information for areas where it is insufficient or absent. ODFW believes PC's methodology underestimates the habitat potential by eliminating habitats because of seasonal water quality and quantity conditions, without an analysis of the relative importance of these conditions to life history stages. The availability and presence of cold water refugia needs to be further investigated. PC should calibrate habitat suitability criterion against similar basin like the Rogue River where there is a lot of information on life histories and distribution.

Assessment of existing habitat quality above the Project also needs to include a consideration of habitat improvements that might be made. All production potential scenarios assume that quality of habitat will be either as it is today or as it was at the time of closure of Copco Dam. PC needs to include scenario(s) that address fish production potential under the implementation of potential PM&E measures that could improve spawning and rearing habitat above the Project. Production potential should also be applied to lamprey and other resident fish.

O&M to minimize impacts to survival and behavior of salmonids thru Project Facilities

PC should 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 JC Boyle, Copco, and Iron Gate dams. PC 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. PC 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 should 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. PC should investigate how structural modifications or changes in operation, e.g. drawdown, affect predator density and feeding at JC Boyle, Copco, and Iron Gate dams.

Salmonid Genetics

Filling in data gaps that currently exist, through tissue sampling and genetic analysis, is essential to monitor reintroduction impacts on the genetic structure of existing resident trout populations and introduced steelhead (Fish Resources FTR 9-35). Additional analyses are needed 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 migration 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.

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).

Pathogen Risk Assessment

A pathogen survey and risk assessment was requested by ODFW (ODFW comments to PC's FSCD). 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 the 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 highly susceptible to infection, and this may limit reproduction. 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.

ODFW recommends the following components be included in a detailed study proposal.

1. Conduct a thorough literature review and document recent history of ecologically serious fish pathogens that might be found in salmonid species in the Lower Klamath River and introduced to Iron Gate Dam.

2. Prepare a list of pathogens of concern. These should be indicative of those pathogens that will most 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 and resident 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 fish disease decision criteria that will be used to determine if anadromous and resident fish should be reintroduced or passed above 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 with erythromycin to prevent excessive mortality prior to spawning from bacterial kidney disease.

Habitat and Project Facilities Scenario Modeling (EDT and KlamRAS)

PC and stakeholders need to complete the review of EDT attributes. As the BLM 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 those inundated by Project reservoirs). Assessment of habitat in the Upper Basin has identified more than 700 miles of potential steelhead habitat and more than 350 miles of potential Chinook salmon habitat upstream of Project facilities that should be accounted for in the EDT modeling effort.

Dam Removal and Decommissioning Options

Dam removal and decommissioning should be evaluated as one of the reintroduction alternatives as agreed upon under the "High Level Option". The assessment should

include whether existing PC 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 as follows: 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.

ODFW reiterates recommendations first stated in ODFW's comment letter on the First Stage Consultation Document, (issued March 2000) that dam removal and decommissioning should be evaluated as one of the reintroduction alternatives. The assessment should include whether existing PC owned dams (PC owned or other) could be removed to assist in the reintroduction of anadromous fish. This assessment should include an evaluation of the probability of success with and without dam removal.

Accepted Practice

The scientific and natural resource community has been conducting evaluations of fish passage for many years. PC conducted a preliminary assessment of the engineering issues associated with developing fish passage. The scientific community has spent considerable time evaluating the technical and biologic needs for fish passage at hydropower dams since the 1960's.

How the Study will be Useful in Furthering ODFW Resource Management Goals

ODFW has multiple resource management goals derived from Oregon statute and adopted rules that guide our recommendations in hydro relicensing processes. Permeating each of these policies is the goal of protecting and restoring native fish and wildlife populations for use and enjoyment by present and future generations. ODFW staff is directed to review and evaluate restoration of fish passage at the change of a license permit, including relicensing.

Completion of this study will provide information necessary for making a fish passage determination (or dam decommissioning and removal) at the Project. Oregon's fish passage law (Oregon Revised Statute 509.580 - 509.645) establishes a state policy that upstream and downstream passage is required at all artificial obstructions in those Oregon waters in which migratory native fish are currently or have historically been present. At existing hydroelectric projects, relicensing by FERC and reauthorization of a hydroelectric license or water right by the Oregon Water Resources Department (OWRD) are the "triggers" that initiate consideration of fish passage. Applicants are required to request approval from the Oregon Fish and Wildlife Commission for either a fish passage proposal or a waiver of fish passage. As part of a waiver proposal, an applicant needs to develop an alternative mitigation package that provides a net benefit to fish species affected over the benefit of providing passage.

Time Required for Study

ODFW recognizes that many years of research will be needed to determine the optimal methods and facilities for reintroduction, passage, and habitat protection. ODFW recommends that PC conduct multiple components of passage feasibility concurrently. At initial relicensing consultation and during the relicensing study phase, ODFW requested that PC initiate the multi-faceted study to obtain initial information regarding the feasibility of fish passage and reintroduction. Because PC did not conduct the requested study or components of the study or delayed initiation of the study during relicensing consultation, it should be started immediately to avoid delay in implementation of initial components of the feasibility plan.

Existing Information and the Need for Additional Information

In 2000, PC initiated studies to develop a relicensing package for the continued operation of the Project. In ODFW's March 2000 comment letter on the FSCD, ODFW indicated that PC should investigate the feasibility of reintroducing salmon, steelhead, and lamprey to the Klamath River and its tributaries blocked by construction of the Project. ODFW recommended that at a minimum, PC 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 reintroduction and an assessment of the risks and benefits of reintroduction. ODFW recommended Project decommissioning and dam removal is included in the options considered, 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. PC has not evaluated the integration of fish passage with upstream watershed studies, biological risk assessment, salmonid population requirements or opportunities for anadromous fish population expansion.

Passage tends to be very site specific and will require innovative thought. Efforts to date have not been sufficient and have only looked at traditional technology. Detailed engineering drawings of what could work for the Project, including major structural or operational modifications are needed. We strongly recommend that the passage studies culminate in clearly identified measures for evaluation and timelines for decision-making, as well as goals and objectives. This will require outlining steps for analysis of alternatives and prototype testing, methods for measuring success, and critical decision points. We expect an in depth analysis and recommended design including cost estimates.

PC's approach to evaluating engineering feasibility of fish passage has focused on an intensive historical information gathering effort. The engineering feasibility analysis identified in PC's has been the focus of the majority of the effort. This recommended engineering feasibility approach includes dam configuration evaluation, evaluation of engineering approach necessary to achieve the physical and biological objectives, and physical constraints and opportunities with different engineering designs and dam management activities.

Cost information is not clearly developed. PC's estimates appear to overestimate costs of some facilities (see ODFW comments to DLA, p. 17). PC places heavy reliance on the cost for facility comparison and the cost estimates are high. The only measure proposed by PC is to replace the current screen at JC Boyle Dam with a gulper, which is generally not considered effective technology at projects in the Northwest where they have been used (i.e. Baker River facility). The brief analysis of upstream fish passage facilities relies heavily on cost rather than feasibility, reliability and effectiveness. ODFW believes that PC significantly overestimated the ladder cost. In the last year, we have reviewed ladder designs at other Projects, and believe that $9 million for a ladder at JC Boyle is high. ODFW staff recently reviewed cost estimates for a ladder to pass trout, salmon, and lamprey over a 77 ft. high dam. The assumptions used for the estimate were also independently reviewed, and the final estimate was $1.0 to $3.1 million. At another dam that is 100 ft high, costs of a new ladder with multiple entrances are estimated at $5 million. We recognize that costs may be higher at Boyle due to its remote location. However, we question why this should double the cost.

Request during Pre-Filing

Although a complete and thorough fish passage study was requested during pre-filing consultation PC has partially completed the study with engineering cost estimates and partial completion of the EDT and KlamRAS models. However, much of the remaining work has not been completed or scanty attention with literature reviews and assumptions of applying fish abundance surveys to estimates of mortality.

7. Description of Recommended Study: ENTRAINMENT/MORTALITY STUDIES

PC should fund and conduct site-specific entrainment and mortality studies at all Project diversions with the exception of Eastside and Westside diversions. Fish moving downstream in the Klamath River, including federally-listed suckers and native redband trout, are entrained into Project generation facilities with unknown and unquantified, but likely significant mortality. When anadromous passage is re-established above Iron Gate Dam, out-migrating salmonid smolts would be entrained and some unknown portion killed by turbines. With the exception of the JC Boyle facility, there are no downstream fish screens or other exclusion devices to prevent entrainment and mortality. While the FLA acknowledges that the Project and facilities entrain some downstream migrants (Exhibit E, p.4-111 to 4-115), fish mortality estimates are based on literature reviews, limited sampling reservoir data, and huge assumptions. No quantitative information is provided regarding previously documented entrainment of downstream migrant fish. Entrainment has generally been found to be proportional to the amount of flow diverted; therefore, entrainment and Project mortality are likely to be high on native species.

Basis for Request

Significant entrainment of suckers has been documented in 1997-1999 at the Link River Dam hydroelectric facilities (Gutermuth and Kelly 2000). Of ten species observed, larval suckers comprised the second greatest percentage of identifiable fish entrained at Link River in this study. Juvenile/adult suckers comprised between 1%-20.5% of the total 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 JC Boyle.

At the JC Boyle dam, the screens that are currently installed are not designed to current criteria and are ineffective. This is apparent in the number and size of trout salvaged during canal maintenance activities. The ODFW (2001) reported fish salvages in the JC 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 JC Boyle since the last shutdown. The finding of fish in the canal seems to indicate the effectiveness of the JC Boyle dam fish screening devices is limited at best. PC 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 reported sampling the attraction flow diffuser chamber at JC 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 (PC website). In 2003, the JC Boyle fish salvage totaled 86 trout and 17 suckers. All suckers salvaged in the Boyle canal or bypass were less than 6 inches in length and apparently could not be identified as to species. As these salvage data were counts during very limited time periods, they represent only a small fraction of the total fish entrained.

The single radio-tagged adult fish that passed over JC Boyle Dam (Exhibit E 4-31, E4.1.5.1) to spawn in Spencer Creek moved back through the Project via power canal and turbines. The inadequate screens that were installed to protect juvenile trout on downstream migration demonstrated in the tagging study that the screens were not capable of excluding adult size fish. The fragmentation of the wild trout resource has increased its susceptibility to catastrophic events.

PC's proposal to install a gulper (in place of installing modern screens and bypass system to meet current federal and state criteria) for downstream juvenile migration is unsupported by any description or evaluation of downstream passage conditions at JC Boyle Reservoir (Exhibit E 4-163). There is no information on how fish move through the reservoir nor how fish move in the forebay, other than large numbers of fish appear to be entrained in the power canal. While a new screen and bypass system is obviously supported by existing data, there is insufficient justification to install a $5 million gulper that may or may not work.

PC's "sufficient evidence" to construct a gulper at JC Boyle Reservoir is inconsistent with the conclusion to not construct any passage facilities at Copco and Iron Gate (Exhibit E 4 -109). Without site specific entrainment and mortality studies at each Project facility, PC has proposed PM&E measures that are to improve downstream resident fish passage at JC Boyle Dam but do nothing at the California dams.

In the smolt survival study proposed in the FLA (Exhibit E 4-121), PC proposes to evaluate survival of downstream migrating smolts through Copco and Iron Gate reservoirs. However, this study is currently not accepted by stakeholders as a survival study because the proposed numbers of fish are insufficient to estimate survival thru the Project reservoir, or fractional mortality associated with differing Project components (spillways, turbines, screens, ladders). However, the proposed study would increase ODFW's understanding of behavioral aspects including the reservoir travel time and passage characteristics (where fish concentrate, attraction flows, and exposure to predation in the forebay of the reservoirs) in Copco, and Iron Gate Reservoirs and facilities. Like other studies, this is a pilot study and then PC will next need to conduct additional studies for different reservoir operations and with specific facility modifications intended to improve reservoir passage characteristics.

The above information clearly indicates that both small and large fish are passing through or around downstream protection screens at JC Boyle. Studies are necessary to quantify entrainment/mortality at each facility, including JC Boyle.

Responsible Entity

ODFW recommends that PC fund and conduct site specific entrainment and mortality studies.

Study Participants

ODFW recommends that PC and its consultants conduct site-specific study with guidance and gain approval from the AWG. ODFW recommends that PC convene a representative subgroup of the AWG comprised of fish biologists and engineers to develop an appropriate and agreed-upon analysis and interpretation of entrainment studies at JC Boyle, Copco 1 and Iron Gate dams.

Study Objectives and Methods

Study Objectives

Entrainment and mortality studies should evaluate losses due to Project facilities and operations. The Klamath hydroelectric relicensing studies need to include an estimation of entrainment based on empirical, site-specific data collected during a range of representative conditions and over an adequate period of time. Studies also need to determine temporal and vertical distribution fish passage through generation facilities and across spillways at JC Boyle, Copco 1 and Iron Gate dams. Little is known about the temporal and vertical distribution of native fish of interest in the Klamath system and associated vulnerability to entrainment. For example, entrainment of redband trout was usually more common outside of summer months at Link River (Gutermuth et.al. 2000). Information such as this has implications for protection, mitigation, and enhancement measures which resource agencies need to provide to FERC.

Turbine mortality (including turbine fraction (the proportion of water passing through turbines)), bypass mortality (including bypass fraction), and spillway mortality (including

spillway fraction) needs to be estimated using empirical, site-specific data collected at JC Boyle during a range of representative conditions and over an adequate period of time. Mortality at Iron Gate and Copco 1, which have more standard facilities, may be based upon values in the literature.

Study Methodology

Use methods of Guttermuth at JC Boyle and Copco 2. Use split-beam, digital echosounders at the intake of Copco 1 and Iron Gate hydroelectric facilities. Use the Biosonics study proposal provided by California Fish and Game for an example of the potential application of this methodology to the three reservoirs. Species composition for hydroacoustics would be established by subsampling with netting and applied to 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 the following resident fish: redband/rainbow trout (*Onchorynchus mykiss* subspp.), resident lamprey species (*Lampetra* spp.), blue chub (*Gila coerulea),* and Klamath large-scale (*Catostomus snyderi*) and small-scale (*Catostomus rimiculus*) suckers.

Anadromous Species

At each facility, studies will need to estimate passage efficiency and facility-related mortality to out-migrant smolts. These would include estimates of collection mortality and trap and haul mortality, as well as estimates of mortality to be incurred by out-migrants through existing reservoir conditions under a variety of operational scenarios. Flows will need to be mapped through the reservoirs and evaluated for the likelihood that out-migrants could successfully transit them. 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.

Accepted Practice

Guttermuth et al. (2000) conducted entrainment studies at the Eastside and Westside diversions at Link River. The use of hydroacoustics is a standard approach to assessing entrainment and has been utilized successfully within the Pacific Northwest during the past decade by both the Bonneville Power Administration and Portland General Electric (Raemhild et. al 1985; Hedgepeth et al., 1999). PC conducted entrainment studies at the Powerdale Hydroelectric Project on the Hood River (PC 1998).

How the Study will be Useful in Furthering ODFW Resource Management Goals

ODFW has multiple resource management goals derived from Oregon statute and adopted rules that guide our recommendations in hydro relicensing processes. These

policies have the goal of protecting and restoring native fish and wildlife populations for use and enjoyment by present and future generations. ODFW staff is directed to review and evaluate restoration of fish passage at the change of a license permit, including relicensing.

Completion of this study will provide information necessary for making a fish passage determination (or dam decommissioning and removal) at the Project. Oregon's fish passage law (ORS 509.580 - 509.645) requires upstream and downstream passage at all artificial obstructions in those Oregon waters in which migratory native fish are currently or have historically been present. At existing hydroelectric Projects, relicensing by FERC and reauthorization of a hydroelectric license or water right by OWRD are the "triggers" that initiate consideration of fish passage. Applicants are required to request approval from the Oregon Fish and Wildlife Commission for either a fish passage proposal or a waiver of fish passage. As part of a waiver proposal, an applicant needs to develop an alternative mitigation package that provides a net benefit to fish species affected over the benefit of providing passage.

Evaluation of the potential benefits and feasibility of fish passage is fundamental information for a fishway prescription (FPA section 18) and recommendation (FPA section 10j) process. In addition, the requested information will be essential for ODFW to determine compliance with relevant sections of the Oregon Hydropower Relicensing and Oregon Fish Passage statutes.

Time Required for Study

Nine months of one year (February-October).

Existing Information and the Need for Additional Information

With the exception of the salvage information, ODFW research from 1988-91 and the Salt Caves information for JC Boyle, very little information is available on entrainment at Project generation facilities below Link River. To date, PC has declined to initiate site-specific entrainment/mortality studies and has conducted a literature review. The literature review is inadequate because it does not provide an accurate accounting of Project impacts.

Site-specific studies for Project entrainment and mortality 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 lower reservoir fish populations consist of mainly exotic species versus the assemblage of largely native species in JC Boyle Reservoir. Water quality impacts to the Project's eutrophic reservoirs likely have an influence on fish communities and fish behavior. The preliminary relicensing water quality results indicates that the limnological behavior of these reservoirs affects water movement through them at times of the year that are critical to the survival of young fish and their exposure to entrainment. Diurnal behavior of fish in Project reservoirs is not well understood and may greatly influence the risk of entrainment. At Link River, for fish in general, Gutermuth et al. (2000) observed substantially higher night time entrainment.

Second, Project facilities have unique characteristics. For example, JC Boyle is operated as a peaking facility with more than 400 feet of head. 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 PC) 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 same in low-head facilities, located in the upper Midwest on mesotrophic or oligotrophic impoundments, is inappropriate.

Third, some key existing Project studies have been poorly designed and have been implemented over the objection of the Collaborative Group and the AWG. Study Plan 1.9, Fish Assessment, remains unapproved by the Collaborative Group because the study plan is inadequate. Adequate information on fish community structure and habitat use from this study is fundamental to understanding entrainment/mortality.

Fourth, federally-listed suckers and ODFW sensitive species occur in all Project impoundments. Little is known about the behavior of these fish relative to their vulnerability to entrainment and mortality.

Fifth, agency goals for the Klamath watershed include 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 the greatest concern. In the long run, if done correctly, resident fish entrainment studies would likely help narrow the scope of anadromous studies, achieving better use of time and resources.

One of PC's main objections to site-specific studies at each facility seems to be their perceived expense. There is no doubt that adequate studies will cost money. However, the CDF&G proposed less expensive options for entrainment studies that have merit and should be considered by PC (Proposal from BioSonics).

Request During Pre-Filing

Requests for entrainment studies were made repeatedly during pre-filing. PC has been unwilling to conduct necessary entrainment studies, despite past requests from ODFW, CDF&G, USFWS, and NOAA Fisheries.

8. Description of Recommended Study: SEDIMENT/GEOMORPHOLOGY

PC should clarify key elements of the sediment budget by determining the sediment stored in Project reservoirs, complete study plans for assessing fluvial geomorphologic

changes due to the Project, and determine sediment transport rates. This information is essential to develop appropriate PMEs for Project impacts to sediment movement and channel geomorphology.

Basis for Request

The FLA identified a Project sediment budget that is supposed to provide a framework for evaluating the relative magnitude of Project effects (Water Resources FTR 6-24). The sediment budget does not address two core objectives of the sediment transport/river geomorphology study (Water Resources FTR 6-1):

- How do the Project facilities and operation of those facilities affect fluvial geomorphic processes?
- What are potential measures or actions that can be taken to meet resource management objectives related to potential Project impacts on sediment transport and river geomorphology?

Reservoir Sediment Characterization

Sediment trapping within Project reservoirs is a known ongoing Project impact (Water Resources FTR 6-50), although, current assessments of the character of trapped sediment are based on methods inherent with high degrees of uncertainty. Characterization of reservoir sediments uses information from two sources: reservoir sediment mapping (Water Resources FTR 6-44) and sediment samples from tributary deltas (Water Resources FTR Appendix 6B). Reservoir sediment sampling 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 evaluated using a limited number of reservoir samples with only four samples from JC Boyle, nine from Copco and four from Iron Gate. The limited data derived from this effort is appropriate for use in making general comparisons of sediment character at the sediment-water interface in each reservoir and for description of the range of materials encountered at various sampling sites within reservoirs, and but not appropriate for determining decisions regarding geomorphic processes. Similarly, the small number of sample sizes of sediment sampling at tributary deltas affects the usefulness of drawing conclusions particularly at Spencer Creek (one sample) and Jenny Creek (two samples).

Neither of the two studies examined textural characteristics at the upstream end of the reservoirs, where coarse sediment transported by the river would be mostly likely to deposit. The upper samples in JC Boyle and Copco reservoirs were collected more than one mile from the upstream end of the reservoir. While samples were collected at the upstream end of Iron Gate Reservoir; the value of the data is questionable because the upstream Copco facilities have trapped sediment since 1917.

Bedload Transport Dynamics

Project impacts of a reduced sediment supply include bed coarsening/armoring. Therefore, the Project has created conditions in which higher flows are required to mobilize the streambed (Water Resources FTR 6-129 and 6-135). Consequently,

streamflows capable of mobilizing the bed occur less frequently (Water Resources FTR 6-136).

The two components of the sediment transport/geomorphology study that were not completed are the bedload sampling effort and the tracer gravel study. Completion of these study components will improve ODFW's understanding of Project impacts on the rate of sediment movement under current conditions and future conditions, such as a gravel augmentation program.

The planned bedload measurements should be completed at three sites along the Klamath River (Water Resources FTR 6-117). Variability should be incorporated by sampling during at least two peak flow events. Little bedload sampling has occurred to date due to a lack of peak flows in 2002 and 2003, with one sampling event at the downstream end of the JC Boyle peaking reach, during peak flows of 3,000 cfs (Water Resources FTR 6-117). The limited data suggests that Project operations (2 turbine flows at approximately 3,000 cfs) are capable of transporting sand and suspended sediment, but this data does not provide insight into flows at the threshold of bed mobility, which are estimated to be on the order of 4,700 cfs in this reach (Water Resources FTR 6-134).

Tracer gravels were installed in nine river reaches during 2002 and 2003 (Water Resources FTR 6-122). Re-surveys to determine tracer movement have occurred in only three of these reaches. Results from the limited analyses have been used to calibrate estimated thresholds of bed mobility (indeed, the data from one site was extrapolated

across the entire study area; Water Resources FTR 6-128). Data from additional measurements will yield a more robust analysis of Project impacts on sediment transport.

This data will be useful to calibrate sediment transport estimates used in the sediment budget as well as calibrate estimated thresholds of bed mobility, evaluate impacts of Project operations on sediment transport in the JC Boyle peaking reach, and develop Project-specific ratios of bedload to suspended sediment. This information will also be useful for refining the sediment augmentation strategy described in the FLA. Because the proposed gravel augmentation effort is based on an adaptive management framework, baseline assessments of sediment transport rates will be necessary for developing an augmentation program that accomplishes resource management objectives and monitoring the effectiveness of gravel augmentation.

Responsible Entity

PC is responsible for collating, conducting quality assurance, and distributing the data.

Participants

PC should coordinate the study and receive approval by tribal, agency, and NGO representatives to the aquatics and geomorphology work groups.

Objectives and Methodology

Study Objectives

Reservoir Sediment Characterization

- Determine the particle size distribution of sediment stored in Project reservoirs
- Refine assumptions regarding the ratio of fine to coarse sediments in Project reservoirs
- Develop PM&E measures that mitigate Project impacts on several elements of the river sediment regime, including both the volume and character of sediment.
- Determine if reservoir volume has significantly been reduced by sediment accumulations and if Project operation under a new license can continue without removal of reservoir sediment.

Bedload Transport Dynamics

- 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 transport to suspended sediment transport
- Develop a more robust understanding of Project operational impacts on sediment transport in the JC Boyle peaking reach and

- Develop testable hypotheses regarding the fate of sediment placed in the river during augmentation activities.

Study Methods

Reservoir Sediment Characterization

Expand on previous sediment sampling efforts with additional sampling at tributary deltas using similar methods as used in the 2003 sampling (described in Water Resources FTR Appendix 6B). Focus sampling efforts on increasing sample sizes, especially at the Jenny Creek and Spencer Creek deltas. Collect sample sediments for the entire depth of Project-induced sediment deposits at discrete intervals to compare surface and subsurface sediment layers and sample for a range of substrate sizes, including particles greater than 5-cm.

Bedload Transport Dynamics

Using standard methods for bedload sampling, sample occur at three sites at the earliest opportunity (based on peak flow events) (Water Resources FTR 6-12 and 6-117). Complete tracer gravel observations at nine river reaches (Water Resources FTR 6-12 and 6-17). Conduct additional bedload and suspended sediment sampling at the downstream end of the JC Boyle peaking reach in 2004 during a range of hydroelectric peaking operations to develop an understanding of Project impacts on transport and deposition of fine sediments.

Accepted Practice

Most of the recommended methods have been agreed to and used by stakeholders and consultants in this relicensing.

Usefulness of Requested Studies in Furthering ODFW Resource Management Goals

Complete bedload transport and reservoir sediment analyses are necessary to develop a sediment budget and determine Project impacts. In addition, this information is necessary to develop appropriate PME measures that adequately mitigate for Project impacts. The FLA focuses solely on "spawning gravel" for sediment augmentation, however, ODFW believes that PC should mitigate for all Project impacts to the sediment regime including the timing, volume, rate and character of sediment input, and storage and transport. PC has focused on spawning habitat, but the PMEs in the future license should mitigate for maintenance and restoration of other aquatic habitats such as 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.

Study Duration

Reservoir and reservoir tributary delta sediment sampling should occur during drawdown periods in 2004. Bedload sampling and tracer gravel observations need to occur both during and after large peak flows that approach or exceed the estimated threshold of bed mobility. Sampling of bedload and suspended sediment transport in the peaking reach during 3,000 cfs peaking operations should be conducted during 2004.

Existing Information and the Need for Additional Information

ODFW has raised these concerns along with other stakeholders in the many Geomorphology Work Group meetings. The gravel augmentation proposed in the FLA is narrowly focused on one habitat type and does not consider the full array of resources impacted by Project-induced changes in geomorphic processes. In order to determine the impacts to all aquatic resources, the study needs to incorporate the recommendations proposed in the ASR. With the limited data and analyses thus far, ODFW does not believe that PC's geomorphology assessment efforts accurately portray the effects of project operations and facilities on sediment transport. In our opinion, further survey and analysis is necessary. There is too much uncertainty in both the collection of data and interpretation of qualitative results for the ODFW to dismiss impacts to sediment trapping and transport by the Project as major issues.

Request During Pre-Filing

ODFW has participated in Geomorphology Work Group meetings and has commented on these study plan tasks and objectives many times. ODFW commented on the need for a complete evaluation of the historic and current sediment regime for sediment composition, bedload movement, stream gradient, and gravel deposition areas (ODFW Comment Letter to Second Stage Consultation Document July 22, 2001).

9. Description of Recommended Study: RIPARIAN RESOURCES

PC should further develop study information to understand the vegetation/flow fluctuation analysis. The existing and proposed minimum flow in the JC Boyle Bypass

Reach and the daily extreme ramping rate in the JC Boyle Peaking reach will continue to adversely affect riparian and shoreline habitats thereby impacting aquatic and riparian-dependent fish and wildlife species. Continuation of existing Project operations with the minimum flow and rapid stage changes proposed by PC make it difficult for native riparian vegetation to establish and thrive. This impacts riparian dependent wildlife species such as western pond turtle, river otter, mink, muskrat and beaver as well as the plant communities themselves.

ODFW requests that PC conduct an analysis of transects in the JC Boyle Bypass and Peaking reaches to evaluate potential riparian vegetation for a range of operational scenarios. Six transects in the JC Boyle Bypass and 19 transects in the JC Boyle peaking reach would be used with each riparian vegetation plot evaluated for inundation flows less than or equal to 3,000 cfs, and calculation of inundation duration and inundation frequency. These scenarios would include Steady Flow, Without Project, and Without Project II (these scenarios are defined in the Water FTR). Additional scenarios should also be analyzed:

- Proposed Project operations (described in Exhibit 3-196)
- "Modified proposed operations," incorporating a range of minimum flow releases in the JC Boyle bypass reach (from 100 cfs to 600 cfs)
- Other scenarios developed in collaboration with the aquatics, water quality, and terrestrial work groups.

This analysis would utilize modeled hydrologic data from 2000 and 200 and the existing stage-discharge relationships for each transect (described in Terrestrial FTR Appendix 3A).

Basis for Request

In comments on the FSCD, ODFW commented on "concerns with facilities, operations and maintenance activities that affect wildlife species including daily and seasonal reservoir or riverine drawdowns" (ODFW letter March 19, 2001). In follow-up comments on study plans, ODFW requested that PC evaluate the distribution and composition of riparian areas for a full range of alternatives with respect to frequency and magnitude of peaking events.

Riverine reaches that had flow fluctuations also showed that flow fluctuations reduced shoreline habitat and diminished riparian habitat for riparian focal species. The analysis of the varial zone widths showed severe effects to 83 acres in the Peaking Reach. Further information is necessary to understand the vegetation/flow fluctuation analysis. Reduced sediment supply as a result of JC Boyle Dam along with severely reduced flows in the Bypass Reach and flow fluctuations in the Peaking reach have impacted the success of recruiting willow and caused the dominance of reed canary grass.

Information provided by ODFW at the testimony of the proposed Salt Caves hydro project indicated preliminary impacts of flow fluctuations on the wetted fluctuating zone and non-woody riparian zone. The comparison of the horizontal width of the fluctuating

wetted zone and non-woody riparian zone below JC Boyle powerhouse are summarized in Table 2. These results indicate that daily flow fluctuations are having a tremendous impact on riparian habitat.

Table 2. Comparison of the horizontal width of the fluctuating wetted zone and non-woody riparian zone below JC Boyle Powerhouse. A/

Location B/	**Wet Fluctuating Zone C/**	**Non-woody riparian zone D/**
0.4 miles	22.2 feet	21 feet
1.4 miles	15.6 feet	20 feet
3.6 miles	18.4 feet	16 feet
Frain Ranch	10.4 feet	0 feet

A/ all measurements are an average of five actual measurements taken on the road side then doubled to consider both sides.
B/ Location are in nearest 0.1 road miles beginning at the JC Boyle Powerhouse.
C/ The fluctuating wetted zone is the distance between the observed high water mark and low water elevation.
D/ The non-woody riparian zone is the observed distance between the high water mark of the fluctuating zone and the first observed woody plants (brush or trees).

Reed canary grass is an invasive riparian species that displaces other native riparian communities. The current abundance of reed canary grass in the JC Boyle reaches is an indicator of degraded riparian conditions. Existing and proposed Project operations will maintain hydrologic conditions which allow reed canary grass a strong competitive advantage over desired riparian vegetation species. The analysis proposed in this ASR will provide information necessary to assess the impact of potential flow regimes on riparian management objectives.

The information compiled in this analysis will supplement the existing analysis of relationships between streamflow metrics and riparian vegetation communities. Analysis summarized in the FLA demonstrates that inundation duration is moderately correlated

with the distribution of vegetation communities (Terrestrial Resources FTR 3-73). In both the JC Boyle Bypass and Peaking reaches, vegetation types are dominated by reed canary grass and 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 Resources FTR 3-9). Development of similar relationships for the Steady Flow, Without Project, and Without Project II scenarios will enable a more thorough understanding of Project impacts. Development of relationships for the proposed Project operations and "modified proposed operations" will provide insight into continuing Project impacts and enable development of incremental relationships between streamflow and riparian characteristics. Conducting this analysis will give stakeholders the necessary information to understand the hydrologic preferences of desired riparian vegetation (and, perhaps more importantly, undesired riparian vegetation) and develop adequate PM&E measures to balance power and non-power resources.

While riparian species are affected by flow management in the bypass and peaking reaches, inundation and flow fluctuations in reservoirs also indicate ongoing Project impacts. Results indicate that large gaps in riparian/wetland habitat, particularly along Iron Gate and Copco reservoirs, but also along JC Boyle Reservoir, limit habitat quality for amphibians, reptiles and some small species and reduce connectivity. One of the

focal species, the yellow warbler, had a lower habitat quality at JC Boyle Reservoir, likely due to daily water level fluctuations that reduce shoreline riparian shrub habitat. Also, most reservoirs, except Keno, provided very little habitat for breeding amphibians due to frequent water level fluctuations. Western pond turtles were affected by shoreline habitats of fluctuating reservoirs with reduced basking habitat and water level fluctuations that reduced juvenile habitat.

The small animal and avian connectivity study (Exhibit E5.5.5.3) documented riparian habitat connectivity along Project reservoirs and riverine sections affected by inundation. This section demonstrated that the average break in riparian patches along reservoirs was significantly different than along riverine reaches. In addition, the 2-mile long JC Boyle canal disconnects upland habitats from riparian habitats.

Responsible Entity

PC is responsible for soliciting and integrating input from the Terrestrial and Aquatics Work Groups and conducting the analysis.

Study Participants

The analysis must be conducted collaboratively with relicensing stakeholders. PC should discuss and gain approval for hydrologic parameters for model runs with stakeholders to ensure that objectives and information needs are adequately met.

Study Objectives and Methods

Study Objectives

To provide information for use in evaluating instream flow regimes that protect, maintain, or enhance the suite of flow-dependent resources including native riparian, fish and wildlife resources in these two reaches.

To compare hydrology-riparian linkages between a range of operation scenarios and conduct a more thorough analysis of Project impacts on riparian vegetation.

Study Methodology

PC will need to use hydraulic and hydrologic comparisons and analyses developed for other studies conducted during the 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 for the proposed study is readily available and 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.

Accepted Practice

This study uses analyses 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 PC, its consultants, and the Terrestrial Work Group.

How the Study will be useful in Furthering ODFW Resource Management Goals

ODFW's goal is to restore in-stream flows sufficient to create and sustain riparian, aquatic and wetland habitats and to retain patterns of sediment, nutrient and wood routing. This goal includes protecting and restoring the timing, magnitude, duration and spatial distribution of peak, high and low flows that best simulate the natural environment.

ODFW asserts that restoration of the species composition and structural diversity of plant communities in riparian areas and wetlands will 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. These processes, in turn, support native fish and wildlife species.

Riparian and shoreline dependent resources including native vegetation communities, fish, and wildlife resources are strongly impacted by flow management in the two affected Project reaches. ODFW has multiple resource management goals derived from Oregon statute and adopted rules that guide our recommendations in hydro relicensing processes. The major goal in relicensing is to protect and restore native fish and wildlife populations and their habitats. Avoidance of new and ongoing impacts in the future license to these populations and protection and restoration of natural habitats on which these populations are dependent are necessary for restoration of fish and wildlife species. The completion of this study will provide ODFW with information pertaining to the existing and future impacts of load following operations on species that we statutorily manage for the benefit of Oregon's public.

Modeling a sufficient range of operational scenarios is necessary for the development of suitable PME measures and an understanding of the complex tradeoffs that occur as a result of Project operations. ODFW will use the study results to achieve the following objectives:

- Assess the impacts of the Project dams and associated reservoirs on aquatic, terrestrial, and recreation resources
- Assist regional managers and all parties in the relicensing in assessing Project impacts
- Determine scientifically based Project operations scenarios that will provide biological and hydropower benefits.

- Further ODFW's resource management goals by providing information on Project affects on fish populations and habitat in the Klamath Basin and what kinds and levels of mitigation measures would be most appropriate to include in the new license to support protection and restoration of fish populations.

Time Required for Study

ODFW anticipates this study should be completed in approximately three months with 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 flow and riparian vegetation analysis in the FLA established relationships between inundation duration and the distribution of vegetation communities, as well as between inundation duration and the abundance of reed canary grass. However, PC needs to take the next step necessary and calculate results for other operational scenarios (including PC's proposed Project operations). These results can be used to predict the future extent and abundance of reed canary grass and potential restoration of native riparian communities. ODFW has requested this analysis throughout this relicensing process, beginning with comments on the FSCD. Without this additional rigorous quantitative analysis, inadequate PME measures will be proposed for the license and cause continuing Project impacts that will fail to restore native vegetation and fish and wildlife species.

Request during Pre-Filing

Requests for analysis of minimum flows and peaking were requested several times, starting from the FSCD. PC has made partial efforts and analysis but needs to complete the Project impacts analysis to develop appropriate PM&Es for the new license.

10. Recommended Study: RECREATIONAL ANGLING AND FLOW PREFERENCE SURVEY

PC should conduct an angler preference survey for fishing flows and compare angler response to peaking versus non-peaking flows. The current recreation angling analysis is based on asking anglers at which flows they fished given current hydroelectric operations, which cause flow fluctuations in all reaches of the Project.

Basis for Request

ODFW disagrees with conclusions of the recreation flow analysis, in which the existing condition of low flows in different segments of the Klamath River are considered the optimum flow range for recreational angling. The flow evaluation curves incorrectly conclude that lower flows tend to provide the best quality fishing conditions since it provides better wading access, lower velocities in different habitats, and less turbulence in the rapids. The analysis of flow duration curves is based on average daily flows, which lead to misleading conclusions on impacts of flow fluctuations to angling use.

PC has made conclusions backed up by almost no data, and has been unwilling to change its operations to assess fishing at different flows. Anglers would readily adapt and likely

prefer the increased productivity of the river with a steady nature of the flow with run of river operations. PC's analysis is based on huge assumptions that anglers fish the low flow because of a simplistic preference for flow based on PC existing operations. The study only demonstrates that with existing peaking conditions, anglers focus on the trough of the flow periods in the Peaking reach because it presents the easiest angling when fish are most concentrated in a river where productivity is severely impacted. Any biologist or angler with experience on the Klamath River could have reached that conclusion without a study.

The study did not assess anglers' choices to fish the Keno Reach over the Peaking Reach for trophy-sized redband. A well-crafted study may well demonstrate that anglers choose the Keno Reach because of preference for catching larger fish and a preference to angle in a less flow-impacted reach. While the Keno reach flow on average is generally higher, and may be more difficult to fish, anglers still prefer fishing the Keno Reach (Bill Tinniswood and Roger Smith, pers. communication, ODFW district fish biologists).

PC reported "fishing curves" for the best angling at 320 cfs base flows in the JC Boyle Peaking Reach with optimal flows of 300-400 cfs (Recreation Resources FTR p. 2-56). While these flows are based on a few anglers' opinions of best fishing flows, it is based on existing conditions and does not recognize the improved productivity that would occur with higher and more consistent flows with little or no peaking or ramping impacts. This information is misleading and speculative at best. Anglers may choose to fish a river at lower flows that concentrate fish but given a choice between a river with large abundant

fish and a river with reduced population abundance and size, anglers will generally prefer more productive systems.

The FLA notes under the Historical Fisheries Section (Exhibit E Page 4-10) the difference in catch rates with higher catch rates in the Peaking Reach than the Keno Reach. However, the FLA does not note that the catch rate for the peaking reach is zero for most of the day, with the majority of the fish caught when concentrated in low water conditions. Very few fish are caught using hook and line during peak flows because the low abundance of fish present are less available and likely "hunkered" down during peak events. The catch rate increases as the water is removed from the river and the remaining fish are vulnerable in the remaining pools. This is lost on the reader without further explanation. It should be pointed out that a major impact of the hydroelectric facility is that catch rates approach zero during the peak flows. This document only states the maximum catch rate in the peaking reach. The catch rates for Keno and the Bypass reaches are likely more accurate as the water fluctuates less frequently.

The FLA reports that "the redband trout population in the JC Boyle Peaking Reach supports a high quality recreational fishery" (FLA Exhibit E 4-13). The catch rate is then erroneously compared with other rivers catch rates. This analysis is extremely biased because the catch rate for most rivers changes slightly each day based on time of day, insect production and other factors, while the Klamath River Peaking Reach catch rate changes much more dramatically based on the peaking process. The rate goes from zero to very high right before evening during the late hours that allow for legal angling prior to

dark. For most of the year (October-May), all daylight hours the catch rate would approach zero. Catch rates would be greater then zero only during those times when the river is extremely low and the few fish are concentrated during daylight hours.

A comparison of "fishable hours" for the Keno Reach and the JC Boyle Peaking Reach reveals that in the Peaking Reach there are two hours a day when people angle. Available angling hours in the Peaking Reach at 2 hours per day, 30 days per month results in 60 hours per month of angling time. These angling hours fall during daylight periods in June, July and September, therefore, only 180 hours of angling per year is available. The sample angling hours for the Keno Reach are (legal angling January to June and October to December) 9 months at 12 hours/ day angling possibilities which yields 3,240 hours on angling per year available to angle per year, a 19 fold increase in angling.

PC's angling surveys used a very low number of anglers (12 anglers for all river reaches) to draw conclusions on when the best angling occurs and then reach the conclusion that low flows are best for fisheries (Recreation Resources FTR 2-11, table 2.4-3). In addition, the angling survey forms had "leading questions" (see Recreation Resources FTR Appendix 2E, pg 4) and confusing questions that don't ask anglers how they would like to see the river managed for fisheries. Surveys are supposed to be designed carefully to avoid predisposition of the respondents, correct for bias, and avoid the potential for leading the respondents by the surveyors.

PC sought when anglers were more likely to fish rather than input on how anglers would like to see flows managed to improve fisheries. The interviewees were not given the choice of angling under a river with restored flow but only the existing river with ongoing peaking and ramping impacts. The peaking and ramping operations along with other Project impacts such as reduced passage have reduced the productivity of the river, and in turn angler success and satisfaction over the long term. The study relies on existing hydroelectric Project conditions, which have substantially reduced trout abundance, size and distribution. For example, anglers that were interviewed for their preference of fishing conditions in the Keno, bypass and peaking reaches naturally preferred lower flows because fish are more concentrated and easier to catch in low flow conditions. However, lowered productivity has strongly affected anglers' ability to catch fish in what was once a highly productive system known for its large abundant trout populations (Fortune et al. 1966).

Abundance, size, and distribution of fish along with angler success are inextricably tied to quality, quantity and productivity of the habitat. Many of the anglers interviewed expressed valid concerns of separating out the biophysical characteristics of the river caused by Project operations from their ability to successfully fish the river. The historic character of the river was a highly productive river known for its large and abundant trout along with the third largest runs of anadromous fish on the Pacific coast. Therefore, a more natural river hydrograph along with better available habitat, consistent good water quality conditions for all life stages and fish passage would yield more abundant native fish populations and in turn lead to higher quality of fisheries.

Responsible Entity

PC is responsible for soliciting and integrating input from the Aquatics and Recreation Work Groups and conducting the survey and analysis.

Study Participants

The analysis must be conducted collaboratively with relicensing stakeholders. PC should discuss and gain approval from the stakeholder groups for an appropriate survey with an adequate number of anglers and query anglers on peaking and natural hydrologic regimes to ensure that objectives and information needs are adequately met.

Study Objectives and Methods

Study Objectives

To provide information for use in evaluating instream flow and peaking regimes that protect and improve the recreational angling experience and success with angling in the Keno and JC Boyle Bypass and Peaking reaches.

To allow FERC and relicensing stakeholders to compare angler responses to a range of operation scenarios

To conduct a more thorough analysis of Project impacts on productivity and fisheries.

Study Methodology

PC should coordinate with Aquatics Work and Recreation Groups to develop an appropriate survey to characterize angler use and flow management preferences for the 3 riverine reaches between Keno Dam and Copco Reservoir.

Conduct an angler preference survey to characterize how anglers would like to see the river managed in the future (i.e. existing condition, reduced peaking, run of river operations, etc.).

Accepted Practice

ODFW recommends that PC re-conduct the angler surveys and follow a standardized protocol agreed to by a representative subgroup of the Recreation and Aquatics Work Group. Using standard surveys that ask appropriate questions and avoid "leading questions" will permit a more thorough and complete evaluation of the angler responses to current flow management, a range of operational scenarios with no peaking and very limited peaking to derive appropriate future management of flows in the Klamath River. Angler surveys and preference surveys have been used for evaluating angler responses to flow management on other rivers.

How the Study will be useful in Furthering ODFW Resource Management Goals

ODFW's goal is to protect and restore fish and wildlife populations for the enjoyment of present and future generations. This goal includes protecting and restoring fish resources from inappropriate flow regimes that negatively impact productivity of river systems and the resulting angling recreation. ODFW asserts that restoration of the instream flows to a

more natural hydrology along with fish passage will substantially increase productivity of native species and result in a greater benefit to tribal and sport fisheries. In addition, where fish passage is successful in rebuilding runs of anadromous fish, there will also be a greater benefit to interjurisdictional ocean and in-river tribal, sport and commercial fisheries.

The major goal in relicensing is to protect and restore native fish and wildlife populations and their habitats. Avoidance of new and ongoing impacts in the future license to these populations and protection and restoration of natural habitats on which these populations are dependent are necessary for restoration of fish and wildlife species. The completion of this study will provide ODFW with information pertaining to the recreational fisheries that we statutorily manage for the benefit of Oregon's public, presently impacted by the load following operations.

Time Required for Study

ODFW anticipates this study should be completed in approximately six months with time to conduct an angler preference survey, and review and summarize the results of the proposed analysis.

Why Study Objectives cannot be Achieved Using Available Data

ODFW recommends that the portion of the study associated with flow duration curves be deleted from the administrative record because it is technically flawed. Low sample sizes, misleading questions and false conclusions result in a study that disregards the

historical information that showed that the river, in the absence of the JC Boyle peaking facility, was once a highly productive system with abundant trout populations and known for its large-sized trout.

PC's survey queried anglers to characterize angling conditions under the existing Project flow regime, and did not survey for anglers for the preference for a more natural hydrologic regime. Therefore, inappropriate flow evaluation curves were drawn for acceptable and optimum fishing conditions. These curves inappropriately underestimate and recommend minimum flows for fishing well below the natural flows of the river.

Request during Pre-Filing

ODFW commented on the inappropriate analysis conducted for the recreation angling flow duration curves in the DLA. ODFW requests that PC complete a study that is not biased toward anglers condoning existing peaking operations because they anglers can catch fish because the water is more "wade-able" and concentrates fish into a smaller amount of habitat.

11. Description of Recommended Study: SYSTEMS LANDSCAPE OPTIONS MATRIX

PC should complete the systems landscape options matrix (SLOM) to provide sufficient information in the FLA for FERC to conduct a complete NEPA analysis. PC proposed a high level analysis or SLOM to analyze a full range of Project alternatives including dam decommissioning and removal.

The California Energy Commission (CEC) (2003) conducted an energy analysis with a perspective of a high level analysis. The CEC concluded that while PC will be operating with a deficit of power generation to use in the next decade, the relative contribution of the Klamath Hydroelectric Project was considered minimal. The CEC identified decommissioning as a viable alternative that should be examined during the FERC relicensing proceedings.

Basis for Request

For the relatively small amount of power produced, the Project has huge impacts on natural resources in the region, including fish, wildlife, habitat, instream flows, water quality and other resources. PC has not evaluated the cumulative impacts of the Project on environmental resources. Alteration of seasonal and daily basin hydrology, ramp rates that cause direct and indirect mortality and loss of habitat, the slowing and storing of warm, nutrient-rich waters, and installation of barriers by the hydroelectric facilities, has led to reduced habitat quantity and quality. Native fish are now faced with increased nutrient loading, more extreme and fluctuating habitat conditions and water quality, and limited ability to move to better habitat.

Documented impacts of the hydroelectric Project in recent years include fish kills from flow fluctuations and poor water quality conditions. The recent June 2003 outage when flows were lowered for maintenance at JC Boyle caused reduced flows of 250 cfs in the Keno Reach. A fish kill was documented by the district biologists due to ramp and high

temperature conditions. The fish kill of 30,000 salmon in September 2002 due to low instream flows and high water temperatures also document that Project and other anthropogenic changes in hydrology and water quality that affect aquatic life. The long recovery period by aquatic life subjected to episodic sublethal and lethal conditions in their habitat is reflected in severely depressed numbers of fish currently present in the Klamath Basin. While flow diversion and management in the upper basin directly contributed to the fish mortality, Klamath hydroelectric reservoirs may have contributed delayed thermal warming from Project storage to the river below Iron Gate Dam. PC was able to briefly send water downstream from Iron Gate dam to assist in alleviating the situation, and PC should look at such strategies for future operations.

Studies by the Native Trout Research Project showed that Klamath River rainbow trout are a unique stock of fish that adapted to local habitat conditions (Buchanan 1991). They are unique, as they have adapted to water temperatures up to 27^0F in the summer and down to 0^0F in the winter, extremely alkaline pH, and high nutrient levels. Prior to the construction of JC Boyle Dam in the late 1950's, the Klamath River wild trout population was noted for its abundance and large fish. Trout migrated freely through all reaches to spawn in Spencer Creek, a principal tributary of the Klamath River. Endangered shortnose and Lost River suckers, endemic to the Klamath River Basin, are an important indicator of the aquatic health of the basin. However, the combination of alteration of seasonal and daily basin hydrology, ramp rates that cause direct and indirect mortality, the slowing and storing of warm, nutrient-rich waters, and installation of barriers by the hydroelectric facilities, has led to reduced habitat quantity and quality. Native fish are

now faced with increased nutrient loading, more extreme and fluctuating habitat conditions and water quality, and limited ability to move to better habitat.

PC should complete the SLOM to evaluation options for future facilities and operations, and evaluate potential PM&Es that would best restore the Klamath River and associated natural resources. The study should explore options to manage river flows, reservoir levels, water quality conditions to meet beneficial uses, and expected lifespan of facilities. The study should determine a hydropower alternative that integrates recovery of native resident and anadromous fish with improved water quality, passage, and habitat restoration.

While PC worked with stakeholders to develop a "high level" analysis of fish passage through the SLOM, the analysis and documentation of process was not completed. ODFW suggests that completion of the SLOM is an important decision support tool for developing appropriate PM&Es in the future license. Agency and tribal letters have requested information to support an alternative for dam decommissioning and removal of one or more Project facilities in their FSCD and second stage consultation document (SSCD) comments. This evaluation needs to be applied for all resource groups such as hydrology, sediment and geomorphology, and terrestrial issues and not just for water quality and fish passage for "without Project" scenarios.

ODFW believes that the SLOM is an important work product of the Collaborative Process. PC proposed to use the SLOM as the high level analysis however, the SLOM

was never completed. Thus, the SLOM methodology, assumptions, and uncertainties are absent from the administrative record.

Responsible Entity

PC is responsible for soliciting and integrating input from the stakeholders from the Plenary Group and conducting the analysis.

Study Participants

The analysis must be conducted collaboratively with Plenary relicensing stakeholders. PC should discuss and gain approval from the stakeholder groups for populating the SLOM matrix and completing the analysis with appropriate Project impacts and alternatives for Project facilities and operations.

Study Objectives and Methods

Study Objectives

Conduct the SLOM (as promised by PC) to the Collaborative Process Group to evaluate Project facility and operations alternatives

Develop appropriate PM&Es for Project facilities and operations based on results of the SLOM and other relicensing studies

Study Methodology

With the coordination and agreement of the Plenary Group, PC should complete the matrix of alternatives of Project facilities and operations (i.e. alternatives such dam removal, run of river). A decision structure analysis by Gretchen Oosterhout, a decision matrix analyst, could be used to help this process. Ms. Oosterhout's analysis and process was proposed at two of the Plenary Group meetings but was not followed through with any further commitment by PC. This process needs to be completed.

Accepted Practice

Options analyses are useful for making decisions when faced with many difficult choices. Decision analysis has been used at other relicensing such as Pelton Round Butte (FERC #2030) (Oosterhout 1998) to assist regarding fish passage decisions for complex decisions such as the Columbia River basin (Marmorek et al. 1998, Marmorek 2001, Peters et al. 2000, Peters et al. 2001).

The decision structuring approach applied here is recommended by the National Research Council (NRC 1995, 2004) for decisions affecting at-risk species that are listed under the federal Endangered Species Acts (ESA), such as the coho salmon and suckers in the Klamath Basin. It is based on multiple attribute decision theory (MADT), an approach that derives from the fields of statistics, optimization theory, and cognitive psychology (von Winterfeldt and Edwards 1986, Clemen 1996), which has been used for complex decisions involving sensitive fish species like these in a variety of places, e.g., in Maine (NRC 2004), and Washington state (Keeney 1992).

MADT provides a systematic framework for evaluating complex decisions under conditions of uncertainty by rigorously defining the objectives of the decision-makers, and evaluating the alternatives in light of those objectives. Risks affecting achievement of those objectives can be evaluated by following fundamental rules of statistics in order to help ensure that uncertainties are processed appropriately. Decision structuring is helpful for capturing intuition and systematic understanding of relationships, making judgments explicit, and minimizing cognitive biases by incorporating uncertainty and risk into a rational analytical process (Alexander et al. 2002; Clemen 1996; Fiering & Holling 1974; Hilborn & Walters 1992; Howard 1968, 1989; Keeney 1992; Keeney & Raiffa 1976; MacGregor et al. 2002; NRC 1995, 2004; Peters & Marmorek 2001; Peterson & Evans 2003; Punt & Hilborn 1997; von Winterfeldt & Edwards 1986; Watson & Buede 1987).

There are several advantages to formal decision structuring compared to ad-hoc methods often adopted by groups charged with evaluating risky decisions. Because decision structuring is widely accepted as the gold standard for decision analysis (Clemen 1996; Hilborn & Walters 1992; NRC 1995, 2004; von Winterfeldt & Edwards 1986), it is more difficult for critics of the results to justify attacks on the methodology. It helps diverse groups develop a common problem definition, providing a "blueprint" that can be used to guide workgroup efforts and develop presentations to managers. It can be useful for dealing with poorly organized groups, particularly when some group members either already have their minds made up, or do not want a decision to be made. This is because it provides a ready-made structure with well-established tools to fall back on. It also

provides a helpful framework for developing stochastic risk assessment computer tools (Oosterhout 1998, 1999).

How the Study will be useful in Furthering ODFW Resource Management Goals

PC needs to develop more detail in the SLOM to provide sufficient information in the FLA for FERC to conduct a complete NEPA analysis. Agency and tribal letters have requested information to support an alternative for dam decommissioning and removal of one or more Project facilities and/or alternations in Project operations in their comments to FSCD and SSCD. This evaluation needs to be applied for all resource groups such as hydrology, sediment and geomorphology, and terrestrial issues and not just for water quality and fish passage for "without Project" scenarios.

ODFW believes that the cost estimates of fish passage facilities in the DLA are high and overestimate the cost of fish passage. The range of cost of fish passage improvements as stated in the FLA are from $70-$160 million. These costs should be evaluated in the context of dam removal and decommissioning.

ODFW will use the study results to assess Project alternatives to support recommendations for facilities and operations that will avoid or minimize impacts to aquatic organisms. The completion of this study will provide the ODFW with information pertaining to the existing and future impacts of facilities and load following operations on species that we statutorily manage for the benefit of Oregon's public.

Time Required for Study

ODFW anticipates this study should be completed in approximately six months with collaboration from the Plenary Stakeholder Group of federal and state agencies, tribes and NGOs.

Why Study Objectives cannot be Achieved Using Available Data In Plenary Work Group meetings, PC agreed to conduct a SLOM to evaluate Project facility and operations alternatives. For example, one of the alternatives selected was removal of the California dams. A comparison of the costs and benefits of decommissioning the California dams on the mainstem Klamath River deserves serious consideration. The California dams are large, have no fish passage facilities, provide only 65 MW of energy, and are located in a complex watershed. The traditional engineering solutions proposed in the engineering analysis by PC assumed relatively high construction and operations and maintenance costs. The California dams block anadromous fish access to potentially 300 miles or more of historic habitat, impede resident fish movement within the Project footprint, and have converted 15 miles of cold water riverine habitat into warm water reservoirs.

Another alternative is evaluation of no peaking at JC Boyle Dam Peaking effects have been shown to be detrimental to aquatic resources at other hydroelectric facilities and appear to impact fish and aquatic resources in the Bypass and Peaking reaches, according to ODFW data. In fact, mitigating peaking impacts was the justification for building the re-regulating facility at Iron Gate reservoir back in the 1960s.

Request during Pre-Filing

Requests for completion of the SLOM were made several times in Plenary and other work group meetings. PC has made partial efforts and analysis but needs to complete the Project impacts analysis to develop appropriate PMEs for the new license.

INFORMATION REQUEST

1. REMOVAL OF PROJECT FEATURES FROM THE FERC BOUNDARY: KENO DEVELOPMENT AND THE JC BOYLE BYPASS REACH

PC should provide information on Project impacts to fish, wildlife, habitat and water resources and include appropriate PME measures for those Project features and reaches proposed for deletion in the new license. PC has proposed to remove Keno Dam and Reservoir, both constructed and operated under FERC jurisdiction, from the Project boundary. In addition, it appears from Project maps submitted in the FLA that PC has proposed to remove the JC Boyle Bypass Reach from the FERC boundary as well. This proposal has been made since filing of the DLA. Exclusion of these Project features has contributed to insufficiencies in the FLA's discussion of Project impacts and proposed PM&Es. The Project boundary diminished between the DLA and FLA, thus Project impacts were not analyzed as a function of purposeful omission.

ODFW queries that even though PC continues to own and operate the facilities, how would Keno Dam, Reservoir and the river reach be conditioned as well as the JC Boyle Bypass Reach? Who would operate Keno and how would it be operated? How is Keno used for Project operations? PC has yet to model information requested by the stakeholder group in hydrology and water quality relicensing studies on the relationship between draw down at different times of year and reservoir. The existing license includes these facilities as they have been used to manage water flow releases through the

entire Project while the new proposed license has no mention of how these facilities will manage water for the hydroelectric Project.

ODFW's concern about the boundary adjustment and removal of Keno features and the JC Boyle Bypass Reach from the FERC boundary are due to the impacts on natural resources managed by ODFW. These impacts have not been analyzed adequately nor have PMEs to mitigate for impacts been developed. Project impacts and lack of PMEs to restore fish, wildlife and habitat will impact ODFW's ability to meet resource management objectives.

ODFW generally opposes the removal of existing Project features from the FERC boundary unless these features are proposed for decommissioning. Removal of these Project features appears to be a mechanism to avoid relicensing responsibilities to address Project impacts including upstream and downstream fish passage (which facilities do not meet current environmental standards), contribution to water quality violations, and flow fluctuations in the Keno Reach below the dam and minimum flows and ramping impacts in the JC Boyle Bypass Reach.

PC claims that the Keno Development does not substantially benefit power generation and should therefore be removed from FERC jurisdiction. In support of this conclusion, the FLA omitted an analysis of the effect of Keno Development operations on natural resources and social uses. While the facility lacks the capacity to generate power, use of the Keno Development to optimize power production at other Project facilities and

regulate flows during maintenance, are Project operations, and the effects should be analyzed.

ODFW has concerns about removing the JC Boyle Bypass Reach from the Project boundary and believes the reach should be included as part of the Project. The Bypass Reach lies between two PC 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.

PC should be required to analyze Project impacts for these Project facilities and flow impacted reaches. In coordination with stakeholders and agencies authorized to issue terms and conditions, PC should also be required to develop appropriate PME measures. For example, these may include but not be limited to the following PME measures:

- Draw down Keno and make it free flowing, and wetlands riparian restoration, etc.
- Improve water quality downstream through improved flow management
- Improve fish passage with construction of new ladder that meets current NOAA, USFWS and ODFW standards and provides safe effective passage
- Improve downstream fish passage with improvements to the auxiliary water supply and sluice conduit and provide a safe and effective route
- Reduce or eliminate flow fluctuations in the Keno and JC Boyle Bypass reaches

- Improve flow with higher minimum flows to improve habitat for native fish species

This information is requested to assist the ODFW in evaluating project impacts to fish and wildlife resources and their habitats and will also help in development of appropriate PM&E measures.

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ATTACHMENT

3

Oregon Parks and Recreation Department

PRELIMINARY COMMENTS ON THE FINAL LICENSE APPLICATION

ADDITIONAL STUDY REQUESTS

for

Klamath Hydroelectric Project
(FERC 2082)

April 2004

OPRD draft comments on the Klamath Final License Application (FERC# 2082) – 04/20/04

Volume 2, Exhibit E, Environmental Report
E1.2 Proposed Project

PacifiCorp states that it made few changes in its proposed project between its Draft License Application (DLA) and the Final License Application (FLA). PacifiCorp identified these changes as the removal of the East Side and West Side developments and their associated FERC boundaries, and the removal of Keno Dam from the proposed project boundary. PacifiCorp neglects to state, in its FLA, that its DLA was grossly deficient. The DLA identified neither project affects nor protection, mitigation, or enhancement measures: this made it impossible to know what PacifiCorp would include in its FLA as its proposed project. (STATE OF OREGON PROVISIONAL UNIFIED STATE POSITION - PACIFICORP'S KLAMATH HYDROELECTRIC PROJECT - STATE of OREGON WATER RIGHT NOS. PC 34, PC 35, PC 667, AND HE 180, FEDERAL LICENSE NO. 2082 - FEBRUARY 10, 2004). In its FLA, PacifiCorp does not include PM&Es for a number of areas that are directly impacted by project operations. FERC requires the applicant to address project impacts both inside and outside the FERC boundary. (18 CFR 4.41) PacifiCorp has removed the Topsy Campground, developed on the edge of JC Boyle Reservoir (a Project facility), from PM&E discussion. In Addition, with the exception of the most upper and lower reaches, PacifiCorp has excluded from the proposed Project, the land-based facilities of the Upper Klamath River/Hell's Corner Reach. These excerpts from FLA Exhibit E summarize the information PacifiCorp gathered in its recreation and land use studies.

E2 General Description of the Environment
E2.12 Recreation Resources

"Popular recreation activities in the Project area include flatwater and whitewater boating, hiking, bird watching, camping, picnicking, land and bank fishing, rafting, and swimming. Recreation sites in the Project vicinity include…Topsy Recreation Site, Frain Ranch…"

E7.0 Recreation Resources

Page 7-27 Upper Klamath River/Hell's Corner Reach Resource Area. This section identifies Frain Ranch as a "popular stopping place for whitewater boating enthusiasts and other recreationists."
Page 7-30 J.C. Boyle Reservoir Resource Area Recreation Facilities. This section identifies Topsy Campground as providing "access to J.C. Boyle Reservoir (a Project feature)."
Page 7-31 This section identifies key whitewater boat put-ins/takeouts in the Upper Klamath River/Hell's Corner Reach that are not a part of the FLA. Frain Ranch is one of these areas.
Page 7-33 This section describes dispersed sites in the Upper Klamath River/Hell's Corner Reach that receive "light to moderate use, primarily by boaters". Frain Ranch is specifically identified.

E7.1.3 Recreational Use and Demand

Page 7-42 Regional Demand for Proposed Project-Related Recreation Activities. This section discusses Oregon and California recreation documents and their analysis of recreation demand. These studies show that trail hiking/walking (CA) and walking for pleasure (OR) are high demand activities.
Page 7-43 Regional Demand for Whitewater Boating. This section identifies the Upper Klamath River/Hell's Corner reach as providing Class IV and V runs.
Pages 7-43-44 Regional Demand for Fishing. This section states, "The Project area provides a setting that attracts river anglers seeking solitude. This is especially true of the Klamath River Hell's Corner reach, which has limited access."
Page 7-44 Existing Use by Activity in the Proposed Project Area. "Whitewater boating was the most common activity among respondents in the Upper Klamath River/Hell's Corner reach resource area."
Page 7-46 Demand for Whitewater Boating in the Propose Project Area. "…there are three reaches containing just over 30 miles of whitewater within the proposed Project area…" "The most popular whitewater boating is found in Hell's Corner reach between the J.C. Boyle powerhouse and Copco reservoir."

E7.4.2.1 Recreation Flow Analysis

Page 7-68 Hell's Corner Reach. "Daily peaking…determines the frequency and quality of boating and fishing opportunities." "Predictable daily whitewater boating flows have fostered a substantial commercial whitewater boating industry on the river. If the Project did not exist, the Upper Klamath River would probably provide only technical or low-flow boating opportunities after midsummer. Changes in the timing of peaking flows in 2000 and 2001 (to generally occur later in the day) also had impacts on that industry, probably causing use decreases and affecting the quality and timing of trips (outfitters took shorter trips and/or returned clients to town later). Timing effects on fishing were the converse of those for whitewater boating. As peaking floes shifted later in the day, anglers had more fishing time in the morning, but less during the evening."

E7.4.2.4 Recreation Needs Analysis

Page 7-85 Recreation Demand Analysis. "According to the Oregon SCORP (OPRD, 2003) and CDPR report (1998), whitewater boating activities have relatively low existing statewide demand. However, locally, whitewater boating in the proposed Project area is popular along the Upper Klamath River/Hell's Corner reach between J.C. Boyle powerhouse and Copco reservoir. The 8-year average for the number of RDs on this reach of river is 5,250. The 8-7ear high was 6,395 RDs in 1995. The Oregon SCORP (OPRD, 2003) rates fishing as having moderate demand, while the CDPR report (1998) states that fishing has high existing demand. A survey conducted as par of the Recreation Visitor Surveys indicates that, overall, 34 percent of the visitors to the proposed Project are participate in bank fishing (reservoir and river). Angler use here is concentrated at six fishing access sites downstream of the Stateline take-out (PacifiCorp and BLM), at Frain Ranch, and at a few BLM sites upstream from there."

Page 7-87 “The Upper Klamath River/Hell’s Corner reach is unique within the proposed Project area and a large percentage (64 percent) of the visitors are involved in whitewater boating.”
Page 7-88 Recreation Capacity Analysis. “…ecological impacts were minimal except for Frain Ranch (not in the propose Project). Frain Ranch exhibits several ecological impacts from recreation and public use including vegetation trampling and damage, bare ground and soil compaction, erosion, litter accumulation, sanitation problems, and vandalism to existing structures.”

The above citations summarize portions of the recreation and land use studies conducted by PacifiCorp (Recreation Resources Final Technical Report, and the Land Use, Visual, and Aesthetic Resources Technical Report). These studies document that the Topsy Campground and Upper Klamath River/Hell’s Corner reach are high use recreation areas that are directly impacted by the Klamath River Project (FERC 2082).

Draft Recreation Resource Management Plan:
The FLA offers a draft recreation management plan (E7.4.2.5). This plan describes past actions taken by PacifiCorp in response to recreation use within the Upper Klamath River/Hell’s Canyon reach. Following are those actions.

E7.4.2.5 Recreation Resource Management Plan (draft RRMP)

E7.5.1 Existing Measures. “At Frain Ranch, constructed a composting toilet (currently closed because of severe vandalism). This site is located outside the current and proposed Project boundary.”
Page 7-102 “…cooperated with BLM and commercial and private whitewater boating interests to provide flows below the J.C. Boyle powerhouse, at time sufficient to provide whitewater boating opportunities in the Hell’s Corner reach downstream to Fishing Access Site 1.”

The FLA draft RRMP excludes areas that are directly impacted by project operations. The RRMP does not outline PM&Es for Topsy Campground although it acknowledges that this facility provides access to a Project feature, namely J.C. Boyle Reservoir (E7.0). Though PacifiCorp acknowledges that its water releases are directly tied to the whitewater boating and fishing levels (E7.4.2.1), and dispersed camps and day use areas are used by boaters and anglers (E7.4.2.4), they do not provide PM&Es for those facilities in the Upper Klamath River/Hell’s Corner Reach. The draft RRMP ignores the areas between Spring Island and Stateline Takeout (TableE7.5-1).

Recommended Actions:

PacifiCorp should include Topsy Campground and all of the Upper Klamath River/Hell’s Corner reach within their RRMP. Ideally, these areas s would be included in the FERC project boundary because of the direct affect on them by project operations. Inclusion of these areas in the RRMP and in the license conditions would provide them protection.

Topsy Campground: This is a BLM facility with direct recreational use associated with J.C. Boyle Reservoir, a Project facility. PacifiCorp should partner with the BLM to identify a safe and reliable potable water source and in managing the overall operations and maintenance of this facility.

Topsy Road: This road provides shuttle access for whitewater boaters and general access for anglers and upland recreators to the Frain Ranch area and down river to the Fishing Access Sites 1-6. This road should be included in the Project boundary: it serves a direct function as a transportation corridor for those recreating in the Project area. PacifiCorp should partner with the BLM in the maintenance and operations of this road.

Spring Island Access and Powerhouse Road: PacifiCorp has included a new trail to Spring Island (Table E7.5). However, PacifiCorp has not provided for the Powerhouse Road used by numerous boaters and anglers due to its launch site and its day use and camp areas. These recreational activities are directly connected to the operation of the J.C. Boyle Powerhouse. PacifiCorp should partner with the BLM in operating and maintaining the launch site, access road (Powerhouse Road, developed by PacifiCorp), campsites, day use facilities, and the associated structures.

River Loop Trail: This proposal was included in a draft RRMP dated August 2003. This proposed trail, from Spring Island to Frain Ranch, includes the development of a pedestrian suspension bridge at the old bridge crossing. PacifiCorp has identified trail hiking and walking for pleasure (E7.1.3.1) as high demand recreational activities. The inclusion of this river loop trail will assist PacifiCorp in its obligation to provide recreation resources in its Project impact area.

Frain Ranch: PacifiCorp has acknowledged the use of this facility by boaters, anglers, and upland recreators (E2.12, E7.0, E4.2.4). The majority of use at this facility is from whitewater boating as a result of the peaking of the Hell's Corner reach. Boaters use this area as a layover between high-water releases on a day-use and overnight basis. The site has been severely vandalized both structurally and ecologically and needs consistent facility maintenance and law enforcement. PacifiCorp should provided operations, maintenance, and law enforcement support to Frain Ranch.

Caldera Rapid: This whitewater section of the Klamath River falls within the Hell's Corner Reach, adjacent to Frain Ranch. It is considered the premier whitewater section of the river. PacifiCorp should develop and maintain a trail adjacent to the river to allow scouting of the Caldera Rapid, as the existing path is inadequate and unsafe.

ATTACHMENT

4

Oregon Public Utility Commission

PRELIMINARY COMMENTS ON THE FINAL LICENSE APPLICATION

ADDITIONAL STUDY REQUESTS

for

Klamath Hydroelectric Project
(FERC 2082)

April 2004

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Theodore R. Kulongoski, Governor

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April 21, 2004

Magalie R. Salas, Secretary
Federal Energy Regulatory Commission
888 First Street NE
Washington, DC 20426

Subject: Oregon PUC Staff Comment Regarding PacifiCorp's Klamath Hydroelectric Project (FERC # 2082)

Dear Secretary Salas,

The Federal Energy Regulatory Commission (FERC) issued a *Notice of Application Tendered for Filing with the Commission, Soliciting Additional Study Requests, and Establishing Procedural Schedule for Relicensing and a Deadline for Submission of Final Amendments* for PacifiCorp's (PC) Klamath Hydroelectric Project (Project) on February 26, 2004. The Staff of the Oregon Public Utility Commission (OPUC) has prepared a general comment related to the final license application (FLA).

ORS 756.040 directs the OPUC to "represent the customers of any public utility … and the public generally in all controversies respecting rates, valuations, service and all matters of which the Commission has jurisdiction." It also directs the Commission to use its powers "to protect such customers, and the public generally, from unjust and unreasonable exactions and practices and obtain for them adequate service at fair and reasonable rates." These statutory standards, together with the legislative policy established in ORS 543A.020, provide a basis for the OPUC to formulate its position on hydroelectric relicensing issues.

Exhibit D, Section 5.0 - Estimated Annual Value of Power – of Pacific's FLA assumes an annual average value of power of $70 per MWh. The FLA states the range around this estimate is $56 to $83 per MWh. The $70 value yields an annual value of power generation by the Klamath Hydro Project of $48.5 million.

Public Utility Regulatory Policies Act avoided cost information filed by Pacific with, and approved by, the OPUC in 2001 indicates an annual average value of power, adjusted for current natural gas prices, of between $46 and $55 per MWh.[1] Therefore, compared with information on file with the

[1] On November 11, 2003, Pacific filed a revised avoided cost study with the OPUC that claims a 2004 energy only avoided cost value of approximately $27 per MWh. Several interested parties have disagreed with the accuarcy of Pacific's proposed avoided cost values. This filing is currently under OPUC Staff review and has not been acted on by the Commission.

OPUC, the $70 value used in the FLA seems high. OPUC Staff recommends that PacifiCorp should be requested to provide documentation justifying the reasonableness of the annual value of power estimates used in Section D5.0 of its FLA.

OPUC Staff appreciates the opportunity to comment on PacifiCorp's FLA for the Klamath Hydroelectric Project.

William A. McNamee/s

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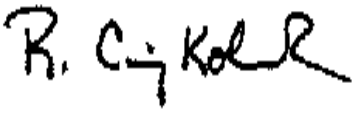
CERTIFICATE OF SERVICE

I certify that I have caused the service of the foregoing STATE OF OREGON ADDITIONAL STUDY REQUESTS FOR FERC PROJECT P-2082, by U.S. Mail upon each person designated on the official service list compiled by the Secretary in this proceeding, or by e-mail where authorized by the recipient, and electronically filed the same with FERC on April 26, 2004. In addition, copies have been sent to other interested agencies and individuals.



_____

R. Craig Kohanek
Hydroelectric Project Analyst
Oregon Water Resources Department

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