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Hydropower - Environmental Impact Statements (EISs)

Final Environmental Impact Statement for Relicensing of the Klamath Hydroelectric Project No. 2082-027
Issued: November 16, 2007

Commission staff prepared a Final Environmental Impact Statement (FEIS) for relicensing of PacifiCorp's 169-megawatt Klamath Hydroelectric Project, located primarily on the Klamath River in Klamath County, Oregon and Siskiyou County, California. On average, the project generates 716,820 megawatt-hours of electricity annually. The project occupies 219 acres of lands of the United States, which are administered by the U.S. Bureau of Reclamation and the U.S. Bureau of Land Management.

The existing project consists of eight developments, seven of which are located on the Klamath River. PacifiCorp proposes to decommission the upstream-most East Side and West Side developments and to remove the Keno development, which has no generating facilities, from the project. The remaining project developments on the main stem of the Klamath River are J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate. The proposed project also includes the existing Fall Creek development, located on a Klamath River tributary.

In this FEIS, Commission staff assessed the environmental and economic effects of:

- Continuing to operate the project with no changes or enhancements (no-action alternative);
- Operating the project as proposed by PacifiCorp (PacifiCorp's proposal);
- Operating the project as proposed by PacifiCorp with additional or modified environmental measures (staff alternative);
- Staff alternative with conditions filed by the Department's of the Interior and Commerce;
- Retirement of the Iron Gate and Copco No. 1 developments with additional or modified measures for the remaining developments; and
- Retirement of the Iron Gate, Copco No. 2, Copco No. 1, and J.C. Boyle developments, with additional or modified measures for the remaining developments.

The staff alternative incorporates most of PacifiCorp's proposed environmental measures, some with certain modifications. The staff alternative also includes 25 environmental measures additional to those proposed by PacifiCorp, including:

- Implementation of an integrated fish passage and disease management program;
- Implementation of an adaptive spawning gravel augmentation program in the J.C. Boyle bypassed reach and downstream of Iron Gate dam.

Based on our detailed analysis of the environmental benefits and costs associated with the five action alternatives considered in detail in this FEIS, we conclude that the best alternative for the Klamath Hydroelectric Project would be to issue a new license consistent with the environmental measures specified in the Staff Alternative.

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The staff alternative incorporates most of PacifiCorp's proposed environmental measures, some with certain modifications. The staff alternative also includes 25 environmental measures additional to those proposed by PacifiCorp, including:

- Implementation of an integrated fish passage and disease management program;
- Implementation of an adaptive spawning gravel augmentation program in the J.C. Boyle bypassed reach and downstream of Iron Gate dam.

Based on our detailed analysis of the environmental benefits and costs associated with the five action alternatives considered in detail in this FEIS, we conclude that the best alternative for the Klamath Hydroelectric Project would be to issue a new license consistent with the environmental measures specified in the Staff Alternative.

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sediment to be removed would depend on site-specific conditions and the nature of contaminants. It could be feasible to allow sediment not subject to scour following dam removal to remain in place with or without capping. However, to provide a conservative estimate of costs if sediment removal should be needed (preliminary sampling results in GEC, 2006, suggest that this would not be the case), we assume all sediment associated with reservoir lost storage (as shown in table 3-3) would need to be removed. Our base costs also assume that the exposed bottoms of the reservoirs would naturally re-vegetate, except for the areas disturbed by dam removal. We assume that no additional restoration costs for reservoir or downstream riparian habitat that may be influenced by sediment releases during dam removal would be required beyond the immediate dam site. In addition, we assume that all project-related roadways would remain in place with no modifications.

4.7.1 Keno Development

The Taintor gates would be opened to drain the reservoir and then removed. The dam and fishway concrete, earthen abutment, and control building with contents would be removed. The site would be re-graded and re-vegetated along the shore of the river channel in proximity to the dam. We estimate the decommissioning and removal of the Keno facilities would cost about $3,412,000 (2006 dollars). If contaminated sediment requires removal prior to dam removal, it could cost an additional $14 to $43 million. Substantial additional costs would be incurred by others if the water supply intakes at Keno reservoir need to be redesigned to retain their current function. We are not aware of any dam removal estimates prepared for the Keno development by others, and therefore we do not include Keno development in table 4-4.

4.7.2 J.C. Boyle Development

The reservoir would be drained in stages to allow much of the dam and associated structures to be removed in the "dry." This also would enable shoreline habitat to gradually acclimate as the reservoir drains. This approach would be used, to the extent possible, for the removal of other project dams on the mainstem. The Taintor gates could be opened to drain the reservoir to elevation 3,781.5 feet. The reservoir could be further lowered to elevation 3,768 feet through the powerhouse conveyance pipeline, canal, and tunnel. If operable, the dam bypass drains could be used to draw the reservoir down to approximately elevation 3,750 feet. The base of the embankment dam is at about elevation 3,726 feet. The remaining water in the reservoir would need to be removed prior to completion of dam removal. This could be accomplished by creating a diversion channel through the dam using sheetpiles driven to bedrock. The entire embankment dam would be removed. Once this occurs, all concrete structures associated with the power conveyance intake, Taintor gate structure, fishway, and other structural components would be removed. The embankments at each end of the former dam would be re-graded and re-vegetated.

The steel pipeline and supporting steel and concrete would be removed. The concrete structures associated with the canal intake, canal flume, canal spillway, and tunnel entrance structure would be removed. The lands under and adjacent to the canal flume would be backfilled and re-graded to stabilize the slopes and the area would be re-vegetated. The downslope channel associated with the former canal emergency spillway would be backfilled and stabilized to the edge of the Klamath River. The penstocks, supports, and anchors would be removed, and the tunnel portals would be sealed.

The powerhouse crane would be dismantled and removed. The powerhouse substructure and surface slab would remain intact. The powerhouse equipment would be removed. Any wooden materials in the powerhouse would be removed. Any components from the powerhouse containing chemical or other hazardous materials would be removed from the site, including transformers, bushings, batteries, tanks, lead bearings, and asbestos-based insulating products. Windows and doors in the powerhouse and the penstock entrance would be sealed to prevent public access. The turbine/generator openings in the concrete powerhouse slab would be sealed with concrete, as would the draft tube openings. The walls of

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the tailrace flume would remain. The tailrace area would be backfilled and re-graded to match the river embankment upstream and downstream of the powerhouse area and stabilized as necessary.

The 0.24-mile-long, 69-kV, de-energized transmission line from the switchyard to Transmission Line 18 would be removed, and the transmission right-of-way would be restored to natural conditions. The switchyard serves non-project purposes and would be retained.

We assume that the support buildings located near the dam would be sold for other purposes. The warehouse near the powerhouse would be removed.

We estimate the decommissioning and removal of the J.C. Boyle facilities would be $18,911,000 (2006 dollars). If contaminated sediment requires removal prior to dam removal, it could cost an additional $2 to $7 million.

4.7.3 Copco No. 1 Development

We assume that it would be feasible to restore the existing dam drainage tunnel and use it to drain the reservoir. The gate structure would need to be refurbished with a new gate and lift mechanism and the tunnel plugs would need to be removed once the gate structure was operational. This would allow for removal of the dam by drilling and blasting or other methods without the need to notch the dam to lower the reservoir. However, due to uncertainties over the feasibility of using the existing dam drainage tunnel, we have increased our contingency factor for Copco. No. 1 from 25 to 50 percent in case detailed investigations reveal that another method would be needed to drain the reservoir in a controlled release.

The impoundment would be lowered by first sequentially opening each of the spillway gates. The reservoir could be lowered further through the penstocks. Finally, the dam drainage tunnel would be used to drain the remainder of the reservoir volume prior to initiation of dam removal. The dam would be removed to the natural river channel upstream and downstream of the dam. No excess foundation material that was required to provide a solid foundation for the dam would be removed. The penstocks would be removed entirely. The powerhouse intake structure foundation and gatehouse would be sealed and the gatehouse secured. Once the dam is removed, the dam drainage structures would be removed and the tunnel sealed. Reservoir sediment would be allowed to pass downstream naturally.

The powerhouse would remain. The penstock and tailrace openings would be sealed. The powerhouse equipment and any wooden materials in the powerhouse would be removed. Any components from the powerhouse containing chemicals or other hazardous materials would be removed from the site. Windows and doors in the powerhouse would be sealed to prevent public access.

The two 0.7-mile-long, 69-kV lines from the Copco No. 1 powerhouse to the Copco No. 1 switchyard would be removed (the Copco No. 1 switchyard serves as a point of interconnection for the Iron Gate and Copco No. 2 powerhouses). We assume for cost estimation purposes that Copco No. 1 dam would only be removed if the Iron Gate and Copco No. 2 developments were decommissioned, and therefore, the Copco No. 1 switchyard would no longer be needed as a point of interconnection. The switchyard site and transmission line rights-of-way would be restored to natural conditions.

We estimate the decommissioning and removal of the Copco No. 1 facilities would cost $20,368,000 (2006 dollars). If contaminated sediment requires removal prior to dam removal, the costs could increase an additional $955 million to $2.9 billion.

4.7.4 Copco No. 2 Development

The reservoir would be drained through the Taintor gates. Once drained, the gates and gate structure would be removed. The power tunnel entrance would be sealed and the majority of the tunnel intake structure removed. The river banks along the abutments of the dam would be re-graded and re-

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vegetated, and the area where the intake structure had been would be backfilled, re-graded, and re-vegetated. Sediment would be allowed to pass downstream naturally.

The woodstave penstock, supports, and anchors would be removed, and the tunnel entrances sealed. The tunnel exit portal and the tunnel spillway portal would be sealed. The powerhouse would remain, and the penstock and tailrace openings would be sealed. The powerhouse equipment and any wooden materials in the powerhouse would be removed. Any components from the powerhouse containing chemicals or other hazardous materials would be removed from the site. Windows and doors in the powerhouse would be sealed to prevent public access.

The Copco No. 2 powerhouse serves as the point of interconnection for the Iron Gate development via the Copco No. 2 transmission connection to the Copco No. 1 switchyard. We assume for cost estimation purposes that Copco No. 2 development would only be decommissioned if Iron Gate development was decommissioned. Thus, the 1.23-mile-long, 69-kV transmission line from the Copco No. 2 powerhouse to the Copco No. 1 switchyard would be removed. The transmission line right-of-way would be restored to natural conditions. Since the Copco No. 2 switchyard serves non-project purposes, it would be retained.

We estimate the decommissioning and removal of the Copco No. 2 facilities would cost $3,731,000 (2006 dollars). It is unlikely that there would be enough sediment in Copco No. 2 reservoir to substantially influence this cost estimate.

4.7.5 Fall Creek Development

The Spring Creek diversion dam and diversion structures would be removed. The excavated diversion ditch from the diversion dam to its end in the Fall Creek drainage basin would be backfilled and graded. The diversion site would be restored to natural grades, if possible, and re-vegetated along the creek banks.

The Fall Creek diversion dam and diversion structures also would be removed. The earth and rock diversion ditch from the Fall Creek diversion dam to the penstock intake would be backfilled and graded. The diversion site would be restored to natural grades, if possible, and re-vegetated along the creek banks.

The penstock, supports, and anchors would be removed. The powerhouse would remain. The penstock and tailrace openings would be sealed. The powerhouse equipment and any wooden materials in the powerhouse would be removed. Any components from the powerhouse containing chemicals or other hazardous materials would be removed from the site. Windows and doors in the powerhouse would be sealed to prevent public access.

The short 69-kV tap line connection to Transmission Line 18 and the 1.65-mile-long, 69-kV transmission line extending from the Fall Creek powerhouse to the Copco No. 1 switchyard would be removed. The transmission line rights-of-way would be restored to natural conditions. There is no switchyard at Fall Creek.

We estimate the decommissioning and removal of the Fall Creek facilities would cost $1,390,000 (2006 dollars). It is unlikely that there would be enough sediment behind the Spring or Fall Creek diversion dams to substantially influence this cost estimate. We are not aware of any dam removal estimates prepared for the Fall Creek development by others, and therefore we do not include this development in table 4-4.

4.7.6 Iron Gate

We assume that the dam diversion tunnel used during project construction could be used to gradually drain the reservoir and control the release of sediment to the Klamath River downstream of the

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dam. Once the reservoir has been drained, the dam would be removed. The drainage tunnel would be used to maintain flow past the site during dam removal. The concrete penstock intake structure and penstock would be removed as dam removal progresses, as would the water supply lines for the fish facilities. The reservoir spillway would be abandoned in place.

The powerhouse crane would be dismantled and removed. The powerhouse equipment and any wooden materials in the powerhouse would be removed. Any components from the powerhouse containing chemicals or other hazardous materials would be removed from the site. The powerhouse substructure and surface slab would be removed to the lowest slab, which would remain. The powerhouse and tailrace area would be backfilled and re-graded to match the new river embankment upstream and downstream of the powerhouse area. The fish facilities at the base of the dam would be removed entirely. We assume that the Iron Gate Fish Hatchery located south of the dam would remain, although its ability to function as a fish hatchery without its historic water supply would be questionable.

The switchyard and 6.55-mile-long, 69-kV transmission line from the Iron Gate switchyard to the Copco No. 2 powerhouse would be removed. The switchyard site and transmission line rights-of-way would be restored to natural conditions.

We estimate the decommissioning and removal of the Iron Gate facilities would cost $36,853,000 (2006 dollars). If contaminated sediment requires removal prior to dam removal, it could cost an additional $485 million to $1.5 billion.

Table 4-5 contains a summary of our recommendations and costs for dam removal at the Klamath Hydroelectric Project.

Table 4-5. Dam removal recommendations and costs. (Source: Staff)

Dam/Environmental Measure	Capital Costs (2006$)	Annual Costs (2006$)	Annual Energy Costs (2006$)	Total Annualized Cost (2006$)
Keno				
Remove Keno from the licensed project	-$3,935,470 (remove net investment in project facilities from project – this represents the 2003 net investment value of the Keno facilities ($4,810,350) depreciated to 2006)	-$57,980 (remove 2003 O&M cost ($54,000) from project expenses)	$0 (no energy implications)	-$589,210 (reduction in annual expenses)
Remove Keno dam (in some cases, if meeting water quality standards and/or if fish passage is not feasible)	$3,411,650	$0	$0	$460,520
Decommissioning and dam removal plan for Keno development	$75,000	$0	$0	$10,120

TOTAL Cost $79,863,000 (PHYSICAL STRUCTURES ONLY)
WITH SEDIMENT ADD AN ADDITIONAL $1.44 Billion to $4.4 Billion
2006 dollars