Evaluation and Determination of Potential Liability Associated with the Decommissioning and Removal of four Hydroelectric Dams on the Klamath River By Any Agent

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For:
U.S. Department of the Interior
Through:
U.S. Bureau of Reclamation

REPORT

July 18, 2008

Executive Summary

This report presents the results of a liabilities assessment for the removal of four hydroelectric dams (J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate Dams) on the Klamath River (See Figure ES-1). This assessment was conducted following the development of the Klamath Basin Restoration Agreement in early 2008 between the U.S. Department of the Interior, PacifiCorp, and the current stakeholder group, which identified the decommissioning and removal of the four dams as a key component of the agreement. Several groups representing resource and regulatory agencies and non-governmental organizations (NGOs) have commissioned studies in an attempt to identify a process and quantify the potential liabilities associated with decommissioning and removal of the four dams. The process for decommissioning studied to date has emphasized the rapid removal of the dams and passage of trapped sediment down the Klamath River.

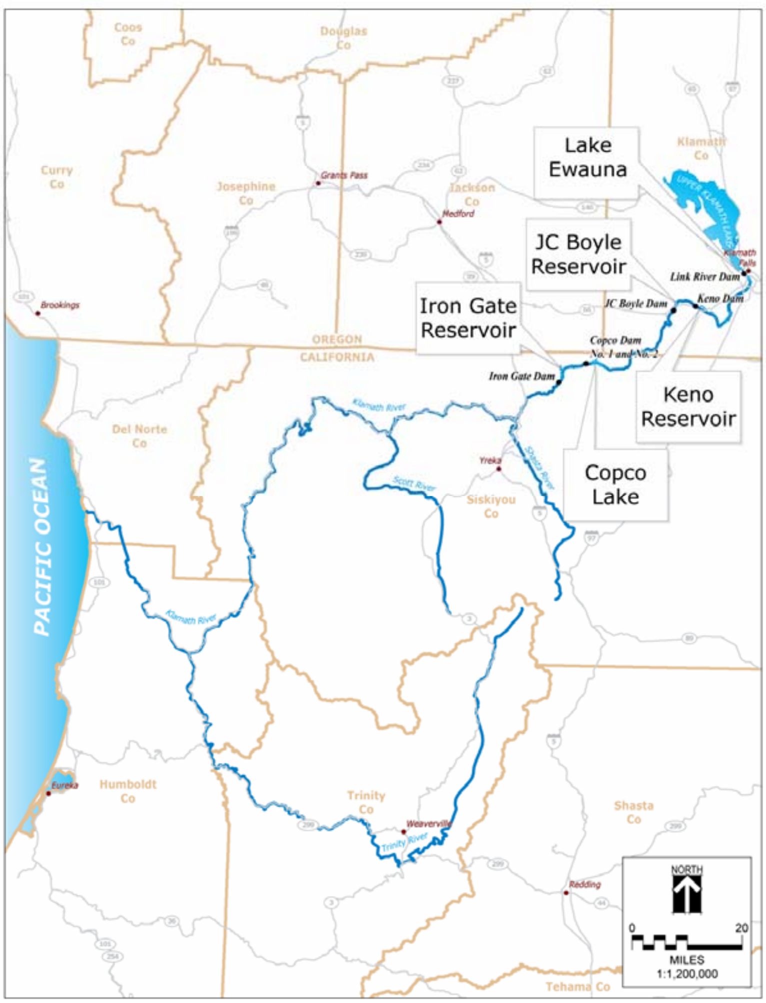

Figure ES-1. Klamath River System

This report identifies and attempts to quantify specific potential liabilities and the associated costs related to the decommissioning and removal of the four dams based upon the existing information developed to date. The report also identifies additional study needs that would help to reduce the uncertainties associated with facilities removal. Potential liabilities and associated costs were developed using existing reports and studies to present decision makers with a relative scale of the potential costs that could be generated by a dam removal action.

Liability Identification and Costing

Liabilities were identified and placed in four categories: (1) physical, (2) biological, (3) socioeconomic, and (4) legal and regulatory. Within each category the liabilities were further divided by their relative resource area and the dam or reach of river they would affect. The liabilities were numbered sequentially by resource area and assigned a corresponding "uncertainty" ranking to indicate confidence in the available data for quantifying the liabilities' total effect on decommissioning. A defined process was followed by the team to cost the liabilities using existing information, research, and engineering and construction judgment. Liability costs fell into two categories: direct costs and indirect costs. Direct costs arise from an identified decommissioning action where indirect costs are those costs that are a result of a decommissioning action in the form of mitigation, compensation, or the recognition of potential litigation of the liabilities described in Chapter 2 of this report. Many of the indirect costs remain unquantified. Presented in Table ES-1 is a summary of quantified liabilities and costs identified in this study.

Costs in Table ES-1 are presented for the quantifiable liabilities only. The unquantified liabilities that remain are presented in Chapter 3 of this report and have the potential to change the partial totals presented in Table ES-1.

Table ES-1. Klamath Dam Decommissioning Liability Investigation Liability Cost Estimate (Quantifiable Costs)

Physical Structure Removal Costs[1]			***Cost Estimate***		
J.C. Boyle			$16,914,700		$16,914,700
Copco No. 1			$25,380,100		$25,380,100
Copco No. 2			$6,112,400		$6,112,400
Iron Gate			$46,023,100		$46,023,100
Physical Structure Removal Subtotal			**$94,430,300**		**$94,430,300**
Quantifiable Liability Cost Estimates					
Liability #	***Liability Description***	***Dam Affected***	***Low Estimate***	***Risk Factor***	***High Estimate***
HW-1 to HW-4	Hazardous Waste Mitigation and Cleanup	J.C. Boyle	$100,000	1.5	$150,000
HW-5 to HW-9	Hazardous Waste Mitigation and Cleanup	Copco No. 1	$100,000	1.5	$150,000
HW-10 to HW-13	Hazardous Waste Mitigation and Cleanup	Copco No. 2	$100,000	1.5	$150,000
HW-14 to HW-18	Hazardous Waste Mitigation and Cleanup	Iron Gate	$100,000	1.5	$150,000
HH-4	Operations of Keno Dam	All Dams	$40,326,000	1.5	$60,489,000
HH-5	Highway 66 Bridge foundation	J.C. Boyle	$500,000		$1,500,000
SE-1	Presence of sediment	J.C. Boyle	$5,464,000	2.0	$10,928,000
SE-5	Presence of sediment	Copco No. 1	$93,560,000	2.0	$187,120,000
SE-9	Presence of sediment	Iron Gate	$76,379,000	2.0	$152,758,000
WQ 1, 2, 3	Downstream water quality during decommissioning	All Dams	$899,000	1.5	$899,000
AQ-2	Loss of spawning areas	All Dams	$45,000	1.0	$45,000
AQ-6	Iron Gate Fish Hatchery funding	Klamath Downstream	Presented above as structure removal cost	1.0	Presented above as structure removal cost
TE-1,3	Change in wetland habitat and loss of habitat	All Dams	$48,000	1.5	$72,000
TE-2	Invasive species	All Dams	$5,600	1.5	$8,400
SR-1	Reservoir restoration	J.C. Boyle	$2,510,000	1.5	$3,765,000
SR-4	Reservoir restoration	Copco No.1	$16,582,000	1.5	$24,873,000
SR-5	Reservoir restoration	Copco No.2	$175,000	1.0	$175,000
SR-7	Reservoir restoration	Iron Gate	$15,946,000	1.5	$23,919,000
RE-1,2	PacifiCorp land ownership and Diminution in Property Value	J.C. Boyle, Copco No. 2 & Iron Gate	$3,375,000		$12,000,000

Table ES-1. Klamath Dam Decommissioning Liability Investigation Liability Cost Estimate (Quantifiable Costs)

Quantifiable Liability Cost Estimates					
Liability #	***Liability Description***	***Dam Affected***	***Low Estimate***	***Risk Factor***	***High Estimate***
RE-3	PacifiCorp land ownership	Copco No.1	$2,500,000		$3,750,000
RE-4	Diminution in property value	Copco No.1	$7,500,000	1.5	$11,250,000
RC-1,4,6	Loss of flatwater recreation	J.C. Boyle, Copco No. 1 & Iron Gate	$288,000		$341,000
RC-2,5,7	Increased distance to water feature	J.C. Boyle, Copco No. 1 & Iron Gate	$488,000		$488,000
RC-3,8	Changes in recreational opportunities	J.C. Boyle, Copco No. 1 & Iron Gate	$1,446,000		$3,744,000
PO–1,2	Loss and replacement of renewable power source	All Dams	$65,169,000		$171,911,000
EC-1, 3, 5, 7	Loss of payroll	All Dams	$4,067,000		$4,067,000
EC-2, 4, 6, 8	Loss of regional fisheries	All Dams	$11,896,000[2]		$66,406,000[2]
Quantifiable Liabilities Subtotal			$337,672,600		$674,702,400
Decommissioning Design, Studies and Programmatic Costs at 10% [3]			$33,767,300		$67,470,200
Total of Quantifiable Liabilities			**$465,870,200**		**$836,602,900**

Notes:
1. Physical structure removal cost calculated using the values presented in GEC 2006 with the GEC estimate for hydroseeding removed to prevent double counting with the estimates presented in SR-1, SR-3, SR-4, and SR-6.
2. Not included in total: Since sediment removal should negate fisheries' impacts and the sediment removal costs are included in the total, fishery liabilities are noted here, but will not be included in the total.
3. 10% contingency calculated using the liabilities subtotal, the contingency does not consider the physical structure removal cost estimates to avoid duplication of contingency estimation completed by GEC in its estimate.

Other Important Study Findings

Several important findings relative to the decommissioning of the four dams follow.

1. Approximately 130 physical, biological, and socioeconomic liabilities associated with the decommissioning action were identified. The top 28 high ranked liabilities and/or uncertainties represent a very large percentage of the decommissioning cost. The

remaining liabilities represent a small cost in comparison to the overall decommissioning action. These liabilities are shown in Table ES-2.

2. Decommissioning approaches reviewed as part of this study proposed and evaluated the passage of sediment to the Lower Klamath River through to the Pacific Ocean. The North Coast Regional Water Quality Control Board (NCRWQCB) effectively prohibits the discharge of sediments to the Klamath River system including dam decommissioning projects, and the mouth of the Klamath River at the Pacific Ocean is an Area of Special Biological Significance (ASBS), with further restrictions on sediment discharge. As has been seen on other dam removal programs, including Condit on the White Salmon River in Washington, this approach has many regulatory challenges and has high potential for litigation.

3. The Federal Power Act grants the Federal Energy Regulatory Commission (FERC) significant authority to impose mitigation and restoration measures related to project decommissioning, potentially including measures to address the liabilities described in this report.

4. There is the high potential for litigation with a dam removal program that proposes to pass large volumes of sediment due to the damage to downstream fisheries and the aquatic ecosystem. On other dam removal projects including the Condit dam on the White Salmon River, arguing the state's authority to issue a CWA 401 Water Quality Certification has been used as an effective litigation tool to impede a dam's removal. Potential litigation could come from the Lower Klamath River tribes, fishery groups, riparian residents, boaters, and recreational users. The Siskiyou County Board of Supervisors has openly opposed the Klamath dam removal program sighting many of the above issues.

5. Dam decommissioning would result in the likely PacifiCorp divestiture of Keno Dam to Reclamation or another entity. The new owner/operator would be responsible for fish passage at Keno Dam and screening of three major canals on Keno Reservoir. Keno Dam would likely become the new water quality compliance point for water entering the lower Klamath River. Water quality in Keno Reservoir and Lake Ewauna has historically been very poor. Meeting water quality compliance goals and managing endangered fish species in Keno Reservoir, together with providing agricultural supply and return flow, will present significant challenges to the new operator.

Table ES-2. Liabilities Representing High levels of Liability and/or Uncertainty

Liability	Topic	Dam	Liability Level	Uncertainty
HH-3	Concurrent reservoir drawdown and sediment passage	All Dams	High	High
HH-4	Operations of Keno Dam	All Dams	High	Mod
HH-6	No low water outlet structure	Copco No. 1	High	Low
HH-7	Dam foundation removal	Copco No. 1	High	Mod
HH-9	Iron Gate Fish Hatchery	Iron Gate	High	High
SE-1	Presence of sediment	J.C. Boyle	High	High
SE-2	Composition of sediment	J.C. Boyle	High	High
SE-3	Sediment organic content	J.C. Boyle	Mod	High
SE-4	Reservoir drawdown rates	J.C. Boyle	Low	High
SE-5	Presence of sediment	Copco No. 1	High	High
SE-6	Composition of sediment	Copco No. 1	High	High
SE-7	Sediment organic content	Copco No. 1	Mod	High
SE-8	Reservoir drawdown rates	Copco No. 1	Low	High
SE-9	Presence of sediment	Iron Gate	High	High
SE-10	Composition of sediment	Iron Gate	High	High
SE-11	Sediment organic content	Iron Gate	Mod	High
SE-12	Reservoir drawdown rates	Iron Gate	Low	High
SE-13	Water temperature and sediment	Iron Gate	Mod	High
WQ-4	CWA Compliance at Keno Reservoir	All Dams	High	High
SR-4	Reservoir restoration	Copco No.1	High	Mod
RE-4	Diminution in property value	Copco No.1	High	Mod
PO–1	Loss of electricity currently generated	All Dams	High	Low
PO–2	Procurement of replacement power	All Dams	High	Low
PO–3	Removal of an emissions-free, renewable power source	All Dams	High	Low
RL-1	FERC Authority to impose mitigation	All Dams	High	High
RL-2	CWA Compliance	All Dams	High	High
RL-3	ITAs	All Dams	High	High
RL-4	Potential for litigation	All Dams	High	High

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Abbreviations and Acronyms

µg/L	micrograms per liter
ASBS	area of special biological significance
BLM	Bureau of Land Management
CDM	Camp Dresser & McKee Inc.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
Corps	U.S. Army Corps of Engineers
CVPSC	Central Vermont Public Service Corporation
CWA	Clean Water Act
DO	dissolved oxygen
EPA	Environmental Protection Agency
ESA	Endangered Species Act
F	Fahrenheit
FEIS	Final Environmental Impact Statement
FERC	Federal Energy Regulatory Commission
FPA	Federal Power Act
$g/m^2/day$	grams per square meter per day
GWh	gigawatt hours
H&H	hydrology and hydraulics
ITAs	Indian Trust Assets
KDDP	Klamath Dam Decommissioning Project
KPAAM	Klamath Project Alternatives Analysis Mode
mg/l	milligrams per liter
mg/kg	milligrams per kilogram
mg-N/kg	milligrams Nitrogen per kilogram
µg/L	micrograms per liter
MW	megawatts
MWh	megawatt hours
NCRWQCB	North Coast Regional Water Quality Control Board (California)
NEPA	National Environmental Policy Act

NGOs	non-governmental organizations
NPDES	National Pollutant Discharge Elimination System
NPS	U.S. Department of the Interior, National Parks Service
NPV	net present value
ODEQ	Oregon Department of Environmental Quality
PCBs	polychlorinated biphenyls
Reclamation	U.S. Department of the Interior, Bureau of Reclamation
ROW	right-of-way
SHPO	State Historic Preservation Officer
SOD	Sediment Oxygen Demand
SWRCB	(California) State Water Resources Control Board
TCPs	Traditional Cultural Properties
TKN	total Kjeldahl nitrogen
TSS	total suspended solids or sediment
USGS	U.S. Geological Survey
VPSB	Vermont Public Services Board

Chapter 1
Introduction

As society's needs and values change over time, it is becoming more common for the owners and operators of dams to evaluate whether the benefits of dam operation outweigh the problems and costs associated with existing dam infrastructure. In the Upper Klamath River Basin, PacifiCorp owns and operates several hydroelectric dams that are undergoing relicensing with the Federal Energy Regulatory Commission (FERC) following 50 years of operation. During the relicensing process, a variety of stakeholders (individuals, Tribes, fishing interests, and conservation groups) expressed a desire to decommission and remove four hydroelectric dams on the Klamath River. PacifiCorp continues to operate under one year temporary renewed contracts, without a long term license from FERC. Figure 1-1 shows the four hydroelectric dams: J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate Dams. Figure 1-2 illustrates the location of the major reservoirs created by the dams in relationship to elevation and river reach.

Figure 1-1. Klamath River System

The U.S. Department of the Interior initiated, through the Bureau of Reclamation, discussions with PacifiCorp on power rates. These discussions were expanded by PacifiCorp to include the current stakeholder group as a part of multi-party settlement negotiations to develop a comprehensive, long-term agreement that would reallocate water and restore fisheries in the Klamath Basin. Early in 2008 the Klamath

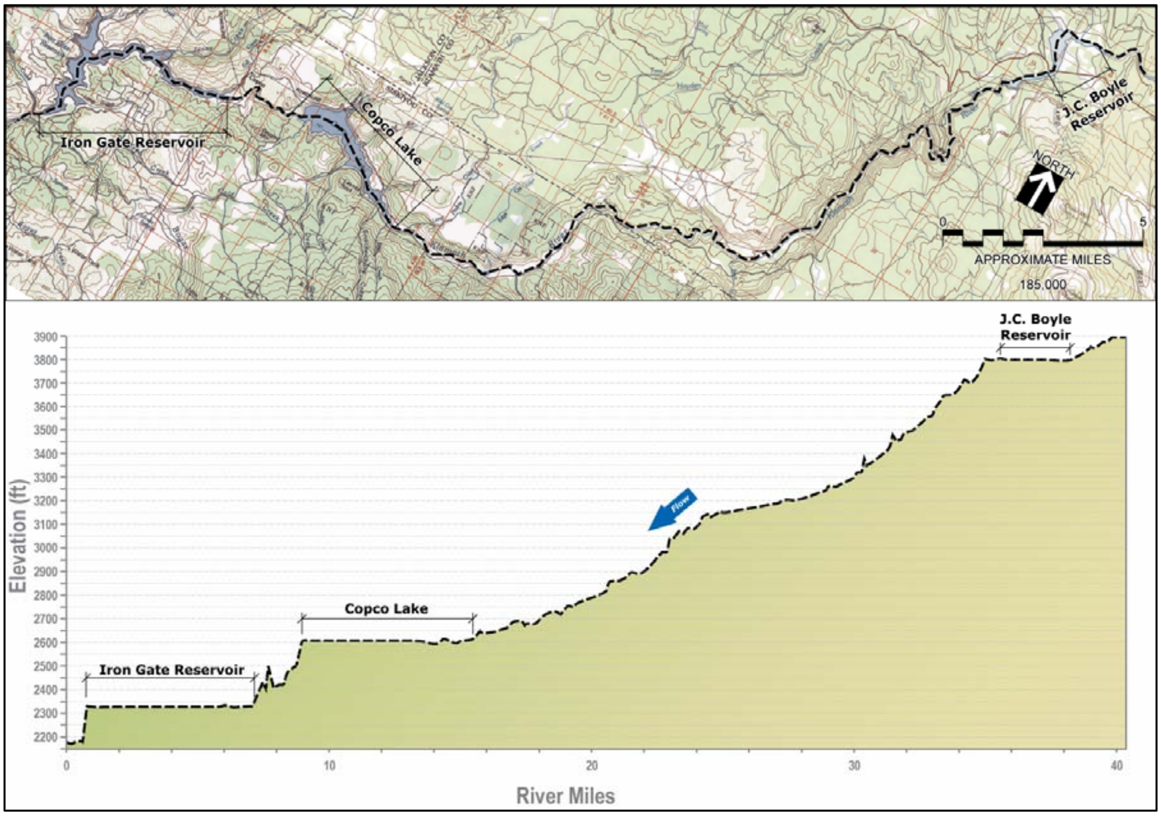


Figure 1-2. Reservoir Locations and River Reaches

Basin Restoration Agreement was released, with a key component being the decommissioning and removal of the four dams. A decommissioning agent has not been identified; however, several groups have commissioned studies in an attempt to identify a process and quantify the potential liabilities associated with decommissioning and removal of the four dams. The process studied to date has emphasized the rapid removal of the dams and passage of trapped sediment down the Klamath River to the Pacific Ocean. Although these studies provided relevant information, in late March 2008 the Bureau of Reclamation (Reclamation) contracted with Camp Dresser & McKee Inc. (CDM) to assess the potential decommissioning program's liabilities based on a review of all information developed to date.

1.1 Purpose and Scope

The purpose of this report is to identify and quantify specific potential liabilities and the associated costs related to decommissioning and removal of the four dams. This evaluation is based upon existing studies and reports. No new studies or surveys were conducted as part of this effort, nor were any alternative removal scenarios developed. The range of liabilities and costs for a particular issue has been tied to the available information. This report also identifies additional study needs (data gaps) that would help to reduce the uncertainties associated with facilities removal. These data gaps were used to frame the degree of liability. The liabilities presented in this report fall into four broad categories: (1) physical; (2) biological; (3) socioeconomic; and (4) legal and regulatory.

The report did not prepare an economic cost-benefit analysis using the four accounts outlined in the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* (P&Gs) (U.S. Water Resources Council 1983). The report instead analyzes the liabilities and associated quantifiable costs to present decision makers with a relative scale of the potential costs that could be generated by a dam removal action.

Chapter 2
Identification of Liabilities

This chapter presents the suite of liabilities that could result from the decommissioning and removal of the four Klamath Hydroelectric Project dams. These liabilities were identified by the Klamath Dam Decommissioning Project (KDDP) Team through the review of existing reports and studies. The liabilities in this chapter are also being presented with a corresponding "uncertainty" ranking to indicate the project team's confidence in the available data for quantifying the liabilities' total effect on decommissioning. For the purpose of this report a "liability" is being defined as something from which direct costs arise from an identified decommissioning action, or where indirect costs result from a decommissioning action in the form of mitigation, compensation, or the litigation liabilities described later in this chapter. "Uncertainty" is defined as the degree that unidentified factors could influence the severity of a liability.

The liabilities described in this chapter are presented in four categories: (1) physical, (2) biological, (3) socioeconomic, and (4) legal and regulatory. Within each category the liabilities are further divided by their relative resource area and the dam or reach of river they would affect. The uncertainty levels identified for the liabilities presented in this chapter are supported by the identification of the influencing data gaps that generate this uncertainty and the potential studies or actions that could be completed to narrow this uncertainty.

To assist the reader in identifying the resource areas and dams with the greatest relative influence on the decommissioning agent, figures indicating the cumulative liability and uncertainty level are presented in each resource area subsection of the chapter. The liabilities presented in this chapter are also listed sequentially by resource area subsection to assist the reader with unique numbers cross referenced to the cost estimates presented in Chapter 3.

2.1 Physical Liabilities

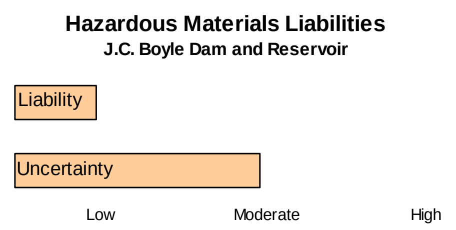
2.1.1 Hazardous Materials

The various studies conducted for the decommissioning of the Klamath Hydroelectric Project have identified the following potential liabilities related to hazardous materials.

- Transformer disposal at each powerhouse.
- Hydraulic oil and hydraulic oil storage disposal at each power house.
- Hydraulic servomotor and operator disposal.
- Oil, sump and various pump disposal at each powerhouse.
- Large equipment disposal at each powerhouse.
- Environmental restoration of switchyards and transmission right of ways (ROWs).
- Insulating asbestos present in the powerhouse, dam and substation structures.
- Heavy metals present in the plant and in paint coatings on exterior surfaces of pipes and structures.
- Existing spills involving mercury and polychlorinated biphenyls (PCBs).

The following subsections summarize how hazardous materials relate to potential dam decommissioning for each of the Klamath Hydroelectric Project dams covered by this report and state which of the above hazardous materials liabilities could be associated with dam decommissioning at each site, based upon material presented in the *Final Environmental Impact Statement (referred to as FEIS throughout this document) for Hydropower License, Klamath Hydroelectric Project* (FERC 2007) and other existing studies. For each dam, these subsections also describe the uncertainties and data gaps associated with hazardous materials liabilities.

2.1.1.1 J.C. Boyle Dam



Hazardous materials liabilities at the J.C. Boyle Development are primarily associated with decommissioning of the powerhouse, substation, and associated mechanical elements. The powerhouse at the J.C. Boyle Dam includes two vertical Francis turbines, two generators with a total of 98-megawatt (MW) of nameplate capacity, two three-phase transformers, one 0.24 mile long transmission line and various pumps and servomotors with hydraulic oil storage facilities. The existing J.C. Boyle substation is not considered as a part of this analysis.

J.C. Boyle Dam Hazardous Materials Liabilities and Uncertainties Potential liabilities generated by the decommissioning and removal of J.C. Boyle Dam and Reservoir include some of those listed at the beginning of Subsection 2.1.1. Of specific concern are the liabilities listed below.

HW-1. PCBs associated with the transformers used onsite. Current transformers are PCB free, but PCBs were commonly used as insulating fluids in transformers in the past and are known to be persistant organic pollutants. The presence of PCBs in the soil around the transformers has not been examined. PCBs are a low liability and of moderate uncertainty given the lack of surveys.

HW-2. Asbestos in insulating materials throughout the powerhouse, substation, and plant. The presence of asbestos has not been examined or quantified in studies. Asbestos is a low liability and of moderate uncertainty given the lack of surveys.

HW-3. Lead paints and coatings on structures and piping. The presence of lead paint at this development has not been examined or quantified in studies. Lead Paint and coatings are a low liability and of moderate uncertainty given the lack of surveys.

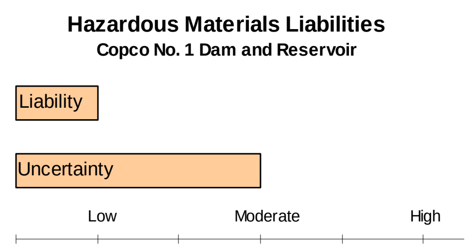
HW-4. The 0.24 miles of transmission line ROW to be restored to a natural state. Pesticides and herbicides may have been used to control animals and plant growth in the ROW. Pesticide concentrations in soil and nearby background concentrations have not been investigated. Pesticides in the ROW are a low liability and of moderate uncertainty given the lack of surveys.

J.C. Boyle Dam – Hazardous Materials Data Gaps Reducing the uncertainties described above will require addressing the data gaps listed in Table 2-1. These hazardous material data gaps apply to all four dams and reservoirs, except where noted in the subsections below.

Table 2-1. Hazardous Materials Data Gaps - J.C. Boyle Dam

Data Gap	Studies/Actions Needed
PCB Presence and Extent	Test soil surrounding transformer locations for the presence of PCBs.
Asbestos Presence and Extent	Test buildings for insulating asbestos.
Heavy Metals Presence and Extent	Perform study of historical paint uses onsite and perform surface sampling of pipes and structures to determine whether heavy metals are present in significant amounts.
ROW Soil Quality	Investigate surface soil along the ROW to determine the presence of pesticides and herbicides in soil.

2.1.1.2 Copco No. 1 Dam



Hazardous materials liabilities at the Copco No. 1 Development are primarily associated with decommissioning of the powerhouse, substation, and associated mechanical elements. The powerhouse at the Copco No. 1 Dam includes two horizontal Francis turbines, two generators with a total of 20-MW of nameplate capacity, six single-phase transformers, one 1.23 mile long transmission line and various pumps and servomotors with hydraulic oil storage facilities.

In addition to elements associated with the powerhouse and substation, Copco No. 1 Development also contains a switchyard that would be restored to a natural state.

Copco No. 1 Dam Hazardous Materials Liabilities and Uncertainties
Potential liabilities generated by the decommissioning and removal of Copco No. 1 Dam and Reservoir include some of those listed at the beginning of Subsection 2.1.1. Of specific concern are the liabilities listed below.

HW-5. PCBs associated with the transformers used onsite. Current transformers are PCB free but PCBs were commonly used as insulating fluids in transformers in the past. The presence of PCBs in the soil around the transformers has not been examined. PCBs are a low liability and of moderate uncertainty given the lack of surveys.

HW-6. Asbestos in insulating materials throughout the powerhouse, substation, and plant. The presence of asbestos has not been examined or quantified in studies. Asbestos is a low liability and of moderate uncertainty given the lack of surveys.

HW-7. Lead paints and coatings on structures and piping. The presence of heavy metals at this development has not been examined or quantified in studies. Lead Paint and coatings are a low liability and of moderate uncertainty given the lack of surveys.

HW-8. The 1.23 miles of transmission line ROW to be restored to a natural state. Pesticides and herbicides may have been used to control animals and plant growth in the ROW. Pesticide concentrations in soil and nearby background concentrations have not been investigated. Pesticides in the ROW are a low liability and of moderate uncertainty given the lack of surveys.

HW-9. Copco No. 1 switchyard would be restored to a natural state. Storage of various chemicals and fuels may also have occurred at the switchyard, with potential chemical and fuel releases to the soil; these liabilities have not been characterized. Chemicals and fuels in the switchyard are a low liability and of moderate uncertainty given the lack of surveys.

Copco No. 1 Dam – Hazardous Materials Data Gaps Reducing the uncertainties described above will require addressing the data gaps listed above for J.C. Boyle Dam, along with that listed in Table 2-2 below.

Table 2-2. Hazardous Materials Data Gaps - Copco No.1 Dam

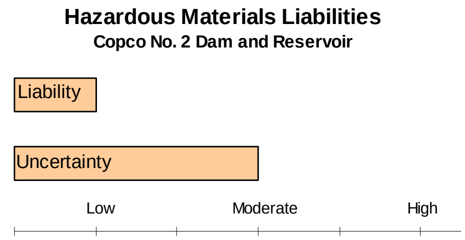
Data Gap	Studies/Actions Needed
Switchyard Soil Quality	Investigate the surface soil within the switchyard to determine presence of transformer oil, PCBs, and any hazardous chemical known to be stored in the area

2.1.1.3 Copco No. 2 Dam

Hazardous materials liabilities at the Copco No. 2 Development are primarily associated with decommissioning of the powerhouse, substation, and associated mechanical elements. The powerhouse at the Copco No. 2 Dam includes two vertical Francis turbines, two generators with a total of 27-MW of nameplate capacity, six single-phase transformers, two 0.7 mile long transmission lines and various pumps and servomotors with hydraulic oil storage facilities.

Copco No. 2 Dam Hazardous Materials Liabilities and Uncertainties

Potential liabilities generated by the decommissioning and removal of Copco No. 2 Dam and Reservoir include some of those listed at the beginning of Subsection 2.1.1. Of specific concern are the liabilities listed below.



HW-10. PCBs associated with the transformers used onsite. Current transformers are PCB free but PCBs were commonly used as insulating fluids in transformers in the past. The presence of PCBs in the soil around the transformers has not been examined. PCBs are a low liability and of moderate uncertainty given the lack of surveys.

HW-11. Asbestos in insulating materials throughout the powerhouse, substation, and plant. The presence of asbestos has not been examined or quantified in studies. Asbestos is a low liability and of moderate uncertainty given the lack of surveys.

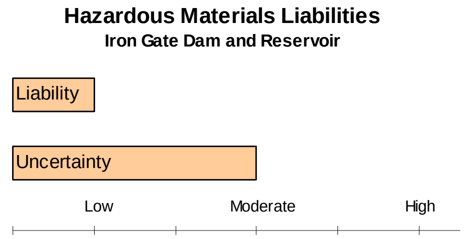
HW-12. Lead paints and coatings on structures and piping. The presence of heavy metals at this development has not been examined or quantified in studies. Lead Paint and coatings are a low liability and of moderate uncertainty given the lack of surveys.

HW-13. The 0.7 miles of transmission line ROW to be restored to a natural state. Pesticides and herbicides may have been used to control animals and plant growth in the ROW. Pesticide concentrations in soil and nearby background concentrations have not been investigated. Pesticides in the ROW are a low liability and of moderate uncertainty given the lack of surveys

According to the *FEIS* (FERC 2007) the main 230-kilovolt (KV) switchyard would be retained for non-project related uses by PacifiCorp and is not included as a source of potential hazardous liabilities.

Copco No. 2 Dam – Hazardous Materials Data Gaps Reducing the uncertainties described above will require addressing the data gaps listed above for J.C. Boyle Dam, with the exception of a data gap regarding deep sediment, as noted above.

2.1.1.4 Iron Gate Dam



Hazardous materials liabilities at the Iron Gate Development are primarily associated with decommissioning of the powerhouse, substation, and associated mechanical elements. The powerhouse at the Iron Gate Dam includes one vertical -Francis turbine, one 18 MW generator, four vertical turbine pumps for fish ladder water supply, one step-up transformer, one 6.55 mile long transmission line and various pumps and servomotors with hydraulic oil storage facilities.

In addition to elements associated with the powerhouse and substation, Iron Gate also has a switchyard which would be restored to a natural state. The length of the transmission line ROW and the presence of a switchyard increase the hazardous liability for the Iron Gate Development when compared with the other three dam developments.

Iron Gate Dam Hazardous Materials Liabilities and Uncertainties Potential liabilities generated by the decommissioning and removal of Iron Gate Dam and Reservoir include some of those listed at the beginning of Subsection 2.1.1. Of specific concern are the liabilities listed below.

HW-14. PCBs associated with the transformers used onsite. Current transformers are PCB free but PCBs were commonly used as insulating fluids in transformers in the past. PCBs are a low liability and of moderate uncertainty given the lack of surveys.

HW-15. Asbestos in insulating materials throughout the powerhouse, substation, and plant. The presence of asbestos has not been examined or quantified in studies. Asbestos is a low liability and of moderate uncertainty given the lack of surveys.

HW-16. Lead paints and coatings on structures and piping. The presence of heavy metals at this development has not been examined or quantified in studies. Lead Paint and coatings are a low liability and of moderate uncertainty given the lack of surveys.

HW-17. 6.55 miles of transmission line ROW to be restored to a natural state. Pesticides and herbicides may have been used to control animals and plant growth in the ROW. Pesticide concentrations in soil and nearby background concentrations have not been investigated. Pesticides in the ROW are a low liability and of moderate uncertainty given the lack of surveys

HW-18. Iron Gate switchyard would be restored to a natural state. Storage of various chemicals and fuels may have occurred at the switchyard over time, with potential chemical and fuel releases to the soil, these liabilities have not been characterized at this point. Chemicals and fuels in the switchyard are a low liability and of moderate uncertainty given the lack of surveys.

Iron Gate Dam – Hazardous Materials Data Gaps Reducing the uncertainties described above will require addressing the data gaps listed above for J.C. Boyle Dam.

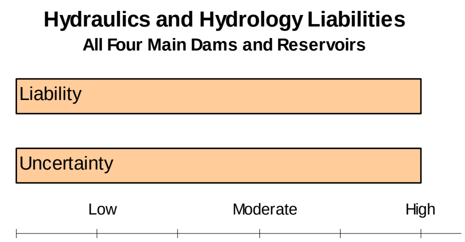
2.1.2 Hydraulics and Hydrology

Potential decommissioning liabilities related to hydrology and hydraulics (H&H) include the following:

- Flooding during and after dam removal.
- Changes in the river hydrograph affecting daily peak flows, seasonal flows, and river morphology.
- Presence of remnant dam structures within restored river channel.
- Reservoir drawdown and diversion methods for each reservoir and as a system.

Dam decommissioning would result in H&H changes to the river downstream of Keno Dam to the lower Klamath River downstream of Iron Gate Dam. The following subsections summarize potential H&H liabilities associated with the entire river system and for the individual dams, and describe uncertainties and data gaps associated with these liabilities.

2.1.2.1 All Four Dams and Reservoirs



H&H Liabilities Associated with All Four Dams During and following removal of the four dams there would be several H&H liabilities with differing levels of concern for the entire system. These liabilities fall in to four groups including flooding, river hydrology, reservoir drawdown sequencing, and operations of Keno Dam.

HH-1. Downstream flooding during reservoir drawdown and following decommissioning. The risks of flooding above current conditions would not be expected to increase substantially over the current condition. The four existing dams were not constructed to provide flood control and therefore the flood risk would not be expected to increase if they were removed. Additionally, little development exists along the Klamath River and any flooding would not be expected to result in substantial damage to existing structures. Any sediment deposited in the river channel during reservoir drawdown would be expected to be flushed downstream during larger flow events, and any increase in stage height would be of a short duration (Stillwater 2004). Downstream flooding is a low liability with moderate uncertainty given the lack of surveys.

HH-2. Flows on the Klamath River between J.C. Boyle and Iron Gate Dams are controlled by releases from Keno Dam. Relative to current conditions, larger quantities of water would remain in the river between the diversion points and the powerhouses following dam removal, but the daily peak flows would be reduced significantly. This H&H change would restore the pre-project river conditions and would be beneficial to fisheries and river ecology but could reduce opportunities for white water boating and eliminate existing opportunities for flat water boating. Subsection 2.3.3, Recreation discusses the loss of boating opportunities due to changes in river hydrology. Changes in river flows are a moderate liability with low uncertainty given available data on historical releases from Keno Dam.

HH-3. Methods of reservoir drawdown and sediment passage were examined in the *Klamath River Dam and Sediment Investigation* (GEC 2006), which proposed a concurrent, rapid drawdown of all reservoirs as the optimal action. The sequencing and constructability of this H&H action remains undefined and highly uncertain. The size and operability of the low-level outlet structures at each dam affects both the ability to dewater the reservoirs and the amount of sediment that could be released during dam removal. The duration of this action, together with the availability of a water supply that would be adequate to move sediment, requires further research and definition. The reservoir drawdown and sediment passage method is a high liability with high uncertainty given the insufficient amount of information on drawdown duration and water supply availability.

HH-4. Keno Dam's main purpose is to maintain a minimum pool to provide water for irrigation diversions, primarily with the North and Ady Canals, and the Lost River Diversion Channel. Keno Dam also regulates flow releases to the four Klamath dams. Keno Dam and Reservoir are owned by PacifiCorp and operated under an agreement with Reclamation (FERC 2007). With removal of the four dams, PacifiCorp would no longer have an interest in Keno Dam's operation and would likely divest ownership and operations to Reclamation or another entity. The operation of Keno Dam would also include improvements to its fish ladder and fish screens for canal diversions off the reservoir's minimum pool. Future ownership of Keno Dam is a high liability with moderate uncertainty given the unknown future ownership and the undefined operational requirements needed to balance fisheries, water quality, and agricultural diversions.

H&H River System Data Gaps Reducing the uncertainties described above will require addressing the data gaps listed in Table 2-3.

Table 2-3. Hydraulics and Hydrology Data Gaps - River System

Data Gap	Studies/Actions Needed
Flooding potential in the Lower Klamath	Update existing flood plain maps for the river without dams and identify potential new flood risks. Discuss with USACE any new requirement for flood management and the seasonal peak and potential modifications needed for PMF and IDF—handling at Keno and Link River Dams

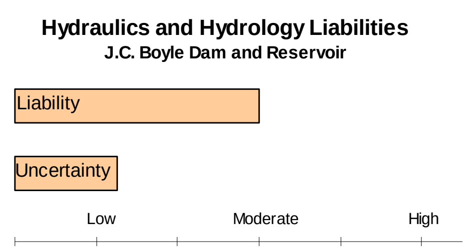
Table 2-3. Hydraulics and Hydrology Data Gaps - River System

Data Gap	Studies/Actions Needed
Reservoir drawdown and sediment passage sequencing	Develop detailed dewatering, dam removal and sediment passage operations plan, linked to available seasonal water supplies.
Operation and Maintenance of Keno Dam and Reservoir	Review PacifiCorp's O&M Plan.

Note:
PMF=Probable Maximum Flood
IDF=Inflow Design Flood

2.1.2.2 J.C. Boyle Dam

H&H liabilities specific to the J.C. Boyle Development relate to physical structures.



J.C. Boyle Dam – Hydraulic and Hydrology Liabilities and Uncertainties Potential liabilities generated by the decommissioning and removal of J.C. Boyle Dam and Reservoir include some of those listed at the beginning of Subsection 2.1.2. Of specific concern are the liabilities listed below.

HH-5. State Highway 66 crosses the upper reach of J.C. Boyle Reservoir via a bridge, approximately 1.3 miles upstream of the dam. If the J.C. Boyle Dam were removed, the foundation piers for this bridge might be affected by local scour during reservoir drawdown and by river action after the dam is removed. The foundation piers of the bridge might require mitigation to minimize structural damage. Information on the magnitude of the flows that could occur during and after dam removal would be required in order to perform an adequate scour analysis. The Highway 66 bridge foundation is a moderate liability with low uncertainty given the assumption that the piers would need some level of reinforcement. .

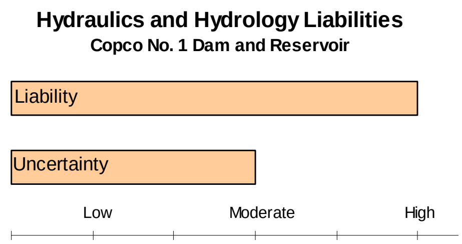
J.C. Boyle Dam Data Gaps Reducing the uncertainties described above will require addressing the data gaps listed in Table 2-4.

Table 2-4. Hydraulics and Hydrology Data Gaps - J.C. Boyle Dam

Data Gap	Studies/Actions Needed
Ability of existing Highway 66 Bridge to withstand scour	Perform scour analysis of Highway 66 Bridge and other minor bridges upstream.

2.1.2.3 Copco No. 1 Dam

H&H liabilities specific to the Copco No. 1 Development are related to the physical removal of the dam and dewatering of the reservoir.



Copco No. 1 Dam – Hydraulic and Hydrology Liabilities and Uncertainties Potential liabilities generated by the decommissioning and removal of Copco No. 1 Dam and Reservoir include some of those listed at the beginning of Subsection 2.1.2. Of specific concern are the liabilities listed below.

HH-6. Copco No. 1 Dam has no low level outlet structure to dewater the reservoir or pass sediment. There is an abandoned low level sluice outlet with a 16'x18' tunnel built during construction in the left abutment that may contain a concrete plug. Associated with this tunnel is an upstream gate which would need to be investigated for use in decommission as there is no information in the records (USBR 2008). The *Klamath River Dam and Sediment Investigation* (GEC 2006) proposed drilling and blasting a tunnel though the dam or developing sequential notches in the dam face to draw down water levels. Tunneling through the upstream dam face while the reservoir is full would represent a high construction safety risk, and sequentially notching the dam would not allow for the rapid passage of sediment downstream with other dams, as proposed in the report. The lack of a low water outlet at Copco No. 1 is a high liability with low uncertainty given the adequacy of the dam removal plan presented in the *Klamath River Dam and Sediment Investigation* (GEC 2006).

HH-7. Because Copco No. 1 Dam is in a narrow, deep river canyon, it might not be feasible to remove the concrete dam foundation. Consequently, a river hydraulic feature might remain, and would require engineering and construction mitigation to ensure boating safety and fish passage. Dam foundation removal at Copco No. 1 Dam is a high liability with moderate uncertainty given the challenges associated with removing the foundation in a narrow, deep river canyon.

Copco No. 1 Dam Data Gaps Reducing the uncertainties described above will require addressing the data gaps listed in Table 2-5.

Table 2-5. Hydraulics and Hydrology Data Gaps - Copco No. 1 Dam

Data Gap	Studies/Actions Needed
Reservoir drawdown method	Investigate further the feasible options for reservoir drawdown, outlet sizing, and sediment release capabilities.

2.1.2.4 Copco No. 2 Dam

H&H liabilities specific to the Copco No. 2 Development are related to diversion of the river during removal.

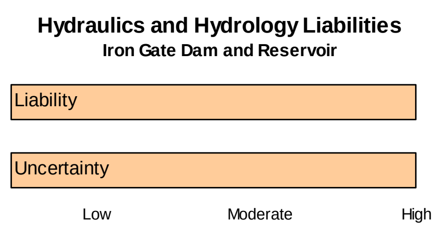
Copco No. 2 Dam – Hydraulic and Hydrology Liabilities and Uncertainties There were no identified potential liabilities generated by the decommissioning and removal of Copco No. 2 Dam and Reservoir.

There are no major data gaps for hydraulics and hydrology at Copco No. 2 Dam.

2.1.2.5 Iron Gate Dam

H&H liabilities specific to the Iron Gate Development are related to the dam's current functions of controlling downstream flows on the lower Klamath River and providing cold water to the Iron Gate Fish Hatchery.

Iron Gate Dam– Hydraulic and Hydrology Liabilities and Uncertainties Potential liabilities generated by the decommissioning and removal of Iron Gate Dam include some of those listed at the beginning of Subsection 2.1.2. Of specific concern are the liabilities listed below.



HH-8. Flows on the lower Klamath River are controlled by Iron Gate Dam. Removal of Iron Gate Dam would reduce the daily peak flows that result from power generation and would eliminate the cold water pool in the reservoir that is released into the Lower Klamath for fisheries in the summer months. Removal of the Iron Gate Dam would be assumed to restore the pre-project river conditions beneficial to fisheries and river ecology. Changes in river flows downstream of Iron Gate Dam are a low liability with low uncertainty given post removal return to pre-project river conditions.

HH-9. The cold water pool in Iron Gate Reservoir provides up to 24 cubic feet per second (cfs) (15,500,000 gallons per day) of water with temperatures below the 60 degrees Fahrenheit necessary for fish production at the Iron Gate Hatchery. To maintain the hatchery, this source of cold water would require replacement. This liability is described further in Subsection 2.2.1, Aquatic Resources. The Iron Gate Fish Hatchery water supply is a high liability with high uncertainty given the lack of an identified year round water source with temperatures below the 60 degrees Fahrenheit post dam removal.

Iron Gate Dam Data Gaps Reducing the uncertainties described above will require addressing the data gaps listed in Table 2-6.

Table 2-6. Hydraulics and Hydrology Data Gaps - Iron Gate Dam

Data Gap	Studies/Actions Needed
Iron Gate Hatchery Water Supply	Perform an analysis of hatchery water supply and availability.

2.1.3 Sediment

Potential decommissioning liabilities related to sediment include those listed below.

- Uncertainty with existing volume and grain size (e.g., clay, silts, sands) estimates for sediment accumulation in the J.C. Boyle, Copco No.1, and Iron Gate Reservoirs. The sediment accumulation estimates in the *Dam and Sediment Investigation* (GEC 2006) relied on a pre-dam survey that the USBR Technical Service Center (TSC) found troublesome to use based on the accuracy level of the survey (personal communication Blair Greimann – USBR TSC, 2007)

- Accumulation of organic matter and nutrients in reservoir sediments and the potential water quality impacts if material is released to the river during decommissioning.
- Passing excessive suspended solids could affect the health of aquatic species, clog raw water intakes, and affect irrigator crops and other water users downstream in the short and long terms.
- Reservoir sediment could be contaminated with hazardous or regulated constituents (e.g., mercury or PCBs).
- Riverbed aggradation downstream could result from releases of coarse sediment, increasing the flood stage for property currently in the floodplain.
- Rapid rates of reservoir drawdown could result in sloughing and landslides that affect reservoir restoration, slope stabilization, erosion, and the amount of sediment to be managed.
- Water quality regulations under the Clean Water Act Section 401 are enforced by the State and/or Regional Water Quality Control Board. Current policies would not allow the natural erosion of accumulated sediments into river systems at the rates proposed in the documents reviewed.

The following subsections summarize how sediment liabilities relate to potential dam decommissioning for each of the Klamath Hydroelectric Project dams covered by this report and state which of the above sediment liabilities could be associated with dam decommissioning at each site, based upon material presented in the available documentation. These subsections also describe the uncertainties and data gaps associated with sediment liabilities. Table 2-7 below lists data gaps associated with sediment for all of the dam developments, and describes the studies or actions needed to fill those data gaps (see also Liability HH-3)

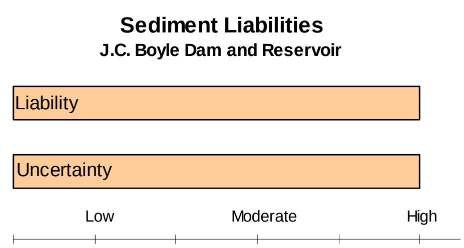
Table 2-7. Sediment Data Gaps Applicable for All Dams

<table>
<tr><th>Data Gap</th><th>Studies/Actions Needed</th></tr>
<tr><td>Timetable and sequencing plan for scheduled and controlled release of sediments during and after reservoir dewatering.</td><td rowspan="2">Model and develop a timetable and sequencing plan for controlling and managing sediment-laden water releases and assess the potential levels of sediment aggradation and suspended solids concentrations that would result from implementation.</td></tr>
<tr><td>Predicted levels of sediment aggradation and suspended solids concentrations downstream from dams during and after reservoir dewatering and dam removal.</td></tr>
<tr><td>Uncertain sediment accumulation in the J.C Boyle, Copco No. 1, and Iron Gate Reservoirs.</td><td>Survey to characterized reservoir sediment profiles is recommended at the J.C Boyle, Copco No. 1, and Iron Gate Reservoirs</td></tr>
</table>

Table 2-7. Sediment Data Gaps Applicable for All Dams

Data Gap	Studies/Actions Needed
Proposed decommissioning actions for the Klamath Project are based upon decommissioning programs at Elwha, Condit and Milltown dams and recommend a single high TSS event rather than trying to keep the TSS at or below acceptable regulatory levels (GEC 2006). There currently is no North Coast Regional Water Quality Control Board policy framework to allow for the discharge of sediment laden water to the Klamath River system at this order of magnitude (see also subsection 2.4.1.1).	Engage state and regional water quality policy makers regarding development of a regulatory framework that would provide for passage of large volumes of accumulated sediment that may have a negative impact on downstream beneficial uses.
Sediment Quality	Conduct a statistically valid and representative sampling program following Environmental Protection Agency protocols.

2.1.3.1 J.C. Boyle Dam



Potential liabilities generated by the decommissioning and removal of J.C. Boyle Dam and Reservoir include all of those listed at the beginning of Subsection 2.1.3. Of specific concern are the liabilities listed below.

SE-1. Existing sediment amounts at J.C. Boyle have been estimated at 636,000 cubic yards, with sands comprising 80 percent (GEC 2006). Sediment volume at J.C. Boyle is a high liability with high uncertainty given the lack of a statistically representative geotechnical survey of sediment in the reservoir.

Figure 2-1. J.C. Boyle Reservoir

SE-2. Only one boring was taken at J.C. Boyle Reservoir to characterize the soils and test for the presence of contaminants (GEC 2006). No contaminants were detected; however, a single soil boring is not adequate to determine soil volume or the presence of potential contaminants. Sediment contaminants are a high liability with high uncertainty given the lack of a statistically representative geotechnical survey for sediment contaminants in the reservoir.

SE-3. An organic content of 5.6 percent was reported in reservoir sediments (GEC 2006). Organics could affect the availability of dissolved oxygen (DO) if released to the river system. Sediment organic content is a moderate liability with high uncertainty given the lack of a statistically representative geotechnical survey in the reservoir.

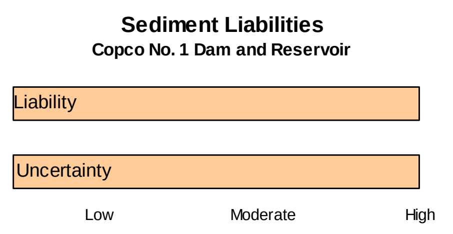
SE-4. High reservoir drawdown rates would evacuate sediment-laden water quickly, potentially inducing slope instabilities around the rim of the reservoir, which would increase the volume of sediment to be managed, relative to the volumes of sediment potentially released with low drawdown rates. Use of drawdown rates higher than 1 foot per day would likely require more study to avoid slope failures. Reservoir drawdown rates are a low liability with high uncertainty given insufficient study of slope failure potential.

J.C. Boyle Dam – Sediment Data Gaps Reducing the uncertainties described above will require addressing data gaps, as follows.

Table 2-8. Sediment Data Gaps - J.C. Boyle Dam

Data Gap	Studies/Actions Needed
Full extent of amount, chemical, and physical character of sediment deposition	Perform statistically representative geotechnical and chemical sampling to characterize the depth, extent, and character of sediments to pre-dam ground surfaces. (see also Table 2-1)
Impacts associated with higher rates of reservoir drawdown	Investigate reservoir rim soils and perform bathymetry to assess sediment strength and potential for slope failures and landslides.

2.1.3.2 Copco No. 1 Dam



Potential liabilities generated by the decommissioning and removal of Copco No. 1 Dam and Reservoir include all of those listed at the beginning of Subsection 2.1.3. Of specific concern are the liabilities listed below.

SE-5. Existing sediment amounts at Copco Reservoir have been estimated at 10,880,000 cubic yards with clays, silts, and sand comprising 48, 31, and 19 percent respectively (GEC 2006). Nearly 80 percent of the sediments behind this dam is silt and clay fraction. These soils would generate higher TSS and would potentially transport more contaminant during decommissioning than other soils, and in general would have higher negative affects on aquatic biota. Sediment volume at Copco No. 1 is a high liability with high uncertainty given the lack of a statistically representative geotechnical survey of sediment in the reservoir.

SE-6. Only cursory investigation was conducted to test for the presence of contaminants in reservoir sediment. Contaminants were not detected; however, contaminated sediment could be found in subsequent explorations (FERC 2007). Sediment contaminants are a high liability with high uncertainty given the lack of a statistically representative geotechnical survey for sediment contaminants in the reservoir.

Figure 2-2. Copco Reservoir

SE-7. An organic content of 5.5 percent was reported in reservoir sediments (GEC 2006). Organics could affect the availability of DO if released to the river system. Sediment organic content is a moderate liability with high uncertainty given the lack of a statistically representative geotechnical survey in the reservoir.

SE-8. High reservoir drawdown rates would evacuate sediment-laden water quickly, potentially inducing slope instabilities around the rim of the reservoir, which would increase the volume of sediment to be managed, relative to the volumes of sediment potentially released, with low drawdown rates. Use of drawdown rates higher than 1 foot per day would likely require more study to avoid slope failures. Reservoir drawdown rates are a low liability with high uncertainty given insufficient study of slope failure potential.

Copco No. 1 Dam – Sediment Data Gaps Reducing the uncertainties described above will require addressing data gaps, as follows.

Table 2-9. Sediment Data Gaps - Copco No. 1 Dam

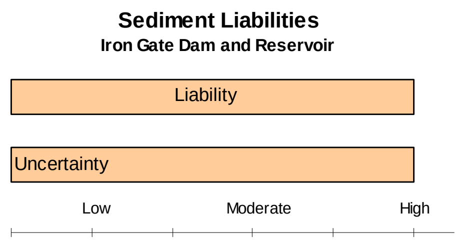
Data Gap	Studies/Actions Needed
Full extent of amount, chemical, and physical character of sediment deposition	Perform statistically representative geotechnical and chemical sampling to characterize the depth, extent, and character of sediments to pre-dam ground surfaces. (see also Table 2-1)
Impacts of higher rates of reservoir drawdown	Investigate reservoir rim soils further and perform bathymetry to assess sediment strength and potential for slope failures and landslides

2.1.3.3 Copco No. 2 Dam

Copco No. 2 Dam forms a very small diversion forebay with insignificant sedimentation accumulation. No sediment liabilities are listed for this facility.

There are no major data gaps for sediment at Copco No. 2 Dam.

2.1.3.4 Iron Gate Dam



Potential liabilities generated by the decommissioning and removal of Iron Gate Dam include all of those listed at the beginning of Subsection 2.1.3. Iron Gate Dam is of critical importance in the decommissioning process as it is the farthest down-stream dam and currently controls flow and sediment discharges to the lower Klamath River system. Of specific concern are the liabilities listed below.

SE-9. Existing sediment amounts at Iron Gate Dam have been estimated at 8,880,000 cubic yards with clays, silts, sand, and gravel comprising 51, 31, 12, and 6

Figure 2-3. Iron Gate Reservoir

percent respectively (GEC 2006). Over 80 percent of the sediment behind this dam is of silt and clay fraction. These sediments would generate higher TSS and would potentially transport more contaminant during decommissioning than other sediments, and in general would have higher adverse affects on aquatic biota. Sediment volume at Iron Gate is a high liability with high uncertainty given the lack of a statistically representative geotechnical survey of sediment in the reservoir.

SE-10. Only cursory investigation was conducted to test for the presence of contaminants in reservoir sediment and some soil borings did not extend the full depth of the sediment column. Contaminants were not detected; however, contaminated sediment could be found in subsequent explorations (FERC 2007). Sediment contaminants are a high liability with high uncertainty given the lack of a statistically representative geotechnical survey for sediment contaminants in the reservoir.

SE-11. An organic content of 3.1 percent was reported in reservoir sediments (GEC 2006). Organics could affect the availability of DO if released to the river system. Sediment organic content is a moderate liability with high uncertainty given the lack of a statistically representative geotechnical survey in the reservoir.

SE-12. High reservoir drawdown rates would evacuate sediment-laden water quickly, potentially inducing slope instabilities around the rim of the reservoir, which would increase the volume of sediment to be managed, relative to the volumes of sediment potentially released with low drawdown rates. Use of drawdown rates higher than 1 foot per day would likely require more study to avoid slope failures. Reservoir drawdown rates are a low liability with high uncertainty given insufficient study of slope failure potential.

SE-13. Water temperature and sediment concentrations downstream from Iron Gate Dam during removal would depend on the amount of in-stream water available and the start date of drawdown operations. Sediment transport models have not been correlated to water quality and water temperature models to optimize flow and minimize downstream impacts (Also see related liability HH-3). Water temperature and sediment concentration downstream of Iron Gate is a moderate liability with high uncertainty given the lack of correlation between sediment transport, water temperature and water quality models.

Iron Gate Dam – Sediment Data Gaps Reducing the uncertainties described above will require addressing data gaps, as follows.

Table 2-10. Sediment Data Gaps - Iron Gate Dam

Data Gap	Studies/Actions Needed
Full extent of amount, chemical, and physical character of sediment deposition.	Perform statistically representative geotechnical and chemical sampling to characterize the depth, extent, and character of sediments to pre-dam ground surfaces. (see also Table 2-1)
Impacts of higher rates of reservoir drawdown.	Investigate reservoir rim soils and perform bathymetry to assess sediment strength and potential for slope failures and landslides.
Availability of water during decommissioning to move sediment load and meet in-stream water quality requirements.	Integrate water quality, flow, and sediment transport models. See Table 2-3 and HH-3

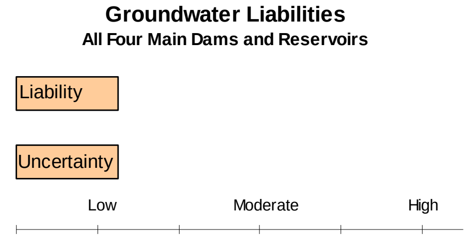
2.1.4 Groundwater

Potential decommissioning liabilities related to groundwater are as follows.

- The effectiveness and options for mitigating the potential impact of rising groundwater during reservoir drawdown (NPS 2005).
- The potential for higher stream levels causing higher groundwater levels, which could affect septic systems (NPS 2005).
- The presence of contaminated sediment could cause leaching of contaminants into groundwater (USBR 2003).

2.1.4.1 Groundwater Liabilities and Uncertainties – All Four Dams

The Klamath River subbasin includes the area between the outlet of Upper Klamath Lake and Iron Gate Dam. Flow monitoring and water quality results indicate that groundwater makes a significant contribution in many streams in the Upper Klamath Basin.



Groundwater discharges to the Klamath River between the Keno gage and the gage downstream from the J.C. Boyle power plant. Nearly all of the discharge is from a spring complex near river mile 224, about 1 mile downstream from the J.C. Boyle Dam and about 3.5 miles upstream of the power plant. During the month of August, mean net groundwater inflow between Keno and J.C. Boyle is approximately 200 cfs to 300 cfs (USGS 2007).

Groundwater pumping from wells in the upper Klamath Basin is primarily for public supply and agriculture. Most of the groundwater wells in the area are near Upper Klamath Lake and along the Lost River. Groundwater is the source of water supply for the communities of Klamath Falls, Bly, Chiloquin, Merrill, and Malin (USGS 2007).

Groundwater liabilities in the Klamath Hydroelectric Project area are related to the removal of the reservoirs created by J.C. Boyle, Copco No. 1 and Iron Gate Dams and the resulting changes in river flows downstream from decommissioned dam sites. Removal of the dams and reservoirs could decrease groundwater levels in the upper Klamath River in the immediate vicinity of the PacifiCorp dam reservoirs. Drawdown of the reservoirs could temporarily increase stream levels and potentially increase groundwater levels on the lower Klamath River downstream of Iron Gate Dam.

Potential liabilities generated by the decommissioning and removal of Klamath Hydroelectric Project dams and reservoirs include all of those listed above. Of specific concern are the liabilities listed below.

GW-1. Sections of the upper Klamath River that are cooled by large groundwater contributions would have higher temperatures due to a decrease in the percentage of flow contribution from groundwater in the bypass reach. Groundwater contribution to the river is a low liability with low uncertainty given the assumption that dam removal would restore the pre-project river conditions and would be beneficial to river ecology.

GW-2. The effectiveness and options for mitigating the potential impact and effects of rising groundwater caused by higher instream flows in the reaches downstream from decommissioned dam sites (NPS 2005). Rising groundwater is a low liability with low uncertainty given the assumption that dam removal would restore the pre-project river conditions and would be beneficial to river ecology.

GW-3. The presence of contaminated sediment could cause leaching of contaminants into groundwater downstream of Iron Gate Dam where discharged sediment settles (USBR 2003). As discussed in other subsections, some uncertainty is associated with the sediment stored behind J.C. Boyle, Copco No. 1, and

Iron Gate Dams. Current studies indicate that the sediment stored behind the dams is not contaminated and would have no negative impact on downstream waters beyond elevated TSS when the dam is breached, but further studies using a representative sampling program are necessary to examine sediment constituents as described in Table 2-10. Sediment ontaminant leaching into groundwater is a low liability with moderate uncertainty given the lack of a statistically representative geotechnical survey for sediment contaminants in the reservoirs.

2.1.4.2 Groundwater Data Gaps – All Four Dams

Reducing the uncertainties described above will require addressing data gaps, as follows.

Table 2-11. Groundwater Data Gaps - All Dams and Reservoirs

Data Gap	Studies/Actions Needed
Use of septic systems in the Klamath Basin	Determine whether septic systems are used in Klamath Basin and how changes in groundwater would affect them.
Groundwater flow contribution following dam removal	Model groundwater to predict groundwater surface water interactions following dam removal.

2.1.5 Water Quality

The water quality in the Klamath River from Upper Klamath Lake to the California state line is impaired due to pH levels, ammonia and nutrient concentrations, temperatures, dissolved oxygen (DO), and chlorophyll *a*. Water quality in the Klamath River downstream from Link River Dam is overwhelmingly influenced by the quality of water leaving Upper Klamath Lake. Several interest groups and stakeholders have suggested that removal of the dams on the Klamath River would significantly improve these water quality impairments. Consequently, much data and many studies exist that have predicted and evaluated the potential water quality changes of dam decommissioning. The liabilities related to water quality from potential decommissioning are listed below.

- Seasonal shifts in water temperature, with the potential spring and early summer temperatures higher after decommissioning than current conditions.
- Long-term elevated levels of total suspended solids (TSS) in the water column following dam removal.

- Short-term water quality degradation during reservoir drawdown, with high TSS, low DO, and high nutrient concentrations.
- Long-term water quality changes due to dam removal and restoration of natural stream conditions.
- Environmental/regulatory compliance and permitting.
- Potentially contaminated sediments.

Some changes resulting from dam decommissioning (e.g., a seasonal shift in water temperature) might or might not be positive changes. The following subsections summarize how water quality relates to potential dam decommissioning, based upon material presented in the *FEIS* (FERC 2007). These subsections also describe the uncertainties and data gaps associated with water quality liabilities.

2.1.5.1 J.C. Boyle Dam

Average monthly water temperatures in J.C. Boyle Reservoir range from 41.9 to 72 degrees Fahrenheit (F). Average monthly DO concentrations in the top 26 feet of the reservoir range from 7.3 to 12.5 milligrams per liter (mg/L). Water quality at the bottom of J.C. Boyle Reservoir is characterized by low DO concentrations (average is less than 6.0 mg/L) and high ammonia concentrations that exceed the acute toxicity criterion of 0.885 to 32.6 mg/L when salmonids are present at 9.0 and 6.5 pH units, respectively. In addition, water entering J.C. Boyle reservoir can have high chlorophyll *a* concentration (peak concentration of 58 micrograms per liter (µg/L). The average pH in J.C. Boyle Reservoir is 7.8 with a peak of 9.3 standard units. Sediment Oxygen Demand (SOD) in reservoirs upstream from the J.C. Boyle Dam are all above 2.0 grams per square meter per day ($g/m^2/day$) (FERC 2007).

Analysis of the sediment in J.C. Boyle Reservoir shows high nutrient concentrations within in the sediment. Ammonia nitrogen, values ranged from 43.6 to 915 milligrams Nitrogen per kilogram (mg-N/kgL). One sediment sample was analyzed for total Kjeldahl nitrogen (TKN) and total phosphorus, with resulting values of 2,730 mg-N/kg and 902 mg/kg, respectively (Shannon and Wilson, Inc 2006).

Water quality within the J.C. Boyle bypassed reach is influenced by the high groundwater contribution (250 to 300 cfs) and diversions to the JC Boyle Powerhouse. The groundwater contribution enhances water quality in this section (PacifiCorp 2004). DO concentrations between Keno Dam and J.C. Boyle Reservoir are typically near saturation due to high aeration from the free-flowing stream.

2.1.5.2 Copco No. 1 and Copco No. 2 Dams

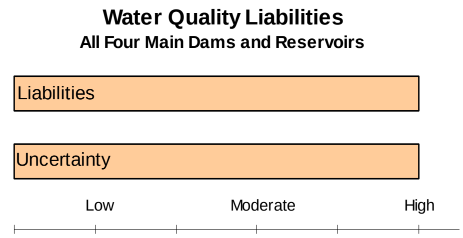
Water quality within Copco Reservoir is characterized by seasonal (spring through fall) thermal stratification into three layers, with maximum temperatures in the upper section of the reservoir near 77 degrees F during late July. Winter minimum temperatures are near 41 degrees F (FERC 2007). Low DO concentrations can exist in deeper portions of the reservoir (33 feet), with concentrations between 4.7 and 6.8 mg/L. Copco Reservoir also has high total phosphorus concentrations and high ammonia concentrations that exceed the ammonia acute toxicity criterion of 0.885 to 32.6 mg/L when salmonids are present at 9.0 and 6.5 pH units, respectively. In addition, high chlorophyll *a* values have been measured at Copco Reservoir (peak concentration of 44 μg/L). During the summers of 2005 and 2006 Copco Reservoir experienced substantial and sustained blooms of blue-green algae. During those periods, the average pH at the surface was 8.2, while 20 meters below the water surface, the average pH was 7.3, with very little variation during June through September (FERC 2007).

Results from sampling within Copco Reservoir show high nutrient concentrations in the sediment. Ammonia nitrogen values ranged from 141 to 1,330 (mg-N/kg). One sediment sample was analyzed for TKN and total phosphorus, with resulting values of 5,130 mg-N/kg and 1,420 milligrams per kilogram (mg/kg), respectively (Shannon and Wilson 2006). DO concentrations between J.C. Boyle Dam and Copco Reservoir are typically near saturation due to high aeration from the free-flowing stream.

2.1.5.3 Iron Gate Dam

Water quality within Iron Gate Reservoir is typical of a stratified lake with maximum summer temperatures near 77 degrees F and minimum winter temperatures near 41 degrees F. Water quality in the deeper portions of the reservoir (36 feet and below) is characterized by low DO (1.9 mg/L to 6.6 mg/L), temperature below 50 F, and pH averaging around 7.2. Iron Gate Reservoir also has high ammonia concentrations that exceed the ammonia acute toxicity criterion. Peak chlorophyll *a* values at Iron Gate Reservoir were 58 µg/L. During the summers of 2005 and 2006 Iron Gate Reservoir experienced substantial and sustained blooms of blue-green algae. During those periods, the average pH at the surface was 8.1 (FERC 2006).

Results from sampling within Iron Gate Reservoir show high nutrient concentrations within in the sediment. Ammonia concentrations measured as ammonia nitrogen, ranged from 58.9 to 816 mg-N/L. One sediment sample was analyzed for TKN and total phosphorus, with resulting values of 4,170 mg-N/kg and 1,360 mg/kg, respectively (Shannon and Wilson, Inc. 2006).



Water Quality Liabilities and Uncertainties – All Four Dams
Potential liabilities and uncertainties associated with decommissioning and removal of the four project dams are as follows.

WQ-1. The temperatures in the mainstem of the Klamath River could be subject to a seasonal shift and could become more responsive to ambient temperatures. Sections of the upper Klamath River that are cooled by large groundwater contributions have higher temperatures due to a decrease in the percentage of flow contribution from groundwater in the bypass reach. The change in temperature would likely affect aquatic species in this reach (see Subsection 2.2.1, Aquatic Resources). According to Bartholow (2005), the temperature shift would likely cool thermal habitat conditions (relative to current conditions) for adult fall Chinook during upstream migration and benefit mainstem spawning. Warmer (relative to current conditions) spring and early summer temperatures could potentially be harmful for Chinook rearing and outmigration in the mainstem. However, Dunsmoor (2006) predicts a net reduction in stressful conditions for aquatic species. Temperature changes post dam removal is a low liability with low uncertainty given the assumption that dam removal would restore the pre-project river conditions and would be beneficial to river ecology.

WQ-2. Sediment erosion following dam removal would elevate the levels of TSS in the water column and potentially transport contaminants from sediment to the water. The *Dam and Sediment Investigation* (GEC 2006) indicates that as the reservoirs are drawn down, river TSS levels would rise when sediment in the path of the river is eroded. Subsequently high TSS levels in the river downstream from the dams may have unfavorable impacts to aquatic and terrestrial species and downstream users. The sequence and timing of dam removal and reservoir drawdown can reduce the magnitude and duration of elevated TSS levels (GEC 2006). TSS levels in the river are a moderate liability with moderate uncertainty. Past work has focused on TSS levels, but significant work remains to understand TSS levels and duration that will ultimately be acceptable by the regulators.

WQ-3. During reservoir drawdown it is likely that there would be water quality degradation in the reaches immediately downstream from the dams in the form of low DO and high TSS. Water quality degradation is likely to affect aquatic species and water users downstream. The *Dam and Sediment Investigation* (GEC 2006) identified 91 locations where water was being withdrawn or could be withdrawn from the river. None of the withdrawals were large industrial or domestic uses. There is a high level of uncertainty associated with the water quality predictions following dam removal due to limited data used to develop the water quality models. The coarse level of detail both spatially and temporally is not sufficient to predict immediate and short-term water quality impacts (see also HH-3, SE-5 and SE-9). Water quality degradation is a moderate liability with moderate uncertainty given the coarse level of data used for the existing water quality models.

WQ-4. After dam removal the water quality compliance point at Iron Gate Dam currently utilized by the NCRWQCB to determine CWA compliance for the Klamath Hydroelectric Project (FERC Project 2082) is likely to be shifted upstream to Keno Dam. Historical water quality monitoring at Keno Reservoir indicates low DO, high temperature, high nutrients and high TSS levels during the summer months. The shifting of the water quality compliance point could potentially increase non-compliance events for pH, temperature, DO, ammonia, and TSS given the removal of the four downstream reservoirs that allow for sediment settling and water quality improvements for these constituents before being measured downstream of Iron Gate Dam.

The long-term water quality changes that would result from dam removal are uncertain. Klamath River water quality is strongly influenced by the quality of water leaving Upper Klamath Lake. High temperatures, nutrient and algae loads, and low DO concentrations are persistent in Upper Klamath Lake and Keno Reservoir during the summer months. Most studies suggest that water quality in the Klamath River would improve with the removal of the dams. However, modeling results used to support water quality predictions are not consistent. Most modeling efforts predict improvements in water quality conditions following dam removal, however some indicate significant water quality impacts following dam removal due to the quality of water in the Keno Reservoir. The complexity of the nutrient system is high and the water quality data used to support these models is limited. Water quality conditions following dam removal and the likely shift of the water quality compliance point to Keno Dam is a high liability with high uncertainty given the coarse level of data used for the existing water quality models.

Water Quality Data Gaps Many studies have addressed water quality in the Klamath River and within the reservoirs, and much data has been collected for the area covered by this report. Several water quality models have been developed for these reaches. The table below lists known data gaps.

Reducing the uncertainties described above will require addressing the data gaps listed in Table 2-12.

Table 2-12. Water Quality Data Gaps - All Dams and Reservoirs

Data Gap	Studies/Actions Needed
Limited water quality data exists to build existing models	Develop a sampling plan designed specifically for model development.
No studies and/or models exist to simulate immediate water quality impacts if sediment is allowed to erode during dam decommissioning	Develop a refined water quality model with sufficient detail (spatially and temporally) to assess immediate/short term impacts from sediment releases and high TSS.
Long-term water quality impacts below Keno Dam after dam removal.	Develop model to predict long-term water quality impacts below Keno Dam

2.2 Biological Liabilities

2.2.1 Aquatic Resources

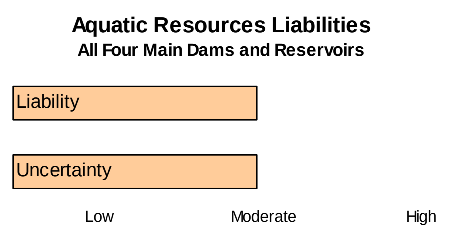
As described in the *FEIS* (FERC 2007), potential decommissioning liabilities related to aquatic resources and their associated issues include the following.

- Change of lacustrine to riverine habitat, with the potential for species composition alteration, such as a loss of warm water species and an increase in coldwater species.
- Potential for invasive and noxious species to colonize new areas.
- Alteration in fish disease location and dynamics.
- Short-term impacts versus long-term restoration.
- Sedimentation, sediment management, and subsequent short-term loss of spawning areas.

- Decreased water quality during sediment flushing, including increases in TSS and changes in DO and other constituents.
- Changes in the predictability, timing, duration, and magnitude of in-stream flows downstream from each dam, which could cause fish stranding and other aquatic resource effects (e.g. scouring of spawning areas and loss of food sources with high flows).
- Changes in temperature, both in magnitude and timing.
- Viability of upstream habitats and current fish populations.
- Alteration of downstream channel geomorphology, potentially causing a loss of habitat.

Multiple studies on the effects of dam removal on river ecosystems have found that over the long-term dam removal generates benefits for the affected environment and enhances fisheries. Generally, dam removal would cause some short-term impacts, such as a temporary increase in sedimentation. A review of the *FEIS* (FERC 2007) identified liabilities of specific concern associated with decommissioning the four dams, and suggested that others may be dismissed, based on the expectation supported by existing studies, that dam removal would improve conditions relative to their continued operation with relicensing. The following subsections summarize the findings of this review. These subsections also describe the uncertainties and data gaps associated with aquatic resource liabilities.

2.2.1.1 Aquatic Resource Liabilities and Uncertainties – Applicable for All Dams and Reservoirs



Aquatic resource liabilities associated with the decommissioning and removal of the four Klamath Hydroelectric Project dams are related to the removal of the four reservoirs created by the dams and changes to river flows between Keno and Iron Gate Reservoir. The potential liabilities generated by the decommissioning and removal of Klamath Hydroelectric Project dams and reservoirs are described below.

AQ-1. Alteration in fish disease location and dynamics. The potential changes in fish disease location and dynamics are uncertain because diseases such as *C. shasta* and their causal mechanisms are not well understood. Alteration in fish disease location is a moderate liability with moderate uncertainty given the limited understanding of the diseases causal mechanisms.

AQ-2. Sedimentation, sediment management, sediment contamination and subsequent short term loss of spawning areas. Although a number of studies have been conducted on sedimentation and sediment management there is still debate about the quantity and quality of sediment. Sediments potential affect on spawning areas is a low liability with low uncertainty given the assumption that dam removal would restore the pre-project river conditions and would be beneficial to river ecology.

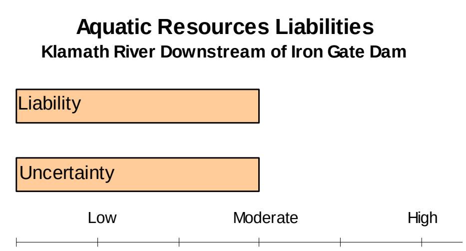
2.2.1.2 Aquatic Resources Data Gaps - Applicable for All Dams and Reservoirs

Reducing the uncertainties described above would require addressing the data gaps listed in Table 2-13.

Table 2-13. Aquatic Resources Data Gaps - All Dams and Reservoirs

Data Gap	Studies/Actions Needed
Sediment passage impacts	Develop a detailed sediment passage operations plan and environmental assessment, linked to available seasonal water supplies. (see also HH-3)
Fish disease impacts	Develop a study that investigated the potential changes in fish disease location and impacts

2.2.1.3 Aquatic Resource Liabilities and Uncertainties - Klamath River Downstream from Iron Gate Dam



Aquatic resource liabilities downstream from Iron Gate Dam are related to removal of the Klamath Hydroelectric Project from J.C. Boyle Reservoir to Iron Gate Dam and the resulting changes to river flows downstream from Iron Gate Dam. Iron Gate Dam and Reservoir are used to reregulate flow fluctuations caused by peaking operations upstream at the J.C. Boyle and Copco No. 1 and 2 Developments, to provide stable flows downstream from the Klamath Hydroelectric Project. The Klamath River downstream from Iron Gate Dam flows unobstructed for 190 miles before entering the Pacific Ocean. Four major tributaries enter this reach: the Shasta, Scott, Salmon, and Trinity Rivers. Each tributary supports anadromous salmon and steelhead runs that are directly affected by conditions on the lower Klamath River.

AQ-3. Alteration in fish disease location and dynamics. The potential changes in fish disease location and dynamics are uncertain because diseases such as *C. shasta* and their causal mechanisms are not well understood. Alteration in fish disease location is a moderate liability with moderate uncertainty given the limited understanding of the diseases causal mechanisms.

AQ-4. Sedimentation, sediment management, sediment contamination, and subsequent short-term loss of spawning areas. Although a number of studies have been conducted on sedimentation and sediment management there is still debate about the quantity and quality of sediment, the length of river downstream of Iron Gate potentially affected by the sediment, and the time needed for the river to flush the sediment from downstream spawning beds. Sediments potential affect on spawning areas is a moderate liability with moderate uncertainty given the lack of a statistically representative geotechnical survey of sediment in the reservoirs and the potential affect on spawning area downstream of Iron Gate Dam.

AQ-5. Support of the Iron Gate Fish Hatchery with a replacement water supply and a replacement for fish hatchery funding currently provided by PacifiCorp. Support of the Iron Gate Fish Hatchery is a moderate liability with low uncertainty given the assumption that continued funding of the fish hatchery would be required as a part of any dam removal agreement to support the fishery through river stabilization after dam removal.

AQ-6. Alteration of downstream channel geomorphology, potentially causing a loss of habitat. The extent of potential downstream channel geomorphology alteration is currently unknown. Downstream channel geomorphology alteration is a low liability with moderate uncertainty given the lack of study on this potential effect.

AQ-7. The potential introduction of invasive and noxious aquatic species currently present in the reservoirs to the lower Klamath River below Iron Gate Dam. Invasive and noxious species introduction is a moderate liability with moderate uncertainty given the lack of available studies investigating this effect.

2.2.1.4 Downstream – Aquatic Resources Data Gaps

Reducing the uncertainties described above would require addressing the data gaps listed in Table 2-14.

Table 2-14. Aquatic Resources Data Gaps - Klamath River Downstream

Data Gap	Studies/Actions Needed
Sediment passage impacts	Develop a detailed sediment passage operations plan and environmental assessment, linked to available seasonal water supplies. (see also HH-3)
Downstream channel geomorphology	Develop a channel geomorphology assessment for the downstream reach of the Klamath River.
Fish disease impacts	Develop a study that investigated the potential changes in fish disease location and impacts

2.2.2 Terrestrial Resources

As described in the *FEIS* (FERC 2007), potential decommissioning liabilities related to terrestrial resources and their associated issues include those listed below.

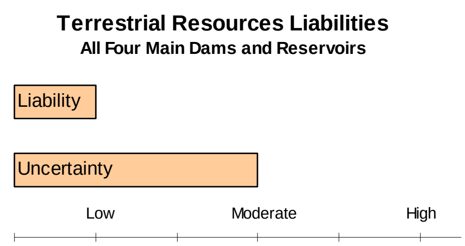
- Changes in wetland habitat area and type.
- Potential for invasive and noxious species to colonize newly exposed areas.
- Change of lacustrine to riverine habitat, such as a loss of resting habitat for waterfowl and foraging habitat for bald eagles and osprey, with the potential for species composition alteration.
- Loss of existing riverside and other habitats caused by flows post-removal and various potential erosion and bank failure scenarios.

Some changes resulting from dam decommissioning (e.g., a change from lake to river habitats) would have both positive and negative effects on terrestrial resources. Examples of these include a reduction in foraging habitat for osprey and bald eagles, but a potential increase in wetland habitats for

Figure 2-4. Riverside Conditions downstream from J.C. Boyle Dam

waterfowl and other riverine and riparian area species. A review of the *FEIS* (FERC 2007) identified liabilities of specific concern associated with decommissioning the four dams, and suggested that others may be dismissed, based on the expectation supported by existing studies, that dam removal would improve conditions relative to their continued operation with relicensing. The following subsections summarize the findings of this review. These subsections also describe the uncertainties and data gaps associated with terrestrial resource liabilities.

2.2.2.1 Terrestrial Resource Liabilities and Uncertainties – Applicable for All Dams and Reservoirs



Terrestrial resource liabilities associated with the decommissioning and removal of the four Klamath Hydroelectric Project dams are related to the removal of the four reservoirs created by the dams and changes to river flows between Keno and Iron Gate Reservoir. Each of these actions would have two primary effects on terrestrial resources: (1) areas left barren and in need of site restoration; and, (2) existing habitats altered (e.g., changes from lacustrine habitats to riverine habitats), which could subsequently alter terrestrial species composition. Of specific concern are the liabilities listed below.

TE-1. Changes in wetland habitat area and type after removal of the four Klamath Hydroelectric Project dams. The extent of change is uncertain due to unknown site conditions post-removal and unknown site restoration plans. Wetland habitat changes are a low liability with moderate uncertainty given unknown site conditions post-removal.

TE-2. Potential for invasive and noxious species to colonize newly exposed areas. Invasive and noxious species introduction is a low liability with moderate uncertainty given unknown site conditions post-removal.

TE-3. Loss of existing riverside/lakeside/lacustrine and other habitats caused by flows post-removal and various potential erosion and bank failure scenarios. The loss of existing habitat is a low liability with moderate uncertainty given the potential extent of these habitat losses is unknown because a complete analysis has not been conducted.

2.2.2.2 Terrestrial Resource Data Gaps - Applicable for All Dams and Reservoirs

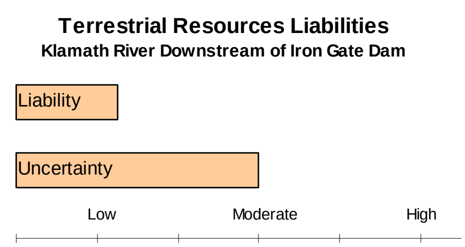
Reducing the uncertainties described above would require addressing the data gaps listed in Table 2-15.

Table 2-15. Terrestrial Resources Data Gaps - All Dams and Reservoirs

Data Gap	Studies/Actions Needed
Habitat and resident terrestrial resource sustainability following dam removal	Develop a habitat viability assessment for existing terrestrial resource populations potentially displaced by reservoir removal.
Invasive and noxious species colonization of exposed lands that are currently in reservoir footprint	Develop a site restoration plan to populate newly exposed areas with native non-invasive species.

2.2.2.3 Klamath River Downstream

The Klamath River downstream from Iron Gate Dam flows unobstructed for 190 miles before entering the Pacific Ocean and supports a wide range of botanical and wildlife resources in the terrestrial environment adjacent to the river.



2.2.2.4 Terrestrial Resource Liabilities and Uncertainties - Klamath River Downstream

Potential liabilities generated by the decommissioning and removal of the Klamath Hydroelectric Project include some of those listed at the beginning of Subsection 2.2.3. Of specific concern are the liabilities listed below.

TE-4. Changes in wetland habitat area and type after removal of the dams and reservoirs. Wetland habitat changes are a low liability with moderate uncertainty given the assumption that dam removal would restore the pre-project river conditions and would be beneficial to river ecology.

TE-5. Loss of existing riverside and other habitats caused by flows post-removal and various potential erosion and bank failure scenarios. The loss of existing habitat is a low liability with moderate uncertainty given the assumption that dam removal would restore the pre-project river conditions and would be beneficial to river ecology.

2.2.2.5 Klamath River Downstream – Terrestrial Resources Data Gaps

Reducing the uncertainties described above would require addressing the data gaps listed in Table 2-16.

Table 2-16. Terrestrial Resources Data Gaps - Klamath River Downstream

Data Gap	Studies/Actions Needed
Habitat and resident terrestrial resource sustainability following dam removal	Develop a habitat viability assessment for existing terrestrial resource populations potentially displaced by changes in downstream flows following dam removal.

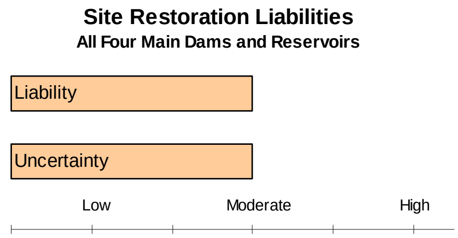
2.2.3 Site Restoration

As described in the *FEIS* (FERC 2007)*,* potential decommissioning liabilities related to site restoration include those listed below.

- Type of site restoration, such as stabilization only or stabilization and habitat enhancement.
- Extent of site restoration, with scope issues such as addressing only the Klamath Hydroelectric Project area or all areas where potential effects occur, including areas downstream.
- Success of site restoration and subsequent duration of site restoration monitoring and maintenance.
- Uncertainty regarding the level of restoration effort needed to recondition sections of the river currently bypassed by hydropower facilities.

A review of the *FEIS* (FERC 2007) identified liabilities of specific concern associated with decommissioning the four dams, and suggested that others may be dismissed, based on the expectation supported by existing studies, that dam removal and the subsequent site restoration would improve conditions relative to their continued operation with relicensing. The following subsections summarize the findings of this review. These subsections also describe the uncertainties and data gaps associated with site restoration liabilities.

2.2.3.1 Site Restoration Liabilities and Uncertainties – Applicable for All Dams and Reservoirs



Terrestrial and aquatic habitats at the four Klamath Hydroelectric Project dams are discussed in Subsections 2.2.1 and 2.2.2. Site restoration liabilities at these four dams are related to the removal of the reservoirs created by the dams, removal of any structures associated with the facilities, and changes to river flows between Keno and Iron Gate Reservoir. Each of these actions would leave areas barren and in need of site restoration to (1) stabilize the areas, and (2) restore the sites to at or near pre-project conditions if that is the goal of the decommissioning agent.

2.2.3.2 Site Restoration Data Gaps – Applicable for all Dams and Reservoirs

Reducing the uncertainties described above would require addressing the data gaps listed in Table 2-17.

Table 2-17. Site Restoration Data Gaps - All Dams and Reservoirs

Data Gap	Studies/Actions Needed
Determination of the level of site restoration needed to return dam, reservoir, and hydropower facilities to a natural state	Engage federal and state policy makers along with involved stakeholder groups to determine the level of site restoration necessary for dam decommissioning.

2.2.3.3 J.C. Boyle Dam

Potential liabilities generated by the decommissioning and removal of J.C. Boyle Dam and Reservoir include all of those described above as applicable to all dams. Other specific liabilities associated with the removal of J.C. Boyle Dam and Reservoir are listed below.

SR-1. J.C. Boyle Reservoir covers approximately 420 acres of land that would require restoration after reservoir drawdown. J.C. Boyle Reservoir restoration is a moderate liability with moderate uncertainty given unknown site conditions post-removal.

SR-2. The level of effort needed to restore the currently bypassed reach of the Klamath River associated with the J.C. Boyle hydroelectric facility is uncertain. Restoration of the bypassed reach is a low liability with moderate uncertainty given unknown site conditions post-removal.

SR-3. Restoration of JC Boyle Power Canal Spillway canyon erosion gully area. Restoration of the gully area is a moderate liability with moderate uncertainty given unknown site conditions post-removal.

2.2.3.4 Copco No. 1 Dam

Potential liabilities generated by the decommissioning and removal of Copco No. 1 Dam and Reservoir include all of those described above as applicable to all dams. Other specific liabilities associated with the removal Copco No. 1 Dam and Reservoir are listed below.

SR-4. Copco Reservoir covers approximately 1,000 acres of land that would require restoration after reservoir drawdown. Copco No. 1 Reservoir restoration is a high liability with moderate uncertainty given unknown site conditions post-removal.

2.2.3.5 Copco No. 2 Dam

Potential liabilities generated by the decommissioning and removal of Copco No. 2 Dam and Reservoir include all of those described above as applicable to all dams. Other specific liabilities associated with the removal of Copco No. 2 Dam and Reservoir are listed below.

SR-5. Copco No. 2 Reservoir covers approximately 40 acres of land that would require restoration after reservoir drawdown. Copco No. 2 Reservoir restoration is a low liability with low uncertainty given the reservoirs small size.

SR-6. The level of effort needed to restore the currently bypassed reach of the Klamath River associated with the Copco No. 2 hydroelectric facility is uncertain. Restoration of the bypassed reach is a low liability with moderate uncertainty given unknown site conditions post-removal.

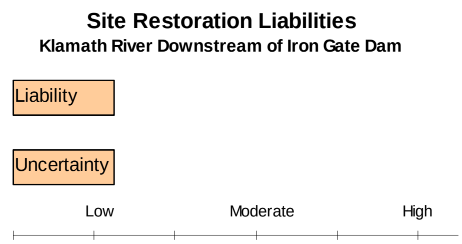
2.2.3.6 Iron Gate Dam

Potential liabilities generated by the decommissioning and removal of Iron Gate Dam include all of those described above as applicable to all dams. Other specific liabilities associated with the removal of Iron Gate Dam are listed below.

SR-7. Iron Gate Reservoir covers approximately 944 acres of land that would require restoration after reservoir drawdown. Iron

Gate Reservoir restoration is a moderate liability with moderate uncertainty given unknown site conditions post-removal.

2.2.3.7 Klamath River Downstream



The liabilities associated with site restoration downstream from Iron Gate Dam are heavily dependant on any potential effects generated by dam removal activities, and any changes in the predictability, timing, duration, and magnitude of in-stream flows in the downstream reaches of the Klamath River after dam removal.

Klamath River Downstream - Site Restoration Liabilities and Uncertainties Terrestrial and aquatic habitats downstream from the four Klamath Hydroelectric Project dams are discussed in Subsections 2.2.1 and 2.2.2, and liabilities related to sediment are discussed in Subsection 2.1.3.

SR-8. The Klamath River downstream from Iron Gate Dam flows 190 miles uninterrupted to the Klamath River Estuary, where it flows into the Pacific Ocean. There is uncertainty surrounding the potential need to restore the downstream reach of the river that could be affected by sediment deposition following removal of the Klamath Hydroelectric Project dams. Restoration of the Klamath River downstream of Iron Gate is a low liability with low uncertainty given the assumption that dam removal would restore the pre-project river conditions and would be beneficial to river ecology.

Site Restoration Data Gaps – Klamath River Downstream Reducing the uncertainties described above would require addressing the data gaps listed in Table 2-18.

Table 2-18. Site Restoration Data Gaps - Klamath River Downstream

Data Gap	Studies/Actions Needed
Determination of any responsibility for restoration activities downstream from Iron Gate Dam as a part of the decommissioning agreement	Engage federal and state policy makers along with involved stakeholder groups to identify responsibilities for site restoration downstream from Iron Gate Dam.

2.3 Socioeconomic Liabilities

2.3.1 Real Estate

As described in *Economic Analysis of Dam Decommissioning* (USBR 2003), potential decommissioning benefits related to real estate include:

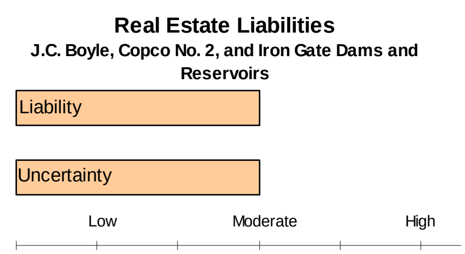
- Potential re-use of land; and
- Potential sale of land to adjacent property owners.

As described in *Economic Analysis of Dam Decommissioning* (USBR 2003), potential decommissioning liabilities related to real estate include:

- Diminution in value associated with a change from lake front property to river front property; and
- Federal government purchase of private dams, associated structures, and even the land.

Some changes resulting from dam decommissioning (e.g., a change from lake to river fishing opportunities) might or might not be positive changes in the perception of lake side property owners. The following subsections summarize how real estate relates to potential dam decommissioning for each of the four Klamath Hydroelectric Project dams covered by this report and state which of the above real estate benefits and liabilities could be associated with dam decommissioning at each site, based upon material presented in existing documentation. For each dam, these subsections also describe the uncertainties and data gaps associated with real estate liabilities.

2.3.1.1 J.C. Boyle, Copco No. 2, and Iron Gate Dams



The majority of land surrounding J.C Boyle, Iron Gate, and Copco No. 2 Dams is currently owned by PacifiCorp. PacifiCorp owns the land beneath the reserviors at each of these three developments.

Real estate liabilities associated with the J.C. Boyle, Iron Gate, and Copco No. 2 Developments are related to the removal of the reservoir created by the dams and changes to river flows between the various dams. Portions of the property abutting the Klamath River upstream of each reservoir are privately owned, or are owned by PacifiCorp. There is a small parcel owned by the Federal Government and managed by

Bureau of Land Management (BLM) on the east side of JC Boyle reservoir where BLM provides a campground (USBR/Klamath County Assessor GIS Information). Klamath County owns Sportsman's Park (sold to the county by PacifiCorp) in the Northern part of the Reservoir.

Real Estate has a low level of potential benefit for the J.C. Boyle, Iron Gate, and Copco No. 2 Dams, and the real estate benefits have low to moderate level of uncertainty.

J.C. Boyle, Copco No. 2, and Iron Gate Dams – Real Estate Potential liabilites generated by the decommissioning and removal of the J.C. Boyle, Iron Gate, and Copco No. 2 Dams and Reservoirs include all of those listed at the beginning of Subsection 2.3.1. Of specific concern are the liabilities listed below.

RE-1. Re-use of land. It is unclear whether PacifiCorp would retain ownership of the land it owns beneath and adjacent to the current reservoir locations, and what the final re-use of the land would be. If the federal government purchases the dams, associated structures, and the land, this benefit would become a liability. Land ownership post dam removal is a moderate liability with moderate uncertainty given the lack of studies on the value this land.

RE-2. Diminution in value of property adjacent to the current locations of J.C. Boyle, Iron Gate, and Copco No. 2 Dams and Reservoirs. It is uncertain what effect, if any, decommissioning would have on the value of adjacent properties. The BLM Campground at JC Boyle may have changes in use patterns. Property value diminution is a low liability with moderate uncertainty given the unknown effect on property value generated by dam removal.

J.C. Boyle Dam, Copco No. 2, and Iron Gate – Real Estate Data Gaps Reducing the uncertainties described above will require addressing the data gaps listed in Table 2-19.

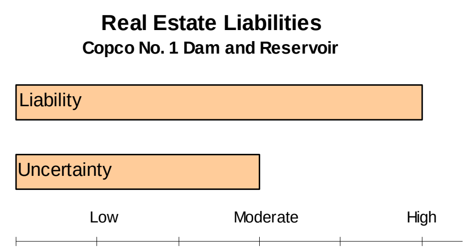
Table 2-19. Real Estate Data Gaps - J.C. Boyle, Copco No. 2, and Iron Gate Dams

Data Gap	Studies/Actions Needed
PacifiCorp's intentions regarding continued land ownership.	Confirm whether or not PacifiCorp intends to maintain ownership of its land that is currently under and adjacent to J.C. Boyle, Iron Gate, and Copco No. 2 Dams and Reservoirs.

Table 2-19. Real Estate Data Gaps - J.C. Boyle, Copco No. 2, and Iron Gate Dams

Data Gap	Studies/Actions Needed
Ownership of property adjacent to J.C. Boyle, Iron Gate, and Copco No. 2 Dams and Reservoirs.	Perform a complete record search and inventory the properties abutting J.C. Boyle, Iron Gate, and Copco No. 2 Dams and Reservoirs.
Diminution in value of property currently adjacent to J.C. Boyle, Iron Gate, and Copco No. 2 Dams and Reservoirs.	Perform a market driven cost comparison approach to estimate costs.
Compliance with existing local land use policies.	Land use study to identify potential land use compliance issues following dam removal.

2.3.1.2 Copco No. 1 Dam – Real Estate Liabilities and Uncertainties



The majority of the land surrounding Copco No.1 Dam is privately owned. PacifiCorp owns the land that is currently innundated by Copco Reservior.

Real estate liabilities in the Copco No. 1 Dam area are related to the removal of Copco Reservoir, which was created by the construction of Copco No. 1 Dam. Portions of the property abutting Copco Reservoir are privately owned and include boat docks. Removal of the dam would significantly reduce the water level, changing the lake front properties to river front properties and stranding the boat docks, potentially reducing the value of the property abutting the reservoir.

Copco No. 1 – Real Estate

Potential liabilities generated by the decommissioning and removal of the Copco No. 1 Dam and Reservoir include all of those listed at the beginning of Subsection 2.3.1. Of specific concern are the liabilities listed below.

Figure 2-5. Real Estate Adjacent to Copco No. 1 Dam and Reservoir

RE-3. Re-use of land. It is unclear whether PacifiCorp would retain ownership of the land it owns under and adjacent to Copco No. 1 Reservoir's current location and what the final re-use of the land would be. If the Federal government purchases the dams, associated structures, and the land, this benefit would become a liability. Land ownership post dam removal is a moderate liability with moderate uncertainty given the lack of studies on the value this land.

RE-4. Diminution in value of property adjacent to the current locations of Copco No. 1 Dam and Reservoir. Over 50 homes abut Copco Reservoir; many have boat docks. It is uncertain what effect, if any, decommissioning would have on the value of these adjacent properties. Property value diminution is a high liability with moderate uncertainty given the unknown effect on property value generated by dam removal.

Copco No. 1 – Real Estate Data Gaps Reducing the uncertainties described above will require addressing the data gaps listed in Table 2-20.

Table 2-20. Real Estate Data Gaps - Copco No. 1, Dam

Data Gap	Studies/Actions Needed
PacifiCorp's intentions regarding continued land ownership.	Confirm whether or not PacifiCorp intends to maintain ownership of its land that is currently under and adjacent to Copco Reservoir.
Ownership of property adjacent to Copco No. 1 Dam and Reservoir.	Perform a complete record search and inventory the properties abutting Copco No. 1 Dam and Reservoir.
Diminution in value of property currently adjacent to Copco No. 1 Dam and Reservoirs.	Perform a market driven cost comparison approach to estimate costs.
Compliance with existing local land use policies.	Land use study to identify potential land use compliance issues following dam removal.

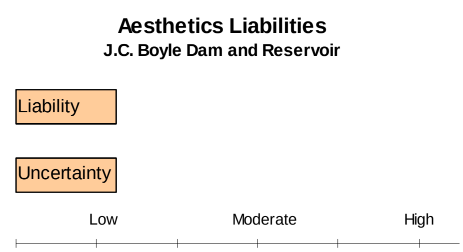
2.3.2 Aesthetics

Dam decommissioning would change the visual quality of the area, thus creating liabilities related to aesthetics. Aesthetic impacts previously identified in the *FEIS* (FERC 2007) and relicensing documentation focus on making the four dams and appurtenances become acceptably integrated into the surrounding natural landscape. The visual liabilities associated with decommissioning and removal of the four dams have not been previously analyzed. Although there is insufficient data to assess complete aesthetic liabilities, the potential liabilities include the following.

- Loss of reservoir and alteration of waterfront views available to tourists and nearby residences.
- Changes to the natural landscape associated with reservoir drawdown and altered instream flows.
- Visual scarring of the land associated with potential incomplete removal of dam structures.
- Change to the topography of the river channel.

Some aesthetic changes resulting from dam decommissioning (e.g., a change from lakefront views to river views) might be positive changes or negative changes, depending on the perception of residents and site users. The following subsections summarize how aesthetics relate to potential dam decommissioning for each of the Klamath Hydroelectric Project dams covered by this report and state which of the above aesthetic liabilities could be associated with dam decommissioning at each site. For each dam, these subsections also describe the uncertainties and data gaps associated with aesthetic liabilities.

2.3.2.1 J.C. Boyle Dam



Aesthetic liabilities in the J.C. Boyle Dam area are related to the drawdown of J.C. Boyle Reservoir, the removal of dam structures, and the resulting topography after dam removal. The river upstream of J.C. Boyle Dam is affected by releases from Keno Reservoir, which is not proposed for removal as a part of this project, and would therefore not generate any new appreciable liabilities upstream of J.C. Boyle Reservoir.

J.C. Boyle Dam – Aesthetic Liabilities and Uncertainties Potential liabilities generated by the decommissioning and removal of J.C. Boyle Dam and Reservoir include all of those listed at the beginning of Subsection 2.3.2. Of specific concern are the liabilities listed below.

AE-1. Loss of J.C. Boyle Reservoir and alteration of waterfront views from surrounding campgrounds. Removal of J.C. Boyle Dam would change the view from lakefront to riverfront. Waterfront view alteration is a low liability with low uncertainty given the assumption that dam removal along with site restoration would restore the pre-project river conditions.

AE-2. The creation of "rings" in the landscape from the drawdown process. While the release of water currently contained in the reservoir would likely leave rings, the extent of this is unknown. Rings in the landscape after dam removal is a low liability with low uncertainty given that this visual issue would be addressed by site-restoration.

AE-3. Visual scarring of the land would result from incomplete removal of the dam and associated structures. Visual scarring is a low liability with low uncertainty given that this visual issue would be addressed by site-restoration.

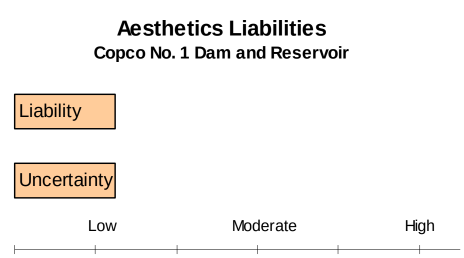
AE-4. Engineered slopes for stabilization of the river channel. The reshaping of the river channel would alter the topography and become a visual liability. Engineered slopes are a low liability with low uncertainty given that this visual issue would be addressed by site-restoration.

J.C. Boyle Dam – Aesthetic Data Gaps The uncertainties described above can only be reduced partially. While modeling and engineering of the removal process would reduce some uncertainty, the inherent subjectivity in aesthetic value prevents complete certainty regarding these liabilities. The actions listed in Table 2-21 could reduce some uncertainty.

Table 2-21. Aesthetic Data Gaps - J.C. Boyle Dam

Data Gap	Studies/Actions Needed
Removal limits	Develop removal plans with specific attention to the feasibility of removing all dam-related structures.
Site restoration plans	Develop site restoration plans with specific attention to the newly exposed ground.

2.3.2.2 Copco No. 1 Dam



Aesthetic liabilities for the Copco No. 1 Development are associated with the drawdown of the reservoir, changes to waterfront views, the removal of dam structures, and the resulting topography after dam removal. Of the four dams covered by this report, the aesthetic liabilities are the highest for Copco No. 1 because of the residences immediately surrounding the reservoir, and the immense structure of the dam and engineering challenge of removing it completely.

AE-5. Loss of reservoir and alteration of waterfront views from private residences. Removal of Copco No. 1 Dam would create riverfront views in place of lakefront views for surrounding homes. (See Subsection 2.3.1 for liabilities related to property values.) Waterfront view alteration is a low liability with low uncertainty given the assumption that dam removal along with site restoration would restore the pre-project river conditions.

AE-6. The creation of "rings" in the landscape from the drawdown process. While the release of water currently contained in the reservoir would likely leave rings, the extent of this is unknown. Rings in the landscape after dam removal is a low liability with low uncertainty given that this visual issue would be addressed by site-restoration.

AE-7. Visual scarring of the land from incomplete removal of the dam and associated structures. Copco No. 1 Dam is particularly massive and its foundation below the riverbed would remain in place. This could become an increasingly negative visual impact, as the river would tend to cut lower into its course, possibly revealing remaining concrete and steel over time. Visual scarring is a low liability with low uncertainty given that this visual issue would be addressed by site-restoration.

AE-8. Engineered slopes for stabilization of the river channel. The reshaping of the river channel would alter the topography and become a visual liability. Engineered slopes are a low liability with low uncertainty given that this visual issue would be addressed by site-restoration.

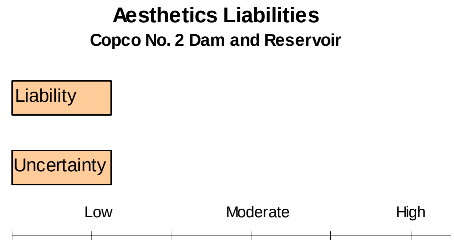
Copco No. 1 Dam – Aesthetic Data Gaps The uncertainties described above can only be reduced partially. While modeling and engineering of the removal process would reduce some uncertainty, the inherent subjectivity in aesthetic value prevents complete certainty of liabilities. The actions listed in Table 2-22 could reduce some uncertainty.

Table 2-22. Aesthetic Data Gaps - Copco No. 1 Dam

Data Gap	Studies/Actions Needed
Removal of spillway, intake structures, outlet works, and powerhouse	Clarify removal plans to resolve conflicting descriptions of the extent of removal.
Site restoration plans	Develop site restoration plans with specific attention to the newly exposed ground.

2.3.2.3 Copco No. 2 Dam

Aesthetic liabilities in the Copco No. 2 area are associated with the removal of dam structures and the resulting topography after dam removal.



AE-9. Visual scarring of the land from incomplete removal of the dam and associated structures. Copco No. 2 Dam is relatively small, yet any incomplete removal of structures would still be a visual liability. Visual scarring is a low liability with low uncertainty given that this visual issue would be addressed by site-restoration.

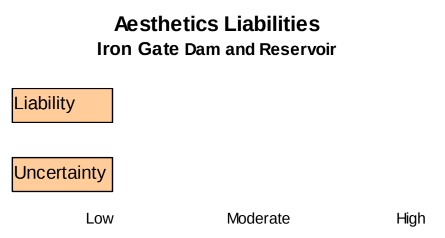
Copco No. 2 Dam – Aesthetic Data Gaps The uncertainties described above can only be reduced partially. While modeling and engineering of the removal process would reduce some uncertainty, the inherent subjectivity in aesthetic value prevents complete certainty of liabilities. The actions listed in Table 2-23 could reduce some uncertainty.

Table 2-23. Aesthetic Data Gaps - Copco No. 2 Dam

Data Gap	Studies/Actions Needed
Removal plans for concrete dam, intake structure, and powerhouse	Develop removal plans with specific attention to the feasibility of removing all dam related structures.

2.3.2.4 Iron Gate Dam

Aesthetic liabilities for the Iron Gate Development are associated with the drawdown of the reservoir, changes to the waterfront views, and the removal of dam structures and the resulting topography after dam removal.



AE-10. Loss of reservoir and alteration of waterfront views from recreation areas. Removal of Iron Gate would replace lakefront views from recreation areas with riverfront views. Waterfront view alteration is a low liability with low uncertainty given the assumption that dam removal along with site restoration would restore the pre-project river conditions.

AE-11. The creation of “rings” in the landscape from the drawdown process. While the release of water currently contained in the reservoir would likely leave rings, the extent of this is unknown. Rings in the landscape after dam removal is a low liability with low uncertainty given that this visual issue would be addressed by site-restoration.

AE-12. Visual scarring of the land from incomplete removal of the dam and associated structures. Visual scarring is a low liability with low uncertainty given that this visual issue would be addressed by site-restoration.

AE-13. Engineered slopes for stabilization of the river channel. The reshaping of the river channel would alter the topography and become a visual liability. Engineered slopes are a low liability with low uncertainty given that this visual issue would be addressed by site-restoration.

Iron Gate Dam – Aesthetic Data Gaps The uncertainties described above can only be reduced partially. While modeling and engineering of the removal process would reduce some uncertainty, the inherent subjectivity in aesthetic value prevents complete certainty of liabilities. The actions listed in Table 2-24 could reduce some uncertainty.

Table 2-24. Aesthetic Data Gaps - Iron Gate Dam

Data Gap	Studies/Actions Needed
Removal plans for concrete dam, intake structure, and powerhouse	Develop removal plans with specific attention to the feasibility of removing all dam related structures.
Site restoration plans	Develop site restoration plans with specific attention to the newly exposed ground.

2.3.3 Recreation

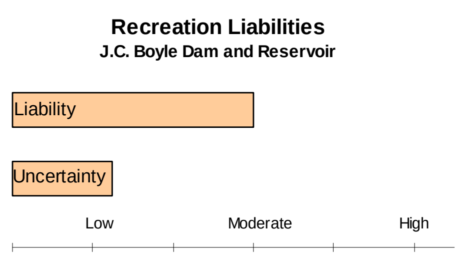
As described in *Economic Analysis of Dam Decommissioning* (USBR 2003), potential decommissioning liabilities related to recreation include those listed below.

- Loss of flatwater recreation activities including power boating, waterskiing, lake swimming and boat angling.
- Increases in the distances between existing recreation sites and water, as reservoirs are removed and reservoir areas revert to rivers.

- Increases in the required travel distance to recreation sites, if access points are changed or removed.
- Changes in the nature and quality of recreation opportunities at existing sites.
- Changes in wildlife populations, potentially affecting fishing and hunting opportunities.
- Changes in the predictability, timing, duration, and magnitude of in-stream flows downstream from each dam, which could affect the profitability of commercial outfitters.
- Changes in scenic viewing opportunities.
- Changes in wildlife viewing opportunities.

Some changes resulting from dam decommissioning (e.g., a change from lake to river fishing opportunities) might or might not be positive changes in the perception of site users. The following subsections summarize how recreation relates to potential dam decommissioning for each of the Klamath Hydroelectric Project dams covered by this report and state which of the above recreation liabilities could be associated with dam decommissioning at each site, based upon material presented in the *FEIS* (FERC 2007). For each dam, these subsections also describe the uncertainties and data gaps associated with recreation liabilities.

2.3.3.1 J.C. Boyle Dam



Existing recreation facilities at the J.C. Boyle Development include two day use recreation sites and one overnight campground facility. The three recreation facilities support flatwater recreation activities with boat launches and boating docks and shoreline activities with picnic tables and fire grills. Sportsman Park, owned by Klamath County, also includes a shooting range, off highway vehicle area, archery range, and model aircraft flying field. The reach downstream from J.C. Boyle Dam includes the Hell's Corner run, an important whitewater recreation resource; boater access points; a campground; and fishing access sites.

Recreation liabilities in the J.C. Boyle Dam area are related to the removal of the reservoir created by J.C. Boyle Dam and changes to river flows between J.C. Boyle Dam and Copco Reservoir. Recreation use upstream of the reservoir is affected by releases from Keno Reservoir, which is not proposed for removal as a part of this project. Keno

Reservoir serves 41 percent of the land irrigated by the Klamath Irrigation Project and Lower Klamath Lake National Wildlife Refuge. The continued operation of Keno Dam under the terms of the PacifiCorp contract with Reclamation would not generate any new appreciable liabilities upstream of J.C. Boyle Reservoir.

J.C. Boyle Dam – Recreation Liabilities and Uncertainties Potential liabilities generated by the decommissioning and removal of J.C. Boyle Dam and Reservoir include all of those listed at the beginning of Subsection 2.3.3. Of specific concern are the liabilities listed below.

RC-1. Loss of powerboating, waterskiing, lake swimming, and boat angling activities due to removal of the reservoir and return of the upstream river area to its natural channel. The path that the river would take after removal of J.C. Boyle Dam is somewhat uncertain. The cost of the loss of flatwater recreation, coupled with a change in recreation type (from flatwater to river-based) is uncertain. Flatwater recreation losses following dam removal is a moderate liability with low uncertainty given the availability of recreation user studies describing the potential effect.

RC-2. Increased distance from area campgrounds to the river channel and stranding of existing boat launches and loading docks due to drawdown of the reservoir, which could reduce user days along the river. Changes in river and reservoir accessibility is a low liability with low uncertainty given the availability of recreation user studies describing the potential effect.

RC-3. Changes in recreational opportunities in the bypassed reach and Hell's Corner whitewater boating run downstream from J.C. Boyle Dam, which have high recreational value for:

- Technical kayaking,
- Whitewater rafting and boating;
- Undeveloped setting;
- Abundant wildlife viewing and hunting;
- Fishing;
- Scenic viewing (see also Subsection 2.3.2, Aesthetics); and
- Cultural resources (see also Subsection 2.3.4, Cultural/Historic Resources).

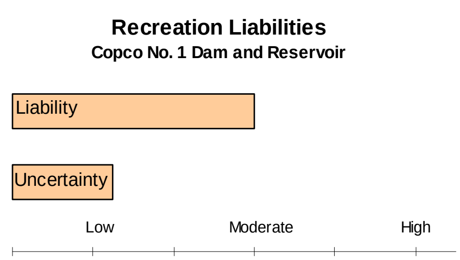
Some uncertainty is associated with whether flows in downstream reaches would be adequate for commercial boating and rafting after dam removal. Changes in recreational opportunities is a moderate liability with low uncertainty given the availability of economic data for the commercial boating and rafting industry potentially affected (see also Subsection 2.3.7, Economics).

J.C. Boyle Dam – Recreation Data Gaps Reducing the uncertainties described above will require addressing the data gaps listed in Table 2-25. These data gaps are applicable for all four dams, as noted in the subsections below.

Table 2-25. Recreation Data Gaps - J.C. Boyle Dam (Applicable to All Four Dams)

Data Gap	Studies/Actions Needed
Effect of dam and reservoir removal on day use and overnight recreation facility user days	Perform user study/survey analyzing recreation user likelihood of utilizing recreation facilities after dam and reservoir removal.
Effect of changes in recreation uses and peak use seasons on local businesses that support recreation activities on the Klamath River	Perform economic study assessing the affect of changes in regional recreation uses and seasons on local businesses.

2.3.3.2 Copco No. 1 Dam



Existing recreation facilities at the Copco No. 1 Development include two day use recreation sites. The two recreation facilities support flatwater recreation activities with boat launches and boating docks as well as shoreline activities with picnic tables and fire grills. The reach of the Klamath River downstream from Copco Reservoir feeds directly into Copco No. 2 Reservoir. This reach of the river is difficult to access, is bordered by private land and does not support recreation activities.

Recreation liabilities in the Copco No. 1 Dam area are related to the removal of the reservoir created by Copco No. 1 Dam and changes to river flows between Copco No. 1 Dam and Copco No. 2 Reservoir. Recreation use upstream of the reservoir is affected by releases from J.C. Boyle Reservoir, as described in Subsection 2.3.3.1.

Copco No. 1 Dam – Recreation Liabilities and Uncertainties
Potential liabilities generated by the decommissioning and removal of Copco No. 1 Dam and Reservoir include all of those listed at the beginning of Subsection 2.3.3. Of specific concern are the liabilities listed below.

RC-4. Loss of powerboating, waterskiing, lake swimming, and boat angling activities due to removal of the reservoir and return of the upstream river area to its natural channel. The path that the river would take after removal of Copco No. 1 Dam is somewhat uncertain. Flatwater recreation losses following dam removal is a moderate liability with low uncertainty given the availability of recreation user studies describing the potential effect.

RC-5. Increased distance from day use facilities to the river channel and stranding of existing boat launches and loading docks due to drawdown of the reservoir, which could reduce user days along the river. Changes in river and reservoir accessibility is a low liability with low uncertainty given the availability of recreation user studies describing the potential effect.

Some uncertainty is associated with flows in downstream reaches and if they would be adequate for commercial boating and rafting after dam removal. The effect of these changes on number of user days and/or commercial outfitter profitability is uncertain (see also Subsection 2.3.7, Economics).

Copco No. 1 Dam – Recreation Data Gaps Reducing the uncertainties described above will require addressing the data gaps listed above for J.C. Boyle Dam.

2.3.3.3 Copco No. 2 Dam

Copco No. 2 Dam is directly downstream from Copco No. 1 Dam and is used to divert water from the reservoir into a concrete lined tunnel that leads to the Copco No. 2 powerhouse downstream from the dam. Copco No. 2 Reservoir and the river reach downstream from the dam do not officially support recreation activities and has no recreation facilities.

Recreation liabilities in the Copco No. 2 Dam area are related to the removal of the reservoir created by Copco No. 2 Dam and changes to river flows between Copco No. 2 Dam and Iron Gate Reservoir. Recreation use upstream of the reservoir is affected by releases from Copco Reservoir, as described in Subsection 2.3.3.2.

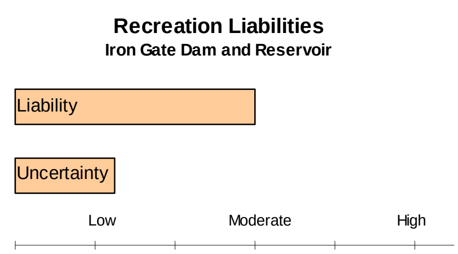
Copco No.2 Dam – Recreation Liabilities and Uncertainties Copco No.2 Reservoir does not support recreation activities but its removal, when considered along with the other Klamath Hydroelectric Project dams, could contribute to the potential liabilities listed at the beginning of Subsection 2.3.3.

Some uncertainty is associated with whether flows in downstream reaches and if they would be adequate for commercial boating and rafting after dam removal. The effect of these flow changes on number of user days and/or commercial outfitter profitability is uncertain (see also Subsection 2.3.7, Economics).

Copco No. 2 Dam – Recreation Data Gaps Reducing the uncertainties described above will require addressing the data gaps listed above for J.C. Boyle Dam.

2.3.3.4 Iron Gate Dam

Existing recreation facilities at the Iron Gate Development include four day use recreation sites and five overnight campground facilities. The nine recreation facilities in the Iron Gate Development, which includes the reservoir and reach of the rivers downstream from the dam to the hatchery, support flatwater and river based recreation activities with boat launches and boarding docks and shoreline activities with picnic tables and fire grills. Camp Creek Day-use and Campground also includes a sports field, and the Iron Gate Fish Hatchery offers seasonal interpretive tours. The Klamath River downstream from the dam extends to the Pacific Ocean and supports multiple fishing outfitter services and fishing guide businesses, and approximately 123 miles of whitewater boating opportunities.



Recreation liabilities in the Iron Gate Dam area are related to the removal of the reservoir created by Iron Gate Dam and changes to river flows between Iron Gate Dam and the Klamath River estuary where it meets the Pacific Ocean. Recreation use upstream of the reservoir is affected by releases from Copco No. 2 Reservoir, as described in Subsection 2.3.3.3.

Iron Gate Dam – Recreation Liabilities and Uncertainties Potential liabilities generated by the decommissioning and removal of Iron Gate Dam and Reservoir include all of those listed at the beginning of Subsection 2.3.3. Of specific concern are the liabilities listed below.

RC-6. Loss of powerboating, waterskiing, lake swimming, and boat angling activities due to removal of the reservoir and return of the upstream river area to its natural channel. The path that the river would take after removing Iron Gate Dam is somewhat uncertain. Flatwater recreation losses following dam removal is a moderate liability with low uncertainty given the availability of recreation user studies describing the potential effect.

RC-7. Increased distance from area campgrounds to the river channel and stranding of existing boat launches and docks due to drawdown of the reservoir, which could reduce user days along the river. Changes in river and reservoir accessibility is a low liability with low uncertainty given the availability of recreation user studies describing the potential effect.

RC-8. Changes in recreational opportunities in the reach of the Klamath River downstream from Iron Gate Dam, which have high recreational value for:

- Technical kayaking,
- Whitewater rafting and boating;
- Abundant wildlife viewing and hunting;
- Fishing;
- Scenic viewing; and
- Cultural resources (see also Subsection 2.3.4, Cultural/Historic Resources).

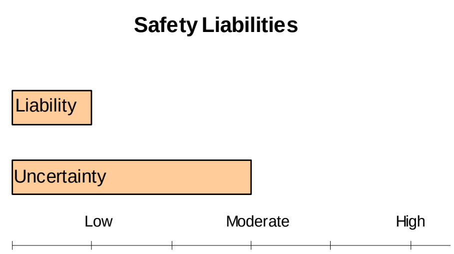
Some uncertainty is associated with flows in downstream reaches and if they would be adequate for commercial boating and rafting after dam removal. The effect of these changes on number of user days and/or commercial outfitter profitability is uncertain. Changes in recreational opportunities is a moderate liability with low uncertainty given the availability of economic data for the commercial boating and rafting industry potentially affected (see also Subsection 2.3.7, Economics).

Iron Gate Dam – Recreation Data Gaps Reducing the uncertainties described above will require addressing the data gaps listed above for J.C. Boyle Dam.

2.3.4 Safety

Several of the liability areas discussed within this document could have secondary safety risks, thus creating safety liabilities. Although previous analyses for the project do not address safety explicitly, liabilities related to safety risks need to be identified and further analyzed. The following safety liabilities are described below.

- Safety liabilities associated with recreation: boating and swimming.
- Safety liabilities associated with hydraulics and hydrology: downstream flooding.
- Safety risks associated with construction and engineering of dam removal.



While these safety liabilities are associated with decommissioning at all Klamath Hydroelectric Project dam sites covered by this report, the three largest dams and their corresponding reservoirs (J.C. Boyle, Copco No. 1, and Iron Gate) have the greatest liabilities. Due to the size and function of the Copco No. 2 Development, the safety liabilities associated with its decommissioning are less significant than those for the other developments considered here. The basis for these liabilities is the information presented in the *FEIS* (FERC 2007) and additional studies. The specific safety risks associated with primary liabilities are discussed below.

2.3.4.1 Safety Liabilities associated with Recreation

SA-1. Boating accidents during drawdown of reservoirs and changes to riverbed morphology. Prior to and during decommission, rapidly changing water level and flows could present a safety risk to boats downstream. Changes to riverbed morphology could create unexpected obstacles (naturally occurring, or man-made structural remains) presenting a safety risk to boats. This could particularly be a risk at the Copco No. 1 Development, where it may not be possible to remove the entire dam structure (because of its size and the associated engineering challenges). Concrete remaining after dam removal could be struck by boats during low water levels. Riverbed morphology changes are a low liability with moderate uncertainty given the challenges associated with removing dam foundations in a narrow, deep river canyon.

SA-2. Health hazards to swimmers due to degraded water quality and altered river flows. The water quality liabilities (see Subsection 2.1.5, Water Quality), and potential for release of hazardous materials (Subsection 2.1.1) could present a human health risk. During and after decommissioning, unexpected alterations to river flow could create dangerous currents for swimmers. Health hazards to swimmers are a low liability with moderate uncertainty given the lack of a statistically representative geotechnical survey for sediment contaminants in the reservoirs and studies describing the anticipated post dam removal river flows during periods when swimmers could be present in the river.

2.3.4.2 Safety Liabilities associated with Hydraulics and Hydrology

SA-3. Increased potential for downstream flooding during and after decommission due to reduced flow control. The potential for downstream flooding, as described in the H&H subsection (see Subsection 2.1.2) could create safety risks for those living near the river system. However, as described in Subsection 2.1.2, downstream flood risk is not expected to substantially increase during and after dam removal. Downstream flooding is a low liability with moderate uncertainty given the lack of surveys.

2.3.4.3 Safety liabilities associated with General Construction and the Engineering of Removal

SA-4. Increased safety risks associated with heavy construction. Although plans for decommissioning have not been designed beyond a pre-appraisal level, there are inherent safety risks in construction of this scale. Construction would include work around materials under significant water pressure and handling of large quantities of rock and sediment. Mitigation for safety risks related to construction would be included in contractor plans. Construction safety is a low liability with low uncertainty given the mandatory development of mitigation for safety risks in contractor plans.

Safety Data Gaps Reducing the uncertainties described above will require addressing the data gaps listed in Table 2-26.

Table 2-26. Safety Data Gaps – All Four Dams and Reservoirs

Data Gap	Studies/Actions Needed
Boater and swimmer safety	Model river flow and stage pre- and post-decommissioning. Engage whitewater boating community to reclassify boating class and stretch.

2.3.5 Cultural/Historic Liabilities

As discussed in *Economic Analysis of Dam Decommissioning* (USBR 2003), significant cultural resources pose non-monetary decommissioning liabilities (effects) which must be taken into account with equal weight with the economic cost-benefit analyses of other resources. Potential decommissioning liabilities related to cultural resources are listed below.

- Adverse effects on potentially significant historic structures and facilities.
- Changes in occupancy of potentially significant historic structures could increase vandalism of historic structures and facilities.
- Changes in scenic viewing opportunities of historic structures and facilities.
- Adverse effects on previously undiscovered cultural resources.
- Adverse effects on presently submerged/buried cultural resources due to exposure or erosion during draining of reservoirs.
- Adverse effects on identified traditional cultural properties.

Existing potentially eligible historic cultural resources at the Klamath Hydroelectric Project dams covered by this report include dams, water conveyance features (flumes, penstock lines, penstock intakes, spillways, spillgates, headgates, pipelines, spillway houses, tunnels, surge tanks, earthen canals), powerhouses, turbines, generators, substations, warehouses, gatehouses, gate hoist system/rails, guest houses, houses and garages, a mortared stone wall, timber cribbing, a coffer dam, an oil and gas shed, a cookhouse/bunkhouse, a transformer house/office, and a fish hatchery. The California State Historic Preservation Officer (SHPO) provided his opinion that none of the Iron

Gate Development structures are eligible for the National Register (FERC 2007).

Existing, potentially eligible prehistoric sites or components of sites at the Klamath Hydroelectric Project developments covered by this report include a number of prehistoric sites divided into five types: (1) open-air sites, with flaked stone artifacts only; (2) open-air sites, with flaked stone and ground stone artifacts; (3) village or temporary habitation sites without apparent house pit features; (4) village or temporary habitation sites with house pit features; and (5) special use sites (burial sites, rockshelters, pictograph sites, and quarries). Historical Research Associates identified five areas with multiple prehistoric sites, all believed to be in the same reach of the river, as a potential National Register district. This potential archaeological district would include the following resources.

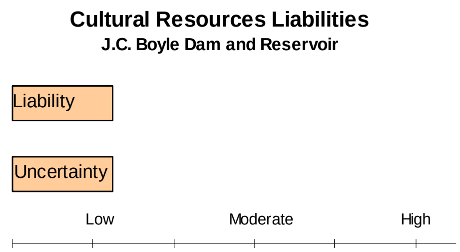
- A complex of non-house pit sites near Teeter's Landing (FH-14, FH-15, and FH-16);
- Sites in the vicinity of J.C. Boyle reservoir (35KL1942, CB-2, CB-3, CB-20, JS-7, JS-5, JC03-9, and JC03-10);
- A fishing station complex called Laik'elmi (collectively, Sites 35KL554/35KL17, 35KL20, and 35KL21/35KL786) on the west bank and 35KL567, 35KL18, 35KL578, 35KL19, and 35KL23/35KL566 on the east bank in the upper Klamath River Canyon; and
- Three large village sites (CA-SIS-2403, JC03-01, and CB-10) near Copco Reservoir (FERC 2007).

The following subsections summarize how cultural resources relate to potential dam decommissioning for each of the Klamath Hydroelectric Project dams covered by this report and state which of the above cultural resource liabilities could be associated with dam decommissioning at each site, based upon material presented in existing documentation. For each dam, these subsections also describe the uncertainties and data gaps associated with cultural resource liabilities.

2.3.5.1 J.C. Boyle Dam

Cultural resource liabilities in the J.C. Boyle Dam area are related to the removal of the dam and its associated facilities; removal of the reservoir created by J.C. Boyle Dam; and changes to river flows between J.C. Boyle Dam and Copco Reservoir.

J.C. Boyle Dam – Cultural Resource Liabilities and Uncertainties



Potential liabilities generated by the decommissioning and removal of J.C. Boyle Dam and Reservoir include all of those listed at the beginning of Subsection 2.3.5. Of specific concern are the liabilities listed below.

CH-1. The decommissioning and removal of the J.C. Boyle Dam and support facilities would be subject to decommissioning plans established in consultation with the California and Oregon SHPOs. The potential to adversely affect the historic facilities by taking these facilities out of use or removing them is a liability, as are changes in occupancy of potentially significant historic structures, which could increase vandalism of historic structures and facilities. The decommissioning and removal of the J.C. Boyle Dam and support facilities would also change the opportunities for scenic viewing of historic structures and facilities. Dam decommissioning and removal is a low liability with low uncertainty given the availability of studies documenting the facilities historical significance.

CH-2. The decommissioning and removal of the J.C. Boyle Dam and support facilities would be subject to necessary Section 106 Consultation with California and Oregon SHPOs and appropriate tribal governments regarding the adverse effects decommissioning could have on potentially eligible archeological sites presently surveyed and those that would be exposed during drainage of reservoirs. The decommissioning and removal of the J.C. Boyle Dam and support facilities and operation of demolition equipment during project demolition has the potential to adversely affect previously undiscovered cultural resources. Dam decommissioning and removal is a low liability with low uncertainty given the availability of studies documenting cultural resources in and around the facilities.

CH-3. The decommissioning and removal of the J.C. Boyle Dam and support facilities would be subject to necessary Section 106 Consultation with California and Oregon SHPOs and appropriate tribal government(s) regarding the adverse effects decommissioning could have on Traditional Cultural Properties (TCPs) presently surveyed and those that would be exposed during drainage of reservoirs. The decommissioning and removal of the J.C. Boyle Dam and support facilities and operation of demolition equipment during project demolition has the potential to adversely affect previously undiscovered TCPs. Dam decommissioning and removal is a low liability with low uncertainty given the availability of studies documenting TCPs potentially affected by dam removal and reservoir drawdown.

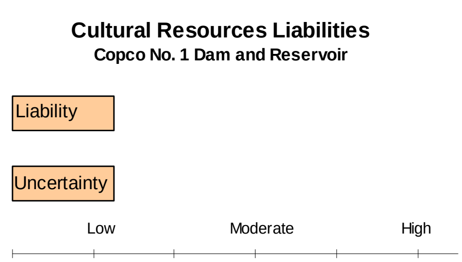
J.C. Boyle Dam – Cultural Resources Data Gaps Reducing the uncertainties described above would require addressing the data gaps listed in Table 2-27.

Table 2-27. Cultural/Historic Resources Data Gaps – J.C. Boyle Dam

Data Gap	Studies/Actions Needed
Cultural Resources Final Technical Report	Because of the confidential nature of cultural resources within the Project area, PacifiCorp has restricted the access to the information by the general public. Make this information available to the dam decommissioning agent.
Draft Klamath Hydroelectric Project - Historic Properties Management Plan - October 2004	Because of the confidential nature of cultural resources within the Project area, PacifiCorp has restricted the access to the information by the general public. Make this information available to the dam decommissioning agent.
Draft Klamath Hydroelectric Project - June 2004 Cultural Resource Inventory Memo	Because of the confidential nature of cultural resources within the Project area, PacifiCorp has restricted the access to the information by the general public. Make this information available to the dam decommissioning agent.
Completion of 106 Consultation Process and concurrence on resource eligibility determination for J.C. Boyle, Copco No. 1, and Copco No. 2	Complete the 106 Consultation Process and eligibility determinations on J.C. Boyle, Copco No. 1, and Copco No. 2 potentially eligible resources.

2.3.5.2 Copco No. 1 Dam

Cultural resource liabilities in the Copco No. 1 Dam area are related to the removal of the dam and its associated facilities; removal of the reservoir created by Copco No. 1 Dam; and changes to river flows between Copco No. 1 Dam and Copco No. 2 Reservoir.



Copco No. 1 Dam – Cultural Resource Liabilities and Uncertainties
Potential liabilities generated by the decommissioning and removal of Copco No. 1 Dam and Copco Reservoir include all of those listed at the beginning of Subsection 2.3.5. Of specific concern are the liabilities listed below.

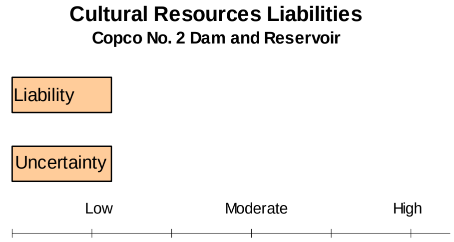
CH-4. The decommissioning and removal of the Copco No. 1 Dam and support facilities would be subject to decommissioning plans established in consultation with the California and Oregon SHPOs. The potential to adversely affect the historic facilities by taking these facilities out of use or removing them is a liability, as are changes in occupancy of potentially significant historic structures, which could increase vandalism of historic structures and facilities. The decommissioning and removal of the Copco No. 1 Dam and support facilities would also change the scenic viewing opportunities of historic structures and facilities. Dam decommissioning and removal is a low liability with low uncertainty given the availability of studies documenting the facilities historical significance.

CH-5. The decommissioning and removal of the Copco No. 1 Dam and support facilities would be subject to necessary Section 106 Consultation with California and Oregon SHPOs and appropriate tribal governments regarding the adverse effects decommissioning could have on potentially eligible archeological sites presently surveyed and those that would be exposed during drainage of reservoirs. The decommissioning and removal of the Copco No. 1 Dam and support facilities and operation of demolition equipment during project demolition has the potential to adversely affect previously undiscovered cultural resources. Dam decommissioning and removal is a low liability with low uncertainty given the availability of studies documenting cultural resources in and around the facilities.

CH-6. The decommissioning and removal of the Copco No. 1 Dam and support facilities would be subject to necessary Section 106 Consultation with California and Oregon SHPOs and appropriate tribal government(s) regarding the adverse effects decommissioning could have on TCPs presently surveyed and those that would be exposed during drainage of reservoirs. The decommissioning and removal of the Copco No. 1 Dam and support facilities and operation of demolition equipment during project demolition has the potential to adversely affect previously undiscovered TCPs. Dam decommissioning and removal is a low liability with low uncertainty given the availability of studies documenting TCPs potentially affected by dam removal and reservoir drawdown.

Copco No. 1 Dam – Cultural Resources Data Gaps Reducing the uncertainties described above would require addressing the data gaps listed above for J.C. Boyle Dam.

2.3.5.3 Copco No. 2 Dam



Cultural resource liabilities in the Copco No. 2 Dam area are related to the removal of the dam and its associated facilities; removal of the reservoir created by Copco No. 2 Dam and changes to river flows between Copco No. 2 Dam and Iron Gate Reservoir.

Copco No. 2 Dam – Cultural Resource Liabilities and Uncertainties Potential liabilities generated by the decommissioning and removal of Copco No. 2 Dam and Reservoir include all of those listed at the beginning of Subsection 2.3.5. Of specific concern are the liabilities listed below.

CH-7. The decommissioning and removal of the Copco No. 2 Dam and support facilities would be subject to decommissioning plans established in consultation with the California and Oregon SHPOs. The potential to adversely affect the historic facilities by taking these facilities out of use or removing them is a liability, as are changes in occupancy of potentially significant historic structures, which could increase vandalism of historic structures and facilities. The decommissioning and removal of the Copco No. 2 Dam and support facilities would also change the scenic viewing opportunities of historic structures and facilities. Dam decommissioning and removal is a low liability with low uncertainty given the availability of studies documenting the facilities historical significance.

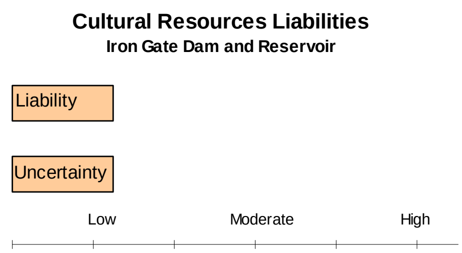
CH-8. The decommissioning and removal of the Copco No. 2 Dam and support facilities would be subject to necessary Section 106 Consultation with California and Oregon SHPOs and appropriate tribal governments regarding the adverse effects decommissioning could have on potentially eligible archeological sites presently surveyed and those that would be exposed during drainage of reservoirs. The decommissioning and removal of the Copco No. 2 Dam and support facilities and operation of demolition equipment during project demolition has the potential to adversely affect previously undiscovered cultural resources. Dam decommissioning and removal is a low liability with low uncertainty given the availability of studies documenting cultural resources in and around the facilities.

CH-9. The decommissioning and removal of the Copco No. 2 Dam and support facilities would be subject to necessary Section 106 Consultation with California and Oregon SHPOs and appropriate tribal government(s) regarding the adverse effects decommissioning could have on TCPs presently surveyed and those that would be exposed during drainage of reservoirs. The decommissioning and removal of the Copco No. 2 Dam and support facilities and operation of demolition equipment during project demolition has the potential to adversely affect previously undiscovered TCPs. Dam decommissioning and removal is a low liability with low uncertainty given the availability of studies documenting TCPs potentially affected by dam removal and reservoir drawdown.

Copco No. 2 Dam – Cultural Resources Data Gaps Reducing the uncertainties described above would require addressing the data gaps listed above for J.C. Boyle Dam.

2.3.5.4 Iron Gate Dam

Cultural resource liabilities in the Iron Gate Dam area are related to the removal of the dam and its associated facilities; removal of the reservoir created by Iron Gate Dam and changes to river flows downstream from Iron Gate Dam.



Iron Gate Dam – Cultural Resource Liabilities and Uncertainties Potential liabilities generated by the decommissioning and removal of Iron Gate Dam and Reservoir include all of those listed at the beginning of Subsection 2.3.5. Of specific concern are the liabilities listed below.

CH-10. The decommissioning and removal of the Iron Gate Dam and support facilities would be subject to necessary Section 106 Consultation with California and Oregon SHPOs and appropriate tribal governments regarding the adverse effects decommissioning could have on potentially eligible archeological sites presently surveyed and those that would be exposed during drainage of reservoirs. The decommissioning and removal of the Iron Gate Dam and support facilities and operation of demolition equipment during project demolition has the potential to adversely affect previously undiscovered cultural resources. Dam decommissioning and removal is a low liability with low uncertainty given the availability of studies documenting the facilities historical significance.

CH-11. The decommissioning and removal of the Iron Gate Dam and support facilities would be subject to necessary Section 106 Consultation with California and Oregon SHPOs and appropriate tribal government(s) regarding the adverse effects decommissioning could have on TCPs presently surveyed and those that would be exposed during drainage of reservoirs. The decommissioning and removal of the Iron Gate Dam and support facilities and operation of demolition equipment during project demolition has the potential to adversely affect previously undiscovered TCPs. Dam decommissioning and removal is a low liability with low uncertainty given the availability of studies documenting TCPs potentially affected by dam removal and reservoir drawdown.

Iron Gate Dam – Cultural Resources Data Gaps Reducing the uncertainties described above would require addressing the data gaps listed above for J.C. Boyle Dam.

2.3.6 Power

As described in the *FEIS* (FERC 2007), the *Economic Modeling of Relicensing and Decommissioning Options for the Klamath Basin Hydroelectric Project* (Economic Modeling Report) (Cubed 2006) and in *Addendum A* of the Economic Modeling Report (Cubed 2007), potential decommissioning liabilities related to power include the following.

- Loss of 562.8 gigawatt hours (GWh) of electricity generated by PacifiCorp's Klamath Hydroelectric Project. (Imposing relicensing conditions would reduce the current license condition 23 percent, to this 562.8 GWh value).
- Procurement of replacement power.
- Loss of an emissions-free, renewable hydroelectric power source.

The following subsections summarize existing power conditions at each of the Klamath Hydroelectric Project dams covered by this report and provide details regarding the above power liabilities, based upon material presented in the *FEIS* (FERC 2007), the *Economic Modeling Report* (Cubed 2006) and *Addendum A* (Cubed 2007). These subsections also include a discussion of the uncertainties and data gaps associated with power liabilities.

2.3.6.1 J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate Dams

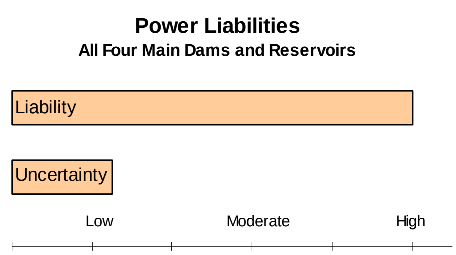
The Klamath Hydroelectric Project has a 169 MW nameplate capacity, and its powerhouses provide low-cost, renewable energy. Table 2-28 lists the nameplate capacities of the four hydroelectric developments covered by this report, as reported in *Exhibit A – Project Description, Klamath Hydroelectric Project* (PacifiCorps 2004, revised 2006).

Table 2-28. Nameplate Capacities of Klamath Hydroelectric Project Dams/Powerhouses

Dam/Powerhouse	Nameplate Capacity (MW)
J.C. Boyle	98
Copco No. 1	20
Copco No. 2	27
Iron Gate	18
Total for Dams/Powerhouses Covered by this Report	163

Source: Klamath Hydroelectric Project Exhibit A

According to Exhibit A, the J.C. Boyle development produces hydropower with two vertical Francis turbines with a rated total turbine hydraulic capacity of 2,850 cfs. The Copco No. 1 development produces hydropower with two horizontal Francis turbines with a rated total turbine hydraulic capacity of 3,200 cfs. The Copco No. 2 development produces hydropower with two Vertical Francis turbines with a rated total turbine hydraulic capacity of 3,200 cfs. The Iron Gate Development produces hydropower from one vertical Francis turbine with a rated total turbine hydraulic capacity of 1,550 cfs.



FERC (2006) estimates the project's dependable capacity at 42.7 MW. Currently, the total system generates an estimated average of 716.8 GWh annually (FERC 2006). Relicensing conditions would reduce the baseline generation to 562.8 GWh, which represents the value of electricity that would be lost as a result of decommissioning. The removal of an emissions-free, renewable energy source and the need to procure replacement power underscore the significance of dam decommissioning effects on power.

Power Liabilities and Uncertainties Potential liabilities generated by the decommissioning and removal of the four main Klamath Hydroelectric Project dams include those listed at the beginning of Subsection 2.3.6. These liabilities amount to a need to replace the total loss in power resulting from decommissioning, as detailed below.

Figure 2-6. Powerhouse at Copco No. 1 Dam

PO-1. Loss of 562.8 GWh of total electricity generated by PacifiCorp's Klamath Hydroelectric Project. The Klamath Project Alternatives Analysis Model (KPAAM) was developed to provide a range of plausible economic outcomes for either relicensing or decommissioning. Representing the new generation baseline as a result of relicensing terms and appropriate mitigation measures, the 562.8 GWh value is used within the model to represent the amount of electricity lost if decommissioning were to take place. This expected generation baseline is an undecided issue and relates to the uncertainty in identifying the system's firm capacity. The *Economic Modeling Report* (Cubed 2006) indicates that FERC has rated dependable capacity at 42.7 MW and the Northwest Power Planning Council has rated the firm winter capacity of the Klamath Hydroelectric Project at 92 MW, while PacifiCorp asserts that all of the 169 MW of nameplate capacity is dependable capacity. Loss of generated electricity is a high liability with low uncertainty given the availability of historical data on power generation from the facilities.

PO-2. Procurement of replacement power. As presented in the *Economic Modeling Report* (Cubed 2006), PacifiCorp's current production costs are estimated at $19/ megawatt hours (MWh), which includes the recovery of remaining investment costs of $13/MWh and current operating costs of $6/MWh. *Addendum A* (Cubed 2007) reports that if relicensing were to take place, mitigation measures alone would drive up production costs within the range of $30 to $61/MWh to set total production costs at $48.12/MWh to $73.19/MWh (midline value of

$60.78). Substantial uncertainty around these estimates exists because the capital costs of mitigation measures have not been clearly defined. As a result, the KPAAM assessment of the relicensing alternative uses an uncertainty factor of plus or minus 30 percent to create a high/low range of cost estimates.

Power forecasts are critical to the estimation of decommissioning costs, and they carry an inherently high level of uncertainty. This uncertainty, combined with the fact that six publicly available sources offered different forecasts based on a range of assumptions and generation resources, is represented by a range of potential decommissioning costs. *Addendum A* (Cubed 2007) reports that the six power forecasts produce a net present value (NPV) economic benefit in the range of $32 million to $286 million for decommissioning and replacing lost power instead of relicensing over a 30 year analysis period. These estimates reflect a revision to the original KPAAM after PacifiCorp submitted a formal critique of the model prepared by Christensen Associates Energy Consulting (Christensen Associates Energy Consulting LLC 2007). The original KPAAM results indicated that the NPV ranged from a cost to ratepayers of $14 million to an economic benefit of $285 million.

Analysis presented in the *FEIS* (FERC 2007) indicates alternative economic figures pertaining to the retiring of the four main dam developments. However, the *FEIS* (FERC 2007) does not present a NPV comparison of power costs between relicensing and decommissioning. The *FEIS* (FERC 2007) reports that, as a result of decommissioning, the hydroelectric project would generate an average of 12,817 MWh of electricity annually from the remaining Fall Creek Development. The post-decommissioning project would have an annual power value of $618,440, and have total annual costs of $13,805,310 from the operation of the Fall Creek Dam. The resulting net annual benefit would be -$13,186,870. Procurement of replacement power is a high liability with low uncertainty given the availability of data describing replacement power costs and availability in the region.

PO-3. Removal of an emissions-free, renewable energy hydroelectric power source. Renewable Energy Action Plans developed in both Oregon (ODE 2005) and California (CEC 2005) encourage increases in renewable energy generation and use in each state. Oregon's goal of supplying 10 percent of the power used in the state with renewable energy by 2015 and 25 percent by 2025 indicates the significance of the potential decommissioning of the Klamath Hydroelectric Project dams. Similarly, California, in its Renewable Portfolio Standard, requires 20 percent of state's power to be supplied with renewable energy by 2010 and 33 percent by 2020 (FERC 2007). Uncertainty lies in the PacifiCorp's ability to develop renewable energy sources to replace its current low cost, emissions free, renewable energy hydroelectric source. The *FEIS* (FERC 2007) identifies potential sources of replacement power, and it reports a potential increase in greenhouse gas emissions by 71,680 to 111,100 metric tons of carbon per year if the 716,800 MWh current Project electric output is replaced with carbon emitting, fossil-fueled generation facilities. The *Economic Modeling Report* (Cubed 2006) and *Addendum A* (Cubed 2007) identify carbon-neutral alternatives for replacement power, including an Oregon Department of Energy proposal for replacing 50 percent of the output with demand side management measures and 50 percent with a biomass energy plant.

The green energy market is dynamic, with uncertainty tied to the price of renewable energy and the rate the public would pay for it. Neither the *FEIS* (FERC 2007) nor the *Economic Modeling Report* (Cubed 2006) included forecasts for renewable energy rates in their economic analyses. According to the California Energy Commission's *Comparative Cost of California Central station Electricity Generation Technologies* (CEC 2003), renewable energy technologies such as wind, hydropower, solar thermal, and geothermal electricity have levelized direct costs ranging from 4.52 cents/ kilowatt hour (kWh) for geothermal technologies to 21.53 cents/kWh for solar thermal technologies. Natural gas sources range in levelized direct costs of 5.18–15.71 cents/kWh. Hydropower has a levelized direct cost of 6.04 cents/kWh. The removal of an emissions free renewable energy source is a high liability with low uncertainty given the availability of data describing renewable energy sources in the region and their capacity to replace the power currently generated by the dams.

Cost estimates for losses of power resulting from decommissioning rely on simplifying assumptions and estimates, which has led to uncertainty regarding the overall costing of facilities and power alternatives. PacifiCorp, in a report prepared by the economics consulting firm Christensen Associates Energy Consulting (2007), critiqued the KPAAM results in the *Economic Modeling Report,* which spawned the

KPAAM revision and *Addendum A* (Cubed 2007). This further increases the level of uncertainty associated with the total loss of power.

Power Data Gaps Reducing the uncertainties described above would require addressing data gaps, as follows.

Table 2-29. All Dams and Reservoirs – Power Data Gaps

Data Gap	Studies/Actions Needed
Nameplate capacity and firm capacity at each of the four main dam developments	Investigate power generation capabilities and optimal operational parameters to reconcile differences between PacifiCorp and agency estimates.
Percent of regional energy demand provided by PacifiCorp's four main dams	Identify sources of electricity in Klamath region to determine PacifiCorp's energy generation as a percent of local demands.
Cost estimates for power generation under the relicensing alternative.	Study the monetary implications of relicensing conditions to power generation at the four dam developments.
Cost estimates for power forecasts under the decommissioning alternatives.	Identify refined estimates for future power generation costs associated with both fossil-fuel driven energy production and renewable energy production.
NPV of economic analysis comparing decommissioning with replacing lost power and relicensing over a 30 year analysis period.	Develop economic models with refined cost estimates and reduce variability in model assumptions.
Replacement power plan identification and location.	Identify fossil-fuel and renewable energy alternatives for procurement of replacement power.
Price of renewable energy.	Evaluate power costs and rates in a renewable energy market for hydroelectric, wind, and other renewable energy production alternatives.

2.3.7 Economics

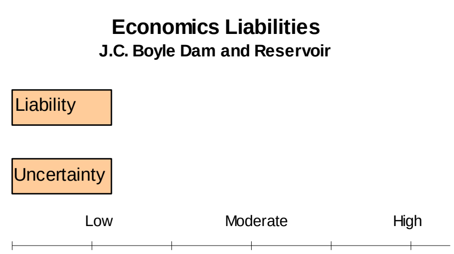
As described in *Economic Analysis of Dam Decommissioning* (USBR 2003), potential decommissioning liabilities related to economics (in terms of the generation of costs) are listed below for the resource areas. The changes that generate these liabilities are described in greater detail in other subsections of this document. The potential decommissioning liabilities related to economics include the following.

- Land and facilities acquisition.
- Changes in regional fisheries.
- Reduction in hydropower.
- Impacts to flood control capacity.
- Real estate costs and county tax revenues.
- Changes in recreation opportunities.

Some changes resulting from dam decommissioning (e.g., a change from lake to river fishing opportunities) might or might not be positive changes in the perception of local residents and visitors to the region. The following subsections summarize how economics relate to potential dam decommissioning for each of the Klamath Hydroelectric Project dams covered by this report and state which of the above economic liabilities could be associated with dam decommissioning at each site, based upon material presented in the *FEIS* (FERC 2007). For each dam, the subsections below also describe the uncertainties and data gaps associated with economic liabilities, providing an overview of these liabilities and referring the reader to other portions of this document that discuss these liabilities with additional detail.

2.3.7.1 J.C. Boyle Dam

Existing project-related economic sectors potentially affected by the removal of J.C. Boyle Dam include payroll and tax revenue, recreation, regional fisheries, hydropower generation, and flood control capacity.



Economic liabilities in the J.C. Boyle Dam area are related to the removal of the reservoir created by J.C. Boyle Dam and the resulting changes to regional economic sectors dependant on or influenced by the dam and reservoir.

J.C. Boyle Dam – Economic Liabilities and Uncertainties Potential liability categories influenced by the decommissioning and removal of J.C. Boyle Dam include all of those listed at the beginning of Subsection 2.3.7. Liabilities for each of these categories that are described in greater detail in their respective resource subsections are not presented in this subsection to prevent duplication. The potential loss of payroll and property tax revenue are unique to the economics subsection and are presented below.

EC-1. Loss of payroll associated with employees displaced by removal of dam and power plant, and loss of property tax payments to local governments. Loss of payroll is a low liability with low uncertainty given the availability of records describing the potential losses.

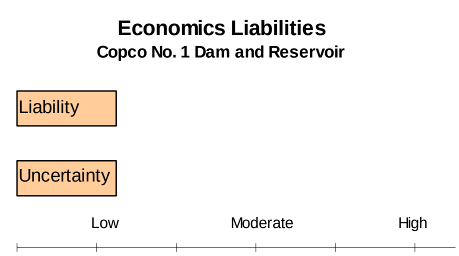
EC-2. Loss of regional fisheries through impacts to both freshwater and anadromous fish populations from reservoir removal and the related effects on downstream water quality and habitat availability (see also: Subsection 2.2.1, Aquatic Resources; Subsection 2.1.3, Sedimentation; and Subsection 2.1.5, Water Quality). Loss of regional fisheries is a low liability with low uncertainty given the availability of studies that quantify the value of the regional fishery.

The uncertainty associated with the recreation, regional fisheries, hydropower generation, and flood control capacity liabilities is outlined in detail in the respective resource subsections, which also include identification of the data gaps and the studies or actions needed to reduce these uncertainties.

J.C. Boyle Dam – Economics Data Gaps As described above the ucertainty generated by economic liabilities and the data gaps related to each of those uncertainties is outlined in the respective resource subsections.

2.3.7.2 Copco No. 1 Dam

Existing project-related economic sectors potentially affected by the removal of Copco No. 1 Dam include: payroll and tax revenue, recreation, regional fisheries, hydropower generation, flood control capacity, and real estate costs.



Economic liabilities in the Copco No. 1 Dam area are related to the removal of the reservoir created by Copco No. 1 Dam and the resulting changes to regional economic sectors dependant or influenced by the dam and reservoir.

Copco No. 1 Dam – Economic Liabilities and Uncertainties Potential liability categories influenced by the decommissioning and removal of Copco No. 1 Dam include all of those listed at the beginning of Subsection 2.3.7. Liabilities for each of these categories that are described in greater detail in their respective resource subsections are not presented in this subsection to prevent duplication. The potential loss of payroll and property tax revenue are unique to the economics subsection and are presented below.

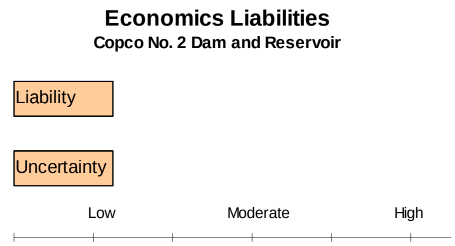
EC-3. Loss of payroll associated with employees displaced by removal of dam and power plant, and loss of property tax payments to local governments. Loss of payroll is a low liability with low uncertainty given the availability of records describing the potential losses.

EC-4. Loss of regional fisheries through impacts to both freshwater and anadromous fish populations from reservoir removal, and the related effects on downstream water quality and habitat availability (see also: Subsection 2.2.1, Aquatic Resources; Subsection 2.1.3, Sedimentation; and Subsection 2.1.5, Water Quality). Loss of regional fisheries is a low liability with low uncertainty given the availability of studies that quantify the value of the regional fishery.

The uncertainty associated with the recreation, regional fisheries, hydropower generation, flood control capacity, and real estate liabilities is outlined in detail in the respective resource subsections, which also include identification of the data gaps and the studies or actions needed to reduce these uncertainties.

Copco No. 1 Dam – Economics Data Gaps As described above the ucertainty generated by economic liabilities and the data gaps related to each of those uncertainties is outlined in the respective resource subsections.

2.3.7.3 Copco No. 2 Dam



Existing project-related economic sectors potentially affected by the removal of Copco No. 2 Dam include: payroll and tax revenue, regional fisheries, hydropower generation, and flood control capacity.

Economic liabilities in the Copco No. 2 Dam area are related to the removal of the reservoir created by Copco No. 2 Dam and the resulting changes to regional economic sectors dependant on or influenced by the dam and reservoir.

Copco No. 2 Dam – Economic Liabilities and Uncertainties

Decommissioning and removal of Copco No. 2 Dam, when considered singularly or combined with decommissioning of the other Klamath Hydroelectric Project dams, could contribute to the potential liabilities listed at the beginning of Subsection 2.3.7. Liabilities for each of these categories that are described in greater detail in their respective resource subsections are not presented in this subsection to prevent duplication. The potential loss of payroll and property tax revenue are unique to the economics subsection and are presented below.

EC-5. Loss of payroll associated with employees displaced by removal of dam and power plant, and loss of property tax payments to local governments. Loss of payroll is a low liability with low uncertainty given the availability of records describing the potential losses.

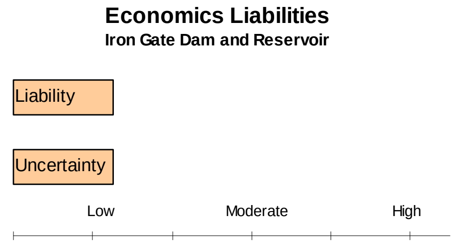
EC-6. Loss of regional fisheries through impacts to both freshwater and anadromous fish populations from reservoir removal and the related effects on downstream water quality and habitat availability (see also: Subsection 2.2.1, Aquatic Resources; Subsection 2.1.3, Sedimentation; and Subsection 2.1.5, Water Quality). Loss of regional fisheries is a low liability with low uncertainty given the availability of studies that quantify the value of the regional fishery.

There is uncertainty associated with the regional fisheries, hydropower generation, and flood control capacity. The uncertainty has been generated by differing results from analysis of the project by multiple interested parties, and in some cases the lack of investigation of potential liabilities. This uncertainty is outlined in detail in the respective resource subsections, which also include identification of the data gaps and the studies or actions needed to reduce these uncertainties.

Copco No. 2 Dam – Economics Data Gaps As described above the ucertainty generated by economic liabilities and the data gaps related to each of those uncertainties is outlined in the respective resource subsections.

2.3.7.4 Iron Gate Dam

Existing project-related economic sectors potentially affected by the removal of Iron Gate Dam include: payroll and tax revenue, recreation, regional fisheries, hydropower generation, and flood control capacity.



Economic liabilities in the Iron Gate Dam area are related to the removal of the reservoir created by Iron Gate Dam and the resulting changes to regional economic sectors dependant or influenced by the dam and reservoir. The reach of the river upstream of the reservoir is affected by releases from Copco No. 2 Reservoir, as described in Subsection 2.3.7.1.

Iron Gate Dam – Economic Liabilities and Uncertainties Potential liability categories influenced by the decommissioning and removal of Iron Gate Dam include all of those listed at the beginning of Subsection 2.3.7. Liabilities for each of these categories that are described in greater detail in their respective resource subsections are not presented in this subsection to prevent duplication. The potential loss of payroll and property tax revenue are unique to the economics subsection and are presented below.

EC-7. Loss of payroll associated with employees displaced by removal of dam and power plant, and loss of property tax payments to local governments. Loss of payroll is a low liability with low uncertainty given the availability of records describing the potential losses.

EC-8. Loss of regional fisheries through impacts to both freshwater and anadromous fish populations from reservoir removal and the related effects on downstream water quality and habitat availability (see also: Subsection 2.2.1, Aquatic Resources;

Subsection 2.1.3, Sedimentation; and Subsection 2.1.5, Water Quality). Loss of regional fisheries is a low liability with low uncertainty given the availability of studies that quantify the value of the regional fishery.

There is uncertainty associated with the recreation, regional fisheries, hydropower generation, and flood control capacity. The uncertainty has been generated by differing results from analysis of the project by multiple interested parties, and in some cases the lack of investigation of potential liabilities. This uncertainty is outlined in detail in the respective resource subsections, which also include identification of the data gaps and the studies or actions needed to reduce these uncertainties.

Iron Gate 1 Dam – Economics Data Gaps As described above the ucertainty generated by economic liabilities and the data gaps related to each of those uncertainties is outlined in the respective resource subsections.

2.4 Legal and Regulatory Liabilities

2.4.1 Regulatory Compliance Liabilities

Potential decommissioning liabilities related to regulatory compliance include:

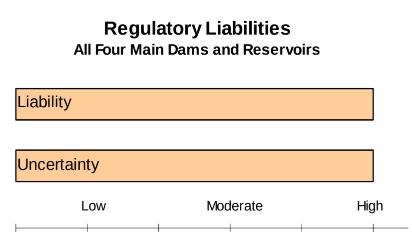
- Approval for dam removal from FERC through a decommissioning order, a new license that permits continued operation of some dams, or a temporary non-power license.
- Endangered Species Act (ESA) compliance with biological assessments, biological opinions, and, if necessary, incidental take statements issued by U.S. Fish and Wildlife Service and National Marine Fisheries Service.
- Fish and Wildlife Coordination Act compliance.
- Clean Water Act (CWA) compliance with water quality compliance certifications from the California State Water Resources Control Board (SWRCB), North Coast Regional Water Quality Control Board (NCRWRCB), Oregon Department of Environmental Quality (ODEQ), and Native American Indian Tribes (CWA section 401); National Pollutant Discharge Elimination System (NPDES) discharge permits from the SWRCB and ODEQ (CWA section 402); and dredge and fill permits from the U.S. Army Corps of Engineers and the Oregon Department of State Lands (CWA section 404).

- California Endangered Species Act compliance and issuance of a take permit issued pursuant to Section 2080 *et seq* of the California Fish and Game Code.
- California Fish and Game Code section 1600 Streambed Alteration Agreement from California Department of Fish and Game.
- CWA section 311(e)(1)(B) Administrative Order that establishes conditions for discharging hazardous substances.
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), section 122 Administrative Order established by the EPA typically in the form of a settlement agreement to establish remedial actions to respond to the release of hazardous substances.
- Consideration of potential impacts to Indian Trust Assets (ITAs) with identification of appropriate compensation or mitigation of those impacts.

The regulatory compliance liabilities generated for a decommissioning agent responsible for removing the four Klamath River dams have the potential to create large costs, scheduling requirements, and legal uncertainty for the dam decommissioning. The time required to complete the required permits and environmental compliance could be several years. Further required environmental study and the cost/benefits analysis of the dam removal would likely significantly change and shape the final decommissioning project.

2.4.1.1 Regulatory Compliance Liabilities - All Dams and Facilities

Regulatory liabilities associated with decommissioning and removal of Klamath Hydroelectric Project dams are related to the decommissioning agent's ability to receive permits, contain program costs, define a realistic schedule, and define the dam removal process without having entered into formal discussions or negotiations with resource and regulatory agencies responsible for permitting. Potential liabilities generated by the decommissioning and removal of the four Klamath River dams include all of those listed above. Of specific concern are the liabilities discussed below.



FERC Decommissioning Approval There is a risk of significant liability under the Federal Power Act (FPA) (including, but not limited to those liabilities described elsewhere in this report) that might arise out of decommissioning the project. The actual extents of these liabilities are dependent on future decisions by FERC and possible judicial review of these decisions.

This unquantified exposure arises out of FERC's potential authority to impose mitigation and restoration measures related to project decommissioning. Many of the mitigation and restoration measures are described elsewhere in this report; FERC might conclude that other measures are warranted. The nature of such conditions is speculative at this time, but could include measures for addressing indirect environmental impacts such as increased greenhouse gas emissions from replacement energy generation and/or economic impacts on third parties. The FPA does not impose a financial limit on the cost of such measures. FERC's authority to impose such requirements can arise from conditions imposed on the expiring license and/or from FERC's asserted authority to impose such requirements upon the expiration of a license, regardless of whether the license contains decommissioning license conditions.

FERC can impose conditions on an original license. It is also established that FERC can include re-opener clauses in licenses. [1]. In more recent years, FERC has included license conditions explicitly authorizing it to later require decommissioning measures.

FERC has extremely broad discretion in determining what conditions to impose on a hydroelectric project. For example, FERC can impose conditions on a new license that are more onerous than the conditions in the original license. Moreover, there is a case authority that FERC can impose conditions that are so expensive that the licensee is compelled to reject the new license and, although not explicit in the FPA, that FERC can shut down a previously licensed project by refusing to issue a new license. [2]

The critical decommissioning approval issue for the Klamath Hydroelectric Project, therefore, is whether FERC can impose decommissioning conditions on a former license. In 1995 FERC issued its *Project Decommissioning at Relicensing: Policy Statement* (1995 Policy Statement) claiming that it had authority to impose such conditions (FERC 1995).

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1 *Wisconsin Pub. Serv. Corp. v. FERC*, 32 F.3d 1165 (7th Cir. 1994).

2 *City of Tacoma v. FERC*, 460 F.3d. 53, 71-74 (D.C. Cir. 2006).

Policy statements are not binding orders and the validity of this particular policy statement has not been reviewed by the courts.[3] If FERC were to impose *post facto* decommissioning conditions on the Klamath Hydroelectric Project, judicial review would be by a U.S. Court of Appeals.[4] The court would make an independent determination whether FERC has such authority under the FPA. If the court concludes that FERC has such authority, the court would then defer to FERC's determination on what conditions are appropriate. FERC's factual findings would be conclusive, as long as they are supported by substantial evidence.[5] Similarly, the courts would not substitute their judgment for that of FERC.[6] The practical effect of the limited scope of review of FERC orders is that, if FERC has the authority asserted in the *1995 Policy Statement* (FERC 1995), then it has broad powers to impose conditions—even onerous and *post facto* conditions—on the licensee, with little likelihood of judicial intervention on the specific conditions.

The most direct method to mitigate open-ended FPA potential liability would be to obtain a FERC order, possibly in the context of the current relicensing proceeding or possibly as amendments to the existing license, stating the conditions that would be imposed upon decommissioning.

RL-1: FERC authority under the FPA to impose mitigation and restoration measures related to project decommissioning. FERC authority to impose mitigation and restoration measures is a high liability with high uncertainty given FERC's authority to impose a wide range of potential mitigation and restoration measures.

CWA Compliance Removal of the Klamath River Dams would require a Water Quality Certification from the State of California under the CWA section 401 and Porter-Cologne Water Quality Control Act. Certification is typically required for any activity that might result in a discharge to a water body, in this case the Klamath River during decommissioning. The certification process ensures that proposed activities would comply with state and federal water quality standards. Most certifications are issued in connection with U.S. Army Corps of Engineers (Corps) CWA section 404 permits for discharges of dredge and fill material into waters of the U.S., including wetlands (SWRCB 2002).

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[3] *City of Tacoma*, 460 F.3d at 72 and 74.

[4] FPA § 313, 16 U.S.C. § 825*l*.

[5] FPA § 313, 16 U.S.C. § 825*l*; *Gainesville Utilities Dept. v. Florida Power Corp.*, 405 U.S. 515, 527 (1971).

[6] *Friends of the River v. FERC*, 720 F.2d 93 (D.C. Cir. 1983).

Existing permitting programs in most states were not developed with dam removal in mind (The Aspen Institute 2002). One of the main issues is the inclusion of the long-term restoration benefits of dam removal in the assessment process, and not just the short-term impacts. For example, if the stored sediments were allowed to erode naturally as currently suggested in the reviewed documents (GEC 2006), their release would likely increase downstream turbidity to levels that exceed water quality standards for the duration of the dam removal process. Once all the erodible sediments had been redistributed to downstream sections, the natural processes and habitats of a free flowing river would return, including baseline turbidity levels.

The NCRWQCB recognizes that its current process for issuing Water Quality Certification under section 401 does not address dam removal projects that involve the presence of substantial quantities of sediment in a reservoir (Plat 2008). In fact, the discharges of sediment as currently suggested in the reviewed documents (GEC 2006) could violate the NCRWQCB's Basin Plan standards and may create challenges in obtaining a permit for this discharge under the Water Quality Certification process. Current basin objectives (see Appendix B) effectively restrict the discharge of excess sediments (either as suspended or depositional) that could be detrimental to beneficial uses or cause a nuisance. Additionally, these documents require that turbidity "shall not be increased more than 20 percent above naturally occurring background levels" (NCRWQCB 2007). The NCRWQCB considers dam decommissioning and removal a construction project and would require the project to follow all excess sediment measures and action plan guidelines. Therefore, early and continuous coordination with the NCRWQCB and SWRCB will be necessary to develop removal alternatives that meet basin objectives and follow basin action plan guidelines.

Discharge of sediment to the Klamath River during dam removal could be considered hydraulic dredging and be subject to a CWA Section 404 permit from the Corps if the discharge could be expected to generate changes to or the impairment of downstream flows These potential changes to or impairment of river flows could be generated by the deposition of discharged sediment downstream of the dams. This could be considered a fill in the waters of the U.S., which would trigger a 404 permit.

Discharge of stormwater runoff as a result of construction activities on the river banks outside of the river bed, to the river could require a Section 402 National Pollutant Discharge Elimination System permit from the SWRCB. This permit would be triggered by construction activities around the river that disturb one acre or more of land and have the potential to result in stormwater discharges to the Klamath River.

RL-2: The removal of the Klamath River Dams could require water quality certification from the SWRCB per section 401 of the CWA, an NPDES permit from the SWRCB per section 402 of the CWA, and a dredge and fill permit from the Corps per section 404 of the CWA. CWA compliance is a high liability with high uncertainty given the current challenges associated with obtaining a discharge permit under the Water Quality Certification process.

CWA Compliance Data Gaps - Applicable for All Dams and Reservoirs Reducing the uncertainties described above would require addressing the data gaps listed in Table 2-32.

Table 2-30. CWA Compliance Data Gaps - All Dams and Reservoirs

Data Gap	Studies/Actions Needed
Permitability of eroding the sediments stored behind the four dams is highly uncertain	Engage in formal discussions with the NCRWQCB, SWRCB, and the Corps on acceptance of this strategy.
Tribes water quality permit requirements under the CWA is not know	Investigate tribes' CWA permit authority.

Indian Trust Assets ITAs represent legal interests in property held in trust by the United States for Indian tribes or individuals, or property that the United States is charged by law to protect for Indian tribes or individuals. Examples of ITAs include lands, minerals, hunting and fishing rights, and water rights. Federal agencies share a duty to act responsibly to protect and maintain ITAs and to carry out their activities to avoid adverse impacts to ITAs when possible. All impacts to ITAs, even those considered non-significant, require addressing under NEPA, including appropriate compensation or mitigation.

Existing studies and environmental analysis of the Klamath Hydroelectric Project relicensing application have not developed a stand-alone investigation of the liabilities and costs associated with ITAs. The *FEIS* (FERC 2007) described the following five federally recognized tribes with the potential to be affected by the project: the Yurok, Karuk, and Hoopa Valley Tribes; Quartz Valley Indian Reservation; and Reghini Rancheria. As a part of its analysis of socioeconomic effects, the *FEIS* (FERC 2007) identified the potential impact on tribal fisheries, on which tribes rely for both subsistence and income in the Klamath River watershed. The potential socioeconomic liability generated by the loss of fisheries in the region (including the tribal fishery) as a result of dam removal is presented in the economic liability Subsection 2.3.7.

The *FEIS* (FERC 2007) investigated the tribal fishery effects on the Yurok and Hoopa Valley reservations' commercial catch in 2001. The *FEIS* (FERC 2007) also described the potential causal relationship between diminished access to subsistence fishery and increases in health problems linked to diet among tribe members. The *FEIS* (FERC 2007) did not quantify the magnitude of this potential effect on the five tribes. The *FEIS* (FERC 2007) describes California EPA grants and contracts (between the California SWRCB and the five tribes) to participate in an environmental justice pilot project to investigate the impacts of the Klamath Hydroelectric Project. The results of these studies were not presented in the *FEIS* (FERC 2007) and represent a data gap.

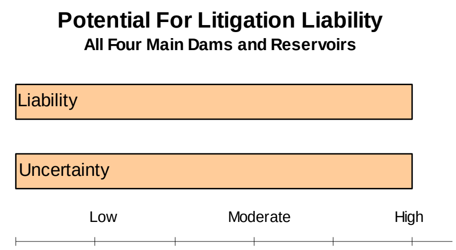
RL-3: The removal of the Klamath River Dams has the potential to affect multiple ITAs. The potential affect of dam removal on ITAs is a high liability with high uncertainty given the unknown potential effect on tribal fisheries.

Indian Trust Assets Data Gaps - Applicable for All Dams and Reservoirs Reducing the uncertainties described above would require addressing the data gaps listed in Table 2-33.

Table 2-31. Indian Trust Assets Data Gaps - All Dams and Reservoirs

Data Gap	Studies/Actions Needed
ITAs related to the Klamath Hydroelectric Project other than losses for the Tribal Fishery	Review of California EPA and SWRCB studies on Environmental Justice effects
Tribal Fishery losses for the Karuk Quartz Valley Indian Reservation; and Reghini Rancheria	Review of California EPA and SWRCB studies on Environmental Justice effects
Unknown impacts to potential Indian Federal reserved water rights with or without dam removal	Complete analysis of water availability to meet reserved water rights on the Klamath River

2.4.2 Potential For Litigation



This section briefly addresses the potential for litigation or regulatory intervention that might arise from the decommissioning of the four dams. Information presented in this section is based upon a review of documents, including a limited review of litigation that has occurred on other dam removal projects, as referenced below. This section was prepared by engineers and planners with CDM and does not represent a legal review of the potential litigation, but rather an overview of the potential litigation that could reasonably be expected based upon the current project description, liabilities identified in Section 2, and litigation or legal action occurring at other dam removal projects.

2.4.2.1 Defining the Dam Removal Project

The degree and type of litigation that might be expected is related directly to the proposed project. To define the liabilities enumerated in this report and the corresponding potential for litigation, CDM relied on the most current project description, which was presented in the *Dam and Sediment Investigation* (GEC 2006). The report states that: "The current [project] investigation assumes that reservoir sediment [all reservoirs] would be allowed to naturally erode as the reservoirs are drawn down. Eroding the sediment will cause downstream water quality to be affected by high total suspended sediment (TSS) concentrations (GEC 2006)." Although CDM believes that this basic project description will likely change as the project is further shaped through the federal planning process and environmental review, this project description presents the starting point for understanding the litigation potential created by the liabilities generated by this approach.

2.4.2.2 Previous Dam Removal Litigation/Regulatory Uncertainty

CDM performed a cursory review of other recent and ongoing dam removal programs that, during the dam removal planning process, have experienced litigation or regulatory intervention that directly affected project cost and schedule. Below are three examples of such litigation, with brief overviews of the legal interventions used to redefine these other dam removal programs. Each of these examples illustrates on a smaller scale the same types of liabilities identified in this study. These examples provide a reasonable starting point for anticipating the type of litigation that a Klamath Dam removal program could encounter.

Dillsboro Dam, Tuckasegee River North Carolina. In July 2007, FERC issued an order accepting the surrender of the license for Dillsboro Dam and Powerhouse, filed by Duke Energy with support from the U.S. Department of the Interior and the North Carolina Wildlife Resources Commission. The Hillsboro Dam is 12 feet high and 310 feet long and creates a reservoir of approximately 15 acres. Although relatively small in size, opponents of dam removal, including Jackson and Macon Counties, the town of Franklin and affected third parties, filed several legal motions and petitions for rehearing with FERC challenging the legality of FERC's decision to surrender the dam license. Project opponents contended that the removal would damage water quality, aesthetics, recreation, and the existing trout fisheries. Central to the opponents' claim is the damage to fisheries that would result from the passage of sediment. As of April 22, 2008, FERC issued its most recent Order on Rehearing and Clarification (*Duke Energy Carolinas, LLC*, 123 FERC ¶ 61,069 (2008) [April 22 Order]). Although FERC granted Duke Energy approval to proceed with dam removal, several significant concessions, including sediment removal from the reservoir and recreational improvements were required in its order.

Peterson Dam Lamoille River, Vermont. Constructed in 1948, Peterson dam is 5.6 miles upstream from Lake Champlain and is owned by the Central Vermont Public Service Corporation (CVPSC). The dam effectively created a barrier to fish movement in the Lamoille River for fish including: sturgeon – a state listed endangered species, walleye, and landlocked Atlantic salmon. Following continuous litigation with resource agencies, fisheries groups, and local stakeholders throughout the 1980s and 1990s, the CVPSC reach a settlement agreement in 2005 as part of the Peterson Dam FERC relicensing agreement, which specified the removal of the dam by 2025. Because the settlement agreement included rate recovery for the CVPSC, it required approval from the Vermont Public Services Board (VPSB). In December 2006 the VPSB rejected the settlement agreement, citing legislative policy and uncertain environmental benefits. The VPSB based its decision on the need to balance environmental benefits of a renewable energy source with the uncertain fisheries benefits of removing the project, and cited 2005 Vermont legislative directives to use renewable energy for meeting incremental electric load growth. The project was relicensed by FERC in 2005; however, the settlement agreement reached by the parties is now in jeopardy because of the VPSB decision on the dam's removal.

Condit Dam, White Salmon River, Washington. The Condit dam is 125 feet high and 471 feet long and sits 3.3 miles upstream from White Salmon River's confluence with the Columbia River. Condit Dam is similar in size and nature to Copco No. 1 Dam and Reservoir and its removal would represent removal of the tallest dam to date. In

September 1999, PacifiCorp developed an agreement with resource agencies, tribes, and environmental groups to remove the dam by October 2006. However, significant objections to the dam's removal were made by both Skamania and Klickitat Counties and local fisheries stakeholders, who were concerned with the short-term environmental effects of sediment releases to the lower river, aesthetic impacts to area residents, and the loss of the established trout fishery in Northwestern Lake created by Condit dam (Becker 2006).

In addition to citing economic impacts, the counties further requested that FERC require the dredging and land disposal of reservoir sediments instead of the natural erosion proposed by the settling parties. In 2002 the counties threatened to sue the State of Washington Department of Ecology over issuance of CWA Section 401 certification for the project. The counties argued that the sediment release would violate downstream turbidity levels and state water quality anti-degradation standards (Becker 2006).

The counties' objections to the removal of the Condit Dam has added at least two years to the timelines for its removal, which is now scheduled for fall 2008. At the time of this writing, the State of Washington Department of Ecology has still not issued the 401 Certification for dam removal activities. It's likely that Skamania and Klickitat Counties will continue their legal challenge of the State's authority to issue the 401 Certification.

2.4.2.3 Potential Klamath Dam Removal Litigation

PacifiCorp's Condit dam removal project is an appropriate small scale comparison to the Klamath Dam removal project and likely represents the same type of litigation that the Klamath Dam decommissioning agent could experience. Although the fisheries benefits for the Condit Dam removal are quite clear and Pacificorp has supported the dam's removal, the project has been tied up in litigation because of concern over the potential short-term damage that might result from the passage of sediment. Skamania and Klickitat Counties have used the 401 Certification process as an effective legal tool to slow the dam's removal.

In comparison, the Klamath dams removal program proposes to release a much greater quantity of sediment from the three major reservoirs, affecting approximately 190 miles of the Lower Klamath River, with the sediment ultimately discharged to the Pacific Ocean. As stated in Section 2.4.1.1, the NCRWQCB has no current mechanism to permit the natural discharge of sediment to the Klamath River from the decommissioning action under a CWA 401 Certification. As with

Condit Dam, issuance of the 401 Certification from the NCRWCB for the project as currently proposed is certain to create legal challenges.

The Siskiyou County Board of Supervisors (Board) at their September 4, 2007 meeting publicly stated opposition to the removal of the in Klamath Dams (Siskiyou County 2007). The Board's opposition focused primarily on the financial and economic damages that would result from dam removal and the loss of local hydropower generation. There was also a desire by the Board to indemnify Siskiyou County for any future damage that might result from sediment accumulated behind the dams. During this meeting, the Board directed County Counsel to "develop a litigation budget with the County Administrator..." presumably to mount a legal challenge to the Klamath dams' removal.

In addition to Siskiyou County, potential litigation could come from the Lower Klamath River tribes, fishery groups, riparian residents, boaters, and recreational users. As stated earlier, the degree and type of litigation will be dependant upon the project definition and any mitigation measures required as an outcome of the environmental process. The future decommissioning agent should be prepared for litigation resulting in mitigation measures associated with the following:

- Fisheries and aquatic ecosystem losses during and following sediment discharge to the Lower Klamath River from Iron Gate Dam to the Pacific Ocean. Potential litigants include the affected tribes and local fisheries, watershed, and recreational groups.
- Whitewater boating losses to commercial companies in the Hell's Corner whitewater boating run downstream of J.C Boyle.
- Unidentified Pacific Ocean based protection groups for the discharge of fine sediment into the Humboldt County Area of Special Biological Significance (ASBS) at the mouth of the Klamath River and the Pacific Ocean. The California Ocean Plan has been updated to include a prohibition on non-point source discharges of sediment to any ASBS.
- Aesthetic and real estate values damages at Copco Reservoir.
- Water quality impacts to downstream diverters during and following sediment passage. Mitigation for this impact was identified in the *Dam and Sediment Investigation* (GEC 2006).
- Unidentified state, local, or non-governmental organizations opposition to the loss of renewable power in a period of rapidly escalating non-renewable fossil fuel prices.

2.4.2.4 Minimizing the Potential for Litigation or Regulatory Intervention

Minimizing the potential for litigation against, or regulatory intervention to the Klamath Dam decommission program will best be accomplished though the federal and environmental planning process, and by engaging the local, regional, and statewide stakeholders affected by the project as part of the planning process. Below is a description of each of these processes and where process-based opportunities for reducing potential litigation may exist.

Federal Planning Process. The federal planning process is an iterative, structured approach that is typically required for federal project financing. The process consists of a series of steps that identifies or responds to problems and opportunities associated with federal objectives or specific state and local concerns. The process culminates in the selection of a preferred or recommended plan. The major steps of the federal planning process are:

- Identification of problems and opportunities.
- Inventories, forecasts, and analyses of resource conditions.
- Formulation of alternative plans.
- Evaluation of the effects of alternative plans.
- Selection of a recommended plan.

The planning process provides an orderly and systematic approach to making determinations and decisions at each step, so that the interested public and decision makers are fully aware of the basic assumptions made; the data and information analyzed; the areas of risk and uncertainty; the rationales used; and the effects or implications of the recommended plan as well as the alternatives. The results of the federal planning process are documented in a Feasibility Report and are provided to Congress, along with the NEPA document, for their consideration and authorization to implement.

CEQA/NEPA Environmental Planning Process. The environmental planning process requires compliance with the California Environmental Quality Act (CEQA), NEPA, and other environmental statues through the completion of an EIR/EIS. The EIR/EIS is a detailed informational document analyzing the project’s potential significant effects and identifying measures to mitigate the effects of the project, including reasonable alternatives to avoid or minimize significant effects. The primary purposes of an EIR/EIS are to inform decision makers and the public about a project’s significant environmental effects and ways to reduce them, and to demonstrate to the public that the environment is being protected.

A thorough understanding and comprehensive compliance strategy with CEQA, NEPA, and other environmental statutes allows the decommission agency the opportunity to create an EIR/EIS that avoid pitfalls and survive court challenges. It is important to understand that avoidance of litigation may not be possible, but a successful defense when challenged in court by local opposition and/or regional, state and federal agencies is always possible if compliance with CEQA, NEPA, and other environmental regulations can be demonstrated clearly to the courts.

Preparation of the necessary CEQA/NEPA documents and establishment of a complete administrative record through a comprehensive compliance strategy and a careful approach to documentation may avoid litigation or may allow the timely and successful defense of litigation challenges.

Engaging Local, Regional, and Statewide stakeholders through Public Participation. Stakeholder participation requirements can be found throughout the Council on Environmental Quality's Regulations for Implementing the Procedural Provisions of NEPA (40 CFR Part 1500-1508 [1999]) While the regulations describe specific requirements, they also state broad goals for public participation in the NEPA process. For example, the Council on Environmental Quality regulations note that public scrutiny is essential to implementing NEPA (40 CFR 1500.1(b) [1999]). For this reason, federal agencies are required, to the fullest extent possible, to encourage and facilitate public participation in agency decisions that affect the quality of the human environment (40 CFR 1500.2(d) [1999]).

The goals of a proactive stakeholder public participation program are to:

- Actively seek and consider public comments and incorporate the views of stakeholders in making decisions.
- Inform the public in a timely manner about the decision making processes and empower them to participate in the process, which should be open, understandable, and consistently followed.
- Incorporate credible, effective stakeholder public participation processes into all activities related to dam decommissioning.

The benefits of a proactive stakeholder public participation program include opening the decision making process and building credibility, enhancing mutual understanding, enhancing community support, and minimizing potential delays caused by litigation.

Open the Decision Making Process and Build Credibility. A good public participation program enables those who are interested in or affected by a proposal to have an opportunity to influence the outcome. Presenting information openly, evaluating issues and alternatives fairly, and following through on commitments all build credibility. Decision making can benefit from a diversity of opinion and expertise. When afforded the opportunity, interested stakeholders with varied backgrounds and experiences can contribute useful information, historical data, and new perspectives to the decision making process. The public may identify issues and alternatives that would have been otherwise overlooked.

Enhance Mutual Understanding. Public participation activities promote substantive communication and improve understanding on all sides. By responding to comments and questions, the decommissioning agent can help the public understand the technical aspects of a particular proposal, as well as the broader policy, political, and legal framework within which decisions are made. The decommissioning agency can, in turn, better understand the effects of its proposed actions on the local community and the environment by listening to those stakeholders directly affected.

Enhance Community Support and Minimize Delays. An effective stakeholder public participation program will not necessarily eliminate all conflicts, controversies, or potential litigation. However, a community that has a voice in the process and is clearly influencing the final decision will be less angry and frustrated with the process than one that feels shut out or ignored. Public workshops, meetings, hearings, and other communications will provide information and help dispel rumors, fears, and misunderstanding. By addressing public concerns up front, the decommissioning agent may avoid time-consuming litigation, or may at least strengthen its position in the event of a subsequent legal or regulatory challenge.

Notably, the courts have not been silent on this topic. For example, the recent *Western Watersheds Project v. Bennett* case (2005) provides a clear indication of how the courts see an agency's responsibility to facilitate public participation. This case is also a good example where a proactive public participation program would likely have avoided injunctive relief against the project and subsequent delays. *Western Watershed Project v. Bennett* is a BLM case in southern Idaho's Jarbidge Resource Area, which comprises about 1.7 million acres of land. Decades of grazing in this area left a mark; BLM describes a bleak landscape where only 16 percent of the rangeland is in "fair" or better condition, while 48 percent is in "poor" condition. In addition, BLM reports a dramatic decline in sage grouse. Despite documentation in its own NEPA analysis of how grazing has caused this degradation, BLM renewed permits for several grazing allotments in the area. When BLM issued its decision without seeking public input, citizen groups sued.

The District Court of Idaho enjoined these permits, reminding BLM that "public scrutiny [is] essential" to NEPA and that the agencies are charged to "encourage and facilitate public involvement in decisions," so that "environmental information is available to public officials and citizens before decisions are made." (*Western Watersheds Project v. Bennett*, 392 F.Supp.2d 1217 [D. Idaho 2005]).

RL-4: The removal of the Klamath River Dams has the potential to generate the risk for litigation or regulatory intervention. Potential for litigation is a high liability with high uncertainty given the many different stakeholders representing a spectrum of interests that have yet to be engaged in the decommissioning process.

Chapter 3 Decommission and Liability Costing

3.1 Introduction

This chapter presents the costs for decommissioning the four Klamath Hydroelectric Project dams and power facilities including a costing of many of the quantifiable liabilities associated with the dam removal activity. The purpose of this chapter is to quantify the potential costs that could be incurred by the decommissioning agent for the decommissioning action (note: many liabilities remain uncosted; hence this costing does not represent a total potential cost for dam decommissioning). This chapter includes costs or costing considerations for:

- Removal of the physical structures (dams, powerhouses, etc.)
- Addressing physical liabilities (e.g., sediment, water quality)
- Addressing biological liabilities (e.g., fisheries, wildlife)
- Addressing socioeconomic liabilities (e.g., loss of jobs)
- Regulatory and legal considerations (e.g., permitting, FERC orders)

This presentation of costs uses two categories: direct costs and indirect costs. Direct costs arise from an identified decommissioning action and include such things as the physical dam removal, real estate transactions, and costs for restoration activities. These direct costs are generally quantifiable, although the extent of the action may be uncertain. Indirect costs are those costs that are a result of a decommissioning action in the form of mitigation, compensation, or the recognition of potential litigation. These indirect costs include items such as increased downstream flooding, damage to fisheries, and loss of whitewater boating.

The direct and indirect costs were developed from the liabilities presented in Chapter 2. These liabilities were identified based on the project description presented in the *Klamath River Dam and Sediment Investigation* (GEC 2006), which assumed that all dams would be removed concurrently or in very rapid succession, with sediment passed to the downstream reach of the Klamath River. No other dam removal alternatives were considered during this costing exercise, with the exception of the sediment removal analysis, that developed a cost estimate under the assumption that 50 percent of the sediment in the J.C. Boyle, Copco No.1 and Iron Gate Reservoirs would need to be removed and disposed of to obtain Clean Water Act 401 Water Quality Certification. This cost estimate was provided as a point of reference for decision makers to help characterize the current uncertainty with the proposed project's Clean Water Act 401 Water Quality Certification (see Subsection 2.4.1).

3.2 Costing Process

The KDDP Team used the following process to assess costs.

1. Review available documents and cost estimates specific to the Klamath River decommissioning action (see Chapter 5 for References).

2. Evaluate the reviewed costs for accuracy.

3. Where necessary, revised previous cost estimates based on new assumptions, and/or updated them to present value (2008) with an escalation rate of 6 percent.

4. Where no direct or indirect liabilities costs were identified in existing documents, the KDDP Team made an estimate based upon engineering and scientific understanding of the liability.

5. For each of the liabilities presented in Chapter 2, an uncertainty factor (1, 1.5, or 2) is assigned to it that corresponds to its level of uncertainty (i.e., low, moderate, high). This factor was multiplied by the cost estimate to arrive at an estimated cost that reflects the uncertainty inherent in costing the liability.

6. Included soft costs for additional studies, permits, engineering, environmental compliance, management and monitoring at a factor of 10 percent of the total identified project costs (see cost summary Table 3-17).

3.3 Removal of Physical Structures

KDDP cost estimates were prepared for the removal of all physical structures including the dams, powerhouses, tunnels and diversions, and power transmission lines. Table 3-17 presents the costs for these actions.

- The KDDP Team reviewed the *Klamath River Dam and Sediment Investigation* (GEC 2006) estimates and determined these estimates to be accurate in scope and costs, with exceptions noted in the second and third bullets. The estimates were prepared after extensive investigation of documents and site conditions. The KDDP Team escalated the costs at 6 percent per year compounded (total 9.2 percent) to bring the GEC estimates to May 1, 2008 dollars.
- As was noted in the *Draft Klamath River Dam Removals – Team Review of A/E Study* (USBR 2008), the GEC estimate did not include costs for the removal of power lines and restoration costs for the transmission line right-of-way. The KDDP Team also developed a cost estimate for riverbed restoration in addition to the work proposed in the GEC estimate. These costs were added to the physical structure removal costs.
- The KDDP Team identified and corrected in this report, an adding error in the *Klamath River Dam and Sediment Investigation* (GEC 2006) cost estimate for J.C. Boyle Dam that underestimated the dam removal cost by $1,975,000.

Table 3-17 in Subsection 3.8 presents the KDDP cost estimates for removal of each of the four main dam and reservoir developments.

3.4 Costs of Physical Liabilities

3.4.1 Hazardous Materials Costs

Decomissioning Klamath Hydroelectric Project Dams has the potential to generate hazardous waste liabilities. Subsection 2.1.1 describes these liabilities, which would have both direct and indirect costs. The indirect costs would be related to mitigation of hazardous waste impacts from normal powerhouse and switchyard operations.

Subsection 3.3 presents assumptions used to develop estimates for the direct costs of dam removal. Some previous cost estimates for hazardous waste effects, presented as environmental cleanup, can be found in *Klamath River Dam and Sediment Investigation* (GEC 2006). These estimates were not based on any known environmental impacts, but rather were inserted as lump sums within three of the four dam removal cost estimates. The J.C. Boyle removal cost estimate contained no environmental cleanup line item. Each cost estimate also included a line item estimate for substation removal and powerhouse removal.

The previous estimates for the costs of hazardous waste effects are not adequate for this analysis. The existing cost estimate is not based on any knowledge of existing environmental contamination. No studies have been done onsite to characterize the extent of possible hazardous waste impacts from chemical or oil spills, lead or asbestos building materials, or pesticide and herbicide use as described in Subsection 2.1.1.

Cost estimate assumptions for powerhouse and substation removal are included within Subsection 3.3. At this pre-appraisal stage it is not possible to generate an accurate cost estimate without knowing the extent of environmental impacts. Table 3-1 below displays placeholder costs for suspected historical hazards including lead, asbestos, and transformer oils.

Table 3-1. Hazardous Waste Liability Cost Estimate

Liability Number	Dam(s) Affected	Topic	Previous Estimates	KDDP Estimate	Uncertainty	Total
HW-1,4	J.C. Boyle	PCBs, transmission ROWs	--	$100,000	1.5	$150,000
HW-2	J.C. Boyle	Asbestos				
HW-3	J.C. Boyle	Lead paint				
HW-5, 8	Copco No. 1	PCBs, transmission ROWs	$100,000	--	1.5	$150,000
HW-6	Copco No. 1	Asbestos				
HW-7	Copco No. 1	Lead paint				
HW-9	Copco No. 1	Switchyard				
HW-10,13	Copco No. 2	PCBs, transmission ROWs	$100,000	--	1.5	$150,000
HW-11	Copco No. 2	Asbestos				
HW-12	Copco No. 2	Lead paint				
HW-14, 17	Iron Gate	PCBs, transmission ROWs	$100,000	--	1.5	$150,000
HW-15	Iron Gate	Asbestos				
HW-16	Iron Gate	Lead paint				
HW-18	Iron Gate	Switchyard				

3.4.2 Hydraulics and Hydrology Costs

Decomissioning Klamath Hydroelectric Project Dams has the potential to generate H&H-related liabilities. Subsection 2.1.2 describes these liabilities, which would have both direct and indirect costs. The direct costs are related to the operations at Keno Dam and impacts to structures in the river. Indirect costs are related to the H&H changes to the river system following dam removal.

Subsection 3.3 presents assumptions used to develop estimates for the costs associated with dam removal and associated H&H liabilities. Earlier studies addressed direct H&H liabilities as they related to the dam structures. Other direct and indirect costs have not been addressed in previous documents and therefore no cost estimates are available.

Table 3-2 summarizes the H&H cost estimates. These estimates are based upon the following assumptions.

- HH-5 Highway 66 Bridge will require strengthening to withstand river scour.
- Keno Dam will be operated by a new entity. The dam will require a new fish ladder and fish screens will be required at North and Ady Canals and the Lost River Diversion Channel. PacifiCorp estimated operations of the dam at $60,000 annually with a net present value of $825,850. The KDDP estimate includes operational costs as well as costs associated with fish screens and fish ladder.
- Long term changes to the hydrograph will not have H&H liabilities unless otherwise noted.

Table 3-2. Hydrology and Hydraulics Liability Cost Estimate

Liability Number	Dams Affected	Topic	Previous Estimates	KDDP Estimate	Uncertainty	Total[1]
HH-1	All	Downstream flooding	--	--	1.5	--
HH-2	All	Changes in river hydrograph - loss of boating	--	Presented in Subsection 3.6.3	1.0	--
HH-3	All	Concurrent reservoir drawdown and sediment passage	--	--	2.0	--
HH-4	All	Operations of Keno Dam	--	$40,326,000	1.5	$60,489,000
HH-5	J.C. Boyle	Highway 66 Bridge foundation	--	$500,000-$1,500,000	1.0	$500,000-$1,500,000
HH-6	Copco No. 1	No low water outlet structure	--	Costs included in Subsection 3.3	1.0	--
HH-7	Copco No. 1	Dam foundation removal	--	Costs included in Subsection 3.3	1.5	--
HH-8	Iron Gate downstream	Downstream hydrograph change	--	--	1.0	--
HH-9	Iron Gate	Iron Gate Hatchery water	$6,547,330	Presented in Subsection 3.5.1	2.0	--

3.4.3 Sediment Costs

Decommissioning Klamath Hydroelectric Project Dams has the potential to generate river and reservoir-based sediment management liabilities. Subsection 2.1.3 describes these liabilities. The current proposed strategy presented in the *Klamath River Dam and Sediment Investigation* (GEC 2006) is to pass all sediment downstream to the Lower Klamath River. The indirect liabilities associated with passing this sediment are not quantifiable. Sediment passage would affect the aquatic ecosystem and water quality for beneficial uses, and could induce flooding. Furthermore, the NCRWQCB has no regulatory mechanism to permit this action in compliance with CWA Section 401 Water Quality Certification (see Subsection 2.4.1).

Subsection 3.3 presents assumptions used to develop estimates for the direct costs of dam removal. No previous costs estimates are available that quantify the indirect liabilities for large scale sediment erosion and passage on regional fisheries and downstream water quality. To develop a cost that characterizes these sediment liabilities, it was assumed that sediment removal from each reservoir would be required to comply with CWA 401 Water Quality Certification and to minimize the currently unquantifiable downstream impacts. Costs for sediment removal were based upon the following assumptions:

- Sediment would be removed with a portable dredge on a reduced lake level surface. The dredged material would be pumped to temporary settling basins onshore in the exposed reservoir areas. As the material dried, it would be loaded into trucks and hauled a maximum distance of 10 miles for disposal in a clean fill site. Other methods of sediment excavation were reviewed but determined to be far more costly and less reliable in execution.
- 50 percent of the sediment estimated in each reservoir would be removed.
- Sediment remaining in the reservoir could be stabilized through restoration measures to minimize erosion and downstream transport. Restoration costs are included in Subsection 3.5.3, Site Restoration.
- The reservoir sediments do not contain State of California or EPA-regulated wastes.

Liability SE-13 is the quantity and flow of water needed to increase river flows to dilute sediment and TSS, to minimize impacts to downstream beneficial uses and the aquatic ecosystem. This availability of water and its costs are not known; no previous estimates regarding this liability have been made. Filling the data gaps associated with this topic

(Subsection 2.1.3) would reduce the uncertainty associated with these estimates. Table 3-3 summarizes the sediment management cost estimates.

Table 3-3. Sediment Management Liability Cost Estimate

Liability Number	Dam(s) Affected	Topic	Previous Estimates	KDDP Estimate	Uncertainty	Total
SE-1	J.C. Boyle	Presence of Sediment	--	$5,464,000	2.0	$10,928,000
SE-2	J.C. Boyle	Composition of Sediment	--	--	2.0	--
SE-3	J.C. Boyle	Organic Content of Sediment	--	--	2.0	--
SE-4	J.C. Boyle	Drawdown Rates	--	--	2.0	--
SE-5	Copco No. 1	Presence of Sediment	--	$93,560,000	2.0	$187,120,000
SE-6	Copco No. 1	Composition of Sediment	--	--	2.0	--
SE-7	Copco No. 1	Organic Content of Sediment	--	--	2.0	--
SE-8	Copco No. 1	Drawdown Rates	--	--	2.0	--
SE-9	Iron Gate	Presence of Sediment	--	$76,379,000	2.0	$152,758,000
SE-10	Iron Gate	Composition of Sediment	--	--	2.0	--
SE-11	Iron Gate	Organic Content of Sediment	--	--	2.0	--
SE-12	Iron Gate	Drawdown Rates	--	--	2.0	--
SE-13	Iron Gate	Water supply availability for sediment passage	--	--	2.0	--

Note: The cost of these studies is accounted for in the cost of removing the dams as a percentage of that cost.

3.4.4 Groundwater Costs

Decomissioning Klamath Hydroelectric Project Dams has the potential to generate groundwater liabilities. Subsection 2.1.4 describes these liabilities, which would have both direct and indirect costs. The indirect costs would be related to removal of J.C. Boyle, Copco No.1, Copco No.2, and Iron Gate Dams and the resulting effects on groundwater contamination through sediment leaching and the impact of rising groundwater levels.

Subsection 3.3 presents assumptions used to develop estimates for the direct costs of dam removal. No costs estimates are available for groundwater liabilities. This report does not include preparation of a new estimate for groundwater liabilities, because these liabilities are subject to data gaps, as described in Subsection 2.1.4. Table 3-4 summarizes the groundwater cost estimates.

Table 3-4. Groundwater Costs Estimate

Liability Number	Dam(s) Affected	Topic	Previous Estimates	KDDP Estimate	Uncertainty	Total
GW-1	All	Decrease in groundwater to river	--	--	1.0	--
GW-2	All	Rising groundwater	--	--	1.0	--
GW-3	All	Contamination through sediment leaching	--	--	1.5	--

3.4.5 Water Quality Costs

Decomissioning Klamath Hydroelectric Project Dams has the potential to generate water quality liabilities. Subsection 2.1.5 describes these liabilities, which would have both direct and indirect costs. The indirect costs would be related to removal of J.C. Boyle, Copco No.1, Copco No.2, and Iron Gate Dams and the resulting effects on instream water temperatures, TSS levels, and DO during reservoir drawdown and following dam removal.

Subsection 3.3 presents assumptions used to develop estimates for the direct costs of dam removal. Previous cost estimates for water quality liability were presented in:

- *Klamath River Dam and Sediment Investigation* (GEC 2006).

The GEC (2006) estimate was based on conceptual measures to provide water quality protection for water users downstream from Iron Gate Dam, and included 40 newly drilled wells and water supply. The cost presented in the GEC estimate of $1.6 million is noted as line items in the physical structure removal estimate. The report applied a 40 percent contingency escalation, and the values presented in Table 3-17 reflect the escalated value of $2.24 million proportionally divided over the four dams. The KDDP Team’s review of the GEC report (2006) identified a moderate level of uncertainty associated with the liability. The value reported in Table 3-5 represents the estimate of the potential effect of this uncertainty based on a 2008 adjusted GEC cost of $1.798 million.

The 2008 adjusted GEC cost of $1.798 million was purposefully used to avoid double escalation in Table 3-17.

The previous estimates for the costs of water quality effects are not adequate for this analysis, as follows.

- The estimates were not thoroughly investigated and are only conceptual level costs.
- The estimates only pertain to water quality impacts downstream from Iron Gate Dam.

This report does not include preparation of a new estimate for water quality liabilities, because these liabilities are subject to significant data gaps, as described in Subsection 2.1.5.

Table 3-5 presents the previous estimates for indirect water quality costs. Filling the data gaps associated with this topic (Subsection 2.1.5) would reduce the uncertainty associated with these estimates.

Table 3-5. Water Quality Liability Cost Estimate

Liability Number	Dam(s) Affected	Topic	Previous Estimates	KDDP Estimate	Uncertainty	Total
WQ-1,2 & 3	All	Downstream water quality during decommissioning	Presented in Table 3-17	--	1.5	$899,000
WQ-4	All	CWA compliance at Keno Reservoir	--	--	2.0	--

3.5 Costs of Biological Liabilities

3.5.1 Aquatic Resources Costs

Decomissioning Klamath Hydroelectric Project Dams has the potential to generate river and reservoir-based aquatic resource liabilities. Subsection 2.2.1 describes these liabilities, which would have both direct and indirect costs. The indirect costs would be related to removing the reservoirs and returning the river from the J.C. Boyle Development to the Iron Gate Development and downstream to an uninterrupted reach and the resulting effects on aquatic resources.

Previous cost estimates for aquatic resources were presented in the *Klamath River Dam and Sediment Investigation* (GEC 2006) and in *Appendix A* of the *FEIS* (FERC 2007). These estimates were based on cost estimates of environmental measures as a part of project relicensing and estimates in the GEC study for effects on the fish hatchery. This previous work provides a starting point for estimating aquatic resource liability costs. However, the majority of the cost work captures the costs for only some of the liabilities associated with removing the four dams.

Table 3-6 presents current estimates based on FERC (2007) and GEC (2006) information for indirect aquatic resources costs. These costs include the development of aquatic resource monitoring and management plans, funding for the Iron Gate fish hatchery, and new hatchery facilities and water supplies. For liability AQ-2, loss of spawning areas, the cost reflects the aquatic monitoring and management plan. For liability AQ-5, Iron Gate Fish Hatchery funding, the cost presented reflects fish hatchery funding (5 years), new fish hatchery facilities, and new hatchery water supply costs were included in the GEC (2006) estimate and are noted as a line item in the physical structure removal costs presented in Table 3-17. No costs were included in the *FEIS* (FERC 2007) or *Klamath River Dam and Sediment Investigation* (GEC 2006) for other liabilities associated with aquatic resources. Where information is not available (i.e., data gaps still exist), Table 3-6 leaves the fields blank, as an unquantifiable liability.

Table 3-6. Aquatic Resources Liability Cost Estimate

Liability Number	Dams Affected	Topic	Previous Estimates	KDDP Estimate	Uncertainty	Total
AQ-1	All	Alteration in fish diseases	--	--	1.5	--
AQ-2	All	Loss of spawning areas	$45,000	--	1.0	$45,000
AQ-3	Downstream	Alteration in fish diseases	--	--	1.5	--
AQ-4	Downstream	Loss of spawning areas	--	--	1.5	--
AQ-5	Downstream	Iron Gate Fish Hatchery funding	Presented in Table 3-17	--	1.0	--
AQ-6	Downstream	Downstream channel geomorphology changes	--	--	1.5	--
AQ-7	Downstream	Invasive Aquatic Species	--	--	1.5	--

3.5.2 Terrestrial Resources Costs

Decomissioning Klamath Hydroelectric Project Dams has the potential to generate river and reservoir-based terrestrial resources liabilities. Subsection 2.2.2 describes these liabilities, which would have both direct and indirect costs. The indirect costs would be related to removing the reservoirs and returning the river from the J.C. Boyle Development to the Iron Gate Development to an uninterrupted reach and the resulting effects on terrestrial resources.

Subsection 3.3 presents assumptions used to develop estimates for the direct costs of dam removal. Previous cost estimates for various terrestrial resources effects were presented as environmental measures in *Appendix A* of the *FEIS* (FERC 2007). These estimates were based on cost estimates of environmental measures as a part of project relicensing. This previous work provides a starting point for estimating terrestrial resource liability costs. However, the majority of PacifiCorp's work captures the costs for only some of the liabilities associated with removing the four dams. Uncertainties associated with the expected costs presented in the *FEIS* (FERC 2007) could be reduced through more comprehensive planning and design efforts.

Table 3-7 presents current estimates based on PacifiCorp information for indirect terrestrial resources costs. These costs include the development of vegetation and wildlife management plans, restoration of riparian and wetland habitats, and control of noxious weeds for removal of four dams. For liabilities TE-1 and TE-3, the vegetation and wildlife management plan costs were added to the riparian and wetland restoration costs to generate one total estimate. The *FEIS* (FERC 2007) did not include costs for downstream effects on terrestrial resources. Where information is not available (i.e., data gaps still exist), Table 3-7 leaves the fields blank, as an unquantifiable liability.

Table 3-7. Terrestrial Resources Liability Cost Estimate

Liability Number	Dams Affected	Topic	Previous Estimates	KDDP Estimate	Uncertainty	Total
TE-1, 3	All	Change in wetland habitat and loss of habitat	$48,000	--	1.5	$72,000
TE-2	All	Invasive species	$5,600	--	1.5	$8,400
TE-4	Downstream	Changes in wetland habitat	--	--	1.0	--
TE-5	Downstream	Loss of habitat	--	--	1.0	--

3.5.3 Site Restoration Costs

Decomissioning Klamath Hydroelectric Project Dams has the potential to generate river and reservoir-based site restoration liabilities. Subsection 2.2.3 describes these liabilities, which would have both direct and indirect costs. The indirect costs would be related to removing the reservoirs and returning the river from the J.C. Boyle Development to the Iron Gate Development to an uninterrupted reach and the resulting effects on terrestrial and aquatic resources.

The direct costs related to site restoration following dam removal presented by GEC (2006) and in *Appendix A* of the *FEIS* (FERC 2007) were refined as a part of the KDDP cost estimating effort, as described in Subsection 3.3. The KDDP cost estimates are presented below in Table 3-8 and are assigned an uncertainty factor due to the high level of uncertainty associated with the degree of site restoration that would be required to complete dam decommissioning.

Current plans for removal of the four dams primarily discuss direct removal, sediment management once the dams have been demolished, and hydroseeding of the reservoir and dam sites to stabilize the areas. The level of planning and design necessary to adequately determine the types, extent, measures of success, and associated costs for site restoration is beyond that which GEC (2006) and the *FEIS* (FERC 2007) outlined and still needs to be determined. Table 3-8 presents current estimates for site restoration costs. Where information is not available (i.e., data gaps still exist), Table 3-8 leaves the fields blank, as an unquantifiable liability.

Table 3-8. Site Restoration Liability Cost Estimate

Liability Number	Dams Affected	Topic	Previous Estimates	KDDP Estimate	Uncertainty	Total
SR-1	J.C. Boyle	Reservoir restoration	--	$2,510,000	1.5	$3,765,000
SR-2	J.C. Boyle	Bypass reach restoration	--	--	1.5	--
SR-3	J.C. Boyle	J.C. Boyle Spillway restoration	--	--	1.5	--
SR-4	Copco No .1	Reservoir restoration	--	$16,582,000	1.5	$24,873,000
SR-5	Copco No. 2	Reservoir restoration	--	$175,000	1.0	$175,000
SR-6	Copco No. 2	Bypass reach restoration	--	--	1.5	--
SR-7	Iron Gate	Reservoir restoration	--	$15,946,000	1.5	$23,919,000
SR-8	Klamath Downstream	River restoration	--	--	1.0	--

3.6 Costs of Socioeconomic Liabilities

3.6.1 Real Estate Costs

Decomissioning Klamath Hydroelectric Project Dams has the potential to generate Real Estate liabilities. Subsection 2.3.1 describes these liabilities. No estimates are available for the costs associated with these real estate liabilities. Subsection 3.3 presents assumptions used to develop estimates for the direct costs of dam removal.

The analysis conducted for this report included preparation of a new estimate for real estate liabilities. Table 3-9 summarizes the real estate cost estimates, which use a market driven cost comparison approach. This method compares the existing real estate to be acquired to sales of similar real estate in the region. These estimates are based upon the following assumptions.

- The decommissioning agent will purchase the reservoirs.
- Reservoir land use is most similar to rural agricultural land.
- Homes abutting Copco Reservoir will lose access to a major amenity.
- Recent sales indicate that the average cost of homes abutting Copco Reservoir is roughly $400,000.
- Recent sales indicate that the cost of similar homes near (but not abutting) the reservoir is $250,000.
- Area of each reservoir:
  - J.C. Boyle – 500 Acres;
  - Copco – 1,000 acres;
  - Copco No. 2 – 50 Acres; and
  - Iron Gate – 1000 Acres.
- Comparisons show that similar large properties (250+ acres) are selling for $1,000–$8,000/acre. This estimate assumes prices of $2,500–$5,000/acre.

Table 3-9 presents these estimates for indirect real estate costs as ranges, in which the optimistic estimate is the lower end of the range, and the pessimistic estimate is the higher end of each range. Filling the data gaps associated with this topic (Subsection 2.3.1) would reduce the uncertainty associated with these estimates.

Table 3-9. Real Estate Liability Cost Estimate

Liability Number	Dam(s) Affected	Topic	Previous Estimates	KDDP Estimate	Uncertainty	Total
RE – 1,2	J.C. Boyle, Copco No. 2, Iron Gate	PacifiCorp land ownership and Diminution in property value	--	$3,375,000 - $8,000,000	1.5	$5,062,500- $12,000,000
RE-3	Copco No. 1	PacifiCorp land ownership	--	$2,500,000- $5,000,000	1.5	$3,750,000- $7,500,000
RE-4 (AE-5)	Copco No. 1	Diminution in property value	--	$7,500,000	1.5	$11,250,000

3.6.2 Aesthetics Costs

Decomissioning Klamath Hydroelectric Project Dams has the potential to generate aesthetics liabilities. Subsection 2.3.2 describes these liabilities, which would have both direct and indirect costs, as discussed below. Direct costs would relate to the extent of dam removal and the extent and nature of site restoration. Subsection 3.3 presents assumptions used to develop estimates for the direct costs of dam removal. The extent of dam removal affects the resulting aesthetics, and aesthetics could influence the dam removal scope.

Indirect aesthetics costs would be related to changes in views, visual scarring of the land, and changes in topography and the resulting effects on real estate, business profitability, recreation, and other entities or factors that relate to scenic viewing opportunities. No costs estimates are available for the indirect costs associated with aesthetics liabilities. The effects of changes in aesthetics will influence the potential cost ranges associated with real estate, site restoration, and recreation, as discussed below and summarized in Table 3-10.

Methods for most effectively minimizing each of the following four aesthetics liabilities include undertaking a high-level of site restoration (i.e. high-end of the range of restoration possibilities). Such a level would include a replenishment of mixed vegetation and topography that as closely as possible achieves the appearance of an intact, pre-project construction condition. Where concrete footings are deeply incised, significant terrain re-sculpting of the canyon walls and floor would be necessary to accomplish a high level of restoration.

- **Loss of reservoir and alteration of waterfront views for nearby residences and tourists**. Changes in the value of nearby home sites would reflect the costs of this liability.
- **Changes to the natural landscape associated with drawdown and altered water flows**. After dam decommissioning, the river might establish a new course, changing the visual quality in the vicinity of each reservoir. Measures such as regrading the drawdown zone, restoring the original river channel, and revegetating the areas using various methods and vegetation types would affect the aesthetic future of these ecological areas, thus ranges of site restoration costs can account partially for these aesthetic liabilities.
- **Visual scarring of the land associated with potential incomplete removal of dam structure**. Removal of large, incised, built-in structures such as the four Klamath Hydroelectric Project dams would affect the aesthetics of the river canyon environment. The extents of structure removal and the extents of restoration at each dam site will determine how much of an aesthetic liability remains after decommissioning.

- **Change to the topography of the river channel**. Changing the topography of the river channel would create aesthetic liabilities as well as associated cost/benefit implications for the area.

Filling the data gaps associated with this topic (Subsection 2.3.2) would reduce the uncertainty associated with any estimates that are possible for this highly uncertain topic.

Table 3-10. Aesthetics Liability Cost Estimate

Liability Number	Dams Affected	Topic	Previous Estimates	KDDP Estimate	Uncer-tainty	Total
AE-1	J.C. Boyle	Alteration of waterfront views	--	See 3.6.3, Recreation	1.0	
AE-2	J.C. Boyle	"Rings" in landscape	--	Presented in 3.5.3, Site Restoration	1.0	
AE-3	J.C. Boyle	Incomplete structure removal	--	Presented in 3.5.3, Site Restoration See also 3.6.3, Recreation	1.0	
AE-4	J.C. Boyle	Visual changes in river channel	--	See 3.6.3, Recreation	1.0	
AE-5	Copco No. 1	Alteration of waterfront views	--	Presented in 3.6.1, Real Estate	1.0	
AE-6	Copco No. 1	"Rings" in landscape	--	Presented in 3.5.3, Site Restoration	1.0	
AE-7	Copco No. 1	Incomplete structure removal	--	Presented in 3.5.3, Site Restoration See also 3.6.3, Recreation	1.0	
AE-8	Copco No. 1	Visual changes in river channel	--	See 3.6.3, Recreation	1.0	
AE-9	Copco No. 2	Incomplete structure removal	--	Presented in 3.5.3, Site Restoration See also 3.6.3, Recreation	1.0	
AE-10	Iron Gate	Alteration of waterfront views	--	Presented in 3.6.3, Recreation	1.0	
AE-11	Iron Gate	"Rings" in landscape	--	Presented in, 3.5.3, Site Restoration	1.0	
AE-12	Iron Gate	Incomplete structure removal	--	See 3.6.3, Recreation	1.0	
AE-13	Iron Gate	Visual changes in river channel	--	See 3.6.3, Recreation	1.0	

3.6.3 Recreation Costs

Decomissioning Klamath Hydroelectric Project Dams has the potential to generate river and reservoir-based recreation liabilities. Subsection 2.3.3 describes these liabilities, which would have both direct and indirect costs. The indirect costs would be related to removing the reservoirs and returning the river from the J.C. Boyle Development to the Iron Gate Development to an uninterrupted reach and the resulting effects on recreation activities.

Subsection 3.3 presents assumptions used to develop estimates for the direct costs of dam removal. Previous cost estimates for recreation effects were presented in the socioeconomic section of the *FEIS* (FERC 2007). These estimates were based on the surveys prepared by PacifiCorp as a part of project relicensing. The previous estimates for the costs of recreation effects are adequate for this analysis. PacifiCorp's user survey-based approach is a reasonable approach to evaluating the potential costs of recreation liabilities. With this approach, the indirect nature of the recreation liabilities can be quantified effectively in terms of how recreation user days would change and the resulting effect on spending that would be linked directly to recreation in the project area. Uncertainties associated with the expected costs presented in the *FEIS* (FERC 2007) could be reduced through new surveys that focused solely on the changes in recreation use that would be expected from removal of the four dams.

The PacifiCorp surveys developed recreation use and expenditure estimates for two geographic regions: a 5-mile corridor and a 50-mile corridor. The 5 mile corridor covered 5 miles on either side of the river and 5 miles inland from the coast. The 50 mile corridor covered 50 miles on either side of the river and 50 miles inland from the coast. Table 3-11 presents these estimates for indirect recreation costs as ranges, in which the 5-mile corridor estimate represents the lower end of the range, and the 50-mile corridor estimate is the higher end of each range. The cost estimates presented in Table 3-11 represent a worst case scenario that assumes the total loss of recreation use types dependant on the reservoirs. It is also assumed that the cost estimates outlined below adequately characterize the costs associated with potential reductions in recreation or heritage tourism due to changes in aesthetic quality following reservoir drawdown and dam removal, as described in Subsection 2.3.2.

Table 3-11. Recreation Liability Cost Estimate

Liability Number	Dams Affected	Topic	Previous Estimates	KDDP Estimate	Uncertainty	Total
RC -1, 4, 6	J.C. Boyle, Copco No. 1, Iron Gate	Loss of flatwater recreation	$288,000 - $341,000	--	1.0	$288,000 - $341,000
RC -2, 5, 7	J.C. Boyle, Copco No. 1, Iron Gate	Increased distance to water feature	$488,000- $488,000	--	1.0	$488,000- $488,000
RC -3, 8	J.C. Boyle, Iron Gate	Changes in recreational opportunities	$1,446,000 - $3,744,000	--	1.0	$1,446,000 - $3,744,000

3.6.4 Safety Costs

Decomissioning Klamath Hydroelectric Project Dams has the potential to generate safety liabilities. Subsection 2.3.4 describes these liabilities, which would have indirect costs. The indirect costs would be related to: the drawdown of reservoirs and changes to riverbed morphology; potentially degraded water quality; altered river flows; potential flooding during and after decommission due to reduced flow control; and the actual physical structure removal. These dam decommissioning activities could result in indirect effects on boating accidents; hazards to swimmers; increased potential for downstream flooding; and increased safety risks associated with heavy construction.

Subsection 3.3 presents assumptions used to develop estimates for the direct costs of dam removal, which include costs for administering safety programs during construction. Table 3-12 summarizes the safety liabilities. No costs estimates are available for the indirect costs associated with safety liabilities given the uncertainty regarding future conditions.

Table 3-12. Safety Liability Cost Estimate

Liability Number	Dam(s) Affected	Topic	Previous Estimates	KDDP Estimate	Uncertainty	Total
SA-1	All	Boating hazards, changes in H&H	--	--	1.5	--
SA-2	All	Swimming hazards, changes in H&H and water quality	--	--	1.5	--
SA-3	All	Downstream flooding during decommissioning	--	--	1.5	--
SA-4	All	Dam decommissioning construction and engineering	--	--	1.0	--

3.6.5 Cultural/Historic Costs

Decomissioning Klamath Hydroelectric Project Dams has the potential to generate cultural resources liabilities. Subsection 2.3.5 describes these liabilities, which would have both direct and indirect costs. The indirect costs would be related to the removal of the dam and its associated facilities subject to decommissioning plans to be established in consultation with the California and Oregon SHPO and the resulting effects on the historic and pre-historic cultural resources.

Subsection 3.3 presents assumptions used to develop estimates for the direct costs of dam removal. No costs estimates are available for these cultural resources liabilities. The analysis conducted for this report does not include preparation of a new estimate for cultural resources liabilities, as the National Register eligibility of the historic and prehistoric cultural resources and resultant potential protection or treatment determined during necessary Section 106 Consultation with California and Oregon SHPO are unknown.

Filling the data gaps associated with this topic (Subsection 2.3.5) would reduce the uncertainty associated with this topic. Table 3-13 summarizes the costs associated with cultural/historic liabilities.

Table 3-13. Cultural Resources Cost Estimate

Liability Number	Dams Affected	Topic	Previous Estimates	KDDP Estimate	Uncertainty	Total
CH-1 through CH-3	J.C. Boyle	Structures, sites, TCPs	--	--	1.0	--
CH-4 through CH-6	Copco No. 1	Structures, sites, TCPs	--	--	1.0	--
CH-7 through CH-9	Copco No. 2	Structures, sites, TCPs	--	--	1.0	--
CH-10 through CH-11	Iron Gate	Sites and TCPs	--	--	1.0	--

3.6.6 Power Costs

Decomissioning Klamath Hydroelectric Project Dams has the potential to generate power-related liabilities. Subsection 2.3.6 describes these liabilities, which have direct costs associated with dam decommissioning. These power costs are related to an overall loss of power from a renewable energy source and the resulting effects on power supply and needs within the Klamath region.

Subsection 3.3 presents assumptions used to develop estimates for the direct costs of dam removal. Previous cost estimates for power effects were presented in the following documents:

- *FEIS* (FERC 2007).
- *Economic Modeling of Relicensing and Decommissioning Options for the Klamath Basin Hydroelectric Project—Addendum A* (Cubed 2007).

Addendum A (Cubed 2007) estimates are derived from power forecasts developed by several sources, including PacifiCorp, and they present net present values of replacement power over a 30 year analysis period. The previous estimates for the costs of replacement power effects are adequate for this analysis. The six replacement power price forecasts from *Addendum A* reasonably capture the uncertainty associated with the energy marketplace and near and long-term mixes of generation resources.

The previous forecasts contain differing assumptions regarding future replacement power technologies, natural gas prices, and discount rates. However, the variety of forecasts effectively captures the range of replacement power source options, including a combined-cycle gas turbine plant proposed by the California Public Utilities Commission and a 50 percent biomass, 50 percent demand side management option proposed by the Oregon Department of Energy. Uncertainties associated with the expected costs of replacement power could be reduced through firm identification of the alternative power generation source. Analysis presented in the *FEIS* (FERC 2007) indicates alternative economic figures pertaining to the retiring of the four main dam developments; however, the *FEIS* (FERC 2007) does not present a net present value for replacement power. Instead, the *FEIS* (FERC 2007) reports economic figures that reflect costs associated with operating only the Fall Creek Dam development after the four main dams are decommissioned. Therefore, the cost estimates presented here for replacement power reflect only those estimates provided in *Addendum A* (Cubed 2007).

An emerging renewable energy market has yet to determine a value associated with renewable energy credits. Consequently, neither the *FEIS* (FERC 2007) nor *Addendum A* (Cubed 2007) identified cost estimates for the loss of value associated with the classification of the lost power generation as renewable. The *FEIS* (FERC 2007) reports a potential increase in greenhouse gas emissions by 71,680 metric tons, to 111,100 metric tons of carbon per year if the 716,800 MWh current project electric output were replaced with carbon emitting, fossil-fueled generation facilities. These carbon emissions cannot currently be translated into dollar cost figures.

Power liabilities identified in Subsection 2.3.6 include the loss of 562.8 GWh of electricity, the procurement of power to replace this electricity, and the removal of a renewable energy generation source. Costing the loss of electricity requires a determination of PacifiCorp's loss of potential income. This is accounted for in the costing of replacement power because it is assumed that the loss of income associated with the loss of electricity is equal to the income generated from selling the same amount of replacement power. Therefore, these liabilities are considered together for costing purposes.

Table 3-14 presents estimates for the direct costs of replacement power as a range, in which the United States Department of Interior power forecast estimate represents the lower end of the range, and the California Public Utilities Commission forecast estimate is the higher end of the range. PacifiCorp estimated the 30 year total replacement power cost at the higher end of this range, at $151 million.

Table 3-14. Power Liability Cost Estimate

Liability Number	Dams Affected	Topic	Previous Estimates	KDDP Estimate	Uncertainty	Total
PO–1,2	ALL	Replacement power	$65,169,000 - $171,911,000	--	1.0	$65,169,000 - $171,911,000
PO-3	ALL	Loss of renewable power	--	--	1.0	--

3.6.7 Economics Costs

Decomissioning Klamath Hydroelectric Project Dams has the potential to generate multiple direct economic and indirect socioeconomic liabilities. Subsection 2.3.7 describes these liabilities, which would have both direct and indirect costs. The direct costs are related to the implementation of dam removal including construction costs and site restoration.

The indirect costs would be related to removing the reservoirs and returning the river from the J.C. Boyle Development to the Iron Gate Development to an uninterrupted reach and the resulting effects on:

- Recreation activities;
- Residential land values along the reservoir shoreline;
- Potential lost local revenue at local businesses and payroll from jobs related to uses at the reservoirs and the river; and
- Lost property tax revenue for local governments.

Subsection 3.3 presents assumptions used to develop estimates for the direct costs of dam removal, and the other direct costs of dam removal are described in: Subsection 3.4.2, Hydraulics and Hydrology; 3.4.3, Sedimentation; 3.5.3, Site Restoration; Subsection 3.6.1, Real Estate; and 3.6.6, Power. The indirect socioeconomic effect of changes in recreation user days is presented in Subsection 3.6.3, Recreation. The indirect effect of dam removal on residential property adjacent to a reservoir is quantified in Subsection 3.6.1 (Real Estate) in terms of potential changes to property values.

Previous cost estimates for potential indirect socioeconomic effects presented in this subsection were presented in the socioeconomic section of the *FEIS* (FERC 2007). These estimates were based on the surveys and research prepared by PacifiCorp as a part of project relicensing. The previous estimates for the costs of socioeconomic effects are adequate for this analysis. Uncertainties associated with the expected costs presented in the *FEIS* (FERC 2007) could be reduced through new research that focused solely on the changes in regional socioeconomics that would be expected from removal of the four dams. Specific uncertainty lies in the value of regional fisheries that could be affected by dam removal. The *FEIS* (FERC 2007) outlines a complete fishery collapse as a worst case scenario. This worst-case scenario is the basis of the cost estimates for fishery liabilities presented in this subsection.

The PacifiCorp research developed socioeconomic effect estimates for two geographic regions: a 5-mile corridor and a 50-mile corridor. The 5 mile corridor covered 5 miles on either side of the river and 5 miles inland from the coast. The 50 mile corridor covered 50 miles on either side of the river and 50 miles inland from the coast. Table 3-15 presents these estimates for indirect socioeconomic costs as a single value, because the previous cost estimates were the same for both zones for the two liabilities reported in this subsection.

The cost estimate quantifies the potential socioeconomic effect on regional fisheries (including the commercial fishing industry in the region, recreational ocean angling dependent on the Klamath River fishery, and the tribal fishery), under a total collapse scenario. The cost estimate for this liability does not include the costs for liabilities outlined in Subsection 3.3.1, Aquatic Resources. The *FEIS* (FERC 2007) presented historical ranges for regional income associated with the regional fisheries for which the potential to return in the future is unknown. Annual costs were estimated at $11,896,000. The net present value of this annual cost assuming seven years to replace the fishery is calculated as a representation of the estimated cost range. The values for the 5 mile and 50 mile impact zones are based on annual costs presented in the *FEIS* (FERC 2007) that have been adjusted to 2008 dollars. The uncertainty in the future value of regional income associated with regional fisheries is accounted for in Table 3-15 with a low uncertainty factor.

Table 3-15. Economic Liability Cost Estimate

Liability Number	Dams Affected	Topic	Previous Estimates	KDDP Estimate	Uncertainty	Total
EC-1, 3, 5, 7	All Dams	Loss of payroll	$4,067,000*	--	1.0	$4,067,000*
EC-2, 4, 6, 8	All Dams	Loss of regional fisheries	$11,896,000 - $66,406,000**	--	1.0	$11,896,000 - $66,406,000**

* For the loss of payroll, we assume this is a one time event and workers will be relocated
** Since sediment removal should negate fisheries' impacts and the sediment removal costs are included in the total, fishery liabilities are noted here, but will not be included in the total.

3.7 Regulatory Cost Considerations

Decomissioning Klamath Hydroelectric Project Dams has the potential to generate regulatory and legal liabilities as described in Subsection 2.4. Regulatory liabilities associated with decommissioning and removal of Klamath Hydroelectric Project Dams are related to the decommissioning agent’s ability to receive permits and secure regulatory approvals, contain program costs, define a realistic schedule, and define the dam removal process without having entered into formal discussions or negotiations with resource and regulatory agencies responsible for permitting. Several of these liabilities have the potential to create large costs, scheduling requirements, and legal uncertainty for the dam decommissioning including (1) CWA Section 401 Certification; (2) unknown aspects of FERC decommissioning project requirements; and (3) Indian Trust Assets. For instance, the unknown aspects of FERC decommissioning project requirements could place onerous standards on the decommissioning agent. The potential for these onerous standards to drive the project provided the rationale for development of the uncertainty factors assigned to the liability costs. Table 3-16 presents the regulatory and legal liabilities identified in Subsection 2.4 and their associated uncertainty levels. No costs estimates are available for the liabilities given the uncertainty regarding the future regulatory environment.

Table 3-16. Regulatory Liability Cost Estimate

Liability Number	Dams Affected	Topic	Previous Estimates	KDDP Estimate	Uncertainty	Total
RL-1	All Dams	FERC Authority to impose mitigation	--	--	2.0	--
RL-2	All Dams	CWA Certification	--	--	2.0	--
RL-3	All Dams	ITAs	--	--	2.0	--
RL-4	All Dams	Potential for litigation	--	--	2.0	--

3.8 Summary Cost Tables

Presented below are summary cost tables. Table 3-17 presents quantifiabile 2008 costs associated with dam decommissioning. Tables 3-18, 3-19, 3-20, and 3-21 present the quantifiable costs unique to each dam, and Table 3-22 presents the cost estimates for liabilities associated with more than one facility. Risk factors are presented to represent uncertainty associated with previous estimates as well as KDDP estimates. Where an uncertainty factor is not listed, the KDDP Team has concluded that the range identified is appropriate. Table 3-23 is a summary of non-quantifiable liability costs. Table 3-24 is a listing of liabilities whose costs are accounted for and estimated in other subsections.

Table 3-17. Klamath Dam Decommissioning Liability Investigation Liability Cost Estimate (Quantifiable Costs)

Physical Structure Removal Costs			***Cost Estimate***		
J.C. Boyle		Physical Structure Removal	$9,818,800[1]		$9,818,800[1]
		Water/Construction/Engineering & Permitting	$5,607,700		$5,607,700
		Escalation of Removal, Water/Cons./Eng. & Permit	$1,419,200		$1,419,200
		Artificial River Bed	$69,000		$69,000
		J.C. Boyle Total:	**$16,914,700**		**$16,914,700**
Copco No. 1		Physical Structure Removal	$14,568,800[1]		$14,568,800[1]
		Water/Construction/Engineering & Permitting	$8,320,500		$8,320,500
		Escalation of Removal, Water/Cons./Eng. & Permit	$2,105,800		$2,105,800
		Artificial River Bed	$385,000		$385,000
		Copco No. 1 Total:	**$25,380,100**		**$25,380,100**
Copco No. 2		Physical Structure Removal	$3,367,500[1]		$3,367,500[1]
		Water/Construction/Engineering & Permitting	$1,923,200		$1,923,200
		Escalation of Removal, Water/Cons./Eng. & Permit	$486,700		$486,700
		Artificial River Bed	$335,000		$335,000
		Copco No. 2 Total:	**$6,112,400**		**$6,112,400**
Iron Gate		Physical Structure Removal	$20,142,200[1]		$20,142,200[1]
		Water/Construction/Engineering & Permitting	$11,503,500		$11,503,500
		Iron Gate Fish Hatchery Funding	$10,500,000		$10,500,000
		Escalation of Removal, Water/Cons./Eng. & Permit	$3,877,400		$3,877,400
		Iron Gate Total:	**$46,023,100**		**$46,023,100**
Physical Structure Removal Subtotal			**$94,430,300**		**$94,430,300**
Liability Cost Estimates			***Cost Estimate***		
Liability #	***Liability Description***	***Dam Affected***	***Low Estimate***	***Risk Factor***	***High Estimate***
HW-1 to HW-4	Hazardous Waste Mitigation and Cleanup	J.C. Boyle	$100,000	1.5	$150,000
HW-5 to HW-9	Hazardous Waste Mitigation and Cleanup	Copco No. 1	$100,000	1.5	$150,000
HW-10 to HW-13	Hazardous Waste Mitigation and Cleanup	Copco No. 2	$100,000	1.5	$150,000
HW-14 to HW-18	Hazardous Waste Mitigation and Cleanup	Iron Gate	$100,000	1.5	$150,000
HH-4	Operations of Keno Dam	All Dams	$40,326,000	1.5	$60,489,000
HH-5	Highway 66 Bridge foundation	J.C. Boyle	$500,000		$1,500,000
SE-1	Presence of sediment	J.C. Boyle	$5,464,000	2.0	$10,928,000
SE-5	Presence of sediment	Copco No. 1	$93,560,000	2.0	$187,120,000
SE-9	Presence of sediment	Iron Gate	$76,379,000	2.0	$152,758,000

Table 3-17. Klamath Dam Decommissioning Liability Investigation Liability Cost Estimate (Quantifiable Costs)

Liability Cost Estimates			***Cost Estimate***		
Liability #	***Liability Description***	***Dam Affected***	***Low Estimate***	***Risk Factor***	***High Estimate***
WQ 1, 2, 3	Downstream water quality during decommissioning	All Dams	$899,000	1.5	$899,000
AQ-2	Loss of spawning areas	All Dams	$45,000	1.0	$45,000
AQ-6	Iron Gate Fish Hatchery funding	Klamath Downstream	Presented above as structure removal cost	1.0	Presented above as structure removal cost
TE-1,3	Change in wetland habitat and loss of habitat	All Dams	$48,000	1.5	$72,000
TE-2	Invasive species	All Dams	$5,600	1.5	$8,400
SR-1	Reservoir restoration	J.C. Boyle	$2,510,000	1.5	$3,765,000
SR-4	Reservoir restoration	Copco No.1	$16,582,000	1.5	$24,873,000
SR-5	Reservoir restoration	Copco No.2	$175,000	1.0	$175,000
SR-7	Reservoir restoration	Iron Gate	$15,946,000	1.5	$23,919,000
RE-1,2	PacifiCorp land ownership and Diminution in Property Value	J.C. Boyle, Copco No. 2 & Iron Gate	$3,375,000		$12,000,000
RE-3	PacifiCorp land ownership	Copco No.1	$2,500,000		$3,750,000
RE-4	Diminution in property value	Copco No.1	$7,500,000	1.5	$11,250,000
RC-1,4,6	Loss of flatwater recreation	J.C. Boyle, Copco No. 1 & Iron Gate	$288,000		$341,000
RC-2,5,7	Increased distance to water feature	J.C. Boyle, Copco No. 1 & Iron Gate	$488,000		$488,000
RC-3,8	Changes in recreational opportunities	J.C. Boyle, Copco No. 1 & Iron Gate	$1,446,000		$3,744,000
PO–1,2	Loss and replacement of renewable power source	All Dams	$65,169,000		$171,911,000
EC-1, 3, 5, 7	Loss of payroll	All Dams	$4,067,000		$4,067,000
EC-2, 4, 6, 8	Loss of regional fisheries	All Dams	$11,896,000[2]		$66,406,000[2]
Liabilities Subtotal			$337,672,600		$674,702,400
Decommissioning Design, Studies and Programmatic Costs at 10%			$33,767,300[3]		$67,470,200[3]
Total			**$465,870,200**		**$836,602,900**

Notes:

1. Physical structure removal cost calculated using the values presented in GEC 2006 with the GEC estimate for hydroseeding removed to prevent double counting with the estimates presented in SR-1, SR-3, SR-4, and SR-6.
2. Not included in total: since sediment removal should negate fisheries' impacts and the sediment removal costs are included in the total, fishery liabilities are noted here, but will not be included in the total.
3. 10% contingency calculated using the liabilities subtotal, the contingency does not consider the physical structure removal cost estimates to avoid duplication of contingency estimation completed by GEC in its estimate.

Table 3-18. Klamath Dam Decommissioning Liability Investigation Summary Costs for J.C. Boyle

		Cost Estimate		
Physical Structure Removal Costs		***Low Estimate***		***High Estimate***
Physical Structure Removal		$9,818,800		$9,818,800
Water/Construction/Engineering & Permitting		$5,607,700		$5,607,700
Escalation of Removal, Water/Cons./Eng. & Permit		$1,419,200		$1,419,200
Artificial River Bed		$69,000		$69,000
Physical Structure Removal Subtotal		$16,914,700		$16,914,700
Liability Cost Estimates				
Liability #	***Liability Description***	***Low Estimate***	***Risk Factor***	***High Estimate***
HW-1 to HW-4	Hazardous Waste Mitigation and Cleanup	$100,000	1.5	$150,000
HH-5	Highway 66 Bridge foundation	$500,000		$1,500,000
SE-1	Presence of sediment	$5,464,000	2.0	$10,928,000
SR-1	Reservoir restoration	$2,510,000	1.5	$3,765,000
Liabilities Subtotal		$8,574,000		$16,343,000
Total		**$25,488,700**		**$33,257,700**

Table 3-19. Klamath Dam Decommissioning Liability Investigation Summary Costs for Copco No. 1

		Cost Estimate		
Physical Structure Removal Costs		***Low Estimate***		***High Estimate***
Physical Structure Removal		$14,568,800		$14,568,800
Water/Construction/Engineering & Permitting		$8,320,500		$8,320,500
Escalation of Removal, Water/Cons./Eng. & Permit		$2,105,800		$2,105,800
Artificial River Bed		$385,000		$385,000
Physical Structure Removal Subtotal		$25,380,100		$25,380,100
Liability Cost Estimates				
Liability #	***Liability Description***	***Low Estimate***	***Risk Factor***	***High Estimate***
HW-5 to HW-9	Hazardous Waste Mitigation and Cleanup	$100,000	1.5	$150,000
SE-5	Presence of sediment	$93,560,000	2.0	$187,120,000
SR-4	Reservoir restoration	$16,582,000	1.5	$24,873,000
RE-3	PacifiCorp land ownership	$2,500,000		$3,750,000
RE-4	Diminution in property value	$7,500,000	1.5	$11,250,000
Liabilities Subtotal		$120,242,000		$227,143,000
Total		**$145,622,100**		**$252,523,100**

Table 3-20. Klamath Dam Decommissioning Liability Investigation Summary Costs for Copco No. 2

		Cost Estimate		
Physical Structure Removal Costs		***Low Estimate***		***High Estimate***
	Physical Structure Removal	$3,367,500		$3,367,500
	Water/Construction/Engineering & Permitting	$1,923,200		$1,923,200
	Escalation of Removal, Water/Cons./Eng. & Permit	$486,700		$486,700
	Artificial River Bed	$335,000		$335,000
Physical Structure Removal Subtotal		$6,112,400		$6,112,400
Liability Cost Estimates				
Liability #	***Liability Description***	***Low Estimate***	***Risk Factor***	***High Estimate***
HW-10 to HW-13	Hazardous Waste Mitigation and Cleanup	$100,000	1.5	$150,000
SR-5	Reservoir restoration	$175,000	1.0	$175,000
Liabilities Subtotal		$275,000		$325,000
Total		**$6,387,400**		**$6,437,400**

Table 3-21. Klamath Dam Decommissioning Liability Investigation Summary Costs for Iron Gate

		Cost Estimate		
Physical Structure Removal Costs		***Low Estimate***		***High Estimate***
	Physical Structure Removal	$20,142,200		$20,142,200
	Water/Construction/Engineering & Permitting	$11,503,500		$11,503,500
	Iron Gate Fish Hatchery Funding	$10,500,000		$10,500,000
	Escalation of Removal, Water/Cons./Eng. & Permit	$3,877,400		$3,877,400
Physical Structure Removal Subtotal		$46,023,100		$46,023,100
Liability Cost Estimates				
Liability #	***Liability Description***	***Low Estimate***	***Risk Factor***	***High Estimate***
HW-14 to HW-18	Hazardous Waste Mitigation and Cleanup	$100,000	1.5	$150,000
SE-9	Presence of sediment	$76,379,000	2.0	$152,758,000
AQ-6	Iron Gate Fish Hatchery funding	Presented above as structure removal cost	1.0	Presented above as structure removal cost
SR-7	Reservoir restoration	$15,946,000	1.5	$23,919,000
Liabilities Subtotal		$92,425,000		$176,827,000
Total		**$138,448,100**		**$222,850,100**

Table 3-22. Klamath Dam Decommissioning Liability Investigation Summary Costs for Liabilities Associated With More Than One Dam Facility

Liability Cost Estimates			***Cost Estimate***		
Liability #	***Liability Description***		***Low Estimate***	***Risk Factor***	***High Estimate***
HH-4	Operations of Keno Dam	All Dams	$40,326,000	1.5	$60,489,000
WQ 1, 2, 3	Water temperature, sediment, DO, TSS	All Dams	$899,000	1.5	$899,000
AQ-2	Loss of spawning areas	All Dams	$45,000	1.0	$45,000
TE-1,3	Change in wetland habitat and loss of habitat	All Dams	$48,000	1.5	$72,000
TE-2	Invasive species	All Dams	$5,600	1.5	$8,400
RE-1,2	PacifiCorp land ownership	J.C. Boyle, Copco No. 2 & Iron Gate	$3,375,000		$12,000,000
RC-1,4,6	Loss of flatwater recreation	J.C. Boyle, Copco No. 1 & Iron Gate	$288,000		$341,000
RC-2,5,7	Increased distance to water feature	J.C. Boyle, Copco No. 1 & Iron Gate	$488,000		$488,000
RC-3,8	Changes in recreational opportunities	J.C. Boyle, Copco No. 1 & Iron Gate	$1,446,000		$3,744,000
PO–1,2	Loss and replacement of renewable power source	All Dams	$65,169,000		$171,911,000
EC-1, 3, 5, 7	Loss of payroll	All Dams	$4,067,000		$4,067,000
EC-2, 4, 6, 8	Loss of regional fisheries	All Dams	$11,896,000[1]		$66,406,000[1]
Total			**$116,156,600**		**$254,064,400**

Notes:

1. Not included in total: since sediment removal should negate fisheries' impacts and the sediment removal costs are included in the total, fishery liabilities are noted here, but will not be included in the total.

Table 3-23. Klamath Dam Decommissioning Liability Investigation Unquantifiable Liabilities

Liability #	***Liability Description***	***Dam Affected***
HH-1	Downstream flooding	All Dams
HH-3	Concurrent reservoir drawdown and sediment passage	All Dams
HH-8	Downstream hydrograph change	Iron Gate
SE-2	Composition of sediment	J.C. Boyle
SE-3	Organic content of sediment	J.C. Boyle
SE-4	Drawdown rates	J.C. Boyle
SE-6	Composition of sediment	Copco No. 1
SE-7	Organic content of sediment	Copco No. 1
SE-8	Drawdown rates	Copco No. 1
SE-10	Composition of sediment	Iron Gate
SE-11	Organic content of sediment	Iron Gate
SE-12	Drawdown rates	Iron Gate
SE-13	Water availability	Iron Gate
GW-1	Decreased groundwater contribution to river	All Dams
GW-2	Rising groundwater	All Dams
GW-3	Contamination through sediment leaching	All Dams
WQ-4	CWA Compliance at Keno Reservoir	All Dams
AQ-1	Alteration in fish diseases	All Dams
AQ-3	Alteration in fish diseases	Klamath Downstream
AQ-4	Loss of spawning areas	Klamath Downstream
AQ-6	Downstream channel geomorphology changes	Klamath Downstream
AQ-7	Invasive Aquatic Species	Klamath Downstream
TE-4	Changes in wetland habitat	Klamath Downstream
TE-5	Loss of habitat	Klamath Downstream
SR-2	Bypass reach restoration	J.C. Boyle
SR-3	J.C. Boyle Spillway restoration	J.C. Boyle
SR-6	Bypass reach restoration	Copco No.2
SR-8	River Restoration	Klamath Downstream
SA-1	Boating Hazards, Changes in H&H	All Dams
SA-2	Swimming Hazards, Changes in H&H and Water Quality	All Dams
SA-3	Downstream flooding during decommissioning	All Dams
SA-4	Dam decommissioning construction and Engineering	All Dams
CH-1	Effects on historic structures	J.C. Boyle
CH-2	Effects on archaeological sites	J.C. Boyle
CH-3	Effects on TCPs	J.C. Boyle
CH-4	Effects on historic structures	Copco No.1
CH-5	Effects on archaeological sites	Copco No.1
CH-6	Effects on TCPs	Copco No.1
CH-7	Effects on historic structures	Copco No.2
CH-8	Effects on archaeological sites	Copco No.2
CH-9	Effects on TCPs	Copco No.2
CH-10	Effects on archaeological sites	Iron Gate
CH-11	Effects on TCPs	Iron Gate
PO-3	Loss of renewable energy	All Dams

Table 3-23. Klamath Dam Decommissioning Liability Investigation Unquantifiable Liabilities

Liability #	*Liability Description*	*Dam Affected*
RL-1	FERC Authority to impose mitigation	All Dams
RL-2	CWA Compliance	All Dams
RL-3	ITAs	All Dams
RL-4	Potential for litigation	All Dams

Table 3-24. Klamath Dam Decommissioning Liability Investigation Liability Cost Estimated in other Subsections

Liability #	*Liability Description*	*Dam Affected*	*Cost Estimate Location*
HH-2	Changes in river hydrograph- loss of boating	All Dams	3.6.3, Recreation
HH-6	No low water outlet structure	Copco No. 1	Subsection 3.3/Table 3-17
HH-7	Dam foundation removal	Copco No. 1	Subsection 3.3/Table 3-17
HH-9	Iron Gate Hatchery Water	Iron Gate	3.5.1 Aquatic Resources
AQ-5	Iron Gate Fish Hatchery funding	Klamath Downstream	Subsection 3.3/Table 3-17
AE-1	Alteration of waterfront views	J. C. Boyle	3.6.3, Recreation
AE-2	"Rings" in landscape	J. C. Boyle	3.5.3, Site Restoration
AE-3	Incomplete structure removal	J. C. Boyle	3.5.3, Site Restoration & 3.6.3, Recreation
AE-4	Visual changes in river channel	J. C. Boyle	3.6.3, Recreation
AE-5	Alteration of waterfront views	Copco No.1	2.6.1, Real Estate
AE-6	"Rings" in landscape	Copco No.1	3.5.3, Site Restoration
AE-7	Incomplete structure removal	Copco No.1	3.5.3, Site Restoration & 3.6.3, Recreation
AE-8	Visual changes in river channel	Copco No.1	3.6.3, Recreation
AE-9	Incomplete structure removal	Copco No.2	3.5.3, Site Restoration & 3.6.3, Recreation
AE-10	Alteration of waterfront views	Iron Gate	3.6.3, Recreation
AE-11	"Rings" in landscape	Iron Gate	3.5.3, Site Restoration
AE-12	Incomplete structure removal	Iron Gate	3.6.3, Recreation
AE-13	Visual changes in river channel	Iron Gate	3.6.3, Recreation

Chapter 4
Summary of Findings

This section presents a summary of important findings related to assessing and costing the liabilities for removal of the four dams on the Klamath River.

1. The KDDP Team identified approximately 130 physical, biological and socioeconomic liabilities associated with the decommissioning action. These liabilities were ranked in terms of their liability level (low, moderate, or high) and associated uncertainty. The top 28 liabilities ranked “high” would represent a very large percentage of the decommissioning cost. The remaining liabilities represent a small cost in comparison to the overall decommissioning action. Future study should focus on the liabilities with high potential cost and/or high uncertainty. These liabilities are shown in Table 4-1.

2. Previous cost estimates for dam and powerhouse removal, estimated at approximately $90 million, appear to be an accurate and representative cost for this effort. The KDDP Team developed two additional line items described in Subsection 3.3 that increased the physical structure removal estimate by approximately $3 million. The team adjusted this cost to a present day (2008) value of $94 million.

3. Dam Decommissioning cost for the identifiable liabilities with quantifiable costs would range from $466 million to $837 million, with removal of structures representing approximately 11 percent of the total cost for the high estimate and approximately 20 percent of the total cost for the low estimate. Costs for liabilities that were identified but could not be quantified as a part of this study could potentially increase project costs.

4. Decommissioning approaches reviewed as part of this study proposed and evaluated the passage of sediment to the lower Klamath River and to the Pacific Ocean. The NCRWQCB effectively prohibits the discharge of sediments (suspended or depositional) from construction projects, and places dam decommissioning in this category. Further, the mouth of the Klamath Rive at the Pacific Ocean is an ASBS, which also restricts sediment discharge. Different approaches to sediment management would be

required to meet the NCRWQCB's Basin Plan sediment measures and action plan guidelines and the California Ocean Plan.

5. The Federal Power Act grants FERC significant authority to impose mitigation and restoration measures related to project decommissioning, potentially including measures to address the liabilities described in this report. The actual extents of the decommissioning liabilities are dependent on future decisions by FERC and possible judicial review. The most direct method to mitigate potential open-ended Federal Power Act liability would be to obtain a FERC order stating the conditions that would be imposed upon decommissioning of the project.

6. There is the high potential for litigation with a dam removal program that proposes to pass large volumes of sediment due to the damage to downstream fisheries and the aquatic ecosystem. On other dam removal projects including the Condit dam on the White Salmon River, arguing the state's authority to issue a CWA 401 Water Quality Certification has been used as an effective litigation tool to impede a dam's removal. Other areas of potential litigation include socioeconomic losses to boating and real estate and the loss of renewable power. Potential litigation could come from the Lower Klamath River tribes, fishery groups, riparian residents, boaters, and recreational users. The Siskiyou County Board of Supervisors has openly opposed the Klamath dam removal program sighting many of the above issues, and in September 2007 started investigation on a litigation budget to challenge removing the dams (Siskiyou County 2007).

7. Dam decommissioning would result in the likely PacifiCorp divestiture of Keno Dam to Reclamation or another entity. The new owner/operator would be responsible for fish passage at Keno Dam and screening of three major canals on Keno Reservoir. Keno Dam would likely become the new water quality compliance point for water entering the lower Klamath River. Water quality in Keno Reservoir and Lake Ewauna has historically been very poor. Meeting water quality compliance goals and managing endangered fish species in Keno Reservoir, together with providing agricultural supply and return flow, will present significant challenges to the new operator.

Table 4-1. Liabilities Representing High levels of Liability and/or Uncertainty

Liability	Topic	Dam	Liability Level	Uncertainty
HH-3	Concurrent reservoir drawdown and sediment passage	All Dams	High	High
HH-4	Operations of Keno Dam	All Dams	High	Mod
HH-6	No low water outlet structure	Copco No. 1	High	Low
HH-7	Dam foundation removal	Copco No. 1	High	Mod
HH-9	Iron Gate Fish Hatchery	Iron Gate	High	High
SE-1	Presence of sediment	J.C. Boyle	High	High
SE-2	Composition of sediment	J.C. Boyle	High	High
SE-3	Sediment organic content	J.C. Boyle	Mod	High
SE-4	Reservoir drawdown rates	J.C. Boyle	Low	High
SE-5	Presence of sediment	Copco No. 1	High	High
SE-6	Composition of sediment	Copco No. 1	High	High
SE-7	Sediment organic content	Copco No. 1	Mod	High
SE-8	Reservoir drawdown rates	Copco No. 1	Low	High
SE-9	Presence of sediment	Iron Gate	High	High
SE-10	Composition of sediment	Iron Gate	High	High
SE-11	Sediment organic content	Iron Gate	Mod	High
SE-12	Reservoir drawdown rates	Iron Gate	Low	High
SE-13	Water temperature and sediment	Iron Gate	Mod	High
WQ-4	CWA Compliance at Keno Reservoir	All Dams	High	High
SR-4	Reservoir restoration	Copco No.1	High	Mod
RE-4	Diminution in property value	Copco No.1	High	Mod
PO–1	Loss of electricity currently generated	All Dams	High	Low
PO–2	Procurement of replacement power	All Dams	High	Low
PO–3	Removal of an emissions-free, renewable power source	All Dams	High	Low
RL-1	FERC Authority to impose mitigation	All Dams	High	High
RL-2	CWA Compliance	All Dams	High	High
RL-3	ITAs	All Dams	High	High
RL-4	Potential for litigation	All Dams	High	High

Chapter 5
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Chapter 6
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Appendix A
North Coast Regional Water Quality Control Board Water Quality Objectives

3. WATER QUALITY OBJECTIVES

The California Water Code, Division 7, Chapter 4, Section 13241 specifies that each Regional Water Quality Control Board (Regional Water Board) shall establish water quality objectives which, in the Regional Water Board's judgment, are necessary for the reasonable protection of the beneficial uses and for the prevention of nuisance.

The federal Clean Water Act (33 U.S.C. § 303) requires the State to submit to the Administrator of the U.S. Environmental Protection Agency for approval all new or revised water quality standards which are established for surface and ocean waters. Under federal terminology, water quality standards consist of the beneficial uses enumerated in Table 2-1 and the water quality objectives contained in this section. The water quality objectives contained herein are designed to satisfy all state and federal requirements.

As new information becomes available, the Regional Water Board will review the appropriateness of the objectives contained herein. These objectives will be subject to public hearing at least once during each three-year period following adoption of this Basin Plan to determine the need for review and modification as appropriate.

The water quality objectives contained herein are a compilation of objectives adopted by the State Water Board, the Regional Water Board, and other state and federal agencies. Other water quality objectives and policies may apply that may be more stringent. Whenever several different objectives exist for the same water quality parameter, the strictest objective applies. In addition, the State Water Board "Policy With Respect to Maintaining High Quality Waters in California" also applies. The state policy incorporates the federal Antidegradation Policy, where the federal Antidegradation Policy is applicable.

Controllable water quality factors shall conform to the water quality objectives contained herein. When other factors result in the degradation of water quality beyond the levels or limits established herein as water quality objectives, then controllable factors shall not cause further degradation of water quality. Controllable water quality factors are those actions, conditions, or circumstances resulting from man's activities that may influence the quality of the waters of the State and that may be reasonably controlled.

Water quality objectives form the basis for establishment of waste discharge requirements, waste discharge prohibitions, or maximum acceptable cleanup standards for all individuals and dischargers.

These water quality objectives are considered to be necessary to protect those present and probable future beneficial uses enumerated in Table 2-1 and to protect existing high quality waters of the State. These objectives will be achieved primarily through the establishment of waste discharge requirements and through the implementation of this Basin Plan. The appropriate numeric water quality standards will be established in waste discharge orders.

The Regional Water Board, in setting waste discharge requirements, will consider, among other things, the potential impact on beneficial uses within the area of influence of the discharge, the existing quality of receiving waters, and the appropriate water quality objectives. The Regional Water Board will make a finding as to the beneficial uses to be protected within the area of influence of the discharge and establish waste discharge requirements to protect those uses and to meet water quality objectives. Resolution Nos. 87-113, 89-131, and 92-135 describe the policy of the Regional Water Board regarding the specific types of waste discharge for which it will waive issuance of waste discharge requirements. These resolutions are included in the Appendix Section of this Plan.

The water quality objectives for the Region refer to several classes of waters. Ocean waters are waters of the Pacific Ocean outside of enclosed bays, estuaries, and coastal lagoons, and within the territorial (3 mile) limit. Bays are indentations along the coast which include oceanic waters within distinct headlands or harbor works whose narrowest opening is less than 75 percent of the greatest dimension of the enclosed portion of the bay; this definition includes only Crescent City Harbor in the Klamath River Basin, and Humboldt Bay and Bodega Bay in the North Coastal Basin. Estuaries are waters at the mouths of streams which serve as mixing zones for freshwater and seawater; they generally extend from the upstream limit of tidal action to a bay or open ocean. The principal estuarine areas of the Region are at the mouths of the Smith and Klamath Rivers, Lakes Earl and Talawa, and at the mouths of the Eel, Noyo, and Russian Rivers. Inland waters include all surface waters and groundwaters of the basin not included in the definitions of ocean waters, enclosed bays, or estuaries. Interstate waters include all rivers, streams, and lakes which flow across or form part of a state boundary. Groundwaters are any subsurface bodies of water which are beneficially used or usable. They include perched water if such water is used or usable or is hydraulically continuous with used or usable water.

The water quality objectives which follow supersede and replace those contained in the 1971 "Interim Water Quality Control Plan for the Klamath River Basin," the 1967 "Water Quality Control Policy for the Klamath River in California," the 1967 "Water Quality Control Policy for the Smith River in California," the 1967

"Water Quality Control Policy for the Humboldt-Del Norte Coastal Waters," the 1969 "Water Quality Control Policy for the Lost River," the 1971 "Interim Water Quality Control Plan for the North Coastal Basin," the 1967 "Water Quality Control Policy for the Sonoma-Mendocino Coast," the 1975 "Water Quality Control Plan for the Klamath River Basin (1A)," the 1975 "Water Quality Control Plan for the North Coastal Basin (1B)," and the 1988 "Water Quality Control Plan for the North Coast Region".

GENERAL OBJECTIVE

The following objective shall apply to all waters of the Region.

Whenever the existing quality of water is better than the water quality objectives established herein, such existing quality shall be maintained unless otherwise provided by the provisions of the State Water Resources Control Board Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California", including any revisions thereto. A copy of this policy is included verbatim in the Appendix Section of this Plan.

State Water Resources Control Board (State Board) Resolution No. 68-16 contains the state Antidegradation Policy. It is titled the “Statement of Policy with Respect to Maintaining High Quality Waters in California and is commonly known as “Resolution 68-16.” The State Water Board has interpreted Resolution No. 68-16 to incorporate the federal Antidegradation Policy where the federal policy applies. (State Board Order WQO 86-17). The federal policy is found at 40 CFR Section 131.12. The state and federal antidegradation policies are included as Appendices to the Basin Plan.

The state Antidegradation Policy applies more comprehensively to water quality changes than the federal policy. In particular, the state policy applies to both groundwater and surface waters whose quality meets or exceeds (is better than) water quality objectives. The state policy establishes two conditions that must be met before the quality of high quality waters may be lowered by waste discharges. First, the state must determine that lowering the quality of high quality waters:

1) Will be consistent with the maximum benefit to the people of the state,

2) Will not unreasonably affect present and anticipated beneficial uses of such water, and

3) Will not result in water quality less than that prescribed in state policies (e.g., water quality objectives in Water Quality Control Plans).

Second, any activities that result in discharges to high quality waters are required to a) meet waste discharge requirements that will result in the best practicable treatment or control of the discharge necessary to avoid pollution or nuisance and b) maintain the highest water quality consistent with the maximum benefit to the people of the state. If such treatment or control results in a discharge that maintains the existing high water quality, then a less stringent level of treatment or control would not be in compliance with 68-16.

Likewise, the discharge could not be allowed under Resolution 68-16 if a) the discharge, even after treatment, would unreasonably affect beneficial uses or b) would not comply with applicable provisions of water quality control plans.

The federal Antidegradation Policy applies to surface waters, regardless of the water quality. Where water quality is better than the minimum necessary to support instream uses, the federal policy requires that quality to be maintained and protected, unless the state finds, after ensuring public participation, that:

1) Such activity is necessary to accommodate important economic or social development in the area in which the waters are located,

2) Water quality is adequate to protect existing beneficial uses fully, and

3) The highest statutory and regulatory requirements for all new and existing point source discharges and all cost-effective and reasonable best management practices for non point source control are achieved.

Under this policy, an activity that results in discharge would be prohibited if the discharge will lower the quality of surface waters that do not currently attain water quality standards.

Both the state and federal antidegradation policies acknowledge that an activity that results in a minor water quality lowering, even if incrementally small, can result in a violation of antidegradation policies through cumulative effects, especially, for example, when the waste is a cumulative, persistent, or bioaccumulative pollutant.

The state and federal antidegradation policies are enforceable independent of this Basin Plan provision. The above summary of the state and federal antidegradation policies is provided merely for the convenience of the reader.

OBJECTIVES FOR OCEAN WATERS

The provisions of the State Water Board's "Water Quality Control Plan for Ocean Waters of California" (Ocean Plan), and "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California" (Thermal Plan), and any revisions thereto shall apply. Copies of these plans are included verbatim in the Appendix Section of this Plan.

OBJECTIVES FOR INLAND SURFACE WATERS, ENCLOSED BAYS, AND ESTUARIES

In addition to the General Objective, the specific objectives contained in Table 3-1 and the following objectives shall apply for inland surface waters, bays, and estuaries.

<u>Color</u>

Waters shall be free of coloration that causes nuisance or adversely affects beneficial uses.

<u>Tastes and Odors</u>

Waters shall not contain taste- or odor-producing substances in concentrations that impart undesirable tastes or odors to fish flesh or other edible products of aquatic origin, or that cause nuisance or adversely affect beneficial uses.

Numeric water quality objectives with regards to taste and odor thresholds have been developed by the State Department of Health Services and the U.S. EPA. These numeric objectives, as well as those available in the technical literature, are incorporated into waste discharge requirements and cleanup and abatement orders as appropriate.

<u>Floating Material</u>

Waters shall not contain floating material, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses.

<u>Suspended Material</u>

Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.

<u>Settleable Material</u>

Waters shall not contain substances in concentrations that result in deposition of material that causes nuisance or adversely affect beneficial uses.

<u>Oil and Grease</u>

Waters shall not contain oils, greases, waxes, or other materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or that otherwise adversely affect beneficial uses.

<u>Biostimulatory Substances</u>

Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses.

<u>Sediment</u>

The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.

<u>Turbidity</u>

Turbidity shall not be increased more than 20 percent above naturally occurring background levels. Allowable zones of dilution within which higher percentages can be tolerated may be defined for specific discharges upon the issuance of discharge permits or waiver thereof.

pH

The pH shall conform to those limits listed in Table 3-1. For waters not listed in Table 3-1 and where pH objectives are not prescribed, the pH shall not be depressed below 6.5 nor raised above 8.5. Changes in normal ambient pH levels shall not exceed 0.2 units in waters with designated marine (MAR) or saline (SAL) beneficial uses nor 0.5 units within the range specified above in fresh waters with designated COLD or WARM beneficial uses.

Dissolved Oxygen

Dissolved oxygen concentrations shall conform to those limits listed in Table 3-1. For waters not listed in Table 3-1 and where dissolved oxygen objectives are not prescribed the dissolved oxygen concentrations shall not be reduced below the following minimum levels at any time.

Waters designated WARM, MAR, or SAL ..... 5.0 mg/l
Waters designated COLD .... 6.0 mg/l
Waters designated SPWN.............................. 7.0 mg/l
Waters designated SPWN during critical spawning and egg incubation periods .... 9.0 mg/l

Bacteria

The bacteriological quality of waters of the North Coast Region shall not be degraded beyond natural background levels. In no case shall coliform concentrations in waters of the North Coast Region exceed the following:

In waters designated for contact recreation (REC-1), the median fecal coliform concentration based on a minimum of not less than five samples for any 30-day period shall not exceed 50/100 ml, nor shall more than ten percent of total samples during any 30-day period exceed 400/100 ml (State Department of Health Services).

At all areas where shellfish may be harvested for human consumption (SHELL), the fecal coliform concentration throughout the water column shall not exceed 43/100 ml for a 5-tube decimal dilution test or 49/100 ml when a three-tube decimal dilution test is used (National Shellfish Sanitation Program, Manual of Operation).

Temperature

Temperature objectives for COLD interstate waters, WARM interstate waters, and Enclosed Bays and Estuaries are as specified in the "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays of California" including any revisions thereto. A copy of this plan is included verbatim in the Appendix Section of this Plan. In addition, the following temperature objectives apply to surface waters:

The natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Water Board that such alteration in temperature does not adversely affect beneficial uses.

At no time or place shall the temperature of any COLD water be increased by more than 5°F above natural receiving water temperature.

At no time or place shall the temperature of WARM intrastate waters be increased more than 5°F above natural receiving water temperature.

Toxicity

All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, bioassays of appropriate duration, or other appropriate methods as specified by the Regional Water Board.

The survival of aquatic life in surface waters subjected to a waste discharge, or other controllable water quality factors, shall not be less than that for the same water body in areas unaffected by the waste discharge, or when necessary for other control water that is consistent with the requirements for "experimental water" as described in "**Standard Methods for the Examination of Water and Wastewater"**, 18th Edition (1992). As a minimum, compliance with this objective as stated in the previous sentence shall be evaluated with a 96-hour bioassay.

In addition, effluent limits based upon acute bioassays of effluents will be prescribed. Where appropriate, additional numerical receiving water objectives for specific toxicants will be established as sufficient data become available, and source control of toxic substances will be encouraged.

Pesticides

No individual pesticide or combination of pesticides shall be present in concentrations that adversely affect beneficial uses. There shall be no bioaccumulation of pesticide concentrations found in bottom sediments or aquatic life.

Waters designated for use as domestic or municipal supply shall not contain concentrations of pesticides in excess of the limiting concentrations set forth in California Code of Regulations, Title 22, Division 4,

Chapter 15, Article 4, Section 64444.5 (Table 5), and listed in Table 3-2 of this Plan.

Chemical Constituents

Waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of chemical constituents in excess of the limits specified in California Code of Regulations, Title 22, Chapter 15, Division 4, Article 4, Section 64435 (Tables 2 and 3), and Section 64444.5 (Table 5), and listed in Table 3-2 of this Plan.

Waters designated for use as agricultural supply (AGR) shall not contain concentrations of chemical constituents in amounts which adversely affect such beneficial use.

Numerical water quality objectives for individual waters are contained in Table 3-1.

Radioactivity

Radionuclides shall not be present in concentrations which are deleterious to human, plant, animal or aquatic life nor which result in the accumulation of radionuclides in the food web to an extent which presents a hazard to human, plant, animal, or indigenous aquatic life.

Waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of radionuclides in excess of the limits specified in California Code of Regulations, Title 22, Division 4, Chapter 15, Article 4, Section 64443, Table 4, and listed below:

MCL Radioactivity

Constituent	**Maximum Contaminant Level, pCi/l**
Combined Radium-226 and Radium-228	5
Gross Alpha particle activity (including Radium-226 but excluding Radon and Uranium)	15
Tritium	20,000
Strontium-90	8
Gross Beta particle activity	50
Uranium	20

TABLE 3-1

SPECIFIC WATER QUALITY OBJECTIVES FOR NORTH COAST REGION

	Specific Conductance (micromhos) @ 77°F		Total Dissolved Solids (mg/l)		Dissolved Oxygen (mg/l)			Hydrogen Ion (pH)		Hardness (mg/l)	Boron (mg/l)	
Waterbody[1]	90% Upper Limit[3]	50% Upper Limit[2]	90% Upper Limit[3]	50% Upper Limit[2]	Min	90% Lower Limit[3]	50% Lower Limit[2]	Max	Min	50% Upper Limit[2]	90% Upper Limit[3]	50% Upper Limit[2]
Lost River HA												
Clear Lake Reservoir & Upper Lost River	300	200			5.0		8.0	9.0	7.0	60	0.5	0.1
Lower Lost River	1000	700			5.0		-	9.0	7.0	-	0.5	0.1
Other Streams	250	150			7.0		8.0	8.4	7.0	50	0.2	0.1
Tule Lake	1300	900			5.0		-	9.0	7.0	400	-	-
Lower Klamath Lake	1150	850			5.0		-	9.0	7.0	400	-	-
Groundwaters [4]	1100	500			-		-	8.5	7.0	250	0.3	0.2
Butte Valley HA												
Streams	150	100			7.0		9.0	8.5	7.0	30	0.1	0.0
Meiss Lake	2000	1300			7.0		8.0	9.0	7.5	100	0.3	0.1
Groundwaters [4]	800	400			-		-	8.5	6.5	120	0.2	0.1
Shasta Valley HA												
Shasta River	800	600			7.0		9.0	8.5	7.0	220	1.0	0.5
Other Streams	700	400			7.0		9.0	8.5	7.0	200	0.5	0.1
Lake Shastina	300	250			6.0		9.0	8.5	7.0	120	0.4	0.2
Groundwaters [4]	800	500			-		-	8.5	7.0	180	1.0	0.3
Scott River HA												
Scott River	350	250			7.0		9.0	8.5	7.0	100	0.4	0.1
Other Streams	400	275			7.0		9.0	8.5	7.0	120	0.2	0.1
Groundwaters [4]	500	250			-		-	8.0	7.0	120	0.1	0.1
Salmon River HA												
All Streams	150	125			9.0		10.0	8.5	7.0	60	0.1	0.0
Middle Klamath River HA												
Klamath River above Iron Gate Dam including Iron Gate & Copco Reservoirs	425	275			7.0		10.0	8.5	7.0	60	0.3	0.2
Klamath River below Iron Gate Dam	350	275			8.0		10.0	8.5	7.0	80	0.5	0.2
Other Streams	300	150			7.0		9.0	8.5	7.0	60	0.1	0.0
Groundwaters [4]	750	600			-		-	8.5	7.5	200	0.3	0.1
Applegate River HA												
All Streams	250	175			7.0		9.0	8.5	7.0	60	-	-
Upper Trinity River HA												
Trinity River [5]	200	175			7.0		10.0	8.5	7.0	80	0.1	0.0
Other Streams	200	150			7.0		10.0	8.5	7.0	60	0.0	0.0
Clair Engle Lake and Lewiston Reservoir	200	150			7.0		10.0	8.5	7.0	60	0.0	0.0

TABLE 3-1 (CONTINUED)

SPECIFIC WATER QUALITY OBJECTIVES FOR NORTH COAST REGION

Waterbody[1]	Specific Conductance (micromhos) @ 77°F		Total Dissolved Solids (mg/l)		Dissolved Oxygen (mg/l)			Hydrogen Ion (pH)		Hardness (mg/l)	Boron (mg/l)	
	90% Upper Limit[3]	50% Upper Limit[2]	90% Upper Limit[3]	50% Upper Limit[2]	Min	90% Lower Limit[3]	50% Lower Limit[2]	Max	Min	50% Upper Limit[2]	90% Upper Limit[3]	50% Upper Limit[2]
Hayfork Creek												
Hayfork Creek	400	275			7.0		9.0	8.5	7.0	150	0.2	0.1
Other Streams	300	250			7.0		9.0	8.5	7.0	125	0.0	0.0
Ewing Reservoir	250	200			7.0		9.0	8.0	6.5	150	0.1	0.0
Groundwaters[4]	350	225			-		-	8.5	7.0	100	0.2	0.1
S.F. Trinity River HA												
S.F. Trinity River	275	200			7.0		10.0	8.5	7.0	100	0.2	0.0
Other Streams	250	175			7.0		9.0	8.5	7.0	100	0.0	0.0
Lower Trinity River HA												
Trinity River	275	200			8.0		10.0	8.5	7.0	100	0.2	0.0
Other Streams	250	200			9.0		10.0	8.5	7.0	100	0.1	0.0
Groundwaters[4]	200	150			-		-	8.5	7.0	75	0.1	0.1
Lower Klamath River HA												
Klamath River	300[6]	200[6]			8.0		10.0	8.5	7.0	75[6]	0.5[6]	0.2[6]
Other Streams	200[6]	125[6]			8.0		10.0	8.5	6.5	25[6]	0.1[6]	0.0[6]
Groundwaters[4]	300	225			-		-	8.5	6.5	100	0.1	0.0
Illinois River HA												
All Streams	200	125			8.0		10.0	8.5	7.0	75	0.1	0.0
Winchuck River HU												
All Streams	200[6]	125[6]			8.0		10.0	8.5	7.0	50[6]	0.0[6]	0.0[6]
Smith River HU												
Smith River-Main Forks	200	125			8.0		11.0	8.5	7.0	60	0.1	0.1
Other Streams	150[6]	125[6]			7.0		10.0	8.5	7.0	60[6]	0.1[6]	0.0[6]
Smith River Plain HSA												
Smith River	200[6]	150[6]			8.0		11.0	8.5	7.0	60[6]	0.1[6]	0.0[6]
Other Streams	150[6]	125[6]			7.0		10.0	8.5	6.5	60[6]	0.1[6]	0.0[6]
Lakes Earl & Talawa	-	-			7.0		9.0	8.5	6.5	-	-	-
Groundwaters[4]	350	100			-		-	8.5	6.5	75	1.0	0.0
Crescent City Harbor	-	-										
Redwood Creek HU												
Redwood Creek	220[6]	125[6]	115[6]	75[6]	7.0	7.5	10.0	8.5	6.5			
Mad River HU												
Mad River	300[6]	150[6]	160[6]	90[6]	7.0	7.5	10.0	8.5	6.5			
Eureka Plain HU												
Humboldt Bay	-	-	-	-	6.0	6.2	7.0	8.5	7			
Eel River HU												
Eel River	375[6]	225[6]	275[6]	140[6]	7.0	7.5	10.0	8.5	6.5			
Van Duzen River	375	175	200	100	7.0	7.5	10.0	8.5	6.5			

TABLE 3-1 (CONTINUED)

SPECIFIC WATER QUALITY OBJECTIVES FOR NORTH COAST REGION

	Specific Conductance (micromhos) @ 77°F		**Total Dissolved Solids (mg/l)**		**Dissolved Oxygen (mg/l)**			**Hydrogen Ion (pH)**		**Hardness (mg/l)**	**Boron (mg/l)**	
Waterbody[1]	**90% Upper Limit[3]**	**50% Upper Limit[2]**	**90% Upper Limit[3]**	**50% Upper Limit[2]**	**Min**	**90% Lower Limit[3]**	**50% Lower Limit[2]**	**Max**	**Min**	**50% Upper Limit[2]**	**90% Upper Limit[3]**	**50% Upper Limit[2]**
South Fork Eel River	350	200	200	120	7.0	7.5	0.0	8.5	6.5			
Middle Fork Eel River	450	200	230	130	7.0	7.5	10.0	8.5	6.5			
Outlet Creek	400	200	230	125	7.0	7.5	10.0	8.5	6.5			
Cape Mendocino HU												
Bear River	390[6]	255[6]	240[6]	150[6]	7.0	7.5	10.0	8.5	6.5			
Mattole River	300[6]	170[6]	170[6]	105[6]	7.0	7.5	10.0	8.5	6.5			
Mendocino Coast HU												
Ten Mile River	-	-	-	-	7.0	7.5	10.0	8.5	6.5			
Noyo River	185[6]	150[6]	120[6]	105[6]	7.0	7.5	10.0	8.5	6.5			
Jug Handle Creek	-	-	-	-	7.0	7.5	10.0	8.5	6.5			
Big River	300[6]	195[6]	190[6]	130[6]	7.0	7.5	10.0	8.5	6.5			
Albion River	-	-	-	-	7.0	7.5	10.0	8.5	6.5			
Navarro River	285[6]	250[6]	170[6]	150[6]	7.0	7.5	10.0	8.5	6.5			
Garcia River	-	-	-	-	7.0	7.5	10.0	8.5	6.5			
Gualala River	-	-	-	-	7.0	7.5	10.0	8.5	6.5			
Russian River HU												
(upstream) [8]	320	250	170	150	7.0	7.5	10.0	8.5	6.5			
(downstream) [9]	375[6]	285[6]	200[6]	170[6]	7.0	7.5	10.0	8.5	6.5			
Laguna de Santa Rosa	-	-	-	-	7.0	7.5	10.0	8.5	6.5			
Bodega Bay	-	-	-	-	6.0	6.2	7.0	8.5	7			
Coastal Waters [10]	-	-	-	-	11	11	11	12	12			

1 Water bodies are grouped by hydrologic unit (HU), hydrologic area (HA), or hydrologic subarea (HSA).

2 50% upper and lower limits represent the 50 percentile values of the monthly means for a calendar year. 50% or more of the monthly means must be less than or equal to an upper limit and greater than or equal to a lower limit.

3 90% upper and lower limits represent the 90 percentile values for a calendar year. 90% or more of the values must be less than or equal to an upper limit and greater than or equal to a lower limit.

4 Value may vary depending on the aquifer being sampled. This value is the result of sampling over time, and as pumped, from more than one aquifer.

5

Daily Average Not to Exceed	Period	River Reach
60°F	July 1 - Sept. 14	Lewiston Dam to Douglas City Bridge
56°F	Sept. 15 - Oct. 1	Lewiston Dam to Douglas City Bridge
56°F	Oct. 1 - Dec. 31	Lewiston Dam to confluence of North Fork Trinity River

6 Does not apply to estuarine areas.

7 pH shall not be depressed below natural background levels.

8 Russian River (upstream) refers to the mainstem river upstream of its confluence with Laguna de Santa Rosa.

9 Russian River (downstream) refers to the mainstem river downstream of its confluence with Laguna de Santa Rosa.

10 The State's Ocean Plan applies to all North Coast Region coastal waters.

11 Dissolved oxygen concentrations shall not at any time be depressed more than 10 percent from that which occurs naturally.

12 pH shall not be changed at any time more than 0.2 units from that which occurs naturally.

\- no water body specific objective available.

TABLE 3-2

INORGANIC, ORGANIC, AND FLUORIDE CONCENTRATIONS NOT TO BE EXCEEDED IN DOMESTIC OR MUNICIPAL SUPPLY [1, 2]

Constituent	Lower	Optimum	Upper	Maximum Contaminant Level, mg/L
	LIMITING CONCENTRATION IN MILLIGRAMS PER LITER			
Fluoride [3]				
53.7 and below	0.9	1.2	1.7	2.4
53.8 to 58.3	0.8	1.1	1.5	2.2
58.4 to 63.8	0.8	1.0	1.3	2.0
63.9 to 70.6	0.7	0.9	1.2	1.8
70.7 to 79.2	0.7	0.8	1.0	1.6
79.3 to 90.5	0.6	0.7	0.8	1.4
Inorganic Chemicals				
* Aluminum				1.0
Arsenic				0.05
Barium				1.0
Cadmium				0.01
Chromium				0.05
Lead				0.05
Mercury				0.002
Nitrate-N (as NO_3)				45.
Selenium				0.01
Silver				0.05
Organic Chemicals				
(a) Chlorinated Hydrocarbons				
Endrin				0.0002
Lindane				0.004
Methoxychlor				0.1
Toxaphene				0.005
(b) Chlorophenoxys				
2,4-D				0.1
2,4,5-TP (Silvex)				0.01
(c) Synthetics				
Atrazine				0.003
Bentazon				0.018
Benzene				0.001
Carbon Tetrachloride				0.0005
Carbofuran				0.018
Chlordane				0.0001

TABLE 3-2 (CONTINUED)

INORGANIC, ORGANIC, AND FLUORIDE CONCENTRATIONS NOT TO BE EXCEEDED IN DOMESTIC OR MUNICIPAL SUPPLY [1, 2]

LIMITING CONCENTRATION IN MILLIGRAMS PER LITER

Constituent	Maximum Contaminant Level, mg/L
(c) Synthetics (cont'd.)	
1,2-Dibromo-3-chloropropane	0.0002
1,4-Dichlorobenzene	0.005
1,1-Dichloroethane	0.005
1,2-Dichloroethane	0.0005
cis-1,2-Dichloroethylene	0.006
trans-1,2-Dichloroethylene	0.01
1,1-Dichloroethylene	0.006
1,2-Dichloropropane	0.005
1,3-Dichloropropene	0.0005
Di(2-ethylhexyl)phthalate	0.004
* Ethylbenzene	0.680
Ethylene Dibromide	0.00002
Glyphosate	0.7
Heptachlor	0.00001
Heptachlor epoxide	0.00001
Molinate	0.02
Monochlorobenzene	0.030
Simazine	0.010
1,1,2,2-Tetrachloroethane	0.001
Tetrachloroethylene	0.005
* Thiobencarb	0.07
1,1,1-Trichloroethane	0.200
1,1,2-Trichloroethane	0.032
Trichloroethylene	0.005
Trichlorofluoromethane	0.15
1,1,2-Trichloro-1,2,2-Trifluoroethane	1.2
Vinyl Chloride	0.0005
* Xylenes [4]	1.750

[1] Values included in this table have been summarized from California Code of Regulations, Title 22, Division 4, Chapter 15, Article 4, Sections 64435 (Tables 2 and 3) and 64444.5 (Table 5).

[2] The values included in this table are maximum contaminant levels for the purposes of groundwater and surface water discharges and cleanup. Other water quality objectives (e.g., taste and odor thresholds or other secondary MCLs) and policies (e.g., State Water Board "Policy With Respect to Maintaining High Quality Waters in California") that are more stringent may apply.

[3] Annual Average of Maximum Daily Air Temperature, °F Based on temperature data obtained for a minimum of five years. The average concentration of fluoride during any month, if added, shall not exceed the upper concentration. Naturally occurring fluoride concentration shall not exceed the maximum contaminant level.

[4] Maximum Contaminant Level is for either a single isomer or the sum of the isomers.

* Constituents marked with an * also have taste and odor thresholds that are more stringent than the MCL listed. Taste and odor thresholds have also been developed for other constituents not listed in this table.

WATER QUALITY OBJECTIVES FOR GROUNDWATERS

General Objectives

Tastes and Odors

Groundwaters shall not contain taste- or odor-producing substances in concentrations that cause nuisance or adversely affect beneficial uses.

Numeric water quality objectives have been developed by the State Department of Health Services and U.S. EPA. These numeric objectives, as well as those available in the technical literature, are incorporated into waste discharge requirements and cleanup and abatement orders as appropriate.

Bacteria

In groundwaters used for domestic or municipal supply (MUN), the median of the most probable number of coliform organisms over any 7-day period shall be less than 1.1 MPN/100 ml, less than 1 colony/100 ml, or absent (State Department of Health Services).

Radioactivity

Groundwaters used for domestic or municipal supply (MUN) shall not contain concentrations of radionuclides in excess of the limits specified in California Code of Regulations, Title 22, Division 4, Chapter 15, Article 5, Section 64443, Table 4 and listed in Table 3-2 of this Plan.

Chemical Constituents

Groundwaters used for domestic or municipal supply (MUN) shall not contain concentrations of chemical constituents in excess of the limits specified in California Code of Regulations, Title 22, Division 4, Chapter 15, Article 4, Section 64435 Tables 2 and 3, and Section 64444.5 (Table 5) and listed in Table 3-2 of this Plan.

Groundwaters used for agricultural supply (AGR) shall not contain concentrations of chemical constituents in amounts that adversely affect such beneficial use.

Numerical objectives for certain constituents for individual groundwaters are contained in Table 3-1.
As part of the state's continuing planning process, data will be collected and numerical water quality objectives will be developed for those mineral and nutrient constituents where sufficient information is presently not available for the establishment of such objectives.

COMPLIANCE WITH WATER QUALITY OBJECTIVES

The Regional Water Board recognizes that immediate compliance with new effluent and/or receiving water NPDES permit limitations based on new, revised or newly interpreted water quality objectives or prohibitions adopted by the Regional Water Board or the State Water Resources Control Board, or with new, revised or newly interpreted water quality criteria promulgated by the U.S. Environmental Protection Agency (USEPA),[1] may not be technically and/or economically feasible[2] in all circumstances.

Where the Regional Water Board determines that it is infeasible for an existing discharger[3] to immediately comply with NPDES permit effluent limitations or where appropriate, receiving water limitations, specified to implement new, revised or newly interpreted water quality objectives, criteria or prohibitions; issuance of a schedule of compliance[4] may be appropriate.

Similarly, immediate compliance may not be technically and/or economically feasible for existing non-NPDES dischargers that, under new interpretation of law, are newly required to comply with new NPDES permitting requirements. Issuance of a schedule of compliance

1 New, revised, or newly interpreted water quality objectives, criteria, or prohibitions means: 1) objectives as defined in Section 13050(h) of Porter-Cologne; 2) criteria as promulgated by the USEPA; or 3) prohibitions as defined in the Water Quality Control Plan for the North Coast Region that are adopted, revised, or newly interpreted after November 29, 2006. Objectives and criteria may be narrative or numeric.

2 Technical and economic feasibility shall be determined consistent with State Board Resolution No. 92-49.

3 Existing discharger as defined in the State "Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California," (CTR-SIP) means: any discharger (non-NPDES or NPDES) that is not a new discharger. An existing discharger includes an increasing discharger (i.e., an existing facility, with treatment systems in place for its current discharge that is or will be expanding, upgrading, or modifying its existing permitted discharge after November 29, 2006). A new discharger includes any building, structure, facility, or installation from which there is, or may be, a discharge of pollutants, the construction of which commenced after November 29, 2006.

4 Schedule of compliance: as defined in Section 502 (17) of the Clean Water Act, means: a schedule of remedial measures including an enforceable sequence of actions or operations leading to compliance with an effluent limitation, other limitation, prohibition, or standard.

may be appropriate in these circumstances as well, to comply with effluent and/or receiving water limitations specified to implement objectives, criteria, or prohibitions that are adopted, revised, or reinterpreted after July 1, 1977, and that were not included in the non-NPDES permit.

Any schedule of compliance shall require achievement of the effluent limitations and/or receiving water limitations within the shortest feasible period of time, taking into account the factors identified in Chapter 4 for the implementation of schedules of compliance. All schedules of compliance will be limited to the time frames set out in Chapter 4.

DRAFT

Measures to Reduce Excess Sediment

I. Purpose:

The Regional Board's intent is to establish a program that will be effective in controlling the discharge of excess sediment into the waters of the state in the North Coast Region by (1) adopting a Prohibition of Excess Sediment to the Basin Plan, and (2) developing an Implementation Plan for both landowners and the Regional Board staff. This Prohibition is intended to encourage application of protective measures that will control the discharge of human-caused (anthropogenic) excess sediment and help meet the Region's water quality standards.

II. Overview and Applicability:

Erosion occurs on the landscape as a natural process. That said, measures are needed that will control the discharge of excessive amounts of sediment to waters of the state by anthropogenic activities. The Regional Board's approach reflects the need for preventing, minimizing and controlling erosion on a scale of cubic yards based on a particular site or area (Option 1).

Or

Erosion occurs on the landscape as a natural process. That said, measures are needed that will control the discharge of excessive amounts of sediment to waters of the state by anthropogenic activities. The Regional Board's approach reflects the need for preventing, minimizing and controlling erosion in an amount that could be deleterious to beneficial uses or causes nuisance based on a particular site or area (Option 2).

This program creates no new administrative authorities. It provides landowners a path they can follow to achieve compliance with the State's Nonpoint Source Pollution (NPS) Control Program. It also gives Regional Board staff a framework to use to assess and respond appropriately to a discharge or threat of a discharge of excess sediment. The Regional Board's preference is to utilize the progressive enforcement option as outlined in the SWRCB's 2002 Enforcement Policy and the 2004 Nonpoint Source Implementation and Enforcement (NPS) Policy.

Types of anthropogenic activities that could result in a discharge of excess sediment from point or nonpoint sources include but are not limited to:

- Construction;
- Mining;

- Agriculture, including ranching, grazing, and farming;
- Dairies and other types of confined animal operation;
- Road construction, reconstruction, maintenance and decommissioning;
- Timber harvesting;
- Other earth-disturbing activities.

III. Prohibition:

The addition of an Excess Sediment Prohibition to the Basin Plan is necessary to comply with title 23, California Code of Regulations, section 2915, and the statewide *Policy for the Implementation and Enforcement of the Nonpoint Source Pollution Control Program* (2004) (NPS Policy).

The State Board's NPS Policy makes available three options or approaches to be used statewide to control nonpoint sources of pollution:

1) The use of a prohibition;
2) Waste discharge requirements (WDRs); or
3) A waiver of WDRs.

The Regional Board finds that Option # 1, a "Prohibition" offers the most workable approach for use in the North Coast Region for those activities not covered by waiver, WDR or other formal Board action.

Therefore, the following language is proposed as an amendment to the Basin Plan: "Prohibition of Excess Sediment". It would apply to all areas of the North Coast Region except for the Garcia River watershed which is regulated by the *Action Plan for the Garcia River Watershed Sediment TMDL.*

Prohibition of Excess Sediment: The discharge or threatened discharge of excess sediment from human caused activities to waters of the state is prohibited. Excess sediment is defined herein as soil, rock, and/or sediments (e.g. sand silt, or clay) discharged to waters of the state in an amount that could be deleterious to beneficial uses or cause a nuisance[1].

IV. Implementation Plan:

This Implementation Plan offers:

[1] Nuisance is defined in Water code section 13050.

A. Landowners the most effective way(s) to comply when planning, designing and implementing new projects or when taking corrective measures to reduce erosion from existing sources.

B. Instruction to Regional Water Board staff on procedures and actions they are to follow to implement the Prohibition.

IVa. Implementation Plan's Guidance for Landowners:

The Regional Board supports implementation of the following sequential elements by persons discharging or threatening to discharge excess sediment:

1. Prevent – Plan, design, and implement the project or activity in such a way that no excess sediment discharge occurs or could occur to waters of the state.

2. Minimize – If the discharge or threatened discharge of excess sediment cannot be fully prevented, then plan, design, and implement the project in such a way that discharges to waters of the state are minimized to the maximum extent possible.

Sediment control practices include, but are not limited to, project design, engineering and scheduling alternatives, and management measures, practices, and techniques that prevent and/or minimize discharges or threatened discharges of excess sediment.

Steps to be taken to address discharge of excess sediment from existing sources include:

1. Inventory: Identify sources of excess sediment or threatened discharge, and quantify the discharge or threatened discharge from the source(s).

2. Prioritize: Prioritize efforts to control discharge of excess sediment based on, but not limited to, severity of threat to water quality and beneficial uses, the feasibility of source control, and source site accessibility.

3. Implement: Develop, and implement feasible sediment control practices to prevent, minimize, and control the discharge.

4. Monitor and Adapt: Use monitoring results to direct adaptive management measures in order to refine and adjust erosion control practices and implementation schedules, until sediment discharges is reduced and no longer causes a violation of any sediment related narrative or numeric objective.

Landowners actively engaged in activities designed to come into compliance with the Prohibition will be considered on a path towards compliance.

IVa. Implementation Plan's Guidance for Regional Board and staff:

This policy recognizes the merits of progressive enforcement and encourages the Regional Board to take the most appropriate enforcement action based on circumstances of the case and Regional Board staff's workload. In cases where preventive or corrective action has not taken place, the Regional Water Board and/or staff will consider applying escalating series of actions as necessary.

Regional Board staff will develop and actively engage in education and outreach activities designed to inform the community of their responsibilities and obligations as well as to provide guidance on project design, implementation and monitoring.

For activities that may result in violation of the Prohibition, Regional Board staff may require a landowner to submit a ROWD. The ROWD shall include information demonstrating that the landowner has designed and will implement the proposed activities so as to minimize sediment discharge to the maximum extent possible

Guidance documents to aid landowners in coming into compliance with the Prohibition are available from a number of federal, state and local agencies, private stakeholder and interest groups and other non-governmental organizations. Guidance documents to help prevent and control sediment discharge are also available from the Natural Resource Conservation Service, University of California Cooperative Extension, local Resource Conservation Districts, and U.S. EPA sources.

Nothing in this Implementation Plan shall limit the Regional Water Board or the Executive Officer from using existing authorities to regulate, require the abatement of or take enforcement action on any existing or proposed discharge of excess sediment.

V. Monitoring

A. The Regional Board considers monitoring to be an essential element of this Program, in order to identify the need for adaptive management changes and to demonstrate the effectiveness of sediment control practices.

B. The Regional Water Board's Executive Officer may establish a Monitoring Program for a specified area or parcel utilizing one or more of the following strategies:

1. Implementation monitoring to assess whether activities and control practices were carried out as planned.
2. Assessment of upslope conditions and whether sediment control practices were effective at reducing discharge of excess sediment.
3. Compliance monitoring: to determine whether specified criteria, such as water quality objectives, are being met.
4. Trend monitoring to determine if water quality objectives are being met and to track progress.

Appendix B
Response to Comments on May 2008 Draft Report

Appendix B
Response to Comments on May 2008 Draft Report

Comment	*Chapter*	*Page #*	*Comment*	*Response*
1	General		Clean Water Act Certification: Processes do exist for State and Regional Water Board(s) to issue the approvals necessary for dam removal. There is no basis for the assumption that Certification by California under the Clean Water Act would require 50% of the total sediment volume (10 million cubic yards!) in the project reservoirs to be removed and disposed of at great expense.	Removal of 50% of the sediment was included as a point of reference to characterize the potential risk generated by the uncertainty surrounding sediment discharge permitting. The GEC 2006 report states "…dredging was not fully investigated. However, further consideration of the effects of TSS may indicate a need to investigate feasibility, cost, and impacts of full or partial dredging of the sediments in future studies".
2	General		Cost Only: While Reclamation recommends benefit-cost analysis, CDM focuses only on costs, and provides no analysis of off-setting benefits.	CDM's scope of work was to identify the potential liabilities associated with removal of the four dams and to identify the potential costs associated with those liabilities. CDM left the assignment of responsibility for these liabilities to Reclamation, the Department of the Interior and the other stakeholder groups party to the Settlement Agreement.
3	General		Baseline: While Reclamation recommends a "with" and "without" analysis, the CDM report looks only at the dam removal alternative, and provides no discussion of costs/liabilities associated with the FERC relicensing alternative.	(Response to Comment #2) CDM's scope of work was to identify the potential liabilities associated with removal of the four dams and to identify the potential costs associated with those liabilities. CDM left the assignment of responsibility for these liabilities to Reclamation, the Department of the Interior and the other stakeholder groups party to the Settlement Agreement.
4	General		Inconsistent Frame: While Reclamation recommends a national perspective (as opposed to regional, local, or individual) for the calculations of benefits and costs, the CDM report includes a perplexing mix of analytical frames. This inconsistency renders a summary table such as Table ES-1 and 4-2 impossible to interpret.	(Response to Comment #2) CDM's scope of work was to identify the potential liabilities associated with removal of the four dams and to identify the potential costs associated with those liabilities. Tables ES-1 and 4-2 were developed to give the reader a perspective on types and potential cost for the liabilities.
5	General		Interpretation of the compilation of different types of costs is further hampered due to the lack of distinction as to where the costs accrue (individuals, organizations, regions, the nation). Metaphorically speaking the list includes apples, oranges, and even bananas and pears. Some are the engineering project costs of the agent, some are the replacement power costs of the utility, some are the dispersed social costs that may result from this landscape level change. My recommendation is that for simplicity of interpretation, the focus of any revision to the draft report should be on liabilities that would accrue to a dam removal agent.	CDM understands that there are a "mixture of costs" presented in the report. The mixture of costs are a result of the complex nature of liabilities that might result from removal of the four dams and CDM's direction not to distinguish potential ownership of the liability. (see also response to Comment #2) CDM's scope of work was to identify the potential liabilities associated with removal of the four dams and to identify the potential costs associated with those liabilities. CDM left the assignment of responsibility for these liabilities to Reclamation, the Department of the Interior and the other stakeholder groups party to the Settlement Agreement.
6	General		Keno costs: The Keno costs are important to analyze, but they are out of place in a study with a title that suggests a focus on removal of four hydroelectric dams. I recommend that the Keno analysis be separated out. I would like to see the inputs, assumptions, and working papers that support the CDM Keno cost estimates.	The responsibility for managing Keno Dam and the associated costs with that responsibility will directly result from the decommissioning project and be borne by a party to the settlement agreement. Keno inputs have been itemized in Chapter 3
7	General		Sediment disposal costs: The proposed project would allow the river to transport 4 million cubic yards of sediment, and would stabilize and revegetate the rest. CDM assumes that California would not be able to permit this project, and so instead lists as a "liability" for the proposed project a cost estimate for a totally different project in which 50% of the sediment is removed! Before finalizing this document, CDM should review the record of other proceedings in California including the Matillija and Battle Creek dam removal projects, as well as the 401 certifications issued by the state of Oregon for the Sandy River dam removal project, and by the State of Washington for the Elwha dam removal project.	The North Coast Regional Water Quality Control Board currently has no program in place to support the permitting (CWA 401) for "flushing" of sediment held behind the four project dams. This position was confirmed in verbal communication with Board staff. The State and Regional Board are engaged in developing an aquatic restoration policy which presumably would apply to the Klamath program but it was not available for review. Given the permitting and technical uncertainties (see comment 1), a conservative assumption was made that 50% of sediment would be removed.

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8	General		Site restoration: 83% of the costs in this category are really site restoration. This should be included in the project engineering costs. Any decommissioning project is going to have a site restoration component to the project design. In fact, there are some site restoration elements in the Gathard 2006 estimate (hydroseeding, etc). That said, I concur with CDM that more will likely be required, although I question the magnitude of the CDM estimates here. I need to see the assumptions, inputs, and working papers. In addition, we will have more information when the two Coastal Conservancy studies on this topic are completed later this year.	The GEC report described hydroseeding costs for J.C. Boyle, Copco No.1, and Iron Gate but did not characterize all potential site restoration costs. The value of the hydroseeding estimate has been removed from CDM's estimate to prevent double counting.
9	General		Other biological "costs": Physical effects listed here as "liabilities" are in fact biological benefits. See comments on Chapter 2 biology section below.	This document did not present a benefit cost analysis but rather was an identification of potential liabilities associated with the removal of the four dams. Benefits associated with some liabilities may be greater than their associated costs, but that determination was not a part of this document's scope. (see also response to Comment #2) CDM's scope of work was to identify the potential liabilities associated with removal of the four dams and to identify the potential costs associated with those liabilities. CDM left the assignment of responsibility for these liabilities to Reclamation, the Department of the Interior and the other stakeholder groups party to the Settlement Agreement.
10	General		Power costs - This cost should not be included in this list. As a regulated utility, PacifiCorp is required to meet its load. They go through a portfolio planning process with the public utility commissions in the 6 states in which they operate. This is a firm cost, there is no scenario in which the dam removal agent or any other party could become "liable" for this.	This is a liability potentially borne by PacifiCorp, ratepayers or other parties to the settlement. see also: (Response to Comment #2) CDM's scope of work was to identify the potential liabilities associated with removal of the four dams and to identify the potential costs associated with those liabilities. CDM left the assignment of responsibility for these liabilities to Reclamation, the Department of the Interior and the other stakeholder groups party to the Settlement Agreement.
11	General		Property purchase – There are two separate issues here, PacifiCorp's land and other private property. CDM appears to assume that all these lands must be purchased at market value. 1. In fact, PacifiCorp's land does not have to be part of an agreement at all, they could simply sell to the highest bidder. 2. The other private property will see an effect from the change in the landscape. 3. For private homeowners, the biggest liability at the moment is the uncertainty – it is difficult to sell if you can't tell the buyer if there will be a reservoir or a riverine amenity in the future. Once the future is known, the market will adjust. A loss for some is gain for others, and there is clearly a temporal element. 4. To the extent that there are losses to homeowners, they are compensable under what legal theory? The landowners live next to a utility asset, if utility redeploys its asset, they do not owe the landowners. Even if as a matter of policy it is decided to compensate, would you really purchase all the land?	CDM's role was to identify potential liabilities. An argument can be made that if the Federal Government acquires the property, they will need to acquire the land under the Federal Uniform Act. The Uniform Act governs an agencies acquisition of private property for public purposes. 1. The reviewer is correct, PacifiCorp could continue to own the property and redevelop it or sell it. 2. The private property affected may also have rights to the reservoir...with removal of these rights, an argument can be made that a damage has occurred to the remainder of their property. 3. The market may adjust. However, The indirect effects on the market may not be realized for may years. 4. Compensation to a homeowner may be through an inverse condemnation. The owners had access to the reservoir e.g. boat dock. That access was removed, therefore damaging their remaining property. With 50 to 70 property owners abutting Copco 1- there is high probability for litigation.
12	General		Societal level costs – If this is a societal level cost-benefit, then these categories may be appropriate. But if this is a study of liabilities that may accrue to a dam removal agent, these categories are only relevant if there is a legal mechanism that could lead to exposure for the agent.	(Response to Comment #2) CDM's scope of work was to identify the potential liabilities associated with removal of the four dams and to identify the potential costs associated with those liabilities. CDM left the assignment of responsibility for these liabilities to Reclamation, the Department of the Interior and the other stakeholder groups party to the Settlement Agreement.
13	General		Legal and regulatory. – There are real and likely significant costs associated with securing regulatory permits. There are real and potentially significant costs associated with legal exposure outside of a "permit shield." Unfortunately, CDM took the view that "A wide variety of other possible legal and regulatory liabilities might arise out of project decommissioning, but they are beyond the scope of this discussion" Page 2-73. I recommend further work in this area, starting with a census of potential plaintiffs, litigation risk analysis, etc	CDM included a subsection in Chapter 2 on the potential for litigation along with an additional numbered liability that was carried forward into Chapters 3 and 4.

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14	General		*Double counting:* The "liability" categories are supposedly additive to the structural project costs taken from Gathard 2006, but in several instances there is duplication and overlap: § Most generally, Gathard 2006 included contingencies for construction management @ 15%, and permitting @ 25%, the CDM summary tables tack on another 10% on top of all of the costs. § Gathard 2006 included treatment for downstream water users, CDM's costs in the physical category may or may not be duplicative. § Gathard 2006 included a replacement facility for Iron Gate Hatchery, the CDM quantity in the biological category may or may not be duplicative.	The ten percent contingency for studies and engineering was applied to only the liability cost totals. It did not add any "double counted costs" to the GEC estimate. The treatment for downstream users outlined in the GEC estimate was presented as a cost for liabilities WQ-2 & 3. This cost was double counted in the draft and has been removed from Table 3-5 and revised in Table 3-16. The Iron Gate Hatchery replacement cost in the GEC estimate was presented in liability AQ-6 which described the cost for fish hatchery funding (5 years), new fish hatchery facilities, and new hatchery water supply costs in one total estimate. This cost was double counted in the draft and has been removed from Table 3-6 and revised in Table 3-16.
15	1	1	In the second paragraph, it is incorrect to state that the Department of the Interior initiated settlement discussions. PacifiCorp originally initiated discussions with the parties as part of the regulatory consultation process in their relicensing proceeding.	Description revised
16	1	1	In the third paragraph: Although these studies provided relevant information, in late March 2008 the U.S. Bureau of Reclamation (Reclamation) contracted with Camp Dresser & McKee Inc. (CDM) for the review of all information developed to date to fully assess the potential decommissioning program's liabilities based on a review of all information developed to date.	Description revised
17	2	13	You would not do things that result in greater impacts and costs. The whole point of additional study to get to feasibility design is to minimize costs and environmental impacts. So if the forthcoming geotechnical analysis suggests that rapid rates will result in sloughing and landslides, then that would not be part of the project design!	A project has not been defined, and feasibility level analysis has not been completed. As such, CDM relied on the most recent project description developed by Gathard. This alternative would utilize a rapid drawdown of the reservoir which according to GEC (2006) could result in sloughing and landslides.
18	2	18	CDM labels the sediment sampling conducted to date "minimal." State the facts, how many cores, how many constituents, etc. What is the marginal benefit of additional samples?	"minimal" change to cursory. Both the TSC and the FERC (2007) reports state that additional sampling should be undertaken to characterize reservoir sediments. Primary concern is samples were not collected at deeper depths which represents older watershed deposition. CDM recommends that a statistically valid sampling plan be developed consistent with EPA protocols to protect the future decommissioning agent from the responsibility of managing a potentially regulated waste as it is the owner's responsibility to characterize the composition of a waste.
19	2	19	Talk to USGS- is this really a concern here given the fractured volcanic geology and the lack of residential development everywhere in the project area except Copco Lake?	This liability has been noted in other dam decommissioning projects (see Elwha, NPS 2005), it was ranked as a low liability low uncertainty issue on page 2-20. It was not studied in any detail beyond its identification based on its identification at other dam removal projects.
20	2	20	It is not a liability to have a river with a spring-fed cold water refugia instead of a spring-fed cold water refugia without a river and without migrating fish. Evidence presented at the trial-type hearing suggests that with the river back in its channel the Boyle springs would still create the largest refugia on the river.	CDM presented the liability and uncertainty surrounding that liability for changes to river temperatures given removal of all four dams. The influence of the Boyle springs was considered as a part of the larger project water quality wide liability assessment. WQ-1 describes studies that indicate long term improvement in water temperature following dam removal. A cost estimate for this liability was not developed and it did not contribute to the project cost estimate.
21	2	21	Surface/groundwater would be neat to have academically, but is it necessary to move to feasibility design on dam removal?	A data gap associated with surface/groundwater interaction was identified and CDM in accordance with its scope of work identified additional studies that could assist with narrowing that data gap. Ultimately the relative potential affect of this data gap on total project cost and environmental effect would need to be weighed by decision makers in determining if the study was necessary.
22	2	22	Water quality within the J.C. Boyle bypassed reach is strongly influenced by the diversion by the hydro project of 90%(on an annual basis) of the water out of the river! Gets temperature effect (thermal lag) wrong – unqualified fish benefit, will cool quicker in the fall to be benefit of migrating fish, and warm quicker in the spring allowing quicker growth of juveniles.	According to the PacifiCorp 2004, the groundwater inflow enhances the water quality in this reach and much of the flow is diverted to the hydro project. The text was modified accordingly.

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23	2	26	Characterization of the Benefits of Dam Removal: On page 2-26, the document implies that the benefits of dam removal are based primarily upon opinion. The document also states that there are relatively few scientific studies on the long term effects of dam removal on aquatic resources. Both are wrong. The benefits of numerous dam removals are documented in American Rivers et al. (1991). The long term effects of dam removal on aquatic organisms have been documented in studies such as Hill et al. (1994); Kanehl et al. (1997); and Burroughs (2007).	The section was revised to better characterize the well established scientific record on the long term benefits of dam removal for a riverine ecosystem.
24	2	27	AQ1 is incorrect, please revise in light of the record of the FERC proceeding, specifically the ALJ's findings and the FERC FEIS.	The Administrative Law Judge found in the September 27, 2006 Findings of Fact "Facilitating the movement of anadromous fish via prescribed fishways presents a relatively low risk of introducing pathogens to resident fish above Iron Gate Dam. Many of the pathogens (such as C. Shasta, F. Columnaris, P. minibicornis, and Ich) present below Iron Gate Dam, are also present above the dam. The evidence is inconclusive as to whether IHN exists either above or below Iron Gate Dam. The evidence is also inconclusive as to whether R. salmoniranrum exists above Iron Gate Dam." The liability was described in the draft report as a moderate liability with high uncertainty. Given the inconclusive evidence described in the ALJ's findings the liability remains unchanged.
25	2	27	AQ2 completely misses the temporal aspect, makes it sound like there will be permanent losses to spawning habitat. There will be some adverse impacts due to sediment. However, this would be a liability limited in time and geographic scope (tens of miles, at the most, for perhaps one or two years) Any losses of spawning areas would be in the short term only and offset by access to historical spawning habitat above the dams and rejuvenated spawning areas below the location of Iron Gate once gravel is replenished.	The liability has been revised to clarify the short term nature of this effect.
26	2	27	AQ-3 is simply incorrect, this must be revised in light of the record of the FERC proceeding, Oregon planning process for reintroduction, etc. Several reports have analyzed this issue. These reports include Fortune et al. 1966, Chapman 1981, Huntington 2004, and Huntington 2006. The Service and NMFS have considered this information carefully as prescribed fish passage should the project be relicensed.	The liability was removed from the report.
27	2	28	Unnecessary Assessments: Some of the assessments described as necessary are not. For example, the document states that the following are needed as studies: Develop a habitat viability assessment for existing fish populations potentially displaced by reservoir removal (on page 2-28 in Table 2-13). Develop a habitat viability assessment for existing terrestrial resource populations potentially displaced by reservoir removal (on page 2-31 in Table 2-15). We are not aware of any management direction that would support the need for either of these studies.	The studies have been removed.
28	2	28	AQ-4 is incorrect. See ALJ findings and FERC FEIS	(Response to Comment #24) The Administrative Law Judge found in the September 27, 2006 Findings of Fact "Facilitating the movement of anadromous fish via prescribed fishways presents a relatively low risk of introducing pathogens to resident fish above Iron Gate Dam. Many of the pathogens (such as C. Shasta, F. Columnaris, P. minibicornis, and Ich) present below Iron Gate Dam, are also present above the dam. The evidence is inconclusive as to whether IHN exists either above or below Iron Gate Dam. The evidence is also inconclusive as to whether R. salmoniranrum exists above Iron Gate Dam." The liability was described in the draft report as a moderate liability with high uncertainty. Given the inconclusive evidence described in the ALJ's findings the liability remains unchanged.
29	2	28	AQ-5, see comments on AQ-2	(Response to Comment #25) CDM concurs, the liability has been revised to clarify the short term nature of this effect.
30	2	35	There are 190 miles of the Klamath River below Iron Gate Dam, not 199	Change Made

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31	2	62	See Interior's comments in the FERC proceeding.	CDM reviewed Interior's comments on power costs in the FERC record as they pertained to power costing, and noted the issues raised by Interior regarding the valuation approach utilized by FERC. In the draft report CDM relied on values presented in the *Economic Modeling of Relicensing and Decommissioning Options for the Klamath Basin Hydroelectric Project—Addendum A.* (CEC Consultant Report April 2007) to develop replacement value estimates. see also: (Response to comment #10) This is a liability potentially borne by PacifiCorp or ratepayers, see also: (Response to Comment #2) CDM's scope of work was to identify the potential liabilities associated with removal of the four dams and to identify the potential costs associated with those liabilities. CDM left the assignment of responsibility for these liabilities to Reclamation, the Department of the Interior and the other stakeholder groups party to the Settlement Agreement.
32	2	64	The studies suggested related to power are not necessary to move from appraisal level to feasibility level project design. These issue are more associated with the utilities decision making, see the Energy Commission reports.	(Response to comment #10) This is a liability potentially borne by PacifiCorp or ratepayers, see also: (Response to Comment #2) CDM's scope of work was to identify the potential liabilities associated with removal of the four dams and to identify the potential costs associated with those liabilities. CDM left the assignment of responsibility for these liabilities to Reclamation, the Department of the Interior and the other stakeholder groups party to the Settlement Agreement.
33	2	67	The section 2.3.7 on economics appears to be completely duplicative of the sections preceding it.	In the draft report they were not double counted and did not contribute to the cost estimate which further supports their deletion from the final report
34	4	2	I do not agree with the characterization of the negative effects of dam removal on spread and alteration of fish diseases, low DO, and losses of spawning areas.	Text updated.
35	Summary		Consistency with Economic Principles. Not consistent with generally accepted economic principles. Improperly combines different types of costs or impacts. Inappropriate treatment of risk and uncertainty. It although it purports to calculate *some* of the same impacts as would be addressed in a benefit/cost analysis; it is neither represented as a benefits/cost analysis, nor should be interpreted or used as such.	The document is not a Feasibility Study and did not complete any cost/benefit comparisons. See also responses to comments #2 and #9
36	Summary		Accuracy in Portraying the Klamath Issues. Results substantially conflict with existing Klamath record. The report contains new, unsubstantiated and highly speculative estimates that exceed other estimates by a factor of 6 - 10. New costs inconsistent with the record add as much as $350 million for sediment, $54 million in double counting, and $27 million in questionable real estate matters, including a gain to PacifiCorp of up to 26 times its land cost, that, if considered, should have been identified as an *off-set* against decommissioning cost, not a "liability.". Inappropriately raises new, false flood control issues. Moreover, a demonstrated Federal liability of $60 million or more annually of allowing current operations to continue was not reported. Factual errors suggest unfamiliarity with Klamath operations and record.	Comment noted and as described in responses to other comments regarding double counting, real estate estimates, and flood control issue changes have been made to the document to improve readibility and help to clarify assumptions made to develop the liabilities and the associated costs. As has also been noted, this document is not a cost benefit analysis but rather an identification of the potential liabilities associated with dam removal to assist policy makers in decisions on dam decommissioning and removal.
37	Summary		Usefulness in Assessing Policy Options. Report attempts to put decommissioning in the context of the other Klamath issues, and does so improperly due to the many factual errors. Asserts liability and tort liability issues when facts suggest "impacts" may be a better descriptor. Solicitor should review if language not changed. The report alleges increased health and safety and flood risks associated with decommissioning without support. Report poorly organized and not useful as a reference or summary.	CDM generally avoided using the term "impact" in recognition of the connotations associated with the term in NEPA/CEQA analysis. Tort liability has been replaced with litigation liability.

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38			Although the report states quite clearly in the executive summary that "the decommissioning and removal of the four dams [is] based upon the existing information developed to date" [CDM ES-1] there is nothing in the record of the proceeding that the contractor was given that that can account for such a large difference. The largest areas of the discrepancy appear to be (1) a *sui generis* characterization of sediment removal costs of $175 - $350 million; (2) purchase of replacement power of $65 - $172 million; (3) a potential double counting in reservoir restoration of $36 - $54 million; and (4) speculative real estate impacts of $14 - $27 million which includes an unexplained windfall to PacifiCorp resulting from Government purchase of PacifiCorp land at between 10 and 26 times book value.	(Response to Comment #2) CDM's scope of work was to identify the potential liabilities associated with removal of the four dams and to identify the potential costs associated with those liabilities. CDM left the assignment of responsibility for these liabilities to Reclamation, the Department of the Interior and the other stakeholder groups party to the Settlement Agreement. (Response to Comment #7) The responsibility for managing Keno Dam and the associated costs with that responsibility will directly result from the decommissioning project and be borne by a party to the settlement agreement. They have been separated and itemized in Chapter 3 (Response to Comment #8) The GEC report described hydroseeding costs for J.C. Boyle, Copco No.1, and Iron Gate but did not characterize all potential site restoration costs. The value of the hydroseeding estimate has been removed from CDM's estimate to prevent double counting. (Response to Comment #11) CDM's role was to identify potential liabilities. An argument can be made that if the Federal Government acquires the property, they will need to acquire the land under the Federal Uniform Act. The Uniform Act governs an agencies acquisition of private property for public purposes. 1. The reviewer is correct, Pacificorp could continue to own the property and redevelop it or sell it. 2. The private property effected may also have rights to the reservoir...with removal of these rights, an argument can be made that a damage has occurred to the remainder of their property. 3. The market may adjust. However, The indirect effects on the market may not be realized for may years. 4. Compensation to a homeowner may be through an inverse condemnation. The owners had access to the reservoir e.g. boat dock. That access was removed, therefore damaging their remaining property. With 50 to 70 property owners abutting the Copco 1 - there is high potential for litigation.
39			For example, the CDM discussion of hydraulics and hydrology (H&H) risks [CDM 2-7 – 2-11] inappropriately raises a "Flooding during and after dam removal" risk [CDM 2-7].[1] Rather than raise flood control issues which neither BOR nor any other party has identified as a concern[2], the report should state explicitly that the dams being considered for removal are limited to the four power production facilities identified; and that flood control is addressed by BOR though its Klamath Irrigation Project which "provides flood control along the Klamath River and downstream of the hydroelectric project." [FEIS 3-526]	Liability HH-1 was identified and described as a low liability with a moderate level of uncertainty. A cost estimate for the liability was not developed and did not affect final liability cost estimate presented on page 3-24, in Table 3-16. Further, the Department of Safety of Dams will require analysis of flood protection during dam decommissioning to protect against sudden or catastrophic collapse and therefore it should remain in the report as a liability.
40			Moreover, the section entitled "Biological Liabilities" [CDM 2-26 – 2-35] reflects a lack of understanding of the biological systems, and unfamiliarity with the extensive analyses by FWS[1]. Moreover, the biological concerns CDM raises appear to be confined largely to the previously identified double-counting in reservoir restoration. FWS is preparing separate comments addressing the biological impacts.	Responses to comments from USFWS on biological liabilities presented above in Comments #1 - 34.
41			See, for example, CDM 1-1. Contrary to CDM's representation, the Department did *not* initiate discussion "Because of declining Klamath River fisheries…" The applicant initiated discussion pursuant to FERC's processes and procedures. In addition, identifying a decommissioning agent other than PacifiCorp is *not* required by or even addressed in the Klamath Restoration Agreement as asserted by CDM.	Description revised
42			PacifiCorp currently owns the land and land rights associated with the facilities, and carries it on its books at a total value of $597,979.[1] Although CDM does not provide a clear explanation, it asserts a potential liability and assumes a Government purchase in the range of $5.9- $15.8 million – a factor of between 10 and 26 times the book value. CDM's assertion of a Government purchase in this amount is further inexplicable since, if the Government wished to take over the project, it has the right to do so for the "net investment of the licensee in the project".	An argument can be made that if the Federal Government acquires the property, they will need to acquire the land under the Federal Uniform Act. The Uniform Act governs an agencies acquisition of private property for public purposes, and mandates the property be acquired at the Fair Market Value. See comment 11.

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43			The draft report concludes that California water quality standards will prohibit discharge of sediments from dam removal. CDM Report pp. ES-3,2-75. This seems to be a legal opinion of the report's author as to a future regulatory out come un supported by a present determination by the California water quality agency. More importantly, based on this opinion, the report adopts the premise that the only way to comply with water quality standards will be to remove 50% of sediments from each reservoir. CDM Report pp. 3-5, 4-1. This premise then becomes the basis for estimating sediment management costs of $175,403,000 to $350,806,000. CDM Report. 3-6. The report's assumed method for managing downstream sediment impacts does not reflect the method logies identified by numerous studies to date for removal of the Klamath dams, which may cost significantly less to implement.	see response to comments #1 and #7
44			The draft report assumes that, with removal of the four mainstem Klamath dams, Keno Dam will be transferred to and operated by a new entity who would incur fish passage and water quality liabilities. CDM Report pp.3-4, 4-2. This might or might not be true, but is not a liability associated with dam removal. The report nonetheless adds $40,000,000 to $60,000,000 for Keno to its calculation of dam removal costs. CDM Report p. 3-5.	see response to comment #6
45			The draft report assumes a "total collapse" of regional fisheries due to dam removal, and assigns a cost of $11,896,000 to $66,406,000 to the commercial fishing industry and others. CDM Report pp. 3-21, 3-22. The report acknowledges this is a worst-case scenario. It nonetheless is not a realistic scenario, considering studies to date showing that dam removal would improve regional fisheries not harm them. Inclusion of this assumption and related estimated costs detracts from the substantive value of the CDM Report to the public and decision makers.	The report indicates as a note in the summary and economics costing tables that costs associated with the total collapse of the regional fishery are "Not included in total: since sediment removal should negate fisheries' impacts and the sediment removal costs are included in the total, fishery liabilities are noted here, but will not be included in the total." Studies have demonstrated long-term improvements in fisheries with short-term, unquantified damage.
46	2, 3	2-9, 3-4	All references to the North, 80, and Lost River canals should read North and Ady canals and Lost River Diversion Channel.	Change made
47	2	2-21,	"Water quality in the Klamath River downstream from Link River Dam is strongly influenced by the quality of water from Upper Klamath Lake, Lost River, and Klamath Straits drain." This sentence should be corrected to read; "Water quality in the Klamath River downstream from Link River Dam is overwhelmingly influenced by the quality of water leaving Upper Klamath Lake." Winter flow additions from the Lost River and water quality contributions from the Straits drain are fairly small contributors to the water quality problems.	Change made
48	2	2-25,	"…Klamath River water quality is strongly influenced by the quality of water entering Klamath Lake." This should read "leaving" Upper Klamath Lake.	Change made
49	ES	ES-1	Figure ES-1 needs the labeling enlarged	Figure revised
50	ES	ES-2	Section titled Liability Identification and Costing needs a paragraph added before Table ES-1 to briefly discuss if and how the table relates to the above four liability category listings	Description added
51	ES	ES-2	At point number 1, third line after ranked liabilities add "and or uncertainties"	Change made
52	TOC	TOC v	KDDP is shown but should it be KDDT? NCRWQCB add connotation "(California)" that this is a CA agency? ODEQ E should stand for Environmental not Water SWRCB is this located in California and should it be connoted as such?	Changes made except for KDDT, "KDDP" is referred to in the document to describe the Klamath Dam Decommissioning Project.
53	1	1-1,	Figure 1-1 needs the labeling enlarged	Figure revised
54	1	1-1,	Line 7 Need to note as part of the Relicensing process the public input part or that PacifiCorp continues to operate under 1 year temporary renewed contracts	Description added
55	1	1-2,	Figure 1-2 Map needs scale bar to help with user noting distances on map with the Klamath River needing a label and profile needs left side connotation of "Elevation"	Figure revised
56	1	1-2,	Line 2 change emphasizes to emphasized Line 5 add "Department of the Interior through the" before the USBR	Change made

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57	1	1-3,	Do we need detailed description of facilities for the reader's reference? Or just say that other documents elsewhere can be referenced?	Upon review KBAO determined that this change was not needed.
58	2	2-1,	Line 1 change section to chapter Line 3 add "CDM" before project team and is project team KDDT? Line 5 change section to chapter Line 1 (Paragraph 2) change section to chapter Line 4 (Paragraph 3) change section to chapter Line 6 change section to chapter	Changes made
59	2	2-2,	Next to last bullet point need to add that asbestos is known health concern. It is also sometimes found in paint. Vinyl mastics and some coal tar enamels are paint that sometimes used asbestos as a binder and a filler. If you have a project that has a vinyl resin paint (VR-3 or VR-6) then the bolt heads and connectors may have a vinyl mastic that has asbestos in it. If you don't have these kinds of coatings then you really don't need to worry. If you do, then you can take samples of the coatings and have them tested. Should the coatings have asbestos then you will need to abate that coating, but only on those surfaces that have that coating, not the whole project. Last bullet point needs to add lead paint is known health concern.	Changes made
60	2	2-2,	2.1.1.1 Paragraph 1 change two 98 megawatt to 80 megawatt total from —FERC PacifiCorp February 2004 Exhibit A	This value was described as 97.98 MW in the 2007 **FEIS**. This value was also described as 97 MW in the 2006 CEC **Economic Modeling of Relicensing and Decommissioning Options for the Klamath Basin Hydroelectric Project**
61	2	2-2,	Need to note that the existing JC Boyle substation is not considered as a part of this analysis.	Description added
62	2	2-3,	Line 1 after "in the past" add "and are known to be persistent organic pollutants."	Change made
63	2	2-4,	Need to label figure additionally FERC Exhibit A 2.1.1.2 Line 4 should read "20 MW Total" instead of 2 20MW gens	Change made
64	2	2-5,	In Table 2-2 delete investigation in line 3 2.1.1.3 two 27 MW should be changed to 27 MW Total from FERC Exhibit A	Changes made
65	2	2-9.	Section HH-3 Line 7 need to switch the and both One FERC FEIS option discusses removing Iron Gate two years after the other three are removed quickly. Section HH-4 Line 3 after Lost River canals add "diversions upstream of the dam." Line 11 after canal add "diversions off of the dam's minimum pool." Add to last line "from the H&H perspective" Table 2-3 First data gap item – Add "Discuss with USACE (?) any new requirement for flood management and the seasonal peak and potential modifications needed for PMF and IDF—handling at Keno and Link River Dams" PMF=Probable Maximum Flood IDF=Inflow Design Flood	Changes made
66	2	2-11,	Section HH-6 (after the first sentence) There is an abandoned low level sluice outlet with 16x18 tunnel built during construction in the left abutment that may contain a concrete plug. There is an upstream gate which would need to be investigated for use in decommission as there is no information in the records. USBR 2008	Change made
67	2	2-12,	(end at top of page) Plug the power supply tunnel, the entrance, and the exit. This may be significant at higher post-decommission flood flows. Section HH-8 Need to answer "What is the function of the spillway at Iron Gate?"	Change made Spillway is designed for the probable maximum flood (PMF) volume estimates and the related DSOD sizing requirements for embankment dams. The removal of the spillway is not likely to generate any liabilities given expected DSOD construction requirements during dam removal would minimize any changes in flood risk.
68	2	2-13,	Section 2.1.3 First Bullet Point "Is this a Liability? How?"	Liability rephrased using information in comment #69

Comment	Chapter	Page #	Comment	Response
69	2	2-14,	Table 2-8 Second Data Gap Item – for the Studies/Actions Needed – Bathymetry is recommended to be performed – comment: Blair Greimann, USBR TSC reports in a May 7, 2008 email "*I obtained this (bathymetry data) from (Dave) Diamond (USDOI). It is zipped up and rather large so it will take a while to download. I think it is both a current survey and a predam survey.* *From Gathard's Nov 2006 report p. 29 : "PacifiCorp's contractor, JC Headwaters, conducted a bathymetric survey of Iron Gate, J. C. Boyle, and Copco 1 reservoirs in 2001 and published the results in 2003."* *Based upon Gathard's report the pre-dam survey it is not very accurate and he had trouble determining the sediment volumes."*	Data gap added to Table 2-7
70	2	2-17,	Table 2-9 – same comment as for page 2-16, Table 2-8	Data gap added to Table 2-7
71	2	2-19,	Section 2.1.4.1 (Paragraph 1) Add" The PacifiCorp dams" before "the Klamath River subbasin" (Paragraph 2) Line 5 the JC Boyle power plant Table 2-10 – same comment as for page 2-16, Table 2-8	Changes made except for adding "The PacifiCorp dams"
72	2	2-20,	Paragraph 2 Line 6 after River "in the immediate vicinity of the PacifiCorp Dam Reservoirs." ?	Text added
73	2	2-21,	Section 2.1.5 Line 1 The Water Quality in the Klamath River Table 2-11 first section of Studies and Actions Needed add "and how the changes to groundwater would impact them."	Text added
74	2	2-22,	Section 2.1.5.1 Line 1 Average monthly "water" temperatures Question regarding last line of first paragraph—Is there any seasonal stratification at JC Boyle and or reservoir turnover issues?	Stratification according to the FERC EIS (page 3-98) is not an issue in J.C. Boyle Reservoir. The temperature variation from surface to the floor in the summer was reported as typically being less than 2º C. Bartholow et al 2005 describes all of the reservoirs as being too small with a turnover rate too high to support temperature control by accessing the hypolimniun.
75	2	2-23,	Question regarding end of first paragraph on page—Are there reservoir turnover issues? Section 2.1.5.3 Same question as above related to end of second paragraph	Bartholow et al 2005 describes all of the reservoirs as being too small with a turnover rate too high to support temperature control by accessing the hypolimniun.
76	2	2-25,	End of first paragraph delete "water" from "to predict water immediate…"	Change made
77	2	2-30,	first section of the page change aquatic to terrestrial twice Line 17 & 24	Change made
78	2	2-34,	Section 2.2.3.3 add SR-3 Restoration of JC Boyle Power Canal Spillway Canyon Erosion Gully Area	Text added
79	2	2-36,	Section 2.3.1 no citation given for "Economic Analysis of Dam Decommissioning" either time listed.	Citation added here and to all other occurrences in the Chapter
80	2	2-37,	Section 2.3.1.1 End of second paragraph add There is a small parcel owned by the Federal Government and managed by BLM on the east side of JC Boyle reservoir where BLM provides a campground. (USBR/Klamath County Assessor GIS Information) County owns Sportsman's park (sold to the county by PacifiCorp) in the Northern part of the Reservoir.	Text added
81	2	2-37,	Section RE-2 at end of section The BLM Campground at JC Boyle may have changes in use patterns.	Text added
82	2	2-38,	Table 2-19 List Studies and Actions Needed Section add Determine land code compliance issues	Description Added
83	2	2-39,	Table 2-20 List Studies and Actions Needed Section add Determine land code compliance issues Question posed—What about the disposition of PacifiCorp owned employee residences? And former schoolhouse @ Copco 2?	Description Added The former schoolhouse is no longer in use and the PacifiCorp switchyard at Copco is expected to remain in operation. CDM assumed that the residences would remain in use and that neither it nor the former school yard represented a liability.
84	2	2-40,	Section 2.3.2 Paragraph after bullets Line 3 add "of" between perception and residents Line 6 the use of "great uncertainty" conflicts with charts which show low uncertainty for all dams. Question posed—View shed modeling for all dams not worth it?	Changes made

Comment	Chapter	Page #	Comment	Response
85	2	2-41,	Section AE-1 high conflicts with charts which show low uncertainty for all dams. Section AE-3 high conflicts with charts which show low uncertainty for all dams. Section AE-4 high conflicts with charts which show low uncertainty for all dams. Same comments for Copco 1 and Iron Gate	Changes made
86	2	2-43,	Section AE-9 high conflicts with charts which show low uncertainty for all dams.	Change made
87	2	2-44,	End of page Question posed—Why? Because these factors mean more visitors? Explain. The reservoir nor dam can be seen from these places.	Description removed
88	2	2-46,	Section 2.3.3.1 First long line under figure add "Klamath County owned" before "Sportsman's Park"	Change made
89	2	2-52,	Section 2.3.4.2 SA-3 no references to back up the last statement	liability revised
90	2	2-53,	Table 2-26 last full section (both sides) this information is redundant—covered in Table 2-3	Deleted
91	2	2-54,	First bullet is not covered in the scope of this report, is it?	Deleted
92	2	2-56,	Table 2-27 In each of first three Studies and Action needed sections delete "CDM through the BOR" and change to "dam decommissioning agent".	Change made
93	2	2-61,	Liabilities PO-1 through PO-3 all discuss uncertainties—is this warranted when power liabilities chart shows low uncertainty?	There is uncertainty associated with the liabilities but the perceived effect of this uncertainty on the relative range of project costs was deemed to be low.
94	2	2-64,	Table 2-29 Data Gap #5 Question—Is 30 year analysis period a given for NPV? Why not 50 Years?	It is typical that Net Present Value estimates are presented based on a 30 year analysis period. The difference in value generated by extending a NPV estimate an additional 20 years was determined to be non-effectual relative to range of project costs being considered for this project, given the size of the values being adjusted.
95	2	2-65,	Section 2.3.7 Add to fifth bullet And County tax revenues	Text added
96	2	2-71,	Section 2.4.1 - Somehow capture at least one itemized liability with number to track so that the liability will be tracked all the way through Section 3.7 and further into Sec 3.8's Summary Cost Tables – probably listed in Table 3-17. I have a concern that someone will only look at the Summary Cost Tables and they will not see the potentially large liabilities of regulatory and ITA issues both with some degree of uncertainty not listed and may forget them in consideration.	Three liabilities added and carried forward into Chapter 3
97	2	2-72,.	Third bullet—What about NCRWRCB? Question—Where is liability and uncertainty chart?	change made and liability chart added
98	2	2-77,	Table 2-33 – for first Data Gap item, under the Studies/Actions Needed – add "Determine impacts to potential Indian federal reserved water rights with or without dam removal scenario."	Text added
99	3	3-1,	Line 1 change section to "chapter" Line 2 last paragraph change section to "chapter" Need to finish the last sentence.	Changes made and description at the bottom of the page was expanded
100	3	3-2,	Section 3.2 KDDT—Is this CDM? #5 change section to "chapter" Section 3.3 It appears Gathard cost estimate is used straightaway What does the FERC EIS say? Was it considered? Was the TSC March 2008 Report considered? That report had a different viewpoint. May need to discuss the differences and why the TSC and FERC reports were not used. TSC USBR 2008 page 6 shows a good table. If using GEC total—this includes permitting and licensing. This would have to be backed out. Discuss what figure from GEC was used to come up with each dam on table 3-16 and the total.	The GEC and TSC Reports were both reviewed and utilized in the estimation of costs. A new description of how the TSC report findings were utilized has been included in Subsection 3.3. The summary costs presented in Table 3-17 (formerly 3-16) have been clarified with multiple line items in the physical structure removal estimates for each dam
101	3	3-3,	End of Section 3.3 Need to provide detailed table to help with issues USBR 2008 identifies, tabulates data gaps—each dam removal item on pages 15-20.	New tables added outlining the dam removal and liability costs unique to each facility and an additional table outlining the liability costs associated with more than one facility.
102	3	3-4,	Second bullet ADY not 80. Change canal to Diversion Channel	Change made

Comment	Chapter	Page #	Comment	Response
103	3	3-5,	Table 3-2 HH-4 Could be bumped up with recent CH2mHill Report HH-9 Add supply to topic Section 3.4.3 Add NC to RWQCB HH-9 Where is Section 3.3.1	Changes made except for CH2mHill costs
104	3	3-6,	Line 3 first full paragraph—Is this needed after the sediment excavation and dam removal is completed? It might be helpful to explain your assumptions.	The time of year that sediment will be passed is not defined. Water supply in addition to base flow may be required to move sediment and satisfy CWA requirements
105	3	3-7,	Section 3.4.4 first paragraph, last sentence - Need to show where the leaching and groundwater level differences would occur. Question posed—Does Elwha case study provide any help quantifying if only by proportioning?	The expected changes in groundwater levels are described in Subsection 2.1.4.1 and the location of potential leaching is described in GW-3 as it is presented in Subsection 2.1.4.1.
106	3	3-8,	First paragraph – Discuss if Gathard mentions what kind of new wells and water supply would be established – domestic, M&I, other? Table 3-5, Liability Numbers WQ-2 & WQ-3, under topic, clarify if this means this includes costs to implement measures to mitigate for d/s water quality issues such as drilling new wells and establishing new water supply	Gathard described the wells as domestic and included in the cost estimates for developing the new well, with filtration, flocculation, chlorination, and or ozonation, and bottled water supplies for short term low volume use. see also: (response to comment #14) The treatment for downstream users outlined in the GEC estimate was presented as a cost for liabilities WQ-2 & 3. This cost was double counted in the draft and has been removed from Table 3-5 and revised in Table 3-16.
107	3	3-9,	Second paragraph, second sentence – discusses that AQ-3 should have a 2.0 uncertainty factor but in Table 3-6 it shows an uncertainty factor of 1.5	Values changed
108	3	3-10,	Table 3-7 shows Liabilities TE-4 and TE-5 (downstream) uncertainties as 1.5. This conflicts with the chart on page 2-31 which shows the uncertainties as low.	Values changed
109	3	3-11,	Table 3-8 shows Liability SR-5 (Copco No 2) uncertainty as 1.0. This conflicts with the chart on page 2-33 which shows the uncertainties for all dams as moderate. Liability SR-7 (downstream) shows uncertainty as 1.5. This conflicts with the chart on page 2-35 which shows the uncertainties for downstream as low.	Values changed
110	3	3-14,15, Table 3-10	Does Elwha case study provide any assistance at estimating aesthetic issues impact costs? Uncertainty column values in Table 3-10 could be listed as 1.0 to align with the charts on pages 2-40 thru 2-44. Also under Table 3-10 KDDP Estimate column, shouldn't Recreation section reference number be listed as 3.6.3?	Elwha was reviewed but was not found to provide guidance on estimating aesthetic liability costs. Uncertainty values changed. Reference number changed in table.
111	3	3-16,	Table 3-11 shows uncertainty as 1.5 for all listed liabilities. This conflicts with the charts on pages 2-46 thru 2-50 which shows the uncertainties for all dams as low.	Values changed
112	3	3-18,	Table 3-13 shows Liabilities CH7 thru CH-9 (Copco No 2) uncertainty as 1.5. This conflicts with the chart on page 2-57 which shows the uncertainties for this dam as low. Paragraph at bottom of page, first sentence mentions the use of a 30 year analysis period in CEC Consultant Report cited – is this an acceptable length or should it be 50 years?	Changes made on liability uncertainty, see response to comment # 94 for description of NPV analysis assumptions.
113	3	3-20,	Last paragraph – reference section numbers need to be checked – they don't seem to be correct.	Values changed
114	3	3-21,	Last sentence of the page infers that future value of regional income associated with regional fisheries has a high uncertainty. Table 3-15 conflicts with this by showing a 1.0 (low) uncertainty factor.	Text changed
115	3	3-24,	Table 3-16 Consider item to be added called - Liability Agent Coordinator/Project management needs to be added before the "Total" line item. Consider adding a table which sorts table 3-16 by dam affected column and provide cost estimate subtotals for each sorted dam affected.	Line item "Decommissioning Design, Studies and Programmatic Costs at 10% " added to replace the line item "Studies and Engineering at 10% ". This line item adds 10% for engineering, studies, administration, etc..
116	3	3-25,	Table 3-17 – Do Liabilities AE-1 thru AE-13 need to be listed also?	Liabilities AE-1 thru AE-13, as was noted in Table 3-18, have costing descriptions presented in other liabilities.
117	4	4-1,	Section 2 Question posed—Have you not considered USBR 2008 Report?	USBR 2008 was reviewed, cost estimates presented in the draft reflected KDDP estimates of missing costs noted in the TSC report. Text in Section 3 and 4 has been revised to reflect this review.
118	4	4-2,	Section 6 Add "likely PacifiCorp" after "result in the"	Text added

Comment	Chapter	Page #	Comment	Response
119			The cost and liability related to Upper Klamath Lake water quality impairment is not assessed. Section 2.1.5 on water quality correctly notes that: The Klamath River from Upper Klamath Lake to the California state line is impaired because of pH levels, ammonia, nutrients, temperatures, dissolved oxygen (DO), and chlorophyll a. Water quality in the Klamath River downstream from Link River Dam is strongly influenced by the quality from Upper Klamath Lake, Lost River, and Klamath Straits drain. (Draft p. 2-21) The draft then notes that: Several interest groups and stakeholders have suggested that removal of the dams on the Klamath River would significantly improve these water quality impairments. (Id.) It doesn't note that there is a substantial risk that serious water quality impairment may well result, with potentially huge impacts. The report lists water temperature seasonal shifts, TSS elevated levels in the long term, short-term degradation during reservoir drawdown, and "long term water quality changes due to dam removal and restoration of natural stream conditions." The text then states that some changes "might or might not be positive changes." The discussion does not take into account as a water quality liability and uncertainty the detailed water quality data and analysis that has been done that raises very substantial questions about long-term water quality problems downstream from Upper Klamath Lake following dam removal. The crux of the problem is that the enormous loads of algae and nutrients from Upper Klamath Lake will travel far more quickly to the estuary of the Klamath River than occurs with dams in place. This is simply not analyzed. The draft states at page 2-25: Due to the complexity of the Klamath River system, however, it is unlikely that any additional sampling or studies will significantly reduce the overall uncertainties associated with water quality impacts (Page 2-25) If that is the case, why is the USBR undertaking major studies in the Upper Klamath Lake basin to address potential ways to improve water quality?	Water Quality liability WQ-4 added to reflect the water quality risks associated with discharge from Keno Reservoir.
120			There does not appear to be anything in this draft evaluating uncertainty and liability issues related to fishery closures (such as the current West Coast salmon fish closure), impacts on tribal fishing, and other fishery closure issues.	These costs are outlined in the economics section - EC-6, EC-4, EC-6, EC-8
121			The draft is confused as to its primary assumptions concerning the timing of dam removal. At page 3-1 it states: These liabilities were identified based on the project description presented in Section 1.2, which assumed that all dams would be removed concurrently or in very rapid succession, with sediment passed to the downstream reach of the Klamath River. No other dam removal alternatives were considered during this costing exercise, with the exception of the sediment removal alternative used (Section 2.1.3). There is no section 1.2 in my copy of the draft document. It is also notable that the draft concludes that: The NCRWQCB effectively prohibits the discharge of sediments (suspended or depositional) from construction projects, and places dam decommissioning in this category. Different approaches to sediment management would be required to meet the NCRWQCB's Basin Plan sediment measures and action plan guidelines. (Page 4-1) There is no reconciliation of that statement with the statement on page 3-1.	Description presented on page 3-6: No previous costs estimates are available that quantify the indirect liabilities for large scale sediment erosion and passage. To develop a cost that represents the liability for sediment, it was assumed that sediment removal from each reservoir would be required to comply with CWA 401 permitting and to minimize the currently unquantifiable downstream impacts. Costs for sediment removal were based upon the following assumptions: • Sediment would be removed with a portable dredge on a reduced lake level surface. The dredged material would be pumped to temporary settling basins onshore in the exposed reservoir areas. As the material dried, it would be loaded into trucks and hauled a maximum distance of 10 miles for disposal in a clean fill site. Other methods of sediment excavation were reviewed but determined to be far more costly and less reliable in execution. • 50 percent of the sediment estimated in each reservoir (see Section 2.3.1) would be removed. • Sediment remaining in the reservoir could be stabilized through restoration measures to minimize erosion and downstream transport. Restoration costs are included in Section 3.5.3, Site Restoration. • The reservoir sediments do not contain State of California or EPA-regulated wastes.

Appendix C
KDDP Construction Cost Estimate

Klamath Dams Decommissioning Project (KDDP)
Cost Estimates

J.C. Boyle

	Existing Cost Estimates	*KDDP Estimate*	*Uncertainty Factor*	*Total*	*Remarks*
Implementation Costs					
Dam Removal	$15,752,600.00	$0.00	1.50		GEC Estimate
Lead Abatement (allowance)	$0.00	$100,000.00	2.00		Placeholder Allowance Only
Asbestos Removal (allowance)	$0.00	$100,000.00	2.00		Placeholder Allowance Only
.24 miles of transmission line ROW	$0.00	$15,000.00	2.00		Includes nominal planting of trees, shrubs & native grasses
PCBs in transformers	Incl.		1.50		Incl. in GEC Estimate
Escalation (Nov 2006 to May 2008)	$0.00	$1,449,200.00	1.50		Escalate GEC Estimate 6% per Year (9.2%)
Sediment Removal	$0.00	$5,464,000.00	2.00		Based on dredge 50% sediment to shoreline, drying, load & haul 10 mile round trip
Site Restoration	$0.00	$2,510,000.00	2.00		Restoration from existing shoreline to new river edge (includes nominal planting of established trees, shrubs & native grasses)
Artificial River Bed @ Dam Site		$69,000.00	1.50		Includes riprap grouted in place
Environmental Compliance					

Klamath Dams Decommissioning Project (KDDP) Cost Estimates					
Copco No. 1					
	Existing Cost Estimates	***KDDP Estimate***	***Uncertainty Factor***	***Total***	***Remarks***
Implementation Costs					
Dam Removal	$28,222,900.00				GEC Estimate
Lead Abatement (allowance)	$0.00	$100,000.00			Placeholder Allowance Only
Asbestos Removal (allowance)	$0.00	$100,000.00			Placeholder Allowance Only
Chemicals / Fuels in switch yard		$50,000.00			Placeholder Allowance Only
PCBs in transformers	Incl				Incl. in GEC Estimate
Escalation (Nov 2006 to May 2008)	$0.00	$2,596,500.00			Escalate GEC Estimate 6% per Year (9.2%)
	$0.00				
Sediment Removal	$0.00	$93,560,000.00			Based on dredge 50% sediment to shoreline, drying, load & haul 10 mile round trip
Site Restoration	$0.00	$16,582,000.00			Restoration from existing shoreline to new river edge (includes nominal planting of established trees, shrubs & native grasses)
Artificial River Bed @ Dam Site		$385,000.00			Includes riprap grouted in place
Environmental Compliance					

Klamath Dams Decommissioning Project (KDDP)
Cost Estimates

Copco No. 2

	Existing Cost Estimates	*KDDP Estimate*	*Uncertainty Factor*	*Total*	*Remarks*
Implementation Costs					
Dam Removal	$5,914,600.00				GEC Estimate
Lead Abatement (allowance)	$0.00	$100,000.00			Placeholder Allowance Only
Asbestos Removal (allowance)	$0.00	$100,000.00			Placeholder Allowance Only
PCBs in transformers	Incl				Incl. in GEC Estimate
Escalation (Nov 2006 to May 2008)	$0.00	$544,100.00			Escalate GEC Estimate 6% per Year (9.2%)
	$0.00				
Sediment Removal	$0.00	$0.00			N/A
Site Restoration	$0.00	$175,000.00			Restoration from existing shoreline to new river edge (includes nominal planting of established trees, shrubs & native grasses)
Artificial River Bed @ Dam Site		$335,000.00			Includes riprap grouted in place
Environmental Compliance					

Klamath Dams Decommissioning Project (KDDP)
Cost Estimates

Iron Gate

	Existing Cost Estimates	*KDDP Estimate*	*Uncertainty Factor*	*Total*	*Remarks*
Implementation Costs					
Dam Removal	$38,012,000.00				GEC Estimate
Lead Abatement (allowance)	$0.00	$100,000.00			Placeholder Allowance Only
Asbestos Removal (allowance)	$0.00	$100,000.00			Placeholder Allowance Only
Chemicals / Fuels in switch yard		$50,000.00			Placeholder Allowance Only
PCBs in transformers	Incl				Incl. in GEC Estimate
Escalation (Nov 2006 to May 2008)	$0.00	$3,497,100.00			Escalate GEC Estimate 6% per Year (9.2%)
Sediment Removal	$0.00	$76,379,000.00			Based on dredge 50% sediment to shoreline, drying, load & haul 10 mile round trip
Site Restoration	$0.00	$15,946,000.00			Restoration from existing shoreline to new river edge (includes nominal planting of established trees, shrubs & native grasses)
Artificial River Bed @ Dam Site		$0.00			N/A
Environmental Compliance					

Summary of Calculations of Physical Structure Removal Costs

GEC Calculation Revisions and Corrections:

Bolded total values are subsequently used in Column 1 of the Final Summary Table below.

Iron Gate GEC Hydroseeding Revision:	
Subtotal (includes HS)	$17,313,750
Subtract HS	$1,200,000
Total	$16,113,750
0.25	$4,028,438
Total	**$20,142,188**

Copco No 1 GEC Hydroseeding Revision:	
Subtotal (includes HS)	$12,855,000
Subtract HS	$1,200,000
Total	$11,655,000
0.25	$2,913,750
Total	**$14,568,750**

JC Boyle GEC Calculation Correction:	
Subtotal	$2,575,000
	$4,000,000
	$180,000
	$800,000
	$150,000
Hydroseeding (HS)	$450,000
	$150,000
Subtotal	$5,730,000
Total	$8,305,000
Subtract HS	$450,000
New Total	$7,855,000
25%	$1,963,750
Grand Total	**$9,818,750**

Additionals:

Values are subsequently used in calculations to determine values for Column 4 of the Final Summary Table below.
Water, Construction, and Engineering/Permitting costs (lableled "Additionals Total") are divided between the four dams based on the % determined in Column 3.
Iron Gate Hatchery costs are included in addition to the % of the "Additional Total" for Iron Gate in Column 4

Water	$1,600,000
+40% Contin.	**$2,240,000**
Construction	**$9,418,078**
Eng/Permit	**$15,696,797**
Additionals Total	**$27,354,875**
Iron Gate Hatchery	$7,500,000
+40% Contin.	**$10,500,000**

Final Summary Table:

Column Number:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Dam	***Cost Estimate from GEC***	***Rounded GEC Estimate***	***Estimate % of Total Cost from GEC***	***Additionals Based on % of Total Cost***	***Rounded Additionals***	***Total in 2006 $ (Column 2 + 5)***	***9.2% of 2006 Total for conversion to 2008 $***	***9.2% Value Rounded***	***Total in 2008 $ (Column 6 + 8)***	***Riverbed Costs (2008 $)***	***Overall Total (Column 9+ 10)***
Iron Gate	$20,142,188	$20,142,200	42.05%	$22,003,536	$22,003,500	$42,145,700	$3,877,404	$3,877,400	$46,023,100	$0	**$46,023,100**
Copco No. 2	$3,367,500	$3,367,500	7.03%	$1,923,235	$1,923,200	$5,290,700	$486,744	$486,700	$5,777,400	$335,000	**$6,112,400**
Copco No. 1	$14,568,750	$14,568,800	30.42%	$8,320,454	$8,320,500	$22,889,300	$2,105,816	$2,105,800	$24,995,100	$385,000	**$25,380,100**
J.C. Boyle	$9,818,750	$9,818,800	20.50%	$5,607,650	$5,607,700	$15,426,500	$1,419,238	$1,419,200	$16,845,700	$69,000	**$16,914,700**
Estimate Total	**$47,897,188**									**OVERALL TOTAL**	**$94,430,300**

Appendix D
Response to Comments on June 2008 Draft Report

Appendix D
Response to Comments on June 2008 Draft Report

Comment No.	Reference (Section & Paragraph)	Comment Description	Commenter	Response	Author
1	ES-1, second sentence	At end of second sentence, should add that agreement is between DOI, PacifiCorp, and current stakeholder group	YKB	Text added.	SMP
2	Table ES-1, p. 1-3	Should "Biological Liabilities" be "Environmental Liabilities" or perhaps add "Environmental Liabilities" to the table? The low and high estimates for structural removal are the same number	YKB	Table ES-1 has been revised in response to comment #60	CP
3	P. 2-22 Water Quality	Should identify/explain the abbreviations/acronyms here, in the text, and add to Abbreviations and Acronyms page	YKB	Text added and acronyms list updated.	SMP
4	p. 1-1, Figure 1-1	Reservoirs should be referenced in the same order on text and in figure	YKB	Reservoirs were referenced beginning upstream and moving downstream throughout the document and have been left unchanged on Page 1-1 to maintain consistency with the analysis that follows in later chapters, the figure was developed using map conventions that presented north at the top of the figure and south at the bottom.	CP
5	P. 2-22 Water Quality	Add bullet for Clean Water Act, Rivers and Harbors Act compliance (or environmental/regulatory compliance) to list of liabilities	YKB	Text added.	SMP
6	p-2-24 WQ-2	Typo: "are drawdown" In third sentence, suggest changing "wildlife" to "aquatic and terrestrial"	YKB	Change made.	SMP
7	Table 2.12 Data Gap 2	Reads funny. Suggest changing "used" to "exist" Add a data gap and needed action for long-term water quality impacts below Keno Dam to be consistent with last statement under WQ-4 on previous page	YKB	Change made. Text added.	SMP
8	p. 2-30 Section 2.2.2 second paragraph, second sentence	After "waterfowl" would add "and other riverine and riparian area species"	YKB	Text added.	SMP
9	p. 2-31 TE-3	After "riverside" add ", lakeside/lacustrine,"	YKB	Change made.	SMP
10	p. 2-31	If not already addressed under a regulatory section, add bullet TE-4 addressing compliance with Fish and Wildlife Ordination Act, Endangered Species Act, California Environmental Quality Act, California Streambed Alteration Permit, etc.	YKB	Added to regulatory section.	SMP
11	p. 2-32 bullet 1	These two items are not mutually exclusive and could be accomplished together	YKB	Text revised (Type of site restoration, such as stabilization only or stabilization and habitat enhancement.)	CP
12	p. 2-72 CWA Compliance paragraph 1	Last sentence in paragraph 1: insert "and federal" right after "state" After "CWS Section 404 permits" delete "dredge" and change to …"for discharges of fill material into waters of the U.S., including wetlands."	YKB	Text added.	SMP
13	p. 2-72 first line last paragraph	Delete "North Coast Regional Water Quality Control Board" as the acronym is previously identified	YKB	Change made.	SMP

Comment No.	Reference (Section & Paragraph)	Comment Description	Commenter	Response	Author
14	p. 2-72 last paragraph, sentence 2	The use of the word "discharge" (of sediment) as it pertains to Clean Water Act authority may be inaccurate. Recommend consulting the U.S. Army Corps of Engineers regulatory branch for their definition of "discharge" of fill material. (I have not read the 2006 GEC and so do not know exactly how dam removal is being proposed, but the Corps can explain if it meets their definition of discharge of fill material into waters of the U.S.	YKB	Discharge is the appropriate descriptor, in response to this comment the following language was added to the report (Most certifications are issued in connection with U.S. Army Corps of Engineers (Corps) CWA section 404 permits for discharges of dredge and fill material into waters of the U.S. (SWRCB 2002).) (Discharge of sediment to the Klamath River during dam removal could be considered hydraulic dredging and be subject to a CWA Section 404 permit from the Corps if the discharge could be expected to generate changes to or the impairment of downstream flows These potential changes to or impairment of river flows could be generated by the deposition of discharged sediment downstream of the dams. This could be considered a fill in the waters of the U.S., which would trigger a 404 permit.) (Discharge of sediment as a result of construction activities on the river banks outside of the river bed, to the river could require a Section 402 National Pollutant Discharge Elimination System permit from the SWRCB. This permit would be triggered by construction activities around the river that disturb one acre or more of land and have the potential to result in stormwater discharges to the Klamath River.)	SMP
15	p. 2-73 RL-2	Change "would require CWA…" to "may require water quality certification from the state SWRCB per section 401 of the Clean Water Act and a permit from the U.S. Army Corps of Engineers per section 404 of the Clean Water Act	YKB	Text revised as presented in the response to Comment #15	SMP
16	Table 3-7	Add a topic and liability number for loss of lacstrine habitat above dams	YKB	Liability TE-3 Is presented in unison with TE-1 in Table 3-7	CP
17	General overall	Much more in depth analyses are needed	YKB	Concur. Future analysis to reduce uncertainty with the liabilities associated with dam removal are necessary to narrow data gaps, quantify cost estimates for currently unquantifiable liabilities, and provide smaller range of dam removal liability costs.	CP
18	p. 2-21, first paragraph of Section 2.1.5, first sentence	Change "because of" to "due to" pH levels, etc.	AMM	Change made.	SMP
19	p. 2-21, first paragraph of Section 2.1.5, first sentence	Suggest changing "ammonia, nutrients" to "ammonia and nutrient concentrations"	AMM	Change made.	SMP
20	last sentence	Rewrite to read: "The liabilities related to water quality and potential decommissioning are listed below:"	AMM	Change made.	SMP
21	p. 2-21, Section 2.1.5, bulleted section	Change "shift" to "shifts"	AMM	Change made.	SMP
22	p. 2-22, Section 2.1.5.1, first paragraph	Discussion of high ammonia concentrations exceeding acute toxicity criterion but no values or ranges are given	AMM	Text revised to read (Water quality at the bottom of J.C. Boyle Reservoir is characterized by low DO concentrations (average is less than 6.0 mg/L) and high ammonia concentrations that exceed the acute toxicity criterion of 0.885 to 32.6 mg/L when salmonids are present at 9.0 and 6.5 pH units, respectively.)	CP
23	p. 2-23, Section 2.1.5.2, first paragraph	Discussion of high ammonia concentrations exceeding acute toxicity criterion but no values or ranges are given	AMM	Text revised to read (Copco Reservoir also has high total phosphorus concentrations and high ammonia concentrations that exceed the ammonia acute toxicity criterion of 0.885 to 32.6 mg/L when salmonids are present at 9.0 and 6.5 pH units, respectively.)	CP

Comment No.	Reference (Section & Paragraph)	Comment Description	Commenter	Response	Author
24	p.2-23, Section 2.1.5.2, second paragraph	The units for temperature suddenly shift from degrees F to degrees C. Need to keep consistent	AMM	Change made.	SMP
25	p. 2-25, last paragraph on page	Should this paragraph be less indented from the previous one? It does not seem to discuss the WQ-4 items listed as it's predecessor.	AMM	WQ-4 describes the liability generated by a shift in the CWA compliance point upstream from Iron Gate Dam to Keno Dam. The second paragraph was intentionally indented as a part of the WQ-4 description given its description of water quality conditions in both Klamath Lake and Keno Reservoirs and the potential downstream water quality changes in the Klamath River downstream of Keno Dam after removal of the four dams and a shift of the compliance point upstream which would remove the current water quality stabilizing effect provided by the four downstream reservoirs prior to compliance measurement.	CP
26	General	The CDM report references Technical Memorandum Number EC-2003-1, "Economic Analysis of Dam Decommissioning" written by Reclamation's TSC Economics Group. The CDM analysis does not follow the recommendations in this memorandum, and inappropriately combines results from the 4 accounts outlined by the P&G's to arrive at a total "liability" of $836 million.	PME	CDM's reference to Tech Memo EC-2003-1 was for the purpose of identifying potential categories of decommissioning liabilities related to economics. It is agreed that the P&G analysis suggested in the Tech Memo is an analysis approach that will need to be completed, but it was beyond the scope of CDM's contract to perform this analysis for this liability assessment.	D Holz
27	2.3.1	Valuing real estate benefits or liabilities could result in double counting. Lost recreation access would likely be addressed in the recreation analysis.	PME	Lost recreation access in general would likely be addressed in any future recreation analysis. However, there would also be a potential connection between recreation access and the value of a specific piece of real estate. Deliberate care was taken to avoid double counting.	D Holz
28	2.3.1	If appropriate to value, changes in real estate values is extremely difficult to determine. Lake front to river front may also increase the property value.	PME	Agreed, changes in real estate values going from lake front to river front are difficult to determine. In Tables 2-19 and 2-20, CDM suggested future actions/studies to address real estate value issues.	D Holz
29	2.3.1.1	BLM campground use should be addressed in the recreation analysis, this is an example of double counting between real estate and recreation valuations.	PME	The recreation value of campgrounds is recognized in Section 2.3.3 of the report. Section 2.3.1 is recognizing the real estate value associated with land that has recreation value. CDM does not view this as double counting.	BS
30	2.3.1.2	Stranding boat docks should be evaluated in the recreation analysis, this is an example of potential double counting between the real estate and recreation valuations.	PME	CDM agrees the potential for double counting exits. CDM has made a deliberate effort to keep the value of recreational impacted real estate and the recreational use values separate.	D Holz
31	2.3.2.1	Alterations of waterfront views at surrounding campgrounds should be addressed in the recreation analysis. This represents an example of potential double counting between what the authors are calling aesthetic liabilities and the recreation analysis.	PME	(Response to comment #30) CDM agrees the potential for double counting exits. CDM has made a deliberate effort to keep the value of recreational impacted real estate and the recreational use values separate.	D Holz
32	2.3.2.4	See comment 6.	PME	(Response to comment #30) TCDM agrees the potential for double counting exits. CDM has made a deliberate effort to keep the value of recreational impacted real estate and the recreational use values separate.	D Holz
33	2.3.3	Loss in flatwater recreation opportunities may be offset by increased in river recreation activities.	PME	Table 2-25 recognizes recreation related data gaps. The suggested studies/actions should address this concern. The intent of the report was not to net out any project gains or losses but identify all potential liabilities.	D Holz
34	2.3.3	The authors list separate "liability" categories for increases in distance between existing reservoirs, increase travel times to recreation sites, changes in nature and quality, etc, these all considered when valuing recreation at a particular site, therefore these are not considered separate categories to be valued.	PME	These are listed to indicate the type of liability categories that are considered when valuing recreation experiences and not to indicate that they are separate categories.	D Holz

Comment No.	Reference (Section & Paragraph)	Comment Description	Commenter	Response	Author
35	2.3.5	It's confusing if the authors intend these "liabilities" to be included in a benefit cost analysis. If so, the cultural and historic resources are included in the EQ account not the NED benefit/cost analysis. This is an example of trying add "values" from various accounts into one lump some, this not appropriate.	PME	We concur that looking at the P&G accounts is an important task but was not one that CDM was contracted to complete.	D Holz
36	2.3.7	This analysis mixes various measures of "liabilities" into a lump sum. It's difficult to determine if the authors are estimating the costs that would go into a Benefit Cost analysis, if so, many of the categories the authors value as liabilities are not appropriate for a BC NED analysis. The "Economic Analysis of Dam Decommissioning (USBR 2003), quoted by the authors describes the an economic benefit-cost analysis as apposed to a regional economic analysis or a financial analysis.	PME	(Response to comment #26) CDM's reference to Tech Memo EC-2003-1 was for the purpose of identifying potential categories of decommissioning liabilities related to economics. It is agreed that the P&G analysis suggested in the Tech Memo is an analysis approach that will need to be completed, but it was beyond the scope of CDM's contract to perform this analysis for this liability assessment. (Response to comment #35) CDM was not contracted to perform a four account P&G analysis. This will be clarified in the "Executive Summary" and also in Section 1.1 of the CDM report.	D Holz
37	2.3.7	If the authors did not intend to do a P&G type analysis they should at least separate the various impacts into the 4 accts, for example NED costs should not be added with RED impacts (lost wages).	PME	(Response to comment #26) CDM's reference to Tech Memo EC-2003-1 was for the purpose of identifying potential categories of decommissioning liabilities related to economics. It is agreed that the P&G analysis suggested in the Tech Memo is an analysis approach that will need to be completed, but it was beyond the scope of CDM's contract to perform this analysis for this liability assessment. (Response to comment #35) CDM was not contracted to perform a four account P&G analysis. This will be clarified in the "Executive Summary" and also in Section 1.1 of the CDM report.	D Holz
38	2.3.7	The "Economic Analysis of Dam Decommissioning (USBR 2003), describes the an economic benefit-cost analysis as opposed to a regional economic analysis or a financial analysis. Changes in county tax revenues is a financial analysis and it not appropriate to add this to a benefit cost (NED) analysis.	PME	(Response to comment #26) CDM's reference to Tech Memo EC-2003-1 was for the purpose of identifying potential categories of decommissioning liabilities related to economics. It is agreed that the P&G analysis suggested in the Tech Memo is an analysis approach that will need to be completed, but it was beyond the scope of CDM's contract to perform this analysis for this liability assessment. (Response to comment #35) CDM was not contracted to perform a four account P&G analysis. This will be clarified in the "Executive Summary" and also in Section 1.1 of the CDM report.	D Holz
39	3.6.1	See comment 2.	PME	(Response to comment # 27) Lost recreation access in general would likely be addressed in any future recreation analysis. However, there would also be a potential connection between recreation access and the value of a specific piece of real estate. Deliberate care was taken to avoid double counting.	D Holz
40	3.6.2	See comment 6.	PME	(Response to comment #30) TCDM agrees the potential for double counting exits. CDM has made a deliberate effort to keep the value of recreational impacted real estate and the recreational use values separate.	D Holz
41	3.6.3	The recreation impacts published in the FEIS are regional economic impacts stemming from changes in recreation use. It's inappropriate to term these as "costs" from a benefit cost standpoint. These impacts would be included in the RED section of a report. This is another example NED type costs and RED impacts being inappropriately added together.	PME	(Response to comment # 35) CDM was not contracted to perform a four account P&G analysis. This will be clarified in the "Executive Summary" and also in Section 1.1 of the CDM report.	D Holz

Comment No.	Reference (Section & Paragraph)	Comment Description	Commenter	Response	Author
42	3.6.3	Increased distance to a water feature and changes in recreational opportunities are taken into account when valuing recreation benefits (or lost benefits), these two items are generally not valued but are captured in the recreation use value. It's unclear how the author calculated these values but it may represent double counting if a recreation economic benefit were calculated based on recreation use. Again lost recreation benefits at the reservoir may be offset by gains in river recreation.	PME	(Response to comment #30) CDM agrees the potential for double counting exits. CDM has made a deliberate effort to keep the value of recreational impacted real estate and the recreational use values separate. (Response to comment #33) Table 2-25 recognizes recreation related data gaps. The suggested studies/actions should address this concern. The intent of the report was not to net out any project gains or losses but identify all potential liabilities.	D Holz
43	3.8	Regional income is a measure often used in a Regional Economic impact analysis or RED analyses. These are a single year measurements, it's inappropriate to calculate a net present value using this measure as it's not a measure of economic fishery benefits.	PME	(Response to comment # 35) CDM was not contracted to perform a four account P&G analysis. This will be clarified in the "Executive Summary" and also in Section 1.1 of the CDM report.	D Holz
44	3.8	Loss of payroll in Table 3-15 is not a measure of economic benefits or lost benefit. This is a regional economic impact. This is an example of how the NED and RED accounts have been combined in this document which is inappropriate.	PME	(Response to comment # 35) CDM was not contracted to perform a four account P&G analysis. This will be clarified in the "Executive Summary" and also in Section 1.1 of the CDM report.	D Holz
45	General comment	When analyzing potential impacts to removing a dam a "with" and "without" or incremental analysis must be conducted to make sure offsetting benefits and costs are accounted for.	PME	See Response # 35. (A "with" and "without" analysis should be done in conjunction to any future P&G/NEPA analysis.)	D Holz
46	General Comment	This analysis is inconsistent with a P&G type benefit cost analysis. While this may have not been outlined in the scope of work, the information presented here has the potential in may areas for double counting.	PME	(Response to comment #30) CDM agrees the potential for double counting exits. CDM has made a deliberate effort to keep the value of recreational impacted real estate and the recreational use values separate. (Response to comment #35) CDM was not contracted to perform a four account P&G analysis. This will be clarified in the "Executive Summary" and also in Section 1.1 of the CDM report.	D Holz
47	General Comment	It's recommended that the economic analysis follow the 4 accounts outlined in the P&G's which are typically presented in a feasibility study in order to provide decision makers an understanding of the benefits and costs with dam removal and avoid double counting issues.	PME	(Response to comment # 35) CDM was not contracted to perform a four account P&G analysis. This will be clarified in the "Executive Summary" and also in Section 1.1 of the CDM report.	D Holz
48	General Comment	The socioeconomic section of this document is not technical defensible as it is currently displayed because of the double counting issues and the aggregations of NED and RED account information.	PME	(Response to comment #30) CDM agrees the potential for double counting exits. CDM has made a deliberate effort to keep the value of recreational impacted real estate and the recreational use values separate. (Response to comment #35) CDM was not contracted to perform a four account P&G analysis. This will be clarified in the "Executive Summary" and also in Section 1.1 of the CDM report.	D Holz
49	General Comment	I believe it is possible that dredging of reservoir sediment will not be required and therefore a low estimate of this liability should be that no sediment will be dredged. The document is written assuming that a minimum of 50% of the sediment is dredged. It is possible that the low and high estimates for the liability are at least $200 million too high and the document should not be released until this issue is resolved.	BG	Sediment removal costs were calculated in part as a surrogate for the downstream aquatic liabilities associated with sediment discharge that were otherwise unquantifiable. Removal of these sediment removal costs from the estimates would eliminate this surrogate costing tool and would result in the potential underreporting of total liability cost associated with the effects of dam removal. The GEC 2006 report states that "...dredging was not fully investigated. However, further consideration of the effects of TSS may indicate a need to investigate feasibility, costs, and impacts of full or partial dredging..."	BS

Comment No.	Reference (Section & Paragraph)	Comment Description	Commenter	Response	Author
50	Sediment a	1. The main concern is with the assumption that 50% of the sediment must be dredged from behind the dams. Even the low estimate of liability made this estimate. We believe a much better assumption for the low estimate is that no dredging is needed and for the high estimate 50% of the sediment must be dredged. Also, there is no need to then multiply the estimate for dredging of sediment by 2 to obtain the high liability estimate. Using the above assumption would reduce costs by $192.5 million for the low and high estimates.	BG	As was described in the response to Comment #49, the sediment removal cost estimates served in part as a surrogate for the unquantified aquatic liabilities generated downstream by dam removal and sediment release. To present the low estimate without the sediment removal costs and the high estimate with the costs would under-report the potential effect of these otherwise unquantified liabilities. It is more probable at this time in the study that significant sediment management will be required by the NCRWQCB. Even with sediment management it is possible that unmitigatable impacts could still result to downstream aquatic resources. Until such time that the NCRWQCB concurs with a sediment passage program, we recommend conservatively approaching sediment removal to remove the opportunities for downstream aquatic impacts.	BS
51	Sediment a	They have overstated the likelihood that litigation will force the dredging of reservoir sediment. Their main argument is that Skamania and Klickitat Counties challenged the CWA Section 401 certification for the project because of the potential water quality impacts from naturally eroding reservoir sediment. They requested that FERC require dredging of sediment at Condit Dam because of the potential water quality impacts. However, these Counties have not been successful in forcing the project to dredge sediment and the current plan that is in place is to allow most all reservoir sediment to erode naturally. They will likely receive a CWA Section 401 certification for the project soon.	BG	The decision to assume sediment dredging to quantify downstream liability costs, minimize downstream water quality impacts, and comply with the CWA Section 401 certification requirements was based on conversations with the North Coast Regional Water Quality Control Board (NCRWQCB) referenced in the document (Plat, Dean. 2008. California North Coast Region 1 Water Quality Control Board. Personal communication on April 23, 2008.). It was determined during these conversations and in subsequent review of 2007 NCRWQCB Basin Plan that its current process for issuing Water Quality Certification under section 401 does not address dam removal projects that involve the presence of substantial quantities of sediment in a reservoir. Passage of sediment from the four dams on the Klamath River system is not directly comparable to Condit Dam or the Matilija Dam removal programs. Significantly greater quantities of sediment with high silt/clay fraction and organics exists on the Klamath providing no recognized benefit to downstream aquatic habitat. With Condit and Matilija Dams, larger coarse sediment fraction provided the benefit of spawning habitat to an otherwise sediment starved portion of the rivers. Further, the length of Klamath River providing important salmonid habitat is significantly greater (190 miles) and terminates into a designated Area of Special Biological Significance (ASBS) at the Pacific Ocean. The California Ocean Plan prohibits the discharge of sediment into an ASBS. Consequently, the passage of sediment as currently proposed presents significant litigation potential.	BS
52	Sediment a	There are also three other examples of dam removal where large quantities of sediment were allowed downstream as part of the permitting process: a) Matilija Dam on Matilija Creek in California: Approximately 4 million of 6 million yd3 of the sediment will be allowed to be naturally transported downstream. The major reason why some of the sediment had to be removed by slurry was that a major water supply is located approximately 2 miles downstream of the dam. Matilija Dam is located 16 miles upstream of the ocean.	BG	Passage of sediment from the four dams on the Klamath River system is not directly comparable to the sited examples . Significantly greater quantities of sediment with high silt/clay fraction and organics exists on the Klamath providing no recognized benefit to downstream aquatic habitat. Further, the length of Klamath River providing important salmonid habitat is significantly greater (190 miles) with four major tributaries and terminates into a designated Area of Special Biological Significance (ASBS) at the Pacific Ocean. The California Ocean Plan prohibits the discharge of sediment into an ASBS. The direct passage of sediment will present significant regulatory challenges and potential litigation.	BS

Comment No.	Reference (Section & Paragraph)	Comment Description	Commenter	Response	Author
53	Sediment a	b) Marmot Dam on Sandy River in Oregon: All of the approximately 1 million yd3 of stored sediment from behind the dam was allowed to be eroded and transported by stream flows. Removal occurred on October 19, 2007. Marmot Dam is located approximately 28 miles upstream of the Columbia River. c) Elwha Dam and Glines Canyon Dam on Elwha River in Washington: All of the approximately 18 million yd3 of sediment will be allowed to be eroded downstream. Glines Canyon Dam is located approximately 13 miles upstream of the ocean and Elwha Dam is located approximately 4 miles upstream of the ocean. There were significant improvements to a municipal water treatment plant to offset the water quality impacts.	BG	(Response to comment # 51) The decision to assume sediment dredging to quantify downstream liability costs, minimize downstream water quality impacts, and comply with the CWA Section 401 certification requirements was based on conversations with the North Coast Regional Water Quality Control Board (NCRWQCB) referenced in the document (Plat, Dean. 2008. California North Coast Region 1 Water Quality Control Board. Personal communication on April 23, 2008.). It was determined during these conversations and in subsequent review of 2007 NCRWQCB Basin Plan that its current process for issuing Water Quality Certification under section 401 does not address dam removal projects that involve the presence of substantial quantities of sediment in a reservoir. Passage of sediment from the four dams on the Klamath River system is not directly comparable to Condit Dam or the Matilija Dam removal programs. Significantly greater quantities of sediment with high silt/clay fraction and organics exists on the Klamath providing no recognized benefit to downstream aquatic habitat. With Condit and Matilija Dams, larger coarse sediment fraction provided the benefit of spawning habitat to an otherwise sediment starved portion of the rivers. Further, the length of Klamath River providing important salmonid habitat is significantly greater (190 miles) and terminates into a designated Area of Special Biological Significance (ASBS) at the Pacific Ocean. The California Ocean Plan prohibits the discharge of sediment into an ASBS. Consequently, the passage of sediment as currently proposed presents significant litigation potential. (Response to comment #52) Passage of sediment from the four dams on the Klamath River system is not directly comparable to the sited examples . Significantly greater quantities of sediment with high silt/clay fraction and organics exists on the Klamath providing no recognized benefit to downstream aquatic habitat. Further, the length of Klamath River providing important salmonid habitat is significantly greater (190 miles) with four major tributaries and terminates into a designated Area of Special Biological Significance (ASBS) at the Pacific Ocean. The California Ocean Plan prohibits the discharge of sediment into an ASBS. The direct passage of sediment will present significant regulatory challenges and potential litigation.	BS
54	Sediment a	The statement "The North Coast Regional Water Quality Control Board (NCRWQCB) effectively prohibits the discharge of sediments to the Klamath River system including dam decommissioning projects," is not supported. It may or may not prohibit discharge of sediment. We do agree with the statement that "early and continuous coordination with the NCRWQCB and SWRCB [California State Water Resources Control Board] will be necessary to develop removal alternatives that meet basin objectives and follow basin action plan guidelines." However, the three projects above prove that it is possible to receive the necessary water quality permits for a release of sediment stored behind a dam. These projects were located closer to large bodies of water, but there is no standard distance by which projects are judged.	BG	As was noted in the response to comment #51 the statement "The North Coast Regional Water Quality Control Board (NCRWQCB) effectively prohibits the discharge of sediments to the Klamath River system including dam decommissioning projects," was based on conversations with representatives from the NCRWQCB and review of the 2007 Basin Plan. The NCRWCB does not currently have a regulatory mechanism that would allow for discharge of sediment above Basin Plan standards to the river system or the Pacific Ocean.	BS
55	Sediment a	In the end, we have to involve the water quality boards directly before the costs are known. Also, we have recommended before that a water quality study be performed that would help quantify the impacts and allow more substantive discussions.	BG	Concur. The NCRWCB will need greater involvement to identify an acceptable sediment management approach.	BS

Comment No.	Reference (Section & Paragraph)	Comment Description	Commenter	Response	Author
56	Reservoir Restoration Costs	2. Another major concern is the assumption on reservoir restoration. The costs associated for reservoir restoration is $35 to $53 Million, for the low and high estimate. This is much higher than previously assumed and more justification is needed for the high costs.	BG	Costs were originally presented by dam in Appendix C. Discussion in Appendix C has been expanded to clarify the nature of the restoration components included in these estimates.	BS
57	General	3. We concur with all the data gaps and studies/actions needed listed under Section 2.1.2 "Hydraulics and Hydrology."	BG	Comment noted	CP
58	General	4. We concur with all the data gaps and studies/actions needed listed under Section 2.1.3 "Sediment."	BG	Comment noted	CP
59	General	While I believe that CDM may have met the minimum requirements of the agreement, the statement of work was unclear as to the extent to which associated costs for specific potential liabilities should be determined. CDM essentially reported only currently available cost estimates from other studies, with the exception of real estate costs and some adjustments to the dam removal costs. Very few new costs were developed for their study.	TH	Additional detail was provided in Chapter 1 on the purpose of this report (The report did not prepare an economic cost-benefit analysis using the four accounts outlined in the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* (P&Gs) (U.S. Water Resources Council 1983). The report instead analyzes the liabilities and associated quantifiable costs to present decision makers with a relative scale of the potential costs that could be generated by a dam removal action.)	CP
60	General	The basic approach used by CDM in identifying and categorizing potential liabilities seems okay, but the presentation of only the totals for their "quantified" costs in Tables ES-1 and 4-2 is VERY misleading and should be removed from the report. The reported range in potential liability costs of $465.9 million to $836.6 million is absolutely meaningless. Instead, a table of all identified potential liabilities should be provided with the associated costs shown where available. Potential responsibility for these individual costs can then be assigned. Any totals presented should be clearly defined as a partial or incomplete estimate of potential costs. CDM has identified 23 different potential liabilities with a "high" level of effect on decommissioning, and have associated costs for only 14 of them. And I would suggest that all of the identified potential liabilities are "quantifiable" but that only some of them have been "quantified."	TH	Text referring to the table in the Executive Summary has been revised to portray the liability costs presented as preliminary. The text referring to the table was revised as follows (Costs in Table ES-1 are presented for the quantifiable liabilities only. The unquantified liabilities that remain are presented in Chapter 3 of this report and have the potential to change the partial totals presented in Table ES-1.) Table 4-2 was removed	CP
61	General	The development of "low" and "high" cost estimates is also misleading. The "low" estimate is defined as the cost estimate developed by CDM (generally based on existing reports) and the "high" estimate is either multiplied by 1.0, 1.5, or 2.0 to reflect a level of uncertainty for the specific potential liability. The "high" estimate for a potential liability with low uncertainty would equal the "low" estimate. Instead, a true range of costs for each potential liability should be developed by defining a low cost associated with the best case, and a high cost associated with the worst case. For example, CDM used the GEC estimates for structure removal (with some minor revisions) and judged them to have a low uncertainty, such that the low and high estimates were the same. This was done despite the FEIS cost estimates which were lower than GEC, and the TSC conclusions that the GEC cost estimates were too low. Assigning a factor of 1.2 for potential liabilities having low uncertainty would at least reflect a difference between the high and low estimates.	TH	CDM developed costs based on our engineering and scientific judgment give the available information. In the case of most liabilities, there was insufficient information to characterize a best and worst case and to do so would provide vast ranges in cost. The intent of the cost estimating is to give decision makers a relative scale of the cost magnitude of the decommission action. Also see the response to comment # 109.	BS
62	General	The CDM report is not consistent in presenting the levels of liability and uncertainty for each potential liability. Sometimes a bar graph, sometimes a statement, sometimes nothing at all.	TH	Where liabilities charts are omitted for specific dams, charts exist for the general liabilities that applied to all of the dam sites (e.g. a chart for site restoration was presented for all four dams and no charts were presented for the dams individually). In the case where charts are presented on an individual basis, a chart may be omitted if no liabilities are identified at a specific dam site (e.g. there are no reservoir specific, recreation liabilities at Copco No. 2, so a chart was not presented). Descriptions of the level of liability and uncertainty were added to each numbered liability.	CP

Comment No.	Reference (Section & Paragraph)	Comment Description	Commenter	Response	Author
63	pg. 2.13	For HH-9, has it been concluded that the hatchery needs to be maintained at all? I thought that it was originally built to mitigate the effect of the dams. See also AQ-5.	TH	Over the long term restoring the upper Klamath River would improve conditions for salmonid survival. The fish hatchery is expected to remain in operation until post dam removal water quality and habitat conditions recover following dam removal.	BS
64	pg. 2.14	Any final design for dam removal would include controlled drawdown to prevent slope failures.	TH	Concur, however GEC's current method proposed would utilize rapid drawdown and sediment discharge that could generate the liabilities described in the report. Further study of the potential effect of this rapid drawdown is needed.	CP
65	pg. 2.14	Table 2-7, I don't agree that additional bathymetry surveys are needed. The current need is for the depths of sediment, or pre-dam surfaces (Table 2-10).	TH	Agreed, text will be change to reflect sediment profiling.	BS
66	pg. 2.21	Part 2.1.5, how does the California state line affect water quality of the river?	TH	The California state line marks the point that water quality compliance requirements for impairment change given differing definitions for water quality compliance between the State of California and the State of Oregon.	CP
67	pg. 2.75	Note that the FEIS describes dam removal project alternatives different from that described in GEC.	TH	Comment noted	SMP
68	pg. 2.79	I don't think CEQA has been defined in this report.	TH	Added text to define.	SMP
69	pg. 3.1	Assumption that 50% of sediment would need to be removed and disposed of to obtain 401 certification seems conservative, as per previous comments, but may be based in part on USBR expectation that only about 50% of the impounded sediments behind the Elwha River dams would erode naturally (although Elwha sediments have a higher percentage of coarse aggregates). As a low estimate alternative, would the loss of regional fisheries for one or two years, with natural erosion of sediments, plus water supply mitigations make sense?	TH	As noted in the responses to comments #51, 52, & 54 other unquantified liabilities could be generated by dam removal without sediment removal. Sediment removal served as a surrogate costing tool to quantify these liabilities.	BS
70	General	The document is well organized and the format enhances the clarity. It is thorough in covering potential liabilities and additional study needs.	MAL	Comment noted	CP
71	Abbreviations and Acronyms	The three page citations need to be replaced with the proper meanings for the acronyms	MAL	Change made.	SMP
72	2.1.1 Hazardous Materials	Additional contamination should be considered on this list. Ex. Spills involving PCB and Mercury. "Heavy Metals" in paint and coatings should replace the use of "lead". Additional metal contamination in coatings can be even more hazardous than lead, and are regulated in addition to lead.	MAL	Change made.	SMP
73	p. 2-3	Mercury spills should be considered if large Mercury manometers were used in the history of the facility. This comment applies to all the four dams.	MAL	Although Mercury was considered as a part of the liability assessment, observations made by the team during site visits were that the quality of maintenance on site as well as the storage of any potential mercury sources within facility enclosures, made the likelihood of spilled mercury contamination in soils adjacent to the facilities very low.	BS
74	Table 2-1	"Heavy Metals" in paint and coatings should replace the use of "lead". Additional metal contamination in coatings can be even more hazardous than lead, and are regulated in addition to lead. Sediment Quality. Add "and representative" after "valid".	MAL	Change made.	SMP
75	HW-7	"Heavy Metals" in paint and coatings should replace the use of "lead". Additional metal contamination in coatings can be even more hazardous than lead, and are regulated in addition to lead.	MAL	Change made.	SMP
76	Table 2-2 Data Gap	Add "PCB, and any hazardous chemical known to be stored in the area"	MAL	Text added.	SMP
77	HW-12	"Heavy Metals" in paint and coatings should replace the use of "lead". Additional metal contamination in coatings can be even more hazardous than lead, and are regulated in addition to lead.	MAL	Change made.	SMP

Comment No.	Reference (Section & Paragraph)	Comment Description	Commenter	Response	Author
78	HW-16	"Heavy Metals" in paint and coatings should replace the use of "lead". Additional metal contamination in coatings can be even more hazardous than lead, and are regulated in addition to lead. This comment should be applied throughout the document. Ex. 3.4.1 Page 3-4	MAL	Change made.	SMP
79	2.1.2.1	Perhaps consider the liability associated with transporting hazardous materials on sediments	MAL	Liability characterized in the sediment section 2.1.3 (Reservoir sediment could be contaminated with hazardous or regulated constituents (e.g., mercury or PCBs).	BS
80	2.1.3 Sediment	P 2-14, 3rd bullet. Sediments could be contaminated with other persistent chemicals in addition to Mercury. Expand the example.	MAL	PCB's were added	BS
81	Table 2-8, 2-10	Add "statistically representative sampling for" after the word "perform". Without samples that represent the large amount of sediment to be characterized, the data would be invalid.	MAL	Text added.	SMP
82	SE-5, and SE-9	Third sentence. Add "and potentially transport more contaminant" after "TSS"	MAL	Text added.	SMP
83	SE-6	The need for a truly representative sampling program should be reiterated.	MAL	Representative sampling program described in Table 2-9	BS
84	GW-3	Add "using a representative sampling program" after "…further studies"	MAL	Text added.	SMP
85	2.1.5	Add "Potentially contaminated sediments" to the list of liabilities affecting Water Quality	MAL	Text added.	SMP
86	2.1.5.3	Second paragraph. Clarify third sentence. Add "DO" after "Average"	MAL	Text added.	SMP
87	WQ-2	First sentence. Add "and potentially transport contaminants from sediment to the water" at end of sentence.	MAL	Text added.	SMP
88	AQ-2, AQ-4	Include "sediment contamination", and add "and quality" after "quantity"	MAL	Text added.	SMP
89	3.4.1	Pages 3-3 and 3-4 of this section refers to Subsection 2.3.3 as describing liabilities related to hazardous materials. Section 2.3.3 discusses "Recreation". Is this the correct reference?	MAL	Text changed to 2.1.1	SMP
90	Table ES-1, page ES-2 and Table 4-2 page 4-3	Paragraphs list 4 liabilities. Table only list 3. It is missing "legal and regulatory".	DKM	Table ES-1 has been revised in response to comment #60 and Table 4-2 has been removed. The ES-1 Table only presents quantifiable costs for liabilities quantified at this time.	CP
91	Chapter 3	CDM used costs from a GEC report and listed these as "previous estimates". See 8170's previous comments on the GEC report.	DKM	CDM reviewed the TSC Klamath River Dams Report dated March 25, 2008 that provided comment on the GEC report.	CP
92	Chapter 3	KDDP Estimates are lump sum and do not include quantities or unit prices. We are not able to comment on their costs without more detail.	DKM	Comment noted, in many cases unit pricing was not available to support line item estimates. In these cases CDM used its professional judgment to develop the lump sum estimates.	BS
93	Appendix C – last page	Several tables do not have costs formatted with "$" and commas. It would be easier to read if they included the standard format.	DKM	Change made.	SMP
94	3.4.1 and Appendix C	They acknowledge that hazardous material abatement costs are place-holder allowances and are pre-appraisal level. These costs could change substantially.	DKM	It is agreed that costs associated with hazardous materials could change substantially and should be studied in greater detail. As was noted in 3.4.1 previous cost estimates were not adequate for this analysis and further analysis will need to be completed to more accurately quantify the potential costs.	CP
95	Chapter 3 and Appendix 3	CDM should have been provided USBR Directives & Standards FAC 09-03 as a guide. Paragraph 4 lists a format the estimate should be in.	DKM	This is not a planning document. If this study becomes a planning document (feasibility study) then FAC 09-03 will be followed.	BS/CP
96	Chapter 3 and Appendix	CDM should have been provided USBR Directives & Standards FAC 09-01.	DKM	This is not a planning document. If this study becomes a planning document (feasibility study) then FAC 09-01 will be followed.	BS/CP
97	3.2.6	Design, studies, and programmatic costs could exceed 10% as this is not a "standard" project.	DKM	The team used 10% based on its generally accepted status as an industry standard, to present decision makers with an idea of potential costs. It is agreed that the costs could be higher	BS
98	3.4.3	Sediment removal is a big cost driver and it is uncertain how much will need to be moved out of the wetland. Their estimate assumes removal of 50%, no regulated wastes, and a permit can be obtained. These costs could change substantially when more information is available.	DKM	Concur, costs could change significantly. 50% was presented as a midpoint cost to present decision makers with an estimate of the potential project costs. The estimates will need to be refined as a part of future study.	BS

Comment No.	Reference (Section & Paragraph)	Comment Description	Commenter	Response	Author
99	3.4.4 and 3..4.5	Groundwater and water quality liability costs are not included as there are too many unknowns.	DKM	The costs associated with the liabilities identified in the report that were not quantified, were not available in the existing studies and reports reviewed. Future review of potential liabilities could utilize the potential studies identified in each section of the report to develop cost estimates.	CP
100	3.5	Biological liabilities cost data are mostly blank due to too many unknowns (data gaps).	DKM	(Response to comment #99) The costs associated with the liabilities identified in the report that were not quantified, were not available in the existing studies and reports reviewed. Future review of potential liabilities could utilize the potential studies identified in each section of the report to develop cost estimates.	BS
101	3.6	Socioeconomic liabilities cost data have a lot of blanks due to too many unknowns.	DKM	(Response to comment #99) The costs associated with the liabilities identified in the report that were not quantified, were not available in the existing studies and reports reviewed. Future review of potential liabilities could utilize the potential studies identified in each section of the report to develop cost estimates.	BS
102	3.7	Regulatory costs are all blank.	DKM	(Response to comment #99) The costs associated with the liabilities identified in the report that were not quantified, were not available in the existing studies and reports reviewed. Future review of potential liabilities could utilize the potential studies identified in each section of the report to develop cost estimates.	BS
103	Table 3-23	The list of “Unquantifiable Liabilities” is long. This could be a large cost that is not addressed.	DKM	It is agreed that the large number of unquantified liabilities could add to final dam removal costs.	CP
104	3.8 First paragraph, last sentence	Table numbers should be 23 and 24 not 18 and 19.	DKM	Change made.	SMP
105	Table ES-1 and 4-2	These tables only show the quantifiable costs and are labeled as such. There are no design contingencies for design changes or unlisted items. There are many unlisted items that are not accounted for. The unlisted items (unquantifiable costs) need to be defined before a meaningful “TOTAL” cost can be determined.	DKM	Table ES-1 has been revised in response to comment #60 and Table 4-2 has been removed.	CP
106	4-1-3.	Suggest changing wording to “Total project costs for the identifiable liabilities WITH QUANTIFIABLE COSTS” would range from…	DKM	Text added.	SMP
107	Chapter 4	Add a paragraph addressing unquantifiable costs.	DKM	In response to the comment the following language was added (Total project cost for the identifiable liabilities with quantifiable costs would range from $466 million to $837 million, with removal of structures representing approximately 11 percent of the total cost for the high estimate and approximately 20 percent of the total cost for the low estimate. Costs for liabilities that were identified but could not be quantified as a part of this study could potentially increase project costs.)	CP
108	2.1.2.1	The lack of and operability of low level outlets at the dams was identified as a liability that would affect the drawdown and sediment release. However, any construction impacts were not addressed.	CS	The GEC estimates considered the lack of outlet structures on at Copco No. 1 and Iron Gate. The GEC and CDM's estimate include actions to address the challenges presented by the outlet structures. The liability associated with these outlet structures was described by the project team as a low risk, but was described to provide decision makers with the full spectrum of liabilities that were identified by the project team.	CP

Comment No.	Reference (Section & Paragraph)	Comment Description	Commenter	Response	Author
109	Table 3-17 3.3	The discussion of the removal of the physical features was very brief. The fact that the high and low estimates for physical feature removal would be the same is hard to believe.	CS	GEC did a comprehensive study of physical structure removal. CDM reviewed GEC's work and did not find any significant problems with its approach or assumptions. CDM did not review any other removal strategies as a part of this investigation, but did investigate the potential liabilities generated by the GEC approach to provide decision makers with a cost estimate that considered these liabilities.	CP
110	3.3	It was unclear if the reviewer agreed with the scope of physical feature removal identified in the GEC Report. It would seem varying the scope based upon some of the other liabilities would be expected. This in turn would impact the costs.	CS	The project team reviewed the GEC estimates for physical removal costs and determined that they were generally accurate in scope and costs with exceptions noted in subsection 3.3. The report did however identify liabilities associated with the approach proposed in the GEC report and developed estimates of potential costs where possible associated with those liabilities.	CP
111	Chapter 1 Introduction, Page 1-2, 1st paragraph	"U.S. Bureau of Reclamation" should be "Bureau of Reclamation"	RJS	Change made.	SMP
112	2.2.1 Aquatic Resources Page 2-26, 1st sentence	"As described in the FEIS…", does this refer to the FERC (2007) citation in the References Section? This is an example of poor citation referencing.	RJS	Text added.	SMP
113	2.2.1 Aquatic Resources Pages 2-26 and 2-27 – bullets	Other potential liabilities include scouring of spawning areas and loss of food sources with high flows. Also, timing and sequence of dam removal may require consideration of downstream fisheries (e.g., timing of upstream migration of adult salmon) due to eroding sediment (source: G&G Associates 2003. Klamath River Dam Removal Investigation)	RJS	Examples added to the liability list presented in 2.2.1	CP
114	2.2.1.1 Aquatic Resource Liabilities and Uncertainties-Applicable for All Dams and Reservoirs, Page 2-27	An additional liability generated by removing the dams would be potential water quality effects on aquatic resources (e.g., nutrients, low DO, high TSS – see WQ-3 and WQ-4 on pages 2-24 and 2-25).	RJS	It was assumed that the liability AQ-2 described in broad terms the water quality effects characterized in this comment and that the specific liability was also characterized in the Water Quality subsection and to some level in the sediment subsection.	CP
115	2.2.1.2 Aquatic Resources Data Gaps-Applicable for All Dams and Reservoirs Page 2-28, Table 2-13 – Studies/Actions Needed	Remove "Develop a habitat viability assessment for existing fish populations potentially displaced by reservoir removal per comment #27 in Appendix B. Suggest adding "Disease impacts" as a Data Gap and add "Disease study" under Studies/Actions Needed. If water temperatures start warming earlier in the spring in the Klamath River with dam removal, young salmonids may become susceptible to disease (e.g., *C. shasta*) earlier in the season if they do not outmigrate sooner (see WQ-1 on page 2-24). This issue needs to be studied.	RJS	Change made	CP
116	2.2.1.3 Aquatic Resource Liabilities and Uncertainties-Klamath River Downstream from Iron Gate Dam Page 2-29	Suggest adding "AQ-7. Invasive species colonizing new areas" as an additional potential liability in the Klamath River downstream from Iron Gate Dam since it is also bulleted in Section 2.2.1, page 2-26.	RJS	Liability added (AQ-7. The potential introduction of invasive and noxious aquatic species currently present in the reservoirs to the lower Klamath River below Iron Gate Dam.)	CP
117	2.2.1.4 Downstream-Aquatic Resources Data Gaps Page 2-29, Table 2-14	Suggest adding "Disease impacts" as a Data Gap and add "Disease study" under Studies/Actions Needed. If water temperatures start warming earlier in the spring in the Klamath River with dam removal, downstream young salmonids may become susceptible to disease earlier in the season if they do not outmigrate sooner. This issue needs to be studied.	RJS	Study description added (Develop a study that investigated the potential changes in fish disease location and impacts)	CP
118	3.5.1. Aquatic Resources Costs Page 3-9	General comment-costs should reflect reducing uncertainty and filling data gaps (see Tables 2-13 and 2-14)	RJS	CDM has not quantified Aquatic Resource Liabilities. We agree that once the data gap if filled that these costs will be quantified.	BS/CP
119	3.5.1 Aquatic Resources Costs Page 3-9, 2nd paragraph	"GEC study and in the FEIS environmental measures (Appendix A)." Which GEC report (2006 or 2007 from the References Section)? Also, is "Appendix A" referring to Appendix A of FERC (2007)? This is a poor way to reference reports.	RJS	Text added.	SMP

Comment No.	Reference (Section & Paragraph)	Comment Description	Commenter	Response	Author
120	3.5.1 Aquatic Resources Costs Page 3-9, Last paragraph	"…estimates based on PacifiCorp and GEC information…" Does PacifiCorp refer to FERC (2007) and which GEC report is being referenced from the References Section? This is a poor way to reference reports.	RJS	Text added.	SMP
121	3.5.1 Aquatic Resources Costs Page 3-10, Table 3-6	Suggest adding "AQ-7 Invasive species" with a 1.5 uncertainty for potential downstream liability.	RJS	Liability added (AQ-7. The potential introduction of invasive and noxious aquatic species currently present in the reservoirs to the lower Klamath River below Iron Gate Dam.)	CP
122	3.8 Summary Costs Tables Table 3-17	AQ-2 – I assume the $45,000 for "loss of spawning areas" refers to preparing an aquatic monitoring and management plan, not implementing the plan as stated in the 1st paragraph on page 3-10. The $45,000 value seems high to develop a plan and low to implement the plan.	RJS	The $45,000 is for the development of an aquatic monitoring and management plan.	
123	Appendix B, Comment #27	This study has not been removed from Table 2-13.	RJS	The study described has been rephrased per the guidance provided in comment #115 The comment response in Appendix B has been revised	CP
124	Appendix B, Comment #40	"Comments on biological liabilities are addressed above under USFWS." Where is "USFWS"?	RJS	The comment response mistakenly described the comments on biological liabilities as being addressed under "USFWS", the repose should have read - "Responses to comments from USFWS on biological liabilities presented above in Comments #1 - 34." The response to comment #40 has been revised in Appendix B of the final report	CP
125	General Comment	Comments were received from Michael Bowen at the State Coastal Conservancy dated July 7, 2008 on the first draft report dated May 2, 2008. These comments were received after release of the second draft report dated June 6, 2008 that had responded to comments received on the May 2, 2008 version.	California Coastal Conservancy	The comments received from the California Coastal Conservancy were in many cases addressed in the second draft report released on June 6th. The second draft report responded to comments from the USFWS, the Oregon Office of Policy Analysis, and the Bureau of Reclamation. The California Coastal Conservancy Comments are as a result not being presented in this appendix.	DA