Volume I

Klamath Facilities Removal Final Environmental Impact Statement/ Environmental Impact Report

State Clearinghouse
2010062060

U.S. Department of the Interior

CA Department of Fish & Game

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Volume I

Klamath Facilities Removal
Final EIS/EIR

State Clearinghouse # 2010062060

U.S. Department of the Interior
California Department of Fish & Game

December 2012

Mission Statements

U.S. Department of the Interior

The U.S. Department of the Interior protects America's natural resources and heritage, honors our cultures and tribal communities, and supplies the energy to power our future.

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Klamath Facilities Removal
Final Environmental Impact Statement/Environmental Impact Report

Siskiyou County, California
Klamath County, Oregon

Lead Agencies: U.S. Department of the Interior, through the Bureau of Reclamation (Reclamation), and California Department of Fish and Game (CDFG), Sacramento, California.

State Clearinghouse # 2010062060

ABSTRACT

This Klamath Facilities Removal Environmental Impact Statement/Environmental Impact Report (EIS/EIR) evaluates the potential impacts of the removal of the four PacifiCorp[1] dams on the Klamath River as contemplated in the Klamath Hydroelectric Settlement Agreement (KHSA). The Klamath Basin Restoration Agreement (KBRA), as well as the transfer of Keno Dam, will be treated and analyzed as a connected action. Together, these two agreements attempt to resolve long-standing conflicts in the Klamath River Basin, located in southern Oregon and northern California. The KHSA and KBRA provide for the restoration of native fisheries and sustainable water supplies throughout the Klamath River Basin. Specifically, the KHSA established a process for a Secretarial Determination. This process includes studies, environmental review, and a decision by the Secretary of the Interior regarding whether removal of J.C. Boyle, Copco 1, Copco 2, and Iron Gate Dams (1) will advance restoration of salmonid (salmon, steelhead, and trout) fisheries of the Klamath Basin, and (2) is in the public interest, which includes but is not limited to, consideration of potential impacts on affected local communities and Tribes.

This EIS/EIR has been prepared according to requirements of the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). Direct, indirect, and cumulative impacts resulting from the project alternatives on the physical, natural, and socioeconomic environment of the region are addressed.

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[1] PacifiCorp refers to the current utility and all previous owners/names.

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Abbreviations and Acronyms

AADT	Annual Average Daily Traffic
AB	Assembly Bill
ACHP	Advisory Council on Historic Preservation
ACS	American Community Survey
AET	Apparent Effects Threshold
AF	Acre feet
AFA	Aphanizomenon flos-aquae
AGR	Agricultural Supply
AIP	Agreement in Principle
AIRFA	American Indian Religious Freedom Act
Alternative 1	No Action/No Project
Alternative 2	Full Facilities Removal of Four Dams Alternative (Proposed Action)
Alternative 3	Partial Facilities Removal of Four Dams Alternative
Alternative 4	Fish Passage at Four Dams Alternative
Alternative 5	Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative
APE	Area of Potential Effects
AQUA	Aquaculture, Mariculture
AQMA	Air Quality Maintenance Area
ARPA	Archaeological Resource Protection
ASDSO	Association of State Dam Safety Officials
ASR	Aquatic Scientific Resources
AUM	Annual Unit Month
AWS	Auxiliary Water Supply
B	Beneficial
BA	Biological Assessment
BB	Black Bullhead
BCoCs	bioaccumulative chemicals of concern
BEP	Business Emergency Plan
BGEPA	Bald and Golden Eagle Protection Act
BIA	Bureau of Indian Affairs
BIOL	Preservation and Enhancement of Designated Areas of Special Biological Significance
BLM	Bureau of Land Management

BLS	Bureau of Labor Statistics
BMIs	Benthic Macroinvertebrates
BMP	Best Management Practice
BO	Biological Opinion
BOD	Biological Oxygen Demand
BOE	Board of Equalization
BP	Before Present
BSLVs	Bioaccumulation screening level values
BTs	Bioaccumulation Triggers
CAA	Federal Clean Air Act
CAAQS	California Ambient Air Quality Standards
Caltrans	California Department of Transportation
CAPCOA	California Air Pollution Control Officers Association
CARB	California Air Resources Board
CAS	California Climate Adaption Strategy
CASGEM	California Statewide Groundwater Elevation Monitoring
CBOD	Carbonaceous biochemical oxygen demand
CCA	California Coastal Act
CCR	California Code of Regulations
CEC	California Energy Commission
CDC	California Department of Conservation
CDC	Centers for Disease Control
CDFG	California Department of Fish and Game
CDM	Camp Dresser & McKee
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CH_4	methane
CHHSLs	California Human Health Screening Levels
CNDDB	California Natural Diversity Database
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide equivalent
COLD	Cold Freshwater Habitat
COMM	Commercial and Sport Fishing

COPCs	Chemicals of Potential Concern
COPCO	California Oregon Power Company
CPUC	California Public Utilities Commission
CRFD	Colestin Rural Fire Protection District
CRHR	California Register of Historical Resources
CRS	Congressional Research Service
CSSC	California Department of Fish and Game Species of Special Concern
CTR	California Toxics Rule
CUL	Native American Culture, Ceremonial and Cultural Water Use
CUPAs	Certified Unified Program Agencies
CWA	Clean Water Act
CWC	California Water Code
CWT	Coded Wire Tags
CZMA	Coastal Zone Management Act
dB	decibels
dBA	A-weighted decibels
DC	direct current
DDE	1,1-bis-(4-chlorophenyl)-2,2-dichloroethene
DDT	dichlorodiphenyltrichloroethane
DEA	David Evans and Associations
DEET	N,N-Diethyl-meta-Toluamide (insect repellant)
DEQ	Department of Environmental Quality
Detailed Plan	Detailed Plan for Facilities Removal
DHS	California Department of Health Services
DMA	Designated Management Agency
DMMP	Dredged Material Management Program
DO	dissolved oxygen
DOA	Department of Agriculture
DOC	US Department of Commerce
DOF	Department of Finance
DOI	United States Department of the Interior
DPS	Distinct Population Segment
DPW	Department of Public Works
DQA	Division of Quality Assurance
DRE	Dam Removal Entity
DSL	Oregon Department of State Lands

DTSC	California Department of Toxic Substance Control
DW	dry weight
DWR	California Department of Water Resources
EBF	Ecological Base Flow
ECST	Environmental Compliance Sub-Team of the Technical Management Team
EDD	Employment Development Department
EDR	Environmental Data Resources
EDRRA	Evaluation of Dam Removal and Restoration of Anadromy
EFDC	Environmental Fluid Dynamics Code
EFH	Essential Fish Habitat
EGC	Engineering, Geomorphology, and Construction Sub-Team
eGRID	Emissions & Generation Resource Integrated Database
EIS	Environmental Impact Statement
EIS/EIR	Environmental Impact Statement/Environmental Impact Report
ENSO	El Niño Southern Oscillation
EO	Executive Order
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
ES	Executive Summary
ESA	Environmental Site Assessment
ESA	Federal Endangered Species Act
EST	Estuarine Habitat
ESU	Evolutionary Significant Unit
FACA	Federal Advisory Committee Act
FEIS	Federal Energy Regulatory Commission Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FGC	Fish and Game Code
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FLIR	Forward Looking Infrared Radiometry
FDOT	Florida Department of Transportation
FNU	Formazin nephelometric units

FOF	Findings of Facts
FPA	Federal Power Act
FRP	Fisheries Restoration Plan
FRSH	Freshwater Replenishment
FSBC	Floating Surface Bypass Collector
ft/day	foot per day
ft/s	feet per second
FTA	Federal Transit Administration
FTEs	Full Time Equivalents
FTR	Final Technical Report
FWCA	Fish and Wildlife Coordination Act
GCM	Global Circulation Model
GEC	Gatherd Engineering Consultants
GHG	Greenhouse Gases
GIS	Geographic Information Systems
GWP	global warming potential
GWR	Ground Water Recharge
HABS/HAER	Historic Architectural Building Survey/Historic Architectural Engineering Report
HALS	Historic American Landscape Survey
HASP	Health and Safety Plan
HAZNET	California Facility and Manifest Database
HCM	Highway Capacity Manual
HCN or CN^-	Toxic free cyanide
HGMP	Hatchery and Genetics Management Plan
HMBP	Hazardous Materials Business Plan
HMMP	Hazardous Materials Management Plan
HPMP	Historic Properties Management Plan
HSC	Health and Safety Code
HTRW	Hazardous, toxic, and radiological waste
HVTEPA	Hoopa Valley Tribe Environmental Protection Agency
ICNU	Industrial Customers of Northwest Utilities
ICP	Interim Conservation Plan
IGD	Iron Gate Dam
IGH	Iron Gate Hatchery
IHA	Indicators of Hydrologic Alteration
IM	Interim Measure

IMPLAN	IMpact analysis for PLANning
IND	Industrial Service Supply
IOD	Immediate Oxygen Demand
IPCC	Intergovernmental Panel on Climate Change
KBAC	Klamath Basin Advisory Council
KBCC	Klamath Basin Coordinating Council
KBRA	Klamath Basin Restoration Agreement
KDD	Klamath Drain District
Keno Transfer	Proposed transfer of the Keno Facilities from PacifiCorp to Reclamation
KFHAT	Klamath Fish Health Assessment Team
KFMC	Klamath Fishery Management Control
KHHD	Klamath Hydroelectric Historic District
KHP	Klamath Hydroelectric Project
KHSA	Klamath Hydroelectric Settlement Agreement
KMZ	Klamath Management Zone
KOPs	Key Observation Points
KRBFTF	Klamath River Basin Fisheries Task Force
KRFC	Klamath River Fall Chinook
KRSIC	Klamath River Stock Identification Committee
KRSMG	Klamath River Salmon Management Group
KRWQM	Klamath River Water Quality Model
KWAPA	Klamath Water and Power Agency
lbs	pounds
lb/ft^3	pounds per cubic foot
Leq	Equivalent average noise level
LKNWR	Lower Klamath National Wildlife Refuge
Lmax	noise levels of equipment operating at full power measured from 50ft away
LMB	Largemouth Bass
LOMA	Letter of Map Amendment
LOMR	Letter of Map Revision
LOS	level of service
LPAHEL	Low Probability of Adverse Health Effects
LRD	Lost River Diversion
LRMP	Land and Resource Management Plan
LRP	Long Range Plan
LTS	Less than Significant

LUST	leaking underground storage tank
LWD	large woody debris
Lv	vibration velocity level
m/sec	meters per second
MAA	Management Agency Agreement
MAR	Marine Habitat
MBTA	Migratory Bird Treaty Act
MCL	Maximum Contaminant Level
MCPA	2-methyl-4-chlorophenoxyacetic acid
MDL	Method Detection Limit
mgd	million gallons per day
MIGR	Migration of Aquatic Organisms, Fish Migration
MLs	Maximum Levels
MLPA	Marine Life Protection Act
mm	millimeters
$MMTCO_2e$	million metric tons carbon dioxide equivalent
mph	miles per hour
MPRSA	Marine Protection, Research, and Sanctuaries Act, or Ocean Dumping Act
mtons/year	metric tons per year
MSAE	*Microcystis aeruginosa*
MTs	Maximum Levels
$MTCO_2e$	metric tons carbon dioxide equivalent
MUTCD	Manual of Uniform Traffic Control Devices
MW	Megawatts
MWh	Megawatt hours
MWMT	Maximum Weekly Maximum Temperature
MUN	Municipal and Domestic Supply
MY	Model Year
N	Nitrogen
N/A	Not Applicable
N:P	nitrogen to phosphorus
N_20	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NAHC	Native American Heritage Commission
NAS	National Academy of Science

NAV	Navigation
NBOD	Nitrogenous Oxygen Demand
NCFEC	No Change From Existing Conditions
NCRWQCB	North Coast Regional Water Quality Control Board
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
N-fixation	Nitrogen fixation
NH_3	ammonia
NH_4^+	ammonia
NHMRC	Australian Government National Health and Medical Research Council
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NNE	Nutrient Numeric Endpoints
NO_2	Nitrogen dioxide
NO_3^-	nitrate
NOAA Fisheries Service	National Oceanic and Atmospheric Administration Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOP	Notice of Preparation
NOx	Nitrogen Oxides
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRC	National Research Council
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NSO	Northern Spotted Owl
NSR	North State Resources
NTU	nephelometric turbidity unit
NVCP	Noise control and Vibration Plan
NWR	National Wildlife Refuge
NWSRS	National Wild and Scenic Rivers System
NWS	National Weather Service
O_3	Ozone
OARs	Oregon Administrative Rules
OCAR	Oregon Climate Assessment Report
OCCRI	Oregon Climate Change Research Institute
OCRM	Office of Ocean and Coastal Resource Management

ODA	Oregon Department of Agriculture
ODEQ	Oregon Department of Environmental Quality
ODF	Oregon Department of Forestry
ODFW	Oregon Department of Fish and Wildlife
ODSL	Oregon Department of State Lands
ODOT	Oregon Department of Transportation
OEHHA	Office of Environmental Health and Hazard Assessment
OHV	Off Highway Vehicle
O&M	Operation and Maintenance
OMB	Office of Management Budget
ON	organic nitrogen
ONHP	Oregon Natural Heritage Database
OPWAS	Off-Project Water Settlement
ORBIC	Oregon Biodiversity Information Center
ORS	Oregon Revised Statute
OSU	Oregon State University
OSTP	Office of Science and Technology Policy
OWRD	Oregon Water Resources Department
P	Phosphorus
PAHs	poly-aromatic hydrocarbons
Pb	lead
PBDEs	polybrominated diphenyl ethers
PCA	Power Control Area
PCBs	polychlorinated biphenyls
PCEs	Primary Constituent Elements
PCPI	Per Capita Personal Income
PDO	Pacific Decadal Oscillation
PDPO	Pollutant Discharge Prohibition Ordinance
PELs	probable effect levels
PFMC	Pacific Fishery Management Council
PG&E	Pacific Gas and Electric Company
PM_{10}	Particulate Matter <10 microns
$PM_{2.5}$	Particulate Matter <2.5 microns
Porter-Cologne	California Porter-Cologne Water Quality Act
POW	Hydropower Generation
PP	particulate phosphorus
ppt	parts per thousand

PPV	peak particle velocity
PRBO	Point Reyes Bird Observatory
PRC	Public Resources Code
PRGs	Preliminary Remediation Goals
PRMS	Precipitation Runoff Modeling System
PROC	Industrial Process Supply
Proposed Action	Full Facilities Removal of Four Dams Alternatives
PSD	Prevention of significant deterioration
PSDDA	Puget Sound Dredge Disposal Analysis
PSPLC	Pokegama Sugar Pine Lumber Company
PUCs	Public Utility Commission
PWA	Phillip William and Associates
RARE	Rare, Threatened, or Endangered Species
Reclamation	Bureau of Reclamation
RCA	Riparian Conservation Area
REC-1	Water Contact Recreation, Water Contact Recreation including Aesthetic Enjoyment
REC-2	Non-contact Water Recreation, Non-contact Water Recreation including Aesthetic Enjoyment
RED	Regional Economic Development
RES	Renewable Electricity Standard
RHJV	Riparian Habitat Joint Venture
RM	River Mile
RMA	Resource Management Associates
RMP	Resource Management Plan
ROD	Record of Decision
ROW	Right of Way
RPS	Renewable Portfolio Standard
RSET	Regional Sediment Evaluation Team
RSLs	Regional Screening Levels
RV	Recreational Vehicle
RWS	River Water Surface
S	Significant
SAL	Inland Saline Water Habitat
SAR	Sediment Accumulation Rates
SCAPCD	Siskiyou County Air Pollution Control District
SCAQMD	South Coast Air Quality Management District
SCF	Sectional Center Facility

SDOR	Secretarial Determination Overview Report
SDWA	Safe Drinking Water Act
SDU	Small Domestic Use Appropriation
Secretary	Secretary of the Interior
SEF	Sediment Evaluation Framework
SF_6	Sulfur hexaflouride
SHELL	Shellfish Harvesting
SHPO	State Historical Preservation Officer
SIP	State Implementation Plan
SLs	Screening Levels
SLVs	Screening Level Values
SMS	Scenery Management System
SO_2	Sulfur dioxide
SOD	Sediment Oxygen Demand
SONCC	Southern Oregon Northern California Coast
SOx	sulfur oxides
SPWN	Spawning, Reproduction, and/or Early Development, Fish Spawning
SQuiRTs	Screening Quick Reference Tables
SRH-1D	one dimensional sedimentation and river hydraulics model
SRP	soluble reactive phosphorus
SRRC	Salmon River Restoration Council
SSC	suspended sediment concentration
SSDI	Suspended Sediment Dose Index
SSO	site-specific objective
SVOCs	semi-volatile organic compounds
SWAMP	California Surface Water Ambient Monitoring Program
SWE	Snow Water Equivalent
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	California State Water Resources Control Board
TAT	Technical Advisory Team
TCC	Technical Coordination Committee
TCP	Traditional Cultural Properties
TDI	Total Daily Intake
T&E	Preservation of Threatened and Endangered Species
TIPU	Transportation, Information, and Public Utilities

Term	Stands For
TEQ	toxicity equivalent quotient
THP	Timber Harvest Plan
THPOs	Tribal Historical Preservation Officers
TID	Tulelake Irrigation District
TIN	Total Inorganic Nitrogen
TIPs	Tribal Implementation Plans
TKN	total Kjeldahl nitrogen, ; a measure of organic nitrogen plus ammonia, nitrate (NO_3) and ammonia (NH_4^+)
TLNWR	Tule Lake National Wildlife Refuge
TMDL	Total Maximum Daily Load
TMT	technical management team
TN	total nitrogen
TNM2.5	Traffic Noise Model version 2.5
TP	Total Phosphorous
tpy	tons per year
TRRP	Trinity River Restoration Program
TRVs	Toxicity Reference Values
TSS	Total Suspended Solids
UFWS	U.S. Fish and Wildlife Service
µg/L	micrograms per liter
UGB	Urban Growth Boundary
UKL	Upper Klamath Lake
UKTR	Upper Klamath Trinity River
UKWUA	Upper Klamath Lake Water Users Association
URBEMIS	Urban Emissions Model
USACE	United States Army Corp of Engineers
USC	United States Code
USBR	United States Bureau of Reclamation
USDA	United Stated Department of Agriculture
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGCRP	United States Global Change Research Program
USGS	United States Geological Survey
UST	underground storage tank
v/c	volume to capacity ratio

VdB	vibration decibels
VOCs	volatile organic compounds
VRI	Visual Resources Inventory
VRM	Visual Resource Management Methodology
WARM	Warm Freshwater Habitat
WECC	Western Electricity Coordinating Council
WHO	World Health Organization
WILD	Wildlife Habitat, Wildlife Habitat and Endangered Species
WQ	Water Quality
WQCP	Water Quality Control Plan
WQMP	Water Quality Management Plan
WRIMS	Water Resource Integrated Modeling System
WSR	Wild and Scenic Rivers
WSRA	Wild and Scenic Rivers Act
WUA	Weighted Usable Area
WURP	Water Use Retirement Program
WY	Water year
W&S	Wild and Scenic
yd^3	cubic yards
YTEP	Yurok Tribe Environmental Program

Glossary

abeyance	A state of temporary suspension.
abutment	Structural element that ties a dam into the existing ground.
acclimation (of fish)	The process of a fish adjusting to change in its environment, allowing it to survive changes in temperature, water and food availability, and other stresses.
acre-foot	The amount of water required to cover 1 acre to a depth of 1 foot. One acre-foot equals 326,851 gallons or 43,560 cubic feet. This volume measurement is used to describe a quantity of storage in a reservoir.
adfluvial	Fish who live in lakes and migrate into rivers or stream to spawn.
adjudication	The final judgment in a legal proceeding; the act of pronouncing judgment based on the evidence presented.
Affirmative Determination	A determination by the Secretary of the Interior under Section 3 of the Klamath Hydroelectric Settlement Agreement that facilities removal should proceed.
alluvial	Deposition of sediment over a long period of time by a river; an alluvial layer; pertaining to the soil deposited by a stream.
ammocoete	Juvenile lamprey.
anadromous	A type of fish that hatch in freshwater, migrate to the ocean, mature there, and return to freshwater to spawn. Salmon and steelhead are examples.
anoxic conditions	Conditions with a deficiency of oxygen.
anthropogenic	Made by people or resulting from human activities.

antidegradation policy	A policy designed to prevent deterioration of existing levels of good water quality.
appropriations	Funds set aside (as by a legislature) for a specific purpose.
attraction flows	Drawing fish to dam fishways or spillways through the use of water flows.
bedload sediment	Particles carried along the bottom of a river or stream, rather than in the current.
beneficial use	The uses of a water resource that are protected by state water quality standards. Beneficial uses include human consumption, aquatic life, recreation, and fish and wildlife habitat.
benthic	The ecological region at the lowest level of a body of water, including the sediment surface and some sub-surface layers. Organisms living in this zone are called benthos or benthic organisms.
berm	A mound or linear embankment of fill material, typically earth fill.
best management practices (BMPs)	Physical, structural or managerial practices that control soil loss and reduce water quality pollution caused by nutrients, animal wastes, toxics, and sediment.
bioaccumulation	The process by which substances accumulate in the tissues of living organisms.
biochemical oxygen demand (BOD)	The amount of oxygen needed by aerobic micro-organisms to decompose all the organic matter in a sample of water; it is used as a measure of pollution.
biological opinion	The product of Endangered Species Act consultation, a document stating the opinion of the United State Fish and Wildlife Service or National Marine Fisheries Service on whether or not a federal action is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat.

blue-green algae	Algae that can cause problems in aquatic environments because some produce chemicals that are toxic to animals, including humans.
bulk bag	A container made from abrasion resistant fabric designed to contain loose material such as seeds, or in this case sand and gravel, and used for work area isolation.
camas	A type of lily used as a food source by Native Americans.
cession (of property)	The assignment of property to another entity.
chlorophyll-a	A photosynthetic pigment that serves as a surrogate measure for abundance of algae.
cofferdam	A temporary enclosure designed to be watertight or minimize water infiltration to isolate work areas for construction.
cohort	A group of fish spawned during a given period, usually within a year.
confluence	The meeting of two or more bodies of water, such as the point where a tributary joins the mainstem.
connected action	The National Environmental Policy Act defines a connected action as an action that (i) automatically triggers other actions that may require environmental impact statements (ii) cannot or will not proceed unless other actions are taken previously or simultaneously (iii) is an interdependent part of a larger action and depends on the larger action for its justification. Connected actions are closely related and therefore should be discussed in the same impact statement (40 CFR Part 1508.25 (a)1).
consolidation (of sediments)	The process by which sediments are compacted together.
contour line	A line connecting points of equal elevation.

Cooperating Agencies	Under the National Environmental Protection Act (NEPA), the agencies having responsibility to assist the Lead Agency by participating in the NEPA process. The role of the cooperating agencies may include conducting environmental analyses of resources which the cooperating agency has jurisdiction by law or special expertise.
critical habitat	Areas that are essential to the conservation of a species listed under the federal Endangered Species Act.
cyanobacteria	Photosynthetic bacteria, also known as blue-green algae. Cyanobacteria form extensive and highly visible blooms in the freshwater and marine environment.
Dam Removal Entity	The party with primary responsibility for carrying out the dam removal and other components of the Klamath Hydroelectric Settlement Agreement.
decommissioning	Taking out of use, such as dismantling a dam or destroying an unneeded road.
desiccation	Drying out.
diel	Pertaining to a 24-hour period; daily.
direct effects	Related to socioeconomics, they are one or a series of production changes or expenditures made by producers/consumers as a result of an activity or policy. These initial changes are determined by an analyst to be a result of this activity or policy. Applying these initial changes to the multipliers in an IMPLAN model will then display how the region will respond, economically to these initial changes.
dissolved oxygen	The amount of oxygen in the water available to aquatic organisms measured in mg/L or percent saturation.
diversion	The act of diverting water from the main river course down a water separate conveyance system.
drawdown	Lowering of the water level in a reservoir.

drop structure	A structure, often part of a dam's spillway, to pass water to a lower elevation while controlling the energy and velocity of the water as it passes over.
elutriate	Separation of fine particles into size fractions according to their rate of fall through an upward current of water.
embankment	Earth or stone fill designed to hold back water.
emergent vegetation	Aquatic plants rooted underwater that grow above (emerge from) the surface of the water (e.g., cattails).
employment (jobs)	Employment in IMPLAN is measured in number of jobs. A job is the annual average of monthly jobs in that industry (this is the same definition used by Quarterly Census of Employment Wages, Bureau of Labor Statistics, and Bureau of Economic Analysis nationally). Thus, 1 job lasting 12 months = 2 jobs lasting 6 months each = 3 jobs lasting 4 months each. A job can be either full-time or part-time.
endemic	Native to or confined to a certain region.
entrainment (of fish)	The loss of fish during water diversion due to their movement with the flow of water. Entrainment can result in mortality from direct contact with structures, from steep drops, or from stranding in areas where water does not persist, such as irrigation systems.
environmental water	The quantity and quality of instream water available to support fisheries and other aquatic resources.
epilimnion	The top-most layer in a lake stratified by temperature. It is warmer and typically has a higher pH and dissolved oxygen concentration than the lower layers (the hypolimnion).
erosion	The wearing away of the land surface by wind or water. Erosion occurs naturally from weather or runoff but is often intensified by land-clearing practices.

ESA consultation	In compliance with the Endangered Species Act, the process by which a federal agency presents information to the United States Fisheries and Wildlife Service or National Oceanic and Atmospheric Administration Fisheries Service regarding actions that may affect listed species or their designated habitat.
escapement (of fish)	That portion of an anadromous fish population that escapes the commercial and recreational fisheries and reaches the freshwater spawning grounds.
escapement floor	The lower bound of an escapement goal, which sets the number of salmonids that are not harvested and return to the river for spawning.
estuary	A partly enclosed coastal body of water with one or more rivers or streams flowing into it, and with a free connection to the open sea.
eutrophic	Waters rich in dissolved nutrients (especially nitrogen and phosphorus); leads to accelerated growth of algae and plants that depletes oxygen levels.
extirpation	Local extinction of a species over a portion of its total range.
ex-vessel value	Gross value of all fish caught within the area of analysis.
final demand	The value of goods & services produced and sold to final users (institutions) during the calendar year. This value is also equivalent to the Direct Effect of the impact.
fine sediment	Sediment with small particle size such as silts and clays.
fish ladder (fishway, fish passageway)	A structure on or around artificial barriers such as dams and locks to allow fish to move around the barrier during migration.
flume	Open-channel water conveyance system.
focal species	Species of ecological and/or human value that is of priority interest for study or management.

forebay	Water conveyance area between reservoir and power generation facilities.
fry	A juvenile salmon or steelhead.
genotype	The genetic identity of an individual.
geomorphic	Relating to surface features of a landscape.
gravel augmentation	The direct placement of spawning-size gravel into the stream channel to increase spawning habitat by increasing the amount of area with suitable substrate.
gravity arch dam	A dam that curves upstream in a narrowing curve that directs most of the water against the canyon rock walls, providing the force to compress the dam.
greenhouse gases	Gases including carbon dioxide, methane, and nitrous oxide, that prevent heat from escaping from the atmosphere, resulting in climate change (also known as global warming).
ground water recharge	The natural or intentional infiltration of surface water for the replenishment of existing natural underground water supplies.
hatchery	A place where large numbers of fish eggs are artificially fertilized and fry are hatched in an enclosed environment.
headcut	An erosional feature in waterways where an abrupt vertical drop in the stream bed occurs.
herbaceous	Referring to a plant that has leaves and stems that die down at the end of the growing season to the soil level. They have no persistent woody stem above ground.
hibernacula	A place where a hibernating animal shelters for the winter.
humic	Having a high organic carbon content.

Hydroelectric Reach	The portion of the Klamath River that includes the four most downstream dams (J.C. Boyle, Copco 1, Copco 2, and Iron Gate Dams).
hydrophilic	Plants especially suited to thrive in soils that are always wet.
hydroseeding	A planting process which utilizes a slurry of seed and mulch. The slurry is transported in a tank, either truck- or trailer-mounted and sprayed over prepared ground in a uniform layer.
hypereutrophic	Very nutrient-rich lakes characterized by frequent and severe nuisance algal blooms and low transparency.
hypolimnetic anoxia	The absence of oxygen in the lower layers of a lake or reservoir.
hyporheic	Beneath the bed of a stream, where there is mixing of shallow ground water and surface water.
hypoxia	Oxygen deficiency.
IMPLAN®	IMpact Analysis for PLANning, a regional input-output model that evaluates regional economic effects.
incidental take	The “take” (adverse effect) of a listed species that results from, but is not the purpose of, an activity. Incidental take cannot result in jeopardy to the species and must be specifically authorized in the biological opinion.
indirect effects	Related to socioeconomics, they represent the impact of local industries buying goods and services from other local industries. The cycle of spending works its way backward through the supply chain until all money leaks from the local economy, either through imports or by payments to value added (employee).
induced effects	Related to socioeconomics, they represent the response by an economy to an initial change that occurs through re-spending of income received by a component of value added (employee). The labor income is recirculated through the household spending patterns causing further local economic activity.

in situ	In the original or natural place.
intake structure	Facility designed to divert water from the river or reservoir.
ipos	Roots of the plant Carum oregonum, important to some Native Americans tribes.
isobath	A type of contour line connecting points of equal water depth in a body of water.
J.C. Boyle Bypass Reach	The reach of the Klamath River between J.C. Boyle Dam and J.C. Boyle Powerhouse. A bypass reach is that section of a river from which water is removed to generate hydropower. Water is often diverted from the river at the dam, transported through channels or penstocks downstream, and released back in the river at the powerhouse.
J.C. Boyle Peaking Reach	The reach of the Klamath River between the J.C. Boyle Powerhouse and the mouth of Shovel Creek. A peaking reach is that section of a river that receives the water from the generation of hydroelectric power at the powerhouse.
Keno Impoundment	The water body created by Keno Dam.
Keno Transfer	The transfer ownership and operational responsibility of the Keno facility from PacifiCorp to the United States Department of the Interior as part of Klamath Hydroelectric Settlement Agreement implementation.
Klamath Allottee	A tribal member who owns a beneficial interest in a tract of land within the original (1864) boundaries of the Klamath Indian Reservation.
Klamath Basin	The portion of land drained by the Klamath River and its tributaries. The Klamath River Basin is divided into the Upper Klamath Basin and the Lower Klamath Basin.

Klamath Hydroelectric Project	A system of hydroelectric components that includes the dams, powerhouses, and other facilities for generation of hydroelectric power on the Klamath River and developed jointly by the Bureau of Reclamation (Reclamation) and the California-Oregon Power Company (COPCO, the predecessor to PacifiCorp).
Klamath River Basin Compact	Agreement between the State of California and the State of Oregon and consented by U.S. Congress in 1957 that established the Klamath River Compact Commission to promote comprehensive development, conservation, and control of the resources of the Klamath River and to foster interstate comity between California and Oregon.
Klamath Tribes	The Tribes of the Klamath Basin include the Karuk Tribe, Yurok Tribe, Klamath Tribes (made up of the Klamaths, the Modocs, and the Yahooskin), Resighini Rancheria, Hoopa Valley Tribe, and Quartz Valley Community.
Lake Ewauna	Also known as Keno Impoundment.
labile	Active, possessing rapid turnover rates.
labor income	All forms of employment income, including Employee Compensation (wages and benefits) and Proprietor Income.
lacustrine	Of or pertaining to lakes.
Lead Agencies	The agencies with the primarily responsibility under NEPA and equivalent state environmental policy acts (e.g., California Environmental Quality Act [CEQA]) for carrying out an evaluation of the environmental effects of their decision-making and for preparation of the appropriate environmental document. For the Klamath Facilities Removal Environmental Impact Statement/Environmental Impact Report, the U.S. Department of the Interior is Lead Agency under NEPA and the California Department of Fish and Game is Lead Agency under CEQA.

lease lands	Land located near Tule Lake National Wildlife Refuge or the Lower Klamath National Wildlife Refuge, leased by Reclamation.
lentic	Of, relating to, or living in still waters (lakes, ponds, or swamps).
levee	A natural or artificial slope or wall to regulate water levels. It is usually earthen and often parallel to the course of a river or the coast.
liquid limit	The water content at which the behavior of the soil changes from a plastic to a semi-liquid state.
littoral	The zone between high tide and low tide waterlines of a lake or ocean.
lotic	Of, relating to or living in actively moving waters (streams and rivers).
Lower Klamath Basin	The portion of the Klamath River Basin downstream of Iron Gate Dam.
macroinvertebrate	Aquatic insects, worms, clams, snails, and other animals without backbones that can be seen without the aid of a microscope.
macrophyte	An aquatic plant that grows in or near water and is either emergent, submergent, or floating.
mainstem	The principal river in a basin, as opposed to the tributary streams and smaller rivers that feed into it.
microcystin	A toxin produced by the blue-green algal species Microcystis aeruginosa.
mitigation	The act of alleviating or lessening an adverse condition.
morphological	Related to the form of. Morphology is the study of the forms of things.
Negative Determination	A determination by the Secretary of the Interior under Section 3 of the Klamath Hydroelectric Settlement Agreement that facilities removal should not proceed.

nonpoint source pollution	A term in the Clean Water Act also called "polluted runoff," water pollution produced by diffuse land-use activities. Occurs when runoff carries fertilizer, animal wastes, and other pollution into rivers, streams, lakes, reservoirs, and other bodies of water.
noxious weed	A plant species that has been designated by state or national agricultural authorities as a plant that is injurious to native plants, agricultural and/or horticultural crops, and/or humans and livestock.
nutrient loading	Discharging of nutrients from the watershed (basin) into a receiving water body (lake, stream, wetland).
off-Project	Not associated with (not receiving water from, in the case of irrigators) Reclamation's Klamath Project.
ogee-type drop structure	A drop structure with a curved shape consisting of two arcs that curve in opposite directions so that their ends are parallel.
on-Project	Associated with (receiving water from, in the case of irrigators) Reclamation's Klamath Project.
output (sales)	Related to socioeconomics, output represents the value of industry production. In IMPLAN these are annual production estimates for the year of the data set and are in producer prices. For manufacturers this would be sales plus/minus change in inventory. For service sectors production = sales. For Retail and wholesale trade, output = gross margin and not gross sales.
PacifiCorp	An electric power company in the northwestern United States that owns and operates the Klamath River dams.
palustrine	Of or pertaining to wetlands or freshwater marsh.
Parties	Signatories to the Klamath Hydroelectric Settlement Agreement.
pelagic	Relating to or occurring, living in, or frequenting the open ocean.

penstock	A pipe or conduit that carries water to a power generation turbine.
periphyton	A complex mixture of algae, bacteria, their secretions, associated detritus, and various species of microinvertebrates attached to submerged surfaces in most aquatic ecosystems.
phytoplankton	Small, photosynthetic aquatic organisms, including diatoms, green algae, and cyanobacteria (blue-green algae).
plasticity	The ability of a soil to transform from a solid state to a liquid state by adding water.
point source pollution	Pollution into bodies of water from specific discharge points such as sewer outfalls or industrial-waste pipes.
polychaete	Aquatic annelid worms belonging to the Class Polychaeta, segmented and have bristles for movement or attachment.
powerhouse	Structure that contains the power generation equipment such as the turbine, may be an enclosed building or an open area with concrete slabs and equipment.
programmatic analysis	For purposes of CEQA, the Klamath Basin Restoration Agreement analysis is programmatic, as described in Section 15168 of the CEQA Guidelines. A program-level document is appropriate when a project consists of a series of smaller projects or phases that may be implemented separately. Under the programmatic Environmental Impact Report approach, future projects or phases may require additional, project-specific environmental analysis.
Project Team	The group of lead, cooperating, and responsible agencies responsible for evaluating the alternatives in the Environmental Impact Statement/Report.

Proposed Action	One of the alternatives evaluated in the Environmental Impact Statement/Report, the Proposed Action (also known as the Full Facilities Removal of Four Dams Alternative) includes the removal of four PacifiCorp Dams (J.C. Boyle, Copco 1, Copco 2, and Iron Gate Dams) during a 20-month period which includes an 8-month period of site preparation and partial drawdown at Copco 1 and a 12-month period for full drawdown and removal of facilities. This alternative would include the complete removal of power generation facilities, water intake structures, canals, pipelines, ancillary buildings, and dam foundations.
protocol-level surveys	Standardized methods approved by the U.S. Fish and Wildlife Service or other resource agency for establishing the presence or absence of special-status species.
radial gate	Tainter gate.
Reclamation's Klamath Project	The system of reservoirs, dams, canals, and pumps built to drain and reclaim lake bed lands of the Lower Klamath and Tule Lakes, to store water of the Klamath and Lost Rivers, to divert irrigation supplies, and to control flooding of the reclaimed lands.
redd	A depression in streambed gravel dug by a female fish for depositing eggs during spawning.
regalia	Especially fine or decorative clothing.
relicensing	The administrative proceeding in which Federal Energy Regulatory Commission (FERC), in consultation with other federal and state agencies, decides whether and on what terms to issue a new license for an existing hydroelectric project at the expiration of the original license.
remediation	To address a problem. Often refers to the removal of pollution or contaminants from environmental media such as soil, ground water, sediment, or surface water for the general protection of human health and the environment.

riffle	A shallow section of river characterized by numerous small waves on the surface often caused by gravel bars.
Resource Agencies	Government entities that have jurisdictional authority over various natural resources.
Responsible Agencies	Under CEQA, the agencies with discretionary approval authority over a portion of a CEQA project such as required permits.
restoration	The return of a landscape, ecosystem, or other system to a predefined historical state.
riparian	The area adjacent to a river or stream (and sometimes along shorelines of lakes or reservoirs).
riprap	Broken stone, cut stone blocks, or rubble that is placed on slopes to protect them from erosion.
river left and right	The designated side of the river when looking downstream in the direction of flow.
river mile	Measure of distance in miles along a river from its mouth. River mile numbers begin at zero and increase further upstream.
river mouth	The place where a river ends by flowing into another body of water such as a lake, ocean, or another river.
riverine	Of or pertaining to rivers.
run (of salmonids)	A group of fish that is migrating from the ocean to spawn in the rivers or streams where they were born.
salmonid	Of, belonging to, or characteristic of the family Salmonidae, which includes salmon, trout, and whitefish.
scour	The hole left behind when sediment is washed away from the bottom of a river. Although scour may occur at any time, scour action is especially strong during floods. Swiftly flowing water has more energy than calm water to lift and carry sediment down river.

secondary effects	Related to socioeconomics, they are indirect effects plus induced effects.
Secretarial Determination	Decision by the Secretary of the Interior based on a thorough scientific review of existing science, data and other information whether removal of the dams: (1) will advance restoration of the salmonid fisheries of the Klamath Basin; and 2) is in the public interest.
sedimentation	Settling of particulate matter in water related to particle size, water velocity, and water flow.
senescence	In plants, death triggered by an increase in the enzymes that promote the breakdown of plant cells.
smolt	A juvenile salmon or steelhead migrating to the ocean and undergoing physiological changes to adapt its body from a freshwater to a saltwater environment.
soil moisture content	The weight of water contained in a sample of soil, typically expressed as a percentage of the dry weight of the soil.
spawning	The process by which fish release eggs and sperm and deposit them on the stream substrate.
special-status species	Plant and wildlife species listed as threatened or endangered under the federal or state endangered species acts. Also included are federal candidate species, federal species of concern, state sensitive species, state species of concern, and those given special status by the Bureau of Land Management, the U.S Forest Service, or Indian Tribes.
spillway	Open-channel used to convey water over a dam, typically constructed of concrete to resist scour and erosion.
stormwater	Water that is not absorbed into soil and rapidly flows downstream, increasing the level of waterways.
stratification (in lakes)	The formation of layers based on temperature, oxygen levels, salinity, and density that act as barriers to water mixing.

subsistence	The way by which a culture obtains its food.
supersaturation	When oxygen (or other substance) is more highly concentrated in water (or other substance) than is normally possible under normal temperature and pressure.
suspended sediment	Particles that settle slowly enough to be carried in flowing water.
switchyard	The enclosed areas at power stations containing switching facilities and equipment for the purpose of connecting to the transmission network.
tailrace	Open-channel area downstream of power generation turbine for return water to flow back to the river.
Tainter gate	A radial arm water control structure used to control flow into a spillway or overflow area.
talus	A deposit of broken, coarse rock found at the base of a cliff or mountain.
thalweg	The deepest part of a stream or river channel.
thermal refugia	Cool, well-oxygenated areas of rivers utilized by salmon and other species to avoid thermal stress.
thermocline	A layer within a body of water or air where the temperature changes rapidly with depth.
Tidal prism	The volume of water in an estuary or inlet between mean high tide and mean low tide, or the volume of water leaving an estuary at ebb tide.
topographical	Of or relating to the arrangement or accurate representation of the physical features of an area.
total effects	Related to socioeconomics, they are direct effects plus indirect effects plus induced effects.
total Kjeldahl nitrogen	A measure of organic nitrogen plus ammonia.
total maximum daily load (TMDL)	A regulatory term in the Clean Water Act that describes the maximum amount of a pollutant that a body of water can receive while still meeting water quality standards.

toxigenic	Producing or containing toxins.
transformer bushings	A transformer is a device that transfers electrical energy from one circuit to another; a bushing provides insulation for the transformer.
transhumance	The seasonal movement of people with their livestock over relatively short distances, typically to higher pastures in summer and to lower valleys in winter.
tributary	A stream or river that flows into a mainstem river and contributes water to it.
turbidity	A measure of the extent to which light passing through water is reduced owing to suspended materials.
Upper Klamath Basin	The portion of the Klamath River Basin located upstream of Iron Gate Dam. The Upper Klamath Basin is divided into two sub-basins: the Klamath Hydropower Reach from Iron Gate Dam to J.C. Boyle Dam and the basin upstream of J.C. Boyle Dam.
V-screen	A V-shaped screen over the water intake to prevent fish from swimming through.
volitional fish passage	The movement of migratory fish around a dam via an upstream fish ladder or downstream bypass system as opposed to being trapped and hauled around the dam or attempting to move through hydropower turbines where many would be killed. Volitional fishways allow anadromous fish to migrate when they are physiologically ready.
watershed	All the land drained by a given river and its tributaries. An entire drainage basin including all living and nonliving components of the system.
weir	A low structure built across a stream to raise the upstream water level while allowing water to flow over the top of the structure.
wocas	The nutritious seeds of the yellow pond lily, important to some Indian Tribes.